Pervasive computing

Design and interaction

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- Principled design of pervasive systems
 - Framework
 - Design tool
 - Additional issues
- Interacting with pervasive systems
 - Gestural interaction
 - Experiment: can we do without GUIs?
- Future research

Design of pervasive systems

What are pervasive systems?

- They pervade the
 - physical,
 - social,
 - cognitive
- environments
 - They affect the way we move, behave and think
- Large scale vs small scale pervasive systems
 - Public vs domestic

A design framework for pervasive information access

Established HCI design foci

- user
- task
- domain

Social considerations

Design for rypublic pervasive systems

- citizen
- sphere 🖊
- space

Citizen

- Traditional "user" focuses on psychological characteristics
 - Large-scale system
 interaction with everyday norms & regulations (user makes no sense?)
- We can say little about the particular user of a large-scale publicly available system, but in respect of citizens we know
 - rights
 - responsibilities
 - membership
- A wide-scale provider of information may be viewed as a public service
 - Public services: characteristics, expectations



Sphere

- Traditional notion of task studies cog aspects
- Pervasive systems: what task?
 - Need to abstract
 - Conceptualise ownership/control
 - Effects of location / technology on task
- Information spheres
 - Public sphere
 - Private sphere
 - Social sphere



- Space: more than GPS
 Architectural/physical space
 Place (i.e. social dimensions)
- Effects of technology, information
- Abstract away those important characteristics
 - Physical space: public, social, private
 - Interaction space: public, social, private



Visual interaction spaces









Auditory interaction spaces











Designing with the framework

- In designing systems for the delivery of information and services, we have a range of artefacts available; e.g. wall displays, PDAs etc
- We use these artefacts to define appropriate interaction spaces
- To know what kind of interaction space to create, we need to take account of the information sphere and the space in which the citizen is currently located

The design process





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Manipulate interaction spaces (change the technology that is used)
Relocate artefacts (relocate technology)
Re-establish links between information and technology (what information to deliver using which technology).

Using the design tool (Hospital A&E case study)



(For the PhD Candidates...)

- Where did my framework come from?
- Testing out of my framework
 - Post hoc evaluation (can I explain something that exists?) hospital case study
 - A priory design (can I propose something new?) city of Bath case study
- Levels of application
 - Generate proposals (city of Bath)
 - Design exploration and alternatives (hospital)
 - Interaction design

Further design issues

Pervasive computing and architecture

Architecture: Manipulates physical spaces
PerComp: Manipulates interaction spaces

Design of pervasive systems:

Effective integration of physical spaces + interaction spaces
Learning from architecture

Interacting with pervasive systems

"Effective integration of architectural spaces & interaction spaces"

- Interaction spaces can be created by
 - devices (PDA, speakers, screen, etc)
 - the physical aspects of interaction (keyboard, touch screen, etc)
- In PerComp we can make use of varying devices to create appropriate interaction spaces
 - What about interaction itself? How can we control the interaction spaces created by the *act* of interaction?
- Need to *decouple* the interaction from the artefact (abstract away)
 - Stroke-based gestural interaction

What is stroke recognition?

- A stroke is a recorded path of a motion performed by an input device or token
- Identify pre-defined paths
- Execute a command assigned to a particular motion / stroke

The DSR (Directional Stroke Recognition)

- Separate the device from the interaction
- Provides flexibility of stroke input & output devices
 - Can use a mouse, stylus, smart ring, smart card, and any object that can be carried
- Uses bare minimum characteristics of a stroke
 - Only the direction is used
 - Position of strokes, or relative position of many strokes is not used





Examples of Strokes

8 Ringle Strokes



Flexibility of Directional Strokes



Touch-Screen Strokes

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👪 Untitled - test

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Camera Tracking

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FindGesture

Mouse Test - Hold LButton Down

How can the DSR help us?

- Define appropriate interaction spaces
 - run time
 - user decides
 - carried across devices
 - carried across systems
 (? future work)



Experiment: Multimodal Interaction

- Separation between device & interaction
- Can we do without GUIs?
- Effects of presence/absence of visual cues



Further work

- Slow object recognition (different technology?)
- Personalization, mental mapping?
- Multiple object tracking?



Research for the immediate future



CHI '05 Workshop

- "Social implications of ubiquitous computing"
- Social issues affect more than just the design...
- ETH Zurich, Fraunhofer Institute, Bartlett UCL
- Interacting with Computers Special Issue
 - "Social impact of emerging technologies"
 - Trends from traditional to emerging technologies, government involvement
- Space syntax of public pervasive systems (Bartlett)
- Cityware (Bartlett, Imperial, Vodafone, HP, etc.)

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