INTRODUCTION TO HCI FOR MOBILES

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Structure

- House, fish, vaccine and kidneys
- What is HCI
  - In the context of mobile computing
  - Beyond smartphones
- Why good designs matter
  - the impacts of poor designs
- What this module is about
- Assessments
Information is power!

Let’s say you’ve just moved into Canterbury and you want to buy a property to live in.

- What kind of information do you need to make a decision?
  - Types of property: flat, semi-detached, terraced, etc
  - Size: how many bedrooms, bathrooms, has it got a garden?
  - Price: how does the price compare with similar properties in Canterbury, or even within the same neighbourhood?
  - What about the crime rate in the neighbourhood?
  - Are there good schools/supermarkets/gyms near by?

How do you get this information?

- Generic search such as Google
- Specific websites such as www.rightmove.co.uk, www.police.uk

What kind of information are you less likely to obtain by yourself?

- How well built is the house? Are there major structural problems? How well is the house insulated? Does it leak in heavy rain?
- What help do you need? What about asking estate agents or the current house owners?
Information asymmetry

• It is very likely that the house owner (and to sometimes the estate agents) knows these “hidden” problems of the house
• For selfish reasons, they will probably not give you all the right information

• This situation is described as “information asymmetry”
  • It deals with the study of decisions in transactions where one party has more or better information than the others.
• Consider “the insurance dilemma”
  • The insurance buyer has more information about their health than the insurance companies (e.g., I smoke really a lot, I don’t exercise much, etc)
  • Therefore, most people who know they will need a health insurance (due to unhealthy lifestyle) will find it worthy to pay a premium. People who are healthy will not pay.
• [Quiz] Insurance companies need to make profits, so what would you do if you ran an insurance company?
  • Ask buyers to fill in a very detailed life questionnaire about their lifestyle, genetic diseases their parents have, etc
  • Increase the premium

The Kerala case study

• Many of the society problems have to do with “information asymmetry”
• In a case study by Abraham (2008), it was claimed that mobile phones have addressed the problem of “information asymmetry” faced by the the fisherman in Kerala

• South Western state of India, Kerala
The Kerala case study (cont)

- In rural regions, information is poor, scarce, mal-distributed, inefficiently communicated… (Geertz 1978)
- Examples:
  - When will the fishing boats dock? When returning from the sea, fishermen spend a lot of time idling on the shore waiting for the boats owners and agents to come collect the fish to distribute to the villages
  - Which villages need fish? Without this information, most fish might end up in one village making the price really low; and some villages don’t get any fish, making the price unusually high
  - Fish is a highly perishable commodity, it is important to coordinate supply and demand
- [Quiz] How do mobile phones help?
  - Fishermen can inform owners/agents when they are about to dock
  - Information about fish stock in each village can be transmitted quickly and accurately
  - Fishermen can use mobile phones to inform each other when they’ve found a large shoal, thus reducing the time spent at sea searching for fish – immediate impact on fuel costs

Fish sounds trivial?

- What about vaccination for children?
- Each year approximately 25 million infants do not receive the necessary immunisations, and at least 2.4 million children die from vaccine-preventable diseases
- [Quiz] Can you think of the information asymmetry problems in this case?
  - accurately identifying an individual infant/child to determine their immune status
  - Connecting vaccine availability (supply) with target populations (demand)
**Quiz**

- How can mobile phones solve the following problems?
  a) accurately identifying an individual infant/child to determine their immune status
  b) Connecting vaccine availability (supply) with target populations (demand)

- Possible solutions:
  a) Phone cameras could be used to keep a record of the children, or even identify individual child through fingerprints
  b) Mobile phones can be used to communicate the supply-demand information (which villages need more vaccines), thus enhancing the coordination effort of vaccine programmes

- The interesting thing about mobile app design is not just about new functionalities and features, it is also about creative and innovative contexts of use to solve personal and society problems

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**Exchange without money**

- Can you write an app to solve the organ transplant problem?
- What is the problem of organ transplant?
  - too many patients (demand) but too few organ donors (supply)
  - Not easy to find a good match
  - Money can’t buy organs
- A case study or Kidney transplant
  - humans are born with two kidneys – we need only one.
  - in a country like the U.S. with a few hundred million people, there are potentially a few hundred million spare kidneys.
  - Normally, price is allowed to let demand meet supply, but organ donation is a market that doesn’t allow money.
- So what is the solution? An app?
Exchange without money

- Let’s say that your sibling needs a kidney transplant. You could voluntarily undergo surgery to give up one of yours.
- But it might not be a biological match.
- You can’t sell yours and buy one that matches. But it is not allowed by law!
- There is an “app” for that!
- The transplant centers could enter the medical and demographic data on potential organ donors and recipients, it would produce a match.

Quiz

- Assuming that there is a very kind person who is willing to give up her kidney for a random patient. How can the “kidney app” maximise the outcome?
What is HCI

- Human Computer Interaction:
  - “Designing interactive products to support people in their everyday and working life” (Preece et al 2002)
  - It is not software engineering, which focuses on the production of software solutions for given applications.
  - It is not just user interface design either!
  - Analogy: architect vs civil engineer
    - Architects are concerned with the people and their interactions with the space and with each other. Is there a right mix of family and private spaces? Are the spaces for cooking and eating in close proximity? The aesthetics of living space, will the people enjoy living there?
    - Engineers are interested in issues like cost, durability, structural aspects, material, fire regulations, construction methods, etc.

How is HCI relevant to mobile?

- Late 90s – massive mobile phones take up
- Around mid 2000s, smart phones entered the market with advanced features: WAP, video calling, mobile payment... but failed!

- Basic mobile devices and services (voice call, messaging) were successful because they meet basic human desires in simple, direct ways.
- More advanced interactions such as web browsing on numpad are frustrating.
How is HCI relevant to mobile?

- Even various touch screen-based smart phones (such as PalmPilot) failed
- It was not until 2007 that Apple completely re-designed mobile interactions that smart phones were starting to take off
- It is the same way Xerox PARC GUI (popularised by Apple Macintosh) transformed desktop interactions in 1970s.
- Thus, we need a mobile interaction design perspective that
  - Is more about "Smart People" than "Smart Phone"

What are mobile devices anyway?

- Mobile vs desktop

<table>
<thead>
<tr>
<th></th>
<th>Desktop</th>
<th>Mobile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reasons for use</td>
<td>Lengthy information processing tasks</td>
<td>On-the-go lookup, quick communication</td>
</tr>
<tr>
<td>Form factors</td>
<td>Require a table; used whilst seated; require power cable</td>
<td>Can be used standing up, typically fitting in a pocket; wearable, implant?</td>
</tr>
<tr>
<td>Input</td>
<td>Full keyboard and mouse/touch pad</td>
<td>Stylus, keypad, mini-keyboard, multi-touch, sensor inputs e.g. gyro, camera</td>
</tr>
<tr>
<td>Display size</td>
<td>Typically 21” or larger</td>
<td>3”-4”, 10” tablets are emerging</td>
</tr>
</tbody>
</table>
Quiz

• Spend some time now and think about other possible wearable mobile interaction modalities (beyond touch-screen based interaction) which are available now or may be available in the future. Please come up with at least 4 examples.
  • Speech recognition
  • Gesture interaction
  • Skin-input
  • Eye gaze
  • Brain computer interaction
  • Head tracking
  • Tongue interaction

Other examples of mobile devices

HCI for mobiles is not restricted to just smart phones!

a) MediaCup (coffee cup with sensors and communication technologies embedded in base) (Gellersen et al., 2002), http://dl.acm.org/citation.cfm?id=743864
b) Skinput, Microsoft research, Skinputs (Harrton, 2011), http://www.youtube.com/watch?v=qZ5PkJw9KUg
Why good designs matter?

- Small display and limited keypad are not excuses for bad design
  - You can’t dismiss a customer’s complaint by saying “what do you expect on such a small screen”
- We encounter bad designs not just on computer systems
  - How do I buy a ticket?
  - Should I push or pull the door?
  - How do I flush this toilet?

People are often very frustrated with computers. Some causes:
- System freezes
- Long download time
- Difficult navigation schemes
- Badly worded error messages

As mobile phones are becoming increasingly sophisticated, they are now facing similar usability problems desktop computers face.
Quiz

Try to identify usability problems of the following app, and come up with design ideas to make it more usable.

Problems:
- Cluttered interface. People download apps out of impulse, the commitment level to the apps is very low.

Solutions:
- Break the interface up into logical screens. Don’t try to do too much on one screen.
- Padding and “negative space” are important in layout design.

Quiz

Try to identify usability problems of the following app, and come up with design ideas to make it more usable.

Problems:
- Inconsistency of the interface and poor layout.

Solutions:
- Set standards for how users move from screen to screen, how you use menus, tabs, or buttons, and other user interface elements.
- Stick to the standard look and feel of your chosen platform as much as possible.
Reasons for poor design

- Perceived cost
  - Poor graphics design of app is immediately visible but interaction design issues may not appear obvious from screenshots/physical design
  - Designers may decide to spend more money/time on the graphics and marketing
- Latest technology is King?
  - Especially for developers/programmers, we are excited by the latest features
  - Remember always put users first in your design.
- Overlook user-based bugs in contexts
  - Developers are usually bad testers! Even developers identify a usability problem, they often try to rationalise the problem and dismiss it as a minor issue
  - Development/testing in the lab vs use in the outside world. This is especially important for mobile apps as they are used in a wide range of locations and situations. Try to think of where you use your phone?

Quiz

- Are the following statements true?
  a) Research in neurosciences showed that memories from strong negative emotions seem to be more easily retrieved than neutral or even somewhat positive emotions. (True/False)
  b) A study found that people waste up to a third of the time in front of the computer trying to fix problems and repeat the work lost due to the problems. (True/False)
  c) Poor usability designs normally result in frustrations but have never resulted in loss of lives. (True/False)
  d) In some cases, better interaction designs can help create a greener environment. (True/False)
Impacts of poor design

- Why should we invest additional resources into interaction design?

- Emotional impact
  - Interaction design can affect people’s emotions, stress level and mental energy
  - People did rate themselves being frustrated with computers (Ceaparu et al. 2004), and worse with mobile devices (e.g. cryptic error message due to small screen)
  - Mobile is needed usually just in time, that causes higher frustration if it fails
  - Studies have indeed showed that frustration with technology has a real physiological impact (Hazlett 2003)

- Economic impact
  - Negative emotional impacts translate directly into economic impact
  - “…usable design saves money and saves jobs” (Nielsen 2003)
  - Want to avoid angry customers on your customer support?

- Ethical impact
  - Poor design may cause lost lives
    - E.g. plane cockpit design, control tower computer system design, car dashboard design
    - Human factors are the most common factor in aircraft crashes
    - Car dashboard interaction design can lead to serious distraction
    - Hospital computer systems that help diagnose, treat and monitor patients. Mobile devices are now increasingly used in the hospital
  - Environmental impact
    - Throw-away culture in mobile device users. In the UK alone, millions of tonnes of electronics are thrown away each year
    - Can a printer driver be designed to automatically optimise the printing layout of a web page, to reduce the use of paper
  - It is ethical for designers to design apps/products that can be used by people with disabilities (visual/hearing/cognitive impairments etc)
Applications areas

• Some key application domains of mobile devices:
  • Education and training
  • Health
  • Persuasive technology
  • Play and entertainment
  • Social interaction/networking
  • Information

• What other application areas can you think of?

The scope of the module

• We will discuss interaction design for Iphone or Android phones/tablets
• We will emphasise designing intuitive, user friendly, enjoyable and beautiful “apps”
• We focus on both “design”, and analysis of users and their contexts
• We are also interested in exploring new and innovative use of mobile devices/apps, solving problems creatively using current and future technologies.
• Multidisciplinary: computer science, psychology, sociology, marketing, usability engineering
Mobile HCI lectures

- Week 1: Introduction to mobile HCI
- Week 2: Everywhere design
- Week 3: Understanding users
- Week 4: Making sense of data
- Week 5: Tasks, requirements and prototypes
- Week 6: Project week
- Week 7: Graphics
- Week 8: Evaluation
- Week 9: Social interaction
- Week 10: Design for everyone
- Week 11: Final presentation
- Week 12: Project week

Please make sure you have access to https://moodle.kent.ac.uk

References

- There is not one single text book I use. A lot of the materials come from research papers, reports and research from my collaborators and myself.
- Unfortunately I cannot recommend a textbook on mobile HCI, but these two might be useful:
  - Mobile Interaction Design (Jones and Marsden 2006)
  - Interaction Design (Preece, Rogers, Sharp, 2007)
Academic articles

- I highly recommend that you have a look at:
  - Conference on Human Factors in Computing System (known as CHI), published by ACM
  - ACM interactions magazine

- Other relevant journals/conferences:
  - Human Computer Interaction with Mobile Devices and Services (MobileHCI) proceeding published by ACM
  - Ubicomp proceeding published by Springer-Verlag
  - International Journal of Personal and Ubiquitous Computing
  - ACM Transactions of Computer Human Interactions
  - International Journal of Human Computer Studies
  - IEEE Pervasive Computing magazine

Assessment

- Research essay on “Internet of Things” (20%)

- Design project (80%)
  - An extended abstract in ACM format (40%)
    - An introduction describing the problem statements and overall design theme
    - Related work outlining similar work done in this area
    - A methodology section explaining data collection methodology
    - A description of your proposed solution, including key screenshots of the prototypes
    - Evaluation and the results
    - Conclusion, recommendations and a list of at least 5 references
  - Supplementary material (40%)
Research essay (20%)

- Read the article:
  - Kramp, van Kranenburg, Lange (2013) “Introduction to the Internet of Things.” in A. Bassi et al. (eds.), Enabling Things to Talk. DOI 10.1007/978-3-642-40403-0_1
  - http://link.springer.com/chapter/10.1007%2F978-3-642-40403-0_1

- You are required to carry out extensive research on a specific topic on “The Internet of Things” in relation to mobile computing, and write an essay (up to 2000 words) to discuss the chosen topic critically.

- Your article should contain the following:
  - an introduction of the topic (3%)
  - a comprehensive review of the state-of-the-art research in the area. Please break down your review into sub-sections (10%)
  - based on the review in b), write a narrative of a possible future scenario that demonstrate how innovative internet of things services and technologies can help users in their life, highlighting any possible challenges (5%)
  - a list of references (at least 5 references are expected) (2%)

- Please include necessary figures, tables and charts to support your arguments.

Workshop

- We will examine some economic theories and identify design opportunities and solutions
- The design topics include:
  - Online booking
  - Online forum
  - Online transactions
  - Health information system
ADDITONAL NOTES

Communication vs information

- Until the end of 1990s, we had two types of phones
  - Communication oriented (call, text)
  - Information oriented (information processing and management) – e.g. PDAs
- Since 2007 (iPhone), the two have merged
- And phones have now become platforms for entertainment, commerce, information management, media prosumption (production + consumption).
- Even the nature of communication has transformed quite radically
  - Phone call: one-to-one
  - Email: one-to-many
  - Social media: many-to-many
Communication vs information

- At the moment the predominant mobile devices are smartphones (communication) vs tablets (information)
- These two devices seem to be doing the same thing (same OS, same apps, etc)
- How many of you have both?
  - What motivated you to get both?
  - How do the two genres of devices complement each other and support/enhance your life?
- Are we now going back to 1990s? Where we had two types of devices? Phones for communication and tablets for information?

Specific vs general purpose

- General purpose devices (Swiss Army knives approach)
  - “Sure, it is fun to look at, sure it is handy if you are off in the wilderness and it is the only tool you have, but of all the umpteen things it does, none of them are done particularly well.” (Norman 1999)
- Current smartphones are an example of general purpose devices
- It is good when you are travelling to have a multi-purposes computing device
Specific vs general purpose

- Specific purpose devices
  - eBook readers such as Kindle, digital cameras, digital photo frame, handheld game consoles, calculator, mp3 player
  - Small, simpler, (usually) cheaper, activity-centred
  - Used in conjunction with other devices

- Some experts believe that in the future, we will surround ourselves with many computing devices, just like we currently fill out homes and offices with books, shelves, washing machines, microwaves. Each applicant supports a specific activity
- Norman foresees a future of the computer becomes more like information appliances which can effortlessly communicate with each other – “Internet of Things”

- What is your view?

Personal v. disposable device

- Do you think of your phone as something personal of disposable?
- Do you think of your car as something personal of disposable?
- How often do you change your mobile phone? What about car?
- Many people think of their phones as something very personal to them, yet they change their phones every other year. Why the paradox?
  - Is the phone a piece of hardware or software/data?
  - Cloud technologies are getting more common. One may change the hardware device frequently (disposable), the data/content/software remains very personal indeed!

http://www.youtube.com/watch?v=oDAw7vW7H0c
HOME EXERCISES

You are highly encouraged to do all these exercises at home (even if you just spend 5-10 min thinking about each exercise if you have no time!)

Design exercise: meaningful and contextual feedback

- Providing meaningful feedback is key to mobile interaction design. For instance, when users receive a text, or when the battery is running low. How is feedback currently provided to the user? Can we think of a better way to alert the users? Can we consider just-in-time or in-situ alert? What about alert for to-do-list?
Design exercise: a mobile app for tourists

- You need to build a mobile app to help tourists find their way around an unfamiliar city. What would you need to find out in order to develop a conceptual model? What kind of model is appropriate? What are the pros and cons for each model?

- Conceptual models:
  - Instructing
    - issuing commands and selecting options
  - Conversing
    - interacting with a system as if having a conversation
  - Manipulating
    - interacting with objects in a virtual or physical space by manipulating them
  - Exploring
    - moving through a virtual environment or a physical space

Exercise: from desktop to mobile

- Take Facebook as an example:

- Try to identify the differences between desktop-based Facebook and the mobile app

- Why are the mobile version different from the desktop version (apart from the fact that mobile screen is smaller)?
  - Please consider how people use desktop vs mobile devices differently (e.g., refer to slide 12)