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PEDESTRIANISED COMMERCIAL AREAS

FROM THE PERSPECTIVE OF THE PEDESTRIAN AND THE VEHICLE

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ABSTRACT

The pedestrianisation of city centre is a developing trend in an attempt to revitalize city centre, often in conjunction with commercial interests (Kumar and Ross 2006) and for a safer environment (Pitsiava-Latinopoulou and Basbas 2000, Sonia and Soni 2016). If the pedestrianisation of high streets is now common in the UK, the implantation of shopping centres nearby increases the surface of pedestrian zones such as Liverpool One in Liverpool or Westgate in Oxford. By extending the pedestrian zones and by pushing the automobile traffic at their periphery, is there not a risk to emulate the Shopping centre model in which access is restricted and circulation contained within its precincts, but at the expense of the surroundings?

The case study is Newcastle City Centre that hosts a shopping centre near a pedestrianised high street. The city council projects to extend the pedestrianisation to a much larger area including the main integrated east-west axis – Blackett Street – that is currently shared by both pedestrians, buses and taxis. This study investigates the potential effects of prospective pedestrianisation on the liveliness of the commercial centre of the city through studying the distribution of pedestrians before and after the closure of Blackett Street to traffic. The main hypothesis of the paper is that an effective pedestrianisation should take into consideration the syntactic primary structure of the city. Hence, this study questions the removal of the most integrated street of the primary structure of the city in terms of public transportation (buses), which is the primary source of potential pedestrians into the centre. How does the pedestrianisation of part of the primary structure affect the liveliness (movement) of the edge of the core?

This paper looks at the logic of the axial map as it is reintroduced by the pedestrianisation of large areas, in relationship with the city scale logic of the street centre-line (Turner 2007, Liu and Jiang 2012). The spatial structure of the city is therefore analysed globally through street centre-lines as well as more locally through axial lines. Moving and static activity is recorded by street segment on the edge of the pedestrianized area and on Blackett Street, over 4 weekend days (on two of which Blackett Street is closed to transit). Three times are recorded: 10h, 14h and 21h. The last time period is also included to compare the rates of pedestrian flows when the shops are closed and the retail

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activities are reduced. Pedestrian counts are then aggregated by axial line, and statistical analyses are developed to compare the association of each representation mode on the distribution of flows.

It is expected that locally, from the point of view of the transit (street centre line analysis), the spatial structure of the city will change drastically since the primary structure is broken and globally the edge becomes the transition space; whereas from the point of the pedestrian (axial lines analysis), it will remain unchanged. Understanding the logic of the axial map in relationship with the street centre-line logic could help in maintaining a lively city centre by preserving the primary structure.

KEYWORDS

Pedestrianisation, axial map, street centerline map, Newcastle UK, pedestrian movement

1. INTRODUCTION

Pedestrianisation is not a new concept, but has been in practice as a traffic policy, more commonly after the 1960s. By 1975, all major European Cities banned cars from historic and retail areas within the CBD with an aim to revive the concept of the "Main Street" as a centre for not only trading, but an area of social gathering in an effort to revive the inner city (Moosajee 2009). The pedestrianisation of selected streets was introduced as a measure to counter air, noise and visual pollution in central areas, to encourage walking and socializing, to boost tourism, and to ensure the financial viability of inner-city retail stores (Parajuli and Pojani, 2018). It is argued that `urban regeneration through pedestrianized spaces` contributes to a decrease in car-dependency, an increase in pedestrian activity levels, and greater economic activity particularly in city centres (Wooller et al., 2012, p.17). City centres may have higher visitor numbers, an increased sense of community and increased economic profits through the implementation of pedestrianisation schemes, which require collaborative efforts between local authorities and other stakeholders (Monheim, 2013). However; these pedestrian environments were also criticized due to a lack of design creativity, leading to monotony and sameness (Hass-Klau, 2015), as well as commercial gentrification/displacement as a result of increasing rents (Ozdemir and Selcuk, 2017).

The pedestrianisation of city centre is a developing trend in an attempt to revitalize city centre, often in conjunction with commercial interests (Kumar and Ross 2006) and for a safer environment (Pitsiava-Latinopoulou and Basbas 2000, Sonia and Soni 2016). If the pedestrianisation of high streets is now common in the UK, the implantation of shopping centres nearby increases the surface of pedestrian zones such as Liverpool One in Liverpool or Westgate in Oxford. By extending the pedestrian zones and by pushing the automobile traffic at their periphery, is there not a risk to emulate the Shopping centre model in which access is restricted and circulation contained within its precincts, but at the expense of the surroundings?

There are various pedestrianisation planning strategies, such as fulltime pedestrian streets, part time pedestrian streets and traffic calming streets, through which planning for pedestrians can be conducted in stages (Akit, 2004). This research will try to provide a basis for prospective urban design alternatives already under investigation by the Newcastle City Council. The City Council already has plans to pedestrianize one of the major streets, the Blackett and NewBridge Street (BNB), in the city centre of Newcastle upon Tyne. This proposal has met both with support and with objection. According to a poll run by Chronicle Live, readers are split down the middle over the potential closure of Blackett Street (over 500 voters, 52% for open, 48% for closed)[2]. Meanwhile, there is an ever-growing dispute between the Council and the Bus companies that currently serve along this street. Council leader Nick Forbes stated that the pedestrianisation of Blackett Street as one tactic that could improve air quality in the city centre[3], while the bus company has criticized council plans to restrict traffic from passing through the city centre route as part of regeneration plans. A spokesperson said: “The city council’s plan to ban buses from Blackett Street, and to temporarily close the street completely, could have a serious impact on the tens of thousands of bus passengers each week who rely on services dropping them off in the heart of the city”[4].

While the majority of studies on pedestrianisation either evaluates the existing conditions of streets before the act of pedestrianisation (Hussein, 2018) or assesses the emergent circumstances after the implementation (Mofidi and Kashani Jou, 2010), this study evaluates simultaneously the two conditions during temporary closures to all traffic of two streets in Newcastle. This is an important contribution to the literature since it provides a data-driven basis for prospective pedestrianisation studies. Another gap in the pedestrianisation literature is that while most studies assess the development of pedestrianised areas in terms of the economic benefit to retailers, traffic calming measures, street furniture, land-use distribution and gentrification (Kumar and Ross, 2006; Bachok et al., 2004; Özdemir and Selçuk, 2017; Litman, 2014), only few consider the pedestrianisation process in terms of its effects on the configurational properties of the surrounding street network (Kubat et al., 2013). This study argues that surrounding street network layout should be considered as a significant component in evaluating the pros and cons of future pedestrianisation projects.

This study investigates the potential effects of prospective pedestrianisation on the liveliness of the commercial centre of the city through studying the distribution of pedestrians before and after the pedestrianisation of Blackett and NewBridge Streets. As such, the aim is to demonstrate the association between the syntactic structure of the street network of the surrounding urban fabric and the distribution of flows to understand the potential effects of the closure of this street in terms of both vehicular and pedestrian traffic. The main hypothesis of the paper is that an effective pedestrianisation should take into consideration the syntactic primary structure of the city. Hence, this study questions the removal of one of the most integrated street of the primary structure of the city in terms of public transportation (buses), which is the primary source of potential pedestrians into the centre. How does the pedestrianisation of part of the primary structure affect the liveliness (movement) of the edge of the core?

[2] https://www.chroniclelive.co.uk/news/north-east-news/what-youre-saying-council-plans-14161299
[3] https://www.chroniclelive.co.uk/news/north-east-news/newcastle-christmas-market-blackett-street-15231199
[4] https://www.chroniclelive.co.uk/news/north-east-news/stagecoach-against-one-newcastle-city-14228254

In the first part, the study investigates the city from a global and vehicular point of view, understanding how the removal of a main thoroughfare will impact the city as a whole. The second part deals with understanding the potential effects of the street closure on pedestrian distribution within the city centre. It concludes with some points to take into account for example bus location and potential shift of the centre of activities.

2. RESEARCH DESIGN AND METHODOLOGY

Study Area

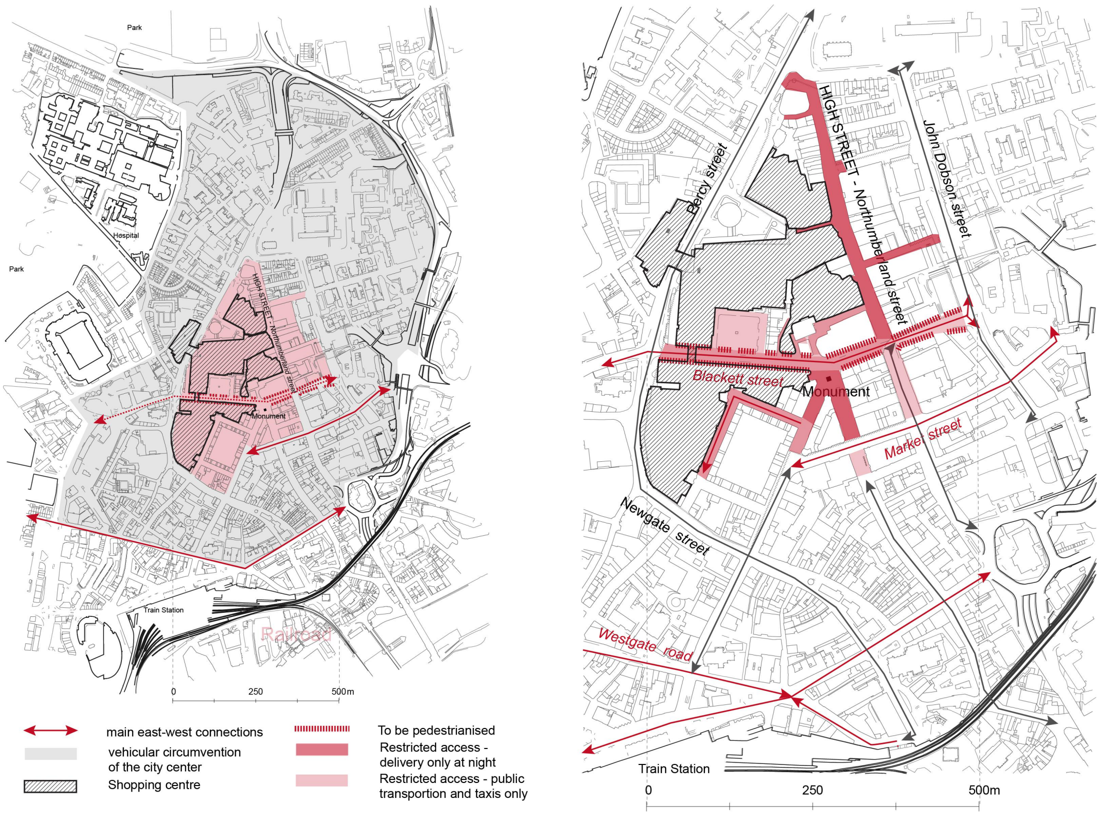

Figure 1. Circulation in the city center showing natural edges for pedestrian access (highway, hospital and railways), road restricted access and pedestrianized areas.

The case study is Newcastle City Centre that hosts a shopping centre near a pedestrianized high street (Northumberland Street). Some infrastructure such as highway, railways and hospital creates a di facto bounded area for pedestrians (120ha), which tends to be also circumvent by vehicular access. Figure 1 highlights the importance of Blackett and New Bridge streets as the main east-west axis and Percy and Newgate streets as the main north-south axis within the area. The city council projects to extend the pedestrianisation to a much larger area (20ha) including the main integrated east-west axis – approximately 500m – that is currently shared by pedestrians, buses and taxis. Blackett Street is located in the heart of the city centre, which is reasonably well supplied with bus lines (with multiple bus stops along Blackett Street). However, many people also access the area by car/taxi and expect parking spaces to be provided within this area. Although private car access is prohibited along the Blackett Street, taxi and bus use is common. The pedestrianisation of this street is seen as reducing accessibility to the heart of the city centre, particularly for bus passengers and those with mobility issues. Surrounding streets along the central grid accommodate bus access and stops as well, but the primary east-west transportation axis is along the Blackett Street and removing this would result in the removal of this access link. Hence, the pedestrianisation of Blackett Street is a rather contentious issue.

Methodology

To understand the effect of pedestrianisation of Blackett Street on the distribution of pedestrian densities, moving and static activity is recorded by street segment on the edge of the pedestrianized area and on Blackett Street, over 4 weekend days (on two of which Blackett Street is closed to transit) (Figure 2). Three times are recorded: 10h, 14h and 21h. The last time period is also included to compare the rates of pedestrian flows when the shops are closed after 20h. Pedestrian counts (both moving and static) are then normalized per 100 meters of segment length and aggregated by axial lines. Two segment-based maps are created and analyzed in this study: first, vehicular network map to understand the effects of the removal of the to-be pedestrianized street on public transportation accessibility, and second, a pedestrian network map to study the correlations of syntactic measures with the distribution of pedestrians. The pedestrian map includes the elevated walkways as well as internal connections such as through shopping center or campus. This paper also looks at the logic of the axial map as it is reintroduced by the pedestrianisation of large areas, in relationship with the city scale logic of the street centerline (Turner 2007, Liu and Jiang 2012). The spatial structure of the city is therefore analyzed globally through street center-lines (segment-based maps at the metropolitan scale) as well as more locally through axial lines (axial map at the city center level). Highways are removed from the segment and axial maps.

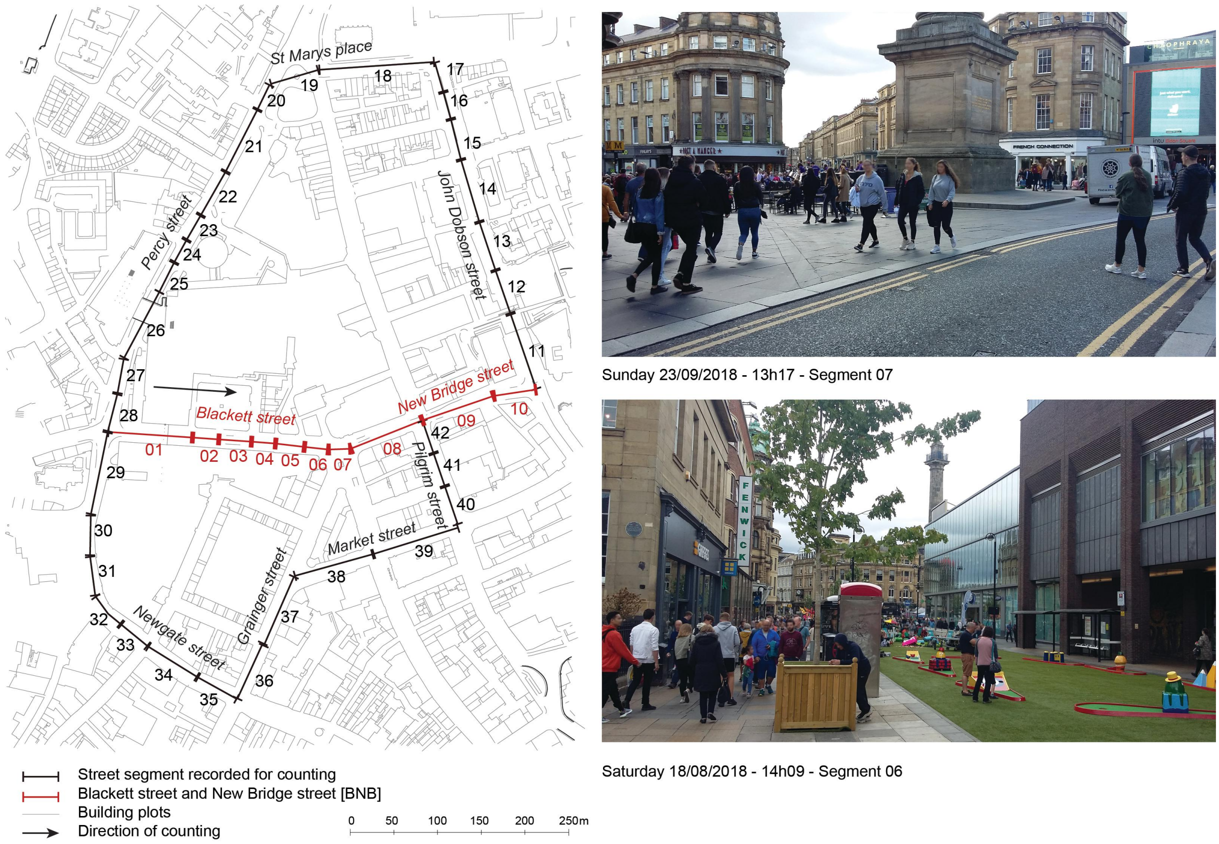

Figure 2. Blackett Street in its surrounding urban context. Top right, when it is open to busses and taxis; bottom right, when it is pedestrianized.

The spatial configuration pattern of street network within study areas are evaluated using Segment Angular Integration, Normalised Angular Choice (NACH) and Metric Reach. *Segment Angular Integration* measures how accessible each space is from all the others within the radius using the least angle measure of distance. Global integration (radius n) measures how accessible each space is from all the others within using the least angle measure of distance; while local Integration (radius 3) measures the accessibility of each segment to all others within 3 steps. NACH measures how many least angular paths lie between every pair of segments within a given distance taking different size of layouts into consideration (Hillier and Iida 2005). Normalised choice divides total choice by total depth for each segment in the system. This adjusts choice values according to the depth of each segment in the system, since the more segregated it is, the more its choice value with be reduced by being divided by a higher total depth number (Hillier et al., 2012). Metric Reach calculates the length of streets (and street segments) captured within a predefined distance from the midpoints of each segment to all directions (Peponis et al. 2008). Metric Reach for 1 km threshold was calculated to capture the vehicular distance traveled; whereas, Metric Reach for 400m threshold was calculated to measure the distance pedestrians can access within a comfortable walking distance. Integration and Metric Reach are calculated for the entire metropolitan city of Newcastle upon Tyne. Integration is calculated in Depthmap (Turner and Friedrich 2010) while Metric Reach is calculated using Java.

Lastly, linear correlations are developed to compare the association of each representation mode (segment vs. axial analysis) on the distribution of flows. Logarithmic transformation is applied to transform the distribution of flows into a normal distribution.

3. RESULTS

Syntactic Variations on the edges of the pedestrian zone

Table 1 shows the average syntactic values of street segments at the edge of the selected route –both calculated as part of both the city centre and the overall metropolitan area–, measured before and after the removal of the Blackett Street.

Table 1. The average syntactic values of street segments at the edge of the selected route –both calculated as part of both the city center and the overall metropolitan area–, measured before and after the removal of the Blackett Street.

Vehicular segment-based map	Edge route			All segments		BNB
	All (n=32)	No BNB (n=32)	Scale of calculation	Mean (max)	Top 10%	(n=10)
Integration (r:n)	13,439	12,161	City centre (n=43,102)	12,019 (15,471)	13,597	13,218
			Metropolitan area (n=259,116)	10,369 (15,999)	12,764	
NACH	1.112	1.024	City centre (n=43,102)	0.847 (1.479)	1.147	1.076
			Metropolitan area (n=259,116)	0.848 (2.21)	1.138	

Based on Table 1, the overall global integration and NACH values of the vehicular segments on the edge are slightly affected by the removal of Blackett and New Bridge Streets (BNB). The removal of BNB slightly decreases the overall value of the edge and as such weakens slightly the role of the edge as superstructure. Figure 3 illustrates these results on the map. Accordingly, the removal would result in the further isolation of John Dobson Street (shown in blue) at the edge, which is already underused. The selected route is part of the global integration core[5] (10%) at the metropolitan scale, thus removing BNB from the vehicular network might disturb the global accessibility for public transportation. On the other hand, looking at the values within the city centre (smaller geographical zone), the BNB is neither part of the integration core (10% integration core) nor the superstructure (10% NACH). Hence, we can argue that the removal of BNB might partially affect the vehicular logic at the global scale but its effects on the local legibility of the city centre is marginal (since these two streets are not part of 10% integration core). Another implication of this removal would be that due to the relocation of existing heavily used bus stops from the BNB to the edge streets (Figure 4), bus users will have to walk a maximum distance of 250 meters (~3 minutes) more to reach the monument (aka the heart of the city centre).

[5] Integration core is defined as the 10% of the top values based on the previous literature (Peponis et al. 1990, Baran et al. 2008, Klarqvist 2015).

Figure 3. Red shows that the NACH value increased after the removal of BNB and blue shows decreased value. The primary structure (black) defined by the top 10% of NACH values for the entire city, and defined by the upper quartile (black dotted).

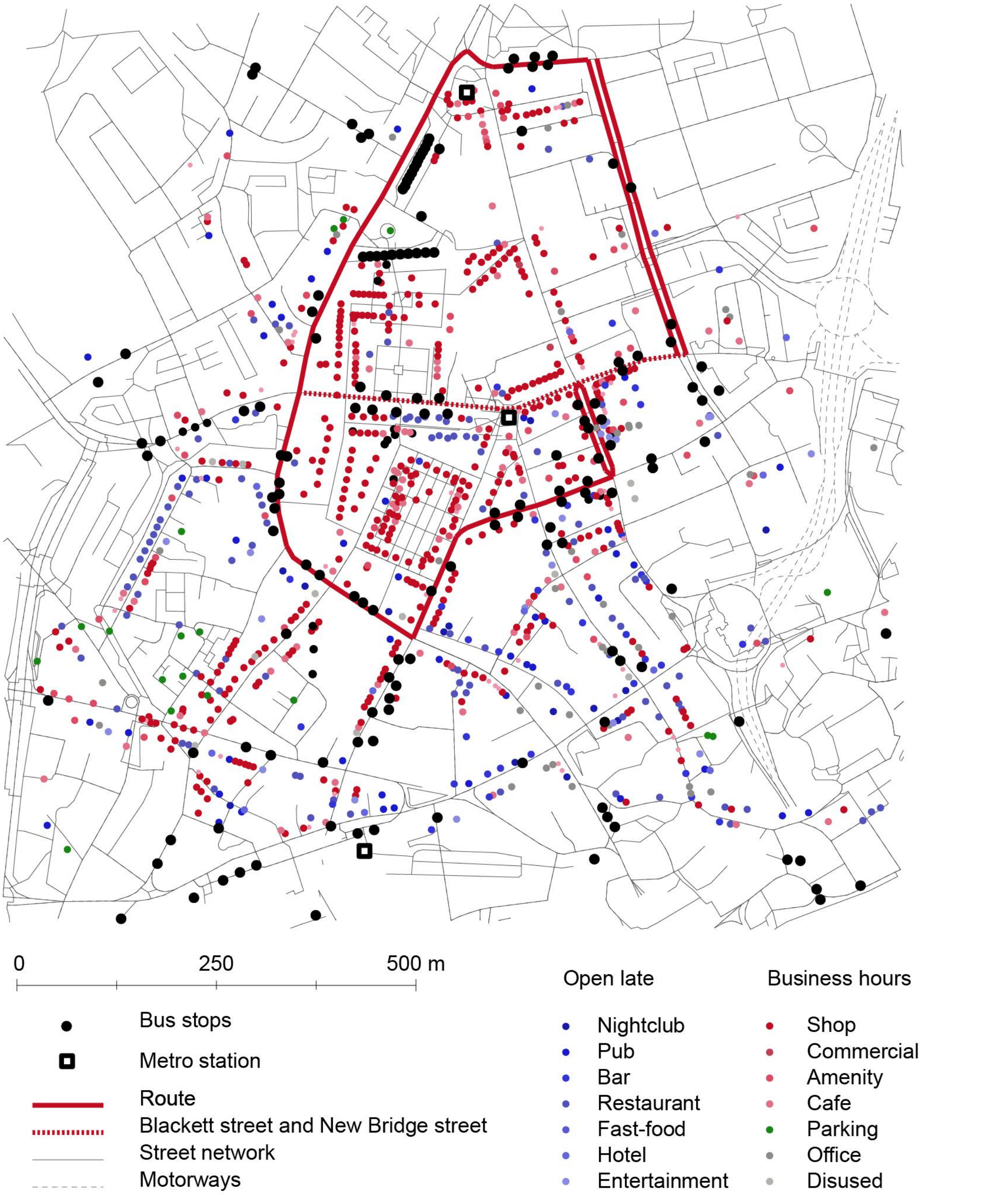

Figure 4. Location of bus stops along the route and within the adjacent neighborhood Location of Businesses depending on their operating hours: remaining open late at night (blue) or normal business hours (red).

Variations in Pedestrian Distributions

Figure 5 illustrates the distribution of pedestrian densities (normalized by 100m., and averaged over 4 days) along the selected route. As is evident, Blackett Street is most densely occupied. Parts of Newgate and Grainger Streets (southern section of the map) are similarly highly occupied due to restaurants and nightclubs (land use attractors opening onto streets) as shown in Figure 4.

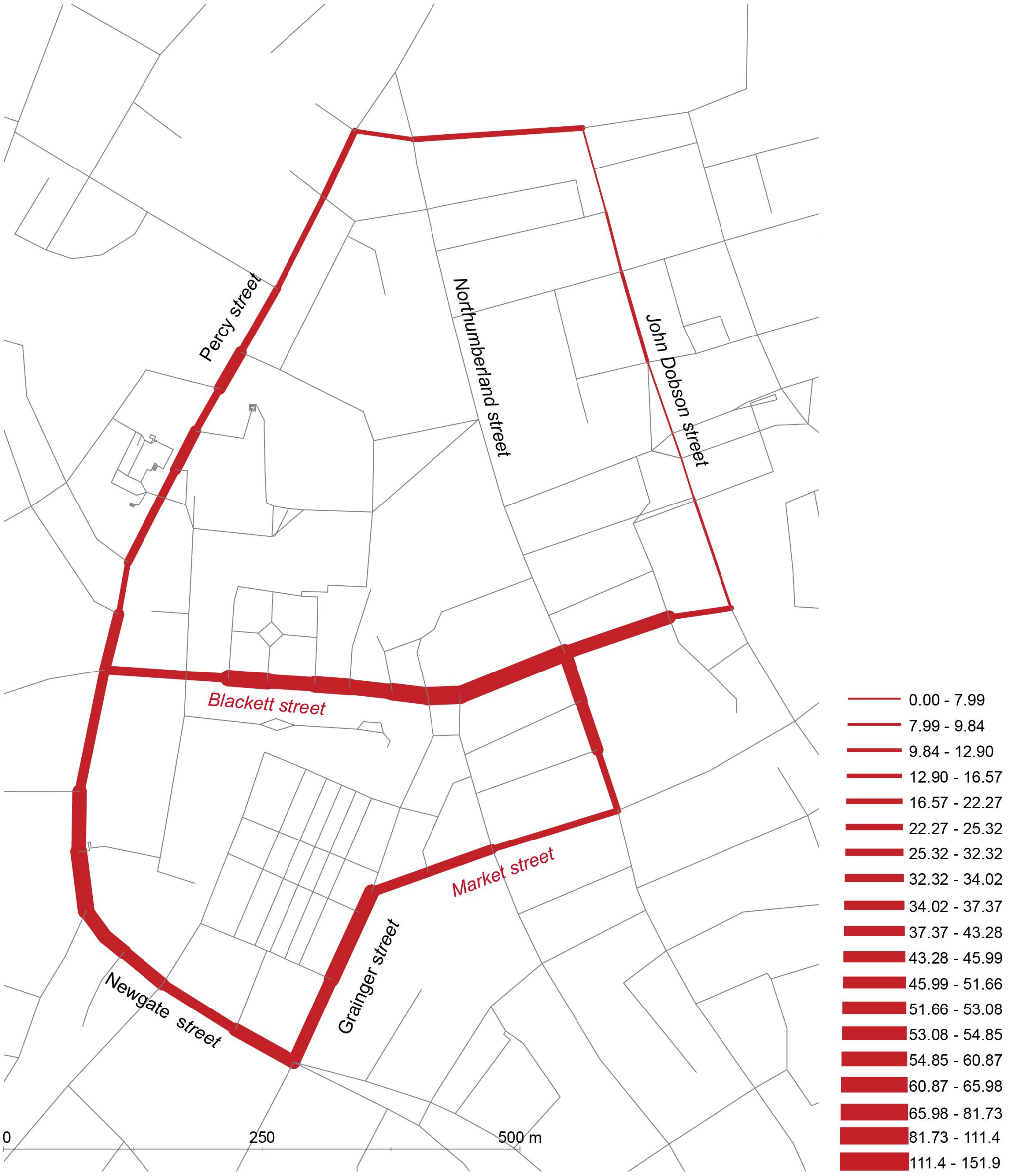

Figure 5. The distribution of pedestrians densities (normalized per 100m, and averaged over 4 days) along the selected route.

In order to compare the distribution of densities before and after the pedestrianisation, a peak time (Saturday, 14h) and the overall average during the weekends are investigated further (Figure 6). As Figure 6a demonstrates, when the Blackett Street is closed to transit, the entire area loses overall in pedestrian occupancy in the peak time (Saturday, 14h.). Only two sections of the street gains in occupancy. Similarly, when the overall difference between open and closed to transit is analysed (Figure 6b), the Blackett Street loses overall in pedestrian occupancy; while the Newgate Street gains in occupancy since the buses are re-located at the southern edge.

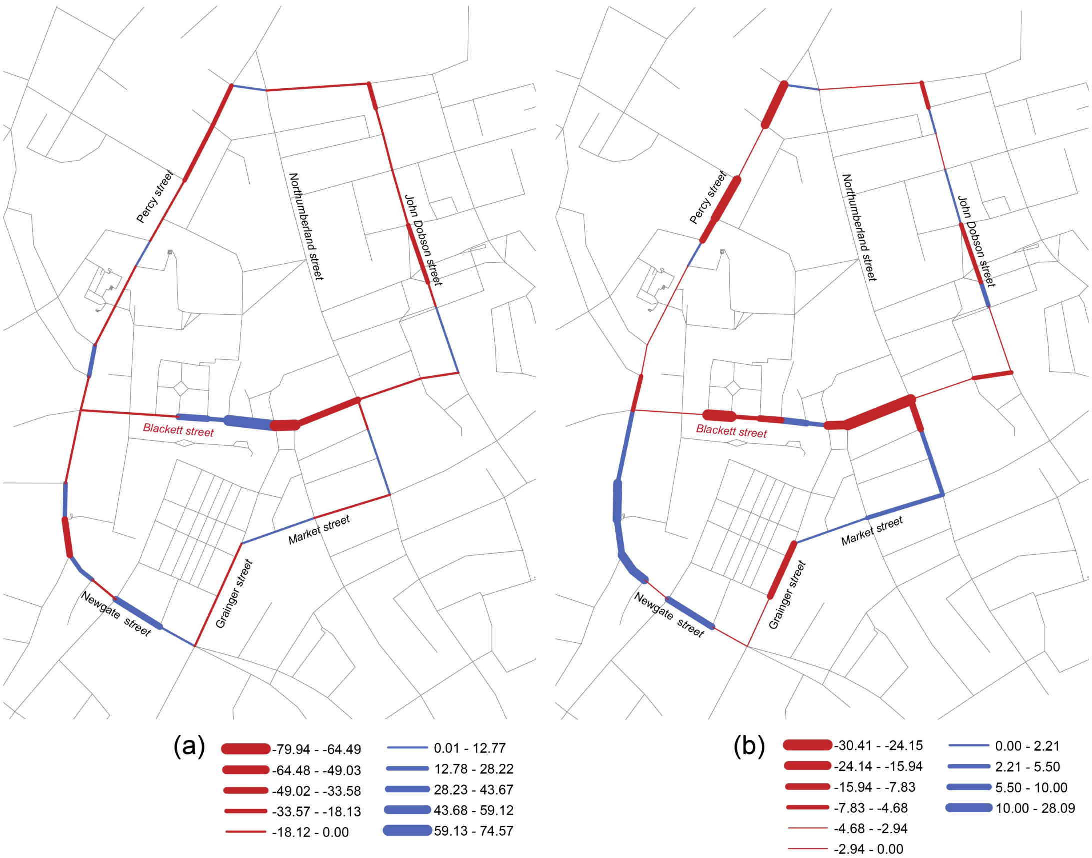

Figure 6. The gain (increase) and loss (decrease) after pedestrianisation in the density of pedestrians along the segments for (a) Saturday, 14h.), and (b) overall average of the weekends is represented. Blue and orange colors denote gain and loss respectively.

Correlations of syntactic measures with presence of pedestrians

Table 2 demonstrates the results of linear correlations between the logarithm of overall pedestrian densities (moving and static, average over 4 days) and various syntactic measures at the segment-level. As seen, there is a significant association between the average pedestrian densities and the spatial configuration of street network. Surprisingly, the distribution of pedestrians is highly associated with global measures (global Integration and Metric Reach 1km) while there are no significant correlations between the pedestrian densities and local measures (local Integration and Metric Reach 400m). Hence, it can be claimed that pedestrians choose to occupy street segments that have increased potentiality of movement options within the entire network. In other words, the distribution of pedestrians throughout the city centre tends to follow the primary structure of streets rather than local street densities. The addition of alternative routes through campuses and the central shopping centre does not influence the overall distribution.

Table 2. Results of linear correlations of logarithm of overall pedestrian occupancy (moving and static, average over 4 days) with syntactic measures at the segment-level. n=42.

	β	std error	t ratio	adj r^2
Integration (r:n)	0.00*	0.000	10.14	0.71
Integration (r:3)	Not significant			
NACH	6.36**	1.073	5.93	0.45
Metric Reach (400m)	Not significant			
Metric Reach (1km)	0.12**	0.015	8.36	0.63

** p<0.001; * p<0.05

Before and after pedestrianisation

Tables 3 and 4 show the results of correlations between pedestrian densities and segment-level and axial map-level pedestrian network respectively, as calculated before and after the pedestrianisation of BNB (moving and static, averaged over 2 days per each scenario). Accordingly, the correlations are stronger when the BNB is closed to vehicular traffic. This might be due to the fact that with the pedestrianisation, the bus stops, and hence potential pedestrians, are shifted towards these highly integrated streets at the edge, helping to meet their potentiality of accessibility. Contrarily, the correlations between pedestrian movement and axial integration (r:n) values are higher when the street is open to vehicular traffic (Table 4). Although this is contrary to expectations (due to pedestrians occupying the entire street and not just the sidewalk once it is blocked to traffic, and hence meeting the requirements of the axial space), this might be due to the limited time that this street was pedestrianized, which did not allow for the pedestrian movement to get tuned to the spatial structure of the urban grid. However, this could change once and if the street is pedestrianized for good in the future. The comparison of before and after pedestrianisation between the syntactic values of edge streets only and pedestrian movement demonstrates a similar trend. In addition, it is important to note that the correlations are stronger with moving people rather than static ones (sitting and standing). This can support the argument that static users are more related to bus stops (i.e. waiting for the bus) or specific land uses (i.e. window shopping).

Table 3. The results of correlations between pedestrian densities and syntactic values for pedestrian network at the segment-level, comparing before and after the pedestrianisation of BNB. n=42.

	β	std error	t ratio	adj r^2
	Closed (pedestrianized) Open (not-pedestrianized)			
Integration (r:n)	0.00** 0.00**	0.000 0.000	10.13 9.19	0.71 0.67
NACH	6.76** 6.08**	1.12 1.10	6.04 5.51	0.46 0.42

Metric Reach (1km)	0.13** 0.12**	0.015 0.016	8.93 7.38	0.66 0.57

** p<0.001; * p<0.05

Table 4. Results of linear correlations of logarithm of overall pedestrian occupancy (moving and static, average over 4 days) with syntactic measures at axial map-level. n=12.

	β	std error	t ratio	adj r^2
	Closed (pedestrianized) Open (not-pedestrianized)			
Axial Integration (r:n)	3.17* 3.50*	0.99 0.99	3.18 3.56	0.45 0.51
Axial Integration (r:3)	1.89* 2.27*	0.81 0.77	2.33 2.94	0.29 0.41

** p<0.001; * p<0.05

4. DISCUSSION

The syntactic analysis of the city centre of Newcastle upon Tyne as well as the correlation analysis of the distribution of pedestrian movement and syntactic measures confirmed the significance of the Blackett and NewBridge Streets (BNB) as a primary element of the commercial centre of the city. Based on the results presented in this paper, it can be argued that from a vehicular (bus and taxis) perspective, the pedestrianisation of Blackett Street has an impact on the legibility of the city superstructure, leading to weakening the role of the surrounding edge streets as part of the global (at the metropolitan scale) superstructure. Since this street is an integral part of the primary skeletal structure of the city (10% global integration core), its removal from the vehicular network will decrease vehicular accessibility at the metropolitan scale. However, this impact is less influential at the scale of the city centre since this street is neither part of the integration core nor the superstructure at this level. As a result of this pedestrianisation, the existing bus routes as well as bus stops along this street are shifted towards the southern edge, weakening the pedestrianised street area in terms of static movement (i.e. people waiting for buses). In addition, this will also create a stronger segregation of the northern-east edge, which is already underused. Hence, one recommendation of this study is to suggest the even distribution of bus stops, when possible, at the edge of the centre, more particularly on John Dobson Street. This will help activate this underused street, which may be less integrated in this sample but is still at the city level.

Newcastle has a clear superstructure with its system of motorways and main streets. BNB has served as the historical spine for growth of the city as they used to be along the medieval town wall. However, the lack of any significant correlations of local syntactic measures with densities of pedestrians indicates a less logical pattern of infill urban fabric (secondary streets), arguably due to the internal logic of the central shopping mall, elevated walkways and two university campuses located at the city centre. None of these architectural elements follow a traditional urban pattern. Hence, at the local level, it might be argued that pedestrian movement is less tuned to the spatial structure of the urban grid and is more associated with non-residential land uses opening onto the streets. Moreover, the comparative analysis of before and after the pedestrianisation of BNB (Tables 3 and 4) showed that correlations of pedestrian movement with the urban grid are higher when the street is closed for traffic. This indicates that pedestrianisation of BNB at the heart of the city might demonstrate an effective way for the city to build upon its exiting potential by relocating bus stops on integrated and accessible streets. In other words, as the numbers of static urban dwellers (people waiting at bus stops) and potential pedestrians (walking to/from the bus) increase along these already integrated street segments, the accessibility potentiality of these segments are met. On the other hand, the correlations between pedestrian densities and axial integration produce lower values for the closed scenario (once the street is closed to traffic). One suggestion could be that since the pedestrianisation was for a limited amount of time, the pedestrian movement did not have sufficient time to get tuned to the spatial structure of the urban grid. However, this could change on the long term after the pedestrianisation of this street. In addition, the significant high correlations between pedestrian densities and axial lines measures at the city centre level indicate that locally pedestrian movement is captured not by the logic of street as a series of centre-line segments but by the logic of street as an open space. Hence, in this case, axial lines map is arguably more representative of pedestrian distribution within the city centre at the local scale. This finding is in conformity with earlier studies arguing the significant association of axial map analysis with pedestrian movement (Monokrousou and Giannopoulou, 2016; Sharmin and Kamruzzaman, 2018; Mansouri and Ujang, 2017; Baran et al., 2008). However, the decrease in pedestrian presence along BNB once this street is pedestrianized should also be taken into consideration before the final decision on pedestrianizing the street. As the analysis in this paper shows (Figure 5), the removal of transportation access along this street would lead to a significant decrease in the numbers of pedestrian occupancy (a total of moving and static) due to the removal of heavily used bus stops. Hence, part-time pedestrianisation (pedestrianisation on weekends only) can be a desirable solution in this case.

Limitations

One of the limitations of this study is the limited number of days on which pedestrian counts were conducted. However; since a total round of twelve rounds of counts were conducted per each circumstance (open versus closed), the error margin is considered to be marginal. Another limitation is the lack of a retail inventory and land use analysis, which might have effects on pre- and post-pedestrianisation. Moreover, this study lacks in any consultation with urban and transport planners for any public transport provision or issues of pedestrianisation (how the pedestrianised space will be utilised over an entire year). Since this intervention could create functional problems, such as the disruption of the major east-west axis of transportation within the city centre, the results of this study need to be complemented particularly by a transport study. Lastly, during the pedestrian counts, people at the bus stops were not considered separately but as part of the overall static movement, which hinders any definitive findings related to the contribution of bus stop users to overall street use.

The temporary closure over several weekends during the summer provided a mean to compare simultaneously the two conditions: with or without pedestrianised area. However, the relatively short duration (2 days a week), and during the week day, lacks in fully capturing the daily commute of workers to the city during the week. Nevertheless, this study provides a comprehensive methodology that links the local patterns of movement to the global logic of the city. Therefore, this methodology can be generalised to assess the impact of local decision of pedestrianisation on the overall functioning of cities.

Implications

Pedestrianisation schemes can contribute to the improvement of the built environment through creating increased safety and visual attractiveness as well as increased environmental health. The findings of this study can guide planning policy decisions on the pedestrianisation of Blackett and New Bridge Streets in Newcastle, in particular, and can facilitate the development of pedestrianisation initiatives, in general. Since this study provides evidence-based information on the potential pedestrianisation of this street, the City Council may use this data to shape their decisions while the bus companies/public can act more critically or be assured more persuasively based on the provided information. In addition, the policy makers and planning agencies can use the same analytical methodology in sketching out plans on designing and developing pedestrianisation schemes without speculating on the future consequences. Such an evidence-based study can also guide the local authorities in developing a vision or master plan for pedestrians by offering before and after scenarios through a qualitative perspective. However, it should be noted that in the process of its application, these findings need to be re-evaluated in cooperation with traffic engineers and transportation agencies. Nevertheless, the key lesson from this study is that before engaging in any detailed process of pedestrianisation, a thorough analysis of the spatial structure of the surrounding street network at different scales (local and global) is needed.

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