The Nature of HCI

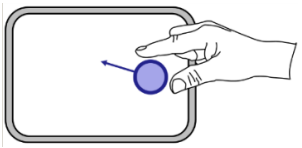
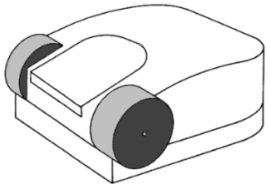
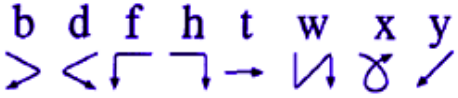
HCI

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. [ACM SIGCHI definition, 1996]

HCI Research

- Research precedes products
- Consider…
  - Two-finger gestures (Apple iPhone, 2007)
  - Acceleration-sensing (Nintendo Wiimote, 2005)
  - Wheel mouse (Microsoft Intellimouse, 1996)
  - Single-stroke text input (Palm's Graffiti, 1995)
- Were these ideas born out of engineering or design brilliance? Not really…

HCI Research

- Two-finger gestures: ~~2007?~~  1978 [1]
- Acceleration-sensing: ~~2005?~~  1998 [2]
- Wheel mouse: ~~1996?~~  1993 [3]
- Single-stroke text input: ~~1995?~~ 

1993[4]

[1] Herot, C. F., & Weinzapfel, G. (1978). One-point touch input of vector information for computer displays. *Proc SIGGRAPH '78*, 210-216, New York: ACM.
[2] Harrison, B., Fishkin, K. P., Gujar, A., Mochon, C., & Want, R. (1998). Squeeze me, hold me, tilt me! An exploration of manipulative user interfaces. *Proc CHI '98*, 17-24, New York: ACM.
[3] Venolia, D. (1993). Facile 3D manipulation. *Proc CHI '93*, 31-36, New York: ACM.
[4] Goldberg, D., & Richardson, C. (1993). Touch-typing with a stylus. *Proc CHI '93*, 80-87, New York: ACM.

Inherent conflicts in HCI

- HCI is complex
- There often is not one optimal solution
- There are trade-offs and multiple stakeholders with conflicting goals
    - Users prefer consistency over change
    - Often, there is a trade-off between usability and security (the highest ease of use would be with no security, which isn't possible)
    - HCI research can be hard to cost-justify

Basic Design principles

- Generalizable abstractions for thinking about different aspects of design
- The do's and don'ts of interaction design
- What to provide and what not to provide at the interface
- Derived from a mix of theory-based knowledge, experience and common-sense

Visibility

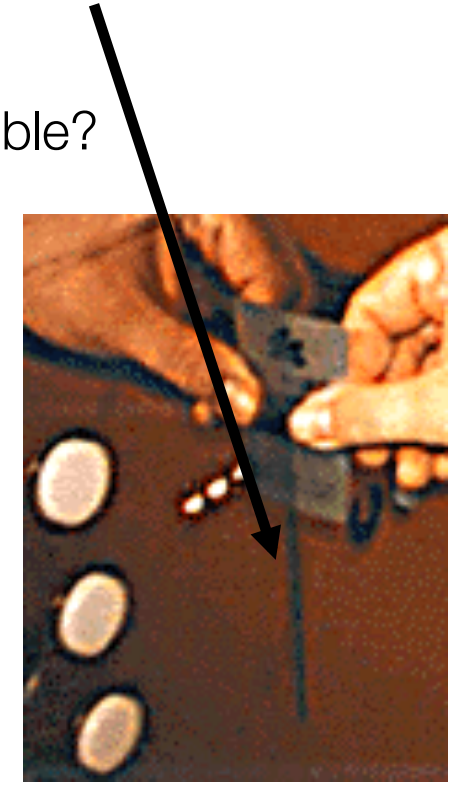
- This is a control panel for an elevator
- How does it work?
- Push a button for the floor you want?

- Nothing happens. Push any other button? Still nothing. What do you need to do?
- It is not visible as to what to do!

From: www.baddesigns.com

Visibility

- …you need to insert your room card in the slot by the buttons to get the elevator to work!
- How would you make this action more visible?
- Make the card reader more obvious
- Provide an auditory message, that says what to do (which language?)
- Provide a big label next to the card reader that flashes when someone enters
- Make relevant parts visible
- Make what has to be done obvious



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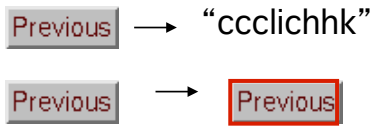
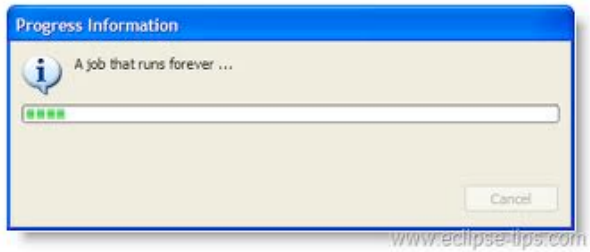
Feedback

- Sending information back to the user about what has been done
- Includes sound, highlighting, animation and combinations of these
  - E.g. when screen button clicked on provides sound or red highlight feedback:





Constraints

- Restricting the possible actions that can be performed
- Helps prevent user from selecting incorrect options
- Physical objects can be designed to constrain things
  - E.g. only one way you can insert a key into a lock

Constraints

- Where do you plug the mouse?
- Where do you plug the keyboard?
- Top or bottom connector?
- Do the colour coded icons help?

From: www.baddesigns.com

Constraints

- Provides direct adjacent mapping between icon and connector

- Provides colour coding to associate the connectors with the labels

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Consistency

- Design interfaces to have similar operations and use similar elements for similar tasks
- For example:
  - Always use ctrl key plus first initial of the command for an operation – ctrl+C, ctrl+S, ctrl+O
- Main benefit is consistent interfaces are easier to learn and use

Consistency

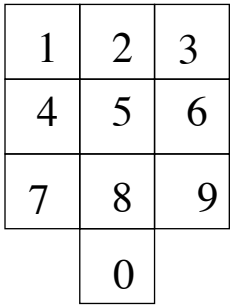
- **Internal consistency** refers to designing operations to behave the same within an application
  - Difficult to achieve with complex interfaces

- **External consistency** refers to designing operations, interfaces, etc., to be the same across applications and devices
  - Very rarely the case, based on different designer's preference

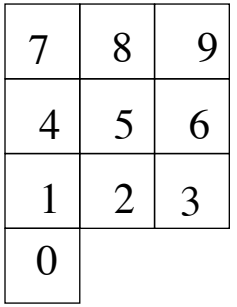
Consistency

- A case of external inconsistency

(a) phones, remote controls



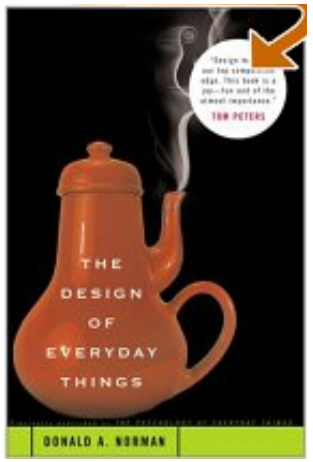
(b) calculators, computer keypad



Affordances

Affordances

- Refers to an attribute of an object that allows people to know how to use it (give a clue)
  - E.g. a mouse button invites pushing, a door handle affords pulling



- Norman (1988) used the term to discuss the design of everyday objects
- Since has been much popularized in interaction design to discuss how to design interface objects
  - E.g. scrollbars to afford moving up and down, icons to afford clicking on

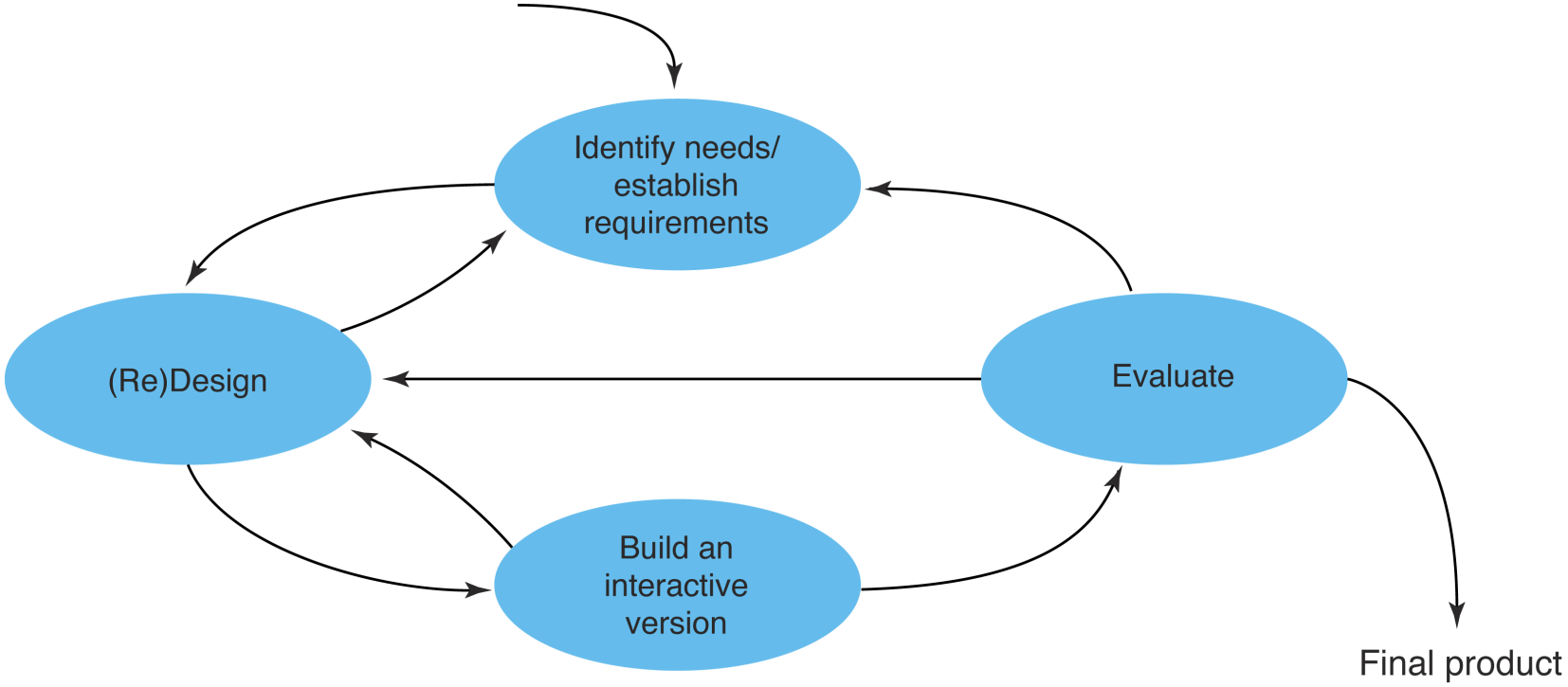
User-Centered Design

- User-centered approach is based on:
  - Early focus on users and tasks: directly studying cognitive, behavioural, anthropomorphic & attitudinal characteristics
  - Empirical measurement: users' reactions and performance to scenarios, manuals, simulations & prototypes are observed, recorded and analysed
  - Iterative design: when problems are found in user testing, fix them and carry out more tests

Four basic activities

- There are four basic activities in Interaction Design:
  - Identifying needs and establishing requirements
  - Developing alternative designs
  - Building interactive versions of the designs
  - Evaluating designs

Interaction design model



Exemplifies a user-centered design approach

Project Components

1. Background research
2. Conceptual model
3. Users needs & requirements
4. Design alternatives
5. Final working prototype
6. Evaluation/usability
7. Results and recommendations