Urban deployment of Bluetooth

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Context

- Collaboration between CMU HCII & University of Madeira
- Joint Master's in HCI
- 4 new faculty to drive the collaboration
 - Ian Oakley
 - Monchu Chen
 - Paula Alexandra Gomes da Silva

• Make Madeira the best HCI lab in Europe

Overview

Motivation

- Deployment of Bluetooth
- Findings
- Facebook

Motivation



User



Design for the Desktop

- Memory
- Attention
- Recognition
- Motor skills
- Fitt's law, GOMS, +/-5 items, etc.



User Space Technology

What's different

- People move => *mobility*
- People interact => sociability

Aim

- Design tools, methods, principles for pervasive computing
- Taking a systemic view of the city
 - People, spaces, technology

Approach

- Establish the "ground truth" about cities
- Passive observation and monitoring
- Develop systemic measures
 - mobility & sociability
- Relate to design

Outline

- Data capturing
 - Juicy Lucy
 - Bluetooth CSI
- Social nets & viruses
- Facebook

Data capturing









Bluetooth & Graffiti a.k.a. "Juicy Lucie"





Do you ever send stuff? (Bluetooth honeypots)

- Bluetooth honeypot
- Various names
- Various device classes

• Are you the girl in the corner! :o);

Do you receive stuff? (BlueSpamming)

- Hypothesis: name of sender affects recipient's reaction
- Issues in automating this process
 - Protocol behaviour, user prompts

What is your Bluetooth name?

- Name-changing patterns
 - Data is too noisy
- Intentional categories
 - Sexual, greeting, invitation, insult
- Lexical categories
 - Default, custom,
 - Identifiers, associations, t-shirt, graffiti

CRIME SCENE INVESTIGATION

Eluctooth

Interactive Crime-Solving Adventure Research



Early morning, November 29, 2006





Results

- Identify "suspects"
 - Taxi driver
 - Cleaner/security guard
 - One-off visitor
 - Return to the scene of the crime

Searching for patterns

Pattern I: usage

Gatecounts



Bluetooth visibility

 Around 7.5% of observed pedestrians had discoverable Bluetooth devices



Pattern 2: flow



Gatecount timelines



Gatecount 5

















Pattern 3: temporal

Dynamic properties

- Our data is not static
- 3D structure
- Chain of events





 $y = x^a$







Chain of events

- John, Mary, 14:20:30
- John, Paul, 14:20:32
- Mary,Nick, 14:20:33

...

Emulation

- Class "device"
- Class "virus"
- During encounter, virus is transmitted
- Device recovers (SIS) or dies (SIR)



Virus spread - bath_sir.txt



Information







No Strangers

No Friends





Pattern 4: spatial



Power laws and exponential decays







Cityware for Facebook

• US

- MIT
- Stanford
- Boston
- Urbana-Champaign
- Michigan
- Portland
- Oklahoma
- New York
- Ohio
- UK
 - Cambridge

- Oxford
- Nottingham
- Lancaster
- Warwick
- Bristol
- Manchester
- Melbourne
- Bremen
- Cairo
- Iceland
- •









Conclusion

- Establish a systemic view of ubiquitous systems (people, space, technology)
- Identify "ground truth", patterns
 - Usage, flows, temporal, spatial
- Ongoing work: relate patterns to design



Thank you

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http://www.cityware.org.uk

Physical phishing

In-situ Wifi phishing. How can we induce trust in users of wifi hotspots?



Little bird

Mobile phone detects nearby people. Looks up their Facebook profiles and notifies the user of upcoming events, wall posts, etc.



Let's touch!

A common activity between people who just met is the establishment of common ground: identifying people they know in common, or memberships they have in common. We built an application to enhance this process.

Using NFC-enabled Nokia phones, our system notifies users of common acquaintances simply by touching each other's phone.



Tilt the maze

Good design principles suggest that feedback should be given at the point of interaction. Does this apply to tangible interfaces?

We explored different feedback mechanisms with a "tilt the maze" game. Using a tablet pc and tilt sensor we tested a tilt-board maze game using a plasma display (top), mouse (bottom left), and tangible interface (bottom right).





JESTER

Is information feedback enough to enhance performance? How can a system motivate its users?

Jester is a system that helps weight lifters achieve correct posture by using tilt sensors, and motivates users by using text-tospeech.





Send me a picture!

While users take many photographs with digital cameras, few of these pictures are actually shared. Using NFC technology, we developed a system to enhance the sharing of photographs by letting users associate physical objects with friends. Thus, when a user is viewing a picture on their phone, they can touch the phone with any augmented object to send the picture to the respective recipient.



Physical hyperlinks

Given the options of a phonecall, SMS, or a website, which service will users prefer in order to get location-based information? We ran a treasure hunt game, where users could choose any of the three types of services to get clues. To access the services, users utilised 2D visual barcodes attached to physical artifacts.