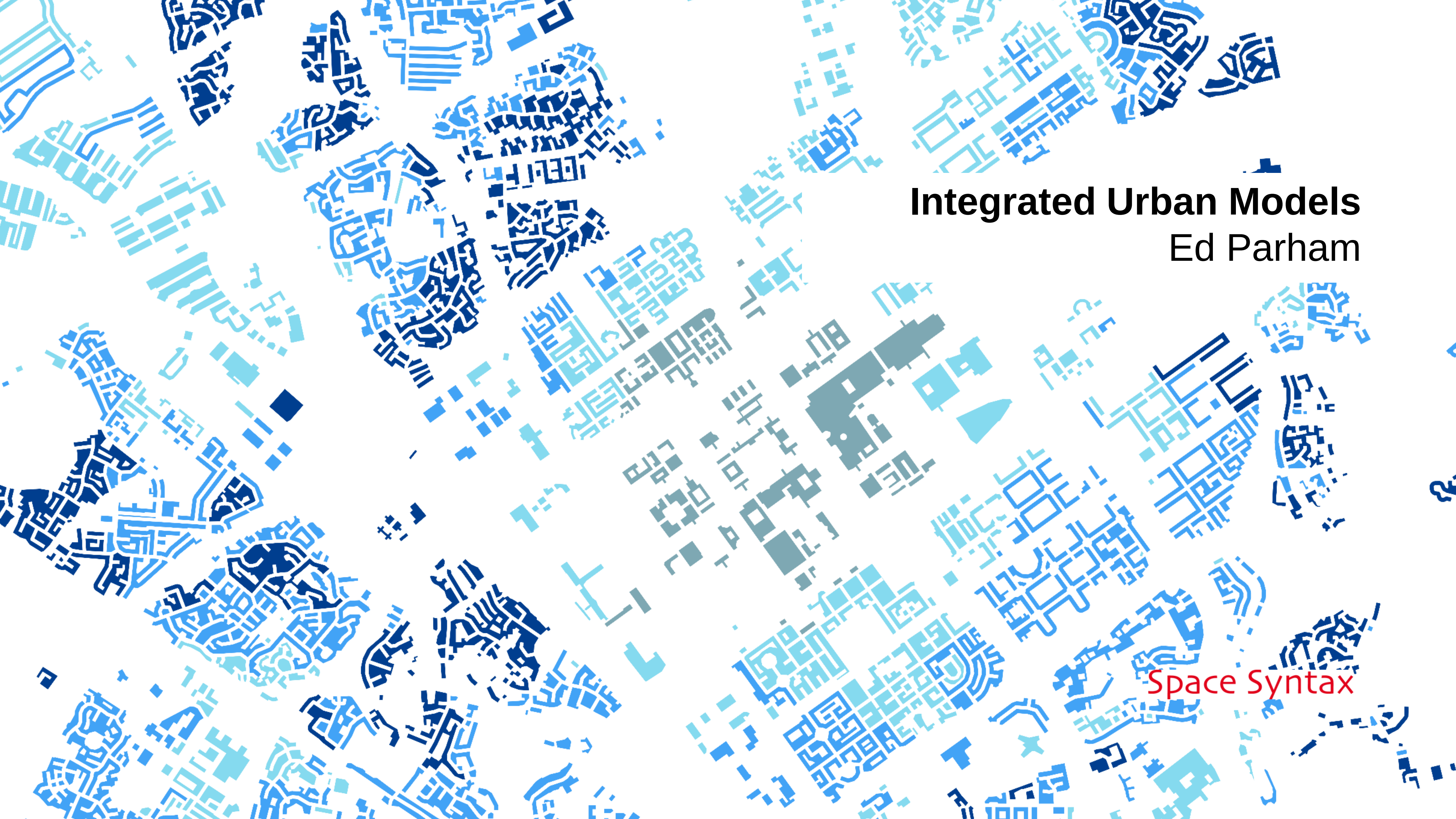
Integrated Urban Models

Ed Parham

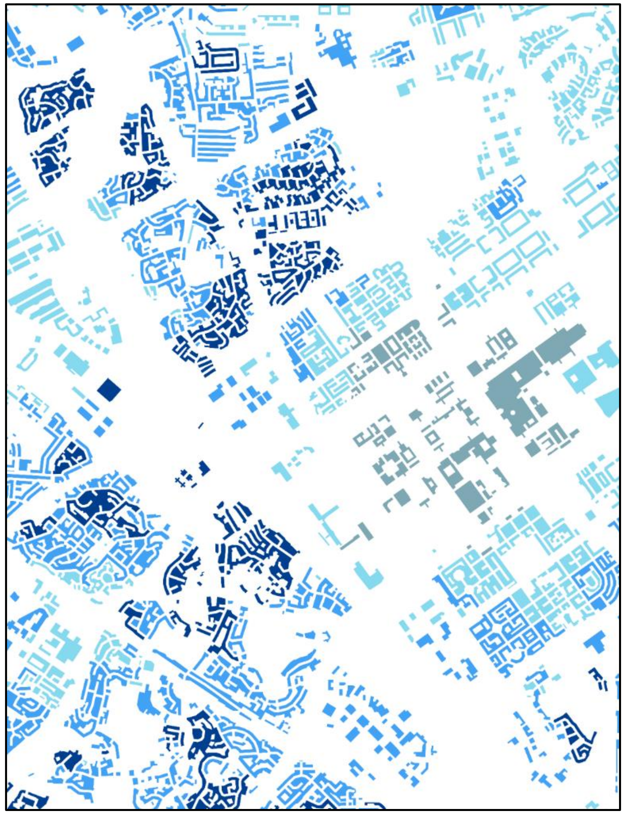


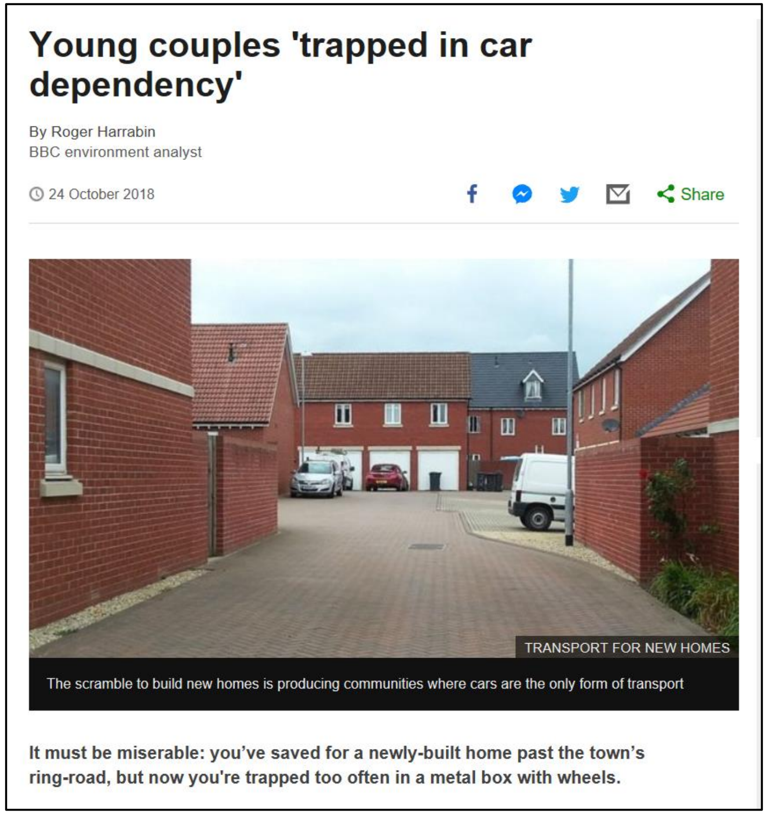
Space Syntax

1. Why do we need Integrated Urban Models?
2. What are they and why are they different?
3. How have they been validated?
4. How have they been used?

1. Why do we need Integrated Urban Models?

Daily activity, outcomes and impacts





Young couples 'trapped in car dependency'

By Roger Harrabin
BBC environment analyst

24 October 2018

Share

TRANSPORT FOR NEW HOMES

The scramble to build new homes is producing communities where cars are the only form of transport

It must be miserable: you've saved for a newly-built home past the town's ring-road, but now you're trapped too often in a metal box with wheels.

BMJ 2014;349:g4887 doi: 10.1136/bmj.g4887 (Published 19 August 2014) Page 1 of 9

RESEARCH

Associations between active commuting, body fat, and body mass index: population based, cross sectional study in the United Kingdom

Ellen Flint *research fellow*[1], Steven Cummins *professor of population health*[1], Amanda Sacker *professor of lifecourse studies*[2]

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Abstract

Objective To determine if promotion of active modes of travel is an effective strategy for obesity prevention by assessing whether active commuting (walking or cycling for all or part of the journey to work) is independently associated with objectively assessed biological markers of obesity.

Design Cross sectional study of data from the wave 2 Health Assessment subsample of Understanding Society, the UK Household Longitudinal Study (UKHLS). The exposure of interest, commuting mode, was self reported and categorised as three categories: private transport, public transport, and active transport.

Participants The analytic samples (7534 for body mass index (BMI) analysis, 7424 for percentage body fat analysis) were drawn from the representative subsample of wave 2 respondents of UKHLS who provided health assessment data (n=15 777).

Main outcome measures Body mass index (weight (kg)/height (m)^2); percentage body fat (measured by electrical impedance).

Results Results from multivariate linear regression analyses suggest that, compared with using private transport, commuting by public or active transport modes was significantly and independently predictive of lower BMI for both men and women. In fully adjusted models, men who commuted via public or active modes had BMI scores 1.10 (95% CI 0.53 to 1.67) and 0.97 (0.40 to 1.55) points lower, respectively, than those who used private transport. Women who commuted via public or active modes had BMI scores 0.72 (0.06 to 1.37) and 0.87 (0.36 to 0.87) points lower, respectively, than those using private transport. Results for percentage body fat were similar in terms of magnitude, significance, and direction of effects.

Conclusions Men and women who commuted to work by active and public modes of transport had significantly lower BMI and percentage body fat than their counterparts who used private transport. These associations were not attenuated by adjustment for a range of hypothesised confounding factors.

Introduction

The beneficial effects of physical activity on obesity and related health outcomes are generally well understood.[1] In high and middle income countries however, lifestyles have become increasingly sedentary, and physical inactivity has become the fourth leading risk factor for premature mortality.[2] Declining rates of functional active travel have contributed to this population-level decrease in physical activity, and ecological evidence suggests that rising levels of obesity are more pronounced in settings with greater declines in active travel.[3,4] Active commuting to work has been strongly recommended by the UK National Institute for Health and Care Excellence (NICE) as a feasible way of incorporating greater levels of physical activity into daily life.[5] Data from the 2011 census show that in England and Wales 23.7 million individuals regularly commute to a workplace—more than half of the 41.1 million adults of working age covered by the census.[6] With 67% modal share, private motorised transport is by far the most common commuting mode reported, followed by public transport (18%), walking (11%), and cycling (3%).[6] Policies designed to effect a population-level modal shift to more active modes of work commuting therefore present major opportunities for public health improvement.

Studies consistently suggest that use of active commuting modes translates into higher levels of overall individual physical activity.[7,8] A recent UK study provided 103 commuters with accelerometers for seven days and found that total weekday physical activity was 45% higher in participants who walked to work compared with those who commuted by car, while no differences in sedentary activity or weekend physical activity were observed between the two groups.[9] However, the definition of "active commuting" should not be limited to walking and cycling. Previous research has suggested that travelling by public

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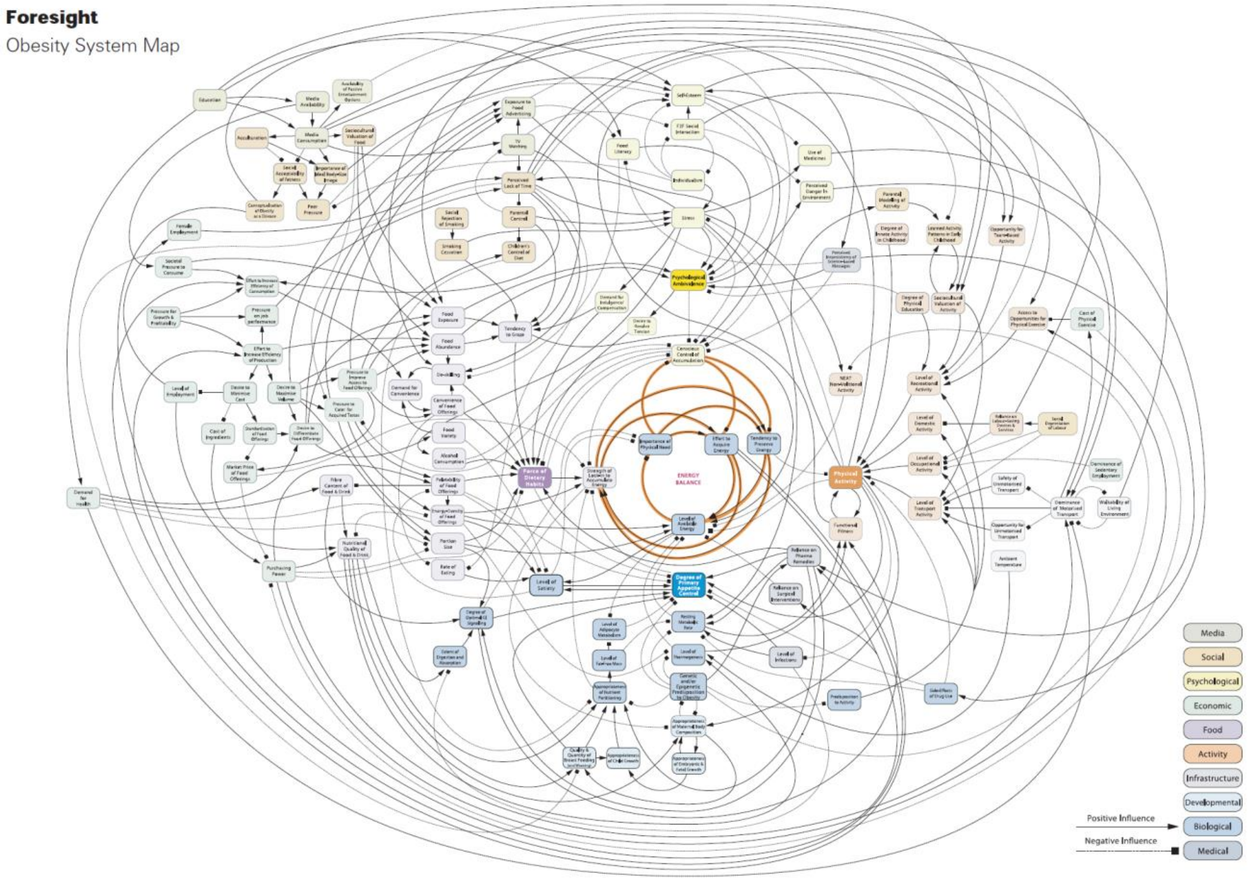
The Social Cost of Automobility, Cycling and Walking in the European Union
Stefan Gössling, AndyChoi, Kaely Dekker, Daniel Metzler

Research in the EU* shows that the car represents a cost to society, on average of €0.11/pkm

Cycling and **walking** incur external benefits, at €0.18/pkm and €0.37/pkm, respectively

External cost of automobility (within the EU) is about €500 billion per year, while cy-cling and walking represent benefits of €24 billion and €66 billion

Health outcomes and complexity

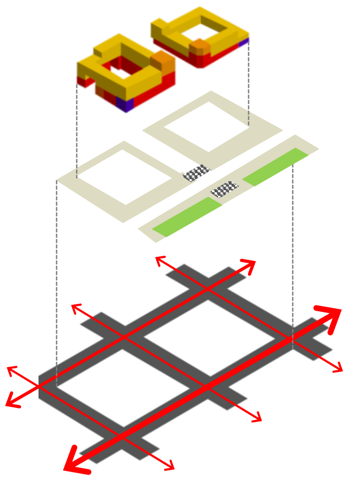


We can’t guarantee positive outcomes but we can make them possible (if we design places properly).

Space Syntax

Built environment data to understand outcomes

A built environment makes decisions possible or impossible…

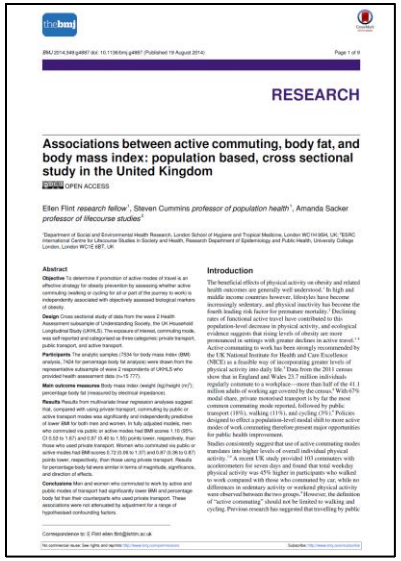


…services can mitigate this environment, but operate within its constraints (as well as creating their own)…

…these create perceptions, which influence…

…daily behaviours and activities…

…which have long term impacts on the individual…



thebmj

RESEARCH

Associations between active commuting, body fat, and body mass index: population based, cross sectional study in the United Kingdom

OPEN ACCESS

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Abstract

Introduction

…and society

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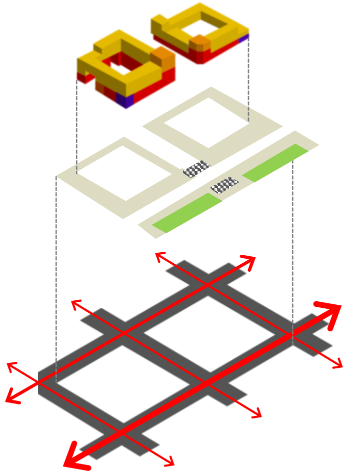
Space Syntax

Built environment data to understand outcomes

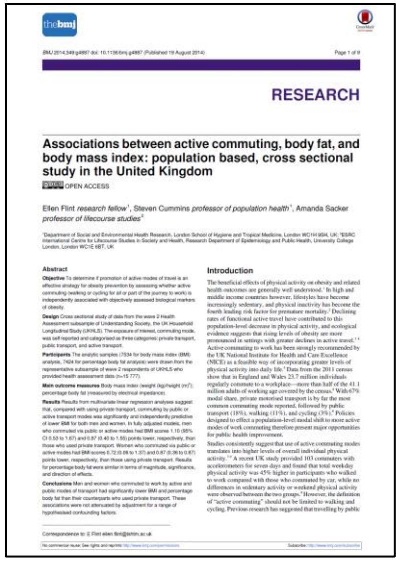
Variables
(Systems that can be altered)

Built environment + Transport services + Perception =



Result

Behaviour and activity



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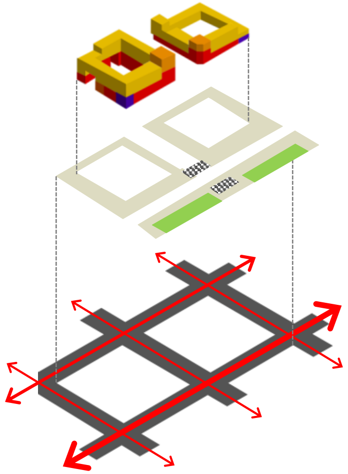
Space Syntax

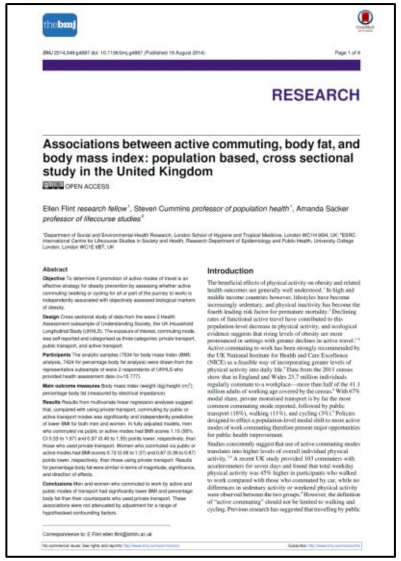
Built environment data to understand outcomes

Variables
(Systems that can be altered)

Result: *What* happens *where* and *when?*

Built environment + Transport services + Perception = Behaviour and activity

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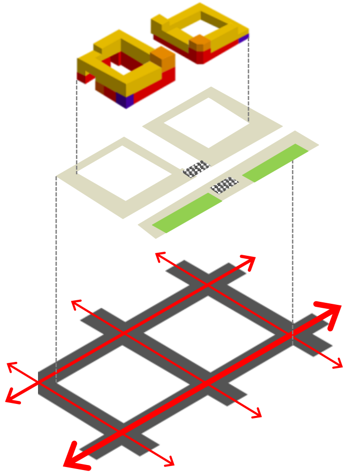
"Live" activity data

Space Syntax

Built environment data to understand outcomes

Variables: *Why* does it happen?
(Systems that can be altered)

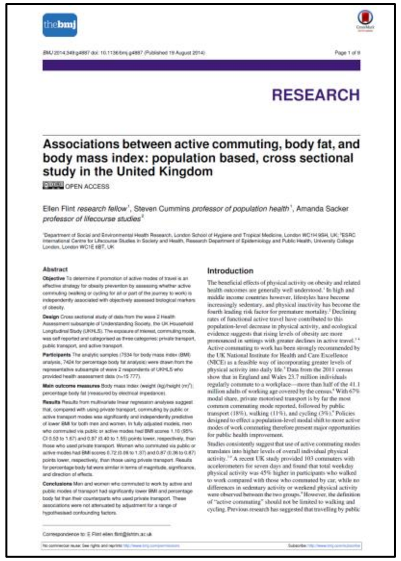
Built environment + Transport services + Perception =



"Slow" infrastructure/system data

Result: *What* happens *where* and *when?*

Behaviour and activity



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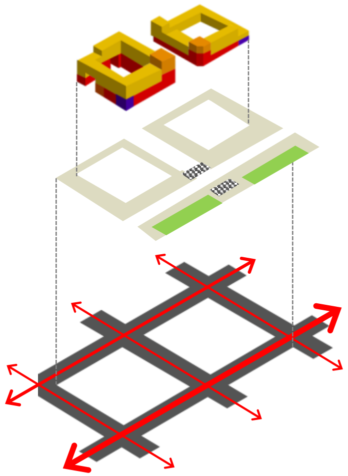
"Live" activity data

Space Syntax

Built environment data to understand outcomes

Variables: *Why* does it happen?
(Systems that can be altered)

Built environment



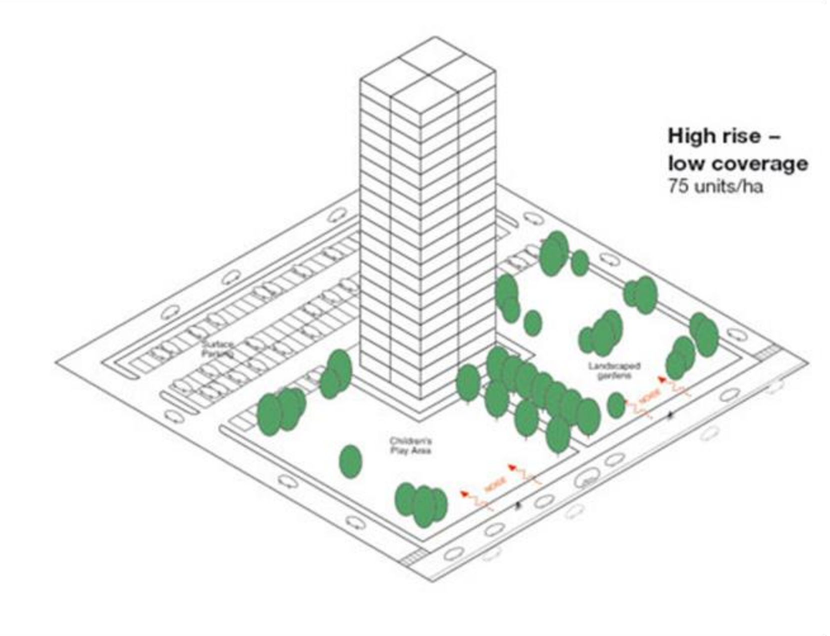
“Slow” infrastructure/system data

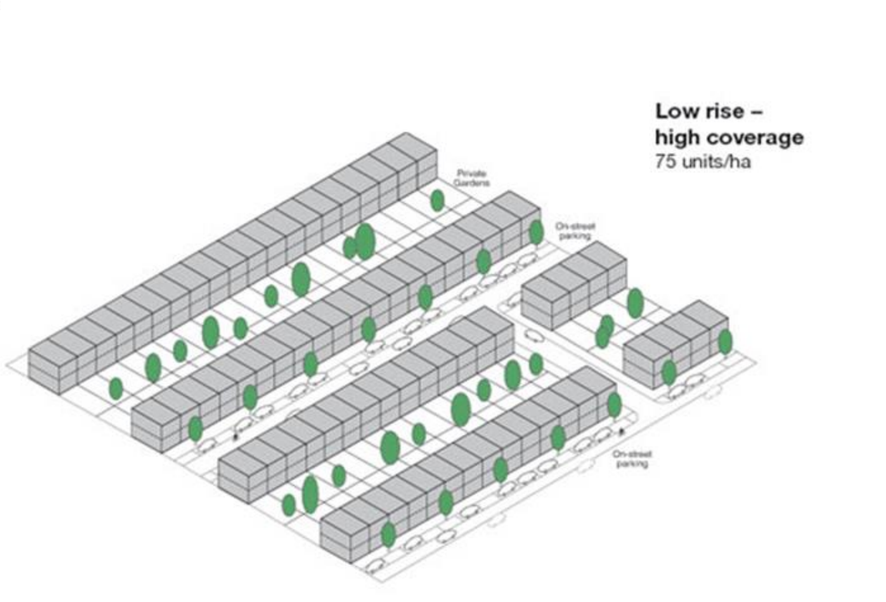
Space Syntax

2. What are they and why are they different?

Consistently describing the built environment

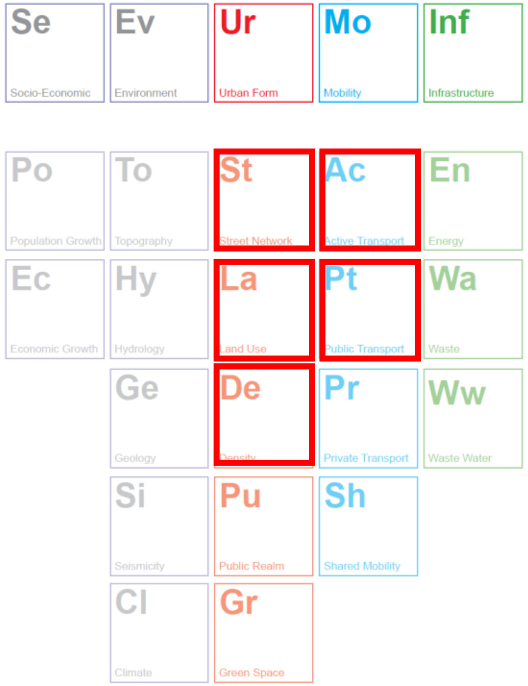
Traditional measures of urban form don’t fully explain interactions between multiple systems.

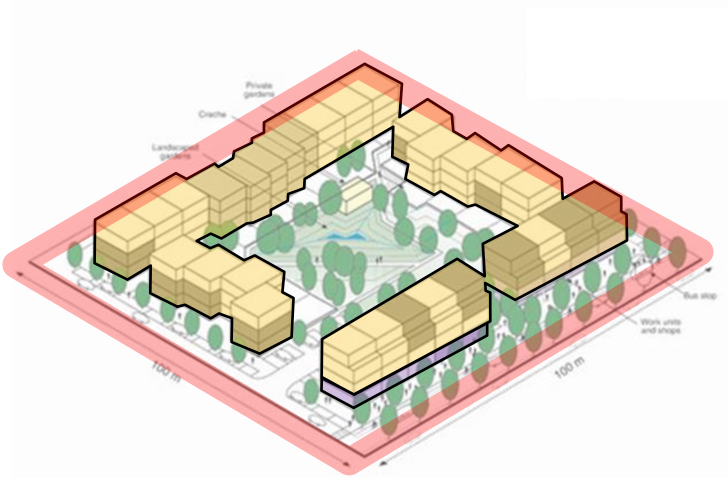


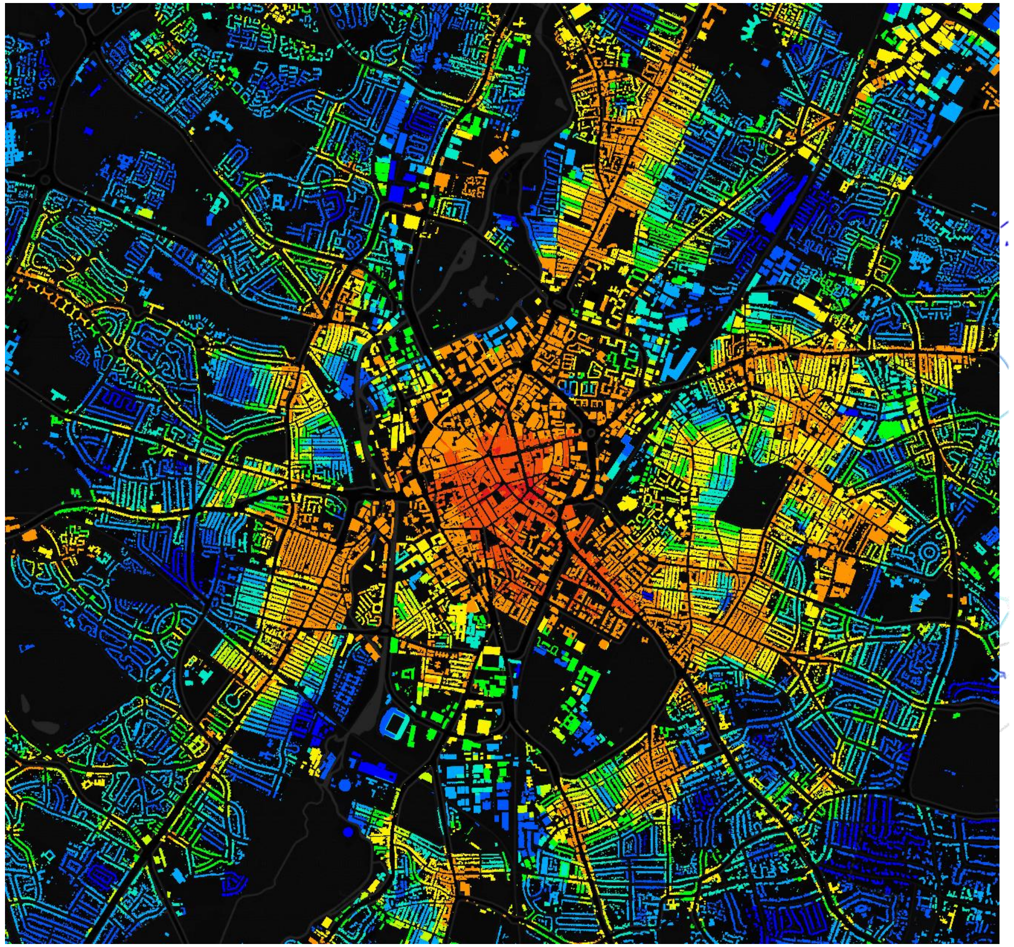


Consistently describing the built environment

Integrated Urban Models use GIS data to show how multiple systems combine from the point of a person.







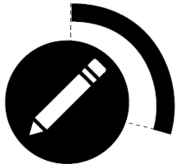
Integrated Urban Models

43%

<10 minutes' walk to primary healthcare

27%

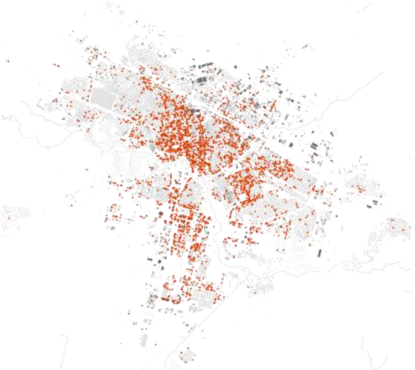
< 10 minutes' walk to school

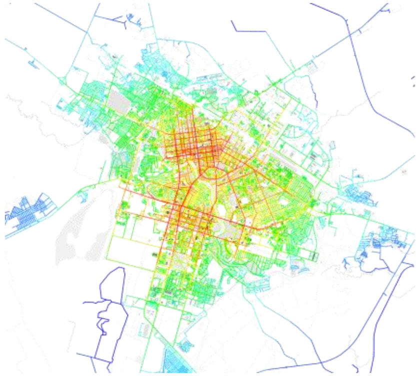


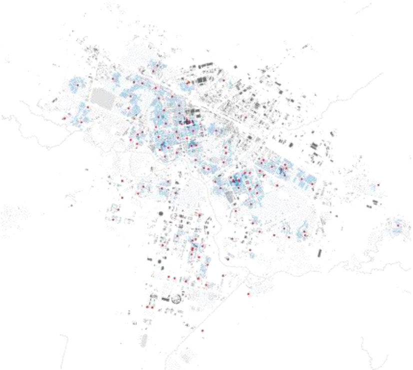
8x

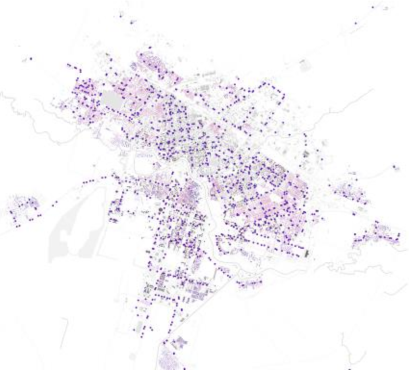
More jobs accessible by car in half an hour than by public or active transport

Public Transport







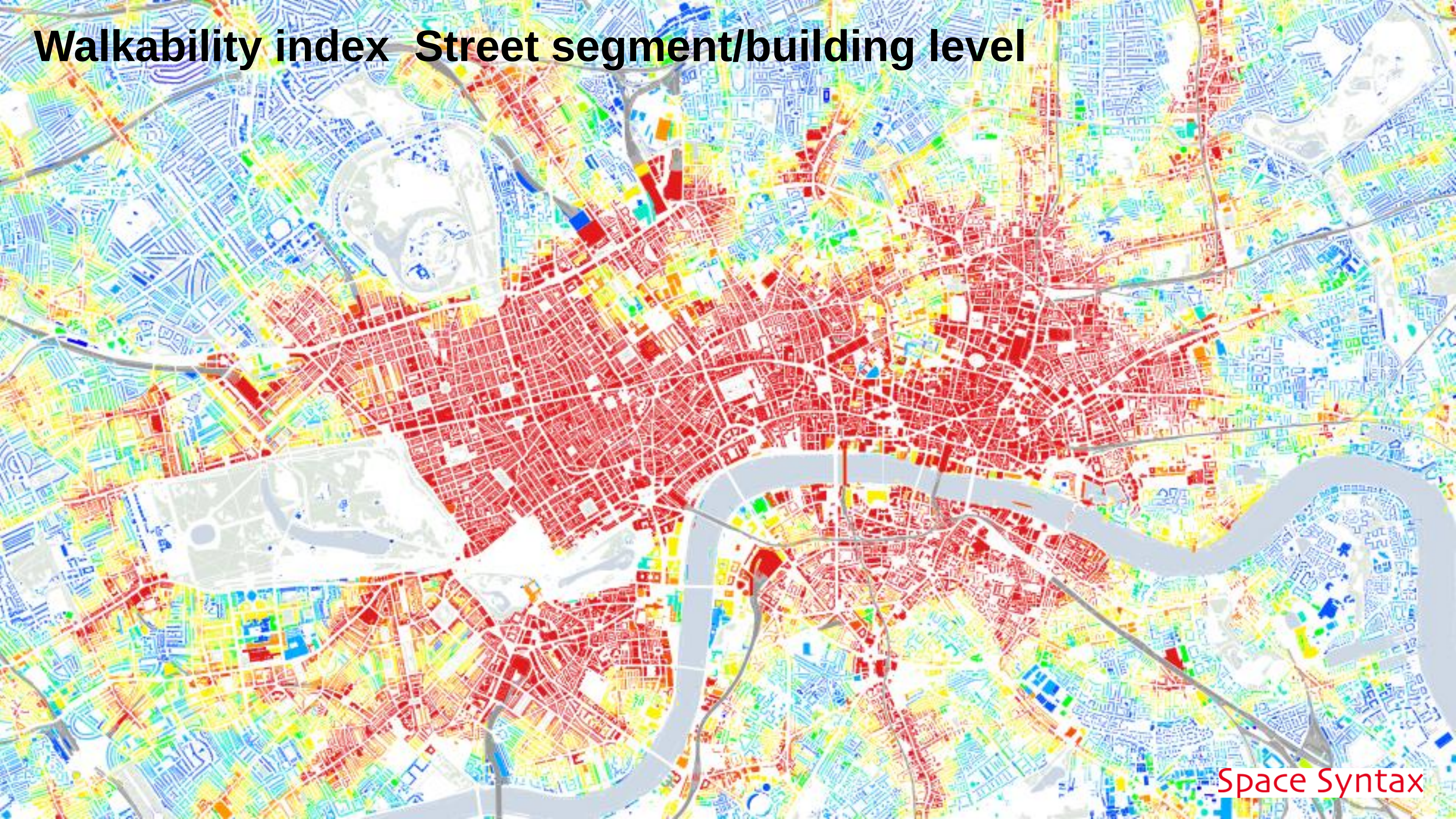


Land use

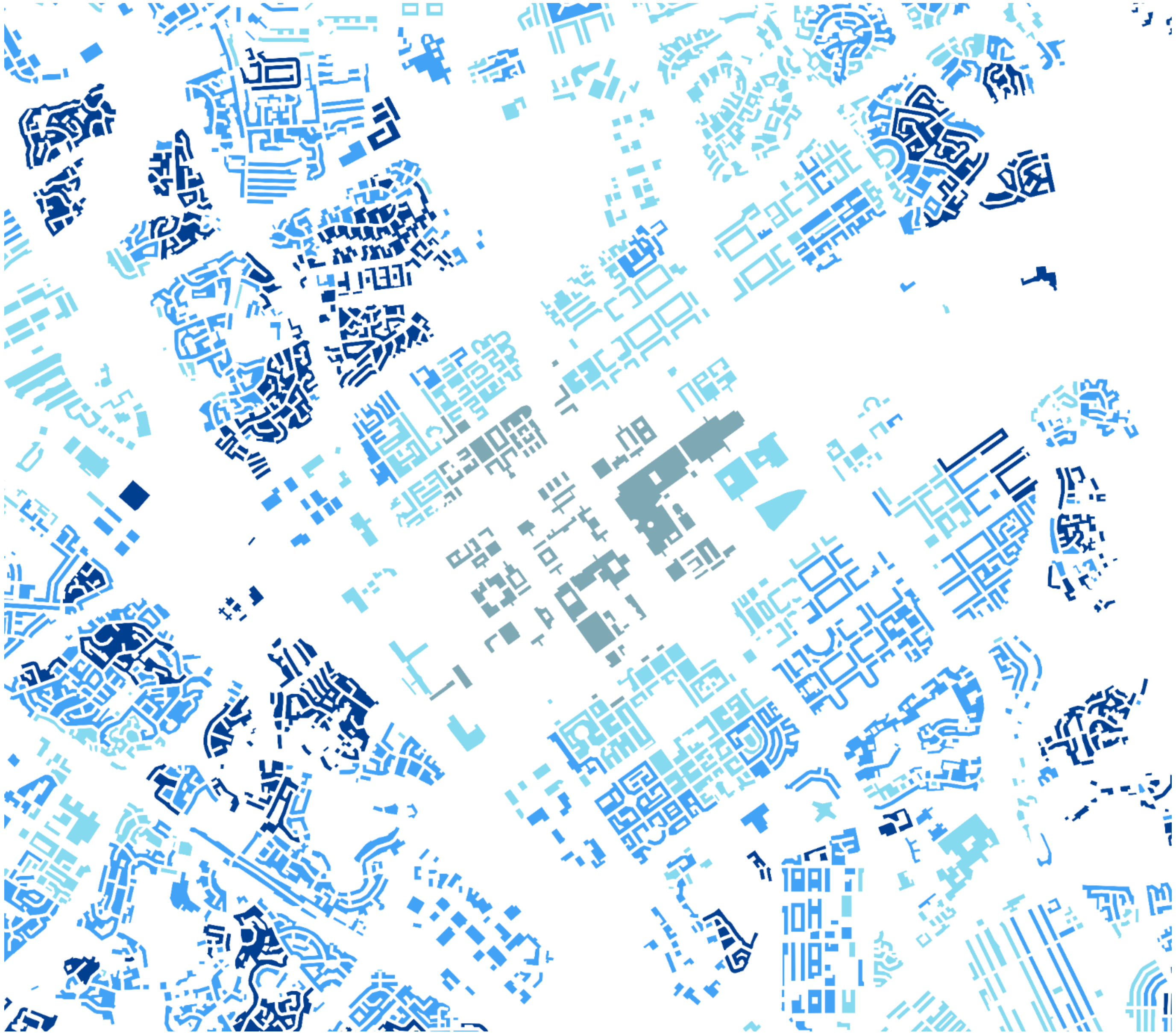
Street network

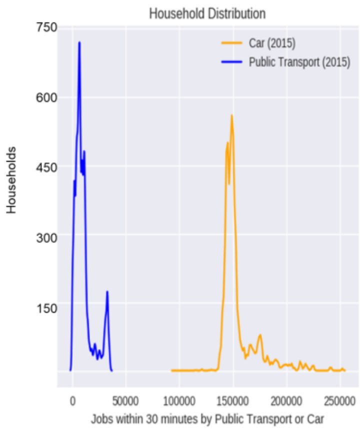
Space Syntax

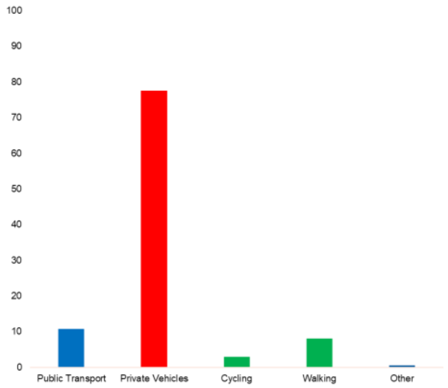
Walkability index Street segment/building level



Car Dependence Street Segment/Building level





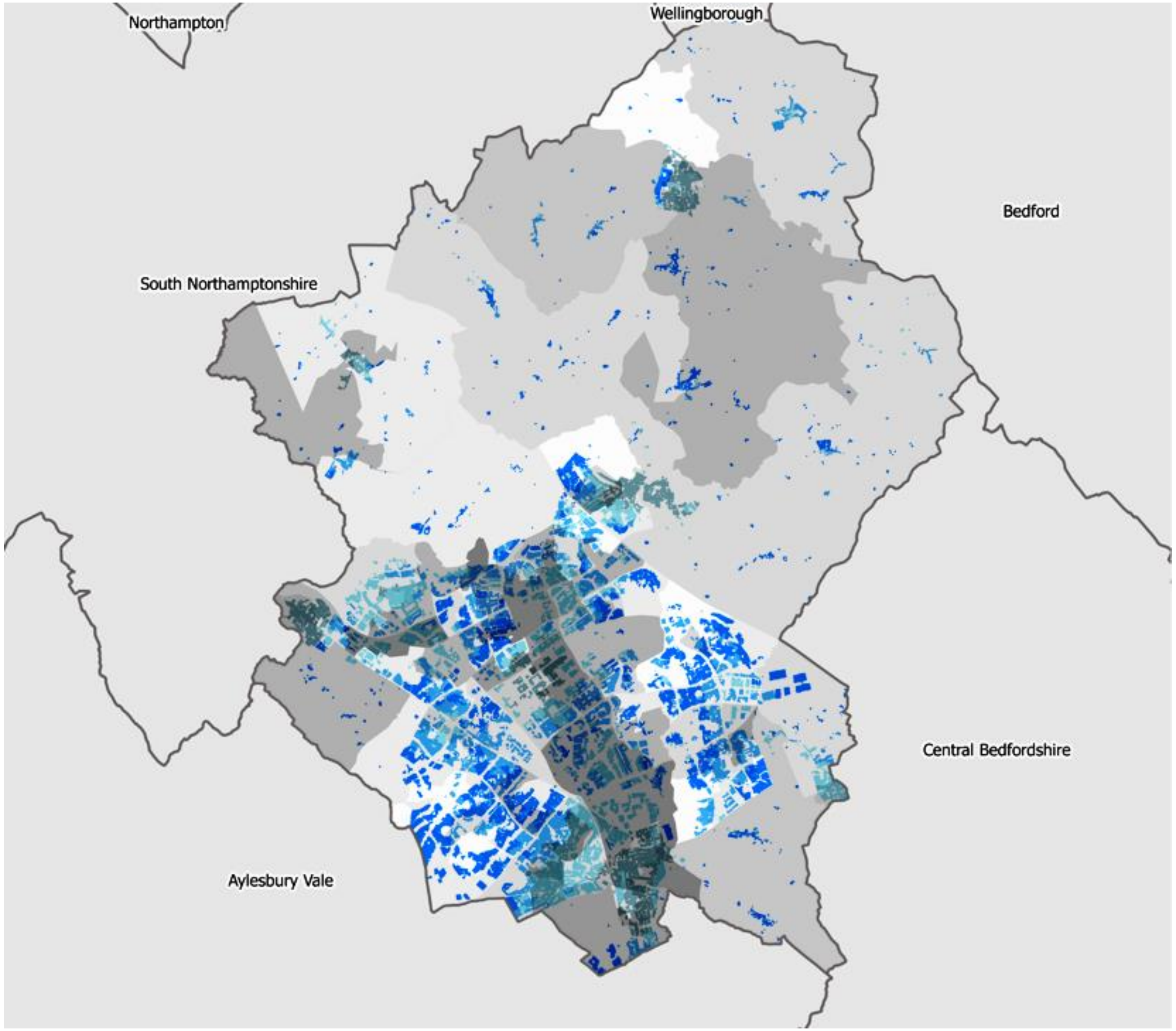


Car Dependence

- Car is equal to Public Transport
- Car is 1.0 x better
- Car is 1.0 - 2.5 x better
- Car is 2.5 - 5.0 x better
- Car is 5.0+ x better

Space Syntax

Place risk & demographic risk Car dependence & Social isolation



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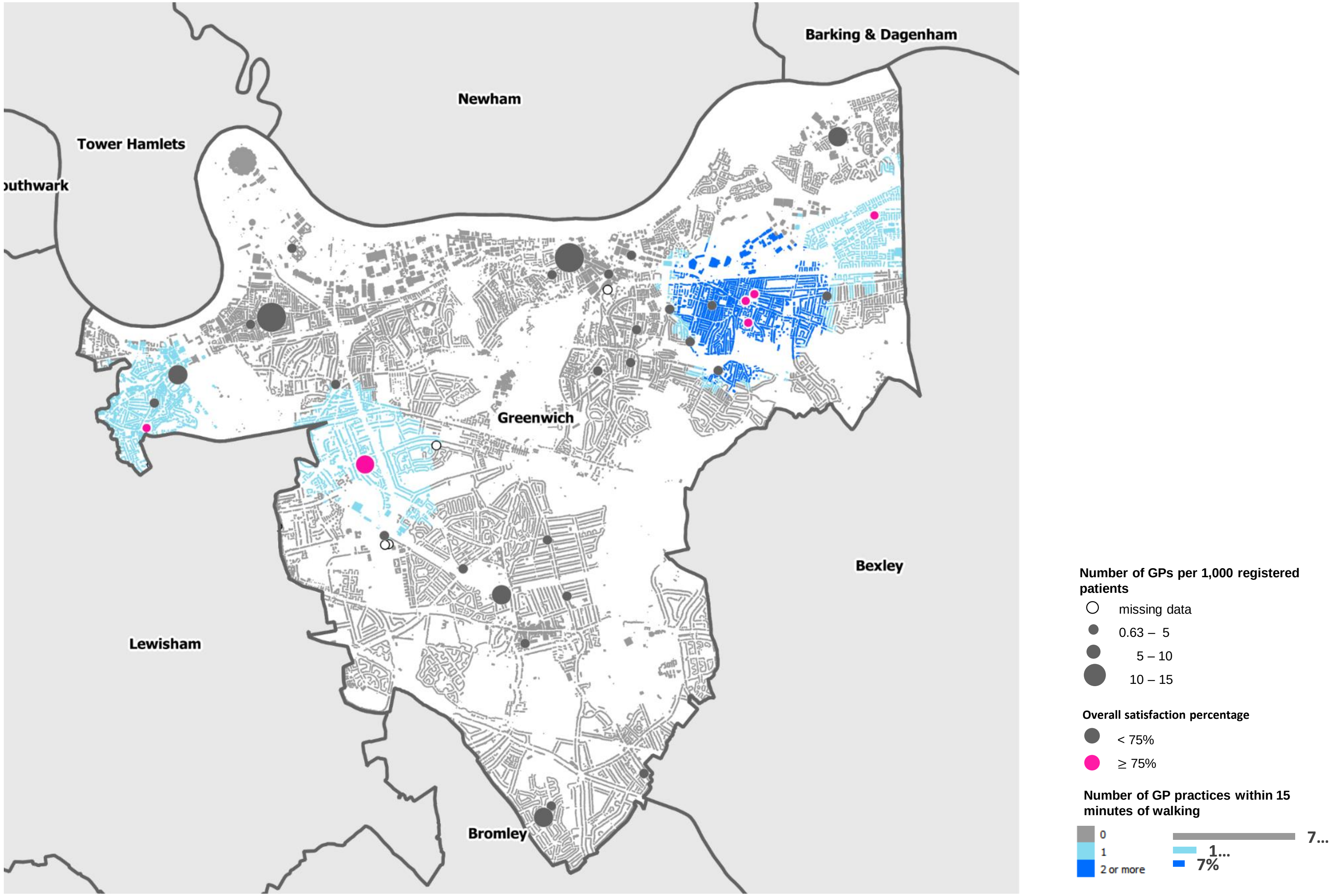
Social Isolation Score

- 0.300 - 0.600
- 0.600 - 0.800
- 0.800 - 0.900
- 0.900 - 0.950
- 0.950 - 1.150
- 1.150 - 1.400
- 1.400 - 2.000

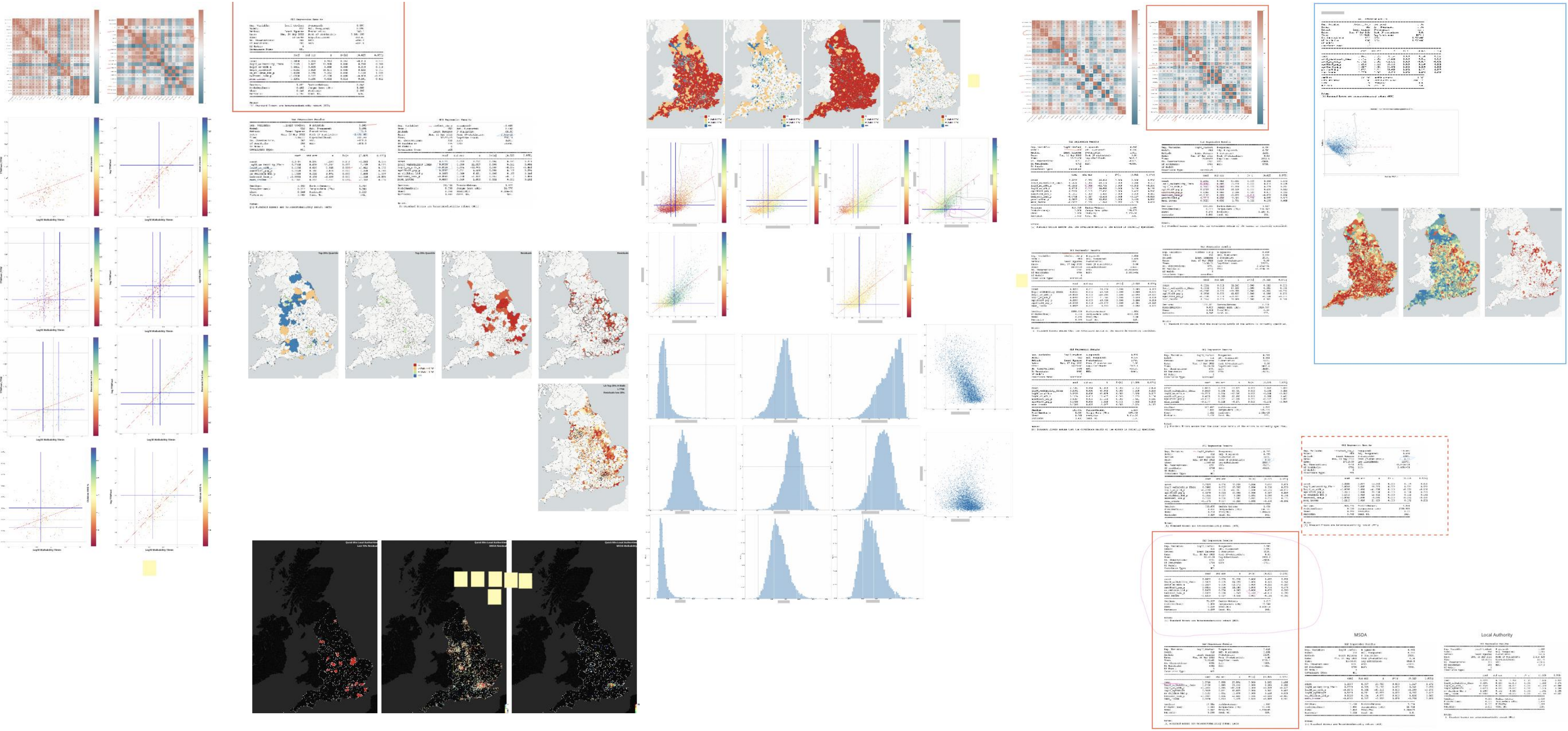
Space Syntax

Choice, capacity and quality of service



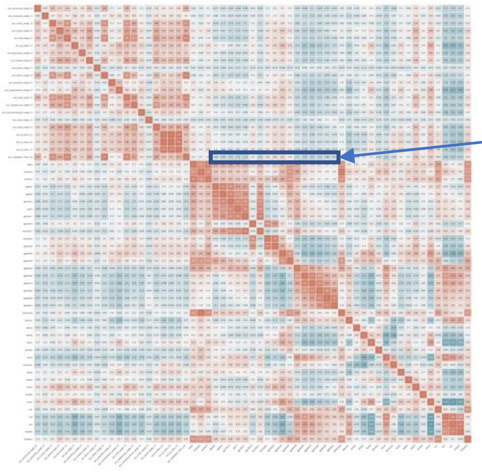
3. How have they been validated?

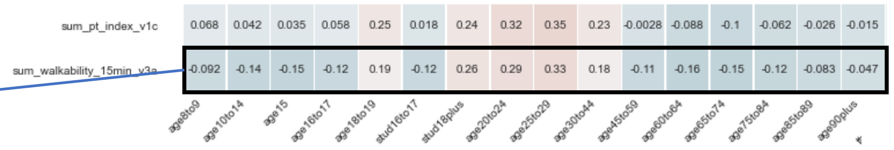
Where do people walk? Methodology



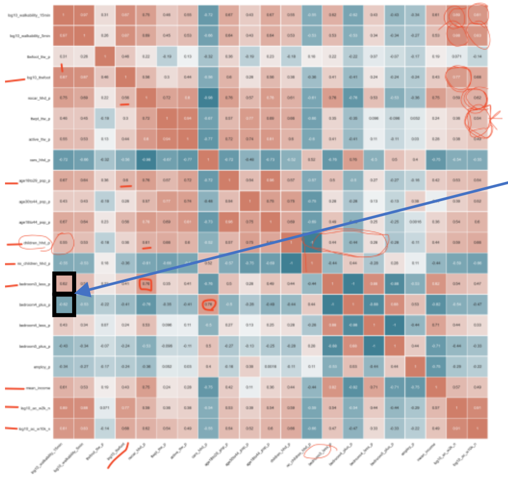
Space Syntax

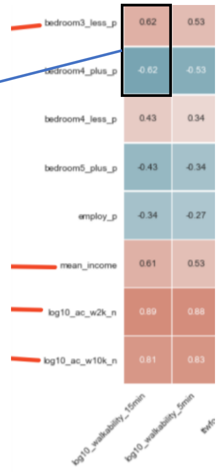
Data exploration





Age and Walkability





Walkability and house size

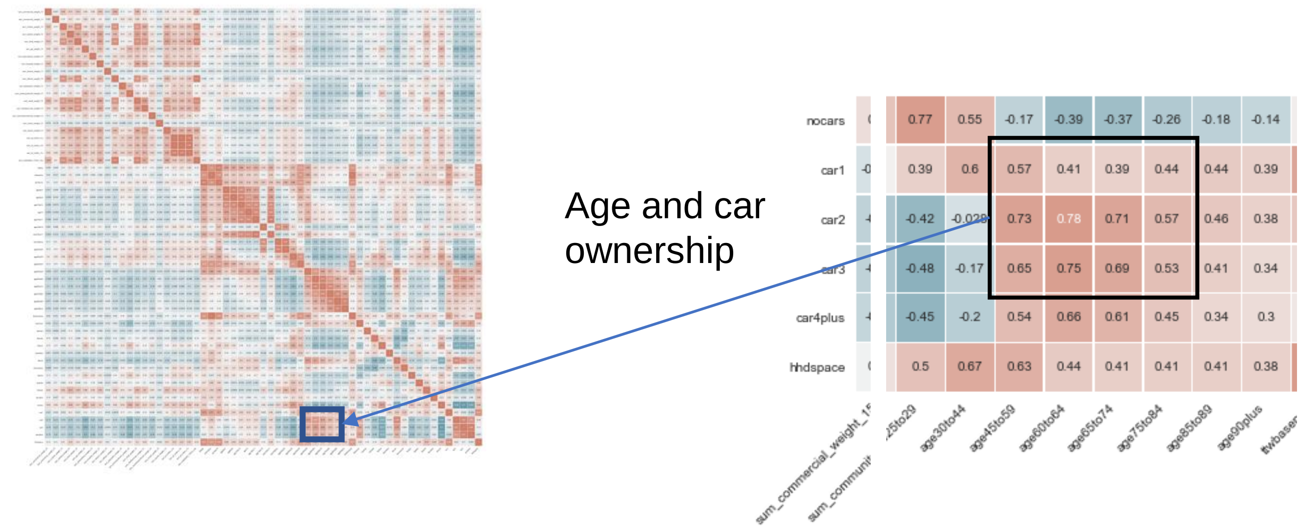
Changing relationship between age and Walkability

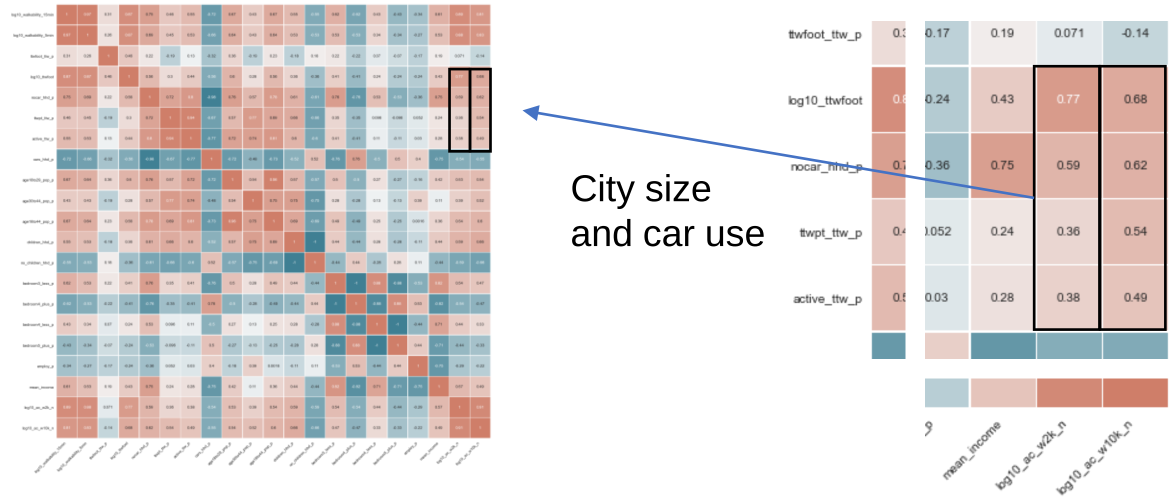
Tendency towards smaller houses in more walkable locations

Earlier work showed relationship between property value and Walkability

Space Syntax

Data exploration





Changing relationship between age and Walkability

Tendency towards larger houses in less walkable locations

Earlier work showed relationship between property value and Walkability

Associations between increase in age and multi-car ownership

In larger cities, higher active and public transport use, and lower car ownership

Space Syntax

Results

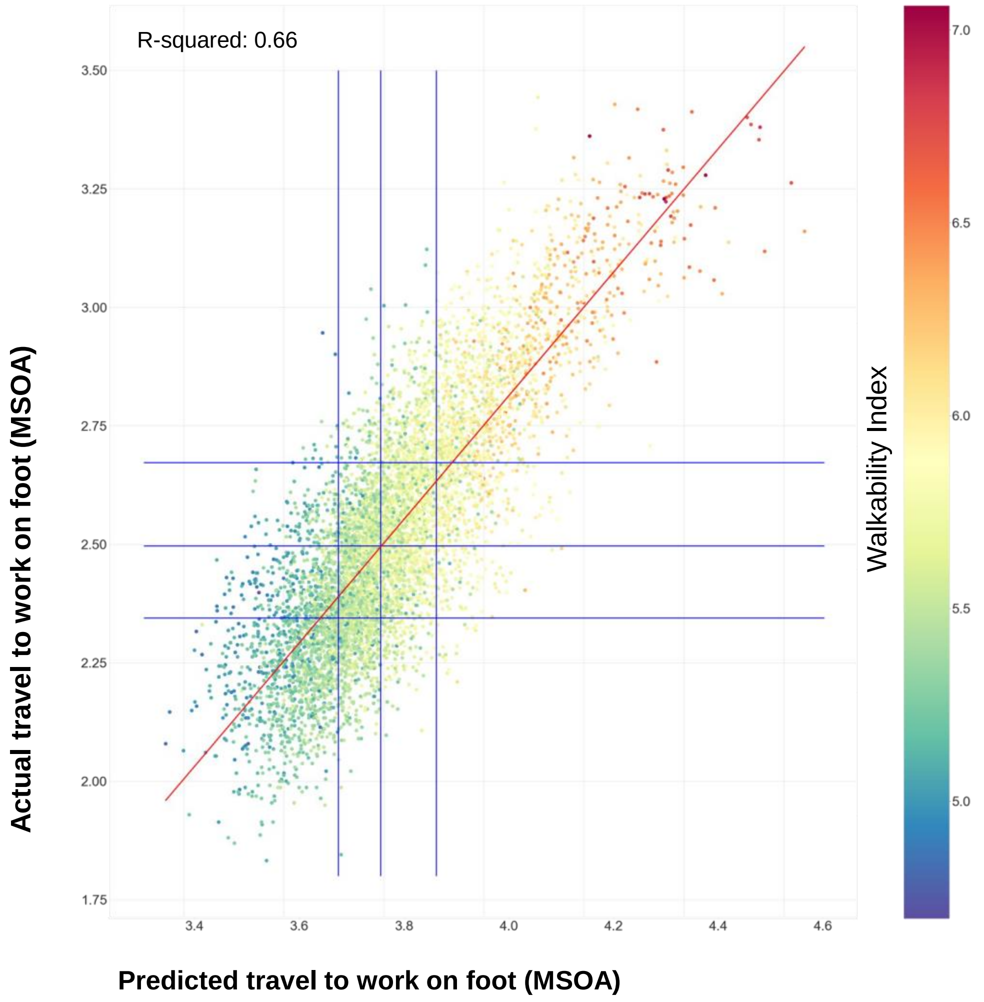
Across 330 Local Authorities and 7,000 MSOAs consistent characteristics were found:

- Larger populations aged 18-29
- Fewer households with children
- Higher Walkability Index score

Unexpected findings included:

- Larger, better-connected cities had lower levels of walking but higher public transport use and lower car ownership
- Income was inconsistent

The built environment is important because it is one of the significant factors that can be affected.



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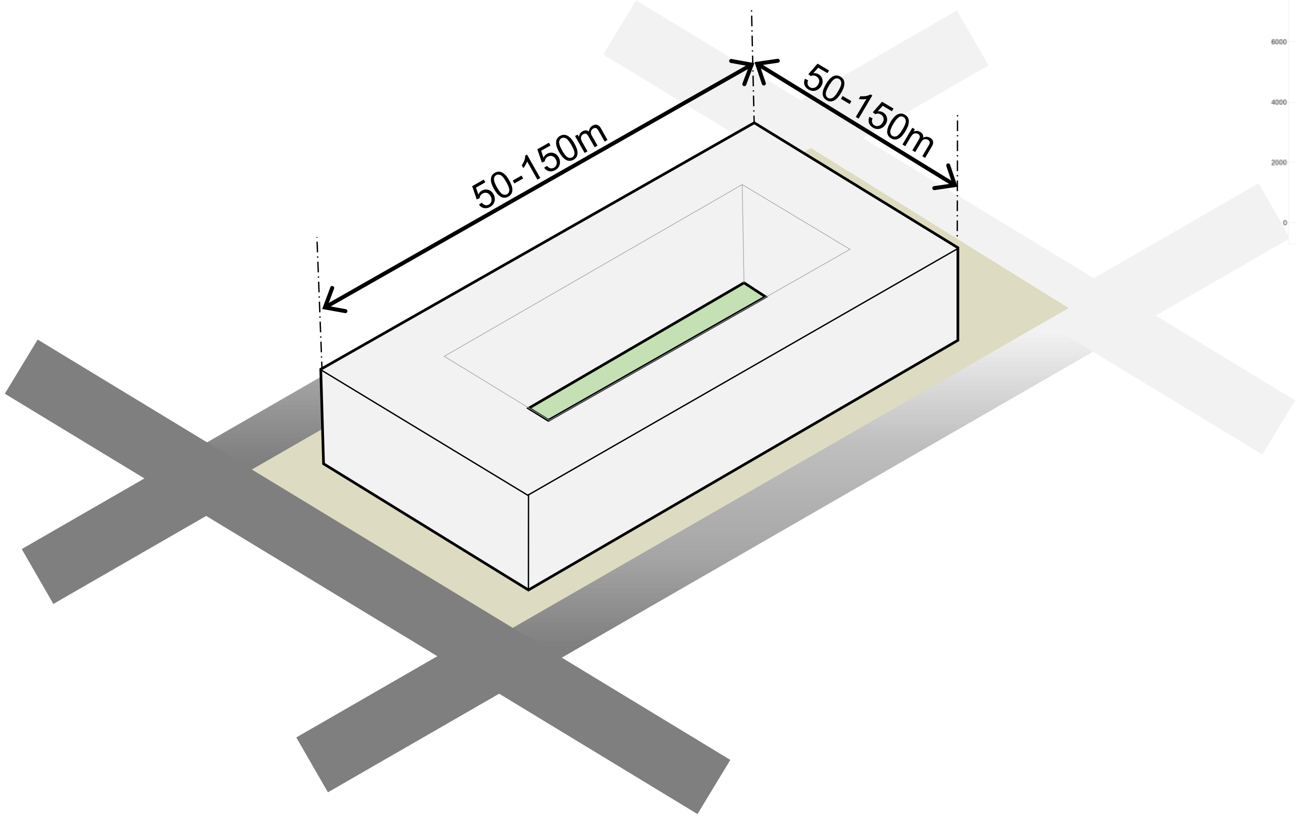
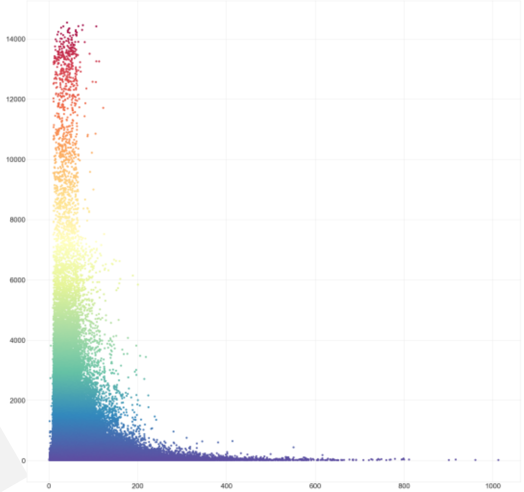
Space Syntax

Findings

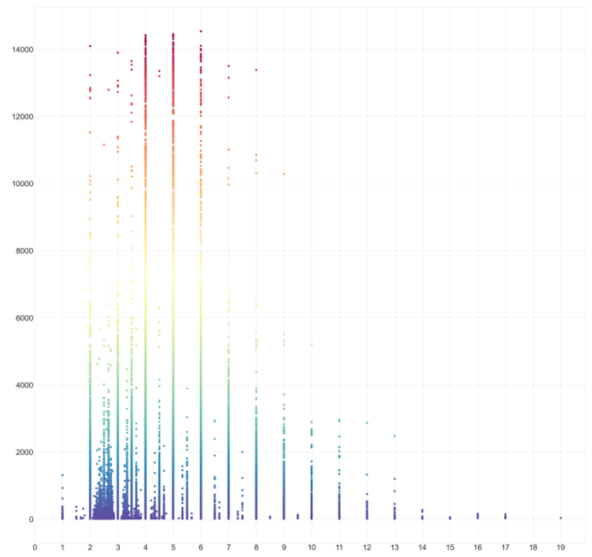
Places which are more Walkable have smaller urban blocks and bring a wider mix of uses closer together.

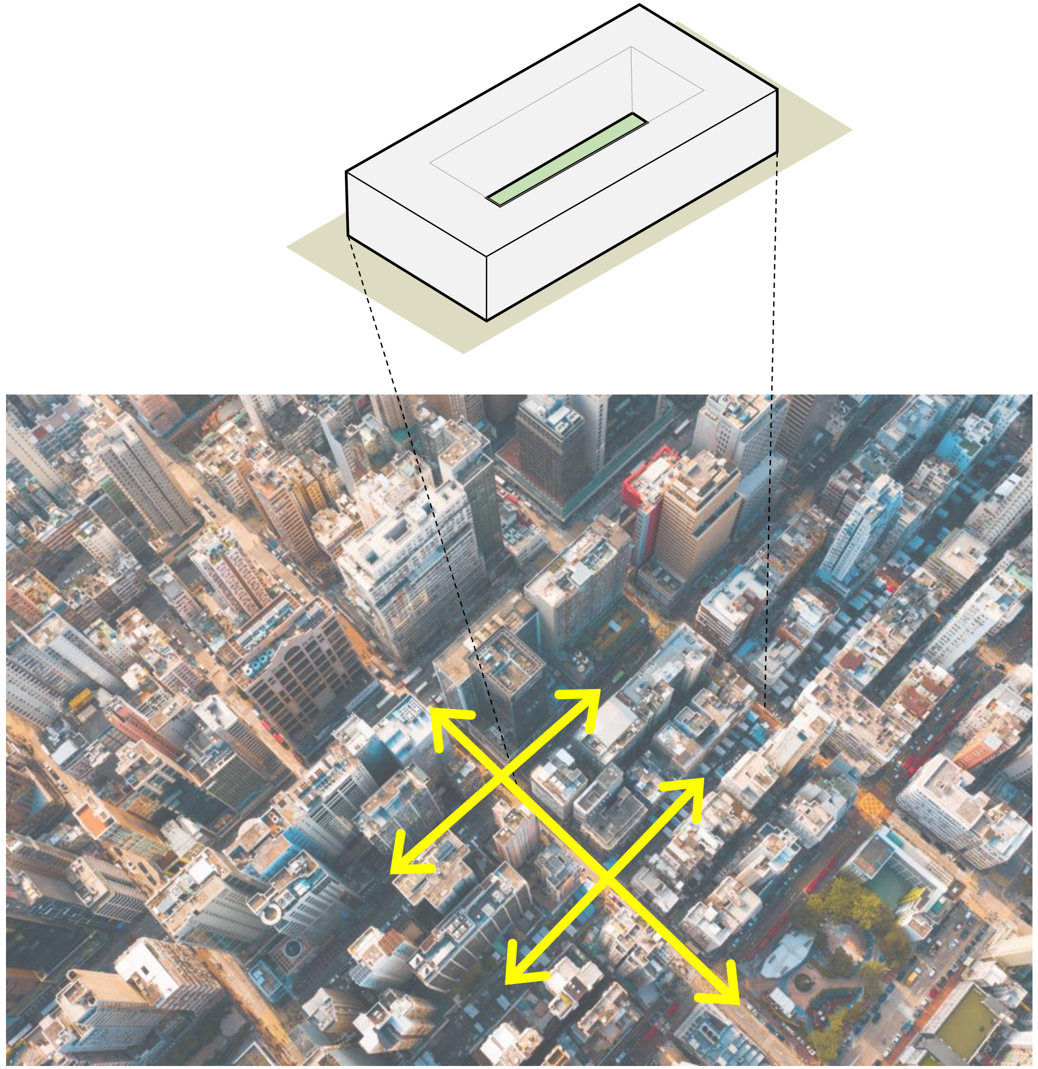




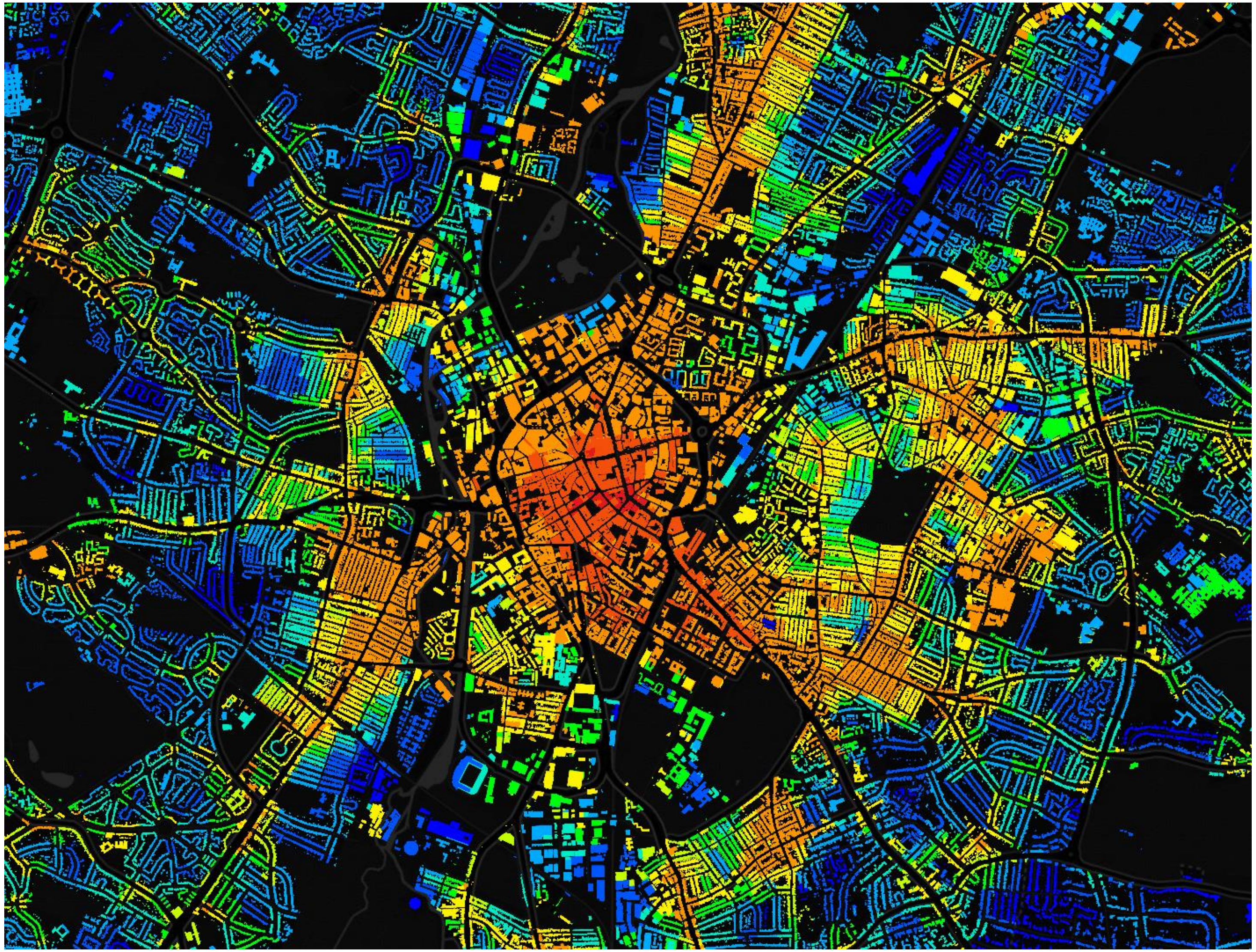
Findings

They are also part of continuously connected networks which embeds them in the wider connective tissue of larger cities.





What does this mean for strategic planning policy?

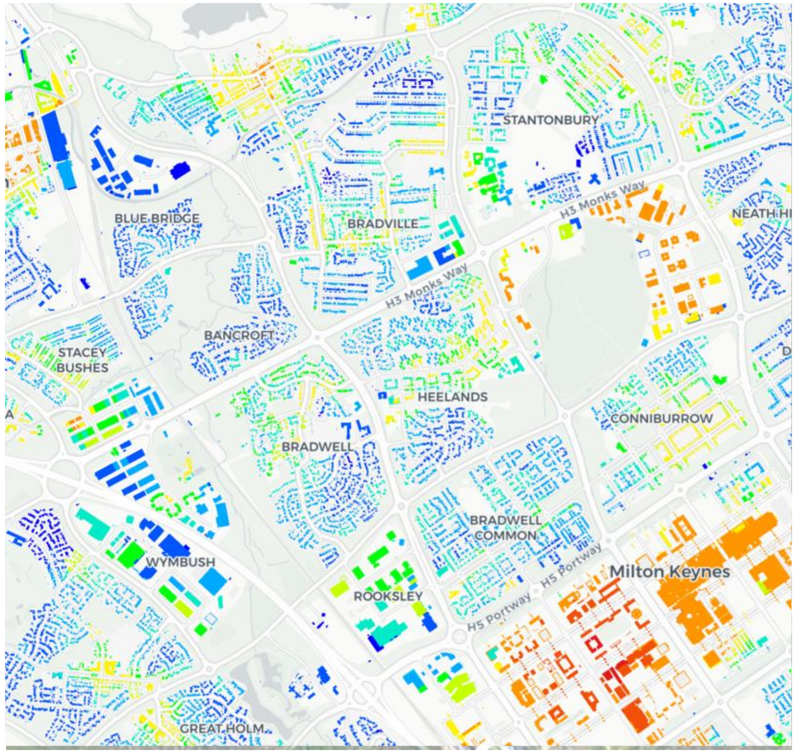


Allocate growth to places which have the built environmental conditions in place to make it possible not to own a car.

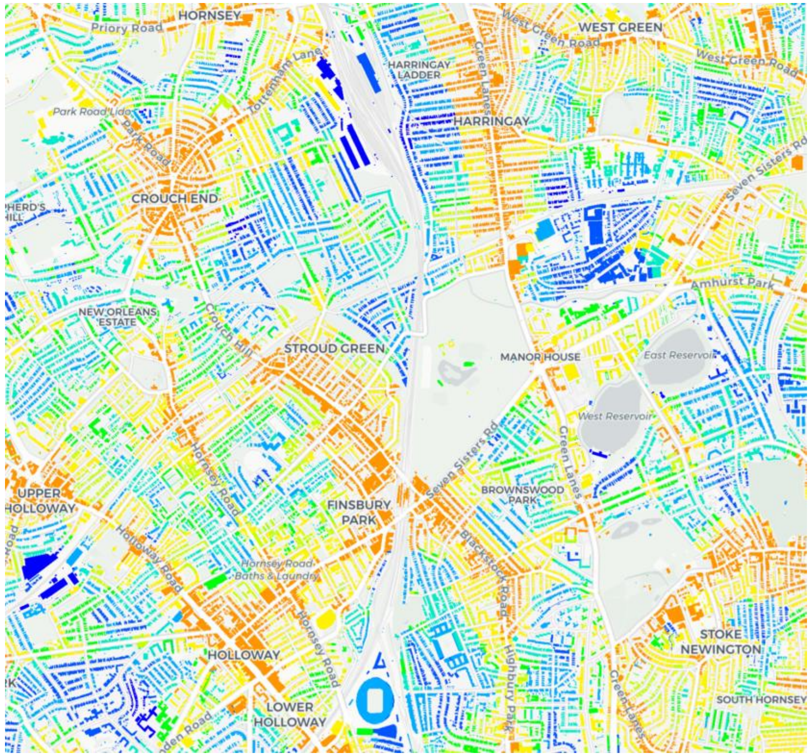
Ensure a mix of housing types and tenures, along with supporting social infrastructure, in measurably more accessible and walkable locations.

Space Syntax

What does this mean for masterplans?



Milton Keynes



North London

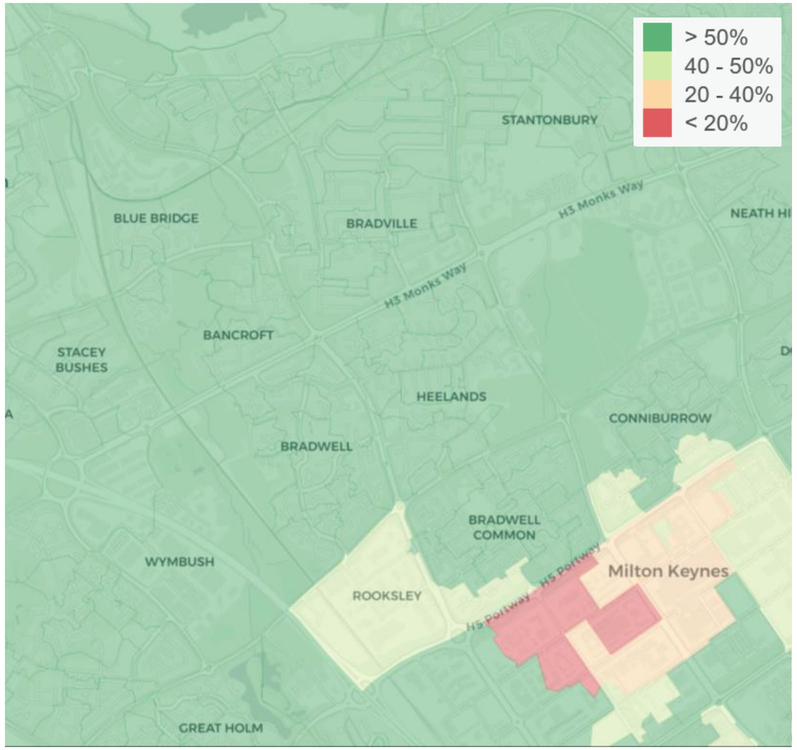
Walkability Index

One risk of the 15 minute city is how it translates into a simplified proposal that focuses only on local scale characteristics.

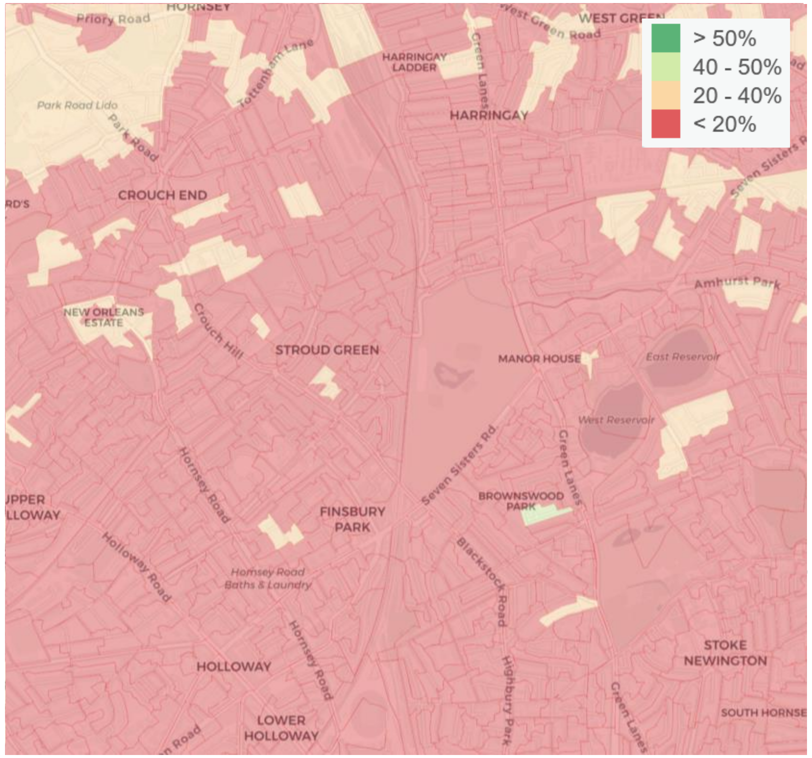
Places where more people walk are integrated across multiple scales at the same time.

We can see the effects of this in the UK.

What does this mean for masterplans?



Milton Keynes



North London

Public Transport use

Active Travel

Car ownership

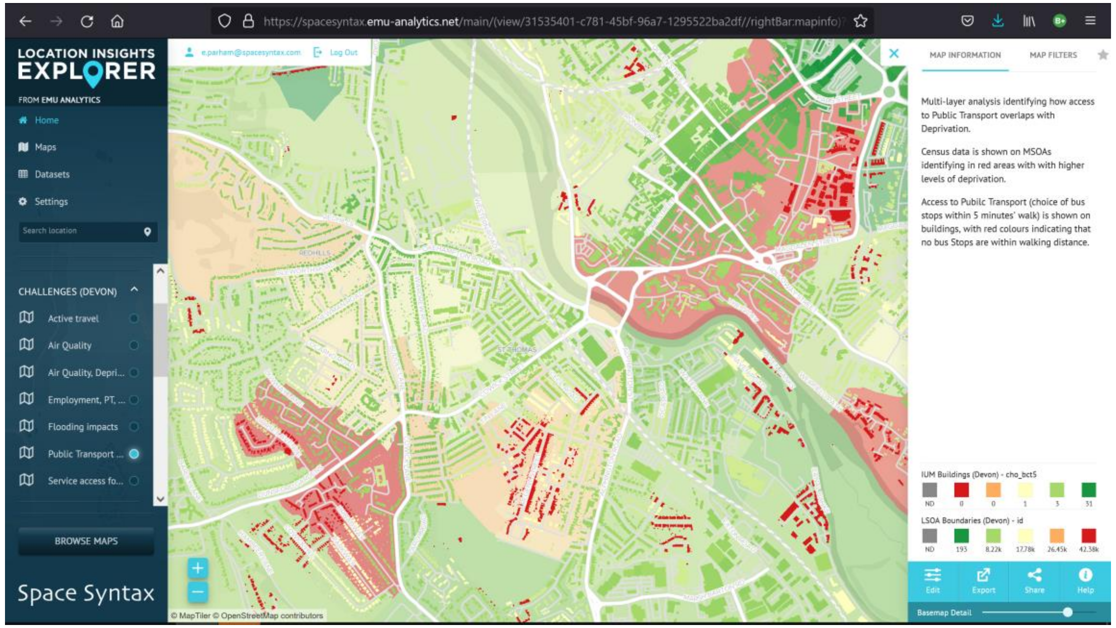
One risk of the 15 minute city is how it translates into a simplified proposal that focuses only on local scale characteristics.

Places where more people walk are integrated across multiple scales at the same time.

We can see the effects of this in the UK.

Space Syntax

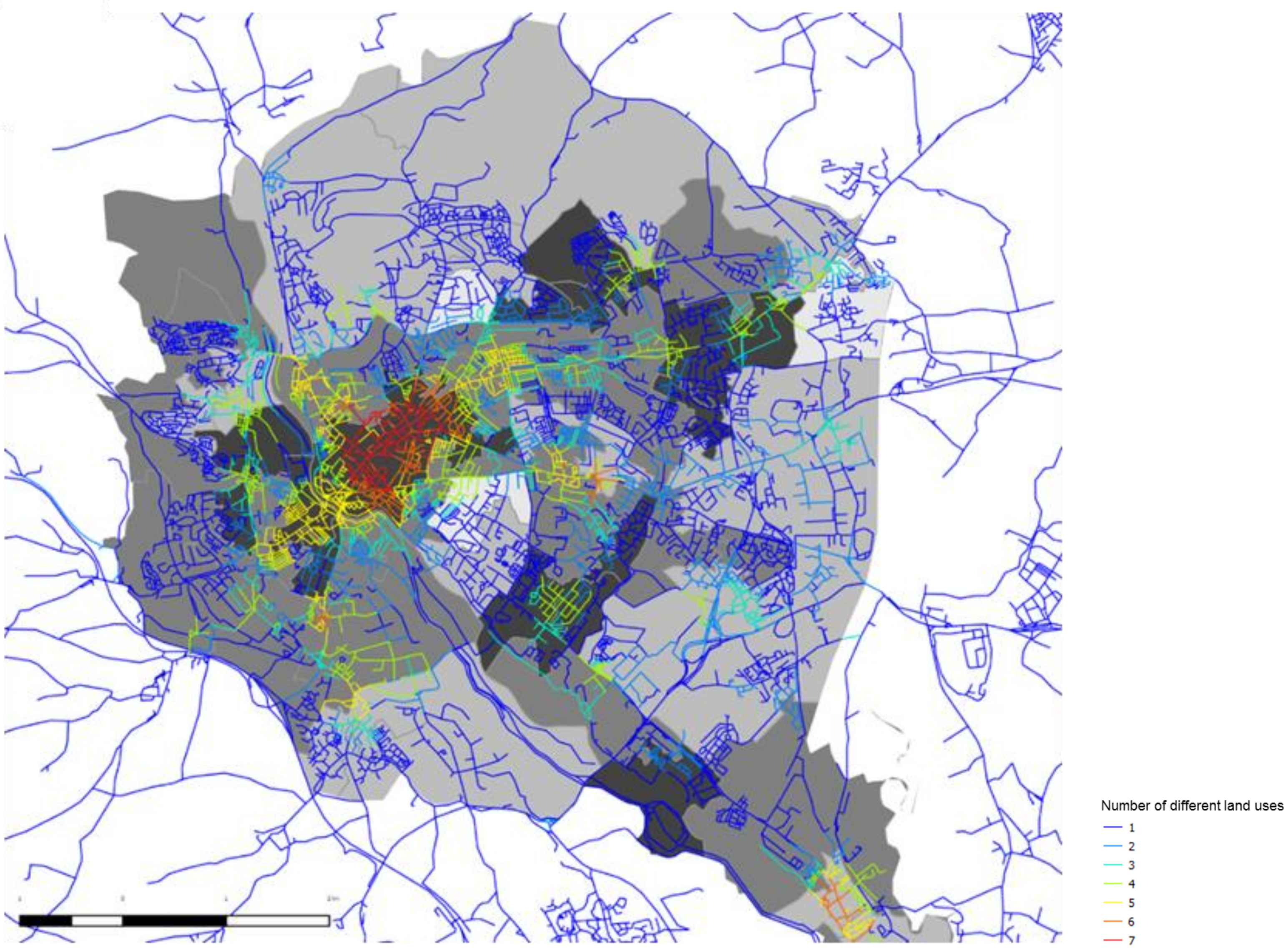
What does this mean for public health strategies?



Potential to identify mis-matches where environmental conditions are in place but not many people walk.

Space Syntax

Health outcomes Walkability and Obesity



indicator	Cumulative Car Dependency (Mean Average)	Average of number of different land uses	Average Number of GP's within 10 minute walk	Average Number of GP's with 80% satisfaction within 10 minute walk	Number of Residential ID's
Emergency Admissions DASR per 100,000 2014-2016	-0.18	0.35	0.17	-0.06	0.25
A&E Attendances DASR per 100,000 2016	-0.01	0.04	-0.04	-0.07	0.14
Falls Admissions DASR 2014-16	-0.25	0.39	0.22	0.24	0.06
KSI on Roads per 100,000 2014-16	-0.01	0.16	-0.08	-0.16	0.33
Census 2011 Health_Bad_SAR	-0.04	0.17	0.16	0.03	0.13
Census 2011 Long_Term_Condition_SAR	-0.14	0.27	0.15	0.00	0.14
Census 2011 Health Limited a lot 16-64 %	-0.08	0.11	0.01	-0.10	0.22
Adult Obesity Estimates (percentage) 2015	0.41	-0.48	-0.43	-0.44	-0.27
Physical Inactivity Estimates (percentage) 2015	-0.01	0.11	-0.06	-0.15	0.10
Life Expectancy at Birth (2011-2015)	0.13	-0.27	-0.15	-0.03	-0.17
Self-Reported Wellbeing 2011-12 Modelled Estimates by LSOA applied to 2014 Population - Low Happiness %	-0.14	0.25	0.08	-0.02	0.15
Respiratory Emergency Admissions (Crude Rate per 100,000), 2014-2016	0.17	-0.11	-0.03	-0.11	-0.01
Respiratory Emergency Admissions DASR per 100,000, 2014-2016	-0.11	0.22	0.25	0.24	0.03
Circulatory Emergency Admissions DASR per 100,000, 2014-2016	0.02	0.13	0.05	-0.05	-0.07
Circulatory Emergency Admissions (Crude Rate per 100,000), 2014-2016	0.23	-0.15	-0.16	-0.25	-0.13

Space Syntax

4. How have they been used?


Astana 2030

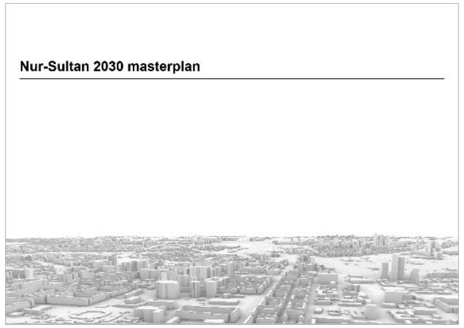
Approach

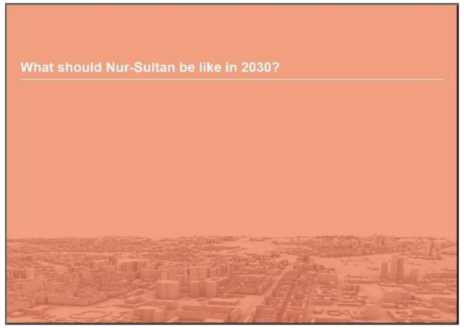
What should Astana be like in 2030?

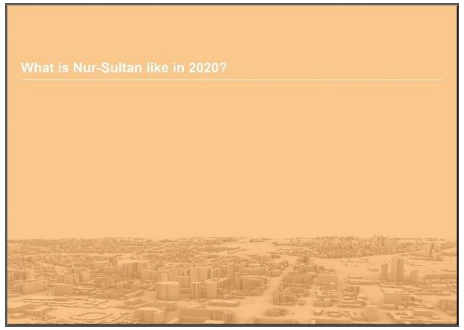
What is Astana like now?

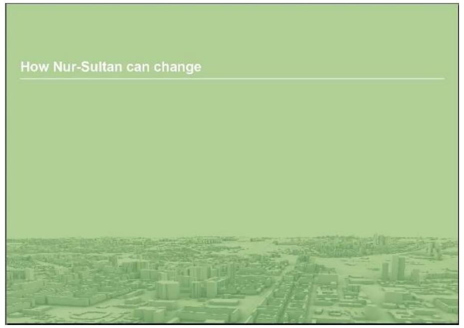
How can Astana change?

Does the 2030 masterplan deliver the vision?





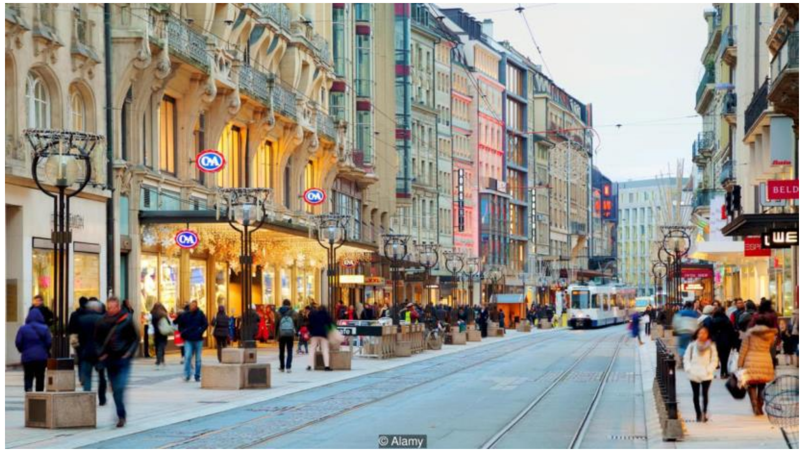




What should Nur-Sultan be like in 2030?

What should Nur-Sultan be like in 2030?

A Liveable City



Nur-Sultan 2030

- active, engaging and interesting to be in.
- easy to move around on foot, by bike or public transport.
- that provides residents with access to quality services within walking distance.
- mitigates its climate.
- **a city that prioritises people**

A Sustainable City

Nur-Sultan 2030

- uses its urban form to reduce energy consumption.
- re-cycles 40% of its waste.
- delivers a 45% reduction in carbon emissions.
- increases net bio-diversity.
- **slows and mitigates the impacts of climate change**

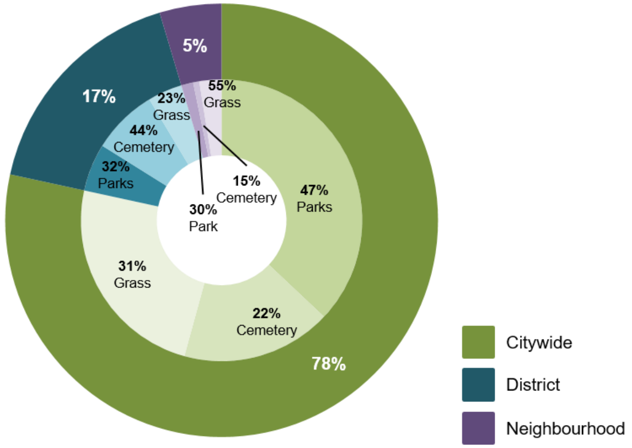
A Healthy City

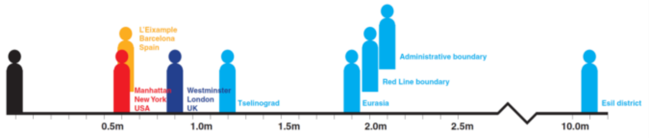
Nur-Sultan 2030

- acting preventatively by enabling its inhabitants to live a healthy lifestyle.
- is walkable, with high public and alternative transport mode shares (50% combined) and clean air.
- provides residents with access to sports and leisure facilities.
- provides inhabitants with access to the health care they need.
- **allows people to be active everyday**

What is Nur-Sultan like in 2020?

A Liveable City?

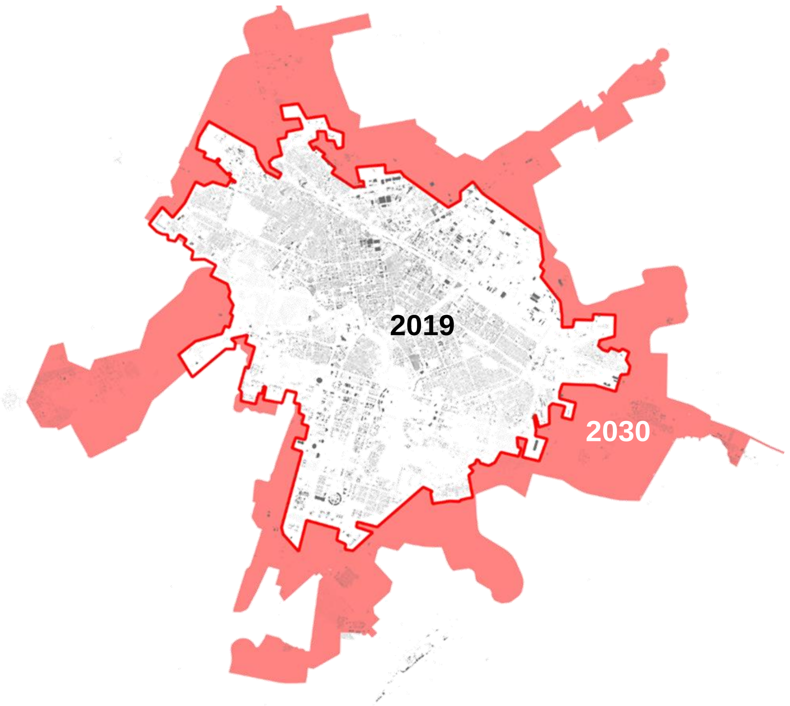




Nur-Sultan 2020

- distributes its population over a wide area and through a large amount of street network.
- provides **27%** of its residents with walkable access to the schools they need.

A Sustainable City?



Nur-Sultan 2020

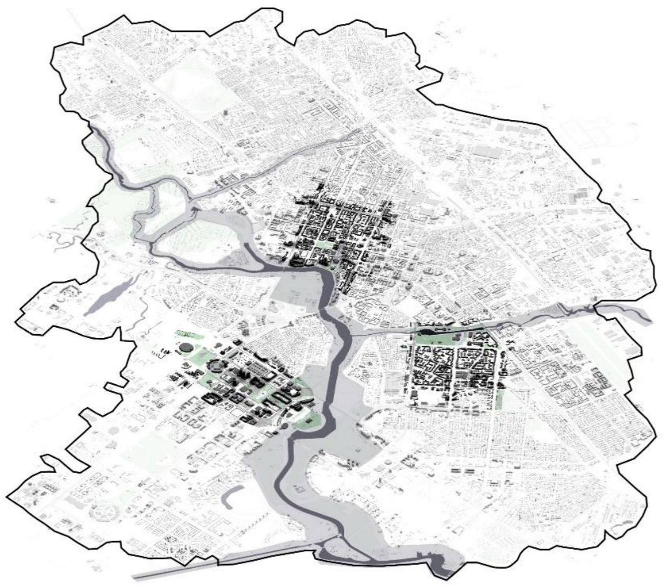
- is large, low density (**68 p/ha**), and energy intensive to operate and move through.
- currently proposes to increase its land area by **90% for a population increase of 60%.**
- needs to increase its renewable energy generation by 50% to meet 2050 targets.

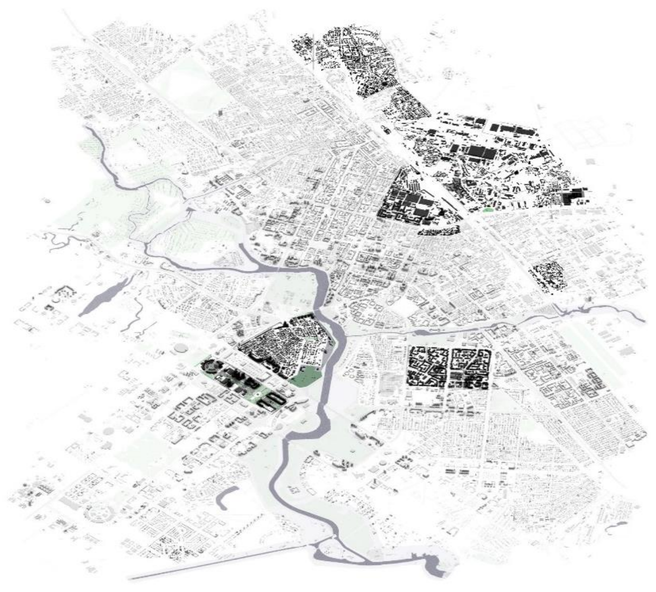
A Healthy City?

Nur-Sultan 2020

- is a city designed for cars, with a lot of road, but also congestion.
- where car ownership provides access to **8 times** as many employment opportunities.
- doesn't provide walkable networks, or streets that mitigate climate.

Coordinate interventions across multiple scales





City-scale strategies set growth boundaries

Opportunity area masterplans intensify the city by accommodating growth

Tactical interventions improve the city

City-scale strategies

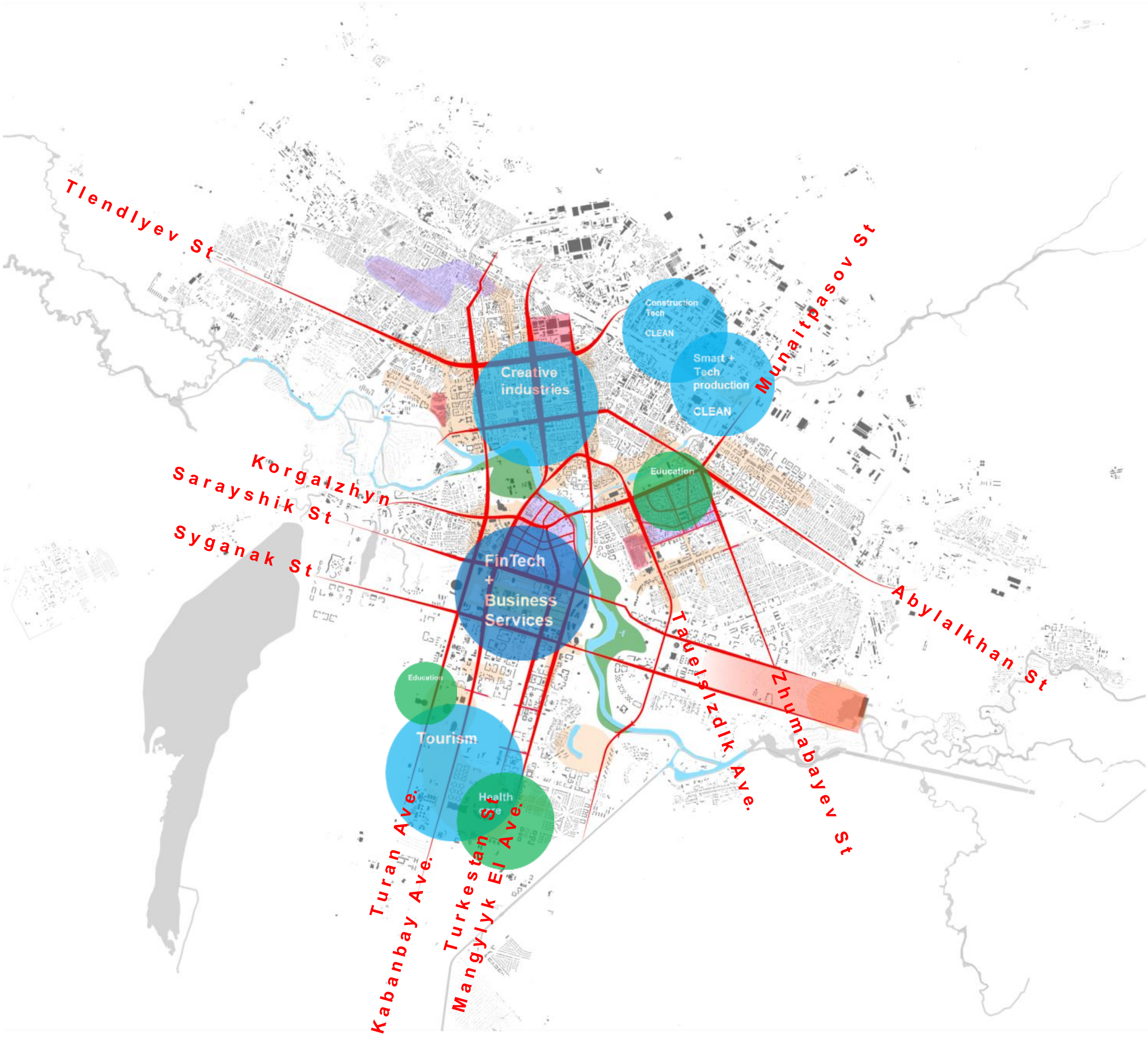
Intensify the city within its existing footprint to prevent sprawl and increase liveability.

Use growth to re-develop, re-generate, and improve existing parts of Nur-Sultan.

Coordinate urban centres with the economic strategy.

Connect the city through active, vibrant urban spines.

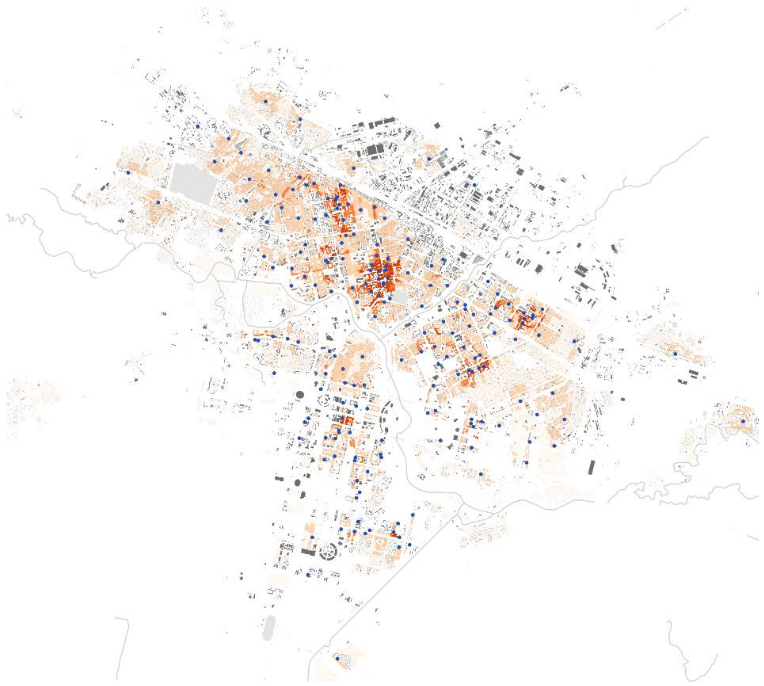
Reinvigorate the river to increase bio-diversity and provide a range of active leisure spaces.



Opportunity area masterplans

How the 2030 masterplan delivers the vision

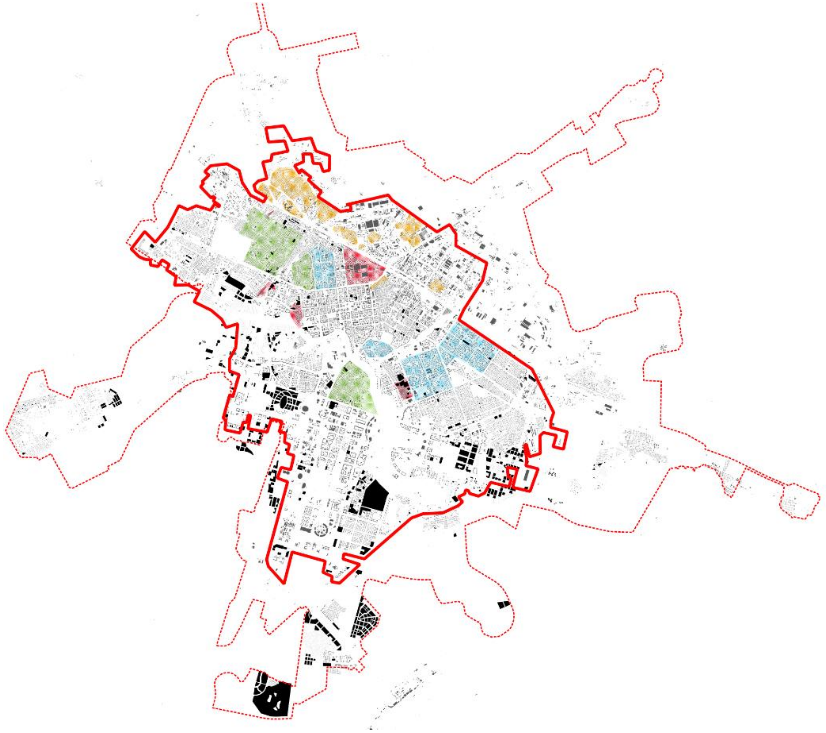
A Liveable City



Nur-Sultan 2030

- Provides active and engaging street-based urbanism
- Mitigates climate through urban form, massing and landscape
- **Improves access to schools by 20%**

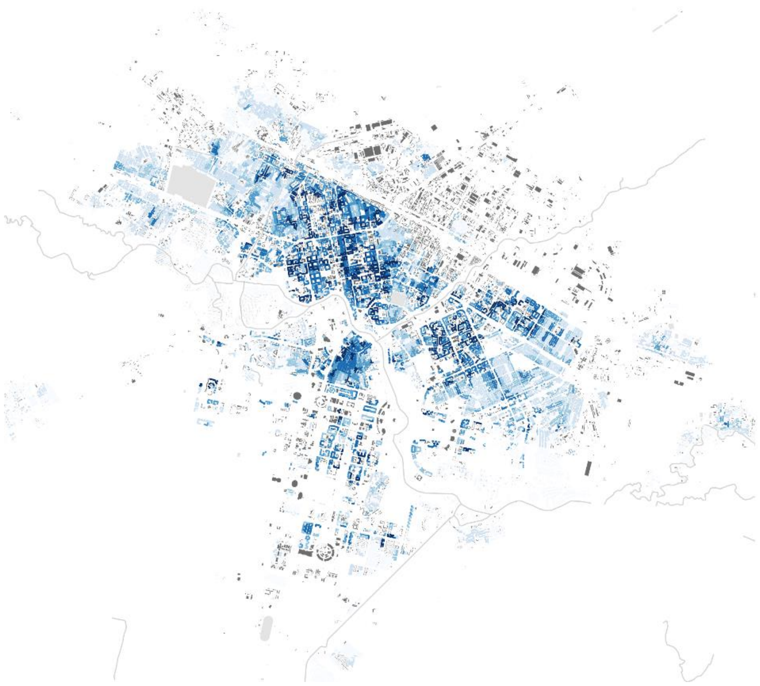
A Sustainable City



Nur-Sultan 2030

- **Sets out a Waste strategy to recycle 40% by 2030**
- **Provides an Energy strategy to deliver a 45% reduction in emissions by 2030**
- Increases net bio-diversity by naturalising parts of the River Esil

A Healthy City

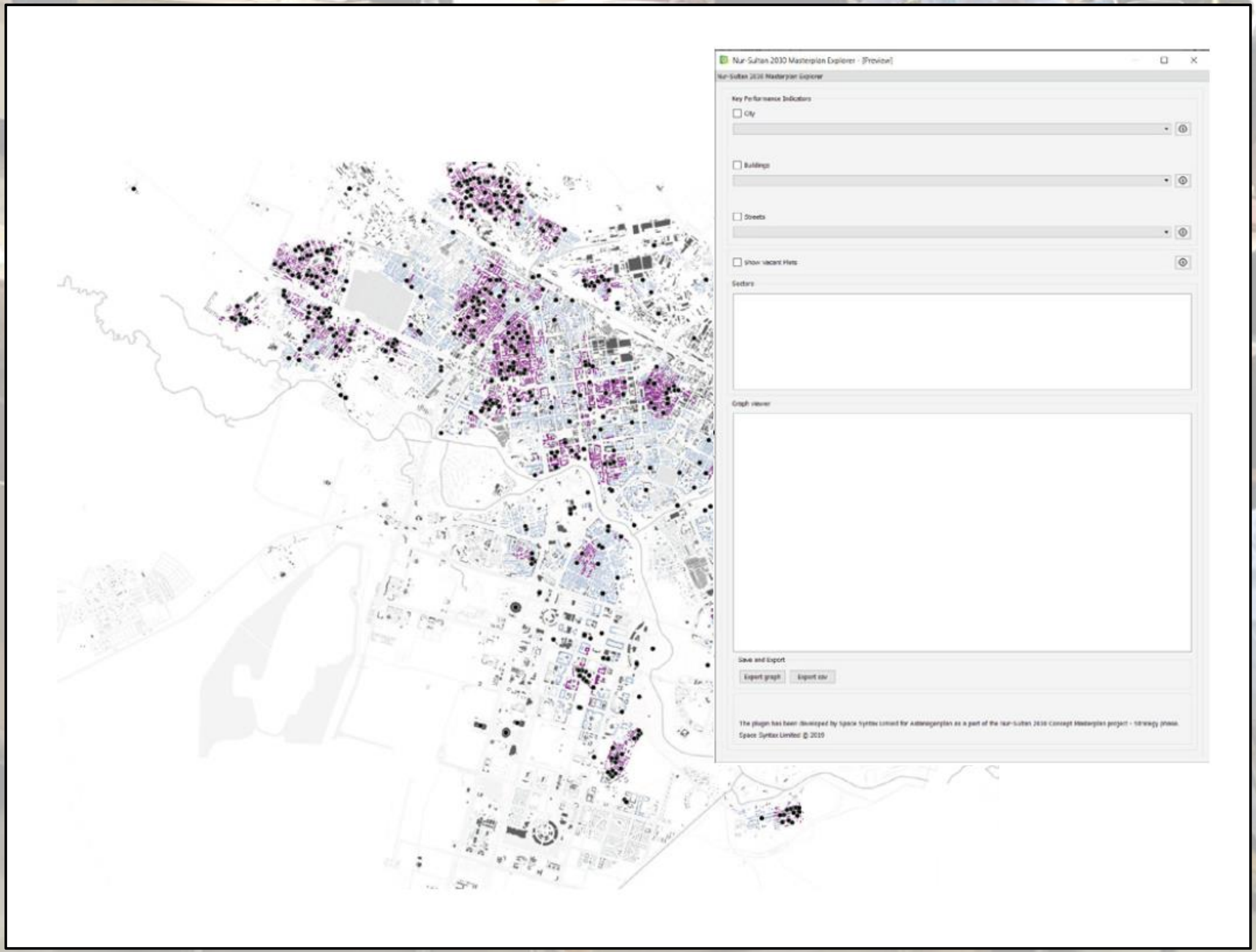


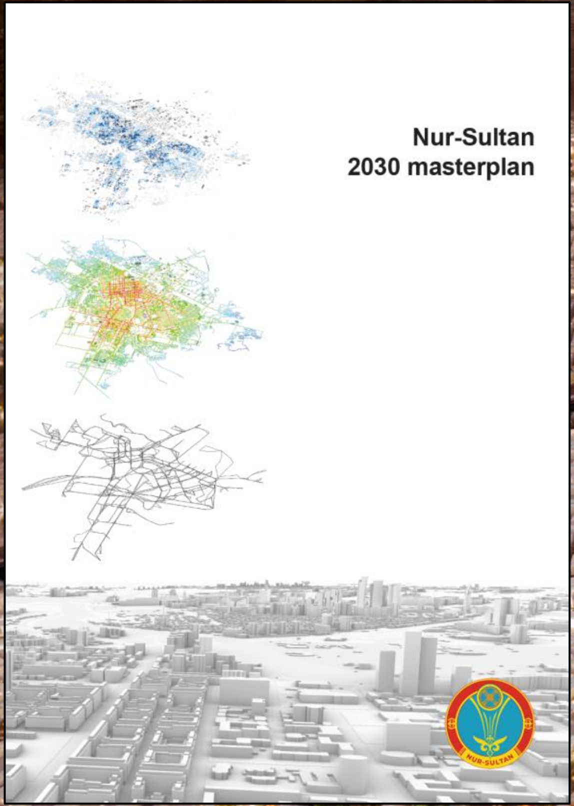
Nur-Sultan 2030

- **Increases average walkability by 10%**
- **Reduces average car dependence by 25%**
- **Improves access to primary healthcare facilities by 20%**

Tactical interventions and training

- Develop standardised improvements to make across the city
- Provide a bespoke GIS profiling tool for the city to match interventions to location
- Deliver capacity building to train the city in use of the profiling tool





Urban Infrastructure
Commended

'This is comprehensive, aspirational and far-thinking'

Nur-Sultan 2030 Masterplan, Kazakhstan
Space Syntax
For City of Nur-Sultan

Using a unique 'digital design' approach, the masterplan improves and intensifies the city before extending it.
New regeneration models will accommodate forecast growth to ensure the capital city is liveable, sustainable and healthy.
These include new bridges, giving highways human focus, and rejuvenating the river to increase biodiversity and manage flooding.
Using integrated urban modelling techniques and consultation provided evidence-based design principles; considering the city as a set of systems, integrating systems around people, and working simultaneously across multiple scales.

ISOCARP
Knowledge for Better Cities

2021
GRAND AWARD FOR EXCELLENCE

WINNER

Space Syntax

for

'Nur-Sultan 2030 Master Plan'

Kate Holmquist
Jury President

Ana Peric
ISOCARP Director for Awards

cityzen Explorer

Ed Parham

Space Syntax

How can decision makers see the city through the eyes of others?

The City

Elderly population

City Manager

What are the key questions for City Professionals?

cityzen powered by Space Syntax

The City

City Professional

Where are the highest risk parts of the city?
What makes them like this?
What could be done to change them?
Where is there a shortfall of facilities?
Where should be prioritised?

City Manager

How does physical health and income affect quality of life in the city?

Analyses the city using 12 elderly personas based on 4 levels of dependency and 3 levels of income:

Dependency

		Robust	Low	Medium	High
	High				
Income	Medium				
	Low				

How does physical health and income affect quality of life in the city?

Analyses the city using 12 elderly personas based on 4 levels of dependency and 3 levels of income:

		Dependency			
		Robust	Low	Medium	High
Income	High				
	Medium				
	Low				

Open data used to create model of City

How does physical health and income affect quality of life in the city?

cityzen
powered by
Space Syntax

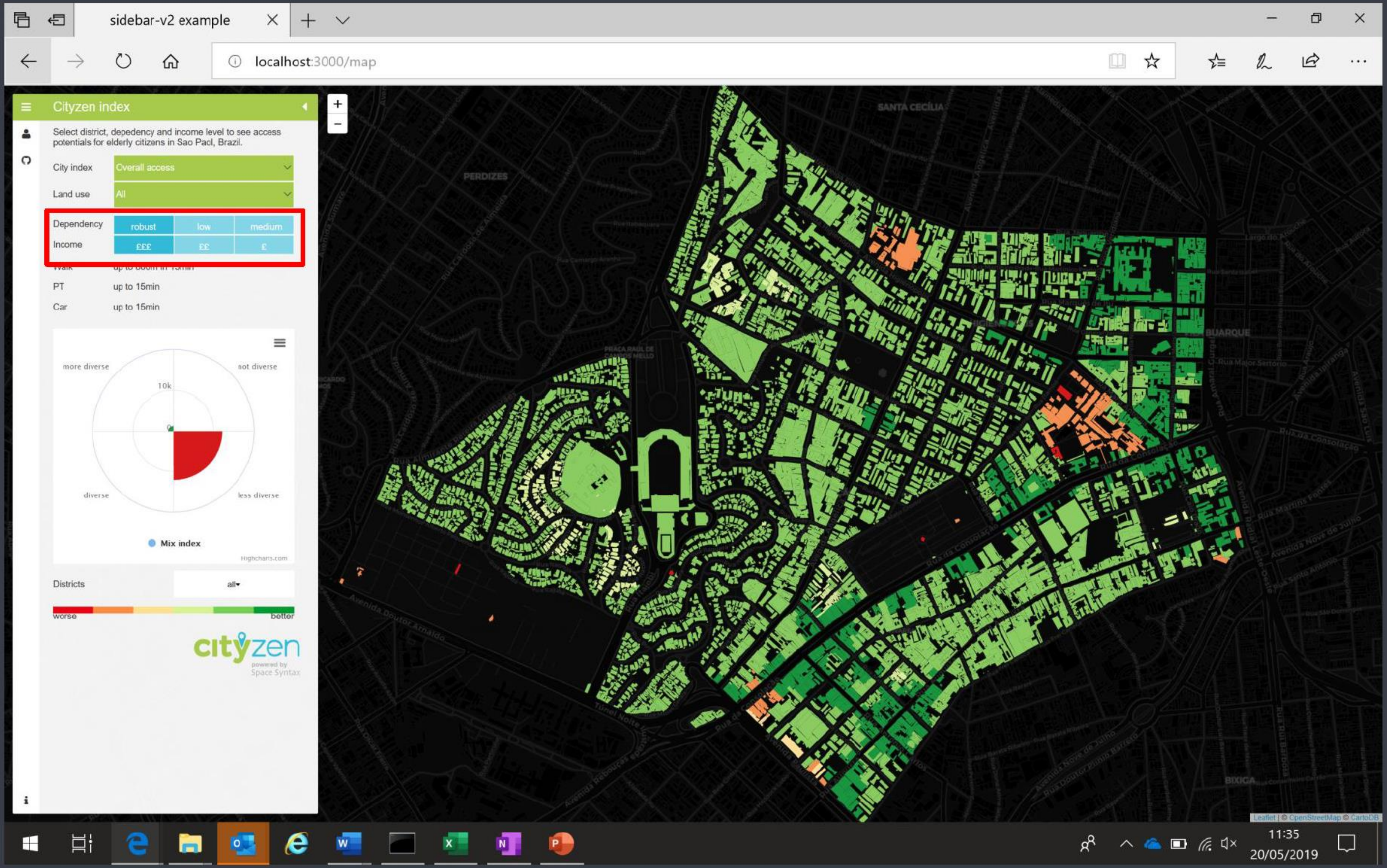
City model analysed to measure how the city supports day-to-day life based on health and income, including:

- Urban Liveability
- Opportunities for Social Interaction
- Opportunities for Physical Activity
- Access to Public Transport
- Access to Health Facilities
- Access to specific Land Uses

		Dependency			
		Robust	Low	Medium	High
	High	Car	Car	Car	Car
Income	Medium	Public	Public	Public	Public
	Low	800m walk	600m walk	400m walk	200m walk

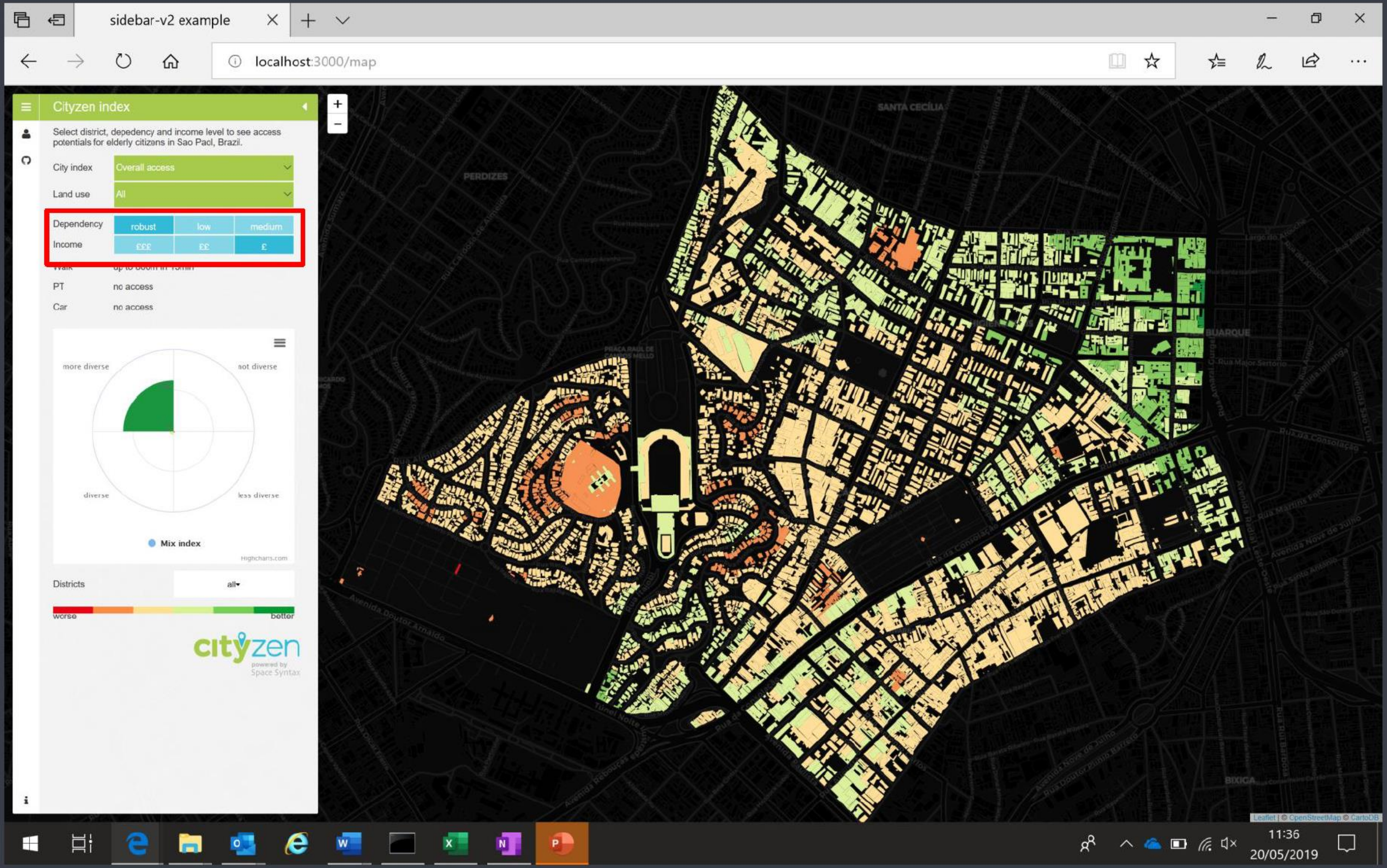
Open data used to create model of City

How does physical health and income affect quality of life in the city?

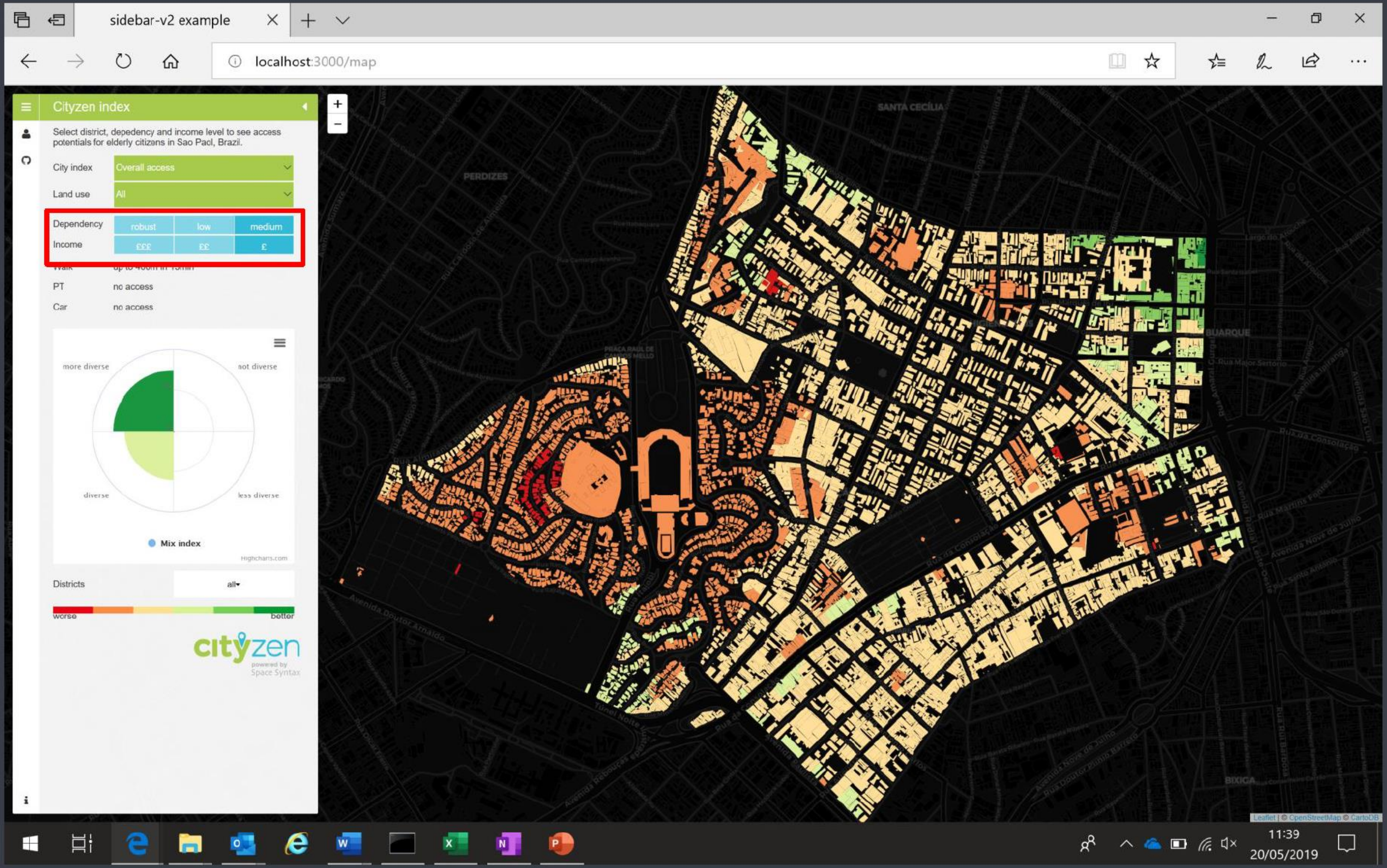


How does physical health and income affect quality of life in the city?

cityzen powered by Space Syntax



Allows users to answer key questions



City Professional

Where are the highest risk areas?

What makes them like this?

What could be done to change them?

Where is there a shortfall of facilities?

Where should be prioritised?

Allows users to answer key questions

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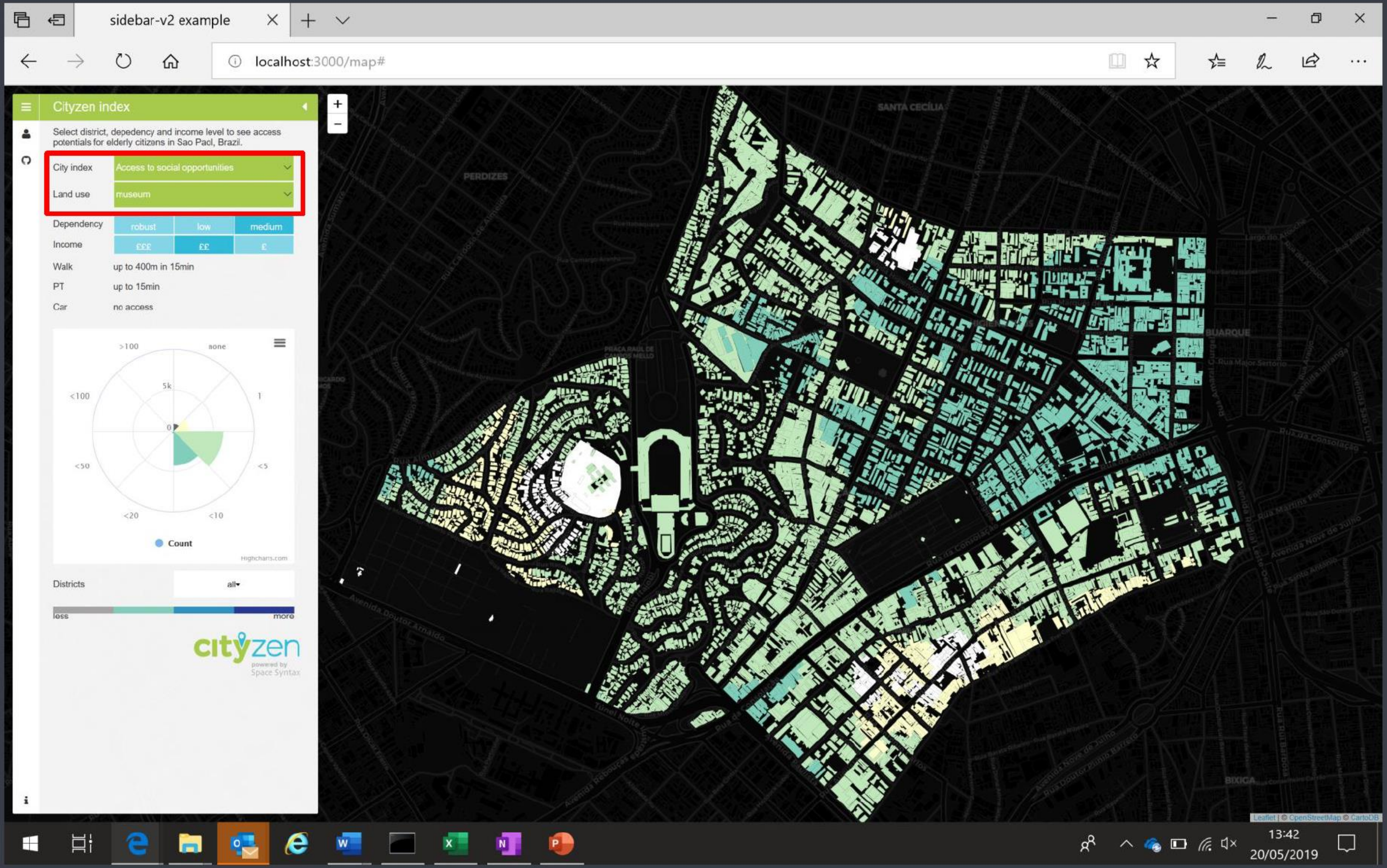

City Professional

Where are the highest risk areas?

What makes them like this?

What could be done to change them?

Where is there a shortfall of facilities?

Where should be prioritised?

"It's easy to feel lonely in this part of the City"

Space Syntax

Allows users to answer key questions

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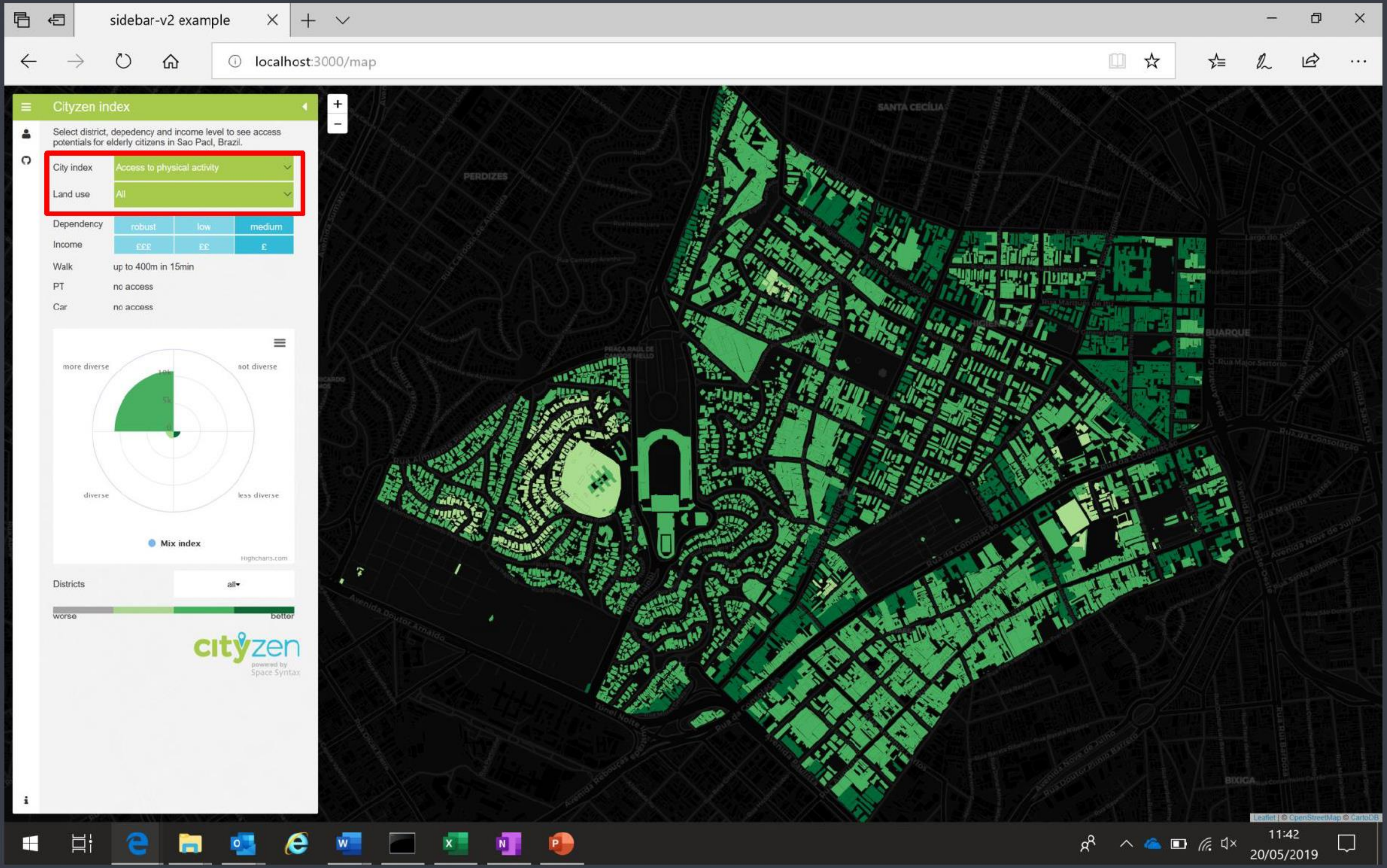

City Professional

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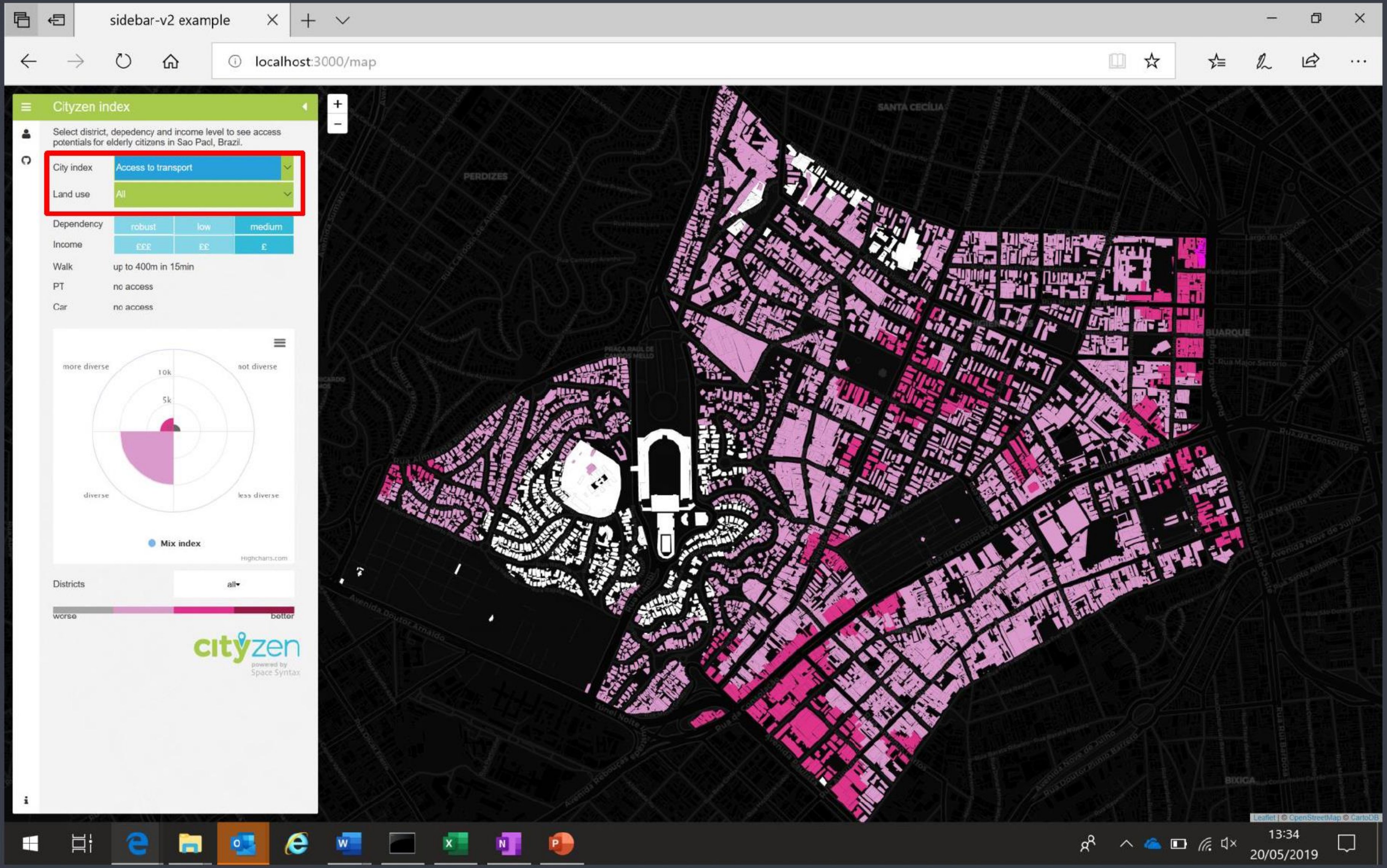
What could be done to change them?

Where is there a shortfall of facilities?

Where should be prioritised?

"It's difficult to walk here"

Allows users to answer key questions



City Professional

Where are the highest risk areas?

What makes them like this?

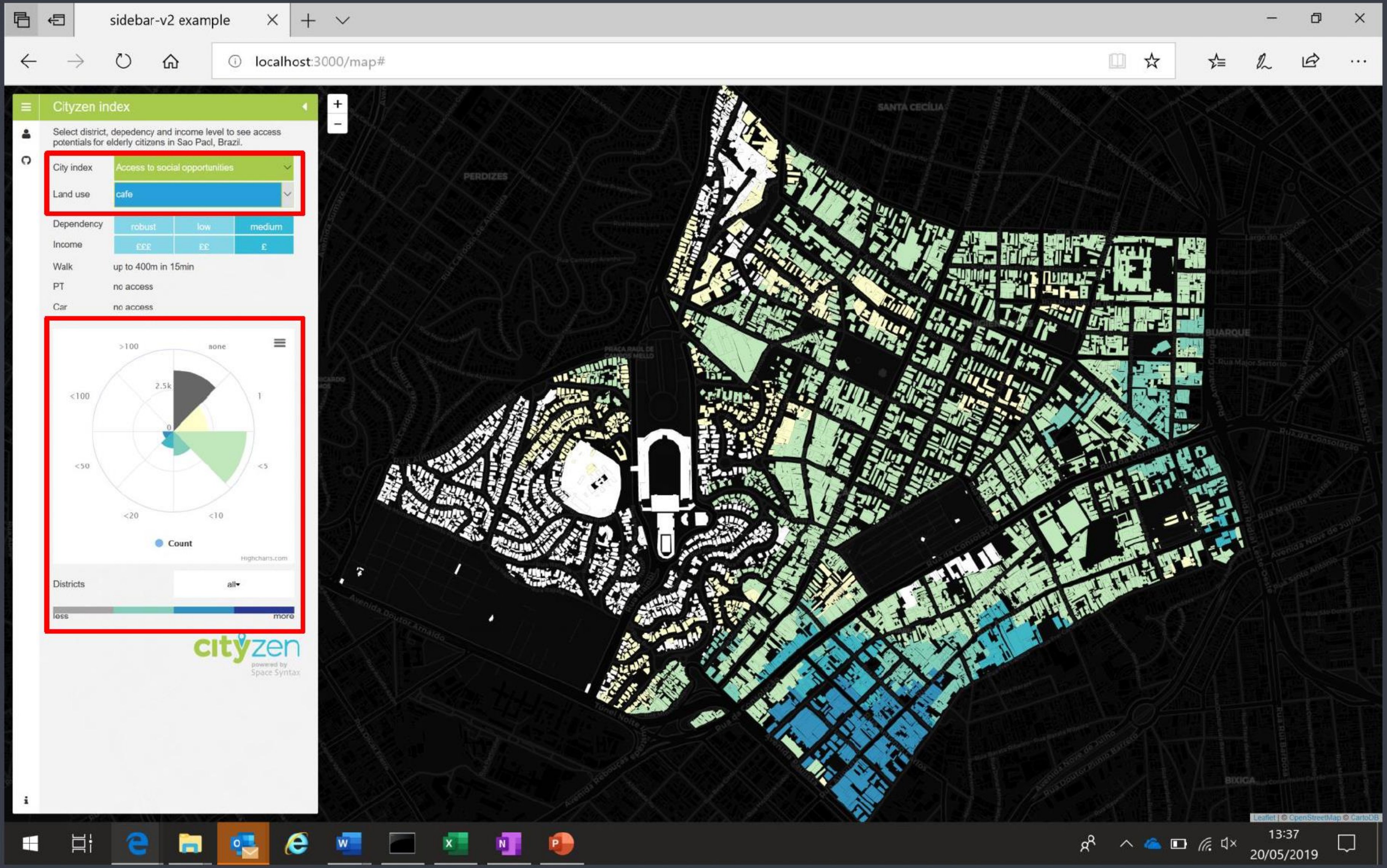
What could be done to change them?

Where is there a shortfall of facilities?

Where should be prioritised?

"I need to use a Taxi to get anywhere"

Allows users to answer key questions



City Professional

Where are the highest risk parts of the city?

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Where should improvements be prioritised

Allows users to answer key questions

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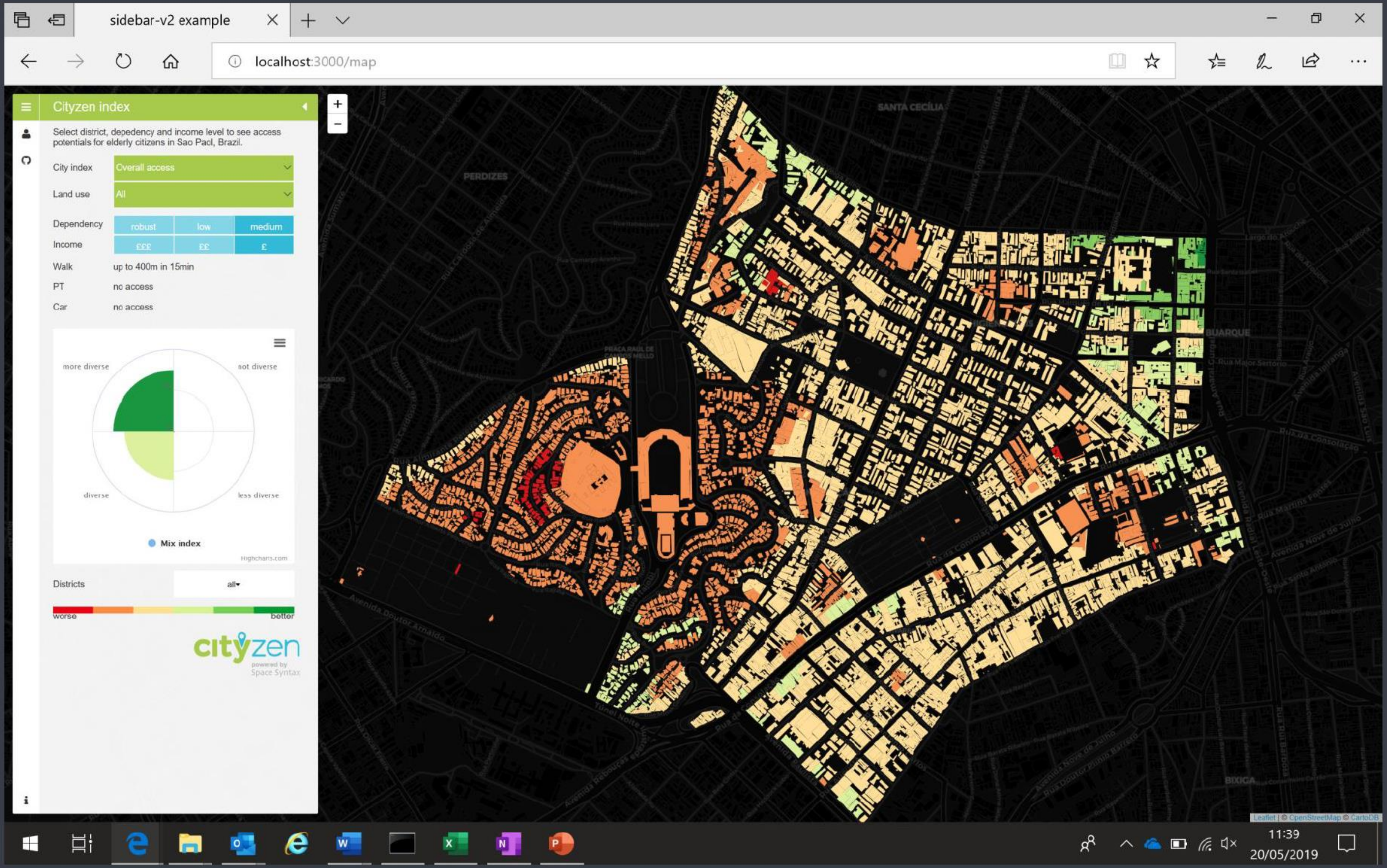

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Space Syntax

Enabling decision makers to see the city through the eyes of others

The City

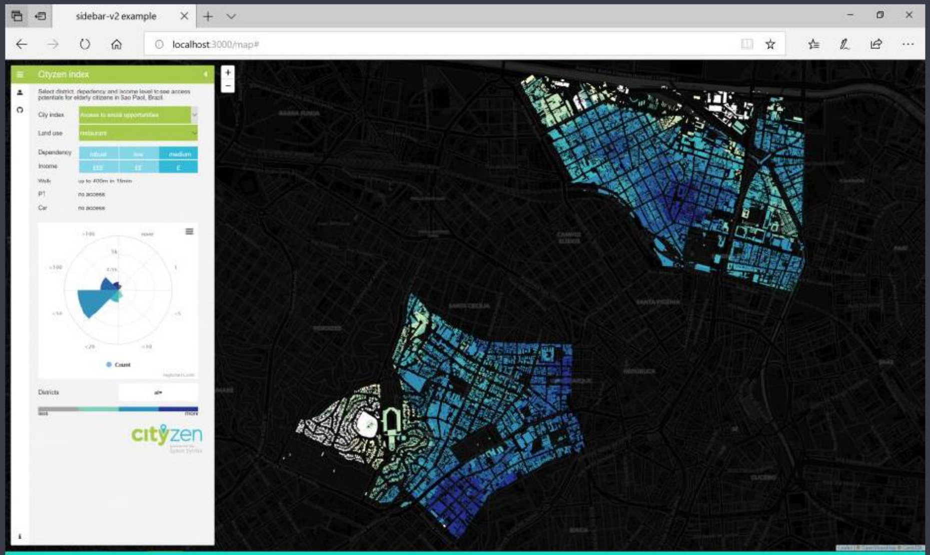
Elderly population

City Manager

Enabling decision makers to see the city through the eyes of others

cityzen powered by Space Syntax


The City



CityZen Explorer

City Manager

- Measures and visualises the impacts of the built environment
- Allows environmental risk to be mapped with demographic risk
- Can be used without training
- Does not need personal data or controlled access
- Can be coordinated with additional (e.g. Census) datasets
- Currently created as a demonstrator for two districts of Sao Paulo

References/Links

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https://www.salus.global/article-show/www-healthycitydesign-global-29-abstracts-connecting-wellness-urban-form-care-models-and-health-outcomes-cranbrook-healthy-new-town-case-study

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https://www.youtube.com/watch?v=Ea_osVYSVOU

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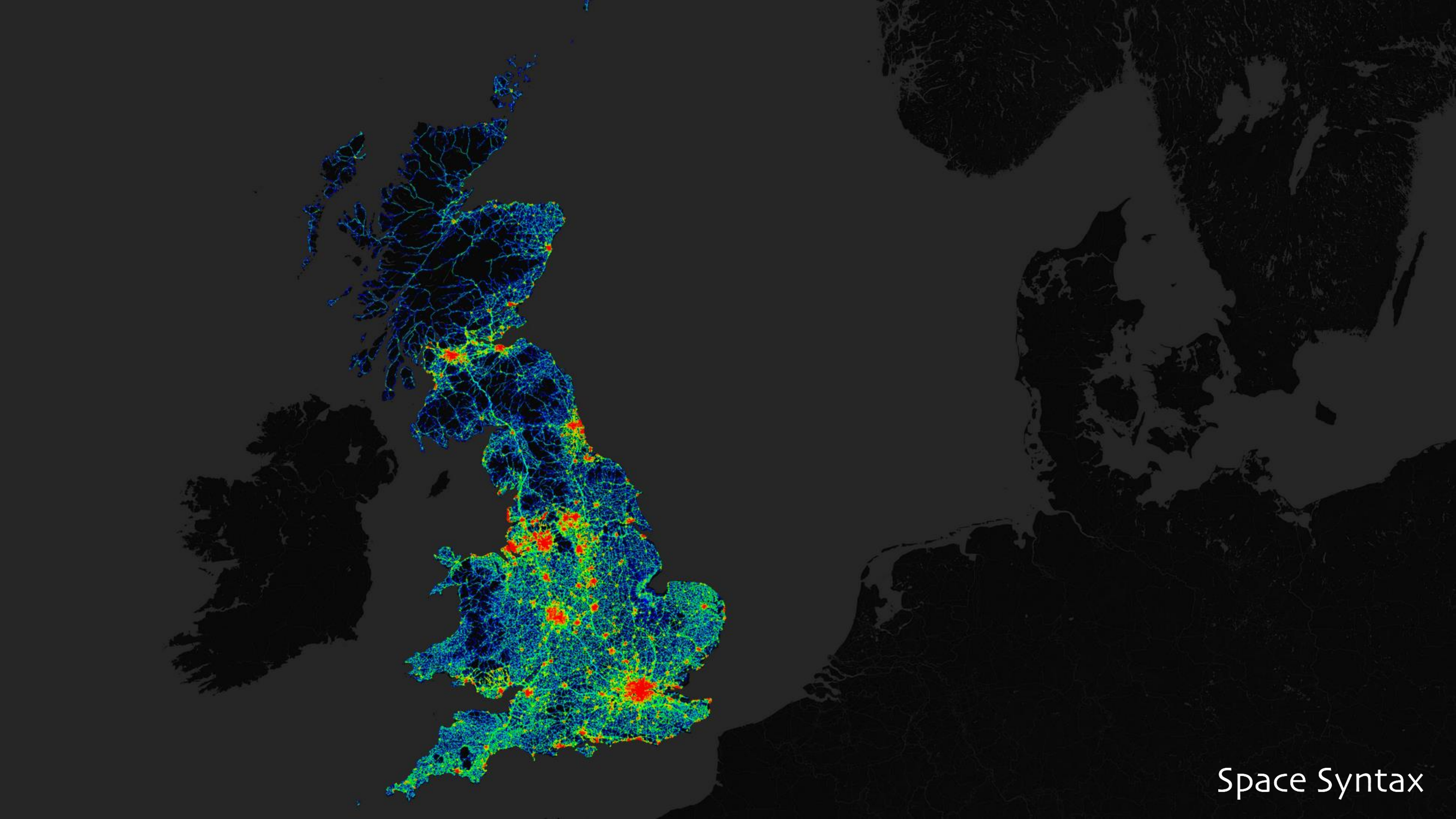

Space Syntax