GUI's and Keyboards

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User Interface Goal

- Convey and gather information from user
- Support a set of standard actions and outputs
- Graphical User Interfaces have been well studied and used
  - Must understand them before generalizing
    - Pervasive computing uses many types of user interfaces
- A web page is an example of a GUI
  - Why is there a need for anything else?
  - Because of historical and efficiency reasons
  - Want more direct and richer variety of interface

User Interface Goal II

"As interfaces become easier to use, they become harder to create" [Meyers 1994]

- Do you agree?
  - KISS: Keep It Simple
  - It takes a lot of hard work to make things look simple
- What user interfaces do you like?
  - iPod, Tivo, ...
- Microsoft Windows 2000 have dynamic pulldown menus
  - Does anyone like them? why not?

KISS: Keep it simple

- Goal is for user to not think about how to do something; it should be automatic:
  - If there is a choice, then one must think
    - movie theaters offer very limited choice of candy
    - supermarkets offer huge variety of soft drinks -- what is difference?
  - Save file via menu, keyboard, icon, rightclick, ...
  - One mouse button simpler than three
  - Pay a lot of money for large screen, why waste it on rarely used menu bar

KISS: Keep it simple

- People do not think about repetitive actions
  - "Do you really want to delete file?"
    - after third time, people usually click OK without thinking
- Lots of research on design principles
  - and it is often ignored :(

Manipulation

- Indirect Manipulation
  - E.g. program places graphic objects on screen
  - Nothing is "clickable"
  - Today it feels awkward to use keys on mobile phone to manipulate objects on screen.
    - Everything used to be that way.
- Direct Manipulation of Objects
  - User directly manipulates Graphical Objects with mouse or keyboard
  - "Tangible User Interface" of the future, users will manipulate physical objects with their hands

Widgets

- For lack of natural term, GUI objects are Widgets
- Everything in a GUI is a widget
- Widget is picture displayed on screen that is under control of the GUI.
- Widgets are hierarchical: they contain other widgets. Examples are:
  - Window frame, radio button, scroll bar, menu, ..
- GUI's support certain types of pictures
  - others types must be converted

Big Idea: Abstraction

- "Any problem in computer programming can be solved by adding a level of abstraction"
- "Performance can be improved in programs by removing a level of abstraction"
- Indirection used to support abstraction

Non-widgets

- A GUI is a level of abstraction between user and program, hence it affects performance
- Graphical Computer Games demand high performance for realistic animations
  - They directly manipulate the screen, mouse, keyboard
- Audio not part of GUI
  - Duh. OK, but not part of window system either
  - Could do it by assigning a “channel” to each application and have user select the channel as in a radio

Mice

- Mouse is clicked inside of window or widget
  - e.g.: controls standard widgets: drag a slider, twist a dial, scroll up or down -- all ways to enter a number
- Major innovation: mouse cursor changes sprite as moves between widgets
  - Real world analogy: frog looks different on a lilly pad and in the pond, car looks same in drive- & park- way
- Mouse is part of GUI, but not multiple mice
  - New need arising from wireless mouse and from pda or cell phone as “mouse”
  - Perhaps we need different sprites per user?

Mice II

- Mouse actions:
  - Click is two actions: “button down” and “button up”
  - Movement is relative: “delta x, delta y” events
  - Drag: move while button is down
  - Wheel: “Button D” or “Button U” events
- One button mouse easier to handle
- Multiple button mouse requires training
  - people have been successfully trained already
- Mouse acceleration big success.
  - Are there other applications of acceleration?

Touch Screens

- Not exactly the same as a mouse
- Click: no button down or button up
  - dwell: leave finger in same location
  - double click hard to hit same pixel twice in a row
- Movement: absolute, no consistent origin
  - top left, or bottom right can be (0,0)
- Drag: very difficult, need “modal” command
  - modes are considered harmful, e.g. shift lock is bad
- Wheel: perhaps use some gesture?
- Not easy to simply replace mouse with touch

Keyboards

- It seems simple, precise, and nothing new
- One hand typing --
  - my idea: double keypress -- means mirror key
    - “aa” means “;;” “ss” means “ll” & “gg” means “hh”
    - I needed it when I sat with a baby in my lap
  - there exist other one hand keyboards:
    - twiddler (chording keyboard)
    - half keyboard
  - Telephone pad keyboard: 1-2, 2-3, 1-4, 1-4-2-5, 2-5
- Keyboard entry not exact
  - on-screen keyboard
    - a “G” could be an “f”, “t”, “h”, or “b”
  - Cellphone keyboard
    - a “G” could be a “4” or “H” or “I”

Dasher

- go to www.finference.phy.cam.ac.uk/dasher

Expressive Typing

- Writing with a pen on paper does more than express words:
  - it is a picture & conveys non-verbal expression
- Use the intercharacter typing speed to vary either the font or the inter-character spacing or vertical alignment

GUI Programming

- Embed in code
  - Java AWT, Python TCL,TK
  - Very hard to code, debug, maintain and modify
- Use GUI builder, e.g. Visual Basic
  - rapid prototype
  - reliable
  - consistency across applications
  - easier to implement “help” and “undo”
  - easier to port

Glade (for linux, x-windows)

- Three layers:
  - user application, user GUI, window system
  - we care about first two, glade deals with GUI
- Application separate from GUI
  - Interface is via “callbacks”
  - Each widget has a set of standard interfaces
- see http://glade.gnome.org/index.html