Acting Across Scales

Describing Urban Surfaces as Technical 'Fields of Action'

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Abstract

The relation between the global and the local is the traditional concern of space syntax. A 'form' and a 'structure' of urban fabrics can be represented in images and graph measures using space syntax techniques and these images and measures correlate with observations of how people use and organize those urban fabrics. The implication is that it is the relation between scales which is crucial to understanding how people act in the city and prepare the city for action. The city fabric is (and this has been suggested before) an apparatus for relating scales in action, and one which people use in not yet clearly specified ways in order to do things. Part of the project of space syntax is to build ever more refined descriptions of this constructed apparatus in order to understand better how this all works and to suggest better ways of planning and designing cities. One of the chief challenges facing city-building today is to understand how to plan and design at much larger scales than those of the central urban neighbourhood and area, and in order to do this we need to be clearer about what it is space syntax is actually doing at the scales of central urban fabrics so we can extend this understanding plausibly to descriptions of large metropolitan and megacity regions. The roles of technologies and technical systems in creating the kinds of spaces we act in is a topic of research and debate in discussion about urban form today, and is one we need to address more clearly in space syntax. I discuss these issues in order to show how we may adapt an interpretation of urban technical systems and their relations with one another, and the way this relates to human action, in order to build plausible descriptions of continuous urban surfaces. This paper initiates a project to model urban regions in the Netherlands and Brazil.

1. A note on method

I intend to take seriously the suggestion by Hacking and others that laboratory scientists purposefully construct the conditions for the consistent and repeatable results they get from experiments in their apparatus. In a science of the city we must I believe understand our 'laboratories' and our 'apparatus' as being historically and purposefully constructed cities or urban systems. The question of the city and what it exactly is may change with this perspective. If we imagined the city to be an outcome of spatial economy say, we could understand the distributions of urban parts or elements to be a product of more or less universal laws of spatial economy. If the city were on the other hand a purposeful construction from the beginning, the 'laws' of the city would instead be the 'laws' of its intentional construction over time and urban structure should reflect the logic of that construction. These 'laws' may not involve us in the sort of 'automatic' causality we ascribe to 'natural' laws, but rather in a more contingent causality involving the human reasons for cities in the light of immediate functional imperatives, and an accumulation of responses to necessity as an evolution over time. They will more than likely also involve us in a co-evolution of the constructors and constructed as these mutually support and change with one another, seeking out and establishing different conditions that work in different times through history.

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My own research has been directed to thinking about what this co-evolution might entail and what people might bring to it as constructors. If cities are deliberate constructions they presumably order the world in some way that adds something to human capacities. It has been proposed for example in the archaeological literature that cities emerged as part of a process of the complexification of work; people gathering together not for reasons of community or kinship but to assemble specialized skills so that they might perform complex tasks in order to interact effectively with other people over distance (Childe). It has been suggested as well that one of the complex functions performed from early cities was trade, and that the combination of cities and trade meant that there was never a first city. Cities were never alone, but in fact emerged together around the trading routes that linked them (Jacobs 1970; Taylor 2004). If this is the case our spatial primitives are the trading networks, rather than the cities themselves. The global scale is not something that needs to be solved in relation to cities as containers and articulators of a logic of proximity, but is involved at the very beginning as the, or a, reason why cities exist at all.

This is subtle but not difficult when we think the problem through in the right space. Most of our urban thinking assumes logics of proximity and distance; proximity is the 'obvious' and unproblematic logic of local contact and distance produces the 'friction' which makes the global problematic and in need of explanation. However these logics are not those of the network 'primitive': in a network logic the relation and its performance are what we start with, and the relation is not what needs to be explained, rather it is what we are using to try to explain how the city comes to be. People and goods are moving, exchange is taking place and the city is purposefully constructed and evolves to support this network of relations. One of the ways it may support this network is by creating another network in the city itself capable of putting together specialized skills, like record-keeping, accounting, logistical, technical and other support for trading; another way it supports the network is by embodying and articulating the places the trading networks and their support structures need to function. Place here is much more than just a point on the map; it is a point of focus and articulation in networks of other points of focus – a thickening in networks of other thickenings, an event in larger arrays of events.

The network becomes primary in another way as well: it is the means to know our place in relation to other places – arguably the only way we could know it. Any city is where and what it is due to the relations it maintains with other cities. The knowledge of how to act at a distance, and towards where, is embedded in the network itself and in the network 'thickenings' that are cities; specifically in the infrastructure and technologies – the roads, sea-routes, coaches and ships, along with their embarkation points and departure times. We think of these things as movement technologies but every infrastructure that facilitates movement also facilitates the knowing of what exists in the network; every movement technology is also a communication technology. Action at a distance becomes not very mysterious at all, it is the reason for the construction and maintenance of networks, the affordance of technical and organizational apparatus to get people, things and ideas to travel – and through all of that also the means to know there are places to travel to. Travel may have its costs but I am talking here about how we know our world and its places in any way at all.

I will be taking a particular view on technology here which sees it as a fundamental condition of human existence. Technology is not simply means to ends or ways of making ends more easily or efficiently achievable; it is the way we engage the world in any way further than the most local at both 'cognitive' and practical levels. The human capacity for making and using tools creates what Leroi-Gourhan describes as 'social memory', outside the body and in the arrays of 'equipment' that constitute a man-made environment. We live in a world of technical things and processes and these constitute the very process of remembering and anticipating and the possibility of acting in ways which would not be possible if we had only our own memory and experience to draw on. In this view culture is our capacity to inherit experience through generations by way of technics and things (Stiegler 1998).

2. Global and local

The issue of the global and the local in urban systems may be approached in a dynamical or systems way. However we have to be careful about the exact nature of the system we are dealing

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with and not over-generalize or simply apply 'general' systems or complexity approaches to the urban system. I suggest that we may even need to be careful of our system of Cartesian space, which may have little to do with the specifics of an urban spatial system. The fact that the 'generality' of Cartesian space is by now something 'naturalized' should only increase our caution. One thing we can say about urban and other human spatial systems over the long duration of human history is that they have been evolutionary. Looking at it from the perspective of the contemporary global world, global integration is something that has been achieved in a generally forward momentum over time, pushed forward and interrupted as empires and trading leagues have waxed and waned (Braudel 2002).

Another thing we can say is that at different times different integrations have been effected, establishing in each case a difference between what was included and what was excluded in network or empire, as well as boundaries between these domains. The domain of the inside and included in the network defined edges beyond which the domain of the excluded started. Before an edge was a domain of known activities ordered and organized spatially in reference to a centre or centres; beyond this edge was a domain of unknown and often feared and demonized goings on. One certain thing we can make of all this is that these networks and empires were not integrated abstractly; they were integrated by their technologies and infrastructures; by their ships, ports and trading routes, their roads, foot-soldiers and cities. Another is that being in the trading league or the empire made one party to the travellers' and soldiers' stories, to the streams of goods, people, trading orders, promissory notes, military orders and bureaucratic reports, and made being outside the flow of this information a matter of simple ignorance, or of fear or espionage. Again we see the network as communicative; as the means to knowing and being 'in the loop'. The nation state we now take for granted, and other institutional forms like Europe, have also been the subject of a 'hidden integration' effected by land-routes, waterways, rail systems, and more recently E-road systems and high-speed cross-continental rail networks. Constructed and emergent national entities have established national identities and governmental autonomies with their inclusions and exclusions – as well as constructing the 'excluded others' out of those on the wrong sides of those borders. Inclusions and exclusions at different scales create the very real tensions of being included with others at one level and excluded at another. Our identities and their conflicts may map quite literally onto projects that see unrestricted Europe-wide travel on the one hand and a securing of the borders of Europe to 'invasion' from both outside and inside on the other.

3. Space

The networks of empires and nation states I have mentioned are also difficult to reconcile simply with our spatial ideas of territory or region defined by borders. Because inclusion and exclusion in the network is defined by what is included in relations rather than by what is on the right side of a line drawn in territorial space. Inclusion and exclusion is also defined by participation, so that inclusion is in the activities that form the network and exclusion is about being 'out of the loop'. The border line in territorial space is an instrument of policing and administration rather than of participation, activity or use. It constructs singular jurisdictions where in reality something much more multiple, overlapped and complex is happening. A city is not defined by its boundaries: rather, according to one view at least, a complex division of labour exists at city level that is a manifold of relational interdependencies supporting complex productive processes. In the case of the small city in a inter-city trading network, we could even say its primary production is the maintenance of the larger network and its ongoing participation in it. The city in a trading network makes of itself a network or series of networks for the purpose of bankrolling and provisioning the ships, producing goods to be shipped, offloading, processing and selling on incoming cargos, repairing and replacing ships, and performing the hundreds or thousands of services which enable the city and its people put together the complex work that produces transactions in the trading network. A lot of work in other words in the city is required that the city participate in the network between cities. In the case of a small European capital much of the division of labour in the city will involve bureaucracy required to enact national government as well as participation at national level in a transnational network of governance. We see that whatever is produced or constructed at one level goes to constructing and sustaining networks of activity at another. The economic base of a

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city is founded on this complex work that produces goods or services that end up outside the city in another network at another scale.

The economic base of a city involves complementary relationships and productive work whose effects are felt at higher scales, and in fact the places where the work is done seem always to be cities: global cities; regional cities; national cities; provincial cities; all do complex work locally to support networks at global, regional, national and provincial scales. None of these networks are abstract or simply 'social'; all are themselves complex organizational, technical and logistical arrangements. All of them are supported by technologies and infrastructures constructed and assembled at great cost in money and effort, often over many years, decades or even centuries, and usually in the cases of the older ones, as part of the public realm. Meanwhile we tend to see these activities and ways of work and doing things as existing extra to the technologies and infrastructures that support them – and to see the networks as technical and somehow separate to the work – while in fact the activities themselves are impossible and may even be inconceivable without the supporting technologies and infrastructures and their total organizational properties and capacities. The trading network would soon fall into disarray without the ongoing effort at keeping the accounting and bookkeeping in order; it would be dysfunctional if inter-city postal communication was disrupted or if any part of the hard apparatus like quays, jetties or sails broke down. And there is no point, no matter how far one goes back, where the technologies were absent though they may have been rudimentary in their early forms. We tend to lose sight entirely of the most established elements in all this technical and organizational and communicative machinery. We notice new technologies like the internet and email for a while before that slips also into the background and becomes just another way we do things. We have long ago lost sight of the technologies of speech and writing as these have become second nature; but we lose sight also of the silent work done by low-tech infrastructures like roads, pavements, even trains and trams that have been around a long time and, like language, have slipped into the background as medium rather than message. Technologies are ways of working, ways of doing and knowing things in consistent and repeatable ways. But the total technological package also evolves as new technologies replace older ones, slipping into on-going ways of working, transforming, even revolutionizing them without ever erasing them or replacing the practices they underpin totally. Alongside this periodic replacement of technologies there exists also a tendency to progressive systematization and standardization of technological systems that make up the most visible and well used parts of the public domain.

4. Urban form as layerings of embedded movement practices

Amsterdam in the sixteenth century was a small city in a European trading network. In the seventeenth century it became a not much bigger city in a network of colonization that reached to the other end of the world (Taylor 181). The shipping routes and their proceeds were supported by other regional and continental networks that took in Italian banking, Swedish timber, and Baltic fishing and wheat. But most of the direct front-end of this work of support – negotiating partnerships and funding, provisioning, ship repairs, outfitting and building, and the storage, processing and selling on of cargoes – took place in the little city of Amsterdam, though other cities of the Netherlands, connected together by an infrastructure of waterways, also played roles (Israel 2002). The city was small enough that the complex work carried out in it could be effected by people walking from place to place on foot through a simple street network. By the end of the nineteenth century industrialization had taken hold and the city was adapting itself to a different economy with a different organization. Small factories, a lively commercial centre, and new workers and middle-class districts, combined with a new ethos of public hygiene and public housing, meant that the city began to expand beyond the old city walls. To maintain integration of the increasingly specialized and standardized parts of the city, and to maintain the efficient carrying out of complex work, public transport was introduced in the form of a tram system. This new technology meant that the city could increase in size without compromising daily working movement practices or losing the flexibility that comes from having different facilities and skills within easy reach. The tram system was extended with the spread of the fabric of Amsterdam through the twentieth century and was supplemented by a bus system. The expansion was controlled and planned by a centralized municipal authority that took public transport and housing

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under its own control early in the century. The same grid of roads was taken over by motor car and delivery traffic as motorized traffic increased through the latter half of the twentieth century. The net consequence of expansion all the way into the 1960s and even beyond was a spread of a typical 'European' pattern of urban fabric consisting of neighbourhood streets and blocks with an overlaid larger more public grid connecting neighbourhoods to each other and to the historical core. This larger grid was specialised and standardised so that it became increasingly separated from the lower scale grid of local streets and blocks. What was also interesting was the fact that much of this larger 'supergrid' became the armature on which commercial activity clustered in a classic high-street centred neighbourhood pattern.

Around the middle of the century the amount of motorized traffic between cities began to increase. This intercity traffic now constitutes the major share of traffic in the whole metropolitan system and has generated daily urban systems that are metropolitan rather than urban in scale. The intercity road network has since mid-century been planned, optimized and specialized as a motorway system, to its own set of standards, for its role in conveying increasing volumes of motor traffic between cities. The inter-city rail system was consolidated out of different rail systems at the beginning of the century, itself became integrated and standardised, and today carries a higher traffic volume than ever before. We see growth in the city today in a form called sprawl between cities clearly oriented to the armature of these intercity road and rail infrastructures. Movement infrastructures have become more specialized and more sharply differentiated from each other. There are today legal constraints on the forms of transport that may use certain roads and there are particular specialized codes of road numbering, and route-finding and signage equipment that distinguishes one class of road from another. The 'gaps' between these infrastructure classes and types are often also distinguished by volumes of traffic. But the main point is that what focuses and directs these infrastructures are the places they interconnect at whatever level we look at them. We see an emergent hierarchy, but the technological systems of inter-city road and rail are focused on places that are historically evolved and have in general not shifted much over centuries (Batty 2001).

Expansion and an increase in the range of the daily urban traffic systems over the last century or more has generated two distinct and strongly standardized and systematized road traffic systems and infrastructures, one which we characterize now as being intra-city and the other inter-city, roughly reflecting respectively industrial and post-industrial daily movement patterns. A little imagination is all it takes to recognize in the neighbourhood street pattern the pedestrian-scaled traffic system and infrastructure of the seventeenth century, now adapted for motor access and parking. There is more than a little truth in what Charles Jencks says when he claims that the city today "works both as a mediaeval village with the equivalent of 13th century inhabitants pottering about, and a global network of 24 hour traders" (Jencks 1996). In fact it works also as a nineteenth-twentieth century city of public transport and shopping streets, and as a contemporary metropolitan city of motorways business parks, airports and malls. Our contemporary city may have its problems but it contains more history and more embedded 'memory' of movement practices of the past than any city before it.

5. How does this relate to structure in space syntax?
Space syntax is different to other methods of spatial analysis in that its results are not produced by calculative procedures involving distances over a Cartesian surface. They are instead produced by calculating simple topological relations between the linear elements of the axial map. These elements string together to represent the movement networks in urban fabric, the elements being distributed such that the least number of elements give a full coverage and continuity of the movement networks. Some of the elements are longer than others because they cover relatively straighter and more continuous road sections, and it is a feature of the axial maps particularly of European cities that long elements tend to join up into a courser grained grid overlaying the total grid of the fabric. This courser grained grid has been called the 'supergrid'. When we look at this supergrid in the real world we find it represents a network that carries a very significantly higher volume of traffic than non-supergrid grids. It also carries most if not all the public transport. I have argued elsewhere, and the history I have outlined above shows, that what we are looking at here is

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not a matter of insignificance or chance but a deliberate construction intended to integrate an urban fabric spreading outwards in the industrial age. The supergrid carries virtually all traffic at a range higher than the scale of the neighbourhood and joins up neighbourhoods with a clear and specialized infrastructure.

The result is a characteristic structure instantly recognizable and usable as urban fabric working simultaneously at neighbourhood and city scales. I have argued as well that this simple two-level structure is the real origin of the structure we find in the space syntax analysis (Read 2005). Again, I don't believe there is anything accidental about the two scales represented here though their origins may be deeper in our stocks of background presuppositions than other planning norms. 'City' and 'neighbourhood' are scalar norms that condition all of our thinking about cities. In conditions as we find them in the Netherlands, where cities are small and relatively close to one another, it is again no surprise that the normative scale that determines the structure we build into multi-city regions is that of the city, this time in aggregate, with cities providing the foci of infrastructural webs. Cities are constructed therefore to a structure founded in the normative scales of neighbourhood, city and city-region, and their characteristic movement infrastructures are founded in the same scales. When it is said in this way it sounds almost trivial; it is only when we try to understand cities separately from the norms in which they have been constructed – in terms of a universalized space of distances for example – that they start to become complicated. Some will object now that cities come in many forms and that they cannot all fit this pattern. Object-form is not the same as relational form and while there is a lot of variation in the outlines of cities around the world, cities all over the world are constructed in patterns of parts to wholes to bigger wholes – the parts also being neighbourhood wholes. Almost all cities, certainly all historical cities, contain in their make-up the relational forms of the small town, the expanding industrial or administrative city and the expanding and aggregating metropolis. The most interesting structure in space syntax concerns the relationship between neighbourhood and city scales; between integration radius 3 and integration radius n in other words. This has been found by experience to be the structure which tells us most about the ways public space activity is distributed in urban fabrics, and it is my argument here that this is because it captures the way normative parts and wholes at the scales of neighbourhood and city respectively are structured as movement systems and produce in their interaction with one another characteristic patterns of public space activity. The structure of urban movement systems can be found empirically in the plans of cities as a characteristic 'layering' of different scaled systems of roads (neighbourhood high streets and back streets represent the different scales involved in space syntax analysis). Researching the 'interaction' between the 'layers' and the mapping of public space effects that are the results, are what keep many space syntax researchers busy.

6. A 'form' and 'structure' of use and organization of urban fabrics

We come to a form of the city given not in a spatial framework of calculative distances and their frictions but in a constructed layering of different everyday movement practices built into different particular movement systems and infrastructures. Planned movement specialization, standardization and systematization play roles in making these different systems distinct and legible as separate systems,[1] but I propose that their origins and meanings are much more fundamental than this: they are part of the technical apparatus of human action and part of what Gregory Bateson called "mind in the world". We spend a lot of time as urban spatial scientists calculating movement options and routes and measuring frictions of distance – while all the time people are taking the high road (they know already where it goes) or getting on the no. 33 bus (they know where that goes as well) or finding their way to the ring road (the signs will tell them the way to Rotterdam from there). Real movement behaviour has little to do with wayfinding or counting steps or kilometers, and much more to do with plugging into whole movement technologies that have been finely systematized through history to make the particular movement actions we are trying to perform predictably and efficiently possible. I would go further than this and say that the systems are themselves the means by which we come to know our movement options – they are 'cognitive' devices which if they weren't there would remove not just the possibility of travelling to particular places but also the knowledge that such places were there to travel to! It is one small step further to recognizing that movement infrastructures are much more

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than devices for movement, they construct the places we know at whatever scale we are thinking about them: the neighbourhood; the city; the region; the nation state; and as Hadrian, Napoleon and Cecil Rhodes knew all to well, the empire.

In a fundamentally relational space distance may matter but it does not constitute the logic of the arrangement. This logic is of a construction and an assembly of entities strung together in infrastructures which establish their particular functionality and its scale and measure. We begin to know the city and measure our place in it by knowing we are in a relational space either between cities, or between neighbourhoods, or between places in a neighbourhood (Read 2009). These infrastructures, topologically related to one another, are therefore the meaningful 'spaces' of the city and themselves establish the conditions of places and the spatial datum for public space activity and other effects of urban movement like the distribution of commercial activities for example. We tend to see cities as seeping inkblots on a flat blotting pad, distributed around the pad according to logics of proximity and distance. We imagine that the 'explosion' of the city into the periphery is some sort of breakdown of this outward seepage of a space of proximity. This that I have just outlined is a quite different story about different sets of places related to one another in their own webs of infrastructure that themselves construct the logics of their use. The space is topological and the metric is scalar. Logics of growth and centrality are non-linear as each system sets out its own distributions of activities and facilities with the webs themselves acting as datum towards which things orient. What are the places then? Not nodes but thickenings of the webs instigated by connections with other webs at lower scale levels – this is to say that nodes are themselves networks (Read & Bruyns 2007). The first interesting feature of this system of systems is that we find empirically, as Bruyns' research has shown, that different qualities of centrality are given not in any 'agglomeration' to a place of proximity but in the ways differently scaled movement and place systems connect with one another. The second interesting feature is that they define a fully 'cognitive' relational spatial system through which we may know and even measure our place in the world without resort to universalizing logics of distance. It is the technological infrastructures we have constructed around ourselves that are the environment of our knowing and of doing things in the world, and there is no mystery to it: we catch the right bus to get where we want to go, or take a car in the infrastructure system appropriate to the range of travel we want to perform. All these systems are set up and already there; tuned for us in an historical process and we just 'plug into' them in order to do what we want to do. The system of the city is in fact not one system, but a layering of systems deliberately constructed around a normative structure of places. These structures of places: cities; neighbourhoods; inner-neighbourhood places; are each focus for their own webs of movement infrastructure. They each distribute themselves around their own webs of movement infrastructure. To say we have constructed sprawl may not sound like news but the fact is we have systematically constructed sprawl – it is legitimately part of the form of the contemporary city. This is also not to say we cannot do anything about it – it does say however we have to intervene intelligently, and understand the relevant logics if we want to steer things into other 'already there' infrastructures and towards other possible futures.

7. Models of the 'already there'
Our history has delivered a resource which contrary to a lot of contemporary commentary is richer rather than poorer than what we had in the past – this is in any event certainly, in my view, the case in Europe. Our project is to build models of this resource of urban fabric and its latent possibilities that we may exploit to restore, invent and promote ways of city building that enable people by doing what cities have always done – by making configurations of places and infrastructures that have people living in the local while being connected to and productive in the global. Technology is the danger only, as Heidegger suggested, if we let it take its own course. If we don't, but rather turn its potentials creatively to our own human ends, we must understand what potentials exist and build deliberately onto these (see Kusumo & Read 2003). The history of cities is about their deliberate construction in the light of contemporary imperatives, and it is for us to motivate these imperatives and promote ways of building that open enabling futures rather than closing them. As a first step we intend building models of whole urban regions, using what we have learned about the ways urban structure expands human capacities to act, and then using these models to define strategies for intervention.

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Notes

1 In the PhD work of Budiarto and Bruyns.

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