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Special Issue Editor, CODATU
Case Studies in Transport Policy

Dear Editor,

Please find enclosed our **revised** paper entitled URBAN SPACE DISTRIBUTION: THE CASE FOR A MORE EQUITABLE MOBILITY SYSTEM for consideration in the CSTP Special Issue from the CODATU conference. We have also included the feedback to the reviewer comments for ease of reference.

I confirm that the paper was presented at the conference and is currently not being considered for publication elsewhere.

Myself and my co-authors have no conflict of interest.

Thank you

Maria Attard
Department of Geography, University of Malta, Msida, Malta maria.attard@um.edu.mt

Luis A. Guzman
Department of Civil and Environmental Engineering, Faculty of Engineering, Universidad de los Andes, Bogota, Colombia la.guzman@uniandes.edu.co

Daniel Oviedo
Faculty of the Built Environment, The Bartlett Development Planning Unit, UCL, London, UK
daniel.oviedo@ucl.ac.uk

Highlights

- In urban planning more space is allocated to the car, promoting rapid urbanisation at the expense of the space for more sustainable modes of transport.
- Urban space is unevenly distributed in many cities reflecting on their social, economic and political contexts.
- Inequalities lead to inequities in the transport system and the availability and use of open and public space
- The study raises awareness of the equity issues surrounding urban transport systems, and the need for more sustainable urban designs for public and open spaces, identify commonalities and structural drivers of spatial inequalities, as well as context-specific determinants of urban space distribution.

URBAN SPACE DISTRIBUTION: THE CASE FOR A MORE EQUITABLE MOBILITY SYSTEM

Maria Attard, Department of Geography, University of Malta, Msida, Malta
maria.attard@um.edu.mt

Luis A. Guzman, Department of Civil and Environmental Engineering, Faculty of Engineering, Universidad de los Andes, Bogota, Colombia la.guzman@uniandes.edu.co

Daniel Oviedo, Faculty of the Built Environment, The Bartlett Development Planning Unit, UCL, London, UK daniel.oviedo@ucl.ac.uk

Abstract

Cities everywhere are struggling to establish more sustainable transport systems to reduce accidents, congestion, pollution and improve overall urban environments for human well-being. Due to increased mobility, particularly with private motorized vehicles, there is pressure and conflicts over space allocation in limited city roads and open spaces. There is also evidence that different transport modes are favoured over others in the allocation of and access to space. In urban planning, there are increasing efforts to allocate more space to the car, promoting rapid urbanisation at the expense of the space for more sustainable modes of transport. This process is leading to negative externalities, making the road environment unsafe for those outside the car. This space distribution is also dynamic and responsive to political agendas that change over time and geography. This research provides a comparative of urban space allocation in three cities, distinguishing between motorized (private and public transport) spaces and spaces allocated to non-motorized modes (walking and cycling). The research builds on analysis across different geographies of development taking examples from Europe, South America and Africa as case studies. We approach the cities of Bogotá (Colombia), Valletta (Malta) and Freetown (Sierra Leone) as examples of high density urban areas from both the global south and global north. The methodology entails the use of high-resolution satellite images and the application of geographic information systems to derive the necessary measurements in each city. Results show how space is unevenly distributed in many parts of the case study cities in the context of their own social, economic and political contexts, reflecting on the distribution of space in relation to other inequalities that might manifest in the urban space. Such inequalities lead to inequities in the transport system and the availability and use of open and public space. The study hopes to raise awareness of the equity issues surrounding urban transport systems, and the need for more sustainable urban designs for public and open spaces, identify commonalities and structural drivers of spatial inequalities, as well as context-specific determinants of urban space distribution.

Keywords: urban space; sustainable mobility; inequities

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Abstract

Cities everywhere are struggling to establish more sustainable transport systems to reduce accidents, congestion, pollution and improve overall urban environments for human well-being. Due to increased mobility, particularly with private motorized vehicles, there is pressure and conflicts over space allocation in limited city roads and open spaces. There is also evidence that different transport modes are favoured over others in the allocation of and access to space. In urban planning, there are increasing efforts to allocate more space to the car, promoting rapid urbanisation at the expense of the space for more sustainable modes of transport. This process is leading to negative externalities, making the road environment unsafe for those outside the car. This space distribution is also dynamic and responsive to political agendas that change over time and geography. This research provides a comparative of urban space allocation in three cities, distinguishing between motorized (private and public transport) spaces and spaces allocated to non-motorized modes (walking and cycling). The research builds on analysis across different geographies of development taking examples from Europe, ~~Latin~~ South America and Africa as case studies. We approach the cities of Bogotá (Colombia), Valletta (Malta) and Freetown (Sierra Leone) as examples of high density urban areas from both the global south and global north. The methodology ~~will~~ entails the use of high-resolution satellite images and the application of geographic information systems to derive the necessary measurements in each city. Results ~~are expected to~~ show how space is unevenly distributed in many parts of the case study cities in the context of their own social, economic and political contexts, reflecting on the distribution of space in relation to other inequalities that might manifest in the urban space. Such inequalities lead to inequities in the transport system and the availability and use of open and public space. The study hopes to raise awareness of the equity issues surrounding urban transport systems ~~and networks~~, and the need for more sustainable urban designs for public and open spaces, identify commonalities and structural drivers of spatial inequalities, as well as context-specific determinants of urban space distribution.

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1. Introduction

There is global consensus on the need to reduce transport emissions as part of climate action and the need to cut carbon emissions in order to limit global temperature increase to below 2ºC above pre-industrial levels and pursuing efforts to limit the increase to 1.5 ºC (United Nations, 2016). This ambitious target was set by the Paris Agreement in 2018 and has since led many policy makers to set this as a political goal for their countries and cities. At the time of writing, two countries have already achieved net zero emissions (Suriname and Bhutan) whilst six countries have or are in the process of implementing legislation. Many others have agreed in principle to achieve net zero emissions by 2050 (Energy and Climate Intelligence Unit, 2020).

The transport system plays a significant role in this debate since transport emissions have continued to grow at a steady pace over the past years and considerable change will be required to achieve emission objectives, especially in urban areas where populations are set to grow further in the coming years. The 2014 revision of the UN *World Urbanization Prospects* estimated that 54% of the world's populatio
to rise to 66% by 2050 (United Nations, 2014). Managing urban areas and their transport systems will be a critical challenge in this century. In some parts of the world, policy documents already highlight the need to reduce vehicle use and invest in more public transport infrastructure. The European Union White Paper on Transport identified demand management and land use planning as main contributors to lower traffic volumes, while *facilitating walking and cycling should become an integral part of urban mobility and infrastructure design* (European Commission, 2011, pp. 8). The focus on infrastructure has also been subject of study in different parts of the world (see for example Newman and Kenworth, 2015 and Vasconcellos, 2001).

This paper focuses on the issue of urban space distribution as facilitator of access for different modes of transport, including the more sustainable forms of transport which would support emission reduction efforts in urban areas. Gössling et al. (2016) attribute space distribution a central role in the sustainability of transport systems, as area allocation is seen to influence attractiveness of different modes and therefore of mobility choices. Nello-Deakin (2019) also raises the issue of fairness, as it relates to space distribution. This study ~~It~~ aims to provide a comparative of urban space allocation in three cities, distinguishing between motorized (private and public transport) spaces and spaces allocated to non-motorized modes (walking and cycling). The research builds on analysis across different geographies of development taking examples from Europe, ~~Latin~~ South America and Africa as case studies. The cities of Bogotá (Colombia), Valletta (Malta) and Freetown (Sierra Leone) are chosen as examples of high density urban areas from the global south, global north and small island states. The methodology ~~will~~ entailed the use of high-resolution satellite images and the application of geographic information systems to derive the necessary measurements in each city.

This research builds on the conclusions ~~work~~ of Gössling et al. (2016) who identify the need to assess space distribution in structurally different cities and in different countries where the results can differ significantly and have substantial impacts in terms of future urban development across different geographies and economic realities. The case study cities also align with the access and resources available to the authors to collect the data. This introduction~~paper~~ ~~will~~ follows with a brief literature review. Section 3 ~~will~~ provides the context and case studies cities selected for this research. Section 4 ~~will~~ discusses the methodology whilst Section 5 ~~will~~ presents the results and analysis. Section 6 ~~will~~ provides a discussion based on the comparative between cities and Section 7 ~~will~~ concludes the study.

2. Literature Review

The concern over land take-~~-~~up for transport has both national and local (urban) implications. At a national level the amount of land taken up by roads and other transport infrastructures impacts the land cover and reduces the ability of the earth to absorb emissions (through the removal of carbon sinks such as natural areas). In Germany, transport infrastructure occupies 5.06% of the land cover (Statistisches Bundesamt, 2018). If we look at the case study countries, the differences in road density is considerable. Whilst in Malta roads took up 705 km/100km^2 in 2005, the situation was very different in Sierra Leone (2002) and Colombia (2006) with a road density of 16 and 15 km/100km^2 respectively (NationMaster, 2020).

At the local and urban scale there are considerable differences between cities around the world in terms of space dedicated to transport. Vasconcellos (2001) stated that the share of road space in Calcutta is 6.4%, but is much higher in Brazil (21%), London (23%) and Paris (25%). The concern here is more focused on the users of that urban (road) space. With modal share of trips varying considerably between cities there is consensus that travel by car is the most common (Gilbert and Perl, 2008), with walking and cycling being a significant modal share in some cities. Both Gilbert and Perl (2008) and Shoup (2005) identify the disproportionate allocation of urban space to car users. This was further confirmed by Gössling et al. (2016) with a study in Freiburg, Agentur für clevere Städte (2014) with a study in Berlin and Nello-Deakin (2019) in Amsterdam among others.

The implications of this are relevant because of the inequalities built into urban transport systems which, in many cases, discriminate against those walking, using the bus or cycling (see for example Vasconcellos, 2018 and Attard, 2020). But there is also the issue of congestion which is present in many cities, and causing high levels of emissions and significant health impacts. The World Health Organisation (WHO) estimates that seven million people worldwide die prematurely as a consequence of air pollution. Over 80% of people living in urban areas that monitor air pollution are exposed to air quality levels that exceed WHO guideline limits, with low- and middle-income countries suffering from the highest exposures, both indoors and outdoors (WHO, 2018).

In addition to this, road accidents involving vulnerable road users are still a global health concern. At least 51,300 pedestrians and 19,450 cyclists were killed on EU roads between 2010 and 2018 (ETSC, 2020). Globally the percentage of pedestrians killed varies between countries starting from Malaysia (7%), Colombia (29.3%), Guatemala (51%), El Salvador (59%), and with islands like Kiribati (67%) and Seychelles (75%) topping the list (data for 2013 from WHO, 2020). The global road death toll has already reached 1.35 million per year and is on course to triple to 3.6 million per year by 2030. In the global south, where this pandemic has hit hardest, it will become the fifth leading cause of death, overtaking HIV/AIDS, malaria, tuberculosis and other familiar killers, ac most recent Global Burden of Disease study (Hundley, 2013). Most accident related injuries and fatalities are due to cars over-speeding or drink driving. In both cases, the unprotected pedestrian and cyclist is the most vulnerable in the road.

In looking at the various users the evidence suggests that different modes are prioritised in cities in terms of allocation and access (Newman and Kenworth, 2015; Pucher and Buehler, 2012). The priority is identified in policies, planning and design in the various cities. Urry (2013) describes the change in urban space distribution with the growth of the car industry and its impact on public transport infrastructures which were removed whilst road infrastructure was extended to accommodate urban sprawl. Similar trends were observed in Europe (Koglin and Rye, 2014) and subsequently in Asia (Hook and Replogle, 1996), prompting rapid motorisation and a focus on more roads for cars. The predict and provide principles in planning still see many cities building additional roads and parking facilities (Hutton, 2013). The fairness issue is described most simply by Szell (2018) where he states that if the share of space for one mode of transport is higher than the city's modal share, the distr the mode gets more space than it needs when compared to usage.

The urban space has always been contested (Jacobs, 1961; Norton, 2008) and changes have required decades even in cities which are at the forefront of designs that promote active travel over the use of the car ~~(e.g. Copenhagen)~~. Many progressive cities, particularly in Europe have introduced a number of measures to make greener modes more attractive. From high residential parking costs in The Netherlands (Ostermeijer et al., 2019), to the introduction of road pricing in London, Stockholm and Valletta (Attard, 2010) and in planning, Barc superblocks (Rueda, 2019), have been rare examples when compared to potentially more systematic approaches.

The focus on actual space distribution as an element of urban transport justice was put forward by Colville-Andersen (2014) as 'the arrogance of space'. He discusses urban space allocation in favour of cars using a less rigorous method of observation, one which is difficult to replicate and is not scalable. Indeed, the explicit measure of urban space distribution in academic research remains scarce. Gössling (2016) went on to provide a framework for urban transport justice, and the method to investigate space allocation was developed as part of the work on the city of Freiburg ~~put forward~~ by Gössling et al. (2016). An alternative approach using crowdsourced quantification of urban mobility space inequality is put forward by Szell (2018). In this work, the author attempts to use data-driven and massive user-generated data to explore city-wide mobility spaces, but focuses only on three modes (car, rail, bicycle) to compare 23 cities. However, the limitations of the work are considerable in view of the data quality issues connected to crowdsourced data (Senaratne et al., 2017), which varies greatly across geographies, and the limitation and availability in mobility related data available on OSM (Open Street Map) in different cities, particularly differences between the global north and global south. In both approaches the authors acknowledge that the results of measuring and quantifying space distribution is affected by~~Although the methodology is relatively easy to replicate in other urban settings, it is also stated that~~ cultural contexts and methodological approaches~~d might impact the outcome~~.

To this end, ~~In light of this,~~ the purpose of this paper is indeed to test the method developed by Gössling et al. (2016) across different geographic areas and highlight the difficulties and limitations, as well as provide some insights into the definition of space in different contexts.

3. Context and case study description

3.1 Valletta, Malta

Malta is a small island (city) state (316km^2) located in the middle of the Mediterranean Sea (Figure 1). A full member of the European Union, it has experienced steady economic and population growth since the 1990s. The increase in standard of living resulted in greater car dependence and use. Today, Malta has one of the highest motorization rates in Europe and the world. The consequences of such a trend have been documented in Attard et al. (2015) who estimated external costs of the current transport system to be as high as 4% of the GDP (in 2012). Malta's public transport system is based on public buses, but even these have struggled with lack of investment in their priority over cars. The modal split in 2018 showed over 80% car use, 10% public transport use, walking recording only 2% of trips and cycling still negligible (Project Aegle, 2018) (see also Table 1).

This situation has resulted in an uneven provision of infrastructure between those inside and outside the car. Attard (2020) documented rising road accident injuries among pedestrians between 2005 and 2015, longer travel times for those using the bus (Transport Malta, 2016), regional differences between car ownership levels and disparities between income groups and household spending on travel. The urban space distribution was also indicated as a potential contributor to a discriminatory transport system developing in the islands main urban agglomeration around Valletta, the islands'

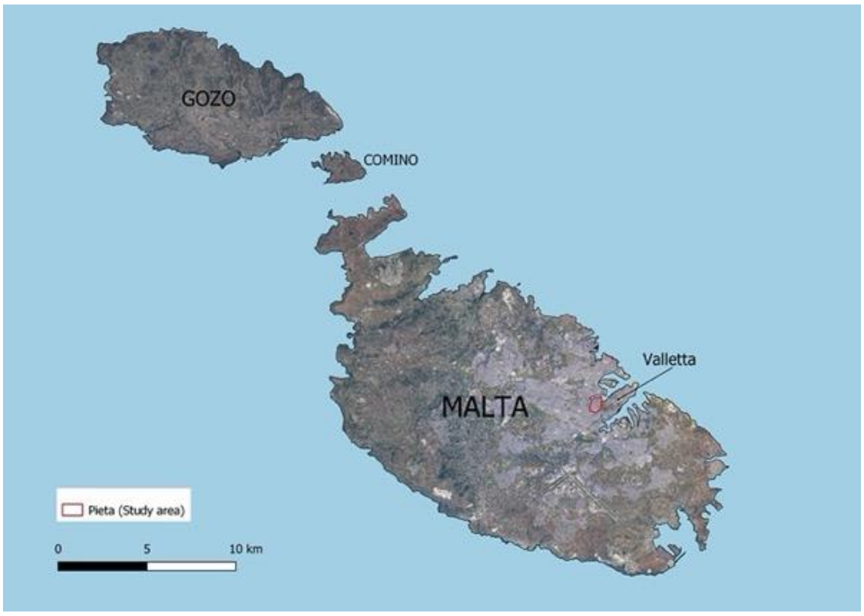


Figure 1.The islands of Malta and the location of the study area close to the historical city centre.

3.2 Bogotá, Colombia

Bogotá is a high-density city, where historically there is a high, unsatisfied demand for housing. This situation has encouraged people to occupy unplanned and informal settlements in the urban periphery. Consequently, the city developed through the merging of many informal neighbourhoods as they developed on the outskirts of the city, with low urban living conditions (Guzman, Oviedo and Bocarejo, 2017). It is in this zones where the highest population densities are present. In 2018, Bogotá had an approximate urban area of 380km^2 and 7.42 million inhabitants (see Figure 2).

This type of development has resulted in inequalities of all kinds: economic, social and those related to mobility. Previous analysis carried out on the territorial development shows a monocentric spatial organization (Guzman and Bocarejo, 2017). This spatial pattern has contributed to the creation of important differences across the different socio-economic groups, such as in the case of travel time. In addition to this, the public space and infrastructure are also unevenly distributed.

There is also a particular spatial distribution of population and employment in the city generating higher travel times and low accessibility levels, especially for the low-income population. The high accessibility inequalities present in the city are due to the strong distributional effects of the socio-spatial and economic structure, its infrastructure distribution, and the effect of transport and land-use trends in the last decades (Guzman, Oviedo and Rivera, 2017).

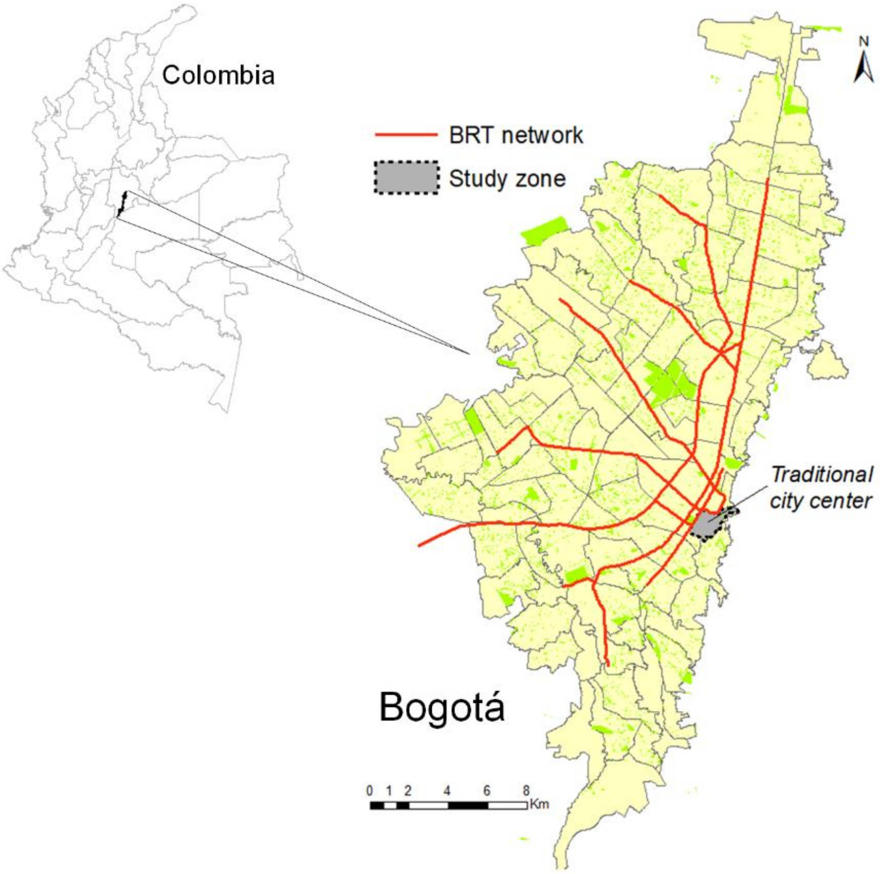


Figure 2. Colombia, Bogotá and the study zone.

3.3 Freetown, Sierra Leone

Freetown is the capital of Sierra Leone, which is located in West Africa bordered by Guinea to the North and East, Liberia to the Southeast and the Atlantic Ocean to the West and Southwest. By 2015, the population of Sierra Leone neared 7.1 million and it is projected to rise to 10.3 million in 2030. The country has one of the highest poverty and informality rates in the world, with over 53% of its population living below USD$1.25 a day by 2011, and where 60% of the economy is informal (UNDP, 2020). The World Health Organisation (WHO) ranks Sierra Leone as the most dangerous country for young people, with a mortality rate of 671 per 100,000 people (WHO, 2015 in Marés, 2017).

Freetown is home to a population of 1,055,964 inhabitants (21.1% of the country's total) (UNFPA Sierra Leone, 2018). It shows one of the fastest population growth rates in the region with 4.2% per annum (World Bank, 2019), which is projected to reach 2 million by 2028 (GOPA-CES Consultants & 3BMD Consulting Engineers, 2014), accounting for 65% of the total population living in urban areas of Sierra Leone (SSL, 2016). Moreover, Freetown accounts for 30% of the country's GDP. The city's economy is highly dependent on self-employment, with a particularly strong informal service economy to support basic needs of workers and their dependents.

As the main urban centre in the country, the administrative capital, and the economic, commercial, financial, educational and cultural centre of Sierra Leone, Freetown has high urban primacy. The city therefore concentrates a large share of capital investment in infrastructure and service provision compared to the rest of the country. Despite having a comparatively more developed infrastructure and a more complex urban structure, public transport in Freetown is provided primarily by the informal sector, using a mix of a few publicly-owned and managed full-sized buses, poda-podas (minibuses carrying approximately 15 passengers), saloon car taxis operating on fixed routes on a shared basis, kekehs (3-wheelers) and okadas (motorcycle-taxis).

Although the city does not have a high private motorisation rate (see summary in Table 1 below), passenger vehicles make up most traffic along the major routes. Motorcycles (okadas), are usually restricted along some routes. However, they make up most of supply along areas that pose challenges to larger vehicles. Collective urban transport services in Freetown are provided almost exclusively by road transport operators with a small contribution by water transport along the coast and to Lungi International Airport. The informal sector has by far the largest share of the market, but it is disorganized and delivers an expensive and poor quality of service for citizens. Moreover, as in many other cities in the global south, regulation of the use of public space for car users is limited, which has led to an increase in traffic congestion associated with rising income and population, increase in vehicle ownership, poor road conditions, street parking, street trading, and inefficient traffic management. Moreover, conditions for pedestrians and cyclists are poor as a result of blocked walkways and damaged or non-existing pavements.

Figure 3. Sierra Leone, Freetown and the study area close to the CBD.

Table 1 below summarises the situation in the three case studies. It is indeed evident from this preliminary comparison that further understanding of the socio-economic and cultural setting would enhance the analysis of the urban space distribution in each city.

Table 1. Population, rate of motorization and modal split in the three case study cities. Sources: Malta National Statistics Office, 2020; Colombia National Road Safety Agency; Bogotá Mobility Survey 2019; Colombia National Statistics Office; Statistics Sierra Leone, 2015; 2017.

City	Population	Population Density	Rate of motorization (per 1,000 pop.)	Modal Split	Road Accident Injury*
Valletta, Malta	493,559 (2018)	1,562	708 (total vehicles - national figures) 607 (private cars - national figures)	80% car 10% bus 2% walking 0.1% cycling 8% other	63% drivers 23% passengers 14% pedestrians and cyclists (2018)
Freetown, Sierra Leone	1,055,964 (2015)	12,878	25 (total vehicles - national figure-) 7 (private vehicles - national figure-)	18% private car/moto 23% poda-poda (minibuses) 22% shared taxis 13% okadas (moto-taxi) 11% kekehs (rickshaws) 12% Buses**	5% drivers 4-wheelers 20% riders motorised 2-3 wheelers 60% passengers 15% pedestrians and cyclists (2014)
Bogotá, Colombia	7,412,566 (2018)	19,506	212 (total vehicles) 138 (private cars) 56 (motorcycles)	24.5% car/moto 39.8% public transport 23.9% walking 6.6% cycling 5.2% other	18% drivers 60% motorcyclists 22% pedestrians (2018)

* This represents the share of injuries (incl. fatalities) suffered by type of user.
** Data for modal split in Freetown is only available for motorised transport

4. Methodology

As stated earlier, the research applied the methodology adopted in Gössling et al. (2016). It uses publicly available satellite imagery (Google Earth) and other publicly available remote sensed data, and maps the space distribution in a single area from each of the three case study cities. Measurements of space are calculated using the tools available in standard Geographic Information Systems (GIS) such as the open source QGIS software. After selecting the areas for investigation, polygons were manually digitized to create layers of different road spaces/categories which included:

- road for motorized traffic;
- public/on-street parking;
- pedestrian spaces including walkways, pedestrian areas and pedestrianised open spaces;
- cycle paths dedicated exclusively to cyclists;
- dedicated public transport spaces and priority lanes;
- areas of mixed use including pedestrian crossings and shared spaces; and
- median strips, otherwise known as central reservations in main roads which can sometimes take up considerable space.

Figure 4 shows the manual allocation of space to these different categories. This categorization of urban space did not come without challenges. Whilst typically one expects to find roads, pedestrian areas, public transport infrastructure, bicycle lanes, public parking and mixed areas for both walking, cycling and public transport, as well as for parking and pedestrian areas, this is not the case in the three cities. A local definition was established which might indeed impact the comparison, as the three urban areas apply different rules for space distribution. There is also a level of subjectivity in the interpretation of remote imagery which can only be eliminated through a common definition and validation on site. This lack of conformity in the definition of space influences the outcome and possible interpretation of results.

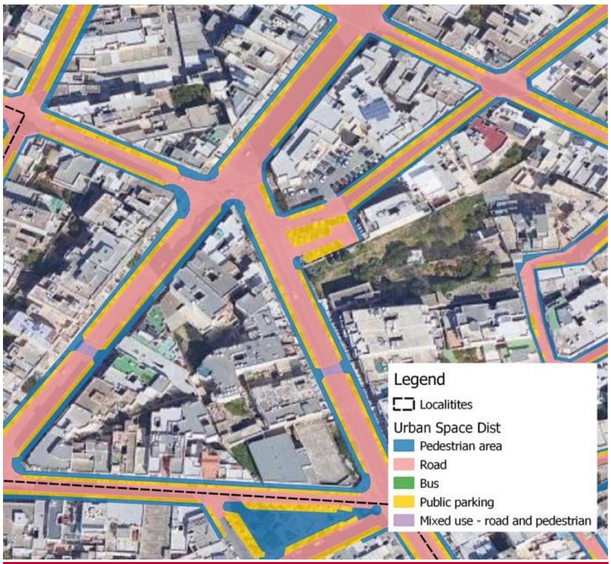


Figure 4. Detailed digitalization of the urban space in Malta.

Due to limitations in time and resources few on-site visits were carried out to validate the data and it is therefore important to acknowledge that the measurements are estimations based on the best possible quality data available for the cities. Three researchers in the different case study cities were engaged in digitizing the maps, taking considerable time and effort. This has an implication on scalability to larger areas which would require more time and human resources to map (and validate) the data for the analysis.

The mapping of very different urban areas across continents and cultures did however produce a number of challenges. The cultural differences between the three cities ~~is also something which~~ is not captured by this study. It is evident that practices in the design, allocation and subsequent use of urban space varies across places. Pavements and sidewalks are an example of how pedestrians and the culture of walking is different in different locations. Whilst in some cities provision of pavements is a requirement, this is not the case in African cities where, off the main road, road space is shared by all users with very little dedicated infrastructure for pedestrians. In Malta, pedestrian space is sacrificed in the narrow residential roads for car parking.

There are further challenges with the definition of space from remote sensed imagery because of the quality of the images, which vary across cities, as well as the maintenance of the infrastructure which affects its visibility in images. One example is the lack of maintenance of pedestrian crossings in Malta, with paint being sometimes very difficult to see in the images. Shadow in narrow roads can also be problematic whilst digitizing with the use of Google Street View used to compensate for the lack of clarity and visibility of infrastructure in overshadowed areas. In Sierra Leone, the large number of informal settlements poses challenges for the analysis of a large number of alleyways and unsurfaced corridors used mostly for pedestrian mobility, which are not accounted for in most official inventories of infrastructure.

5. Results and Analysis

The three case study areas have been identified, one for each city, and mapped according to the methods identified earlier. Table 2 provides for a summary of the allocation of space by transport mode in each city. Although different in morphology and scale there are similarities in the way that space is allocated to vehicular traffic, i.e. roads for moving and stationary cars, with over 72% in Malta, over 50% in Bogotá and 67% in Freetown. In all three city quarters very little is dedicated to public transport (0.6% on Malta, 4.8% in Bogotá and 5% in Freetown). Pedestrian areas vary across cities with Bogotá leading with 36% of the space, 27% in Malta and 14% in Freetown. Only Bogotá reports cycling infrastructure (0.4% of the total share).

Table 2. Allocation of space by transport mode in the three case study cities

	Valletta, Malta		**Bogotá, Colombia**		**Freetown, Sierra Leone**	
	m^2	%	m^2	%	m^2	%
Road	69,886	52.4	287,085	50.9	304,402	60%
Public Parking	26,386	19.8	-*	-	33,571	7%
Pedestrian Area	35,684	26.8	203,856	36.1	71,581	14%
Public Transport	793 (bus)	0.6	27,262 (BRT)	4.8	27,047 (bus)	5%
Bicycle Lane	0	0	2,526	0.4	0	0
Mixed use	488	0.4	-	-	61,622**	14%
Median Strip***	-	-	43,222	7.7	-	-
Total	133,237	100	563,952	100	511,291	100

* In Bogotá, it is not allowed to park on public roads. There is no available information about public parking.
** This refers to unsurfaced roads in Freetown.
*** This is also referred to as central reservation.

The islands of Malta are divided into six regions and 68 local authorities. Most of these towns form one large urban agglomeration around the historic city (Valletta) and ports (Grand Harbour). The population distribution is relatively homogenous although lower incomes are reported in the southern harbour and southern regions of the main island.

The area that is mapped for the purpose of this study lies just outside the historic city in an area of relative low income but which is adjacent to and has access to a marina with ample pedestrian area access for recreation. It covers an area of 2km^2 and has a population of less than 5,000 people (Figure 54). It has an ageing population and being so close to Valletta, it is well served by public transport. It used to house the main hospital for the islands even though this is not in use anymore. Much of the land area is indeed residential with very few office uses in the main roads and along the promenade.

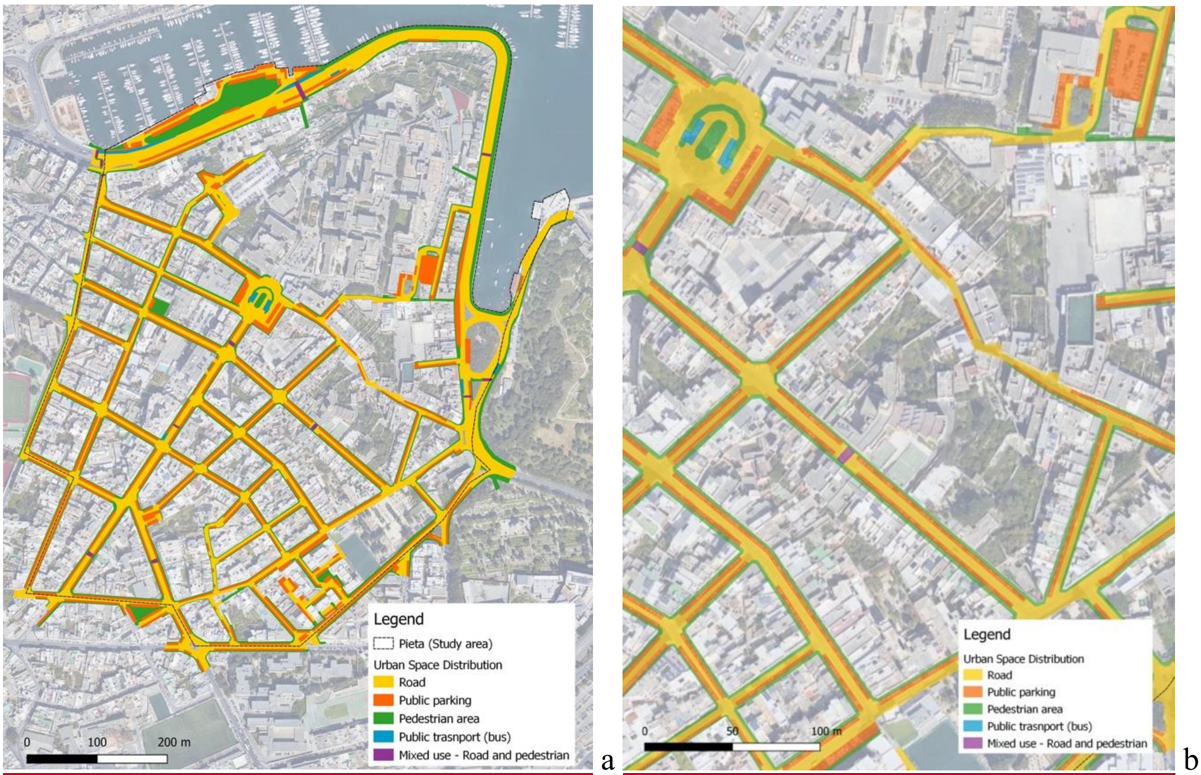


Figure 54. Mapping space distribution in Malta (a) entire study area coverage; (b) map detail. Source: Own elaboration

The city of Bogotá is classified in six socio-economic categories based on a local administrative classification named as socio-economic strata (SES). These are described from 1 to 6 and reflect the urban living condition of a residential zone. This indicator is correlated with average household income, although the relation depends also on household size, vehicle availability and workers and students per household (Cantillo-García et al., 2019). The lower the SES, the lower the income, and the urban environmental and living conditions are generally poorer.

The study zone in Bogotá has a total urban area of 2.06km^2 and an estimated population of 22,200 inhabitants (Figure 65). As for the residential area, there are only the 3 lowest SES (one to three) occupying 47.6% of the area. The economic activities, including areas housing several National Government institutions occupy 27.2%, and the public space, parks, roads and sidewalks occupy 12.7% of the area.

In mobility terms, the study zone produces around 148,000 trips per day. The highest share of trips is done by public transport (46.1%), then there is walking (27.5%), private transport (20.6%), cycling (1.5%) and others (4.3%). A first symptom of unequal distribution of space in this area has to do with the area dedicated to roads (50.9%) and the private vehicle share (20.6%), even though these same roads are also used by buses.

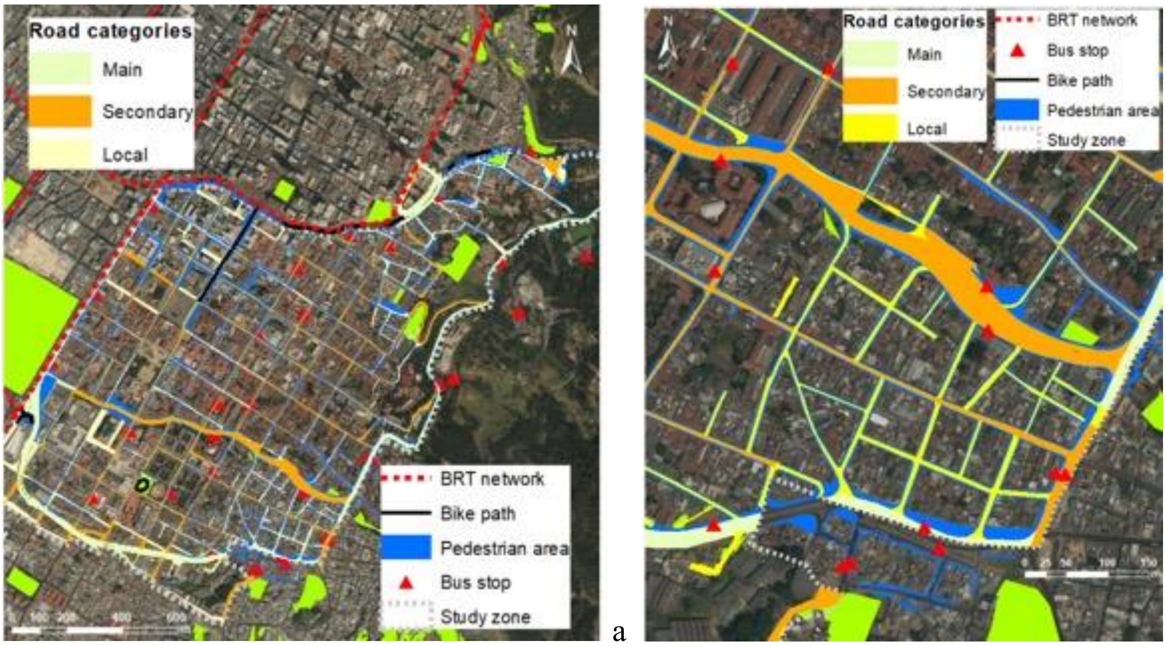


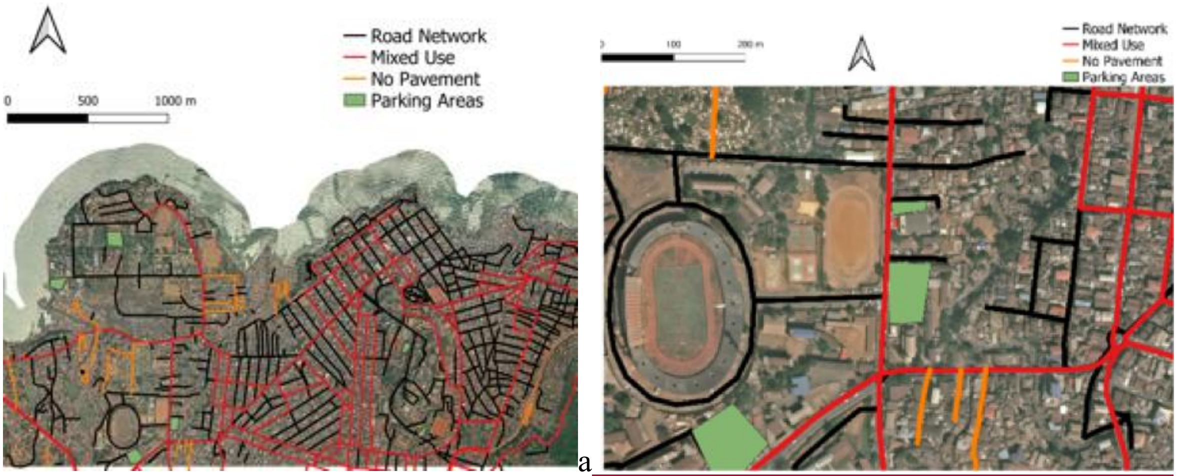
Figure 65. Mapping space distribution in Bogotá (a) entire study zone; and (b) map detail. Source: Own elaboration.

According to city-level statistics, 5% of total land in Freetown is allocated to roads, of which only 24% are paved compared with regional benchmarks of 10% and 50% respectively (DFID, 2018). The city has one of the lowest road densities per capita, which is about 165 meters of paved road per 1,000 citizens in the Greater Freetown Area, which is around half of the average in low-income African countries (318m/1,000 people) (AfDB, 2017; World Bank, 2018). One of the main constraints for urban mobility in the city is the almost generalised lack of sidewalks, which if they exist are usually occupied by parked vehicles or traders.

The application of the methodology to the case of Freetown was the most challenging of the three cities given the lack of reliable detailed geocoded data and open satellite imagery from sources such as Google Earth Pro. The authors relied on high-quality remote sensing imagery commissioned by the local authority for planning purposes, which enabled a much better quality compared to other sources of data for the analysis.

The selected zone for analysis is a 4.2 km^2 mixed land use zone close to the main areas of economic activity of the city, close to the city's commercial port, the north-western side the study section (Figure 6). Despite a large share of the area of analysis is occupied by different forms of transport-related infrastructure, it can be highlighted that as opposed to Valletta and Bogotá, Freetown shows a much higher portion of land devoted to other uses or not developed. During the morning peak in the main road corridor of the area one can observed traffic dominated by private cars (44%) and single-use motorcycle (20%). By contrast, buses represent only 3% of the total observable traffic demand and two and three-wheelers are 20% of the rest of the traffic. The supply of public transport services by low-occupancy vehicles is evidenced by the 20% of the traffic being represented by shared taxis.

Allocation of road space in Freetown reflects various degrees of inequalities for road users and transport injustice driven by increased exposure and vulnerability for those users already at a disadvantage such as pedestrians. In contrast with Bogotá, Freetown has not one single km of segregated cycling infrastructure, which contributes to the very low level of use of the bicycle as a regular transport mode. Moreover, pedestrian areas measured in the field in various road sections are between 0.8 and 1.4 metres. While the wider sidewalks are 1.6 metres wide and there often is only availability of sidewalks on one side of the main road network. In many cases, there are high levels of on-street parking across secondary and main corridors, which not only reduce space for traffic but often make sidewalks unusable. Furthermore, mixed traffic road space is often blocked by minibuses, shared taxis and informal transport stopping and waiting for passengers, which leads to a very dynamic and almost always reduced operational section of the roads. Large spaces, particularly around the stadium (see detail in Figure 7~~6~~) have been devoted exclusively for public parking, adding to traffic and road safety issues in adjacent corridors. Finally, a large share of relevant unpaved access roads (14% of the total study area) mix non-motorised and motorised use, often forcing the pedestrian to the edges of the roads, next to large drainage canals and exposure to dust and dirt during the dry season and becoming almost unusable during the rainy season.



a b

Figure 7~~6~~. Mapping space distribution in Freetown (a) entire study zone; and (b) map detail. Source: Own elaboration.

6. Discussion

The application of the methodology to three cities across different social, economic and cultural conditions contributes ~~to~~ a fresh perspective on what inequalities in the distribution of road space and transport (in)justice can mean in different contexts. The struggle for space, and how that space reflects the city dates back to Jane Jacobs's reference to the street (Jacobs, 1961). The conflicts between different modes of transport and how they developed over time are testament to this struggle. It is indeed this historical development that has shaped our streets (see for example Norton, 2008), into being there primarily for the car just like in the three case studies selected for this research. The factors shaping urban space distribution, as described in the literature and the cities under study here, are summarised in Figure 8.

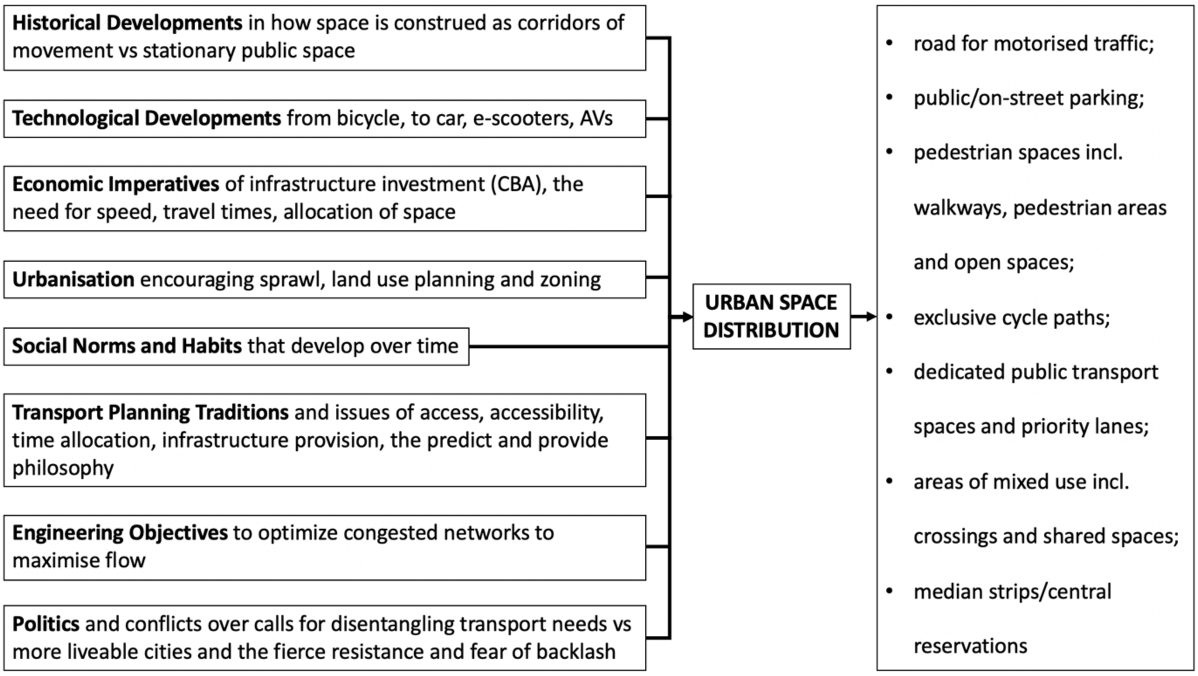


Figure 8. Factors affecting the urban space distribution. Authors ’own elaboration.

These factors help to explain the unequitable distribution of urban space, especially in how much of the space was accorded to the car over time. The complexity of the issues highlighted in Figure 8 also shed some light into the difficulties of space re-distribution in cities, with Gössling (2020) suggesting three elements that could support a culture change for the re-distribution of space in his brief discussion paper. These include viable public transport services for long distance journeys (e.g. suburban to city centre), investment in infrastructure for active travel at the local level, and strategies for communicating the change in urban transport in a way which address drivers’ concerns.

The methodology selected for this study has obvious limitations and data requirements that are not always met in the same degree in cities with variable levels of technical and financial capacity to produce information. In this sense, Malta appears as the case with best data from openly accessible sources, while Bogotá and Freetown build on various levels of documentation and analysis led by the public sector. Such conditions call for a reflection about the relevance of transparency in governance and data sharing for participation and research, as well as the role of open information in the construction of better understanding of transport systems.

Regarding the content of the analysis, clear differences are observed across case studies. Although the comparability in terms of scale and size of the cities can be put into question, the analysis at the meso and micro scale enabled by the selected method levels the playfield to draw meaningful conclusions about different approaches to the development, management and use of road space in different cities. While the analysis focused mainly on the observable distributions of different forms of infrastructure and its use, the understanding of underlying temporal and city-level conditions are important factors in interpreting the results and making comparisons. Despite being at different stages of private motorisation uptake, it is clear all three cities are grappling with the tensions and challenges associated with the re-allocation of road space from the private vehicle and redistributing it, more equitably to public transport, pedestrians and cyclists. It also reflects the consequences of different policy agendas in relation to traffic demand management and investment in infrastructure. In Bogotá, a change in paradigm and priorities in previous city administrations regarding urban mobility has led to a higher provision of space for cyclists, pedestrians and the banning of on-street parking from various corridors across the city. By contrast, Freetown, which has a fraction of the motorisation rate of the other two cities, seems to be facing a congestions crisis and suffering from the loss of road space to the car by means of parking and the lack of efficient space management used by informal transport and informal vendors. In Malta, the current political drive to build more roads and parking areas for cars is further feeding into the growing car dependence with very little in sight for those outside the car, walking or cycling, or simply using the bus.

The experience of the case study cities is not unique, as indicated by previous studies in various cities around the world by Newman and Kenworth (2015) and Pucher and Buehler (2012). This research has demonstrated how the "*system of automobility*" (Urry, 2013) is still dominating urban transport. Examples of space re-distribution need more visibility and research into understanding their potential for transfer and replicability in different geographic contexts. The research into (transport) policy transfer has, so far, focused on a number of examples (e.g. Attard and Enoch, 2011; Stead, 2012), with little done on the successful (or failure) of urban space distribution in achieving sustainable transport. Attempts at defining and quantifying (mapping) the space distribution, as attempted in this research, remains a key contribution.

7. Summary

This study has provided a first look at the allocation of urban space for transport, ~~and has~~ highlighting possible~~ed~~ inequalities in this space distribution in three cities in Europe, Africa and South America. The meso and micro-scale analysis enabled a comparison~~s~~ and some reflections across different geographical contexts. The overwhelming dominance of the car is evident across the sites. This despite the evident differences in geography, socio-economic and cultural contexts of the study cases.

Further work is envisaged to refine the methodology and the visualisation of the geographic outputs (maps), in order to make it possible for the work to be reproduced. Expanding the methodology ~~is restricted by~~remains difficult due to availability of data. However, by testing it in contexts with various degrees of access to information, we have proven that even in cities with limited data and resources, ~~even~~ a reduced version of the analysis is possible. This has potential for regional analysis of cities that share more similarities or between cities of the same country.

Some similarities are striking in the case study cities. In particular, the close percentages of road infrastructure dedicated to the car, which bear witness to the long-term consequences of the application of a similar paradigm of transport and infrastructure planning centred around the private vehicle. The comparison between three cities in different continents highlights furthermore the need to look at cities and their transport infrastructure to improve well-being and promote sustainability in line with the Sustainable Development Goals and in particular SDG11 Sustainable cities and communities.

In the absence of resources and capacity for investment and development of infrastructure, the pedestrian and cyclist are the road users that tend to be overlooked in the provision of space. However, a stronger policy stance such as that taken in Bogotá can help redress some of these inequalities through the provision of safe infrastructure that promote sustainable mobility but also provide for a more equitable transport system and urban space distribution. Some initial discussions on the remedial measures necessary to address the issue of unequitable space distribution have pointed towards both infrastructural investments (for active travel but also for public transport) and campaigns aimed at drivers and car users on the need for change. Further research is required to address the transport system changes required to reduce inequality.

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Feedback and Response to Reviewer Comments

Answers to the reviewer comments are in bold. Modified text is reproduced in red and italics to assist in the review.

Reviewer #1: The paper compares the urban space allocation for motorized and non-motorized modes of transport in three cities. Measurements of urban space are obtained by processing high-resolution satellite images using GIS, following the method proposed by Gössling et al. (2016).

In general, the method is interesting and the information on urban spatial distribution that can be derived from the proposed method is useful. However, I have major issues with the manuscript in its current form.
A: Thank you for your overall positive outlook on our manuscript.

1. The literature review seems to be all about providing information on road density, share of road space for transport, issues arising from urban spatial inequalities (e.g., congestion, emission, health, road accidents, etc.). It then ends with a brief note about the method proposed by Gössling et al. (2016). It seems to me that the main merit of the paper is empirical data on urban space allocation obtained from satellite images using the method by Gössling et al. (2016). I would like then to see a thorough literature review on the various alternative methods that may be useful for obtaining the same information regarding urban space allocation for motorized and non-motorized.
A: Thank you for this very valuable comment. We have added further reviews of the methods that have been used in the literature, reproduced below for ease of reference.

The urban space has always been contested (Jacobs, 1961; Norton, 2008) and changes have required decades even in cities which are at the forefront of designs that promote active travel over the use of the car. Many progressive cities, particularly in Europe have introduced a number of measures to make greener modes more attractive. From high residential parking costs in The Netherlands (Ostermeijer et al., 2019), to the introduction of road pricing in London, Stockholm and Valletta (A free superblocks (Rueda, 2019), have been rare examples when compared to potentially more systematic approaches.

The focus on actual space distribution as an element of urban transport justice was put forward by Colville-Andersen (2014) as "the arrogance of allocation in favour of cars using a less rigorous method of observation, one which is difficult to replicate and is not scalable. Indeed, the explicit measure of urban space distribution in academic research remains scarce. Gössling (2016) went on to provide a framework for urban transport justice, and the method to investigate space allocation was developed as part of the work on the city of Freiburg by Gössling et al. (2016). An alternative approach using crowdsourced quantification of urban mobility space inequality is put forward by Szell (2018). In this work, the author attempts to use data-driven and massive user-generated data to explore city-wide mobility spaces, but focuses only on three modes (car, rail, bicycle) to compare 23 cities. However, the limitations of the work are considerable in view of the *data quality issues connected to crowdsourced data (Senaratne et al., 2017), which varies greatly across geographies, and the limitation and availability in mobility related data available on OSM (Open Street Map) in different cities, particularly differences between the global north and global south. In both approaches the authors acknowledge that the results of measuring and quantifying space distribution is affected by cultural contexts and methodological approaches.*

To this end, the purpose of this paper is indeed to test the method developed by Gössling et al. (2016) across different geographic areas and highlight the difficulties and limitations, as well as provide some insights into the definition of space in different contexts. (page 3, 4)

2. How do we evaluate if such (unequal) urban space distribution for different modes is truly unjust? Since the paper presents a case of more equitable urban spatial allocation for more equitable mobility system, the reader is left wondering how such empirical data on spatial distribution derived from satellite images may be interpreted to be unequitable/unfair or not? Can we assume right away that if the distribution is unequal, it means right away that this is unequitable?

A: Thank you for these comments and questions. The introduction has been modified to strengthen the argument that urban space distibution is A FACTOR of unequalitable transport systems. We have added the reference of Gössling et al. (2016) and supported further the argument that explains this. It is also clear from the introduction and further supported in the literature review, that there are several aspects of unequality in transport systems, using the papers from Gössling et al. (2016), Vasconcellos (2001), Attard (2020) and adding the article from Nello-Deakin (2019) in support of this. Changes in the introduction and literature review have been made accordingly to reflect that.

This paper focuses on the issue of urban space distribution as facilitator of access for different modes of transport, including the more sustainable forms of transport which would support emission reduction efforts in urban areas. Gössling et al. (2016) attribute space distribution a central role in the sustainability of transport systems, as area allocation is seen to influence attractiveness of different modes and therefore of mobility choices. Nello-Deakin (2019) also raises the issue of fairness, as it relates to space distribution. (page 2)

The predict and provide principles in planning still see many cities building additional roads and parking facilities (Hutton, 2013). The fairness issue is described most simply by Szell (2018) where he states that if the share of space for one mode of transport is higher than the city's modal share, the distribution is *unfair* *in that* *needs when compared to usage. (page 3)*

The focus on actual space distribution as an element of urban transport justice was put forward by Gössling (2016) and the method to investigate space allocation was developed as part of the work on the city of Freiburg by Gössling et al. (2016). (page 3)

3. The method section has no discussion on how the satellite images, and other remote sensed data, are processed. Can a flowchart be presented in how exactly the following

types of space allocations have been derived from satellite imagery and other remote data using GIS - Road, Public parking, pedestrian area, public transport, bicycle lane, mixed use, median strip? Perhaps provide sample images classified as "road", "public parking", "pedestrian area", etc in each of the three cities. Is the identification/classification of these images done manually? If there is an element of subjectivity in image classification, how many GIS specialists perform the calculation/measurements? How do we ensure the reliability of the results if there is subjectivity? There are very few details in the paper, and anyone who wants to replicate this study and apply the same methodology to other contexts for comparison is left guessing how these values for space allocation have been derived from the raw data. Was the use of GIS all done manually? If yes, there is an issue on scalability of the method to other cities and larger geographical areas.

A: Thank you for the valuable comments. We have expanded the methodology section to better describe the data processes. We have provided a sample image of the digitalization process and included details of the resources involved in the image classification and measurement. The subjectivity is described also in the methodology and limitations explained further. The limitations imposed by the labour intensive process are also highlighted.

As stated earlier, the research applied the methodology adopted in Gössling et al. (2016). It uses publicly available satellite imagery (Google Earth) and other publicly available remote sensed data, and maps the space distribution in a single area from each of the three case study cities. Measurements of space are calculated using the tools available in standard Geographic Information Systems (GIS) such as the open source QGIS software. After selecting the areas for investigation, polygons were manually digitized to create layers of different road spaces/categories which included:

- *road for motorized traffic;*
- *public/on-street parking;*
- *pedestrian spaces including walkways, pedestrian areas and pedestrianised open spaces;*
- *cycle paths dedicated exclusively to cyclists;*
- *dedicated public transport spaces and priority lanes;*
- *areas of mixed use including pedestrian crossings and shared spaces; and*
- *median strips, otherwise known as central reservations in main roads which can sometimes take up considerable space.*

Figure 4 shows the manual allocation of space to these different categories. This categorization of urban space did not come without challenges. Whilst typically one expects to find roads, pedestrian areas, public transport infrastructure, bicycle lanes, public parking and mixed areas for both walking, cycling and public transport, as well as for parking and pedestrian areas, this is not the case in the three cities. A local definition was established which might indeed impact the comparison as the three urban areas apply different rules for space distribution. There is also a level of subjectivity in the interpretation of remote imagery which can only be eliminated through a common definition and validation on site. This lack of conformity in the definition of space influences the outcome and possible interpretation of results.

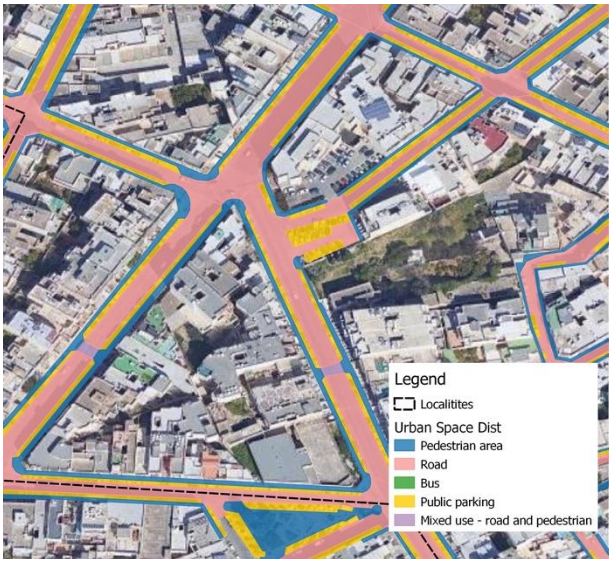

Figure 4. Detailed digitalization of the urban space in Malta.

Due to limitations in time and resources few on-site visits were carried out to validate the data and it is therefore important to acknowledge that the measurements are estimations based on the best possible quality data available for the cities. Three researchers in the different case study cities were engaged in digitizing the maps, taking considerable time and effort. This has an implication on scalability to larger areas which would require more time and human resources to map (and validate) the data for the analysis. (page 9, 10)

4. In the discussion section, can the authors summarize in one figure the possible factors that may account for the urban space distribution as determined using the proposed methodology? It seems to me that there are several factors that can explain the (unequitable) distribution (e.g., cultural differences), besides the undue favor accorded to car.

A: Indeed, this is stated in page 4, at the end of the literature review. And links to previous arguments put forward in the literature review and introduction on the role of space distribution in the more complex concern over equitable and sustainable transport systems.

A new figure has been added in the discussion as requested by the reviewer.

The struggle for space, and how that space reflects the city reference to the street (Jacobs, 1961). The conflicts between different modes of transport and how they developed over time are testament to this struggle. It is indeed this historical development that has shaped our streets (see for example Norton, 2008), into being there primarily for the car just like in the three case studies selected for this research. The factors shaping urban space distribution, as described in the literature and the cities under study here, are summarised in Figure 8.

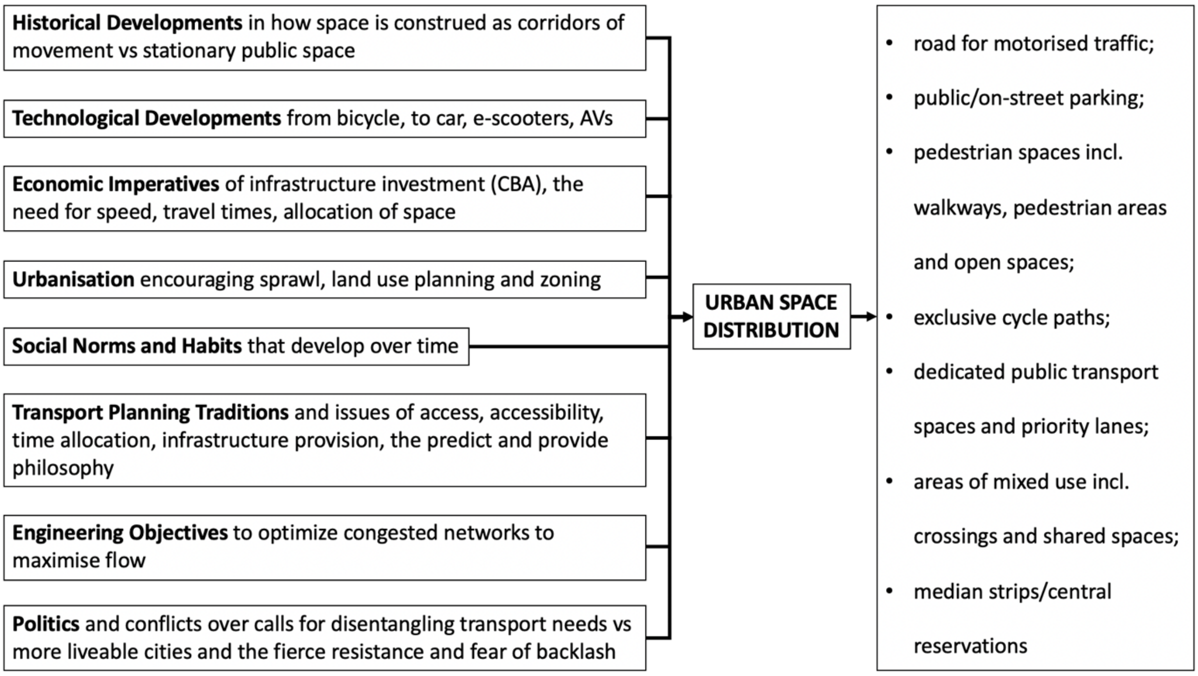

Figure 8. Factors affecting the urban space dist

These factors help to explain the unequitable distribution of urban space, especially in how much of the space was accorded to the car over time. The complexity of the issues highlighted in Figure 8 also shed some light into the difficulties of space re-distribution in cities, with Gössling (2020) suggesting three elements that could support a culture change for the re-distribution of space in his brief discussion paper. These include viable public transport services for long distance journeys (e.g. suburban to city centre), investment in infrastructure for active travel at the local level, and strategies for communicating the change in urban transport in a way which addresses drivers' concer *(page 13, 14)*

5. Minor: Kindly remove the email in this sentence: "The focus on infrastructure has also been subject of study in different parts of the wo tess.mfed@gov.mt rld (see for example Newman and Kenworth, 2015 and Vasconcellos, 2001)." (page 2)

A: Removed. Thank you for spotting that.

Reviewer #2: At the outset, I would like to congratulate the Author(s) on the prepared article and the contribution of work put into writing it. Paper brings interesting information about the urban space for mobility in different parts of the world. However, I would like to draw attention to a few points that I believe need to be improved.

A: Thank you for your overall positive outlook on our manuscript.

First of all, please pay attention to technical mistakes:

1. In the penultimate line of the first paragraph of the introduction, an email address appears - please delete.

A: Removed. Thank you for spotting that.

2. Before resending the article, please also review the punctuation and the dots and capital letters in the chapter names.
A: Done, thank you.

3. Figure 6 - part B is invisible - please check and correct.
A: Done, thank you. I think the part of the figure was removed in the conversion.

On the merits, I would suggest paying attention to the following elements:
1. Better justification of the choice of analyzed case studies. The analyzed examples are very valuable and I think it is worth presenting examples of these cities. However, it would be worth arguing why these cities were taken into account in the work.
A: Thank you for this comment. We have extended the justification provided in the introduction.

This research builds on the conclusions of Gössling et al. (2016) who identify the need to assess space distribution in structurally different cities and in different countries where the results can differ significantly and have substantial impacts in terms of future urban development across different geographies and economic realities. The case study cities also align with the access and resources available to the authors to collect the data. (page 2)

2. Maps should be made in a more careful way. However, if this is not possible, it would be worth standardizing the markings - the road network in Freetown is marked identically to the bicycle path in Bogota. In addition, it would be worth providing its source under each of the graphics (e.g. own elaboration).
A: It is not possible at this stage of the research to modify the maps. We will include this as further work in the summary, at the end. We have added the "own elaboration" under each figure as suggested.

Further work is envisaged to refine the methodology and the visualisation of the geographic outputs (maps), in order to make it possible for the work to be reproduced. Expanding the methodology remains difficult due to availability of data. (page 15)

3. The article presents a pure case study, and with a small effort the results could be presented in a universal way. In the discussion, it would be worth referring to the current results from the literature and trying to broaden the horizon - refer to the general trends in the redistribution of transport space in other cities in the studied regions and with similar spatial specificity.
A: Thank you for this comment. We agree and have added a further paragraph to the discussion. We have also brought in the need for further research into policy transfer or successes or failures in such urban system changes.

The experience of the case study cities is not unique, as indicated by previous studies in various cities around the world by Newman and Kenworth (2015) and Pucher and Buehler

(2012). This research has demonstrated how t
dominating urban transport. Examples of space re-distribution need more visibility and research into understanding their potential for transfer and replicability in different geographic contexts. The research into (transport) policy transfer has, so far, focused on a number of examples (e.g. Attard and Enoch, 2011; Stead, 2012), with little done on the successful (or failure) of urban space distribution in achieving sustainable transport. Attempts at defining and quantifying (mapping) the space distribution, as attempted in this research, remains a key contribution. (page 15)

4. A better title for chapter 7 would be Summary. If the authors would like to leave it unchanged - Conclusions, I would suggest better emphasizing the conclusions - e.g. in the form of bulletpoints.
A: We have followed the recommendation of the reviewer and changed the title of the last section to Summary

To sum up, the article brings new, valuable information, but it requires some technical corrections and consideration of introducing substantive corrections. I leave the above indications to the Author(s) of the work to think about, once again appreciating the work done so far on this article.
A: Thank you for your valuable comments. A thorough review of the language and grammer was also undertaken and many mistakes have been corrected (in track changes in manuscript).

Reviewer #3: Dear Researchers,

Greetings.

First of all, I appreciate your work and I am thankful to you for selecting this journal for the publication of your paper.
A: Thank you for the favourable outlook to our paper.

Following are my suggestions to make the paper reader friendly.
1. Improve methodology. It is not clear what steps you have taken sequence wise. (Your research should be replicable .)
A: Thank you for your valuable comment, which mirrors the concern of another reviewer. We have now extended the methodology to include the steps taken in the digitilisation process and data handling.

As stated earlier, the research applied the methodology adopted in Gössling et al. (2016). It uses publicly available satellite imagery (Google Earth) and other publicly available remote sensed data, and maps the space distribution in a single area from each of the three case study cities. Measurements of space are calculated using the tools available in standard Geographic Information Systems (GIS) such as the open source QGIS software. After selecting the areas for investigation, polygons were manually digitized to create layers of different road spaces/categories which included:

road for motorized traffic;
public/on-street parking;
pedestrian spaces including walkways, pedestrian areas and pedestrianised open spaces;
cycle paths dedicated exclusively to cyclists;
dedicated public transport spaces and priority lanes;
areas of mixed use including pedestrian crossings and shared spaces; and
median strips, otherwise known as central reservations in main roads which can sometimes take up considerable space.

Figure 4 shows the manual allocation of space to these different categories. This categorization of urban space did not come without challenges. Whilst typically one expects to find roads, pedestrian areas, public transport infrastructure, bicycle lanes, public parking and mixed areas for both walking, cycling and public transport, as well as for parking and pedestrian areas, this is not the case in the three cities. A local definition was established which might indeed impact the comparison as the three urban areas apply different rules for space distribution. There is also a level of subjectivity in the interpretation of remote imagery which can only be eliminated through a common definition and validation on site. This lack of conformity in the definition of space influences the outcome and possible interpretation of results.

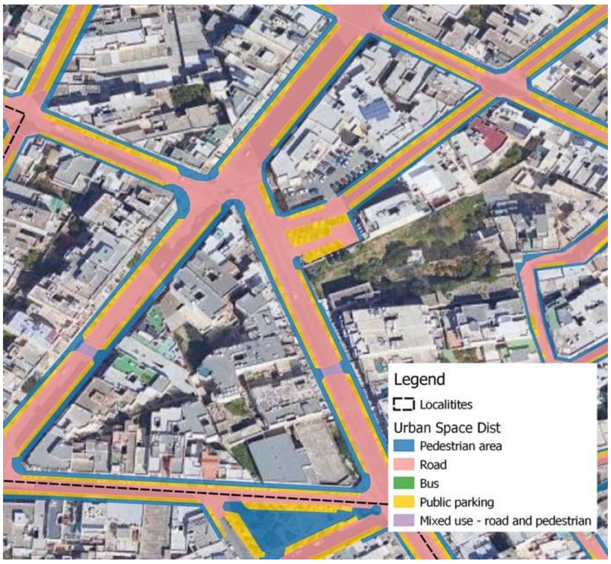

Figure 4. Detailed digitalization of the urban space in Malta.

Due to limitations in time and resources few on-site visits were carried out to validate the data and it is therefore important to acknowledge that the measurements are estimations based on the best possible quality data available for the cities. Three researchers in the different case study cities were engaged in digitizing the maps, taking considerable time and effort. This has an implication on scalability to larger areas which would require more time and human resources to map (and validate) the data for the analysis. (page 9, 10)

2. In figure 4 legends are not clearly visible.

A: Figure 4 has been replaced to improve visibility of the legend. Thank you for pointing this out.

3. Check for plagiarism and reference style. (Both should be as per journal guidelines.)
A: These have been checked.

4. It is better if you can suggest remedial measures to reduce the unequal distribution of the space.
A: Thank you for this suggestion. This has been addressed both in the discussion and summary of the paper.

The complexity of the issues highlighted in Figure 8 also shed some light into the difficulties of space re-distribution in cities, with Gössling (2020) suggesting three elements that could support a culture change for the re-distribution of space in his brief discussion paper. These include viable public transport services for long distance journeys (e.g. suburban to city centre), investment in infrastructure for active travel at the local level, and strategies for communicating the change in urban transport
(page 14)

and

Some initial discussions on the remedial measures necessary to address the issue of unequitable space distribution have pointed towards both infrastructural investments (for active travel but also for public transport) and campaigns aimed at drivers and car users on the need for change. Further research is required to address the transport system changes required to reduce inequality. (page 16)

All the best.
A: Thank you!