

Segregation, Mobility and Encounters in Jerusalem: The Role of Public Transport Infrastructure in Connecting the 'Divided City'

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Abstract

This paper assesses ways in which urban segregation is shaped and transformed by Jerusalem's public transport network, enhancing mobility and potential group encounters. We suggest that segregation should be understood as an issue of mobility and co-presence in public space, rather than the static residential-based segregation that continues to be a central focus of debate in urban studies. We explore public transport infrastructures, considering how their implementation reflects the variety of ways that transport can have impact: segmenting populations, linking populations and/or creating spaces for interaction or conflict between the city's Jewish Israeli and Arab Palestinian populations. Space syntax network analysis suggests that in the case of Jerusalem, access to public transport is multi-dimensional: as well as providing access to resources, it shapes opportunities for spatial mobility that may either overcome or reinforce area-based housing segregation. We discuss these opportunities in the light of Jerusalem's on-going ethno-national division in an-increasingly-fractured-urban-reality.

Key Words: Urban Segregation, Contested Cities, Public Transport, Mobility and Co-Presence, Jerusalem, space syntax.

1. Introduction

While residential segregation continues to be a central focus of debate in recent urban studies and planning literature, we suggest it is useful to consider the alternative perspective of how ethno-national and socio-economic groups can encounter each other in the public realm. The potential for major public transport infrastructure to connect across groups and the opportunity for mobility to bridge across group difference establishes the problem of segregation as an issue of a lack of interaction and co-presence in public space (Legeby 2013). This article is based on the premise that among other factors, urban segregation is formed but may also be transformed due to the mobility flows and public transport connections of Jerusalem's variegated population.

Jerusalem's current socio-spatial form is an outcome of the city's patterns of growth and in-migration over the past century. Jerusalem is located in the vortex of the Palestinian-Israeli conflict and the separation of ethnic groups within its residential areas remains a dominant Israeli state-led policy at both national and local scales (Rokem 2013, Rokem and Allegra 2016).

Unequal power relations in the city as well as the uneven funding of planning and construction projects have resulted in differing levels of spatial, socio-economic and political development between Arab¹ and Jewish areas (Wari 2011; Rokem 2016b). The city's planned landscape recently changed with the construction of the 'security barrier' (also known as 'separation fence'²). This has had a significant impact on the city's geographic continuity and impinged on the daily movement of Palestinian through Israeli controlled checkpoints to and from the West Bank, (Figure 1).

Jerusalem was selected for this study due to its paradoxical history of contested ethnic divisions that coincides with quotidian cross-ethnic

¹ The terms Arab and Palestinian are both used in the paper; they indicate the population living in East Jerusalem that defines themselves as Arab Palestinians and who are also referred to as "Palestinian Jerusalemites".

² Depending on political narrative.

interaction. The following sections describe recent research, which is based on spatial statistical analysis of key components of the city's public transport system, its public bus network and the recently opened (2011) "Red Line" Jerusalem Light Rail (JLR) tramline. Space syntax theories and methods are used as a framework for analysing Jerusalem's street network and its intersection with public transport provision on the one hand, and socio-economic and ethno-national settlement patterns on the other.

There is a widespread focus in the literature on area-based housing segregation (Maloutas & Fujita 2012; Musterd & Ostendorf 2014; Lloyd et al 2014), which tends to view segregation as an aspect of the social division of space. This is certainly the case with most research on ethno-national 'divided' or 'contested' cities that commonly emphasises the ethnic separation and the segmenting of populations into static groups living in separated areas (Calame & Charlesworth 2009; Anderson 2010; Bollens 2012). The urban studies literature emphasises the diverse, delicate and often controversial role played by urban planning and design in framing encounters among groups and communities (Brand 2009; Healey 1997; Sandercock 1998). However, most contested cities are largely understood as fixed ethno-spatial and social clusters (Kliot and Mansfeld, 1999; Kotek, 1999; Bollens, 2000; Hepburn 2004; Calame and Charlesworth, 2011).

Jerusalem itself is firmly placed in the literature on 'contested' cities (Kliot and Mansfeld, 1999; Kotek, 1999; Bollens, 2000; Rosen and Shlay 2014) – for reviews see: Allegra, Casaglia, Rokem (2012), along with other commonly cited cases, such as Belfast, Nicosia and Beirut. In the context of the study presented here, Jerusalem is analysed as one of many cases of urban segregation and mobility.

The way in which the quotidian rhythms of urban life can shape – or prevent – patterns of encounter and interaction often receive little attention in discussions of segregation and polarisation (Wallach 2011: 11). In this article we focus on the potential that public transport infrastructure has in overcoming residential segregation by increasing individual mobility as well as the mixing of different

ethno-national rival groups. The research tests the proposition that there is a correspondence between urban segregation, physical distance and local encounter (Valentine 2008).

The article starts with an overview of urban segregation, co-presence and mobilities literature. Next a brief description of Jerusalem's urban context is given. The methods and spatial analysis sections follow with explanations of the findings. In so doing, the research suggests in the conclusion, that it is timely to consider mobility as an important aspect in establishing urban segregation as an issue of a lack of interaction in public space.

2. Literature Review

Defining *urban segregation* is not an easy task; the field is characterized by widespread disagreements on theoretical and methodological issues, which are reflected in a kaleidoscope of definitions and proposed measures (Smets & Salman 2008: 1312). Urban segregation contains a wide spectrum of theoretical and conceptual principles, ranging from the effects of neo-liberal globalisation on social inequalities in cities (Marcuse & van Kempen 2002; Schnell & Benjamini 2005), the injustices of state-led spatial planning and housing policies (Sandercock 2003) while other important aspects relate to the differing trajectories of housing according to economic status and cultural capital (Peach 1998), and how ethnicity and race affect the more long-term formation of spatial and social segregation in cities (Marcuse 1997; Philips 1998; Varady 2006; Wacquant 2008, 2016).

The wide extents of the urban segregation literature testifies to the growing importance attributed by academics, policymakers and practitioners to the analysis of new and diverse kinds of divisions and conflicts in contemporary urban contexts (Allegra, Casaglia, Rokem 2012). Historically the debates surrounding urban segregation stem from the Chicago School's biological model of *the city* (Park et al 1925) and the North American racial typology of *the ghetto* (Marcuse 1997, 2006; Wacquant 2008). Its U.S. origins are one of the main reasons that the subject (at least in the English language literature)

has historically been dichotomized as a (literally) black/white race-based urban problem, rather than the more multi-faceted ethno-racial, economic and spatial condition that manifests itself worldwide (Nightingale 2012). Phillips (2007: 1153) suggests that “[t]he time may be coming for research into ethnic segregation to shift its gaze to incorporate spheres of interaction (e.g. work, virtual spaces and social networks) that transcend residential space”. This is also manifested in the recent call to pay more attention to the intersectionality of multiple identities within urban segregation research (Valentine 2007).

Contemporary cities are generating new forms of spatial segregation (Caldeira 1996, 2000, Rosen & Razin 2009); in turn, spatial inequalities tend to reinforce social inequalities (Vaughan 2007). Many authors have interpreted this trend as the progressive demise of a more integrated model of urban development in favour of a fragmented patchwork of impoverished ghettos and affluent enclaves (Davis 2007, Graham & Marvin 2001, Allegra, Casaglia, Rokem 2012), while others have observed the delicate and often controversial role played by urban planning in framing the encounters between groups and communities (Bollens 1998, Healy 2007, Brand 2009). Several contributions focus on the way geopolitical or ethno-national rivalries can lead to a rupture in the unity of urban systems (Kliot & Mansfeld 1999, Bollens 2000, Hepburn 2004, Calame & Charlesworth 2009, Anderson 2010). However less attention has been given to the effect transport infrastructure has on mobility patterns and consequential patterns of interaction in contested urban space. Or more specifically to how “infrastructural systems lay out patterns of social integration or differentiation, create feelings of belonging or alienation, connection or isolation, and lead to political engagement or lack thereof” (Angelo & Hentschel 2015:311). With this in mind, the next section asks whether co-presence might be an important precursor to interaction in public space and a key to overcoming urban segregation.

Co-presence as precursor to interaction

Physical and social dynamics of public space play a central role in the formation of publics and in the public culture (Amin 2008). Madanipour (2004) suggests that it is necessary for a group to display itself in the public sphere in

order to built group identity and communication toward others. The starting point of this process is in the public spaces of the city. Different social groups have different principles of solidarity, which translate into “different daily routines and practices that, in turn, lead to different modes of spatial co-presence. These routines will naturally be “realized in patterns of local encounter” (Hanson, 2000: 115) across different groups.

The literature on daily encounters in public space (normally referring to streets, squares and the public realm in general) tends to be divided on whether this translates into meaningful face-to-face interaction (see: Goffman 1963, Giddens 1984) or if it remains superficially at the level of familiarity (Amin 2002, Valentine 2008). Collins’ (2004) approach understands co-presence as being ‘prior’ to something else, or a “precondition for social interaction” suggesting that the characteristics of the spatial setting in which physical co-presence takes place is an essential aspect of any ‘interaction ritual’ (Collins 2004, 53 in Legeby 2013: 58-59). Possibly a more useful approach is to see these matters as being on a continuum, from familiarity through co-presence, to encounter, to interaction and – occasionally – to actual social engagement (Lofland 1998). As such, public space without public presence is unarguably dysfunctional and becomes most meaningful when it encourages the encounter of difference (Sennett 1990).

Whether it leads to interaction or not, recent research in Swedish cities has shown that public space can play a key role in the matter of segregation (Legeby et al 2015: 3; Legeby, 2013; Legeby & Marcus, 2011). One central question is how exchanges between different ethnic groups could be realized. In cities that are described as being residentially segregated across ethno-national lines. When society is particularly divided such as in the case of Jerusalem, we argue its importance is greater still. Without mobility, mixing of difference cannot occur. In other words, public space has the potential to “reassemble what society divides” (Hanson and Hillier, 1987: 265). We will explain this further in the next section, emphasizing the role of public transport infrastructure in enhancing opportunities for interaction in public space.

Mobility and Public Transport

Cities cannot be separated from the mobilities that support and develop modern lives within them (Freudendal-Pederson & Cuzzocrea 2015). “[I]t has long been recognized that mobility or mobilities are both generating and an outcome of inequalities and exclusion” (Kwan & Schwanen 2016: 248). It has also been suggested that political rationality, rather than only instrumental rationality should be accounted for when determining the route of new light railway lines (Cohen-Blankshtain and Feitelson 2011:359). As such, the availability of public transportation and personal mobility has critical implications for access to employment and it affects housing and education opportunities. Immobility, or being trapped within one’s neighbourhood, constitutes one of the main causes of social exclusion (Massey 1994; Leitner et al 2008). We propose that mapping the potential for mobility and interaction allows for a view of segregation as more multifarious and complex, then the dominant focus on residential patterns. Instead, we suggest that urban segregation is simultaneously a political, social, economic, ethnic and racial artefact of an individual’s mobility in the city. Spatial congregation alone is not necessarily a problem, but overcoming a combination of segregation and immobility is an urgent challenge in seeking spatial and social justice.

In this context Urry (2002) rightly asks how much equality is there in access to the same *modes* of mobility, knowing that access to different modes is socially divided by gender, age, ethnicity, social class, dis/ability and so on. Carss et al (2005: 553) suggest social inclusion is about being part of the networks that matter to the persons involved, considering the relation between social exclusion, mobility and access to be a dynamic one. In other words, there is a constant overlap and change in segregation patterns depending on the extent to which transportation connects to certain parts of the city and not to others. For example, in the Colombian context of Medellín’s cable car, it serves not only to reconnect the poor to the city at large, but also to improve lives socially and economically by providing access to work and training in the heart of the city (Dávila 2013).

The unequal funding of urban planning and construction projects between the

Eastern and the Western parts of Jerusalem has resulted in the city being split into two distinct growth trajectories (Rokem 2016b). Until recent times, Arabs and Israelis had separate public bus networks, each with their own central bus terminus. (Figure 2) illustrates this, showing that the Jewish population has a more extensive bus service than the Palestinian-run bus network, which operates primarily in the east of the city. The relatively new JLR modifies this to some extent by linking the two central bus terminals, connecting between Arab and Israeli majority areas in the central and northern parts of Jerusalem. Moreover, since car ownership is exceptionally low in the city, with only 54.3% of the population owning a private car in contrast with the national average of 67.3% (JIIS 2015: 188), access to public transport becomes even more important.

In a geographical study of Jerusalem, Greenberg-Ra'anan & Shoval (2013: 39) found that both ultra-orthodox Jewish women and Palestinian-Muslim women had similar levels of self-perceptual segregation. In their comparison of actual spatial behaviour of the two groups over time (tracked in a Geographical Information System - GIS), the researchers found that the spatial behaviour of both groups generally matched their spatial segregation, with both groups having limited movement outside of the area. At the same time both groups perceived the general (namely, secular) Jewish territory as shared space, belonging to neither group. Their research was carried out during 2009-2010 just before the opening of the JLR in 2011, and was limited to only the female population, however it gives a valuable indication of people's perceptions of spatial segregation and mobility in Jerusalem.

Jerusalem

With its unique position as the global centre of the three largest monotheistic religions, Jerusalem's history stretches back over three thousand years to biblical times. Jerusalem is a symbolic and tangible focal point in the Israeli-Palestinian conflict, earning its place in urban studies and planning literature as a self-explanatory category of an ethno-national divided and contested city (Bollens, 2000, 2012; Calame and Charlesworth, 2011; Shlay & Rosen 2015; Rokem and Allegra 2016). West Jerusalem has been the capital of Israel since

1948 when the Palestinian neighbourhoods were conquered/fell³ in the 1948 War⁴. Despite some significant international opposition, the entire city has served as the Israeli capital since its reunification/annexation in the 1967 War⁵, when the Israeli government expanded the municipal boundaries of Jerusalem to include 71 km² of the West Bank, chosen to follow key strategic and political considerations. On the one hand this approach would allow the city to expand on a metropolitan scale, through the annexation of vast tracts of empty land beyond the narrow (6.5 km²) limits of the Jordanian municipality of Jerusalem (for a detailed overview of Jerusalem's shifting municipal boundary, see: Rokem and Allegra 2016). Territorial and demographic concerns over the status of Jerusalem remain at the heart of Israeli national politics and have been paramount in determining planning decisions. Although Palestinians living in Jerusalem are permitted to vote in the municipal elections, most of them refuse to do so, as they believe that voting would afford legitimacy to what they feel to be Israel's illegal annexation of the city. They are consequently not electorally represented in the Israeli-governed Jerusalem Municipality (Rokem 2013).

One of the main reasons for the tight control of infrastructure development in Israel and in Jerusalem more explicitly, is the Palestinian-Israeli conflict. Alongside the on-going interest by the Israeli government in retaining a Jewish majority and thus control over security, land and resources, in what has been termed "the battle over demography" (Fenster, 2004: 96), national politics have had significant impact on planning for future infrastructure developments, especially in Jerusalem. This has created a growing divide between Jews and Arabs, particularly in the last decade since the failure of the Camp David peace talks and the outbreak of the second intifada (Palestinian uprising) in 2000. This is reflected in the growing tension in urban life in Israel, which is manifested at different scales of urban space (Khamaisi 2002, 2010; Savitch & Garb 2006).

³ Terminology depends on political narrative

⁴ As above, the terminology will depend on political narrative. *War of Independence* (Israeli name) / *Naqba* "The Disaster" (Palestinian name). For simplicity, the common term *1948 War* is used here.

⁵ The 1967 Six Day War between Israel and its Arab neighbours ended in the conquering/occupation by Israel of the West Bank, Gaza strip and Golan Heights.

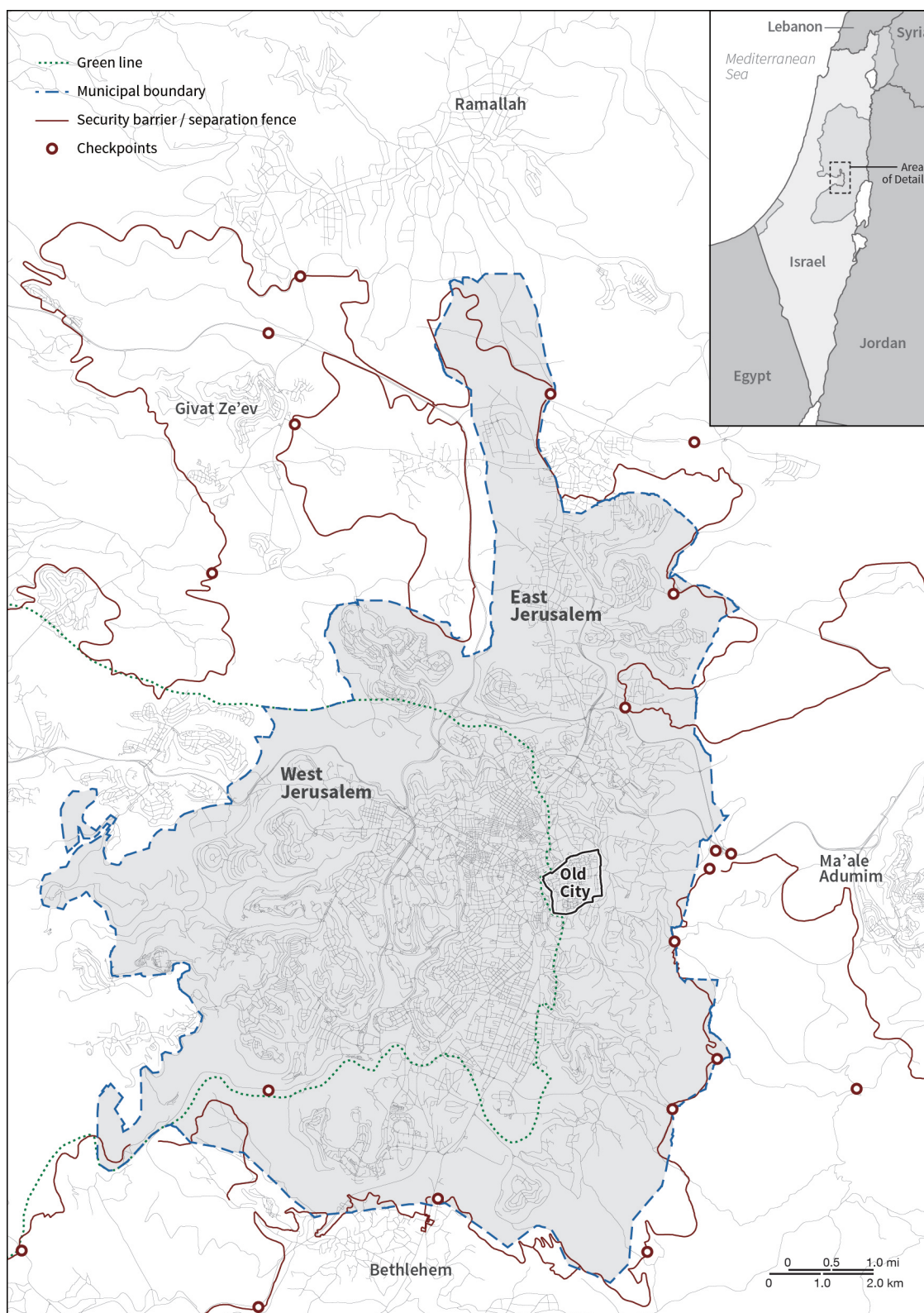


Figure 1: Jerusalem's borders and boundaries

Indeed, when assessing the trends in a recently published UN report about the condition of the local Palestinian population in Jerusalem, the gap between the two populations was reported to have become deeper in recent years (UNCTAD 2013).

At the end of 2013 the population of Jerusalem numbered 816,000. The Jewish population totalled 515,000 (63%) and the Arab population (Muslim and Christian) totalled 301,000 (37%) (JIIS 2015). It remains both the largest and the poorest city in the country with 76% of Arabs and 46% of Jews living in poverty (JIIS 2015: 187). The aforementioned 'security barrier'/ 'separation fence'⁶ running along the eastern edges of the city has had a significant impact on the Palestinian population, limiting movement through Israeli controlled checkpoints to and from the West Bank, (Figure 1). This has resulted in a marked gap between the city's two principal communities in terms of housing, public services provision and infrastructure investments (Wari 2011, El-Atrash 2015) According to Khamaisi (2010) and Jabareen (2015) this coincides with a general erosion of Palestinian rights in East Jerusalem.

An important aspect of Jerusalem's demography is the sub-division of its population into its various religious constituencies, often overlooked in the context of the contested cities literature. The importance of religious background in this context is in its relationship to socio-economic status as well as to the political allegiances of the city's communities. The Arab population consisted in 2013 of a 96.6% Muslims majority and 3.4% Christian minority (JIIS 2015). Arab Jerusalemites were granted special status after the 1967 War and given Israeli residency. The purported aim was to integrate them into the city receiving equal legal rights. This differentiates them from other West Bank residents and (as mentioned above) technically gives them the right to vote in the municipal elections as well as the use of the city's social services (Romann & Weingrod 1991: 193). On the Jewish side the "Charedi", ultra-orthodox population is the fastest growing Jewish group in the city, characterized by large families and greater poverty than average, with 59%

⁶ depending on political narrative

classified as poor compared to the 46% Jewish average (JIIS 2015: 187). This has spatial impact, with increasing housing demands, as well as a greater reliance on public transport (Kahaner 2009). In the following section we outline the methods employed in this study to address the complex spatial aspects of segregation and mobility in Jerusalem.

3. Methods

As discussed above, there has been a wide interest in the political dimensions of contested cities in the academic literature (Kliot & Mansfeld 1999, Bollens 2000, Hepburn 2004, Calame & Charlesworth 2009, Anderson 2010). However a specific interest in taking account of the political context in quantitative spatial research is relatively limited. Murtagh's (2011) work in Belfast provides an example of the importance of taking account of the political when undertaking spatial analysis, particularly in contested cities where space is rarely benign in its shaping of housing segregation or public space interaction. Here we build on the notion of urban segregation as "a multi-dimensional process requiring a multi-disciplinary approach" (Vaughan and Arbaci 2011: 128; see also Schnell et al 2015), by adding a political dimension to the analysis of the social and spatial understanding of urban public space, using space syntax methods to take account of the measurable dimensions of segregation in Jerusalem.

Space syntax analysis of the configuration of street networks has been at the forefront of quantitative urban research for several decades since publication of the formative 'The Social Logic of Space' (Hillier & Hanson, 1984). Space syntax theories propose that urban space shapes flows of movement, which can result in a pattern of natural co-presence in public space, providing opportunities for social and cultural exchange (Hillier, 1996; Hillier & Vaughan, 2007). Space syntax research has tested these theories by developing methods for calculating the relative centrality of the spatial network. Numerous studies using these methods across diverse urban settings have found that a significant proportion of movement through urban streets is determined by the structure of the grid itself, rather than by specific attractors or generators of activity. We suggest that applying space syntax to account for political

dimensions in the analysis of contested urban space can lead to insights about the opportunities created for co-presence and encounter in public spaces which take account of political context as well as the normative socio-economic setting.

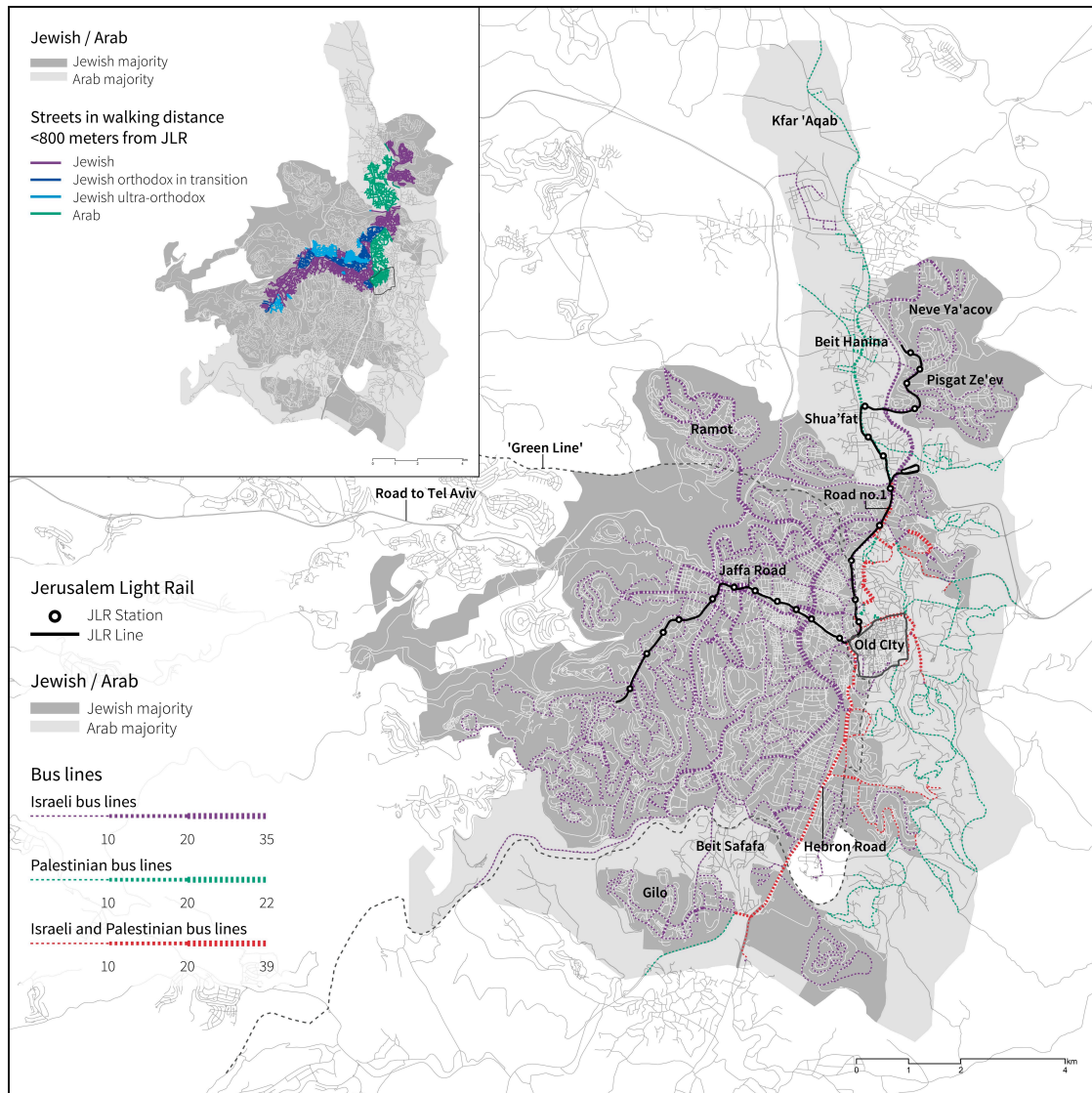


Figure 2: Main Map: Bus Network Intensity and JLR (Inset: street segments within 800m walking distance of the JLR: divided into Arab and Jewish / Jewish ultra orthodox / Jewish in transition).

For the Jerusalem study, the city's pedestrian routes through the urban grid were modelled as a network of street segments based on a road centreline map (data obtained from openstreetmap.org, an open user-generated source of geospatial data). The model was analysed using two space syntax measures. *Choice*, which measures potential flow of movement through public

space (streets, squares, pathways and so on) and is calculated by counting the number of shortest paths connecting all road segments to all other road segments within a specified radius along the pathways (as opposed to ‘as the crow flies’); and *integration*, which is a measure of the proximity of one street segment to all other street segments within a specified search radius. In both cases the model measure the directness of routes by using fewer angular changes between one street and the next. It could be said to be that integration is related to exploratory movement; while choice is highly influenced by the scale (or distance) at which you are measuring and it will tend to highlight major roads in the network. In other words the measures of choice or integration at different distances are representative of different levels of movement. For example choice at a small radius, such as 800 metres, tends to predict short walking journeys of around 10 minutes.

The spatial model itself covered Jerusalem within its Municipal Boundary (Figure 3) with an additional buffer of 5000 metres excluding the areas beyond the ‘security barrier/separation wall’ (Figure 1), where there is limited data availability. The space syntax analysis of the street network was made with depthmapX software, using the measures ‘choice’ (NACH) and ‘integration’ (NAIN). Put simply, the two measure the relative centrality of a route to all others within a given search radius (choice) or its relative proximity to other places within the city (integration).⁷ The largest search radius used here is 2000m, since this has been shown to give a good overview of the city’s overall structure, yet is small enough to eliminate any distortion to the results at the city edges (Hillier et al, 2012). The demographic data in all figures are from the Statistical Yearbook of Jerusalem (JIIS 2015, an independent Israeli research institute considered to be one of the main sources for international demographic research on the city). One exception to this are the religious group statistics, which are based on Israeli national election results from 2013.

⁷ Integration (NAIN) is a measure of the proximity of one street segment to all other street segments within a specified search radius. Choice (NACH) accounts for the centrality of a street segment on routes between any two street segments within a specified search radius. A street segment will have a higher betweenness choice if it is traversed many times on the shortest angular path between a pair of origins and destinations. The two measures of integration and choice are similar to the standard network analysis measures of angular closeness and angular betweenness centrality, respectively.

The bus network data are from the Israeli Public Transportation Information Centre (<http://www.bus.co.il>) and the Jerusalem Bus Map (<http://www.jlembusmap.com>), while the data on the Palestinian bus network are collected from the maps and timetables provided to the authors by the Israeli Ministry of Transport and the Palestinian bus companies.

4. Spatial Analysis: mobility patterns and co-presence in Jerusalem

The space syntax analysis of the metropolitan area of Jerusalem in Figure 3, shows it has a dominant north-south spine, which follows the alignment of the ancient routes to Jerusalem from Ramallah to the north and Bethlehem to the south. Jaffa Road has evolved as the key westerly access route to the ancient port of Jaffa and the coast. The two routes intersect in the city's historical economic heart, the streets around Jaffa Road (Figure 3, which shows the measure of normalised choice at 2000 metres)⁸. This illustrates how cities commonly follow a 'deformed wheel' structure with radial routes converging on an intensified grid containing the commercial heart of the city. This pattern is said to create a natural interface between inhabitants and strangers (Vaughan 2007). Yet the model also shows that there is much less accessibility to the east. This may be due to a number of causes. First, this is evidently an outcome of both the expansion of the city westwards in the past century as well as natural limitations of development to the east due to the city's topography, with a sharp drop in elevation east of the Old City, descending through the Judean hills to the desert. In addition, Jerusalem suffers from reduced connectivity eastwards due to the longstanding Israeli government limitations on construction in Palestinian neighbourhoods as well as the more recent 'security barrier'/'separation wall'. (The space syntax model does not account for any limitations to movement brought about by the security barrier/fence or any other political restrictions on mobility).

Figure 3 highlights how Jerusalem's peripheral neighbourhoods are particularly disconnected from the heart of the city. The following analysis considers the

⁸ We use normalized versions of the measures to allow for cross-comparison between cities. As with all space syntax analysis, the streets are coloured in a scale from red to blue, indicating high to low accessibility.

extent to which public transport infrastructure connects between periphery and centre, especially when different ethno-national and socio economic groups are considered.

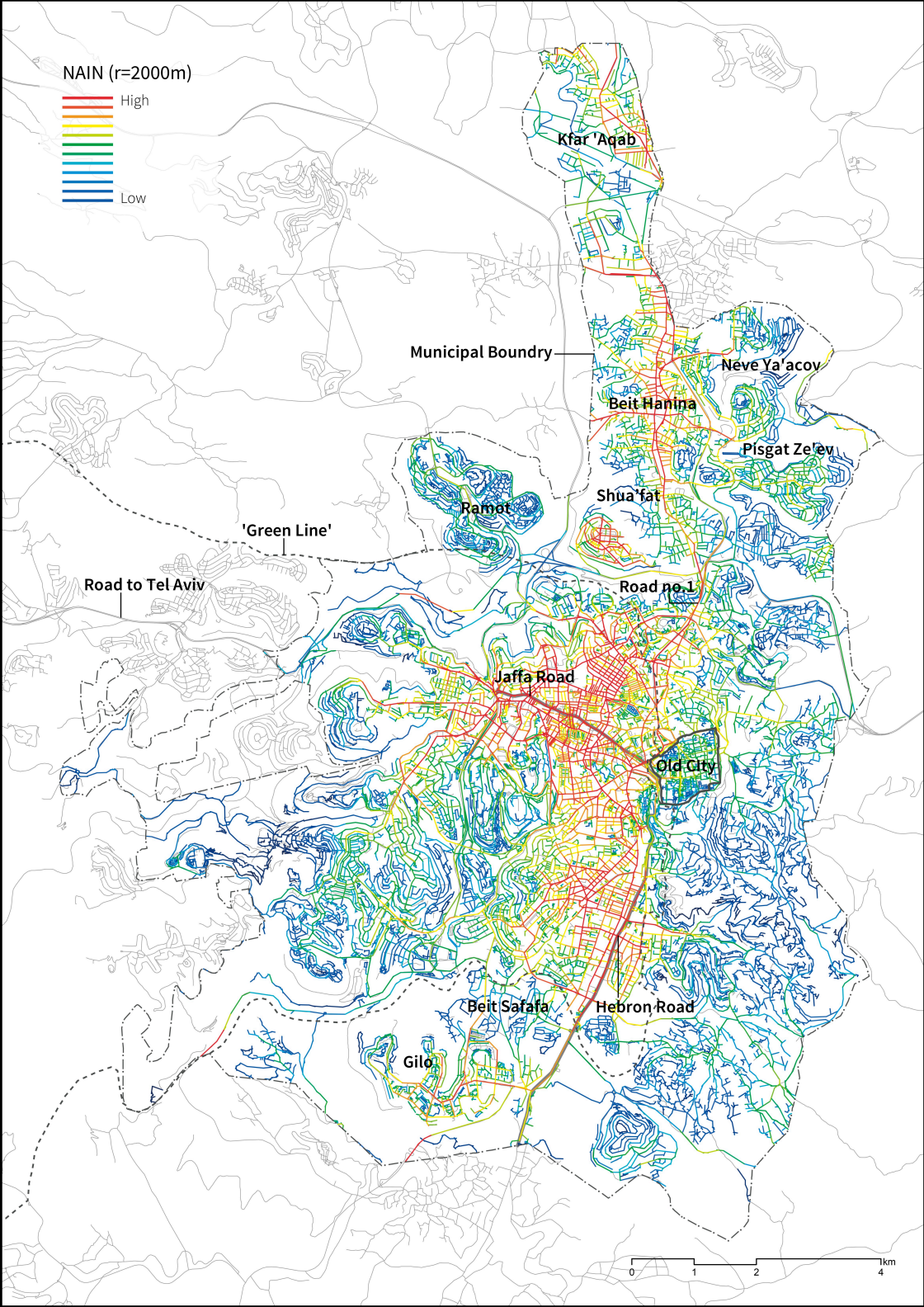


Figure 3: Space Syntax Analysis of Jerusalem's spatial structure, showing Normalised Choice (NACH) 2000 metres (The colour range from red to blue indicates high to low values).

Jerusalem Mobility Patterns

Figure 2 (above) illustrates the current demographic situation in Jerusalem (correct for 2013), with generally a strong east-west divide between primarily Jewish and Arab areas, respectively. Layered on top of this are the principal bus routes and the Jerusalem Light Railway (JLR). The map inset shows how far each of the JLR stations reaches into the neighbouring streets to a maximum of 800 metres⁹). A study of the street structure alone presumes citywide accessibility, that a population as impoverished and ethno-nationally divided, as Jerusalem's cannot in reality benefit from in full.

Before the opening of the JLR in 2011, there were two public bus networks in the city, each serving the Israeli and Arab majority areas – with little overlap between them in terms of ticketing, nor did their routes share many pathways through the city (see Figure 2 inset: showing the street segments accessible within a 2000 metre walk, highlighting differences between the Jewish and Arab groups). Considering the bus network alone, the city has a reasonable coverage of buses, serving the western side of the city quite well when compared to the sparser network on the eastern side. Nevertheless, it is only since the recent construction of the JLR, which follows a westerly/northerly route, that the remote northern Jewish and Arab neighbourhoods can gain relatively fast access to the city's heart.

The role of the JLR in connecting between populations is enhanced by its ability to link central commercial and transport hubs with peripheral neighbourhoods. The connection to the north is especially critical, given it has had much less accessibility until now, not just between the periphery and the centre, but between local neighbourhoods.

⁹ We measured metric depth from stations: how far one can reach from a segment (in this case this is all the street segments carrying JLR stations) along the surrounding streets till it reaches a set distance: 800, 1250, 2000 metres.

The bulk of the academic literature concerning Jerusalem's urban planning and policy relates to the contested nature of the city's development (Dumper 1997, 2014; Klein 2001, Rokem 2016a). Some researchers see the JLR as a negative political infrastructure (Nolte 2016) or a source of continued friction (Bauman 2015). While at times of heightened political tensions the JLR has been a target of terror attacks, at times of calm it has had the opposite effect of increasing co-presence. This is indicated by the JLR average boarding of passenger on week days, with 105,000 passengers in 2012, 145,000 passengers in 2013 and a decrease to 130,000 passengers in 2014 (JIIS 2015: 372), corresponding to a rise in ethnic violence during the summer of 2014. One of the most important roles public transport plays in Jerusalem is to connect residential neighbourhoods to the places where encounter can play a part in daily life, namely employment and commercial activity. As Shtern has recently shown (2016a), 38% of Jerusalem's Arab population works in the western Jewish side of the city and they frequently visit west Jerusalem's shopping malls whose consumer culture is an important force for the opportunity for bridging ethno-national divides (Shtern 2016b).

The distribution of Jewish and Arab majority areas is illustrated in Figure 2, indicating that there is a high degree of ethno-national infused residential segregation by the two principal populations. A less documented aspect of life in Jerusalem is the concentration of the city's ultra-orthodox population in a series of neighbourhoods fanning out in a sequence from the city centre to its north and northwest. This is a fast-increasing trend, indicated by the statistics, with a 5% increase between 2008 and 2013. Currently 53% of the city's population lives in the ultra-orthodox and orthodox transition areas (JIIS 2015: 102). Evidently the neighbourhoods which constitute the backbone of Jerusalem's central Jewish are undergoing a rapid process of transformation to becoming ultra-orthodox dominated areas. This is a notable trend, given the tendency for this demographic to suffer from much higher levels of impoverishment than the norm amongst Israel's non-orthodox Jewish population.

A vital aspect of the JLR is how it serves to increase the connectivity of the heart of Arab neighbourhoods of Beit Hanina and Shua'fat in the north of the city and the more remote Jewish neighbourhoods of Pisgat Ze'ev and Neve Ya'acov to their north, than was previously provided by the public transport system (Figure 2). This can be captured numerically, by analysing access to the JLR for the various groups. The statistics which underly the inset to Figure 2, allow us to compute the JLR stations reach within 800 meters, namely how far one could go along its adjacent streets within about 10 minutes. Given the demographic balance of the city with approximately 63% Jewish to 37% Arab in 2013 (JIIS 2015), the split of 75% to 25% respectively for street segments accessible by foot to/from JLR stations indicates that the Jewish areas are marginally more accessible to the light rail. Interestingly, if the demographic split within the Jewish population is taken into account, it is notable that the most impoverished of the Jewish population, the ultra-orthodox areas and those in transition to becoming ultra-orthodox, have a significant proportion of all Jewish streets within walking distance from a JLR station – 27.6% of all streets within 800m, 28.5% of all streets within 1250m and 26.1% of all streets within 2000m.

Co-Presence

Mobility is not only an aspect of access to employment and commercial activity. The increased connectivity provided by the JLR provides the opportunity for the different populations to intermingle more intensely than was previously the case, by allowing a wider range of the city's population to gain access to its key nodes. Thus, the JLR connects between the western Central Bus Station (the main public transport hub connecting Jerusalem to the rest of the country), *Machane Yehuda* (the city's central open market), City Hall and the Old City and the main East Jerusalem public transport hub.

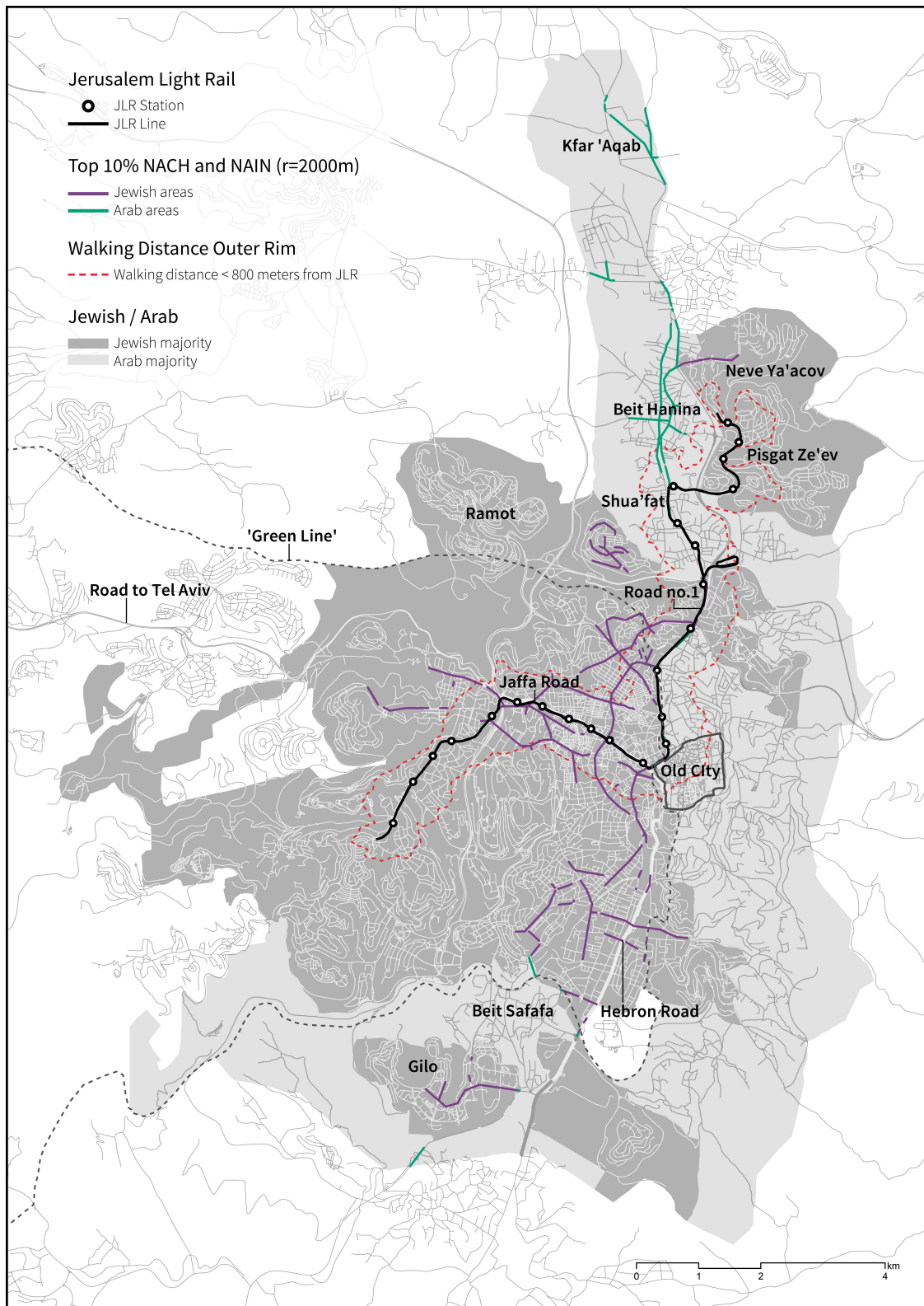


Figure 4: segments with values at the top 10% of both integration (NAIN) and choice (NACH) 2000m across the city, (dotted line highlighting the street segments within 800m walking distance of the JLR).

The extent to which these key points of encounter between the city's populations are accessible can be modelled. This is done by considering where there is most likely to be a cross-over between different flows of movement through the city. Hillier, et al. (1987: 237) were the first to propose that a correlation between the mathematical values of spatial integration and choice might "index the degree of 'movement interface' between inhabitants and strangers". Vaughan (2015) has recently tested this proposition further, analysing the intersection between the different types of movement flowing through and to London's street network, finding that the peak of this intersection occurs in locations with the highest land-use diversity (Vaughan et al 2010; Vaughan 2015).

The premise of our spatial analysis is that depending on political conditions and the permeability of public space – where the two networks of *integration* and *choice* coincide – there will be an increase in convergence of routes for people moving to and through the area and that this mixing is likely to create opportunities for encounter across groups. Hence the analysis in Table 1 and Figure 4 shows where the streets with top values of both integration and choice calculated for a distance of 800m are located. We then look at how easy it is to reach those streets using the JLR, drawing a red dotted line around the furthest extents of station walking catchment (2000m). Table 1 calculates how many of these streets fall within three catchments from JLR stations (800m, 1250m and 2000m).

Percentage of Segments Entire City within the Top 10% of NAIN & NACH for JLR access (radius=2000m)	Arab	Jewish
within 800m walking distance	21.6%	44.1%
within 1250m walking distance	33.4%	58.5%
within 2000m walking distance	59.7%	66.2%

TABLE 1: Percentage of Street Segments in the Entire City within the Top 10% of NAIN & NACH within JLR access (radius=2000m)

Table 1 indicates how the JLR provides access to key points of intersection within the city particularly well for the Jewish population, with 44% of Jewish segments situated within a reasonable 10 minute walk (800m walking distance) from strategic streets near a JLR station. While only around 22% of the Arab population is brought within reach of such streets, this is still a significant proportion, given their relative isolation within the city and overall, almost a quarter of the two main groups in the city have opportunities for encounter created by the JLR.

The strategic segments highlighted by the analysis illustrated in Figure 4 constitute the spaces with the highest potential to be carrying mobility and circulations of public activity in Jerusalem. Given that a significant proportion of the city's streets – (59.7% of Arab and 66.2% of Jewish) streets segments fall within 2000m meters of the JLR, we suggest that the JLR and its surroundings can foster encounter in public space between the two principal ethno-national groups in the city. Nevertheless, such encounters are not necessarily benign. The increase in accessibility created by the JLR is open to positive or negative outcomes depending on the political climate. For example, the eruption of Israeli-Palestinian violence in summer 2014 led to sustained attacks on the JLR and stations in Palestinian neighbourhoods (Nolte 2016). Such events illustrate how mobility and accessibility can paradoxically contribute to increased violent conflict. Several terror attacks during the second half of 2015 outside the Old City's Damascus Gate illustrate this further. Not only is this entry point to the walled city a central linking point between the two sides of the city, it also has a history of inter-communal friction going back decades, if not centuries, (Romann & Weingrod 1991: 41).

5. Conclusion

Cities function as movement networks with their local morphology and street patterns shaping wider transport connections. To understand mobility patterns is to interrogate a complex set of socio-spatial practices. The importance of understanding these multifaceted aspects of mobility and travel becomes significant in providing opportunities for co-presence and interactions and is central to any discussions of the role of the city in overcoming segregation. We

have shown how ethno-nationally motivated segregation in cities is a complex reality, embedded in political structures but also driven by geospatial factors that are not easily unpacked, especially in a case such as Jerusalem with its religious and ethno-national significance as well as millennia of urban change. Whether in Jerusalem or elsewhere, it is clear that simply labelling a city as 'divided', ignores a complex reality that evolves in response to the competing drivers of its operation; a reality that must also take account of the everyday needs of a working city.

We have shown that Jerusalem has high concentrations of residential segregation between ethno-national groups and also across Jewish religious communities. The city's patterns of connections are set against the background of some significantly unequal conditions and obstacles to movement and interaction – physical, economic and political. The recently constructed JLR line has enhanced mobility across the city, increasing opportunities for encounter between different groups. At the same time it has been the source of political violent contention. The long-term ramifications of the JLR infrastructure in connecting the two populations are yet to be fully understood, although on current trends, existing imbalances of political power are likely to intensify given the population growth trajectories of the Jewish ultra-orthodox population on the one hand and the Palestinian on the other.

This paper has raised the importance of connectivity as an issue of spatial and social justice, rather than a function of urban economic development. We have highlighted the way in which various forms of urban mobility loosen the fixity of the concept of the contested city being defined by the separation between its residential populations. Indeed, we argue that analysis of segregation too frequently disregards the mobility of people in the city and opportunities for cross-group encounters. Future research may wish to study other cities to test whether their transport infrastructure serves to potentially reinforce or bridge divisions as is the case here. Such an agenda will highlight the need to construct a more flexible nomenclature for segregation than one that focuses on residential separation. This will entail taking into account the political context as well as how mobility provides the opportunity to link between

populations, creating access and usage of public space that allows for interaction between different ethnic and religious groups in an ever more fractured world of cities.

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References

- Allegra, M. Casaglia, A. & Rokem, J.(2012) The Political Geographies of Urban Polarization - A Review of Critical Research on Divided Cities. *Geography Compass*, 6 (9): 560–574.
- Amin, A. (2002) Ethnicity and the multicultural city: living with diversity. *Environment and Planning A*, 34: 959 – 980.
- Amin, A. (2008) Collective culture and urban public space, *City* 12 (1): 5-24.
- Anderson, J. (2010) Democracy, territoriality and ethno-national conflict: a framework for studying ethno-nationally divided cities. Working Paper no.18, *Conflict in Cities and the Contested State Working Paper Series*.
- Angelo, A. & Hentschel, C. (2015) Interactions with infrastructure as windows into social worlds: A method for critical urban studies: Introduction, *City* 19 (2-3): 306-312.
- Bollens, S. A. (2000) On narrow ground: urban policy and ethnic conflict in Jerusalem and Belfast. Albany: State University of New York Press.
- Bollens, S. A. (2012) *City and Soul in Divided Societies*, Routledge, London New York.
- Bollens, S.A. (1998) Urban planning amidst ethnic conflict: Jerusalem and Johannesburg. *Urban Studies* 35 (4): 729–750.

- Baumann, H. (2015) Enclaves, borders, and everyday movements: Palestinian marginal mobility in East Jerusalem, *Cities*, <http://dx.doi.org/10.1016/j.cities.2015.10.012>
- Brand, R. (2009) Urban artifacts and social practices in a contested city. *Journal of Urban Technology* 16 (2), 35–60.
- Calame, J. & Charlesworth, E. (2009) *Divided cities: Belfast, Beirut, Jerusalem, Mostar, and Nicosia*. Philadelphia: University of Pennsylvania Press.
- Caldeira, T. (2000) *City of Walls: Crime, Segregation, and Citizenship in Sao Paulo*. Berkeley: University of California Press.
- Calderia, T. (1996) Fortified Enclaves: the new urban segregation. *Public Culture*, 8: 303-328.
- Cass, N. Shove, E & Urry, J. (2005) Social exclusion, mobility and access, *The Sociological Review* 53(3): 539-555.
- Cohen-Blankshtain, G. & Feitelson, E. Transportation (2011) 38: 343-361. doi:10.1007/s11116-010-9305-x
- Collins, R. (2004) *Interaction Ritual Chains*. New Jersey: Princeton University Press.
- Dávila, J. eds. (2013) *Urban Mobility and Poverty: Lessons from Medellín and Soacha, Colombia*, London: DPU, UCL and Universidad Nacional de Colombia.
- Davis, M. (2007) *Planet of Slums*. Verso Press.
- Dumper, M. (1997) The politics of Jerusalem since 1967. *Colombia University Press*, New York.
- Dumper, M. (2014) Jerusalem unbound: geography, history and the future of the holy city. *Colombia University Press*, New York.
- El-Atrash, A. (2015). Right to Develop: Planning Palestinian Communities in East Jerusalem: United Nations Human Settlements Programme (UN-Habitat).
- Freudendal-Pederson, M & Cuzzocrea, V. (2015) Cities and Mobilities, *City and Community*, 27 (1): 4-8.
- Giddens, A. (1984) *The Constitution of Society: Outline of the Theory of Structuration*, Cambridge: Polity Press.
- Goffman, E. (1963) *Behavior in Public Places*. New York: Free Press.
- Graham, S. & Marvin, S. (2001) *Splintering Urbanism*. New York: Routledge.

- Greenberg Raanan, M. & Shoval, N. (2014) 'Mental Maps Compared to Actual Spatial Behavior using GPS Data: A New Method for Investigating Segregation in Cities', *Cities*, 36, pp. 28-40.
- Hanson, J. (2000) 'Urban transformations: A history of design ideas', in *Urban Design International*, Vol. 5 (2): 97-122.
- Hanson, J. and Hillier, B. (1987) The Architecture of Community: some new proposals on the social consequences of architectural and planning decisions, *Architecture et Comportement / Architecture and Behaviour*, 3 (3): 251-73.
- Healey, P. (1997) Collaborative planning: shaping places in fragmented societies. London: Macmillan.
- Hepburn, A.C. (2004) *Contested Cities in the Modern West*, New York: Palgrave.
- Hillier, B (1996), 'Cities as Movement Economies', *Urban Design International*, 1 (1), 49-60.
- Hillier, B. & Hanson, J. (1984), *The Social Logic of Space*, Cambridge: Cambridge University Press.
- Hillier, B. and Vaughan (2007) The City as One Thing, *Progress in Planning*, 67, 205–230.
- Hillier, B. Burdett, R. Peponis, J. & Penn, A. (1987) Creating Life: or, does architecture determine anything? *Architecture & Behaviour* 3: 233-250.
- Hillier, B. Yang, T. & Turner, A. (2012) 'Normalising Least Angle Choice in Depthmap: And How It Opens Up New Perspectives on the Global and Local Analysis of City Space', *Journal of Space Syntax*, 3(2) pp. 155-193.
- Jabareen, Y. (2015) The right to space production and the right to necessity: Insurgent versus legal rights of Palestinians in Jerusalem, *Planning Theory*, doi: 10.1177/1473095215591675
- JiIS - The Statistical Yearbook of Jerusalem (2015) *Jerusalem Institute for Israel Studies*, <http://www.jiis.org/?cmd=statistic.525#.VwY-WDaSXII> [accessed: March 2016]
- Khamaisi, R. 2010. "Sustainable in Jerusalem". In *International Society of City and Regional Planners*. The 46th ISOCARP Congress 'Sustainable City Developing World'. Nairobi, Kenya, 19-23 September 2010.
- Kahaner, L. (2009) *The Development of Spatial and Hierarchical Structure of Ultra-Orthodox Population in Israel* (PhD dissertation, Haifa University).

- Klein, M. (2014) *Lives in Common: Arabs and Jews in Jerusalem, Jaffa and Hebron*, Hurst Publishers.
- Klein, M. 2001. Jerusalem the Contested City. London: Hurst and Company.
- Kliot, N. & Mansfield, Y. (1999) Case studies of conflict and territorial organization in divided cities. *Progress in Planning* 52 (3): 167–225.
- Kotek, J. (1999) Divided cities in the European cultural context. *Progress in Planning* 52 (3): 227-237.
- Kwan, M. & Schwanen, T. (2016) Geographies of Mobility, *Annals of the American Association of Geographers*, 106(2): 243-256.
- Legeby, A. (2013) *Patterns of co-presence: Spatial configuration and social segregation*. PhD diss. KTH School of Architecture, Stockholm: KTH.
- Legeby, A. & Marcus, L. (2011) 'Does Urban Structure of Swedish Cities Inhibit the Sharing of Public Space?' *Built Environment*, 37(2): 155-169.
- Legeby, A. Berghauser Pont, M. & Marcus, L. (2015) Streets for co-presence?, *Proceedings of the 10th International Space Syntax Symposium*, London, UK.
- Leitner, H. Sheppard, E. & Sziarto, K. M. (2008) The spatialities of contentious politics. *Transactions of the Institute of British Geographers*, 33 (2): 157-172.
- Lloyd, C. Shuttleworth, I. & Won, D (2014) *Social-spatial segregation*, Policy Press.
- Lofland, L. H. (1998) *The Public Realm: Exploring the City's Quintessential Social Territory*, Transaction Publications.
- Madanipour, A. (2004) Marginal public spaces in European cities, *Journal of Urban Design* 9(3): 267-286.
- Maloutas, T. & Fujita, K. (2012) *Residential Segregation in Comparative Perspective*, Ashgate.
- Marcuse, P. (1997) The Enclave, the Citadel, and the Ghetto: What has changed in the Post-Fordist U.S. City. *Urban Affairs Review*, 33: 228-264.
- Marcuse, P. (2006) Enclaves Yes Ghettos No: Segregation and the State. In Varady, D. (eds.) *Desegregating the City, Ghettos, Enclaves and Inequality*, Albany: State University of New York Press, pp. 15-30.
- Marcuse, P. & van Kempen, R. (eds.) (2002) *Of States And Cities: the partitioning of urban space*. Oxford University Press, Oxford; New York.
- Massey, D. (1994) *Space, Place and Gender*. Minneapolis: University of Minnesota Press.

- Murtagh, B. (2011) Ethno-Religious Segregation in Post-Conflict Belfast. *Built Environment*, 37, 213-225.
- Musterd, S & Ostendorf, W (2013) *Urban Segregation and the Welfare State: Inequality and Exclusion in Western Cities*. Routledge.
- Nightingale, C. H. (2012) *Segregation: A Global History of Divided Cities*. Chicago: The University of Chicago Press.
- Nolte, A. (2016) Political Infrastructure and the Politics of Infrastructure: The Jerusalem Light Rail, *City*, 20.3,
- Park, R. Burgess, E. & McKenzie, R. (1925) *The City*. Chicago: University of Chicago Press.
- Peach, C. (1998) South Asian and Caribbean Ethnic Minority Housing Choice in Britain, *Urban Studies*: 35, 1657-1680.
- Phillips, D. (1998) Black Minority Ethnic Concentration, Segregation and Dispersal in Britain *Urban Studies*: 35 1681-1702.
- Phillips, D. (2007) Ethnic and Racial Segregation: A Critical Perspective. *Geography Compass*, 1 (5): 1138– 1159.
- Rokem, J.. (2013) "Politics and Conflict in a Contested City - Urban Planning in Jerusalem under Israeli Rule." *Bulletin du Centre de recherche franc_ais a' Je'rusalem* 23: 2–12.
- Rokem, J. and Allegra, M. (2016) Planning in Turbulent Times: Exploring Planners Agency in Jerusalem. *International Journal of Urban and Regional Research*, published online 2nd November 2016 (DOI:10.1111/1468-2427.12379)
- Rokem, J. (2016a) Introduction: Learning from Jerusalem - Rethinking Urban Conflicts in the 21st Century. *CITY 20* (3): 407-411.
- Rokem, J. (2016b) Beyond Incommensurability: Jerusalem from an Ordinary Cities Perspective. *CITY 20* (3): 472-482.
- Romann, M. (1996) Between Conflict and Coexistence in Jerusalem?. In Kotek, J. Susskind, S. Kaplan, S. (eds.) *Brussels and Jerusalem: From Conflict to Solution*. The Harry S Truman Research Institute for the Advancement of Peace. The Hebrew University Jerusalem.
- Romann, M. & Weingrod, A. (1991) *Living Together Separately*. Princeton: Princeton University Press.
- Rosen, G. & Razin, E. (2009) The Rise of Gated Communities in Israel: Reflections on Changing Urban Governance in a Neo-liberal Era. *Urban*

Studies, 46; 1702 -1722.

Rosen, G. and A.B. Shlay (2014) Whose right to Jerusalem? *International Journal of Urban and Regional Research*: 38 (3) 935–950.

Sandercock, L. (1998) *Towards Cosmopolis*, Chichester: Wiley.

Sandercock, L. (2003) *Mongrel Cities of the 21st Century*. New York: Continuum Press.

Savitch H. V., and Garb Y. (2006) Terror, Barriers, and the Changing Topography of Jerusalem, *Journal of Planning Education and Research*, 26, 152-173.

Schnell, I. & Benjamini, Y. (2005) Globalisation and the structure of urban social space: the lesson from Tel Aviv, *Urban Studies*: 42 2489-2510.

Schnell, I. Abu Baker Diab, A. & Benenson (2015) A global index for measuring socio-spatial segregation versus integration, *Applied Geography* 58: 179-188.

Sennett, R. (1990) *The Conscience of the Eye*. New York: Alfred A. Knopf publishers.

Shlay, B. A. & Rosen, G. (2015) *Jerusalem: The Spatial Politics of a Divided Metropolis*, Polity Press.

Shtern, M. (2016a) Occupational Integration in a Fragile reality: East Jerusalem's residents in the local labor market (Hebrew). *Israel Institute for Israel Studies*.

Shtern, M. (2016b) Urban neoliberalism vs. ethno-national division: The case of West Jerusalem's shopping malls, *Cities*, 52: 132-139.

Smets, P. & Salman, T. (2008) Countering Urban Segregation: Theoretical and Policy Innovations from around the globe. *Urban Studies*, 45: 1307-1332.

Urry, J. (2002) Mobility and Proximity, *Sociology*, 2002 36: 255-274

Valentine, G. (2007). Theorizing and researching intersectionality: A challenge for feminist geography. *The Professional Geographer*, 59, 10–21.

Valentine, G. (2008). Living with difference: Reflections on geographies of encounter. *Progress in Human Geography*, 32(3), 323–337.

Varady, P. D. (eds.) (2006) *Desegregating the City, Ghettos, Enclaves and Inequality*, State University of New York Press.

Vaughan, L. (2015) The Ethnic Marketplace as Point of Transition, in: Kershen A. ed *London the Promised Land Revisited* Ashgate: Farnham, Surrey 35-54.

- Vaughan, L. (2015) High Street Diversity, In Vaughan, L. (ed.), *Suburban Urbanities: suburbs and the life of the high street*, UCL London: 153-174.
- Vaughan, L. (Ed.). (2007) The Spatial Syntax of Urban Segregation [whole issue]. *Progress in Planning*, 67 (3), 199-294.
- Vaughan, L. and Arbaci, S. (2011). The Challenges of Understanding Urban Segregation, *Built Environment*, 37 (2).
- Vaughan, L. Jones, CE. Griffiths, S. Haklay, M. (2010) The spatial signature of suburban town centres *Journal of Space Syntax*: 1(1) 77-91.
- Wacquant, L. (2016) Revisiting territories of relegation: Class, ethnicity and state in the making of advanced marginality, *Urban Studies*, 53(6): 1077–1088.
- Wacquant, L. (2008) *Urban Outcasts - A Comparative Sociology of Advanced Marginality*. Cambridge: Polity Press.
- Wallach, Y. (2011) Shared Space in pre-1948 Jerusalem? Integration, Segregation and Urban Space through the Eyes of Justice Gad Frumkin: Working paper n. 21: *Divided Cities/Contested States Working Paper Series*.
- Wari, S. 2011. "Jerusalem: One Planning System, Two Urban Realities". *City* 15 (3–4): 456–472.