




UNIVERSITY OF SCIENCE  
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# Mobile UI

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# Outline

- 
- Prevalence and Importance of Mobile Computing
  - Mobile UI Design
  - Mobile Usage Space
  - Mobile Operating Systems
  - UI Hall of Fame and Shame

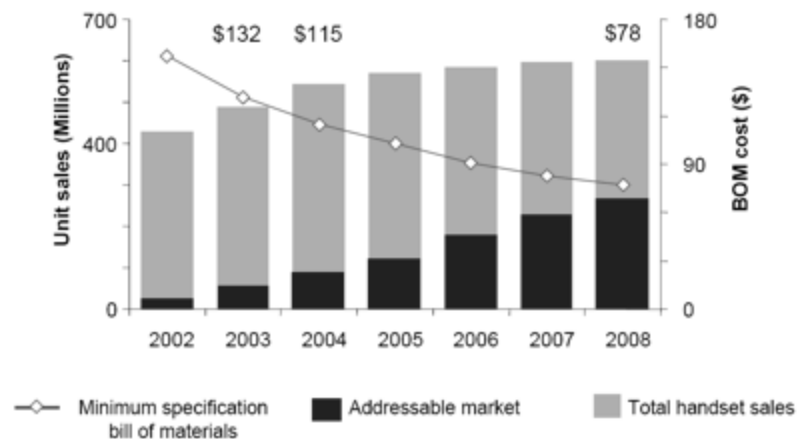
# Mobile phones



# Prevalence of mobile devices

- Reaching the mass-market
  - over 5.3 Billion mobile phones users (2010)
  - ~302 million mobile phones in US – 96% (2010)
  - Multiple handsets per user in some countries
  - By 2015, more users will access the Internet via mobile devices than via PCs

Smartphone addressable market



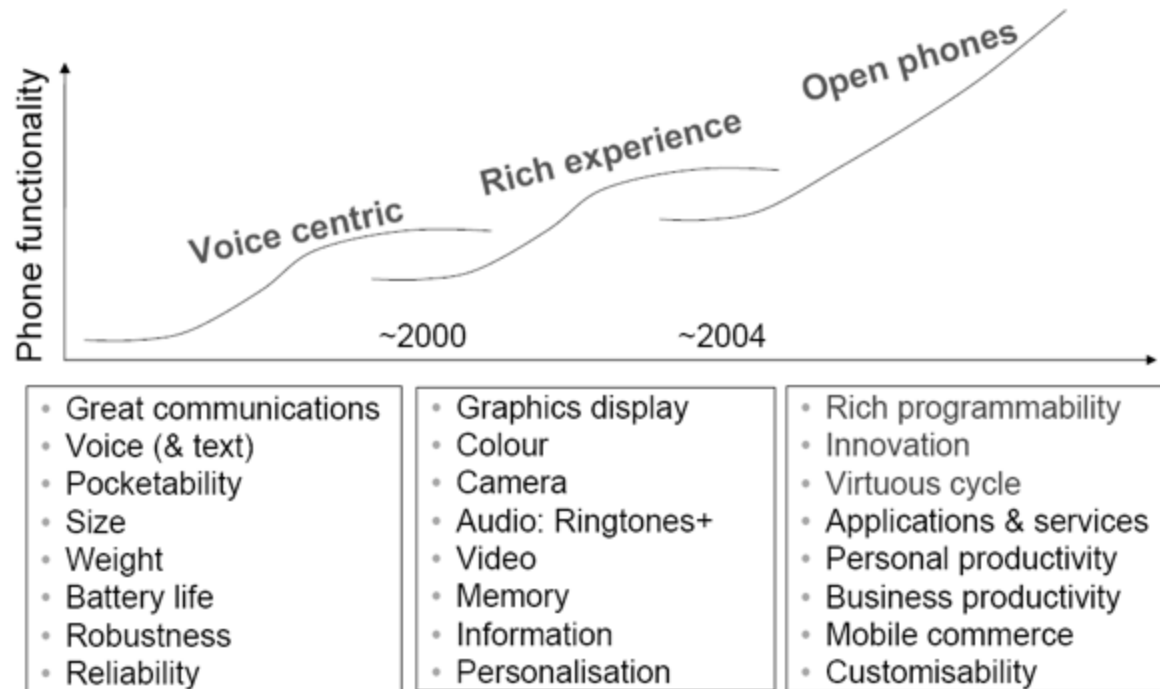
Source: Symbian Ltd

# More than just “Talking”

- Mobile phones with significantly increased capability:
  - Greater on-board intelligence (software & hardware)
  - Larger on-device data storage
  - Better connectivity to networks & to other devices
  - Larger, clearer, colorful screens
  - Easier input of data (via pens, keys, touch, voice...)
- With easier programming of the on-board intelligence
- And allow users to easily use the intelligence

# Waves of mobile telephones

## Three waves of mobile telephones



Source: *Symbian Ltd*

# Dimensions of meeting extra

- Communication
  - voice, message, image, video, VoIP...
- Information access
  - location, navigation, presence, education
- Entertainment
  - audio, graphics, video, multimedia...
- Gaming capabilities
  - multi-player, gaming, mobile access to online worlds
- Personal/Business productivity
  - PDA, scheduling, email, meeting...
- Electronic commerce
  - shopping, electronic wallet, banking...

# Mobile computing

## ■ Mobile computing

- ❑ is a generic term describing one's ability to use computing technology while *moving*, as opposed to PCs, which are only practical for use while deployed in a stationary configuration

## ■ Types

- ❑ Wearable computer
- ❑ Ultra-Mobile PC (UMPC)
- ❑ Handheld computer (PDA)
- ❑ Smart phone
- ❑ Tablet computer






# Mobile computing (cont'd)

- >50% of Internet access is by non-PCs
- Diverse form factors
  - size, shape, interaction elements...
- Diverse set of functions
  - multimedia, game, mini-computer...
- Users attachment to them...
  - wearable, handheld, RFID, implants...
- Hot research area in HCI



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# Mobile HCI

## ■ HCI and Mobile HCI

“Human-Computer Interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them”

... and Mobile HCI deals with the **above issues** for mobile devices such as PDAs, mobile phones/pagers, wrist watches, memo devices, GPS, small size embedded systems, etc.

... and has to concentrate on more restricted issues raised by mobility.

# Mobile is really different

- They are mobile
  - otherwise, no one will carry
- More connectivity
  - wireless, Bluetooth, Infrared, WLAN
- More sophisticated expectations
  - user patterns, personalization, economics...
- More advanced in
  - hardware features
  - software features and necessities

# Mobile UI restrictions



# Mobile UI restrictions (cont'd)

- Claim:
  - people want PC functionality
  - but, they do not want the PC's overhead
- Cannot simply make the screen bigger and add a keyboard
  - because no one will carry it!
- Cannot use a too faster processor or add more memory
  - because they use too much power
- Hard to interact
  - because mobile phone has no screen when it is at your ear

# Mobile UI constraints

- Limited input and output
  - keypad, small screen size, low resolution
  - data entry is error prone and slow
  - user's environment: glare
- Slow processor, small memory, slow network connection
  - like old PC's - 1996 Pentium
- Limited power consumption

→ We need imaginative ways of overcoming those restricted issues

# Mobile UI design

- The design goal of Mobile HCI is still the same
  - **designing for maximum usability**
- The Golden Rules of interaction design are still applicable
- Interaction design has a key role to play
  - But ... good interaction design for complex UI software itself relies on the substrate containing sophisticated software
- A model to help generate better user interfaces for the small displays present in mobile devices
  - consists of User Interface Design Components



# Golden rule of design

- Understand computers
  - limitations, capacities, tools, platforms
- Understand people
  - psychological, social aspects
  - human error
- Understand tasks
  - goals, constraints
- Understand user's interaction

# User interface design components

- Metaphors
  - the fundamental concepts the UI communicates
- Mental models
  - the ideas trying to be conveyed by the UI
- Navigation
  - movement through the mental models
- Interaction
  - areas where the user is allowed to have input into the system and output provided

# Discovering user's needs

- Follow user's through role play
- What current artifacts are they using?
  - e.g. a joystick, stylus, keyboard, etc.
- What is current HW/SW capability available?
  - e.g., on-board camera, motion sensor

# Input solutions

- Small physical keypad, on-board or attached keyboard

Twiddler



Virtual keyboard



# Input solutions (cont'd)

- Ease of navigation



# Input solutions (cont'd)

- Touch screen



# Alternative ways of input

## ■ Handwriting recognition

- ❑ solution as writing is natural and well learned
- ❑ better recognition rate
- ❑ fast training to learn a new alphabet or put up with errors
- ❑ sometimes, processor too slow for handwriting recognition

12345 67890 ↵  
12345 67890 ↵  
abc defg hijk lmnc  
abc defg hijk lmnc

# Alternative ways of input (cont'd)

- Speech recognition and synthesis
  - look natural choices for mobile interaction
  - problems
    - speaker dependent
    - domain dependent
    - recognition rates
    - noise environment
    - out-of-vocabulary words
    - cognitive burden





# Alternative ways of input (cont'd)

- Gestural interfaces
  - Micro-gestures
  - Device-based gestures
    - e.g. Apple's multi-touchpad
  - Embodied interaction
    - e.g., EyeToy (PlayStation 2)



# Alternative ways of input (cont'd)

## ■ Sensor

- ❑ tilted, gyro, acceleration sensors for orientation control
- ❑ camera sensor with computer vision
- ❑ mobile augmented reality (MAR)



Example of MAR



Wii



# Output solutions


- How can problems with output be solved?
  - ❑ sound output (speech and non-speech)
  - ❑ better display color, resolution
  - ❑ large document, small screen

# Output solutions (cont'd)

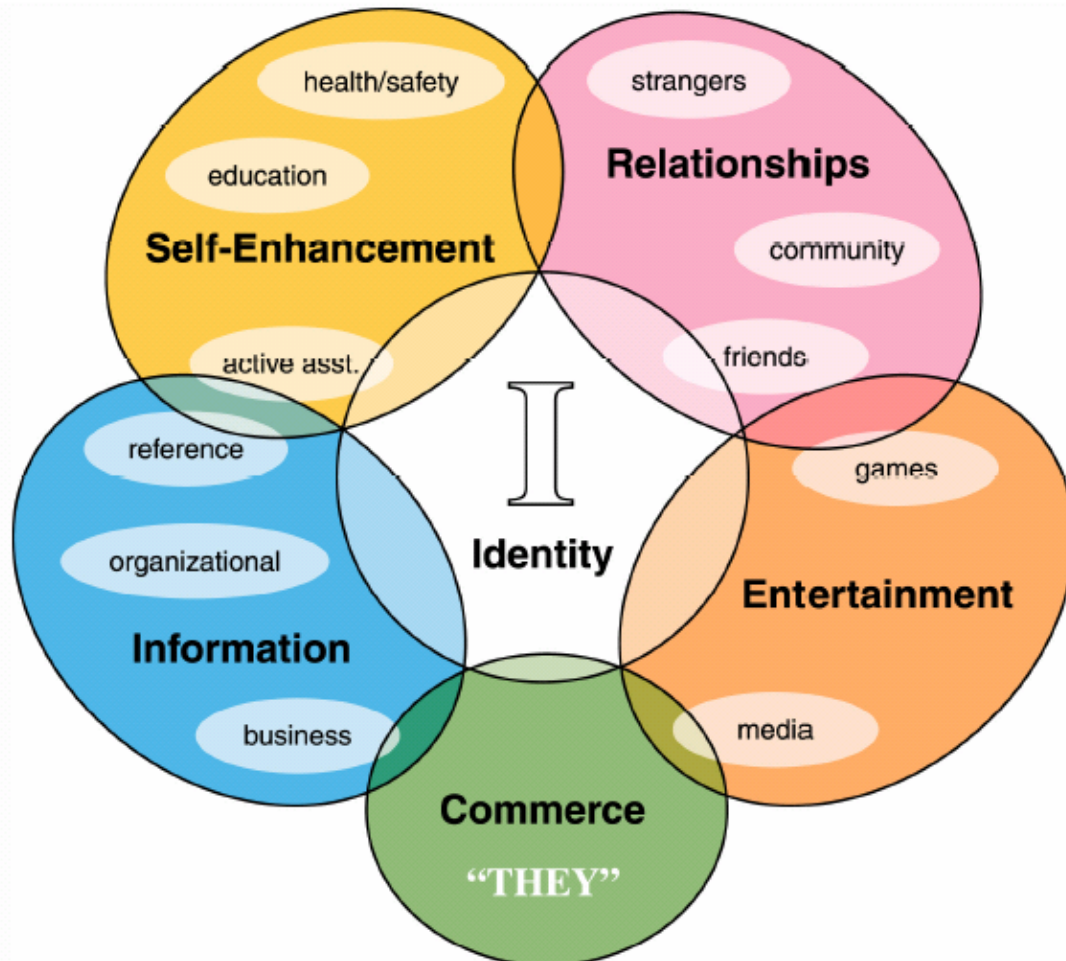
- Context-aware, location-based, activity-based computing
  - Take into account the user's state and surroundings
  - Enable the user's mobile computer or environment to adapt accordingly



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# Analytical framework for usage space



Source: American Center for Design, Re: Wireless, Mobile Device Design Seminar, 5 April 2002, Page 3  
The usage of a device is organized as illustrated. It helps to organize the complexity of the user's behavior.

# Information space

- The device's content of static reference information
- Examples
  - Contact information
  - Class schedule
  - Blood glucose history
  - Tasks/to-do list

# Self enhancement space

- How the device extends the user's normal capabilities
- Examples
  - Alarm clock program reminds you to be on time to meetings
  - Voice recording program allows you to take quick notes of forgetful things



# Relationships space

- How the device extends the user's relationship with others
  - beyond normal phone to phone conversation
- Examples
  - Community programs
    - chat with others in your area
  - Social networking



# Entertainment space

- How the device's programs give enjoyment and stress relief

- Examples

- ☐ Games
- ☐ Karaoke
- ☐ Music



# M-commerce space

- How the device extends the user's commercial capability
- From the business world to individual
- Examples
  - ❑ E-coupons if in nearby area of shop
  - ❑ Mobile banking
  - ❑ Trade stock



# Identity space


- How the device becomes a part of the identity of the user
- Over time the device gains knowledge about the user
- Remembering complex behavior patterns

→ Someday your mobile phone knows you more than you to yourself

# Summary: Mobile device usage spaces

- **Information space:** Static reference information
  - e.g. stock quotes, news
- **Self Enhancement space:** Extending one's abilities
  - e.g. memory/vocabulary builder, jogging monitor
- **Relationships space:** Allow extended social relationships
- **Entertainment space:** Enjoyment
  - e.g. games, music
- **Commerce space:** Services provided from business
  - e.g. e-coupons, electronic money
- **Identity space:** The device becomes aware of the user
  - e.g. wearable, invisible devices

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# Mobile operating systems

- Desktop OS is just ***too big*** for mobile computers
- Major Mobile OS's
  - ❑ Palm OS (Palm Computing)
  - ❑ BlackBerry OS (Research In Motion)
  - ❑ Windows CE / Windows Mobile (Microsoft)
  - ❑ iPhone OS (Apple Inc)
  - ❑ Android, open system (Google)
  - ❑ Symbian OS, open system (Symbian Ltd, Nokia)
  - ❑ Maemo OS, open system (Nokia)
  - ❑ MeeGO, open system (Intel, Nokia)

# The role of an OS

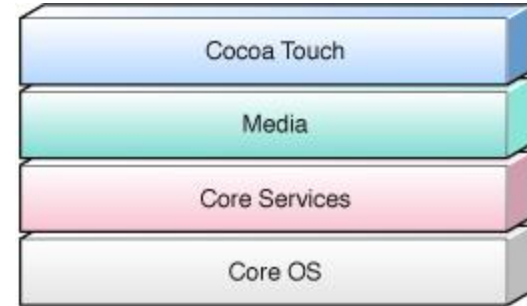
- Tame the underlying technological complexities
  - abstract out the “accidental differences”
- Allow myriad software components to co-exist & collaborate
  - Present-day components and future components
- Make it look simple
  - the end user should find it straightforward & natural
- A good OS works very hard on behalf of the user
  - even though the user is unaware of the OS



# Mobile platforms and tools

## ■ iOS

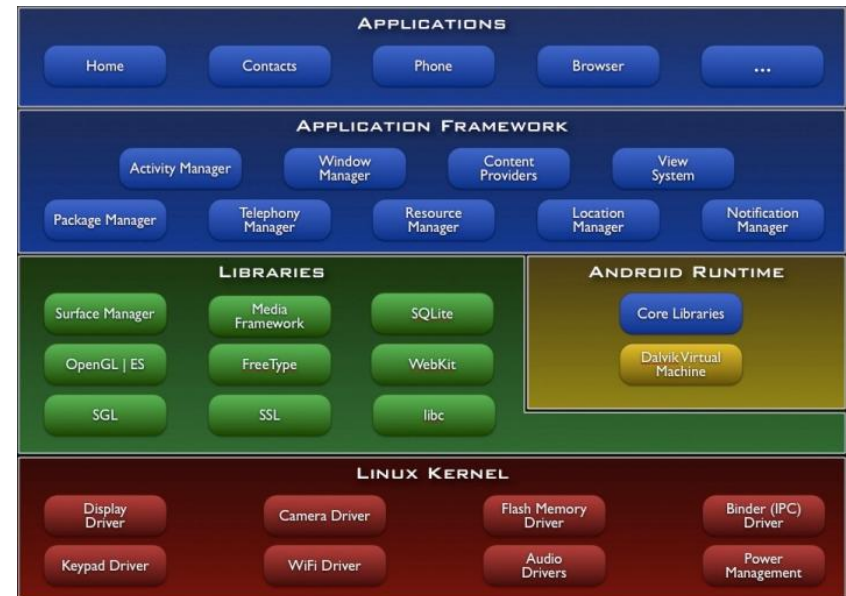
- ❑ Apple mobile platform
  - iPhone, iPod Touch, iPad
- ❑ Four layers
  - Core OS layer
  - Core services layer
  - Media layer
  - Cocoa touch layer
- ❑ Includes core applications
  - email, calendar, photos, camera..
- ❑ Xcode programming environment, SDKs



# Mobile platforms and tools (cont'd)

## ■ Android

- ❑ Google mobile platform
- ❑ A software stack for mobile devices
  - OS, middleware, tools, apps.
- ❑ Includes core applications
  - email, browser, maps, SMS
- ❑ Application Framework
  - Apps and GUI builder
- ❑ Linux kernel
- ❑ Java programming language



# Mobile platforms and tools (cont'd)

- Windows Mobile platform
  - ❑ Pocket PC, Windows CE, Window Mobile, Windows .NET
  - ❑ Windows GUI builder
    - integral components
  - ❑ Object oriented programming environment
    - VC++ IDE, .NET Compact Framework, SDKs, Emulator, Tools



# Mobile platforms and tools (cont'd)

- Platforms and tools for mobile development
  - [http://en.wikipedia.org/wiki/Mobile\\_Development](http://en.wikipedia.org/wiki/Mobile_Development)



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# UI Hall of Fame or Shame

- Nokia N700
  - Nice phone
  - But many errors
    - Stop while calling
    - Wifi connection slow
    - Built-in apps not stable
    - Messaging app allows you to send empty messages
  - Too small screen
    - 3.2 inch ~ 8 cm



# UI Hall of Fame or Shame

- Nokia N700 apps scroll bar and scrolling



scroll bar

Apps scroll up when you drag the scroll bar down (opposite direction)

But when you drag other areas down, apps scroll down (same direction)

If you click here, apps jump up causing unexpected result (you may think you want to drag apps)