The world according to iTunes: mapping urban networks of music production

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Abstract *In this article, I present a social network analysis that explores and maps relational urban networks of production within the global recorded music industry. Within the analysis, recorded music albums are viewed as temporary market-based projects that bring together teams of skilled creative workers in recording studios across the globe. New tools and techniques for networking studios in geographically distant locations give mobile musically creative workers the ability to coordinate musical recordings on a global scale, resulting in new relational geographies of music production. An innovative approach is taken to the social network analysis to assess the connectedness of cities and determine the centrality and power of cities within networks of production for three major Anglophone digital music markets. The result is a mapping of the relational urban networks of music production as indicated through the interdependencies between projects, studios and local urban agglomerations.*

Keywords GLOBAL CITY, URBAN NETWORKS, MARKET-BASED PROJECTS, SOCIAL NETWORK ANALYSIS, MUSIC INDUSTRY, RECORDING STUDIOS, ITUNES

Considered as the elementary units of collective commercial agency, in economic geography firms have been largely unproblematized as unitary and coherent actors (Maskell 2001; Taylor and Asheim 2001; Yeung 2003). As Grabher (2004) suggests, economic geography research at the meso-level on networks has largely been focused at an inter-organizational level. This has particularly been the case in much of the research being undertaken on world city networks, which has to date largely focused on the role of advanced producer services firms and their transnational office networks (see Sassen 2000, 2001; Taylor 2004). It is typical of much world cities research that overlapping social networks, and the individual actors who constitute them, are uncritically subsumed into inter-firm networks. Ettlinger (2003) argues that this top–down strategy excludes the people involved in the daily practices of work, and leads to an 'ecological fallacy' whereby it is presumed that what holds for firms in networks also holds for individual actors. For Grabher (2002a), organizational practices built around projects involving a multiplicity of organizational and personal

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networks are increasingly undercutting the integrity of the firm as the basic analytical unit. For Yeung (2005a), there is a need for a relational conception of the firm as social networks in which actors are embedded in ongoing power relations and discursive processes and, as such, mapping the power geometries of the firm entails significant analytical attention to the relational power of social actors and their territorial organization. These arguments have important implications for research into the formation of the urban networks of world cities. It is now widely accepted that cities do not have power in themselves, but rather find it in the urban networks in which they are embedded. Recent research on relational geographies and on project working highlights that there are actors of network formation other than firms that need to be considered – agents that are crucial for cities to achieve 'global reach'. For cities to project their power over distance, the successful enrolment of these actors in networks is crucial (Smith 2007). From a relational perspective, it is social actors, rather than the firm as an abstract entity, that become the key analytical focus (Yeung 2005a).

Social network analysis provides a set of tools that can be employed to assess empirically the centrality and power of cities, through the analysis of social actors and their networks. In this article, I employ social network analysis to undertake an examination of urban networks based on the social connections occurring through project work, namely relational data linking cities with other cities rather than on attributional data for specific cities. I am concerned with the production of music, which provides a particularly revealing focus for research due to the ways in which its production is caught up in multiple layers of networks (Connell and Gibson 2003) involving a wide range of actors, particularly given the rise of new internet technologies enabling enhanced networking over geographical space. Specifically, I examine the working flows that occur between recording studios, based in cities across the globe, when they are part of temporary creative projects that are brought together to produce recorded music albums. The result is a mapping of the power and centrality of cities within the relational urban networks of music production.

To begin, I consider the production of musical recordings as market-based temporary project work, with a specific focus on key skilled actors, their personal and professional networks, and the crucial role played by technology in facilitating networking over distance. Following on from this, I examine the ways in which power in relational networks has been conceptualized, with specific reference to world cities research, and how power can be measured through social network analysis methodologies. Following a brief discussion of data collection, I then describe the results of a social network analysis that attempts to define and map the urban networks formed through creative project working in the recorded music industry. It assesses the level of connectedness of cities, and employs a number of measures to determine the power and centrality of cities within networks of production for digital music markets.

Project work in the recorded music industry

For Yeung (2003: 451), the 'firm' is a 'messy constellation of multiple identities, contestation of power, and shifting representations', and as such, monolithic 'black

box' conceptions of this crucial analytical category need to be revised. He argues that there is a need for a relational conception of the firm as social networks in which actors are embedded in ongoing power relations and discursive processes. A relational perspective on economic geography explicitly draws attention to the importance of economic actors and to how they act and interact in space (Bathelt and Glückler 2003). Thus, from a relational perspective, it is social actors, rather than the firm as an abstract entity, that become the key analytical focus (Yeung 2005a). For Yeung (2003), actor networks, ranging from personal/social networks to inter-firm business networks, are an important focus for research in new economic geographies because these heterogeneous associations and relations among actors constitute all kinds of networks. Further, Dicken et al. (2001) argue that for human intentionality to take effect it must be mediated through such heterogeneous actor networks, which are spatially and temporally constructed. Projects represent particular forms of temporal and spatial actor-networks. Projects can be defined as systems of production that are constituted by a variety of different economic, social and cultural agents, often with specialized and complementary competencies collaborating over a predetermined period in order to complete a pre-specified and usually complex task (Lundin and Söderholm 1995). The complexity of the task necessitates the coordination of multi-disciplinary skills that are not economically efficient to bring together on a permanent basis (Lorenzen and Frederiksen 2005). Such temporary project systems are not a new phenomenon, having always been present in certain industries (Asheim 2002), although the development of innovative new technologies now allow even more flexible arrangements for project-based working (see Christopherson 2002).

Lorenzen and Frederiksen (2005) suggest that, in the music industry, product innovation is organized into projects to facilitate experimentation and product variety to deal with demand contingencies arising from ambiguous and changing consumer tastes. They demonstrate that projects are carried out mainly in the market, rather than inside the boundaries of firms, in order for projects to include new and shifting resources and skills, skill holder motivations and deal with tasks that render internal governance and planning inefficient. Whereas much of the literature on projects has focused on 'project teams', in which skilled actors are employed within the same firm, in 'market-based' projects participating skill holders are employed in different firms or may be freelancers, transcending the boundaries of firms (Lorenzen and Frederickson 2005). As DeFillippi and Arthur (1998) assert, fluid project working challenges the idea of core competencies existing as internal resources, and the knowledge base required to produce a recorded musical product is largely external to the record company, and often is not internal to the industry (see, for example, Power and Jansson 2004). To produce successful products on increasingly global markets, record companies must be able to draw on relevant knowledge bases for the relevant part of the value chain in production (Asheim 2002), and draw essential competencies into the firm as individual projects require, including freelance labour. As the record-ing industry cannot ultimately control what is going to be commercially successful, larger firms often have attempted to monopolize access to the best recording facilities and most talented engineers and producers (Negus 1992). Musical recording in the

late 1960s was recentralized in cities and strongly reconnected to the music industry. This was because the new technology demanded considerable investments in studios and skilled personnel that only major record companies could afford (Watson et al. 2009). As Gibson (2005) notes, the best technology was rare, and usually found in cities with thriving music scenes, at studios such as the EMI Abbey Road studios in London and Capitol Studios in Los Angeles. Such studios typically employed permanent staff. However, since the 1970s, new sound recording technologies have broken monopolies (Jones 2002), brought about democratization of the recording process, and undermined the position of many recording studios (see Leyshon 2009). Patterns of project work in music production have become more flexible, and we have seen the comparatively recent development of a freelance project-based model for recording. Studios now largely act as an independent service within the contemporary recorded music industry, with many owned and operated by entrepreneurial producers and engineers (Watson et al. 2009). This has had important repercussions for project work in the music industry by increasing the number of studios and number of skilled studio workers available to firms and musicians.

Musical recordings are essentially 'one-off' projects that bring together, temporarily in space and time, a group of skilled creative workers to undertake a project with a definite end product. However, as personal networks are built, further projects may be undertaken involving recurrent collaboration, with new projects tending to draw on core members of successful prior projects. As projects are repeated over time, project *ecologies* may emerge, involving a range of different firms and organizations, individual actors, technologies, spaces and places (Grabher 2002a, 2002b). These ecologies will form the backdrop to every subsequent project initiated, for new projects find their participants in the ecology (Lorenzen and Frederiksen 2005). Grabher (2002b, 2002c) emphasizes that the reputations members gain, or lose, in previous collaborations hold together, or indeed cut off, such chains of repeated cooperation. Individual knowledge embodied in highly mobile project members dominates activities in temporary projects. As these embodied creative knowledges are for sale on the labour market, any competitor can potentially draw on competencies that have developed (see Lam 2000). Individual skills are transferred between projects as project members typically collaborate simultaneously with a wide range of firms. Networking is then the emblematic practice in projects (Wittel 2001). However, as well as professional networks and communities of practice revolving around firms, projects also involve personal networks that 'symptomatically efface the distinction between private and business' (Grabher 2004: 105). In project-based working, it is often personal networks, rather than formal firm contractual networks, that provide the basic social infrastructure for putting together a project team. Previous research on the music industry has highlighted the importance of geographical proximity and face-to-face interaction in the development of personal and social networks and relationships in the music industry, the dynamics of which are built around an informality that blurs the business–social divide (Watson 2008) and transgresses the boundaries of the firm. As such, spatial agglomerations function as potent frameworks of cultural reproduction (Scott 1999). It is important, however, to note

that these milieux are not geographically constrained. For Asheim (2002), the increasing importance of temporary project working can challenge the continued importance of localized learning. Personal and professional creative networks are increasingly spanning the globe, resulting in geographically far-flung project collaborations (see for example, Cole 2008). In the case of the music industry, new technologies that network studios in geographically distant locations enable musical recording projects to be coordinated on a global scale and so allow them to draw on pools of creative labour in geographically dispersed locations. Musical recording projects therefore often span and connect multiple cluster-based ecologies and, as such, I provide here a geographically wider frame of analysis than those studies focusing on a single ecology in a particular place (for example, Grabher 2002a on the advertising industry in London).

Conceptualizing and measuring power in urban networks: social network analysis methodology

Dicken et al. (2001) and Yeung (2005a) suggest that a central component of a relational analysis is recognition of the existence of differential power relations within actor networks. Powerful and active actors play a key role in driving networks and making things happen. Their ability to do so is dependent on their control of key physical, political, economic, social and technological resources. However, while the control of resources is necessary in order to have power, it is an insufficient condition for the ascription of power to an actor (Dicken et al. 2001; Yeung 2005b). For Yeung (2005b), power is the relational effect of the capacity to influence and the exercise of this capacity through actor-specific practice. Power can therefore be defined in terms of both position and practice within networks, a relational and emergent concept manifested through practice. Some actors within networks derive their capacity to influence from structural positions, whereas others may experience power through relational practice with power emergent through practice rather than being dependent on position. In world cities research, the power of particular cities within world city networks has been defined in both terms. From a structural position perspective, city power has been conceptualized in terms of power as a *capacity* for domination (Allen 1997), based on a stock of resources that can be used instrumentally as power over other cities (Friedmann 1978). From a practice perspective, power has been conceptualized as a *medium* (Allen 1997) with a city occupying a strategic position in the world city network based not on capacity but on its interrelations with other cities. The essence of this 'networked' understanding is power *to* rather than power *over*, with every city in an urban network occupying an incipient position of power (see Taylor et al. 2002). World cities are understood not simply as places, but as *processes*, hubs through which flows are articulated with power residing in the flows themselves (Castells 1996). The understanding of power developed in this article is based on this networked conception. However, whereas much of the research undertaken on world city networks largely focused on the role of advanced producer services firms and their transnational office networks, the analysis I present here

focuses on the social connections and actor networks of project working within the recorded music industry.

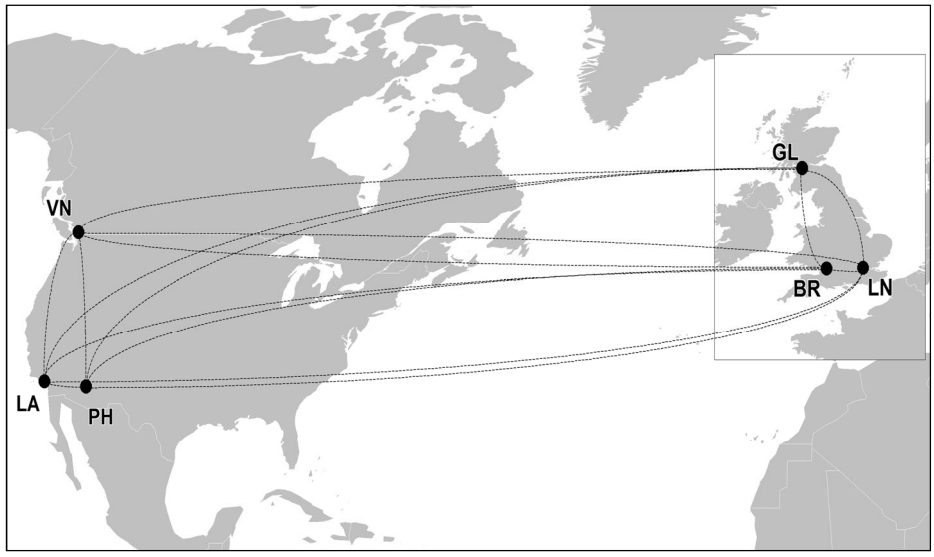
In this analysis, I employ two different measures to assess the power of cities in urban networks. The first is Bonacich's power-based centrality measure (see Hanneman and Riddle 2005). In applying this measure to urban networks, centrality and power in the network is a function of the connections of the cities to which a particular city is connected. The more connected the cities to which a particular city is connected, the more central the city. The less connected the cities to which a particular city is connected, the more powerful the city, and the less connected cities will be more dependent on it. The second measure used is flow betweenness. This measure is based on the proportion of the entire flow between two actors, through all of the pathways connecting them, which occurs on paths of which a given actor is a part. The measure adds up how involved the actor is in all the flows between all other pairs of actors, as a ratio of the total flow betweenness that does not involve the actor (Hanneman and Riddle 2005). Betweenness centrality is an important indicator of control of information exchange and resource flows within a network (Knoke and Yang 2008), as the measure ascertains the extent to which an agent can play the part of a 'gatekeeper' with a potential for control over others (Scott 1991). Although they may not necessarily have the most connections to other cities, cities with a high degree of flow betweenness centrality are considered the most important *mediators* in the urban network. Because of the position they occupy in the network, these cities are better situated than other cities (Alderson and Beckfield 2004) due to their own and their neighbours' network connections. A core–periphery analysis is also undertaken on the valued data matrices to identify those cities belonging to the core of the network and those that belong to the periphery. The social network analysis presented in this article was undertaken using the UCINET software (Borgatti et al. 2002). The network visualizations provided are derived through the embedded NetDraw visualization tool.

Data collection

The projects on which the analysis focuses are recorded popular music albums, defined as a group of audio tracks with a generally consistent track list across the different territories in which it is released. Each album is its own temporary project, consisting not only of firms (record companies), but also localities – recording studios in particular cities, and the professional and personal networks of the musicians and studio producers and engineers – 'creative labour'. Within these projects, elements of creative labour may be fixed in particular studios, with recordings being transferred digitally, or this labour may be mobile between studios in different cities. These movements, of both labour and recordings, are the connections that form urban networks of musical production within the recorded music industry. Thus, in collecting data for the social network analysis described in the following section of the article, an event-based strategy has been employed in which network boundaries are drawn by including actors who participate in a defined set of activities occurring in specific

times and places (see Knoke and Yang 2008). Each of these events, in this case temporary music industry projects (albums), has its own distinct production network, varyingly dispersed in terms of its geography. An example of a geographically dispersed network is shown in Figure 1, for the album 'Tonight' by Franz Ferdinand, released on Domino Records/Epic Records in January 2009. The network of recording for this particular album is dispersed across six studios in six cities, including cities in the UK (London, Bristol, Glasgow), the USA (Los Angeles, Phoenix) and Canada (Vancouver). By including multiple events (albums) in the network analysis, it is possible to produce a comprehensive and inclusive network, in which many distinct networks overlap with one another.

Figure 1: Example album project network: Franz Ferdinand 'Tonight' (Domino Records/Epic Records, 2009)



City codes: BR – Bristol; GL – Glasgow; LA – Los Angeles; LN – London; PH – Phoenix; VN – Vancouver.

Databases of recording information for albums, consisting of information the recording studios used and the creative labour involved in the recording, were constructed from the details given in the credits of albums appearing in the top ten iTunes download charts, for the UK and US digital music markets, during the first six months of 2009. Notwithstanding the 'crisis' in the music industry that has resulted from the introduction of digital software formats (see Leyshon 2001, 2003, 2009; Leyshon et al. 2005; also Hughes and Lang 2003), the digital music market is forming an increasingly important part of the global music market. In January 2009, digital platforms accounted for around 20 per cent of global recorded music sales, with the digital revenues of international music companies growing by an estimated 25 per cent in 2008 to $3.7 billion (IFPI 2009). I chose iTunes sales charts for

analysis because iTunes is the leading player in the online downloads market, and it became the largest music retailer in the USA in 2008. Its top-ten music sales charts are published online and are continuously and automatically updated, and are available for most of the major national digital music markets. This allows comparisons to be made between a range of national digital music markets. In this article, I make comparisons between the UK, US and Australian digital music markets. I selected these three Anglophone markets for analysis primarily because of the availability of the required data in English. An exploratory data collection exercise for a number of non-Anglophone markets, including Japan, revealed such significant difficulties in obtaining the required data that a full and comprehensive analysis would have been impossible for these markets within the limits of the research.

For reasons of practicality, I did not constantly follow the continuous updates to the charts, but analysed them on a weekly basis. I sampled data between 1 January and 31 June 2009 and only included in the sample full albums released at this time and up to one year before, plus newly released material. EPs (releases containing a smaller number of tracks than a full album), compilations, 'greatest hits' compilations, and albums originally released more than one year before the sampling date, were excluded. The final databases contain data on 53 albums from the UK download charts, 52 albums from the US download charts, and 39 albums from the Australian download charts respectively. The data are coded as non-directional, that is to say there is no distinction made between 'senders' and 'receivers' in relationships; rather, they are considered to involve mutual exchange. The data produce three symmetrical and valued matrices, one for UK networks of production, one for US networks of production, and one for Australian networks of production with the matrices linking 36, 43 and 29 cities across the globe respectively. Inevitably, a significant amount of overlap occurs between the three databases.

Urban networks of musical production

Table 1 ranks the top five cities based on the release of albums into the UK digital music market. The figures given are based on the number of albums for which studios in the city were involved in the recording 'project' expressed as a percentage of the total number of albums captured from chart data. Based on this, London is shown to be the pre-eminent centre for the output of sales-successful recorded music into the UK digital music market. Studios based in the city were involved in the recording projects for over 50 per cent of all the albums captured in the data. Los Angeles and New York, with 38 and 36 per cent respectively, trail behind London but are far ahead of a second tier of smaller UK, European and US cities. Many other cities with individually smaller levels of output make up a third tier of production. These figures clearly highlight the dominance of the global city triad of London, New York and Los Angeles in terms of sales-successful output for the UK digital music market.

Table 2 ranks the top five cities based on output of albums into the US digital

music market. In the US digital music market, Los Angeles appears as the pre-eminent centre for the output of sales-successful music, with its studios involved in the recording of almost 60 per cent of all the albums captured in the data. New York, with its studios involved in 46 per cent of the albums sampled, follows it closely. Contrasting with the case of the UK digital music market, London is significantly behind both Los Angeles and New York in terms of sales-successful output into the US digital music market, accounting for 25 per cent of the albums sampled. These cities are followed in the top five cities by two more US cities, Nashville and Portland (Maine), accounting for 10 per cent and 8 per cent, respectively.

Table 1: Top cities ranked by output of albums – UK digital music market

Rank	City	Albums output from the city (% of total number of albums)
1	London	52
2	Los Angeles	38
3	New York	36
4	Cardiff	7
5	Bristol	5
~	Glasgow	5
~	Portland (Maine)	5
~	Miami	5
~	Dublin	5
~	Stockholm	5

Note: A single album can be considered as output from more than one city where the album is produced within a creative project network of cities.

Table 2: Top cities ranked by output of albums – US digital music market

Rank	City	Albums output from the city (% of total number of albums)
1	Los Angeles	58
2	New York	46
3	London	25
4	Nashville	10
5	Portland (Maine)	8

Note: A single album can be considered as output from more than one city where the album is produced within a creative project network of cities.

Table 3 provides the same rankings for the Australian digital music market. In this case, New York and London are pre-eminent, with studios in both cities involved in over 40 per cent of all the albums captured in the data respectively. Los Angeles, whose studios are involved in 38 per cent of the albums sampled, follows closely. The Australian city of Melbourne follows next. Accounting for 13 per cent all the albums captured in the data, it is well behind the global city triad, but ahead of another Australian city, Sydney, which accounts for 8 per cent of all albums. These data for the US and Australian markets thus highlight the dominance of the global city triad of London, New York and Los Angeles.

Table 3: Top cities ranked by output of albums – Australian digital music market

Rank	City	Albums output from the city (% of total number of albums)
1	London	41
~	New York	41
3	Los Angeles	38
4	Melbourne	13
5	Sydney	8
~	Portland (Maine)	8

Note: A single album can be considered as output from more than one city where the album is produced within a creative project network of cities.

Connectivity in urban networks

While these output data usefully provide a hierarchy of cities based on levels of production, they tell us nothing about networks of production *between* cities. The data gathered on connectivity, based on the links between cities occurring as part of creative projects, are more informative regarding the configuration of urban networks of musical production. The data for connectivity for networks of production for the UK digital music market further highlight the dominance of the triad of London, New York and Los Angeles. Table 4 ranks the top cities according to their total number of connections to other cities. London, New York and Los Angeles dominate the rankings as the three most connected cities, with around three times the number of connections as the city in fourth place, Bristol. All three cities have their highest connectivity with each other, and all the other cities have their highest connectivity with one or more of these three cities. The strongest link between individual cities is between New York and Los Angeles, very closely followed by the connection between London and Los Angeles. The remainder of the list consists of other smaller UK, US and European cities. Figure 2 provides a visual representation of the urban networks these connections form. The visualization displays the triad of London, New York and Los Angeles lying at the centre of the network, surrounded by a web of less connected

cities whose role as music recording centres is articulated through the three highly connected global cities.

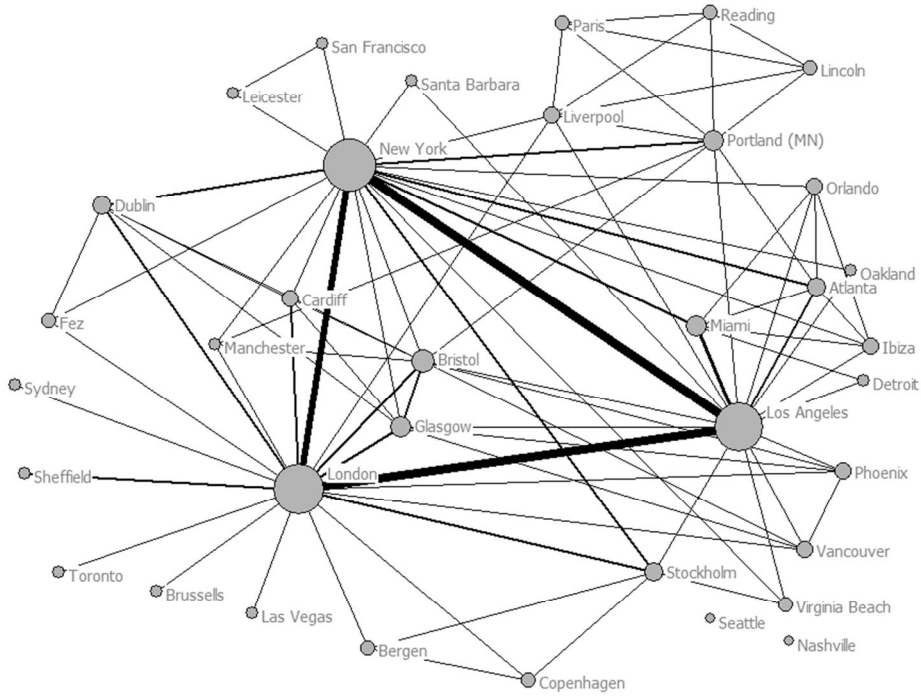
Table 5 ranks the top cities within the urban networks of production for the US digital music market, based on their total number of connections to other cities. The US global city dyad of New York and Los Angeles dominates the rankings of the most connected cities. Both cities have over twice the number of connections of the city in third place, London. The two cities have an extremely strong level of connection to each other compared with the strength of their links with other cities, having around four times more connections with each other than they have with London.

Table 4: Top cities ranked by total number of connections; UK digital music market

Rank	City	Total connections	Highest connectivity
1	New York	38	9 (Los Angeles) 6 (London)
2	London	37	8 (Los Angeles) 6 (New York)
3	Los Angeles	35	9 (New York) 8 (London)
4	Bristol	12	2 (London, Glasgow)
5	Glasgow	10	2 (London, Bristol)
~	Portland (Maine)	10	2 (New York)
7	Miami	9	3 (Los Angeles) 2 (New York)
8	Atlanta	8	2 (New York, Los Angeles)
~	Dublin	8	2 (New York, London)
~	Stockholm	8	2 (New York, London)

Figure 3 provides a visual representation of the urban networks these connections form. The visualization displays the dyad of New York and Los Angeles lying at the centre of the network of production. By contrast with the network for the UK digital market shown in Figure 2, London does not match these two cities in terms of importance at the centre of the network. Table 6 ranks the top cities within the urban networks of production for the Australian digital music market. Mirroring the case for the UK market, the triad of London, New York and Los Angeles dominates the rankings, with New York marginally ahead of the other two cities. The highest ranked Australian city, Melbourne, has only a fraction of the number of connections of the triad. Figure 4 provides a visual representation of the urban networks formed by these connections. The network diagram displays a very similar configuration as that of the UK digital music market (Figure 2), with the triad of London, New York and Los Angeles lying at the centre of the network.

Figure 2: Global urban networks of recording, UK digital music market

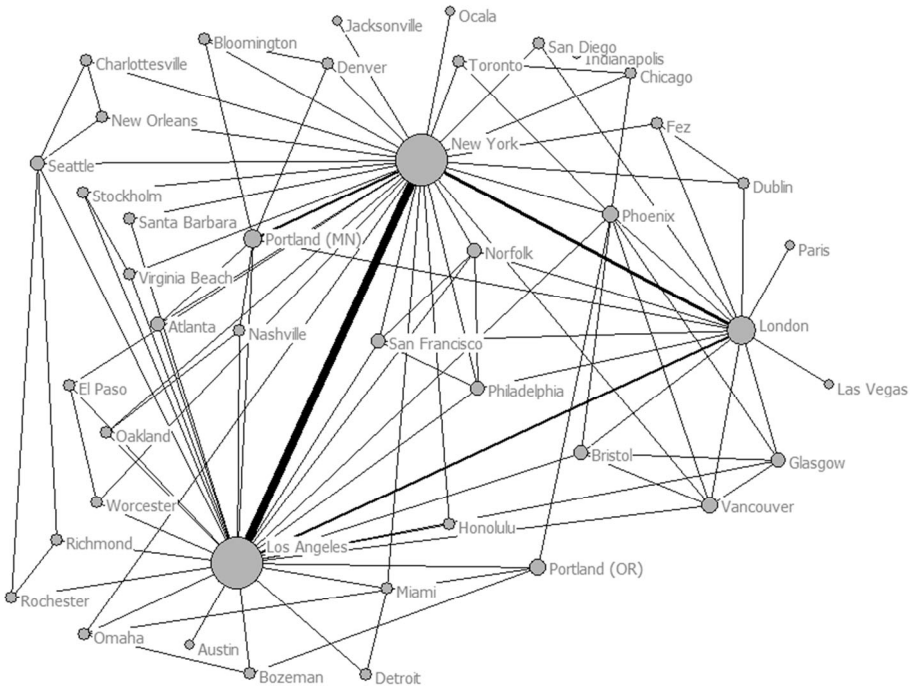


Note: Tie strength is based on number of inter-city links; the size of the nodes is based on the total connectivity of the city.

Table 5: Top cities ranked by total number of connections; US digital music market

Rank	City	Total connections	Highest connectivity
1	New York	54	18 (Los Angeles) 5 (London)
2	Los Angeles	53	18 (Los Angeles) 4 (London)
3	London	23	5 (New York) 4 (Los Angeles)
4	Portland (Maine)	11	3 (New York)
5	Phoenix	9	1
6	Portland (OR)	7	1
7	Vancouver	7	2 (Los Angeles)
8	Seattle	6	1

Figure 3: Global urban networks of recording, US national market

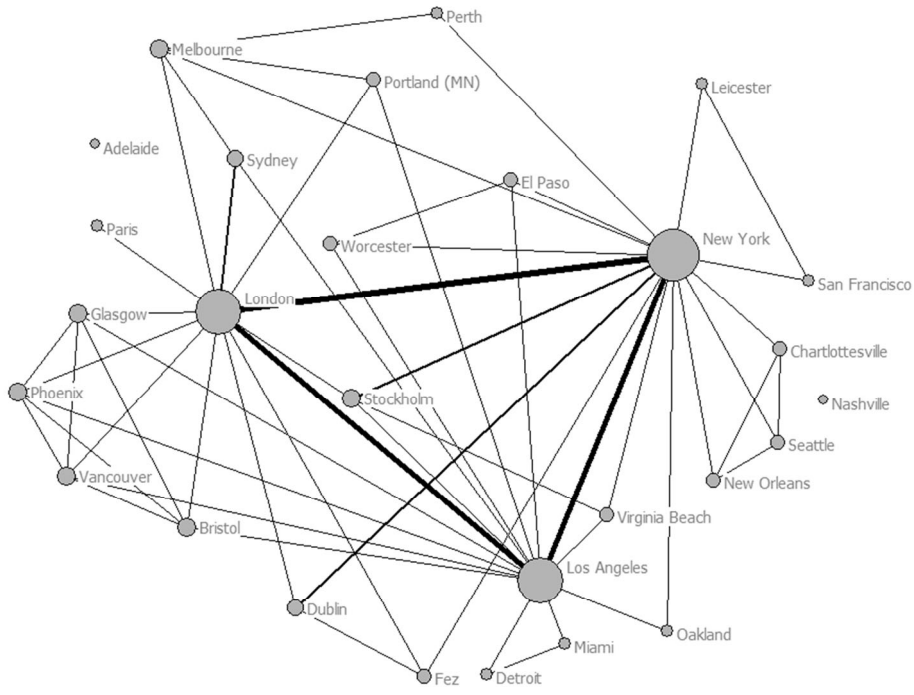


Note: Tie strength is based on number of inter-city links; the size of the nodes is based on the total connectivity of the city.

Table 6: Top cities ranked by total number of connections; Australian digital music market

Rank	City	Total connections	Highest connectivity
1	New York	27	6 (London) 5 (Los Angeles)
2	Los Angeles	23	5 (New York) 5 (London)
~	London	23	6 (New York) 5 (Los Angeles)
4	Bristol	5	1
~	Glasgow	5	1
~	Melbourne	5	1
~	Phoenix	5	1
~	Stockholm	5	2 (New York)
~	Vancouver	5	1

Figure 4: Global urban networks of recording, Australian national market



Note: Tie strength is based on number of inter-city links; the size of the nodes is based on the total connectivity of the city.

Centrality and power in networks of production

In the urban network of production for the UK digital music market, Los Angeles, while only the third most connected city in terms of total connections, has the highest degree of *centrality*. In other words, it has the most connections to other cities with a high degree of connectivity, marginally above both New York and London. Although London accounts for the output of many more albums into the UK digital music market than Los Angeles and New York (52 per cent of albums, compared with 38 per cent and 36 per cent respectively), by this measure it is the least central of the dominant three cities. However, in terms of *power* in the urban network, namely in terms of many cities with low degrees of connectivity being dependent on the city, London is calculated to be the most powerful city in the network, very closely followed by New York. Los Angeles is the third most powerful city, but appears far less powerful than both London and New York. London is also calculated to be the most important *mediating* city in the network based on the flow betweenness centrality measure, significantly more important than New York, which in turn is a significantly more important mediator than Los Angeles. These results, outlined above and summarized in Table 7, are indicative of London's dominance as the most important city in the urban network of production for the UK digital music market.

Table 7: Centrality measure rankings for London, New York and Los Angeles

Market	City rankings; Bonacich centrality	City rankings; Bonacich power	City rankings; Flow betweenness centrality
UK	1. Los Angeles 2. New York 3. London	1. London 2. New York 3. Los Angeles	1. London 2. New York 3. Los Angeles
USA	1. New York 2. Los Angeles 3. London	1. New York 2. Los Angeles 3. London	1. New York 2. Los Angeles 3. London
Australia	1. New York 2. London 3. Los Angeles	1. New York 2. Los Angeles 3. London	1. New York 2. Los Angeles 3. London

In the urban network of production for the US digital music market, New York scores highest on all three measures (Table 7). This is despite having a weaker album output than Los Angeles (involvement in 46 per cent of total albums compared with 58 per cent), and only a marginally higher number of connections (54 compared with the 53 of Los Angeles). Based on the Bonacich measure, New York has the highest degree of *centrality*, namely the most connections to other cities with a high degree of connectivity, although it is only marginally ahead of Los Angeles. Both cities have much higher centrality rankings than London, which in turn is significantly ahead of the city in fourth place, Atlanta. New York is also the city with the most *power* in the urban network, at least in terms of how many cities with low degrees of connectivity are dependent on it. By this measure, New York is much more powerful than Los Angeles. Los Angeles is only marginally ahead of London in terms of power in the network, despite accounting for a much higher output of albums (involvement in 58 per cent of total albums compared with 25 per cent) and having many more connections (53 compared with the 23 of London). This highlights London's power over certain weaker cities in the urban network, cities that New York and Los Angeles may have to go through London to access. New York is also the most important *mediating* city in the network based on the flow betweenness centrality measure, significantly more important than Los Angeles, which in turn is a significantly more important mediator than London. These results are indicative of New York's dominance within the urban networks of production for the US digital music market.

New York also scores highest on all three centrality measures for the Australian digital music market (Table 7) and therefore has the highest degree of centrality, to be the most powerful city, and the most important mediating city in the network in the urban network of digital music production for the Australian market. It is, however, only very marginally ahead of London in terms of its centrality. Los Angeles comes ahead of London on the Bonacich power measure and flow betweenness centrality

measure, despite having a marginally weaker album output, although it is below London on the Bonacich centrality measure. One interesting outcome is the score of the Australian city Melbourne on the flow betweenness centrality measure. It is clearly in fourth place, behind the global city triad but well ahead of other cities in the network. This demonstrates that Melbourne occupies an important position in the network as a *mediator* city, playing the part of a 'gatekeeper' for access to the Australian music market.

A core–periphery analysis for the networks of production for the UK digital music market gives a core that contains nine of the 36 cities involved in the production of the musical outputs included in this analysis. Along with the three dominant cities of London, New York and Los Angeles, there is a second tier of core cities – Atlanta, Bristol, Dublin, Glasgow, Miami and Stockholm. These cities have relatively strong ties to the three dominant cities, and to each other, when compared with peripheral cities. The same analysis for the networks of production for the US digital music market gives a core that contains just five of the 43 cities included in the data. New York, Los Angeles and London are present in the core; Atlanta and Portland (Maine), the only second-tier core cities, join them. All other cities in the network have relatively low connections with the core cities and each other. A core–periphery analysis for the networks of production for the Australian digital music market gives no distinct core or periphery.

Prestigious studios in prestigious cities

As stated previously, the data used in the study are non-directional in that they do not distinguish between connections to and from a city. Indeed, I assume that links between cities involve mutual exchange and communication in both directions. However, although not directly measured in the data, there is one particular part of the musical recording process where cities may perhaps be considered 'senders' and 'receivers' – the mastering of recordings. Here recordings are sent via electronic means to be mastered in specific studios that undertake mastering for an unbalanced share of the recordings produced. Thus, this key production process plays an important role in concentrating production networks through certain key cities.

In terms of the UK digital music market, the most significant mastering studio is Metropolis Studios in London, followed by Sterling Sound in New York (see Table 8). Together, these two mastering studios account for one-third of the total number of albums sampled. Bernie Grudman Mastering (Los Angeles), Masterdisk (New York), and Gateway Mastering (Portland, Maine) join these studios to make up the top five. Together these five studios account for 55 per cent of the total number of albums sampled. This highlights the concentration of this key process in particular studios in particular cities. In terms of the US digital music market, a US-based studio is prominent. Sterling Sound, based in New York, dominates the list of key mastering studios (Table 9), accounting for 27 per cent of albums, followed by Bernie Grudman Mastering (Los Angeles), Gateway Mastering (Portland, Maine), Marcussen Mastering (Los Angeles) and Metropolis Studios (London). Together these five studios

account for 66 per cent of the total number of albums sampled, suggesting even greater concentration of the mastering process than found in the networks of production for UK digital markets. Sterling Sound in New York also dominates the list of key mastering studios for the Australian digital music market (Table 10), accounting for 28 per cent of albums, followed by Metropolis Studios (London), Bernie Grudman Mastering (Los Angeles), Gateway Mastering (Portland, Maine), and The Exchange (London). Together these five studios account for 62 per cent of the total number of albums sampled.

Table 8: Top five mastering studios in networks of musical production – UK digital music market

Mastering studio	City	Number of albums mastered (% of total number of albums)
Metropolis Studios	London	20
Sterling Sound	New York	13
Bernie Grudman Mastering	Los Angeles	8
Gateway Mastering	Portland (Maine)	7
Masterdisk	New York	7

Table 9: Top five mastering studios in networks of musical production – US digital music market

Mastering studio	City	Number of albums mastered (% of total number of albums)
Sterling Sound	New York	27
Bernie Grudman Mastering	Los Angeles	13
Gateway Mastering	Portland (Maine)	10
Marcussen Mastering	Los Angeles	8
Metropolis Studios	London	8

We might consider these select cities, to which a disproportionate amount of recordings are 'sent', as *prestigious* because they receive many directed connections. As Alderson and Beckfield (2004) describe, these are cities that other cities seek out, have ties directed to them, and are chosen over others. It is perhaps unsurprising that the three most central and powerful mediating cities as indicated by the centrality measures – London, New York and Los Angeles – are also the three most prestigious cities based on these connections. There are two central reasons for the concentration of the process in these cities. First, technology is central to the mastering process, so potential clients will most desire studios that can afford to invest in the latest technology. However, having the most desired technology is not enough alone.

Table 10: Top five mastering studios in networks of musical production – Australian digital music market

Mastering studio	City	Number of albums mastered (% of total number of albums)
Sterling Sound	New York	28
Metropolis Studios	London	10
Bernie Grudman Mastering	Los Angeles	8
Gateway Mastering	Portland (Maine)	8
The Exchange	London	8

As described previously, the process requires studio engineers with the appropriate level of skill and creativity to employ the technology to best effect. All the major mastering studios have mastering engineers contracted to them. Clients not only seek to use particular studios, but also to use particular mastering engineers based on their reputation. For example, Ted Jensen, chief mastering engineer at Sterling Sound in New York, alone accounts for 15 per cent of the total number of albums sampled from the US digital market. Mastering engineers John Davis and Tim Young of Metropolis Studios in London together account for the mastering of almost 20 per cent of the total number of albums sampled from the UK digital market. Bob Ludwig of Gateway Mastering in Portland alone accounts for 10 per cent of the total number of albums sampled from the US digital market, and 7 per cent of those from the UK digital market. The prestigious nature of certain studios, and thus of particular cities, can then be directly attributed to the skilled engineers who are working in the studios and living in the cities. Recent work in economic geography, led by Richard Florida (2002, 2005), has emphasized how large global cities such as London, New York, and Los Angeles act as magnets for these talented individuals from across the globe, in which many both work and live.

Conclusions

In market-based projects in the music industry, ties between record companies, musicians and specialized producers and engineers reach out between musically creative cities across the globe, resulting in the development of new relational geographies of creativity. Through social network analysis, I have provided an exploration and mapping of a sample of urban networks of production within the global recorded music industry. From the social network analysis presented it has emerged that the spatial agglomerations of music industry firms, studios and creative labour in particular key cities remain central to the music recording process in the age of digital music markets, with outstanding technical studio facilities strongly centralized in particular key cities. This is especially the case for the triad of global cities of New York, Los Angeles and London, home to very strong concentrations of record companies and recording studios (see Scott 1999; Watson 2008). The path

dependence of networks of recording is then intimately embedded in physical infrastructures, material outcomes of economic processes that are localized in certain places and territories and exist over long periods of time (see Bathelt and Glückler 2003).

In this article, I have demonstrated the way in which one can ascribe causal power to networks when network relationships generate an emergent effect where the sum of the relationships is much greater than that of individual actors (Dicken et al. 2001). The emergent effect in this case is the dominance of the triad of global cities New York, Los Angeles and London. My argument lends empirical support to incumbent theory on global cities and cultural production, theory based largely on anecdotal evidence that to date has suffered from an empirical deficit (Short et al. 1996; Taylor 2004). The outcomes from the analysis presented here, based on novel data and innovative empirical work derived from social network analysis, are significant in this respect. However, the strength of this outcome is at least in part due to some of the limitations of the sampling strategy and data used in this empirical analysis. Recognition of these limitations highlights some interesting areas for further work. First, a focus solely on three Anglophone markets means I only present a partial picture of the globalized nature of the contemporary music industry. If one were to undertake the same analysis for major non-Anglophone markets, such as China and Japan in Asia, the resulting urban networks would likely configure rather differently from the results presented here. Second, in sampling only music that appears in the top ten of the iTunes charts, the study inevitably focuses predominantly on artists and genres of music that the narrow repertoire policies of the global music industrial system have prioritized (see Negus 1993, 1996). Employing an alternative sampling frame other than national sales charts would also likely give a very different set of results. Finally, in exploring and mapping the power and centrality of cities through social network analysis, the results of the empirical analysis hint at the power that actors exercise within networks through relational project-based work. However, the more detailed aspects of social power that lie behind these quantitative representations remain concealed. To document the operation of this power within projects at different spatial scales would require more in-depth qualitative methods, including interviews with studio producers and engineers. This represents a rich area for further research.

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