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?

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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

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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?

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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"

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Dasher

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

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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

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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