



Advances in Geographic Data Science and Urban Analytics

Alex Singleton

*Professor of Geographic Information Science
Department of Geography and Planning*



Northern
Regional
Data Facility



UNIVERSITY OF
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Consumer
Data
Research
Centre



www.cdrc.ac.uk
www.geographicdatascience.com
www.alex-singleton.com
[@alexsingleton](https://twitter.com/alexsingleton)

LIFE CHANGING
World Shaping



Geographic
Data Science
Lab



geographicdatascience.com



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Traditional Social Sciences

"[Sample survey's] glory years, we contend, are in the past"

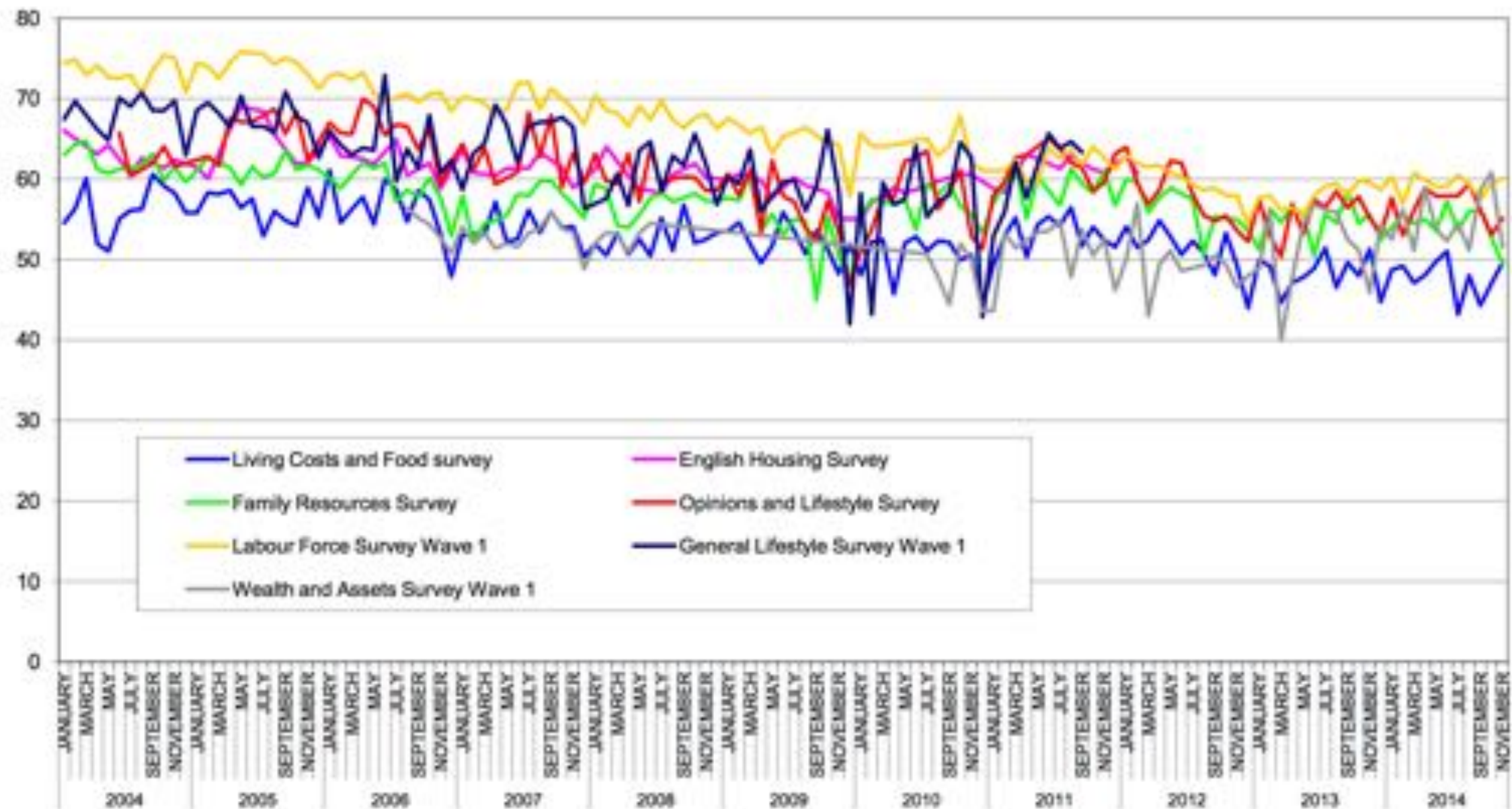
Savage and Burrows, 2007: 890

"Refusals to participate are also increasing"

de Heer, 2004:5



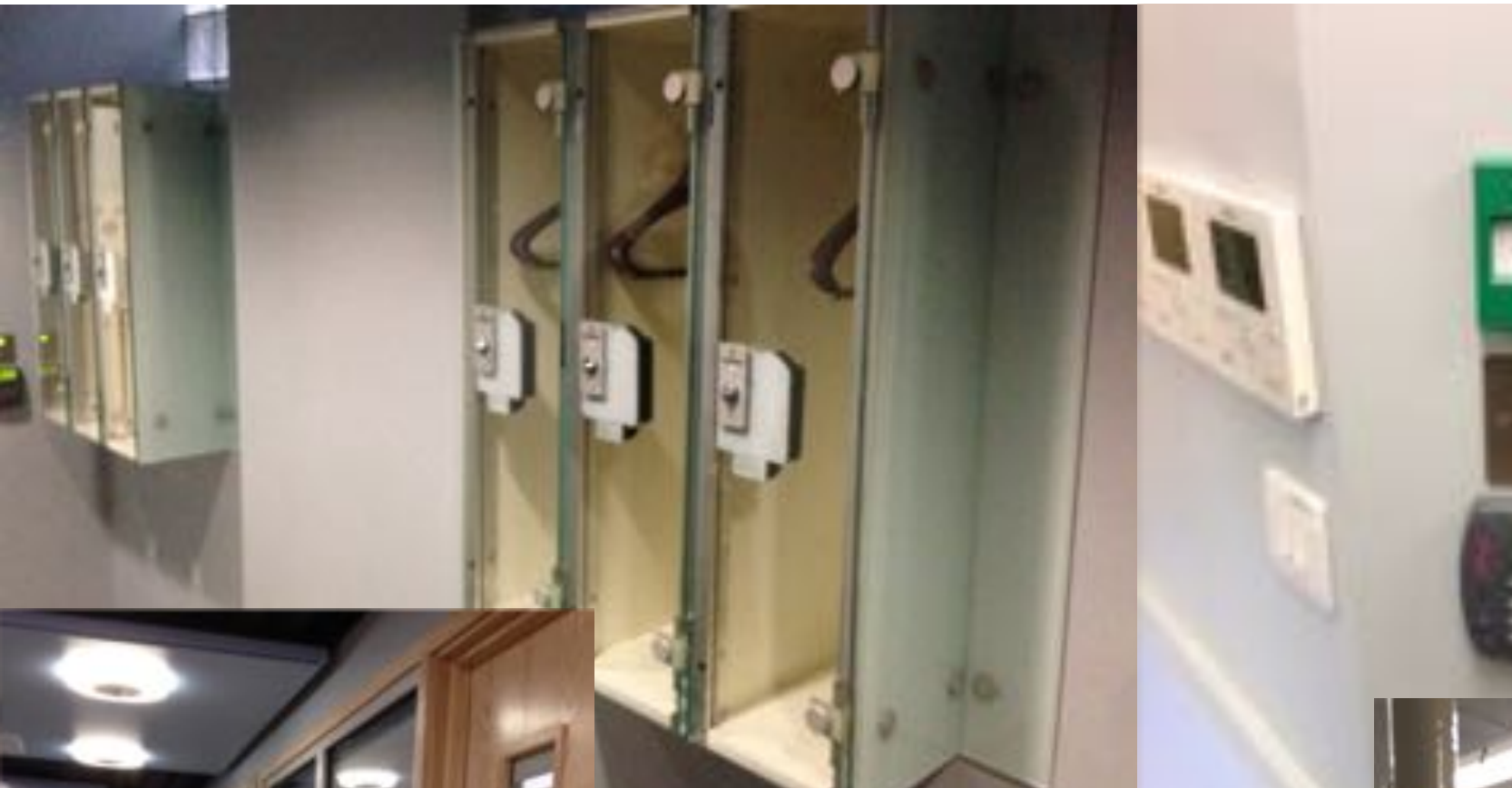
Response Rates 04-14



Great Opportunities

- Transactional data
- Consumers in the private and public sectors
- VGI - social media
- Sensor technology
- Mobile / dynamic / linked humans
- IOT - urban contexts

New Forms of Access



maps.cdrc.ac.uk
data.cdrc.ac.uk
cdrc.ac.uk



Challenging Social Sciences

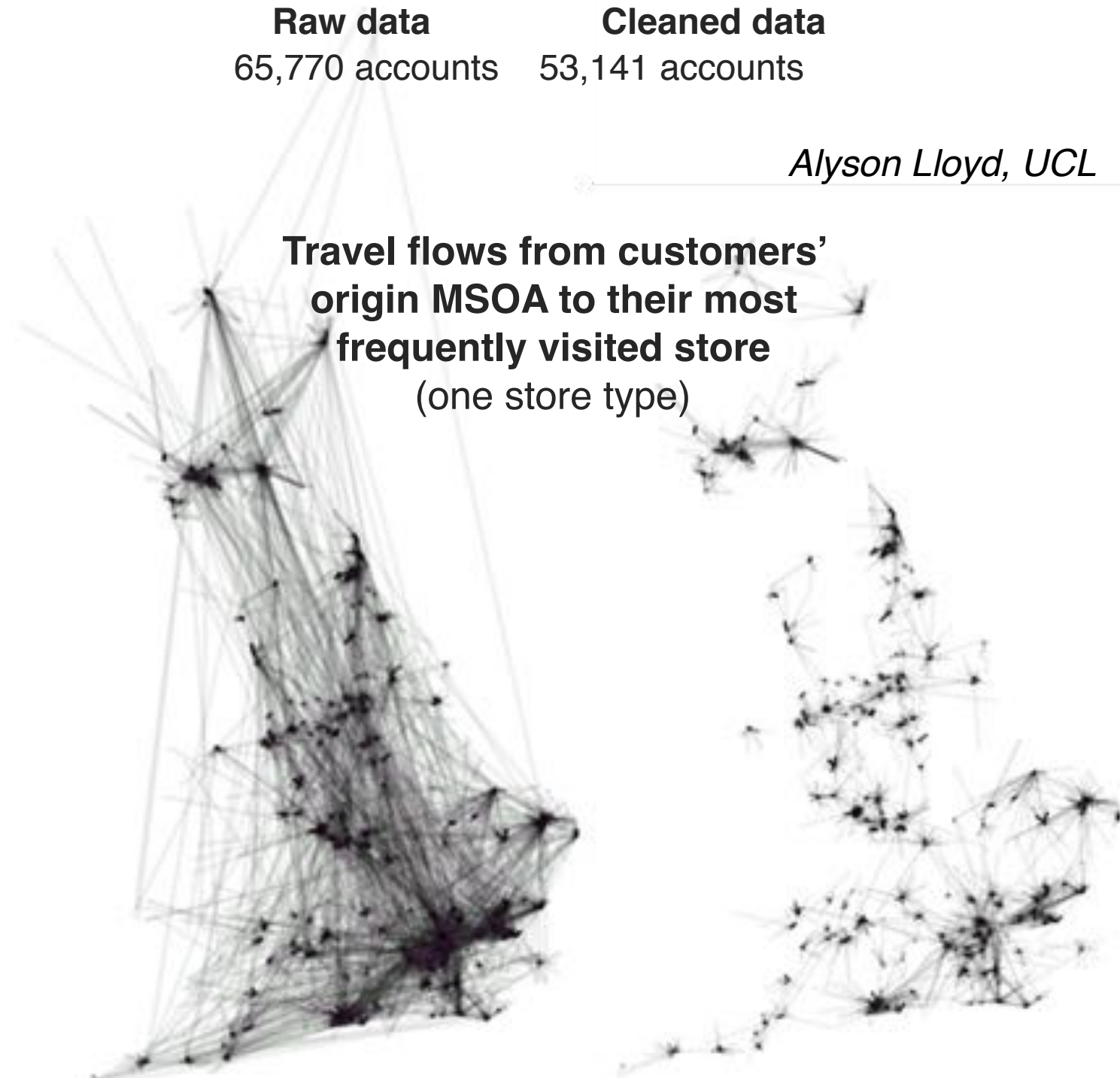
- Data cleaning
- “Big” Data
- Infrastructure
- Access
- Techniques...

Raw data
65,770 accounts

Cleaned data
53,141 accounts

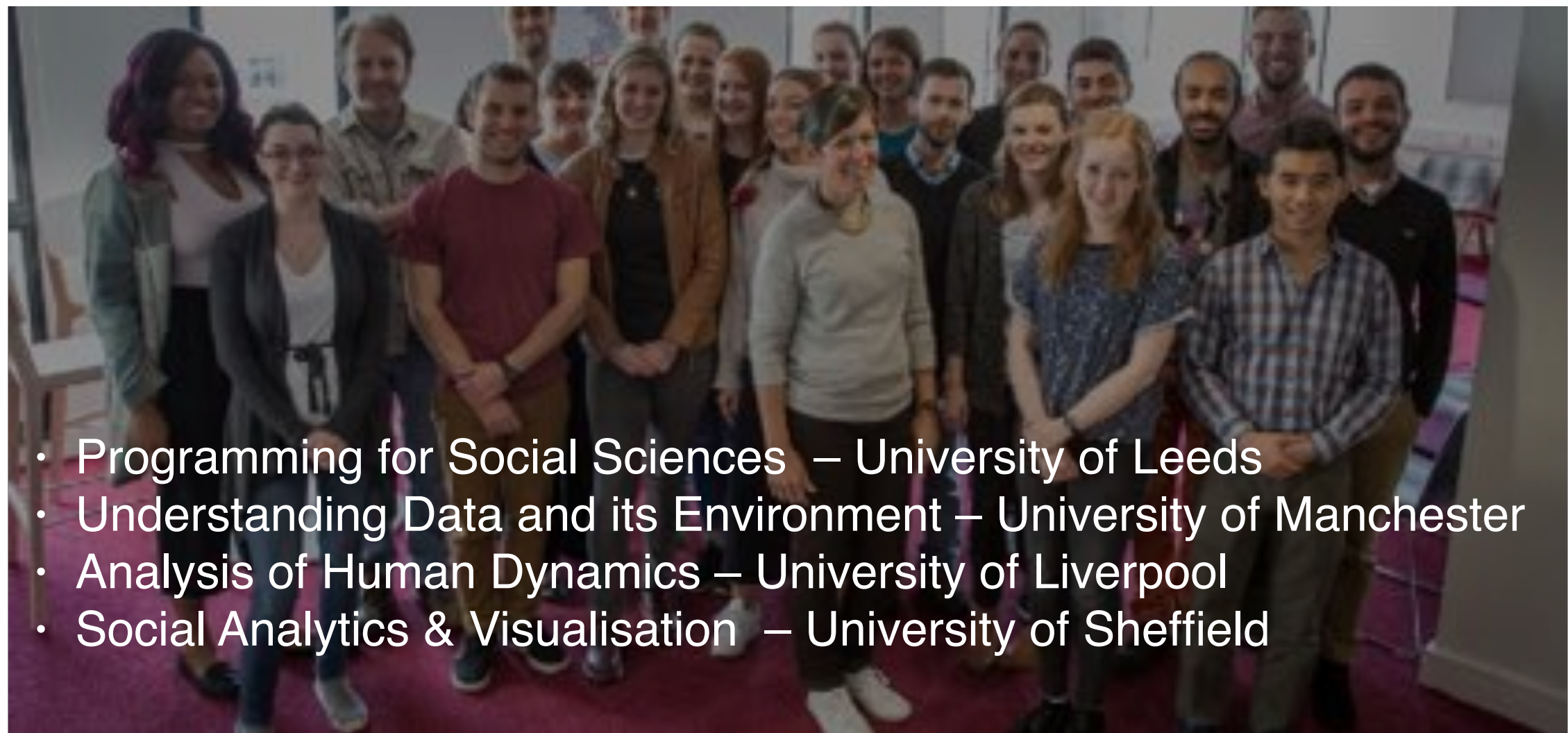
Alyson Lloyd, UCL

**Travel flows from customers’
origin MSOA to their most
frequently visited store
(one store type)**



Challenging Social Sciences

- Skills acquisition



- Programming for Social Sciences – University of Leeds
- Understanding Data and its Environment – University of Manchester
- Analysis of Human Dynamics – University of Liverpool
- Social Analytics & Visualisation – University of Sheffield



Urban Analytics Examples...

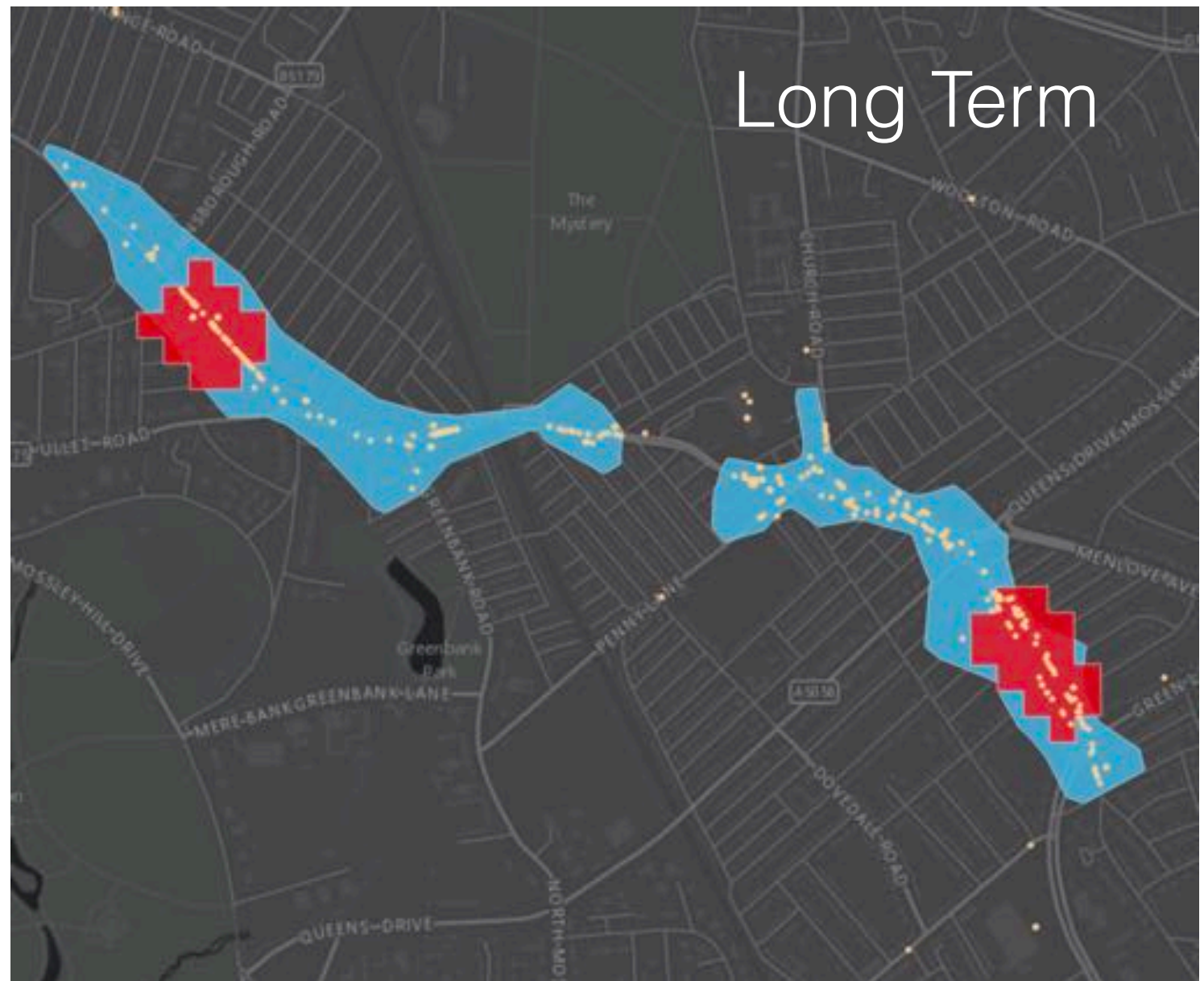
- Retail **Dynamics**
- Urban **Contexts**
 - Geodemographics
- Applications and Data Fusion
 - e-Resilience - regional retail systems
 - Dynamics
 - Sensors



Retail Dynamics



- 2004 Boundaries (ODPM / DCLG)
 - Defined "Town Centres"
 - Outdated
 - Not retail specific



Retail Dynamics

Short Term



Grimsby: Centre (red), Convenience (blue), Comparison (Green)



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Urban Contexts





Supermarket



Local Shop

Sports Injury



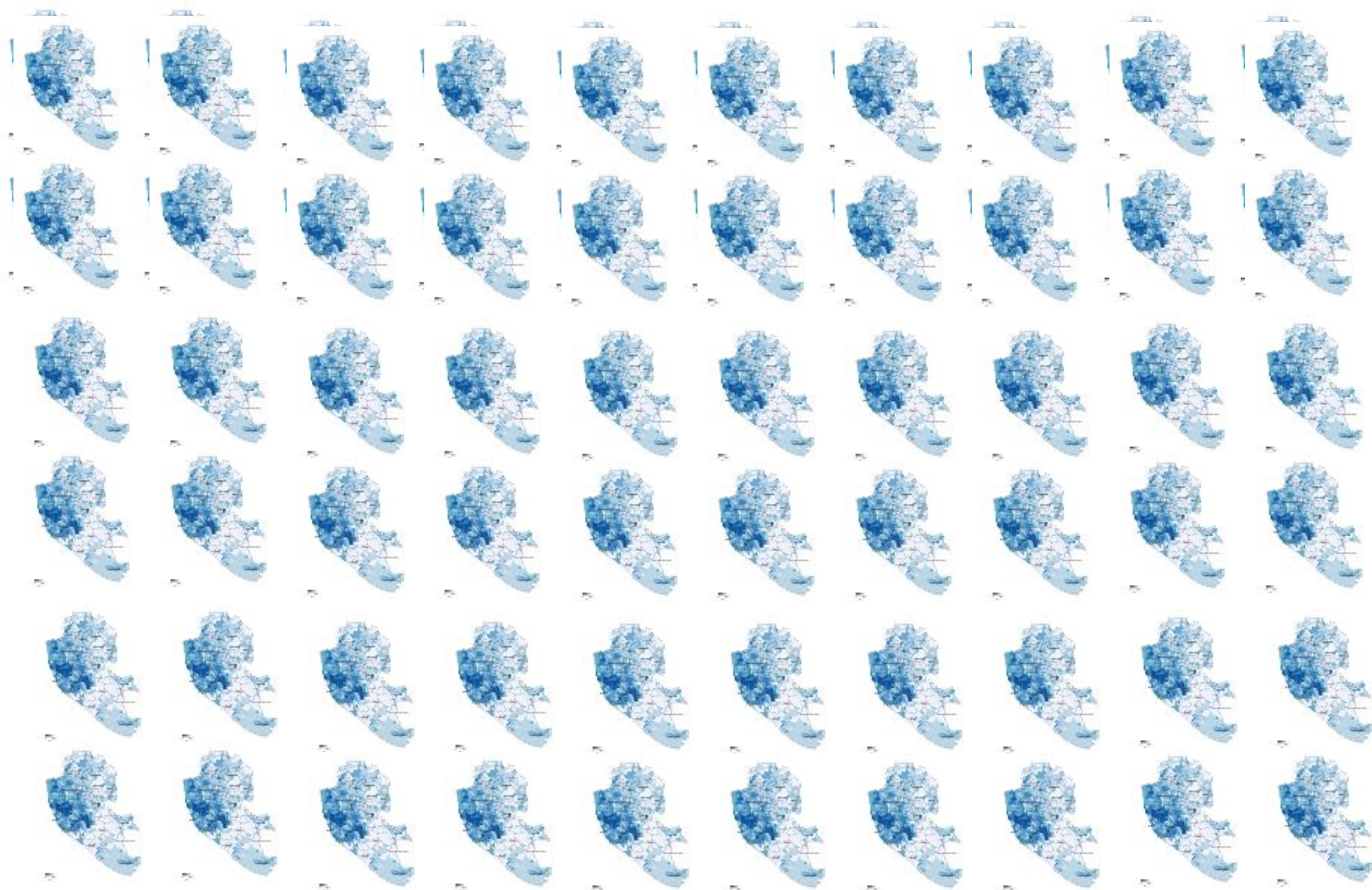
Heart Problems



Urban Contexts

The image shows a purple and white form titled "Urban Contexts" with various sections for data entry. The form is divided into several columns and rows, each with a heading and a list of questions or prompts. The sections include:

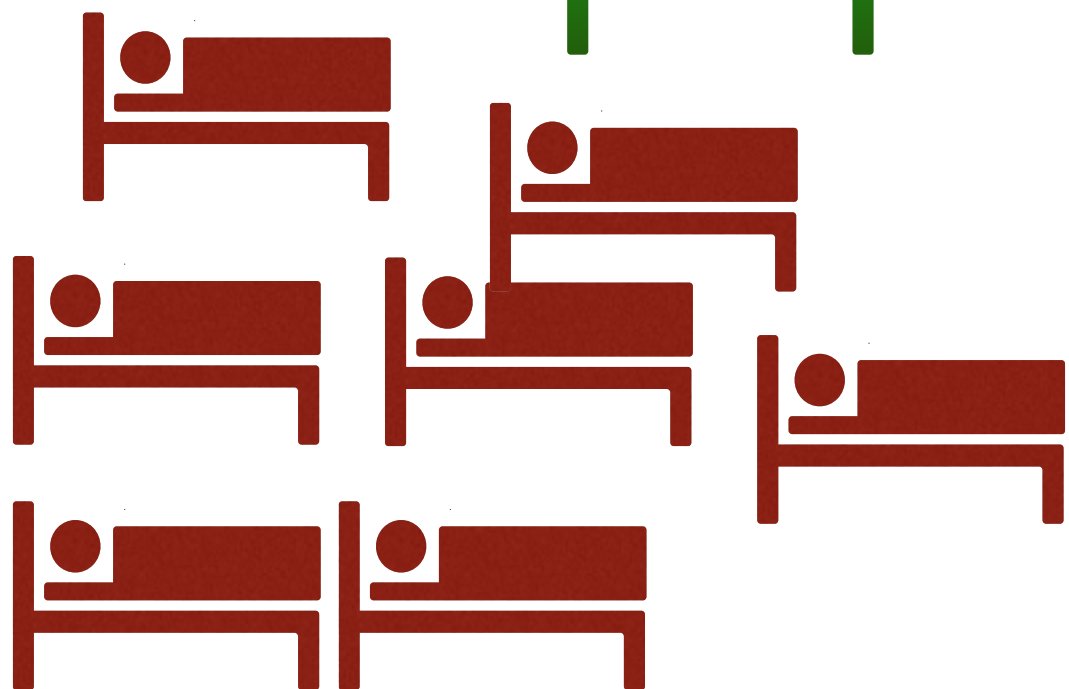
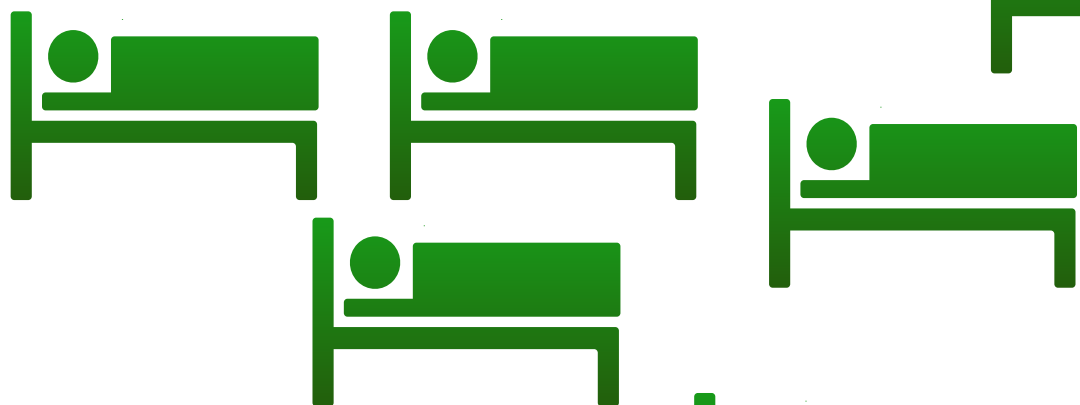
- Section 1: What is your name?** (Name, Address, City, State, Zip)
- Section 2: What is your phone number?** (Home, Cell, Office)
- Section 3: What is your email address?** (Email)
- Section 4: What is your date of birth?** (Date)
- Section 5: What is your gender?** (Male, Female, Other)
- Section 6: What is your race/ethnicity?** (White, Black, Asian, Hispanic, Other)
- Section 7: What is your education level?** (High School, College, Graduate)
- Section 8: What is your occupation?** (Student, Teacher, Doctor, Other)
- Section 9: What is your income level?** (Less than \$10,000, \$10,000-\$20,000, \$20,000-\$30,000, \$30,000-\$40,000, \$40,000-\$50,000, \$50,000-\$60,000, \$60,000-\$70,000, \$70,000-\$80,000, \$80,000-\$90,000, \$90,000-\$100,000, More than \$100,000)
- Section 10: What is your housing situation?** (Own, Rent, Other)
- Section 11: What is your housing type?** (Single, Double, Other)
- Section 12: What is your housing size?** (1-2, 3-4, 5-6, 7-8, 9-10, 11-12, 13-14, 15-16, 17-18, 19-20, 21-22, 23-24, 25-26, 27-28, 29-30, 31-32, 33-34, 35-36, 37-38, 39-40, 41-42, 43-44, 45-46, 47-48, 49-50, 51-52, 53-54, 55-56, 57-58, 59-60, 61-62, 63-64, 65-66, 67-68, 69-70, 71-72, 73-74, 75-76, 77-78, 79-80, 81-82, 83-84, 85-86, 87-88, 89-90, 91-92, 93-94, 95-96, 97-98, 99-100, More than 100)
- Section 13: What is your housing age?** (Less than 1 year, 1-2, 3-4, 5-6, 7-8, 9-10, 11-12, 13-14, 15-16, 17-18, 19-20, 21-22, 23-24, 25-26, 27-28, 29-30, 31-32, 33-34, 35-36, 37-38, 39-40, 41-42, 43-44, 45-46, 47-48, 49-50, 51-52, 53-54, 55-56, 57-58, 59-60, 61-62, 63-64, 65-66, 67-68, 69-70, 71-72, 73-74, 75-76, 77-78, 79-80, 81-82, 83-84, 85-86, 87-88, 89-90, 91-92, 93-94, 95-96, 97-98, 99-100, More than 100)
- Section 14: What is your housing condition?** (Good, Fair, Poor, Very Poor)
- Section 15: What is your housing location?** (Urban, Suburban, Rural)
- Section 16: What is your housing density?** (Low, Medium, High)
- Section 17: What is your housing accessibility?** (Easy, Difficult, Very Difficult)
- Section 18: What is your housing safety?** (Safe, Unsafe, Very Unsafe)
- Section 19: What is your housing security?** (Secure, Insecure, Very Insecure)
- Section 20: What is your housing quality?** (Good, Fair, Poor, Very Poor)
- Section 21: What is your housing value?** (Low, Medium, High)
- Section 22: What is your housing investment?** (Low, Medium, High)
- Section 23: What is your housing return?** (Low, Medium, High)
- Section 24: What is your housing risk?** (Low, Medium, High)
- Section 25: What is your housing opportunity?** (Low, Medium, High)
- Section 26: What is your housing challenge?** (Low, Medium, High)
- Section 27: What is your housing solution?** (Low, Medium, High)
- Section 28: What is your housing impact?** (Low, Medium, High)
- Section 29: What is your housing benefit?** (Low, Medium, High)
- Section 30: What is your housing cost?** (Low, Medium, High)
- Section 31: What is your housing time?** (Low, Medium, High)
- Section 32: What is your housing effort?** (Low, Medium, High)
- Section 33: What is your housing result?** (Low, Medium, High)
- Section 34: What is your housing outcome?** (Low, Medium, High)
- Section 35: What is your housing achievement?** (Low, Medium, High)
- Section 36: What is your housing success?** (Low, Medium, High)
- Section 37: What is your housing goal?** (Low, Medium, High)
- Section 38: What is your housing vision?** (Low, Medium, High)
- Section 39: What is your housing mission?** (Low, Medium, High)
- Section 40: What is your housing purpose?** (Low, Medium, High)
- Section 41: What is your housing strategy?** (Low, Medium, High)
- Section 42: What is your housing plan?** (Low, Medium, High)
- Section 43: What is your housing action?** (Low, Medium, High)
- Section 44: What is your housing step?** (Low, Medium, High)
- Section 45: What is your housing move?** (Low, Medium, High)
- Section 46: What is your housing change?** (Low, Medium, High)
- Section 47: What is your housing update?** (Low, Medium, High)
- Section 48: What is your housing improvement?** (Low, Medium, High)
- Section 49: What is your housing enhancement?** (Low, Medium, High)
- Section 50: What is your housing optimization?** (Low, Medium, High)
- Section 51: What is your housing maximization?** (Low, Medium, High)
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- Section 54: What is your housing productivity?** (Low, Medium, High)
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- Section 56: What is your housing quality of life?** (Low, Medium, High)
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- Section 60: What is your housing health?** (Low, Medium, High)
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- Section 100: What is your housing change?** (Low, Medium, High)







A



B

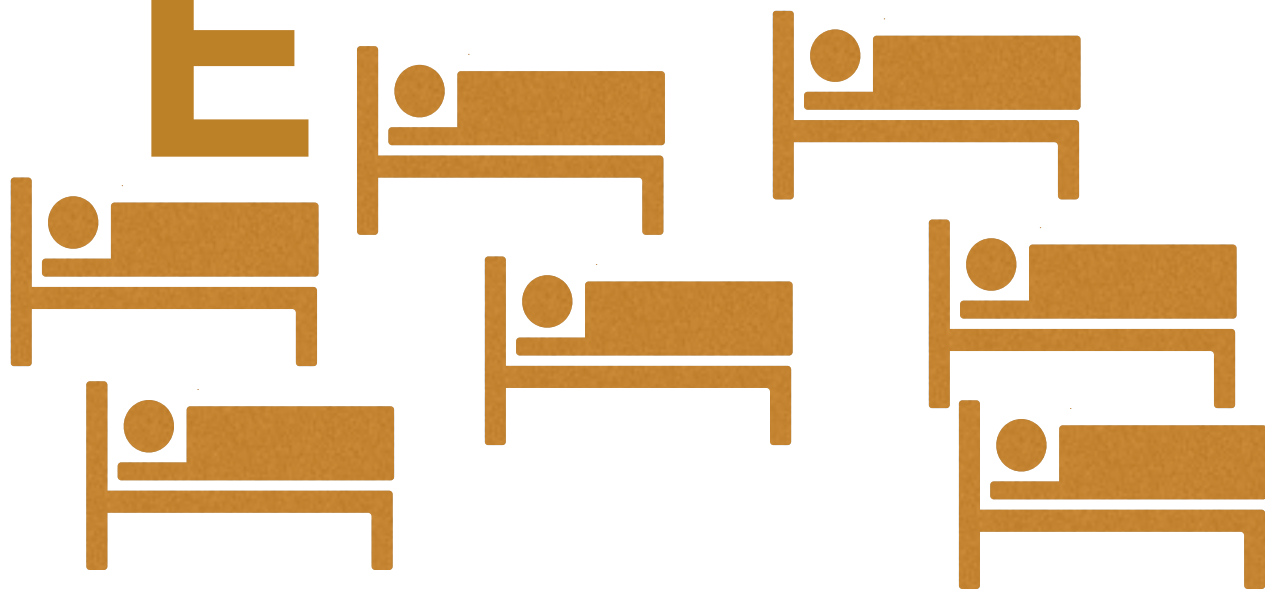
C



D



E





Manchester



Liverpool

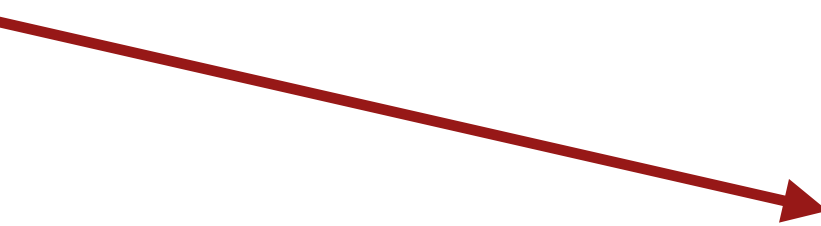
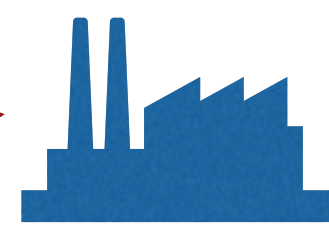
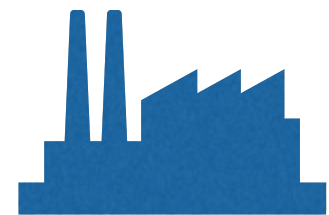


Gale, C, A. Singleton and P. Longley (2016). "Creating the 2011 area classification for output areas (2011 OAC)". In: *Journal of Spatial Information Science*, pp. 1-27. URL: <http://dx.doi.org/10.5311/JOSIS.2016.12.232>.

Night



Day



London Classification of Workplace Zones

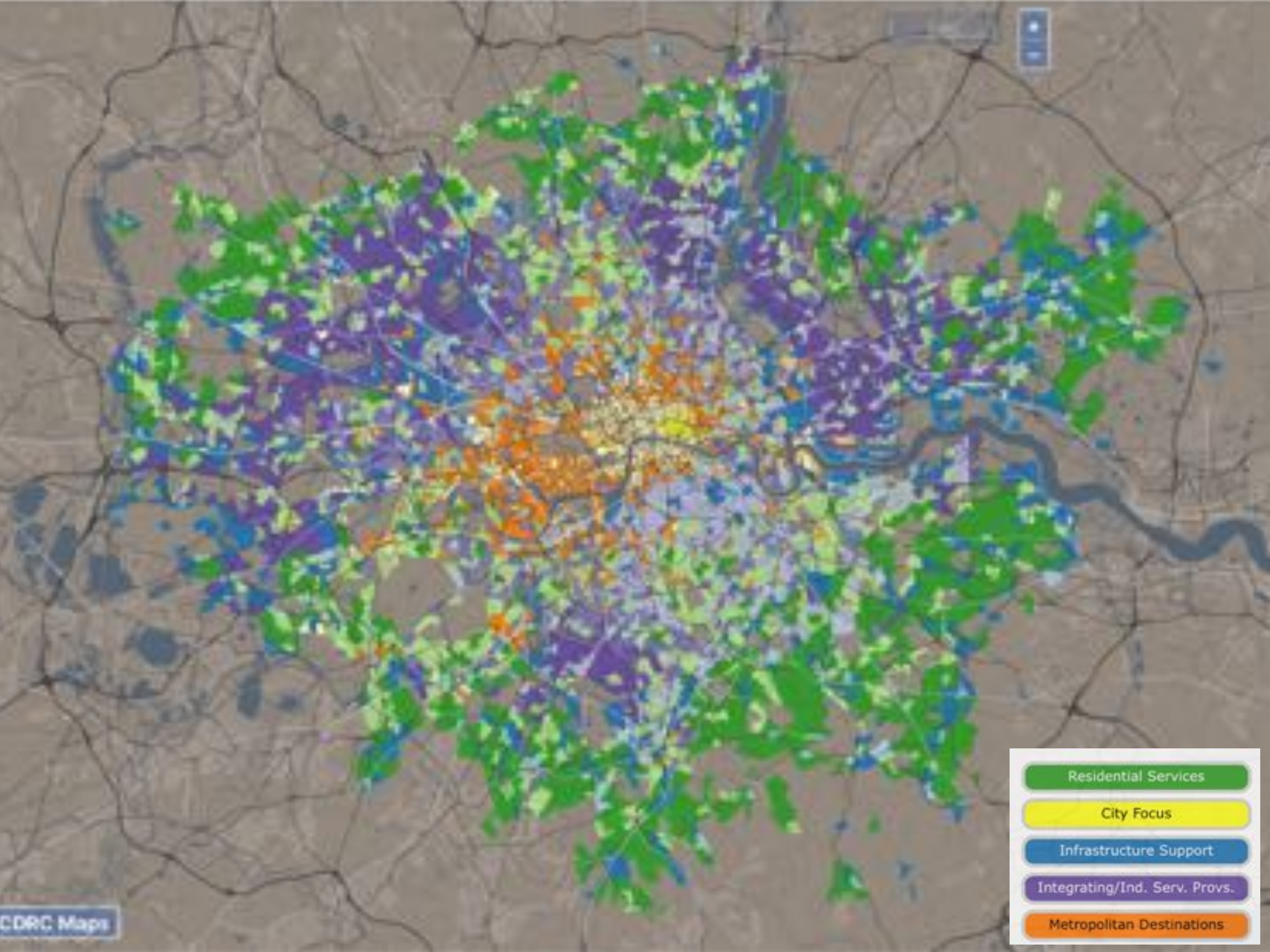
Domain	Sub Domain
Employment Type	Employment
	Occupation Types
	Retail Density
Dynamism / Attractiveness	Change
	Night-time Economy
Employee Characteristics	Demographic
	Diversity
	Socio-economic
Job Characteristics	Qualifications
	Working day
	NS-SEC
Commuting / Connections	Distance / Accessibility
	Mode
Residential Context	Demography
	Socio-economic
	Family structure
	Education
	Residential Mix



- 2011 Census
- Business Register and Employment Survey



- Location and type retailers
- Sensor data



- Residential Services
- City Focus
- Infrastructure Support
- Integrating/Ind. Serv. Provs.
- Metropolitan Destinations

Groups & Sub Groups

- **Group – A: Residential Services**

- A1: Predominantly older, local education and health workers
- A2: Lowly qualified workers in construction and allied local trades

- **Group – B: City Focus**

- B1: Dynamic financial centres with extended operating hours
- B2: Professional, retail and leisure Services in dynamic central locations

- **Group – C: Infrastructure Support**

- C1: Younger customer service workers in wholesale or retail occupations
- C2: Blue collar, manufacturing and transport services

- **Group – D: Integrating and Independent Service Providers**

- D1: Health care support staff and routine service occupations
- D2 Locally sourced, home helps and domestic or manual workers
- D3: Travelling or home-based general service providers

- **Group – E: Metropolitan Destinations**

- E1: High street destinations and domestic employers
- E2: Accessible retail, leisure and tourist services

B: City Focus

These areas bring focus to a range of specialised professional activities and also accommodate more general support services and retail activities.

The portfolio of over-all activity may also be catalytic to the occurrence of night-time economies.

Workers in all of these activities are predominantly drawn from a core (age 25-39) labour force



Group – E: Metropolitan Destinations

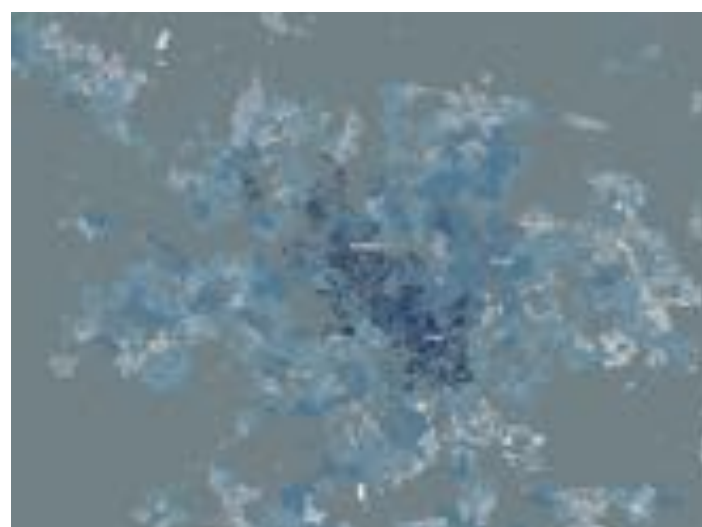
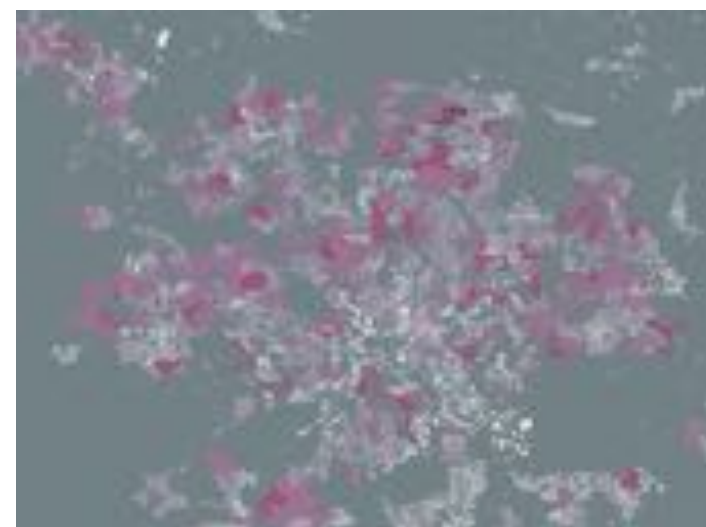
These areas are overwhelmingly located in Inner London and many serve as retail destinations.

A very international range of workers provide a wide range of high value and retail services. Many of these workers also reside in central London locations.



Integration - Internet & Retail

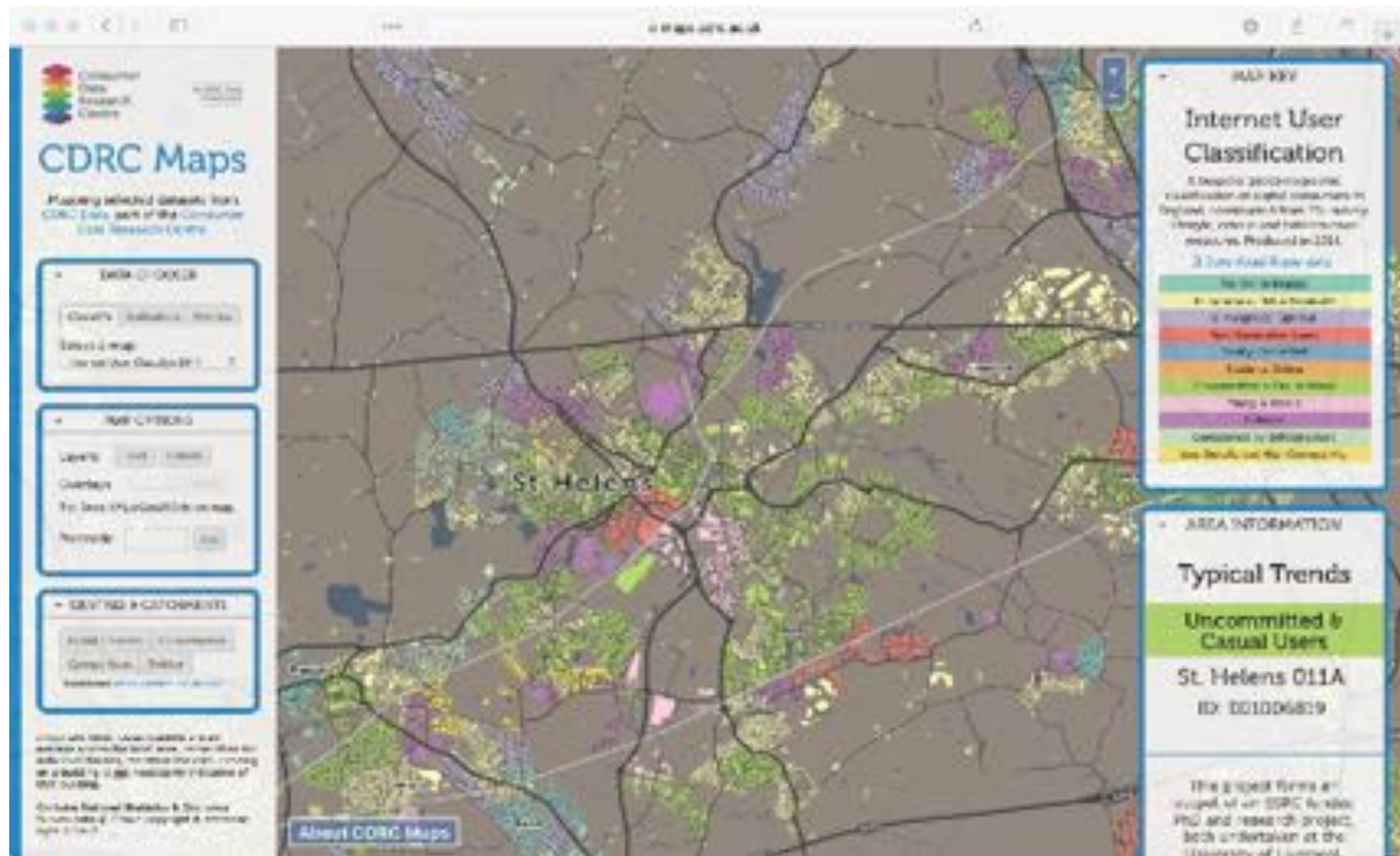




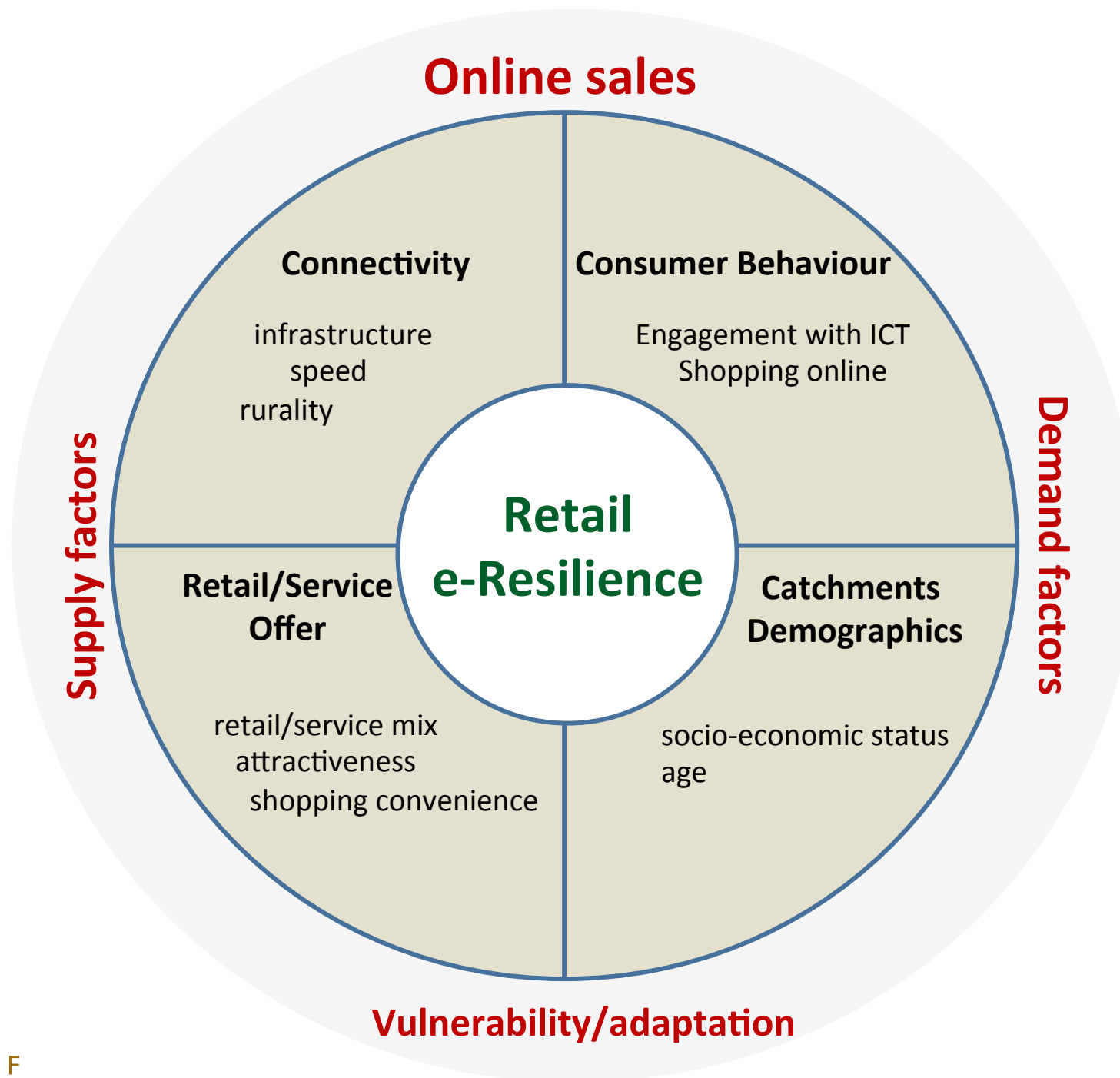
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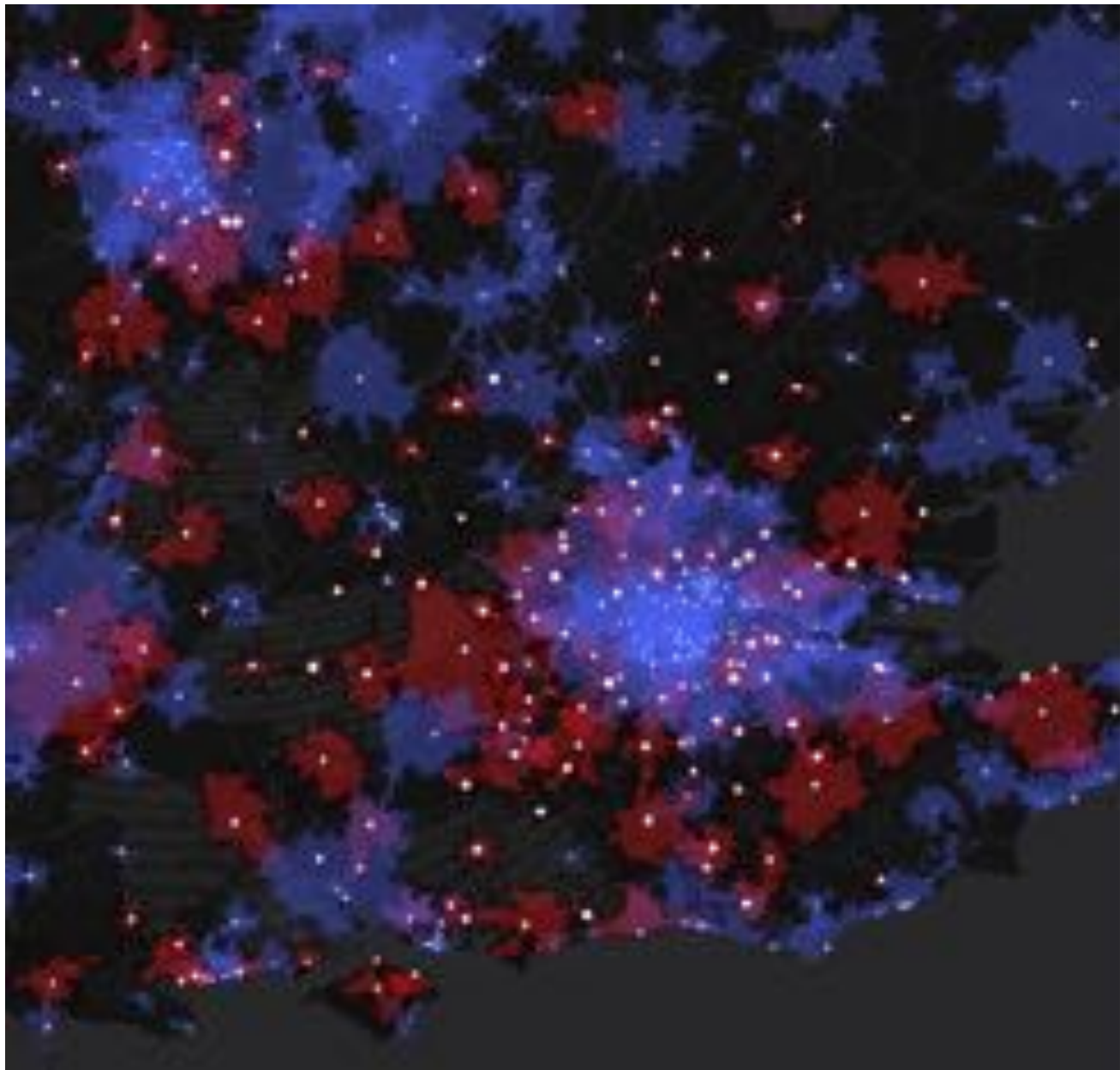
Internet User Classification



e-Resilience



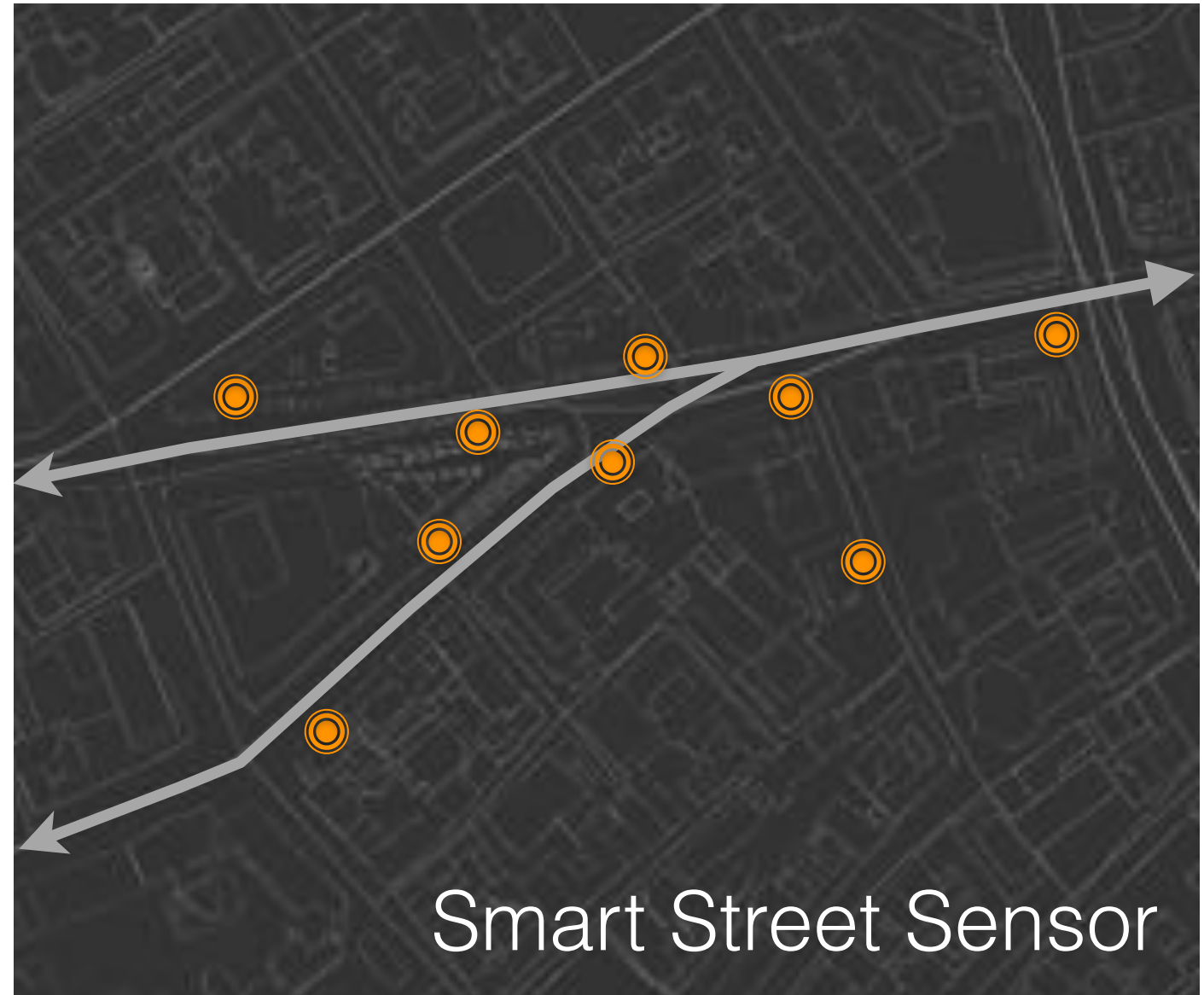
e-Resilience



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Singleton, A, L. Dolgea, M. Pavlis and P. Longley (2016). "Measuring the spatial vulnerability of retail centres to online consumption through a framework of e-resilience". In: *Geoforum* 69, pp. 5-18.

Integration - Urban Dynamics



Smart Street Sensor

Smart Street Sensor



Smart Street Sensor

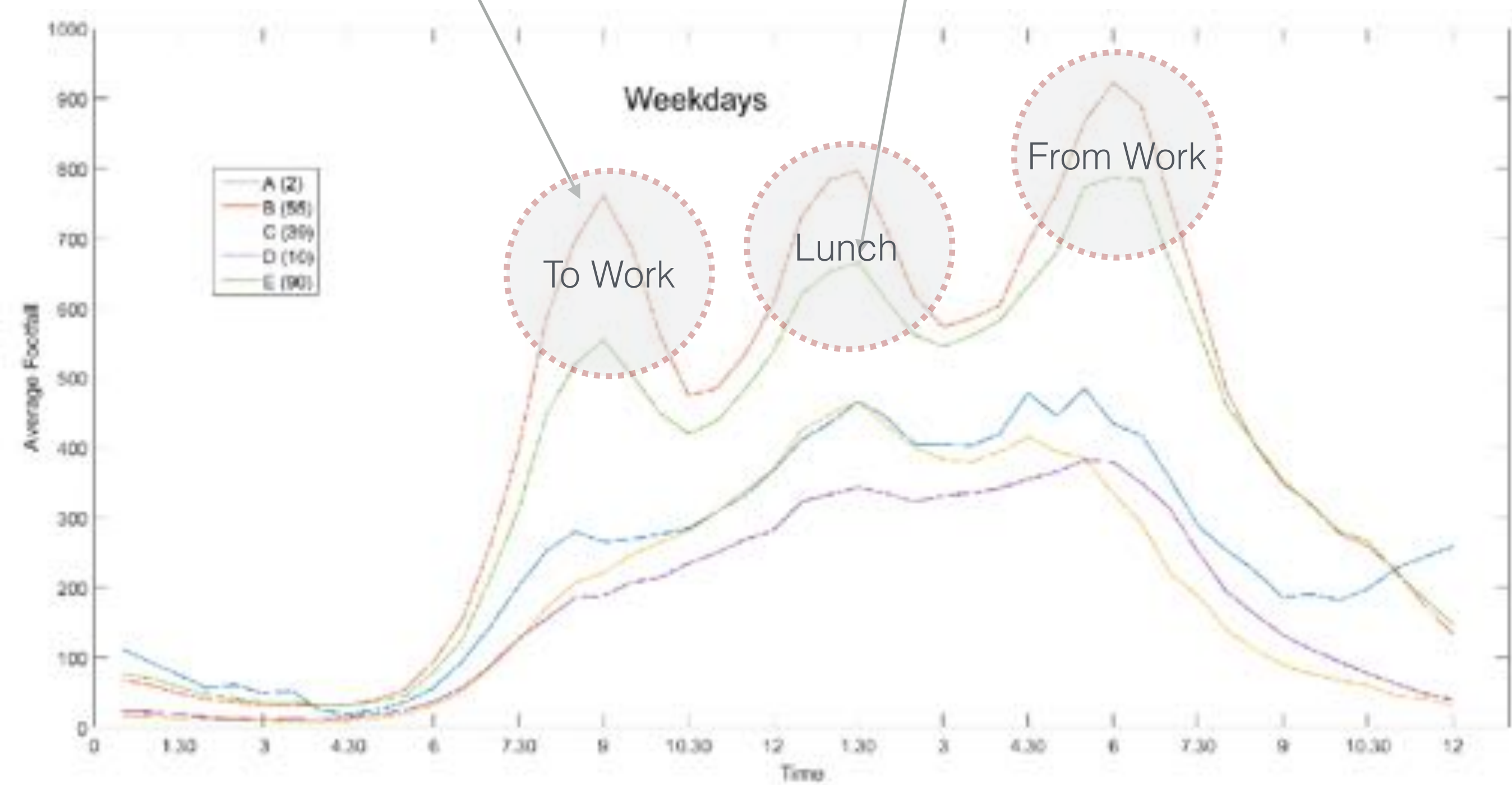


Smart Street Sensor

Group	Number of sensors
A: Residential Services	2
B: City Focus	55
C: Infrastructure Support	39
D: Integrating and Independent Service Providers	10
E: Metropolitan Destinations	90

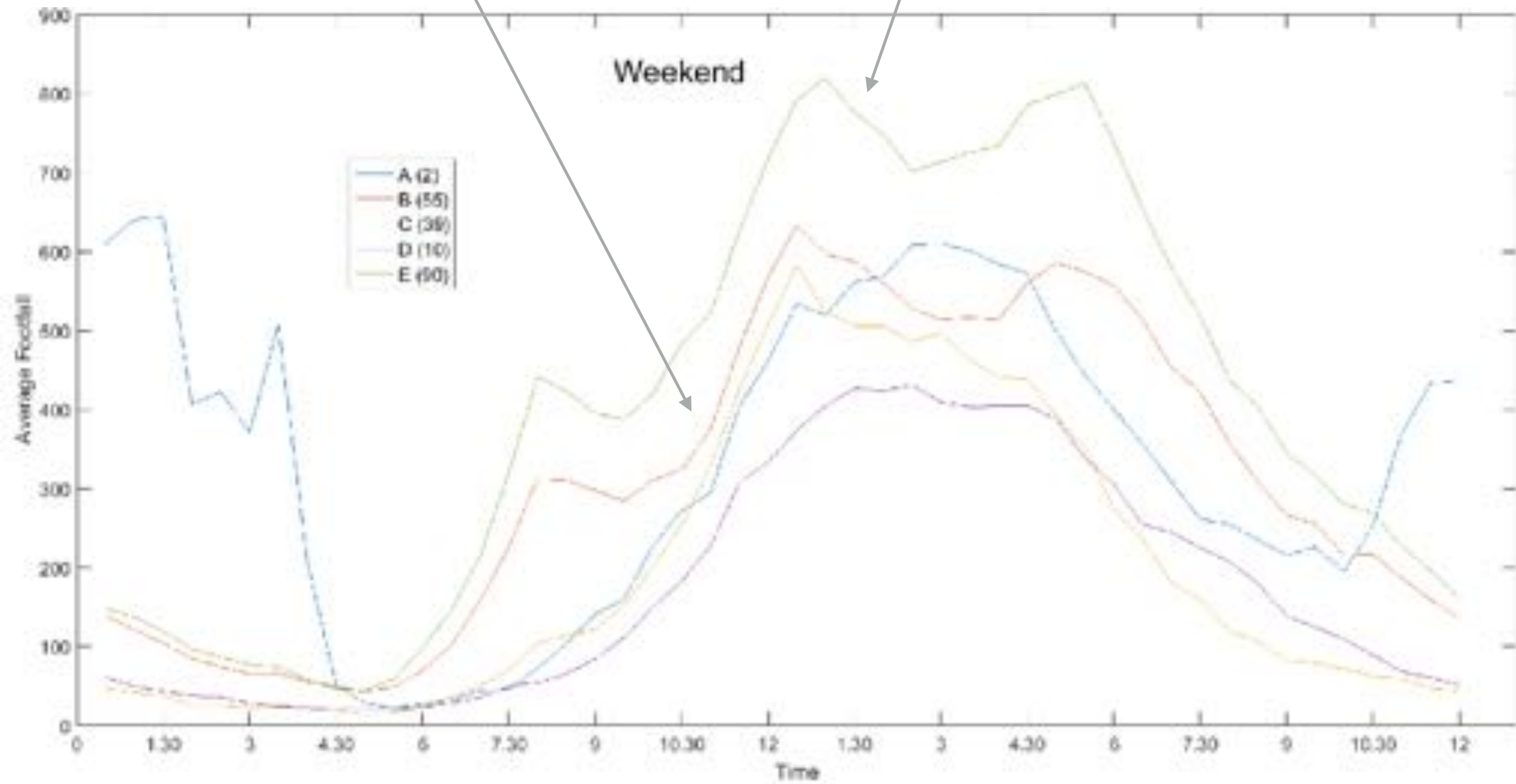
B: City Focus

E: Metropolitan Destinations



B: City Focus

E: Metropolitan Destinations

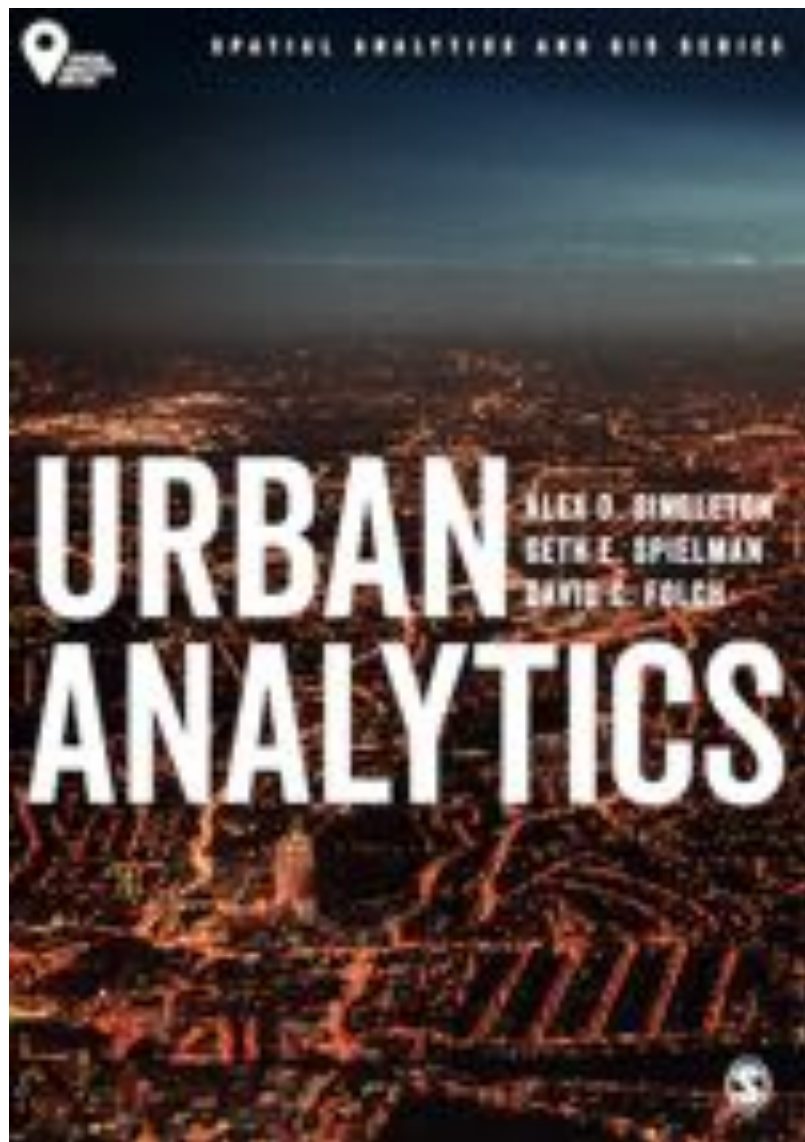


Conclusions

- New forms of data offer great opportunities to study the structure and function of cities
 - Future of urban social science
- Challenges for both access and analysis
- Urban analytics is interdisciplinary - framework through which we can study cities using new forms of data



Many thanks...



1. Questioning the City through Urban Analytics
2. Sensing the City
3. Urban Data Infrastructure
4. Visualizing the City
5. Differences within Cities
6. Explaining the City
7. Generative Urban Systems
8. Cities as Networks and Flows
9. The Future of Urban Analytics