AMSTERDAM AND ITS REGION AS A LAYERING OF SOCIO-TECHNICAL SYSTEMS

AUTHOR: Stephen READ  
Delft University of Technology, Netherlands  
e-mail: s.a.read@tudelft.nl

Jorge GIL  
Delft University of Technology, Netherlands  
e-mail: j.a.lopesgil@tudelft.nl

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Abstract

Space syntax reveals structure in the plans of cities. It misses however an explanation of how this structure arises and what it means. We argue political geographies are structured by the way we have constructed them historically as social organisation, and the means (technique) we have used. These structures depend on a layering of state of the art socio-technical networks constructed at different times in history. These networks internalise their own orders as particular ‘technological rationalities’ which give meaning to the objects subjects and practices they contain. They have also, as an aspect of these rationalities, a strongly normative character, fixing in place geographical entities like neighbourhoods, cities, regions etc. They fix these through the ‘structures of places’ they contain – networks of ‘isotopic’ locations (neighbourhood places; city places; regional places) whose scale and relation with places of other scales is fixed by the network involved and by the part-whole normativities of neighbourhood to city; city to region; etc. relations. This all constitutes a profound level of organisational order, embedded in the real world, that passes under the radar of reductive and ‘theoretical’ thinking. It is not so much pre-conceptual as about the historical and material realm in which geographical concepts and percepts arise. This level of order is what space syntax is in an indirect way finding. It is also a level of order we can use in a far more direct way as a means of modelling our built environment. This paper is an exploratory attempt to reveal the significant elements of this order in the case of Amsterdam, preparatory to modelling them. It begins by reviewing previous work done to show that what space syntax reveals is an effect of the interface of ‘neighbourhood’ and ‘city’ as these were realised technologically in urban infrastructures installed in the industrial era. It goes on to show pre-industrial and post-industrial Amsterdam are forms in their own right and that there are path-dependent processes of transformation between each of these forms. These processes of transformation establish articulations between these different forms, the articulations themselves becoming the vivid centres and the way the different forms (or layers) of the city work together. We conclude that the idea of modelling these human organisational orders embedded in infrastructures so as to reveal the active centres they produce in urban fabric seems plausible.
INTRODUCTION

Space syntax under-consider the developmental aspect of its object, the city. If we consider the city as an all-in-one-moment structure, we will miss the significant ways it is articulated and formed in historical time and in a process of constructive inhabitation. We will miss the ways this articulation delivers complex evolved structures in contemporary urban space. The purpose of this paper is to demonstrate that specific spaces or, as we will call them, ‘infrastructures’, formed at specific historical moments, and to specific historical and technical rationalities, are the basis of urban structures. Places in particular infrastructures are related through those infrastructures and share scales and a factor of similarity or family-resemblance we will call ‘isotopy’.1 Places through which different infrastructures cross tend to be highly central. Here a factor of ‘heterotopy’ characterises the fact that these centres involve a heterogeneity of rationalities coming together in one place. It is in the crossings and articulations of different infrastructures that the structures of active centres space syntax finds in city fabric appear (Read, Lukkassen & Jonauskis 2012).

Infrastructures are networks of interrelated places and the objects aligned on these networks. These places and objects derive their meanings and significances from being aligned together. We place objects and places in networks and connect them up so that they make make sense in relation to one another and in situ. Networks facilitate action by distributing sense and bringing other objects and places which may be out of immediate sight into relation with present objects and places – so that Rotterdam is known in Amsterdam through being included in the same infrastructures. Infrastructures are ‘differentials’ – networks or arrays of objects that distribute their meanings in relation to one another and internally in the network. These meanings are related to human practices which take place in the networks and that the networks are designed to facilitate. We could call these networks of interrelated objects and practices ‘material cultures’. Infrastructures are ‘socio-technical’ (Edwards 2003): they have strong technological and social-organisational characters which include, but are not restricted to, the movement – or more generally communication – technologies which facilitate practical movement and life patterns between the places, and related to the material cultures, concerned. Infrastructures are also ‘spatial cultures’.

So, for example, an airline network will consist of a network of places and arrays of highly organised material and practices. This whole system constitutes a differential into which not just objects but also their meanings are tied. The culture is supported by a particular technological rationality or ‘systematicity’ within which parts make sense in relation to one another and to the whole. The main technology of flight paths and airliners is supported by multiple subsidiary technological and organisational systems of ticketing, customs, customer support, maintenance, etc. Organisation is what hold the whole together, standardisation, procedurisation and bureaucratisation are factors of this internal rationality or ‘systematicity’ and are characteristic of these sorts of socio-technical systems.

There is at the same time a ‘normativity’ to infrastructures in that they conform with and to a large extent constitute, in scales and substance, neighbourhoods, cities, nations, global regions and so on. Infrastructures conserve the structures of these normativities as ‘flat’ networks of equally scaled and ‘isotopic’ places. So places interior to neighbourhoods exist in ‘flat’ relationships with other places interior to neighbourhoods; neighbourhoods exist in ‘flat’ relationships with other neighbourhoods; cities exist in ‘flat’ relationships with other cities; and so on. These ‘place structures’ exist for all practical purposes within infrastructures, as parts of their defining logics. Each of these normativities tend to have particular infrastructures attached to them and supportive of their orders. Multiple of these ‘place structures’ and infrastructures overlap and impose

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1 Isotopy refers to the sort of sensible similarity and difference that is internal to an arrangement of different things. Words in a sentence for example are isotopic: they make sense together and derive their meanings from their relations with one another.
scalar hierarchies on territories. Infrastructures conserve these place structures (of neighbourhood places; city places; regional places; etc) and prevent places from ‘slipping’ between levels. Different scale levels then relate to one another through normative part-whole logics: for example, part-whole relations between ‘neighbourhood’ and ‘city’, or between ‘city’ and ‘region’, which are fixed and embodied in the infrastructures that structure city and region.

This means that infrastructures are much more than networks providing accessibility across flat landscapes; they are the elements that structure and scale our political geographies. The layers of infrastructures introduce a vertical dimension or ‘depth’ to urban and geographical structure which powerfully influences the way places are used and their relative ‘visibilities’ from our positions of immersion within them. For example, places interior to neighbourhoods will tend to be less visible to a person immersed in these structures than neighbourhood centres, will tend to be less visible than city centres, and so on.

What we have shown before in the case of the supergrid in Amsterdam, and what we want to extend in this paper, is the idea that infrastructures don’t just distribute things and places but also, in their articulations with one another, generate active centres (Read 2012). We want to demonstrate how the development of active centres is not a continuous process, or a process of a continuous space, but a product of a historical series of distinct spatial and infrastructure developments – and the articulations of these with infrastructures already in place. The intention in this paper is to demonstrate, using Amsterdam and the spaces built and structures developed there from the sixteenth century to today, firstly an idea that cities are layerings of infrastructures which each locate and distribute material cultures as arrays of interdependent objects, subjects and practices; then to demonstrate how intensely-used places are located by the intersections or articulations between the layers. We will show how these developments are constrained by the normative-logical structures (of the relations of places to other places) that are themselves embedded in the infrastructures, so that processes of development and transformation are powerfully path-dependant and conservative of the structures involved.

Each of these infrastructure developments have accompanied transformations of urban societies, and new societies have been spatially integrated around these infrastructures and their networks of places. These discontinuities and re-articulations conform broadly with breaks in urban development noted by Lefebvre, Mumford and others: those between the pre-industrial and the industrial and the post-industrial cities. What we present here therefore is a first step towards constructing a model founded in the historical emergence of distinct infrastructures and the relations and articulations between them. An inspiration for this work is that of Stuart Kauffman on historical-material processes of biological and ecosystem formation (Kauffman 2000).

**SPACE SYNTAX AND THE ‘SUPERGRID’**

Space syntax is a technique that describes its own method as ‘configurational’. ‘Configuration’ here has a very particular meaning however and relates to the disaggregation of the plans of public open space known as the ‘axial map’ of given cities on which a relational analysis is carried out. One of us has argued previously that this relational analysis will tend to reveal a characteristic structure hidden in the open space grid. This structure serves to define quite distinct scales: those of the neighbourhood and city and is called the ‘supergrid’ (Read 2012).

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2 Rather than the areal entities we draw boundaries around.
The supergrid is a structure found in historically formed urban fabrics of European centres which appears as a larger scaled grid superimposed over the more general street and block grid of the fabric. It exists as joined-up network of main roads that carries the bulk of the traffic in historically formed urban fabrics, and, crucially, virtually all of public transportation. The point in this paper is that it is an historical structure and intentionally constructed as a structure to perform in the way it does. However two more functional, less historical working definitions follow: it is the usually rather well-defined and joined-up grid of streets passing through the fabric of European centres whose intensity of use is considerably or very significantly higher than the other streets local to them; it is the coarser-grained grid of high-streets that pass through the finer-grained grids of back-streets of European centres.

The supergrid becomes very significant in space syntax because, given the set-up of space syntax, the existence of a form which tends to shorten the step-wise distance across the whole axial map will impose a very powerful global-local structural asymmetry on the whole. It is this structure space syntax is revealing and one of us has argued that dealing with the supergrid directly as the source of structure in complex urban grids is a more direct and transparent way of doing space syntax.

A long-running discussion of the role of geometry in space syntax has called for a rapprochement between space syntax and geometry through conventional spatial science (Batty 2010). Bill Hillier’s contribution has been to suggest that there are “pervasive geometric properties” in the fabrics of centres whose role has been to create an urban environment in which relations become predictable and knowable. He pointed to the regular ways line length and angle of intersection are found in fabric geometries and argued that these were generic (Hillier 1999). But what he was referring to, in simpler and more global terms, was the supergrid and the way it relates to the fine-grained street and block grid. The supergrid is central to the structure space syntax reveals, so that our contribution would be to say that the supergrid is the answer to the question of what the geometry of space syntax is. This has implications for ‘space’ and what we call here ‘infrastructures’ are ‘space’ technically realised and may also be called ‘technological spaces’.

While we see the supergrid highlighted consistently in space syntax maps it is difficult to explain how or why such a structure exists without considering the history of its formation and subsequent transformations. The supergrid is a grid-form which, notwithstanding its generic characteristics – related to technology transfer rather than ‘spatial laws’ – is particular to each city and establishes the reality of our experience of ‘city’ and ‘neighbourhood’ by way of the constructed place structures mentioned previously. We argue that these relations are established at a specific moment in time, are historical rather than generic, and are active in the way we understand and use the space of the city. It is only in our sustained experience of these structures and their relations to each other that we have come to understand them as generic. These relations are not so much ‘natural’ as ‘naturalised’, contextual (or better context) rather than abstract or ‘theoretical’. This geometry has established ‘city’ and ‘neighbourhood’ as simultaneously material and meaningful realities by locating city and neighbourhood objects in relations through which the forms of city and neighbourhood become sensible. This has happened at a moment in historical time, so that rather than treating space as a factor framing the working of the urban grid – in particular rather than treating it as a factor of Euclidian geometry and metric distance – we should regard this structure itself as ‘space’. Our alternative contribution to this discussion emphasises therefore the idea that there are specific (concrete and geometric) engineered infrastructures that are themselves the sources of structure and orders of activity in urban space (Read 2012).

We have defined ‘infrastructures’ as “technical networks arranging and especially distributing things and practices that have and draw their significance in relation to one another” (Read 2009). Infrastructures are
more than means to movement; they are whole arrangements of subjects, objects and practices that work together to construct larger entities – like the neighbourhood or the modern city. Infrastructures are intrinsically political in that they are set up to connect selected features of the world in new structural configurations which relate to but transform what existed before.

We have traced the emergence of the supergrid in Amsterdam to a moment in history when new urban and social forms emerged. The social form related to an expanding population of industrial workers and a new modern social contract between citizen and government (van der Woud 2001:194). There was nothing ‘organic’ or even gradual about the urban form that accompanied this: this social ‘infrastructure’ was planned and constructed between 1900 and 1928 and then extended in another phase of development from 1960 to 1980. In both phases the tram and its routing through an expanded supergrid played a key role in structuring the fabric and in joining up the city into a configuration of neighbourhoods serving industrial and commercial cores.

The supergrid was the route of the new public transportation network of the electric tram. This network was just one of a variety of new technical systems that were installed at the time as components of a new

Figure 1. Amsterdam supergrid today, highlighted in red. Determined from historical maps and observations of traffic intensity in situ.
modern industrial city (Hård & Misa 2010). The industrial workers' neighbourhood and the bourgeois commercial centre were modern and technical inventions, as were electric street lighting, water reticulation and sewerage. The industrial worker and the bourgeois were new political subjects in an industrial society (Harvey 2006; Rabinow 1989). We can treat the supergrid as a strategy for fixing a new urban organisation appropriate to this new urban society. The specifications and technical standards for these components were designed in different places all over Europe in the last half of the 19th century and were then implemented often first as private sector commercial undertakings, but later integrated into the public sectors in cities governed along social democratic lines.

The infrastructural, or social-technical components of the new modern industrial city were however never simply means; they were the instruments and equipment to the making and maintaining of whole new social and political forms. They were also the instruments through which the workings of those forms became visible and readable – the meters which displayed the consumption of water, gas or electricity, for example. The supergrid itself was a socio-technical system and a chief technical dimension of a particular material culture (Read 2009). This had a political dimension, related to a planned reconstruction of society,
derived and adapted from examples like that of Louis Napoleon and Haussmann in their social-technical reconstruction of Paris. It defined a characteristic scale and working of the city for a modern industrial era which has also powerfully informed all later transformations of the city, so that it could be seen as the most significant structuring and defining component of the city through the 20th century to today.

Haussmann had approached the city as a technical object to be regulated (Rabinow 1989:77). Priorities were hygiene, circulation and a modern social organisation: this meant wide, straight avenues allowing for direct connections between the significant parts and institutions of the city; it meant also the organisation and distribution of health, education, administration and other facilities, and park space. As well as connecting the more traditional monuments, new railway stations formed main points of articulation for the remodelling. The seven major new stations were linked into the centre and to each other, and an articulation was made between these two new infrastructures which still powerfully shapes the experience of Paris as the centre of the nation – and of the national railway system which was one of the socio-technical means to the reality of ‘nation’ in the first place.

Rabinow argues, referencing Choay, that Louis Napoleon and Haussmann implemented almost no programs aimed at industrialization, workers’ housing, and the suburbs. Spatially, however, he used the new boulevards to establish a new network connecting what he saw (and selected) as the significant components of the new industrialising city. Although this was not yet an explicit social programme, it positively selected, incorporated and integrated in a new urban space the material elements of a new society, and established a transparent space of the use and significance of the new city. It was into this space that “huge complementary universes of bureaucrats and developers funnel[led] unimaginable flows of energy and money” (Koolhaas). Notwithstanding the lack of an explicit social vision, the field had been opened for the emergence in a unified urban space, articulated with national and other spaces, of a new configuration of practice, agency and worldview.

These sorts of modernising spaces are easily seen as technical, but their political dimension is often overlooked. This is given in the way societies are largely constituted in spaces which incorporate objects and subjects (and objectivity and subjectivity) and roles, and enable action in selective ways. David Harvey recognised this in his description of the life of the boulevard and its role in the emergence of the bourgeois and the industrial worker as new ‘political subjects’ (Harvey 2006). Amsterdam was formed in a climate of ideas and new technological opportunities: a transfer of technologies was effected to integrate the elements of the new industrial society around the supergrid (Hârd and Misa 2010). The supergrid founded the realities of workers’ neighbourhood and industrial city and fixed the relations between them. The supergrid operated at the scale of the city and to the speed of the tram, and the elements of the new city were disposed around it. The supergrid was the new space of modern industrial and bourgeois Amsterdam – as the boulevards were in Paris.

The supergrid and tram system have a topological dimension; they establish places in the network and their relations with one another. The tram and its stops became also, in a sense, instruments for reading the place system and its working. In particular they established an order by which neighbourhood places could be related to other neighbourhood places and distinguished from city places which were related to other city places (isotopy (or complementarity) and heterotopy) without any confusion between the two. It is not only the topological network or ‘region’ of neighbourhoods that is stabilised and systematised, it is also the relations between the place of the city and the places of neighbourhoods – the part-whole structure of the city in other words.
The systematicity of these spaces is not a product of ‘natural’ spatial laws but of these historically and technically systematised logics, set up to support material cultures, and defining and transforming relations between relatively autonomous spheres of urban life. Both city and neighbourhood are defined in situ as configurations of city or neighbourhood things. By neighbourhood objects and places we mean those objects and places internal to a neighbourhood which are incorporated through use and activity in the social, economic and political life of the neighbourhood. By city objects and places we mean those objects and places internal to the city which are incorporated in the social, economic and political life of the city. These specifications of things by their ‘internal relations’ means they are defined also by being emplaced in such a way that are ‘handy’ or ‘to-hand’ at respectively city or neighbourhood scales. And then, material cultures are spatially integrated around the objects and places that perform significant roles in that society (Dobres and Hoffman 1994).

The supergrid fixed at the same time an ‘interface’ between neighbourhood and city which was the neighbourhood shopping street as a relational production of the infrastructure. This was produced in the relations maintained in the infrastructure, and derived its necessary conditions from being maintained in these relations. This construction constitutes also the geographical context of action. Action is possible in the same conditions that produce the shopping street; the two processes are entirely complementary. The conditions necessary are those of the consistent sense of the relations maintained between neighbourhood and city places. Action takes place not in a theoretical world and in relation to an absolute geometry and space, but in a technological world that fixes and makes sensible the context for action.

Neighbourhood and city start as autonomous spaces, each defined by the characteristic objects and places these spaces distribute. But then the relations between these two spaces, in the vividness and life they generate at this interface, begin to define the places themselves. The supergrid space may carry facilities oriented to both the neighbourhood and the city and it is in the meeting of different spaces of city and neighbourhood that centralities emerge as linear patterns of shopping streets centring neighbourhoods. These shopping streets are also the routes which people take to other parts of the city: they are the spaces of passing strangers as well as the places centring neighbourhoods; of catching the tram and everyday shopping and conviviality. Though the specific contents of ‘neighbourhood’ and ‘city’ have changed in the hundred or so years since their building, these streets exist in a nexus of relations that sustains a generalised urbanity and contributes sociability, colour and definition to these urban places.

Productivity also implies power as centres and city spaces (supergrids) become better used and more visible, and ‘lifted out of’ neighbourhood spaces. We see new spaces constructed today in electronic space that allow a new capitalist class embedded in a space of electronic capitalism to become ‘lifted out of’ – to ‘secede’ – from the rest of society. These ‘secessionist cultures’ (Spivak 2000) and the technics which support them are not however limited to electronic space but represent only the latest version of a mode of transition that has long operated and is distinctly urban (Read, 2009). The serial imposition of more powerful spaces and the subjects, objects and practices that attach to them are a serial feature of urban history.

New spaces ‘secede’ from what exists before but they also reorient older spaces towards themselves in a relation of service. One of us has described for example how the A4 ‘business belt’ linking Amsterdam, Den Haag and Rotterdam, with Schiphol at its heart, has reorientated the older spaces of Amsterdam, Den Haag and Rotterdam towards itself as these older spaces service the new one, in a sense maintaining it in its power and autonomy (Read & Rocco 2012).
PRE THE INDUSTRIAL CITY

We can see how the establishment of these vivid urban places has a technical dimension, one which stabilises place and its logical relations, and firmly emplaces the urban society which uses these modern spaces and technologies. This raises the question of how places were established before these kinds of modern technologies. In fact, if we ask this question in relation to Amsterdam what we find, pre industrial modernity, is a city comprised of slightly less modern but no less ingenious, and certainly no less technical, technologies.

The 17th century city was a walled enclosure connected to its outside on the land side through gates but for the most part connected to the outside world through its harbour. Roland Barthes has described how goods moved from harbour to warehouses in a ‘water-merchandise complex’ – an ‘infrastructure’ of canals “giving all the nuances of a calm planar mobility, collecting supplies, shifting them without perceptible transition from one exchange to the other, making the entire city into a census of agile goods” (Barthes 1972). On the other side of the harbour was an ‘infrastructure’ of cities isotopic (‘complementary’) with Amsterdam. The urban infrastructure of a ‘water-merchandise complex’ was coupled with the regional infrastructure of a network of trading cities in the harbour, and it was the harbour that was the busiest and most vivid place of the small city.

The distribution of the major facilities was along the canals. There was also a fine-grained network of land-based (technical) movement spaces which partly served the canal network and partly formed another movement system interior to the small city and linked via gates and markets with the outside on the land side.

![Amsterdam canal network 1690](image)

Figure 3. Amsterdam canal network 1690.
There was a considerable work of adjustment at the transition between the preindustrial city and the industrial. Much of this had to do with adjustment of the space of the city within walls to the new city for the most part outside the line of these walls. Lines of movement from the old city had to be lined up with the new supergrid and some canals were filled and converted to ‘boulevards’ with department stores, newspaper offices, banks and other facilities of industrial capitalism. By this time the social and functional character of the city was changing – itself a reason for the transformation – but the historic centre remained the core of the expanding city; the relation of the centre to the neighbourhoods set by the radial topology of the supergrid and tram system originating in the old centre. The adapted city, structured by the supergrid, existed also in a ‘gravitational’ relationship with a new rail network, fixing and consolidating a national space of cities. Central Station was built in the 1880s on the site of the old harbour, so that the orientation of the city on the new rail network and the national space could be achieved with less disruption to the fabric than may have been the case if the station had been sited elsewhere.

We can see that this work was for the most part work of reorienting and rearticulating the old city in relation to new infrastructures and spaces that were being constructed. Where these spaces articulated with the old spaces became sites for development, and especially of objects and places that contributed to the space of the new infrastructures and the new material cultures which they gathered to them. These sites became new central places.

**POST THE INDUSTRIAL CITY**

The transition from the industrial city to the city we know today began in the 1950s and is nearing completion. The train network, newly understood and reorganised as a daily commuting system, has been involved in this as has the freeway network with its twice-daily rush hours and traffic jams (the A10 Amsterdam ring road was completed in the early 1990s). This new city is organised around and oriented to the freeway system. A metropolitan, even national and transnational city has ‘seceded’ from an older pattern of urban centres.

The socio-technical rationalities embedded in these ‘infrastructures’ are only ostensibly of engineered accessibility. The whole is a project of ‘restructuring’ of the city to a metropolitan scale organised to maintain and then expand real-estate value (Harvey 2001). A regional scale and space has been constructed, establishing a perceptual-conceptual space quite distinct from that of the modern city. But most of the significant metropolitan places metropolitan people travel to are articulations with other already established infrastructures. Metropolitan infrastructures are articulated with historical infrastructures creating new potentialities and centralities and reinforcing and transforming existing ones at the hinge points. The old city and its neighbourhoods become reoriented towards a new city centred on the freeway – a city turned inside out in a way so that the prime real estate is not at the core of the industrial city any more but on the edges – on the A10 ring road for example and in a ‘gravitational’ relationship with the airport. ‘Urban regeneration’ on the deprived fringes of the industrial city adopts the strategy of reorienting away from the tram and to the ring road and ‘mixed’ development of different spatial and material cultures who often have little to say to one another (share location without sharing spaces).

The new normative urban entities are the urban region integrated by the freeway and the enclaves attached to it. The old industrial city is far from left out however but is articulated with the new; some old industrial neighbourhoods and the centre become reoriented to and accessed from the ‘outside’ – from the freeway and ring road – others are built with a stated intention of being new traditional neighbourhoods (IJburg) but
are nonetheless (somewhat ostentatiously with a star-architect designed bridge) oriented to the A10. The most vivid and characteristic (and very contemporary) places are (somewhat paradoxically) (some of) the reoriented industrial neighbourhoods and centres. The industrial city has had to be retrofitted, as the preindustrial had before, to accommodate the reorientation. We see again how the growth of a new infrastructure is always and necessarily constrained by and oriented to what was built before, while it at the same time ‘secedes’ from it and develops another ‘level’ of power in relation to it. At the same time it ‘secedes’ from, reorients towards itself, and rearticulates and transforms what was built before.

At the beginning of the 21st century it is the European motorway and rail links, and the airport that frame the still evolving form of Amsterdam. European spaces are being constructed via road and rail and Amsterdam’s place in this cannot be separated from Schiphol airport, through which these spaces are articulated with global networks. Amsterdam’s tourist heart remains tied to the airport by 7 trains per hour while Holland’s business zone stretches itself between the airport and the major cities, settling on the freeway-connected edges of these cities, including especially the west and southern wings of the A10 ring road. The idea of something ‘evolving’ from the top down can be a little difficult to get our heads around, but this is also a character of the evolution of biospheres (Kauffman 2000). What is different in this case is the role of technologies – here creating layers of higher-scaled spaces to which lower-scaled spaces are eventually all oriented.

The knot of the city with its spaces of enablement and encounter has been serially retied; the historic centre remains not as a place of ‘agglomeration’ of accumulated cultural and economic ‘capital’ in a cartographic space, but as an accumulation of infrastructural spaces serially rearticulated in layers and one around which further articulations with new spaces will no doubt be constructed in the future. It is this layering of different technological spaces all with the different technological logics they bring that makes the centre a centre and a vivid place that will always exceed any singular rationality or systematicity.

**MODELLING THE CITY AS A HISTORICAL LAYERING OF FORMS**

What we have just sketched is a short history. It is also a model conceived in terms of infrastructures. The rationale for this model is that structures of vivid and characteristic places (what space syntax is known for finding) are to be found in the joints between infrastructures – between the supergrid and the neighbourhood grid in the industrial city for example, but also between the air-travel infrastructure of global places and the freeway infrastructure of a business and suburban automobility culture – and between the spaces and cultures of the freeway networks and those of the supergrid. This sets up a complex set of articulations which it is nevertheless, in principle, quite straightforward to model. Although the elements of this model are relatively simple, the number of articulations between elements is going to be high. This set of articulations has an historical dimension in that new things are always connected to and articulated from what existed before. This is the ‘path-dependency’ built into the model. We intend to try out this hypothesis notionally. The idea is not to produce a model that outperforms space syntax in doing what space syntax is good at, but this model goes further than a model founded in the supergrid into one which may be able to incorporate also the logics of the freeway and the post-industrial city. We want to produce a model that like space syntax highlights places and their relative intensities, but now for whole regions.

What we also want to do is remove some of the ‘black-box’ mystique from space syntax and explain what space syntax is finding more clearly. We intend to show how the structure space syntax finds is a product of the re-articulations of spaces historically constructed by and ordering and aligning successive urban
societies. What we also point to however is ‘another’ human and urban geography that bypasses absolute spaces and their geometric and cartographic rationalities entirely. It is intended in this way to resuscitate and further develop an original space syntax idea that space is a human construction and a form of order in itself, created for social purposes (Hillier & Hanson 1984:9). Urban cultures are organised in the ‘infrastructures’ we have described here (canal system; tram system; rail system; freeway system). Each infrastructure integrates a particular configuration of practice, agency and worldview in their original forms. But they then serve as points of origin and articulation with later infrastructures. Transformations are rearticulations and reorientations of existing places in new spaces: older forms are transformed in this way while their technical systems are appropriated and reconfigured within new socio-technical configurations.

It is possible to outline the basic shape of the model and what its results may look like by starting off listing the main ‘infrastructures’ (air network; freeway network; rail network; supergrid/tram grid; neighbourhood pedestrian grid. These 5 entities will, we propose, be all it takes to show the logic of the territorial structure we have outlined. Each of these represents a network of places with common history, culture and movement modes. These are places that fit into a logical part-whole structure in some bigger place or region.

Places are defined by these structures and may be alternatively parts in wholes or they are wholes made up of parts. Our experience of these can be very different: Amsterdam as a major stop on the rail network for example (isotopic with other major stops) is different to Amsterdam as a network of tram stops. From a relational-technological perspective Amsterdam is not one thing that all these different definitions from inside the technologies refer to. Rather it is many things, each defined in a specific ‘topo-technology’, which we manage to merge in practice because of the work of organisation already embedded in the technical systems and their articulations with one another. It is this organisation that facilitates a convergence of these different definitions in practice. Hence it is possible to get out of the train at Amsterdam and immediately step onto the tram to travel through Amsterdam. It is at the interface of different technical systems that the ‘articulation’ we spoke about takes place and it is here, we propose, vividness or centrality occurs.

One of the things that makes Amsterdam the vivid and attractive destination it is to the train traveller is precisely this organisational convergence with the Amsterdam of the tram system – and with a number of other technical systems at the same time of course. All of these are organised and aligned with each other to be ‘handy’. It is this ‘handiness’ in action that defines the organisational structure and it is the work of maintenance of this factor we as urbanists are professionally engaged in. This is a different take on movement and communications technology which we often regard as a rather general and abstract ‘force’ acting on, speeding up, compressing or making simultaneous or instantaneous, our modern lives. It is a different take to the ‘space of flows’ which is just a view of speed and instantaneity ‘from the outside’. This model shows how our experience of the world and of reality itself is founded in the way this world has been organised and constructed technologically and historically. We should remember this is a story about Amsterdam. It is not necessarily generic although technology transfer – a factor in any case of the isotopy of these cities as a network – meant there appeared a certain consistency in the organisation of European industrial cities.

We can see in principle how the model works and how it might be used to find and even explain active centres by looking first at the road infrastructures.
1. the street and block grid. This infrastructure distributes neighbourhood things and places – community centres, local shops like tobacconists, newspaper shops, butchers, bakers, grocers etc, local mosques and churches, local cafes etc.

2. the supergrid. This infrastructure distributes city things and places – cinemas, libraries, employment agencies, clusters of specialist shops, furniture shops, kitchen outfitters, flooring shops etc – and neighbourhood centres. However we can also understand traditional neighbourhood centres (high streets) as products of the interface of the infrastructures of neighbourhood grids and supergrids.

3. freeway network. This infrastructure distributes metropolitan things and places – airports, cities, office clusters, business and industrial parks, industry and industrialised agriculture, Vinex neighbourhoods and suburbs, theme parks and recreational areas etc.

What we see then is that high streets on the supergrid act as the 'interface' between neighbourhood and city. Neighbourhood things and places gravitate towards high streets (which are centres of neighbourhoods located on the supergrid). So-called ‘S’ roads act as the 'interface' between supergrid and freeway network so city things and places tend to gravitate towards ‘S’ roads (where they are also available from the A10; these become city subcentres). This is where office clusters and shops like Habitat are for example and many other larger functions like hotels which benefit from being available both from within and from outside the city.

‘Active’ centres locate at the points of articulation between infrastructures. These will be starting points for the construction of the model which will be supported by collections of data to test the results of the model. Some of these articulations include:

1. Global tourist city: served by > air network > rail shuttle > <tourist centre> serviced by < tram < ethnic neighbourhoods (data: souvenir shops).

2. Global business city: served by > air network > freeway network <office space> serviced by < freeway network (white vans) serviced by < tram < ethnic neighbourhoods (data: office space).

3. Regional shopping city: served by > rail network <> (centre) (data: global brand shops).
This also starts to suggest there may be a logic of urban modalities related to these ‘active’ centres – where active centres are connected to their infrastructural ‘regions’ not by a logic of distance-related accessibility but by a logic of modality. These ‘modality centres’ located between ‘regions’ of walking and the tram in the case of neighbourhood centres and of the tram and automobility or rail in the case of city subcentres. These modalities will tend to be ‘locked’, with their infrastructures, in the same normative logics of neighbourhood and city – and in the extra one of the metropole – as we saw before.

CONCLUSION

The geometries of urban form are not given in the geometric space Batty refers to. They are not the “pervasive ... properties” Hillier refers to. Rather the geometries we are looking for are those realised as socio-technical infrastructures which, as human constructions and as networks, incorporate normative logics of places and their relations, internalise these logics in technologies and technological spaces and fix them in cities. The teleologies embedded in all this are not those of spatial laws but of organisational and human logics of things making sense in relation to one another. They are simultaneously of technological logics which are not at odds with human logics but are precisely how human logics are realised. This suggests a different way of understanding the form of the fabric of the (post-industrial European) city: as a technical
and strategic construction which fixes human and urban geographies as a hierarchical and normative arrangement of differently scaled places.

Urban form consists of layers of consistently scaled human and topological networks, which in their relations with differently scaled networks, establish part-whole structures which we normalise and naturalise as elements of urban and geographical order. We have shown previously that what we call the supergrid is one of these networks, that in its relation with a finer grained street network, establishes the normative part-whole structure of neighbourhood-city. It is a form with an historical origin, being of the European industrial city – at least in the form we are discussing here. It is one that when extended to the contemporary post-industrial metropolitan region, as we have begun to show here, will establish another normative part-whole structure of city-region. The historically formed metropolitan or post-industrial city will consist of two sets of these relations – neighbourhood-city and city-region. The vivid central places of infrastructures are the places of the neighbourhood-city and of the city-region; the relations between infrastructures mirror the part-whole relations between neighbourhoods, cities and regions. A new set of vital urban places is being established in the second of these relations whose rationale is different to the set of places established in the first industrial relation. In fact above we have suggested we can extend all this to a fourth global level with another set of (global-regional) places. All of this seems from the above to be plausible and we conclude that the construction of a different space syntax model on this basis is feasible.

Space syntax misses an explanation of how structure arises in cities and what it means. We argue political geographies are structured by the way we have constructed them historically as social organisation, and the means (technique) we have used. These structures depend on a layering of state of the art socio-technical networks constructed at different times in history. These networks internalise their own orders as particular ‘technological rationalities’ which give meaning to the objects subjects and practices they contain. They have also, as an aspect of these rationalities, a strongly normative character, fixing in place geographical entities like neighbourhoods, cities, regions etc. They fix these through the ‘structures of places’ they contain. This all constitutes a profound level of organisational order, embedded in the real world, that passes under the radar of reductive and ‘theoretical’ thinking. It is not so much pre-conceptual as about the historical and material realm in which geographical concepts and percepts arise. This level of order is what space syntax is in an indirect way finding. It is also a level of order we can use in a far more direct way as a means of modelling our built environment.

REFERENCES


