Understanding mobility and encounter in the digital cityscape

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Overview

• Understanding the city as a system

• Architectural space & interaction space
  - mobile wireless interaction spaces

• Augmenting space syntax empirical methods to account for the digital forms of the city

• Patterns of Bluetooth presence and encounter

• Representations, analytical methods and applications
The city as system

- Understanding the city as a system - its physical and digital forms and their relationships with people’s behaviours

- Development, use and refinement of methods - observing, recording, modelling, analysing

- Space syntax already does much of this - but addresses only the physical forms of the city, relating architectural space to behaviour

- Can we “augment” space syntax to take account of the digital forms of the city?
Wireless interaction spaces

- Humans “join” pervasive systems through interaction spaces created by technologies in the environment
  - visual, auditory, wireless
  - fixed, mobile

- Fixed wireless interaction spaces defined by an access point and characteristics of the environment
  - e.g. 802.11, GSM/GPRS or 3G “hotspot”/coverage

- Mobile wireless interaction spaces typically created by small, personal devices such as mobile phones
  - e.g. Bluetooth, NFC, P2P WiFi
Extending space syntax

• In contrast to the fixed interaction spaces created by static access points, the wireless interaction spaces created by mobile Bluetooth devices map closely to the movements of people around the city - which are a primary concern of space syntax.

• We augmented space syntax empirical methods (gatecounts & static snapshots) to include observing and recording mobile wireless interaction spaces created by Bluetooth.

• 10 long-term gatecounts around Bath.
Observing copresence
Gatecount timelines

Gatecount 10

Gatecount 6

Gatecount 5

Gatecount 8

Gatecount 9

Gatecount 3
Encounters
Social networks
The blob
Power laws and exponential decays
Emulation

• Taking account of time

• Emulation vs. simulation

• Class “host”

• Class “virus”

• During encounter, virus is transmitted

• Host recovers (SIS) or dies (SIR)
Viral updates
Ongoing work

- DTN forwarding algorithms
- Social network features
  - Node degree
  - Node betweenness
  - Node closeness
- Average geodesic path (Bath = 3.3)
- Clustering coefficient (45%)
- Community detection (21 using Newman’s algorithm)
Take home points

• Urban pervasive computing is the development of a system (of systems)

• May be characterised as a system of architectural spaces and interaction spaces

• Augmenting space syntax empirical methods

• Developing data visualisations & analytical methods

• Patterns of Bluetooth presence & encounter

• Implications for epidemiology and DTNs

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the end
Bluetooth visibility

- Around 7.5% of observed pedestrians had discoverable Bluetooth devices.

(R^2 = 0.88)