UNIVERSITY OF SCIENCE
HO CHI MINH CITY

User Interface Design

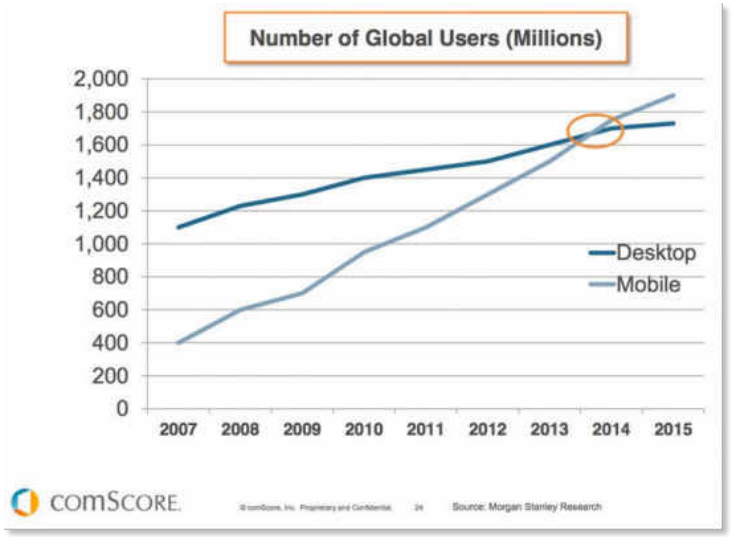
Mobile UI

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



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 computing

- Portability
- Miniaturization
- Connectivity
- Convergence
- Divergence
- Apps
- Digital Ecosystems

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 as compared to desktop
- Limited power consumption

→ We need imaginative ways of overcoming those restricted issues

Mobile UI design

- Design goal for Mobile HCI is still the same
  - **designing for maximum usability**
- UI design golden rules applicable
- UI design components

Golden rules of design

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

Understand users and tasks

- What features do users use?
- Where do they go?
- What actions do they take?
- When do they use?
- How much time do they spend on app?
- How much time do they spend on tasks?

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

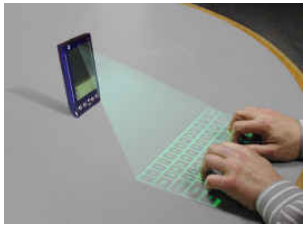
- Follow user's through role play
- What current artifacts are they using?
  - e.g. a joystick, stylus, keyboard, etc.
- What is current HW/SW capability available?
  - e.g., on-board camera, motion sensor

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

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
- Deep learning
- Technologies
  - Apple Siri, Amazon Alexa, Google Now

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
  - screen sizes
  - screen resolutions
- VR/AR
  - Virtual touch screens (VTS)
  - Metaverse
  - Products
    - MS HoloLens
    - Facebook's Oculus
    - Samsung's Gear VR

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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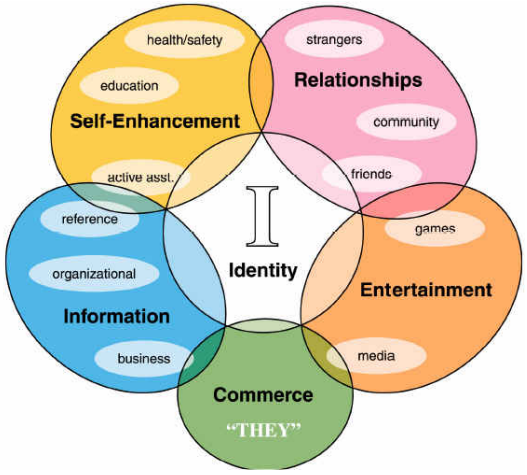
Analytical framework for usage space



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

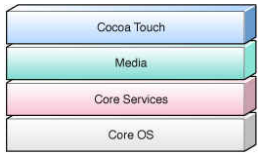
- Desktop OS is just ***too big*** for mobile computers
- Major Mobile OS's
  - Palm OS (Palm Computing)
  - BlackBerry OS (Research In Motion)
  - Windows CE / Windows Mobile (Microsoft)
  - iPhone OS (Apple Inc)
  - Android, open system (Google)
  - Symbian OS, open system (Symbian Ltd, Nokia)
  -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

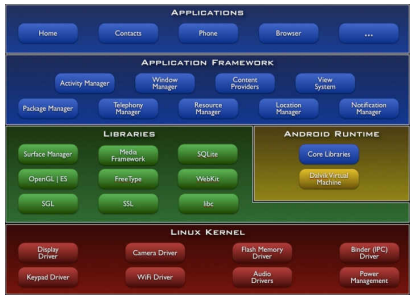
Mobile platforms and tools

- 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

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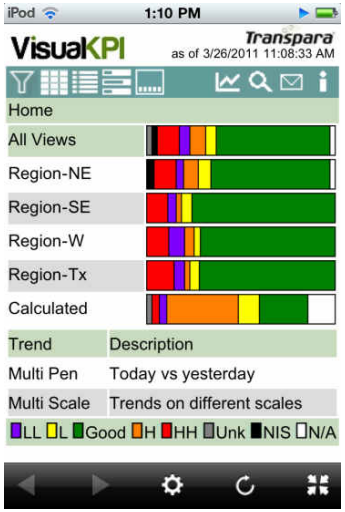
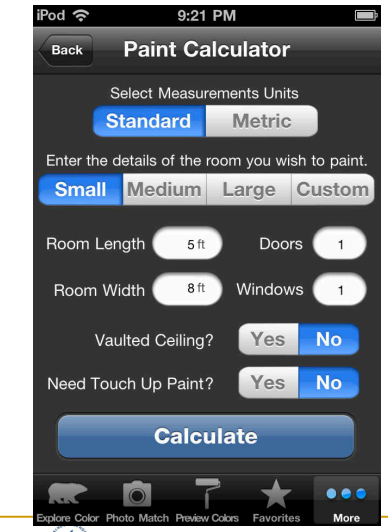
UI Hall of Fame or Shame

- Visual KPI



Source:
http://theresaneil.wordpress.com/2011/08/22/bad-mobile-apps-ui-design-gone-wrong/

Hall of Fame or Shame



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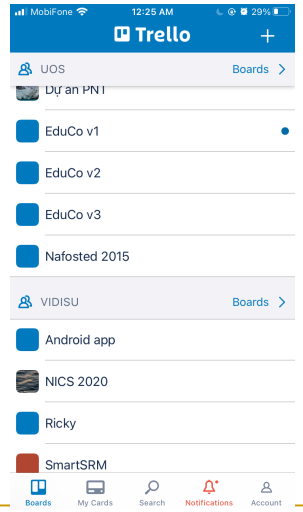

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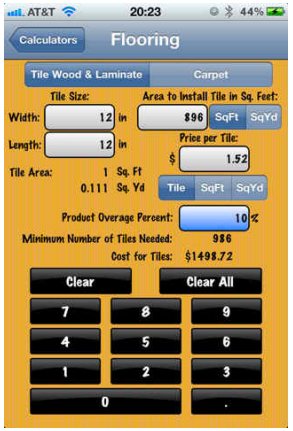

Hall of Fame or Shame