

A Research Odyssey: from Interlocking Network Model to Extraordinary Cities

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Introduction

The interlocking network model for cities is a means of measuring the connections between cities generated by advanced producer service firms facilitating contemporary globalization of economic process. The model was specified as a 'world city network' over a decade ago (Taylor 2001) and has since generated its own mini-literature. In this essay I do not wish to simply describe applications, developments and embellishments of the model but rather take a more dynamic personal approach, to portray it through my research odyssey over the last decade. The model is geographically broad (global) but substantively narrow in scope, necessarily so to achieve its purpose. However, for me, it has led to pastures I never expected to graze. The grazing has been good in the sense that it has led me to ponder the nature of cities as truly extraordinary so that I have been able to chew over some very broad matters indeed (Taylor 2013).

My odyssey has been part of a collective research effort within the framework of the Globalization and World Cities (GaWC) Research Network (www.lboro.ac.uk/gawc). This is reflected in the text below through using the first person style of addressing in an unusual manner: its singular (I) and plural (we) forms are interweaved to distinguish, respectively, the continuous indirect intellectual inputs of colleagues to my thinking from their direct research collaborations. The odyssey is presented in four parts. I begin with what I call an 'elemental geography', the distinction between local and non-local as categories in economic process. The importance of this simple idea is probably the most productive notion I have encountered in the research I report. The second section is devoted to the analytic model and the research paths it has opened; I call it 'specifics' because it deals largely with cities in globalization, the subject the model was devised to help comprehend. This is followed by a third section I term 'generics'. I rehearse the argument that the modelling of contemporary inter-city relations is actually a reasonable representation of how cities have always related to each other. This huge claim is briefly illustrated using examples

far removed from contemporary globalization. Finally I conclude by placing the interlocking network model in a disciplinary and methodological context as a means for looking forward.

Elemental geography

There is an elemental geography at the heart of understanding how humanity has reached the situation where it has the potential to destroy the Earth as a living world. As pointed out by Adam Smith and latterly emphasized by Jane Jacobs, humans use space in a different way from all other animal species. Animals materially reproduce their social organization by drawing on the resources of their local environment; this can be territorial (fixed place) or migratory (moving place) but in all cases there is an accessibility limit to what is procured at any one point in time. Humans also use local resources but uniquely they have developed a second means of social reproduction: procuring from beyond their local environment. This began as inter-group exchange and has evolved into organized trading. Thus human societies are not restricted to their local environment for their reproduction. This has always been very clear from archaeological studies, where non-local artefacts – stone tools from distant specific geological sources – are present in excavations. Archaeologists call this ‘the release from proximity’ (Rodseth et al 1991); although Gamble (2007, 213) notes that material from further than ‘daily foraging range’ usually constitutes less than 1% of an excavation assemblage, it does represent ‘the local rule broken’ and that is the key point. It is not the quantity that matters; a qualitative difference in the manner of reproduction has been broached. Hence there is a critical local/non-local distinction within human social development, a truly elemental geography behind the spectacular success in material reproduction of humanity beyond other natural evolution.

Differentiating local from non-local is implicit to much traditional geographical thinking as, for instance, recognising both site and situation in settlement geography. However contemporary human geography has had to undergo a new ‘relational turn’, partly reacting to a period when non-local effects were

neglected. Certainly a geographical focus on 'place' can lead to such neglect; developments in urban geography as reported by Bassett and Short (1989) represented just such an example (Taylor 2004, 2). This latest relational turn in a spatial sense can be said to have begun with Doreen Massey's (1997) 'progressive sense of place' where she reaffirmed the importance of non-local for understanding place. But we have to go outside geographical studies to understand how the non-local was brought back into inter-urban relations leading to the use of interlocking network analysis: Jacobs' (1969) import shifting growth model and Castells' (1996) spaces of places/spaces of flows distinction are the key sources.

Although their work is very different in provenance and purpose, Jacobs and Castells have both emphasized the role of cities in their respective understandings of social change. Furthermore they share an important perspective on how we should view cities: they both treat cities in the plural as process. For Jacobs, cities exist in groups and it is trade between cities in groups that grows cities. This is how she brings the non-local into her analysis; as she argues, no city ever grew by just trading with its hinterland (i.e. locally). For Castells, he interprets Sassen's (1991) global cities as networked, as hubs and nodes in global spaces of flows, through which places (local) are being transcended in a new informational society. We have brought together these two positions to define 'city-ness' in opposition to 'town-ness' (Taylor et al 2010a). The former is the urban process that encompasses inter-city relations and the latter is the urban process of city-hinterland relations. Thus is Christaller's (1966) central place theory reinterpreted as modelling local urban process to which we have added 'central flow theory', in the form of the interlocking network process, to cover non-local relations. I have subsequently shown how this identification of distinctive urban processes is crucial to understanding the nature of city origins and development (Taylor 2012a, 2013), and to assessing green initiatives (Taylor 2012b, 2013).

Jacobs (1984, 2000) is particularly good on showing why incorporation of the non-local is imperative for understanding economic development. As a process,

development should not be measured by accumulation of signifiers of development (machinery, tractors, industrial plants, factories, offices, dams, etc.) and development does not happen by simple allocation of such items to a place. She dismisses such thinking as merely 'a collection of things for producing', which is not a process of development (Jacobs 1984, 140), designating it later as 'a fallacious "Thing Theory" of development' (Jacobs 2000, 32). A place that is allocated the cutting edge technology will not succeed on this alone; these 'things' will not generate development without being part of a process that constructively incorporates the non-local. The same point is made by Eric Sheppard (2002), coming from a perspective closer to Castells' use of Sassen's global cities. One of the examples he draws upon in his broad discussion of geographical 'positionality' is the 'status' of cities being defined 'by their position within transnational networks' (p. 324). In this he is arguing for the importance of the non-local in constituting cities because the conditions for change depend upon 'direct interactions with distant places' and not just 'local initiative' (p. 319).

There is one very explicit way in which the ideas of Jacobs and Castells diverge. Jacobs' work abounds with both contemporary and historical examples that are intermingled to reinforce her arguments in a very trans-historical manner. In other words she is producing generic knowledge about cities and economic development. In complete contrast, Castells is overtly concerned with the present, which he sees as a new post-industrial historical era. In other words he is producing knowledge that is temporally specific.ⁱ I use this generic/specific distinction to organise my argument in the next two sections. I begin with the contemporary specific because this is where the interlocking network model originated – in the foundation paper (Taylor 2001) both Castells (1996) and Sassen (1991) are cited, but there is no mention of Jacobs (she first appears in my work with the book based on the model (Taylor 2004)).

Specifics: cities in contemporary globalization

I admit my research odyssey got off to a bad start. A paper deriving from a study of London's external relations described a roster of world cities - ordered alpha, beta, gamma - based upon the presences of some leading business service firms (Beaverstock et al 1999). This adopted a classic 'thing theory' approach, assessing a city's importance by its collection of firms rather than relationally through the connections of its firms as in Taylor (2001). Embarrassingly, despite its severe limitations, the 'Thing Theory' paper became very widely cited and continues to be so (e.g. Goerzen et al. 2013).ⁱⁱ However its success has proven to be personally useful in highlighting two rampant deficiencies in the world cities literature (Beaverstock et al 2000). First, there was a severe empirical deficit; very little data was available on cities in globalization (Taylor 1999). Second, the overt empiricism revealed a theoretical deficit in the form of conceptual confusion (Taylor and Lang 2003). The interlocking network model provided a solution to both deficiencies simultaneously (Taylor 2001, Taylor et al 2002).

The literature on cities in globalization can be said to begin in the 1980s with the work of John Friedmann (1986; Friedmann and Wolff 1982). This path-breaking writing was hugely influential for some two decades wherein a 'world city hierarchy' was identified as the prime structure. The key process was a new integration of the local (world city) into the global (world city hierarchy) but the actual specification was a 'Thing Theory', a list of seven criteria. It was with Sassen's (1991) concept of global cities that an urban process is brought specifically into play: global cities are simultaneously markets for, and producers of, advanced producer services. Still adhering to hierarchical structures, she provided a comparative study of three such cities, drawing parallels across their recent developments, but this comparative approach resulted in a relative neglect of their inter-city relations. It was this lacuna that was filled by my specification of a world city network (Taylor 2001). Sassen's identification of advanced producer service firms as the key economic agents provided the route into the interlocking network thinking. This network model's unusual triple-level structure - agents, nodes and network - allowed me to avoid reification of the city as agent since it was firms who were the network makers. Enabling global technologies has meant these service firms can provide their wares in cities

across the world. Thus their large office networks are firms' location strategies connecting cities as global service centres. The network model derives potential work-flows between offices and their aggregation produces measures of the world city network. Ipso facto, we have a conceptually sound and theoretically grounded means to begin understanding inter-city relations in globalization.

One of the tests of a good specification is that it should provide a clear indication of the data required to operationalize the model. In this case the data requirements were straightforward: information on advanced producer firms' networks - which cities they have offices in, and differences in importance of these offices for their business needs. Because their multiple-locations are an important selling point for these firms – both to attract customers (market) and to aid recruitment (future production) – information on worldwide offices is generally forthcoming on their websites. Thus is data collection undemanding, albeit long winded (firm by firm) and requiring sensible evaluation of offices. The end-result is a 'service value matrix' arraying firms against cities in which each cell indicates the importance of a city in a firm's office network so that each column describes the 'global strategy' of a firm and each row describes the 'service mix' of a city. It is this matrix that is the basic input for interlocking network analyses.

The main purpose of developing a model is to open up new avenues of research. In this case a mini-literature of numerous publications has been produced covering seven main themes: applications of different techniques to global service value matrices; disaggregation of inter-city connections; extensions to different agents; extensions to different situations; comparisons with other spaces of flows; temporal comparisons allowing the monitoring of global changes; technical assessments/improvements of the model. Breakdowns of these broad categories with specific references can be found in Derudder and Painreiter's (2013) appendix.

I will make just three points concerning this work. First I am pleased that the actual model is belatedly being subject to constructive critical assessment. Until

recently this process had been largely conspicuous by its absence despite such critique being necessary for the credibility of any model, but especially so for one generating a mini-literature.

Second I have been disappointed that standard techniques of social network analysis have not been more useful. Seemingly an obvious model/technique match, their use has been limited because of the aggregative nature of the model leading to complete graphs with value links. For instance, in one use of network analysis (clique analysis) links had to be reduced to simple presence/absence, thereby losing information from the service values matrix. Further, most social network analysis is designed to deal with incomplete graphs so that 'gaps' and 'paths' (number of links between nodes) are vital properties. But with complete graphs these are not relevant (the cities we are interested in all have at least one service link to London, New York, etc., etc.). Perhaps we have been looking in the wrong direction for borrowing ideas and techniques. In network economics the emphasis is upon growth effects of networks focusing on the potential flows emanating from new nodes joining a network. Each new node is exponential in its effect on growth in contrast to non-network add-ons (e.g. a new factory in a commodity chain), which are merely cumulative in their effect (Shy 2001). This is the difference between adding relations and adding things. There may be another avenue for future research here.

Third I want to finish this section on global specifics by emphasizing the simple notion that underlies the modelling. Very often modelling can become more and more complex and initial basic ideas get lost and forgotten. It is important that this does not happen in this case since the grounding of relations in work practices is what makes findings from world city network analysis both believable and relevant. It is for this reason that I stay with 'network' and do not extend to 'system', as in 'global urban system'. The idea of a system comes with baggage that implies a series of properties I am not convinced exist in inter-city relations such as 'feedback loops' and 'tendencies toward equilibrium'. It derives from an audacious spatial jump in central place theory from its bottom up rural marketing origins (Christaller 1966), to a top down statist model as 'national

urban system' (Berry and Horton 1970, Bourne 1976).ⁱⁱⁱ Treating inter-city relations as a system encourages inward thinking about cities whereas for me cities should never be viewed as a separated set of relations: for instance my interest is how city networks are interposed with state territories (Taylor 2013). The original thought upon which the interlocking network model was built is to simply answer the question: if I walked into the London office of a major advanced producer service firm, what level of service could I expect for my business needs in city X. Obviously I would expect tip top service for my dealings in New York since pretty well all such firms in London also have a New York office to provide the necessary connected service. But what if I needed help with new work in Sydney, or in Lagos, or Turin? Clearly the chances of there being an office in these cities will be less than for New York, and the degree of service offered by offices that did exist in these cities would likely be much less than in New York. The interlocking network model provides a way of answering such inter-city questions quantitatively.

Generics: the nature of cities

That the interlocking network model for cities might have generic relevance for understanding cities is a surprise outcome of this research and led to my designating cities as extraordinary. As previously noted, the model was explicitly based upon Sassen's 'global cities', which in turn were explicitly defined as contemporary urban phenomena. However there were early indications of divergence from Sassen's analysis. Whereas her early ideas on inter-city relations generally followed Friedmann's hierarchical presumption, in the original specification of a world city network I recognised that the new model foregrounded mutuality in inter-city relations (Taylor 2001, 192). Coincidental research on relations between London and Frankfurt importantly reinforced this position (Beaverstock et al 2001). Hierarchies imply competition, which is inimical to network development; networks imply cooperation, which means cities need each other (Taylor 2012c). The latter insight provided an entrée for bringing the city economy ideas of Jane Jacobs (1969, 1984, 2000) into play (Taylor 2004).

Using Jacobs encourages thinking beyond contemporary globalization, and in particular the agency of advanced producer service firms in this period. The latter can be interpreted as a current mechanism for facilitating inter-city trade; prior to globalization there will have been other such mechanisms. Braudel (1982, 1984), for instance, for the period 1400 to 1800 mentions merchant banks, trading houses, dispersed family firms, specialist ethnic diasporas, maritime insurance and other ways of sharing geographical risks as means for facilitating trade. In the nineteenth century many small firms facilitated non-local connections for their cities. For instance, Newcastle upon Tyne was experiencing a Jacobs' 'explosive city growth' episode in the late nineteenth century (Taylor et al 2010b) and Table 1 lists occupation sectors that facilitated the non-local component of this process. This shows over a thousand firms engaging in this work in over 100 different specialisms such as tea agents, chemical brokers, foreign and fancy goods importers, and oyster merchants. Through all these ways, world city network formations^{iv} preceded their current global manifestation. Using population estimates to indicate city economic success, such networks can be traced back at least as far as Mesopotamia in the third millennium BC (Algaze 2005; Taylor 2012a, 2013). Here is one clear example for which there is abundant archival evidence. Larsen (2000) describes a large-scale commercial space of flows operating through an interlocking city network centred on Assur from 1920 to 1800 BC. In fact the evidence comes from Kanesh, an Anatolian city far from Assur, where archives of some 20,000 texts have been found. These archives were 'kept by private commercial firms that had offices at ancient Kanesh, but whose main headquarters were in Assur' (p. 79). The size of transactions is impressive: over a 40-50 year period, it is estimated that 20-25 tons of silver, 100,000 textiles, and 100 tons of tin were traded (p. 81). The latter, added to Anatolian copper, would have been enough to manufacture as many as 1.5 million bronze swords (p. 81). The mechanism for operating this economy was as follows:

'This commerce was in the hands of private family firms whose main offices naturally were in Assur itself. ... the distant markets in Anatolia, some 1,000-1,200 km away, were monitored by agents who spent most of

their time in one of the branch offices that had been established in the vicinity of, or in some cases within the major towns of Anatolia. These agents were sons, brothers, nephews etc. of the head of the family and firm ... Kanesh Port was also the administrative and commercial centre for the merchants operating throughout the Anatolian and north Syrian region.' (p. 81)

This is an interlocking network process not exactly the same as current advanced producer service practices but functionally equivalent for its times. It is through using these types of evidence that I have come to consider the interlocking network model for cities to be a generic process (Taylor 2013).

Of course these ancient world city networks were not operating in a political vacuum; there is a continuous process of rise and fall of empire. The blossoming of a commercial network in which Assur was a key component was in part possible because of the demise of the great empire based upon Mesopotamian Ur. What this indicates is changing patterns of interactions between territorial imperatives and commercial opportunities: in Castells' (1996) terminology a varying relation between spaces of places and spaces of flows. I interpret this in terms of city/state relations, a process essential for understanding city networks at any time (Taylor 2013). This is illustrated as the Assur story continues as follows.

In time, Assur became the capital of a successor empire, that of the Assyrians. This coincided with Phoenician creation of the first Mediterranean-wide world city network. This development has engendered a debate concerning the nature of the inter-city relations leading to network development. One traditional explanation has highlighted competition between cities in the Levantine home area where there were about fifty 'city-states'. But Niemeyer (2000, 103) does not think that such competition was the stimulus for the massive trading that developed. He argues that 'Phoenician expansion and settlement in the Mediterranean should be understood as the outcome of Assyrian oppression, initiated and unleashed simply to serve Assyria's ever-growing demand'. The amounts involved were huge: for instance in one year, 732 BC, Tyre paid the

Assyrian king a total of 4,300 kg of gold! (p. 103). Niemeyer interprets this as follows:

‘But over a long period these tributes were apparently paid in a climate of economic and political symbiosis, which on the one hand gave a certain independence from the great military power of Mesopotamia to the small and comparatively weak border states of the coast, and on the other hand granted Mesopotamia a more or less regular supply of luxury goods, vital raw materials (iron is mentioned explicitly as well) and finally financial means in the form of gold and silver. In other words, the agreement was of mutual benefit, and it is out of well-planned political opportunism and the desire to survive as political communities that the Phoenician city-states had developed into a kind of service society for Assyria.’

This might seem to be a rather one-sided arrangement, but it represents the city/state relation that came to be very common before the rise of modernity. Cities remain creative and networked but are constrained by payments to states as the lesser of the much greater evil that is a military sacking (p. 103).

That cities were able to survive, even to prosper, in such a world is remarkable and points towards an inherent, powerful resilience of cities through their commerce. The very nature of cities is about the building up of economic capital, much of it grounded in the city (physical infrastructures), but also social capital in terms of agglomerations of production work and connectivities of exchange work. It is in this sense that cities constitute unique knowledge-rich milieus. Thus the fundamental economic advantage of cities can be reduced to two externalities: interior cluster externalities and exterior network externalities. Both these ‘non-market dividends’ for commerce in the city are generic to all cities;^v in the case of today’s advanced producer services, it is the same firms that we have studied to describe the world city network that are also part of the formation of financial (e.g. in banking), professional (e.g. in law) and creative (e.g. in advertising) clusters within cities (see Taylor et al 2003 for this process in London). This links back to Sassen’s (1991) initial comparisons of her global cities as both production centres of, and markets for, these business services. But it is to Jacobs (1969, 1984), and later Sassen’s work (e.g. Sassen 1999), that we

have to look to understand their relational geography. In Jacobs' work, the interior and exterior are articulated through local production and non-local production linked together in her import-shifting model of economic growth. It is this elemental local/non-local thinking that has enabled us to identify the interlocking network model for cities as a 'central flow theory' of non-local connections to complement the standard treatment of inter-urban relations, central place theory, as representing local (hinterland) connections (Taylor et al 2010a). Currently this is as far as our formal understanding of generic inter-city relations has reached.

Reflections: from whence and to where?

I conclude with reflections on this research odyssey, which requires a little more personal background. My intellectual identity is as a world-systems analyst, deploying a radical historical approach to social science that privileges long-term large-scale thinking (Wallerstein 1993, 2004). In the 1980s and 1990s I employed this approach to develop a world-systems political geography. In the third edition of the textbook resulting from this work (Taylor 1993), I included world cities for the first time; the book now concluded with the idea that cities were beginning to rival states in the contemporary world-economy. Thus my starting point in this field was city/state relations on which I continued to develop ideas (Taylor 1995, 2000 and 2013). This has meant that I have brought a particular intellectual baggage to the study of the interlocking network model of inter-city relations. Not being an urban geographer but studying cities, not being an economic geographer but studying firms, both left me rather semi-detached from human geography as a discipline. No matter, I take an interdisciplinary view on the knowledge structures we have inherited from the late nineteenth century so as to be partially insulated from the straightjackets of discipline fashions and agendas.^{vi}

This positionality is important when relating to criticisms. For instance, studying macro-social change leaves me generally vulnerable to post-structural and related 'post-' critiques of both large-scale quantitative modelling and grand

narratives.^{vii} In practice this has generated concerns that global applications of the interlocking network model are coincidentally too broad and too narrow. In the former case it is suggested that a 'western model' of the city is being imposed on cities from other world regions and thereby distorting our understanding of 'non-Western' cities. This is a variant of the more general argument that rejects the idea of globalization as a homogenizing force across the world. I agree with the latter position: my view is that all cities are affected by globalization (there is no such entity as a 'non-global city') but that this does not create homogeneity because there is a geography to globalization reflecting variations in degrees of influence on cities that themselves have very different provenances. The inter-city process that the interlocking model describes is simply one process among a cacophony of processes, local and non-local, that constitute cities across the world. The importance of this global process will vary amongst cities: for instance, it is more important in New York and Johannesburg compared to Cleveland and Maputo, which is what the interlocking model attempts to measure. It is not saying that Maputo is like New York or Cleveland is like Johannesburg but it is saying that this inter-city commercial process can be found in all four cities. In other words, we are not defining a 'type' of city; we are measuring a process.

It can be argued that the model is too narrow because it focuses upon just one particular sector of firms, those providing advanced producer services. As indicated earlier, the choice of this sector is taken from Sassen's (1991) specification of her 'global city' process. The provision of professional, creative and financial services to businesses is a cutting-edge industry of our times, combining sophisticated ICT with specialized knowledges to manage the political division of the world. At one level these firms are enabling global corporations to operate as if there really was a borderless world (e.g. law firms making multi-state contracts conform to either New York state law or English common law), at the same time as enabling them to take advantage of borders for optimal geographical distribution of profits (e.g. accountancy firms advising on tax havens). Put simply, these business service firms working through multiple knowledge-rich cities are essential to the operation of contemporary

globalization. Although not the largest of firms in global terms, nevertheless, advanced producer services are an 'indicator sector' in the complex ecology that is the global economy. Just like indicator species in nature demonstrate the wellbeing or otherwise of an ecology, this indicator sector shows the same for today's worldwide economic process. In other words, we are not describing economic globalization as a whole; we are focusing on the strategic places in its organization.

My interdisciplinary approach is also important for the posture of cities within the study of macro-social change. Release from state-centric social science allows consideration of cities as input – the prime process through which our world is produced and reproduced – rather than merely a particular output, a result of more general (national) social processes.^{viii} Thus when I refer to 'extraordinary cities' I am not designating an elite group of major cities; rather I follow Jacobs (1969) in considering all cities to be extraordinary. They are a unique form of settlement that has enabled human creativity to blossom from the first cities and their civilizations onwards (Taylor 2013). In particular, I argue that these dense connected concentrations of humanity have generated economic development over several millennia. Thus in this argument the current economic successes of major cities is not a consequence of the global economy, rather contemporary economic globalization, with its neo-liberal world of ever-increasing inequalities, is the latest outcome of extraordinary cities. Therefore from a radical political position cities are a critical part of the problem that is our unequal and unsustainable world as both Frank (1969) and Jacobs (1984) have taught us.

But what goes on in cities is not set in stone; cities are like mega-tools that have facilitated different worlds in the past and can do so again in the future. In fact, since most of humanity now live in cities, this can be interpreted positively in relation to projected travails of the twenty first century. I consider extraordinary cities to be the current antidote to neo-Malthusian determinism: it is not the simple demography of the oft-quoted ten billion people that is important (Emmott 2013) but their settlement geography in cities. In other words if there is to be a successful resolution of the threat to the Earth as the home of humanity

it will derived in and through cities. And so I return to the elemental geography with which I began this essay. Current architectural concern for developing urban places as 'green cities' is a very partial and essentially local approach to global sustainability. A future settlement geography of green cities scattered across the landscape misses out the cosmopolitan nature of cities behind human creativity, something that will be needed more than ever in decades to come. Keeping cities extraordinary, but not to their current ends, requires maintaining the non-local dynamic: in the spirit of the interlocking network model, I envisage integrated and vibrant green networks of cities. Expediting what this can mean is my current research focus.

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Facilitating non-local connections, Newcastle city-region in 1883

| Sector | Number of firms | Number of specialisms |
|-------------------------|------------------------|------------------------------|
| Agents | 256 | 28 |
| Brokers | 187 | 12 |
| Commercial traveller | 149 | 1 |
| Importers | 11 | 5 |
| Merchants | 570 | 66 |
| Total | 1173 | 112 |

Source: derived from the 1883 edition of *Kelly's Directory of Newcastle, Gateshead, Sunderland, North and South Shields and Suburbs*

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- ⁱ In subsequent generalization of Castells' social space concepts beyond the present I am following Giovanni Arrighi (1994, 84).
- ⁱⁱ This is despite the fact that the paper was explicitly preliminary in its purpose; it admitted to being an Adansonian taxonomy, a simple multivariate inductive method for initial ordering of data (Sokal and Sneath 1968).
- ⁱⁱⁱ In fact, Christaller (1966) did model local hinterlands hierarchically so that they became larger and larger culminating in a transnational scale hinterland in his empirical demonstration. But this is very different from a national city system delimited by sovereign state boundaries – see Taylor et al (2010a).
- ^{iv} These networks are described as 'world' not in the sense of worldwide (i.e. global) but in the world-systems sense of encompassing a distinct social entity such as the classical 'Roman world' or the pre-conquest 'Inca world'.
- ^v I originally drew of Hicks' (1969) externality concepts that are temporally specific. In his traditional Marxist format they are applied only to the 'commercial stage' (i.e the immediate 'pre-industrial' period) of economic development; I generalise them as generically commercial.
- ^{vi} Our social science disciplines are state-centric products of specific conditions a century or so ago and are becoming less and less relevant in our more global times. Instead of partial solutions such as inter-, multi-, or even trans-disciplinary approaches, I prefer to think in interdisciplinary ways – see Taylor (2013, 22-4).
- ^{vii} Generally the most trenchant critic has been Robinson (2002, 2005) and specifically Smith (2013), in a curiously dated argument, has been most dismissive of the model.
- ^{viii} In this way I differ fundamentally from how urbanization and cities appear in David Harvey's work, for instance as counter-cyclical economic tools (1982) or political arenas (2012). Of course we do not want to get into 'chicken or egg' arguments here, rather it is interesting how different starting points can produce different knowledges.