

Human Factors

Human Factors

We take a closer look at the human factors that affect how people interact with computers and software:

Physiology

- physical make-up, capabilities

Cognition

- thinking, reasoning, problem-solving, memory

Perception

- how a person perceives what input they get through their senses



Preece et al, Chapter 3, 4, 5
Shneiderman, Chapter 5, 8

Human Factors

In order to design, it is important to understand the capabilities and limitations of those we are designing for.

Key point from this lecture:

- Users share common capabilities, but are individuals with differences which should not be ignored.

Handy slogan:

- Design for the *majority*, design for the *minority*

Physiology

Human physiology often affects the design of devices, by applying constraints. For example, are games controllers for children or adults? Men or women? Keyboard keys are limited by finger size.

How small can a keyboard be?

- Smaller machines must use different input facilities.



Physiology

Particular HCI factors to consider:

- Left or right-handed?
- Reaction times
- Movement
- Loss of usual facilities - disabilities

Reaction Times

Human reaction times:

- Audio signal - 150ms
- Visual signal - 200ms
- Pain - 700ms

Examples of use:

- Design of video games
- Double-click feature on mice

Movement

Speed of accuracy of movement important for interactive systems.

Examples:

- Mouse - keyboard movement (affects choice of which controls operate which actions of the system)
- Time taken to move to a target on screen (Fitts' Law)
- Accuracy required to select target
 - E.g. Large buttons on calculators
- Careful arrangement of menu items so that frequent choices are placed first

Disabilities

Designers must design so that disabled users can achieve maximum functionality and usability from computer systems e.g. Java Accessibility API allows keyboard navigation (full mouseless controls)

Also devices to assist disabled users:

- Speech input and output systems (useful for blind people and those with severe motor impairment)
- Keyboard pressing devices
- Eye movement detection devices

Stephen Hawking

- Has motor neurone disease
- Confined to a wheelchair, unable to talk
- Speech synthesizer and word processor controlled using a single switch
- Uses every known technique to speed up text input!



Cognition

Cognition - the processes by which we become acquainted with things, how we gain knowledge.

Involves understanding, remembering, reasoning, attending, awareness, acquiring skills, creating new ideas.

The HCI objective is to understand the interaction between humans and computers in terms of how knowledge is transmitted between the two. Cognitive psychology underpins this understanding.



Preece, Ch 3

Attention

Focused attention

- our ability to concentrate on one event from a mass of competing stimuli

Divided attention

- attending to more than one thing at a time

Interface designers need to focus attention on the right place:

- Structured information
- Information grouped into meaningful parts
- Amount of information presented not too much/little

Memory

Different forms of human memory:

- Sensory store
- Short-term memory (working memory)
- Permanent long-term memory

Memory is limited

- eg approx 7 ± 2 new things can be remembered for about 20 seconds in short-term memory

Human memory very versatile

- music and lyrics
- where are my car keys?
- fingers remembering password

Memory

Features appropriate to memory constraints:

- Use of graphical interfaces substantially reduces memory needed
- Material is far more easily recognized than recalled

Be consistent with the user's mental model - use meaningful interfaces:

- command names and icons should be selected carefully

What is meaningfulness?

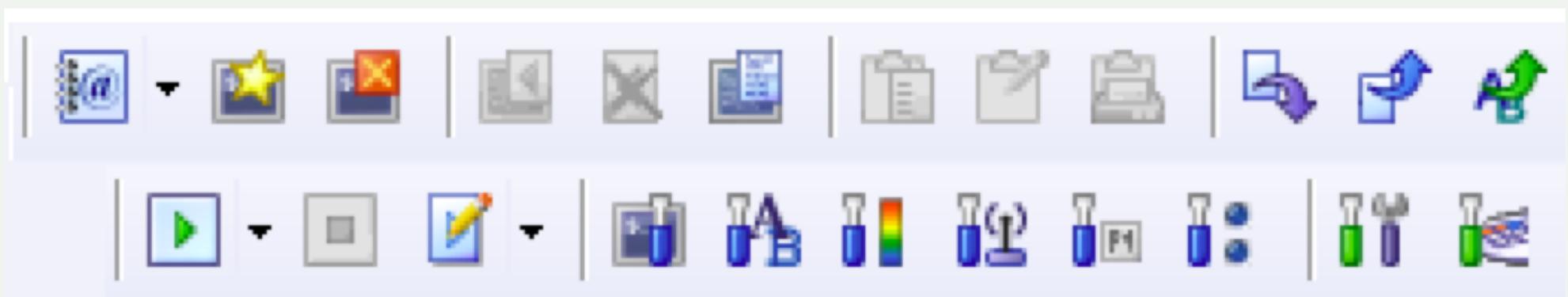
- Context in which used
- Task for which it is being used
- Form of the representation (icon?)
- Underlying concept being represented

Example 1: Icons (bad)

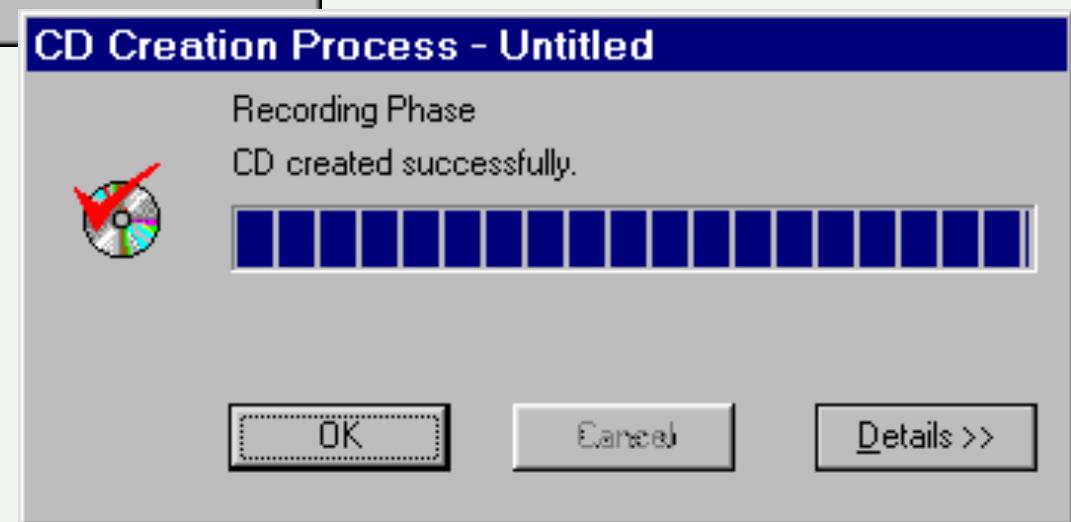
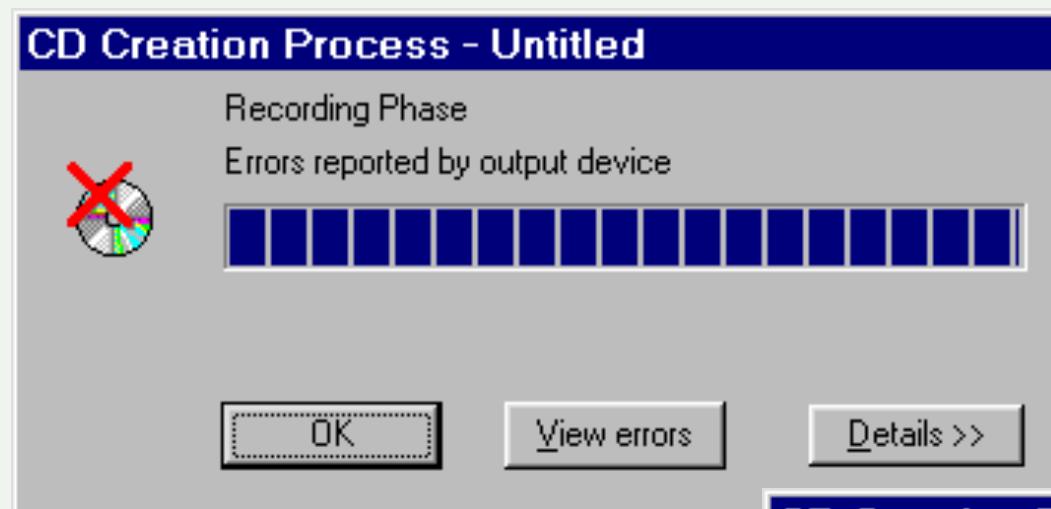


Zoc (a communications application):

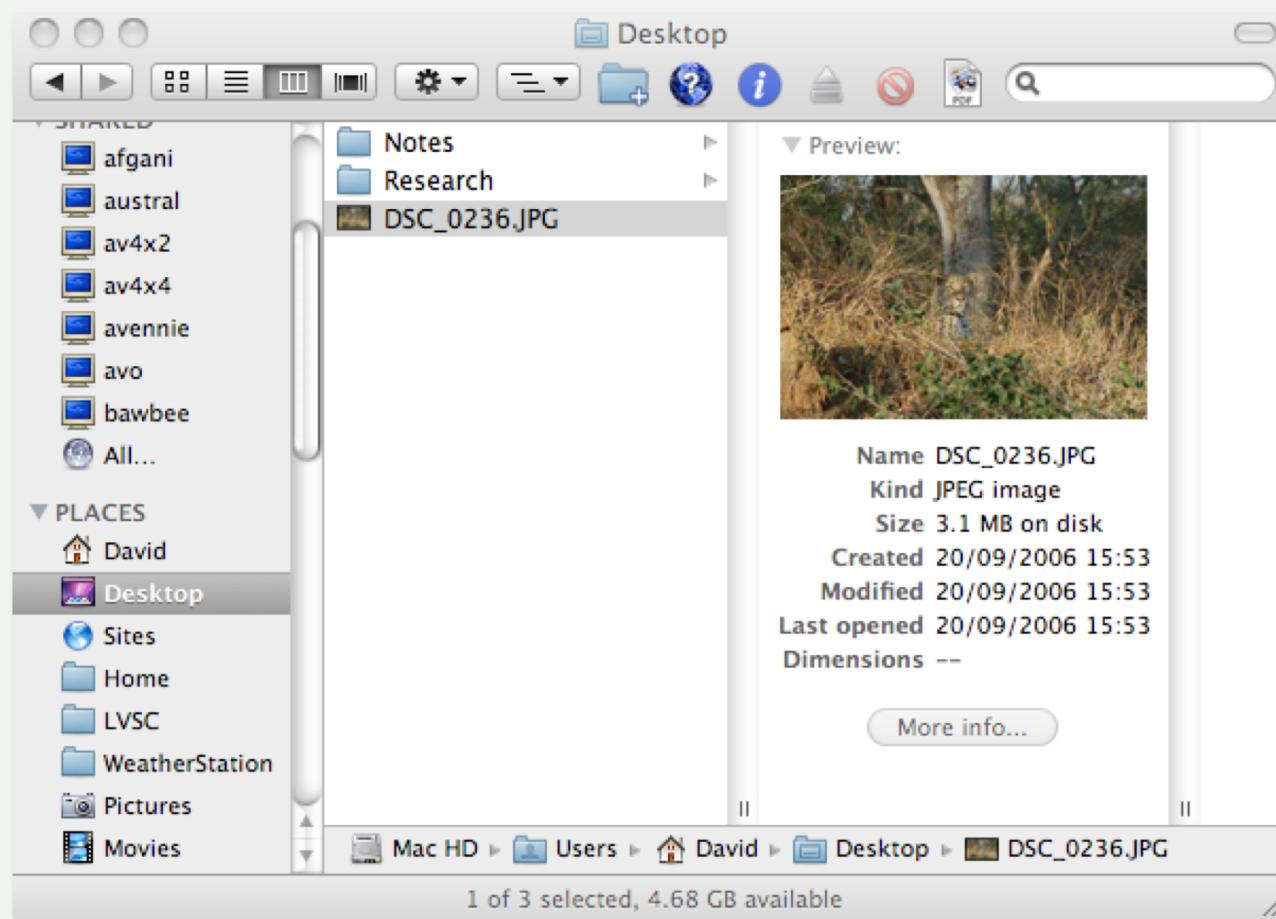
- Send
- Send without carriage returns
- Send with quotes



Example 2: Easy CD Writer (bad)



Example 3: Document Preview



Perception

Input from the different senses

- Auditory Perception
- Haptic (Touch) Perception
- Visual Perception
- Taste and smell - not currently used widely in computing

We need to understand how the input information is perceived by humans, and what difference this makes to us when considering good HCI

Auditory Perception

Sound is rarely used to its full potential in interface design.
Uses of non-speech sounds include the following:

- Attention attracting
 - eg to an emergency situation that the user should respond to
- Status information
 - eg quiet background noise can monitor the progression of a file downloading
- Confirmation sound associated with an action,
 - eg file deletion

More in sound section of the course...



Dix Section 1.2.2

Preece Section 12.4

Haptic Perception

Less important than sight or hearing, but crucial

Three main types of touch receptors

- Thermoreceptors (temperature)
- Nociceptors (intense pressure, heat, pain)
- Mechanoreceptors (pressure)

Simple tasks like picking up objects are made very difficult without the feedback from touch receptors!



Dix Section 1.2.3

Haptic Perception

As far as use in computing design goes...

Touch is an important source of feedback when using devices:

- Pressing buttons
- Using keyboard (dots on the 'f' and 'j' keys)
- Hand-held devices (even your smartphone)

For users with other senses impaired, touch may be a vital additional source of information (eg braille)

Visual Perception

Three main aspects:

- Size/depth
- Brightness
- Colour

All these factors affect the graphical design of interfaces.
(See design guidelines earlier in course)

Perception of Size/Depth

Our two eyes give us 3D vision, but we can see in 3D even with one eye closed.

In order for us to perceive the 3D world, some very powerful constraints must be placed on our interpretation of 2D images.

These same constraints are responsible for many illusions, which deliberately go against these constraints.

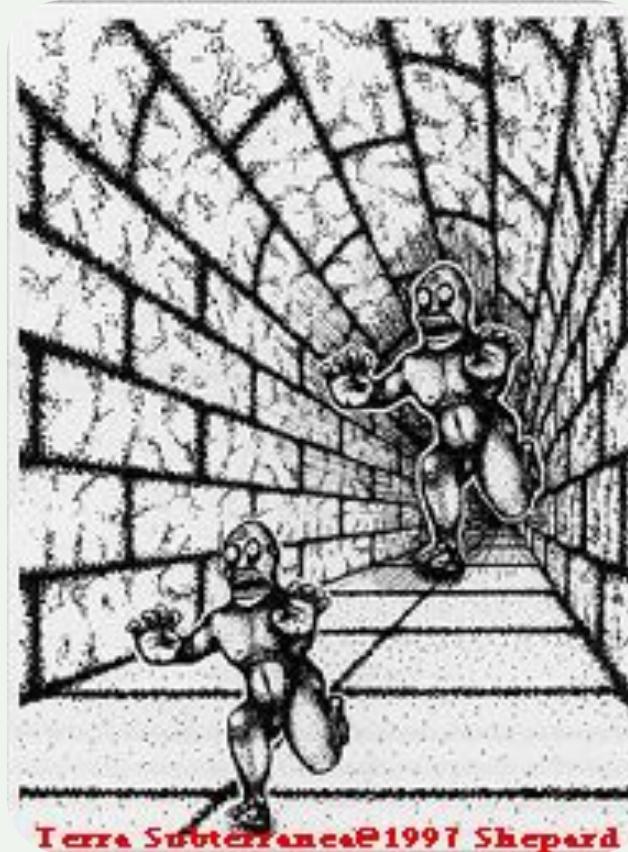
Illusions are very good for revealing the interpretations we place on visual information.

Perception of Size/Depth

These same automatic interpretations are responsible for many illusions.

- Illusions are very good for revealing the interpretations we place on visual information.
- Links on the Canvas resources page for optical illusions

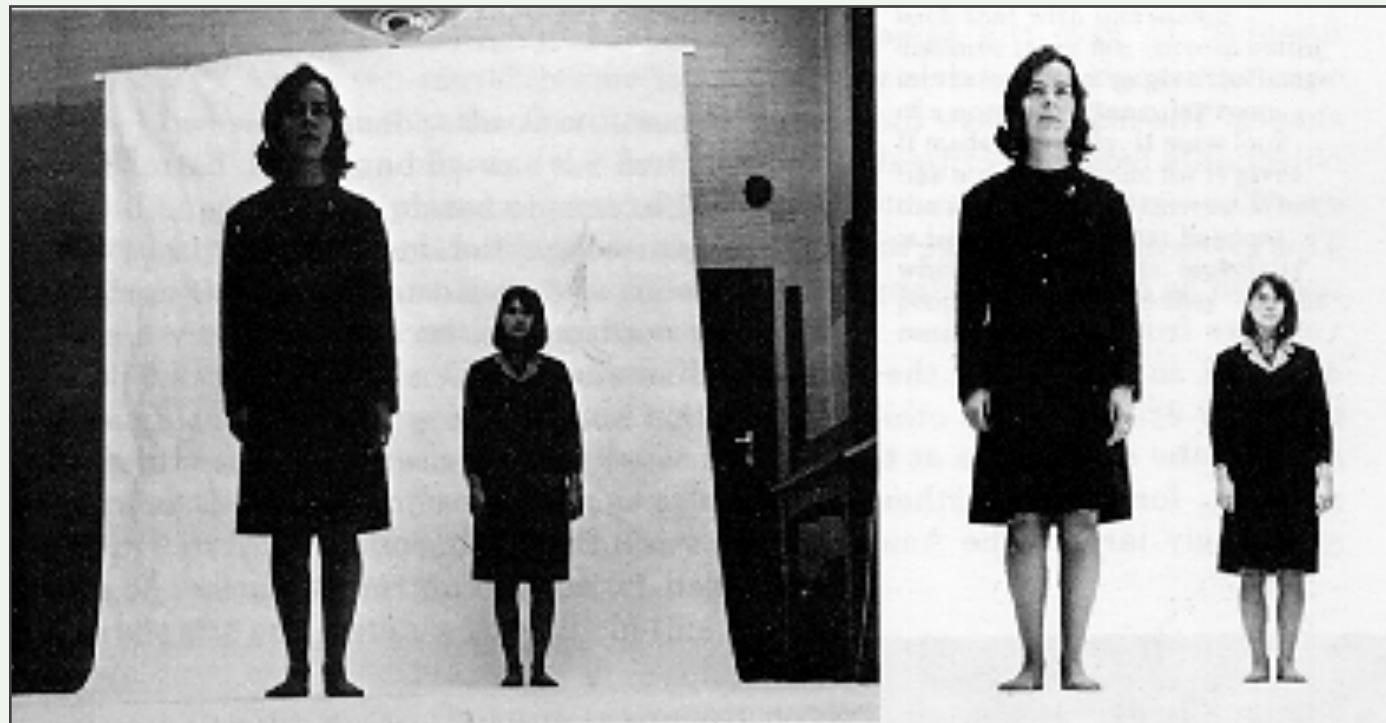
Size/Depth Perception



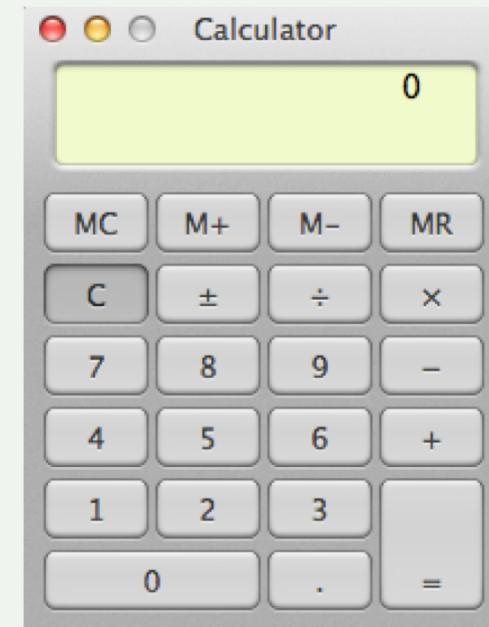
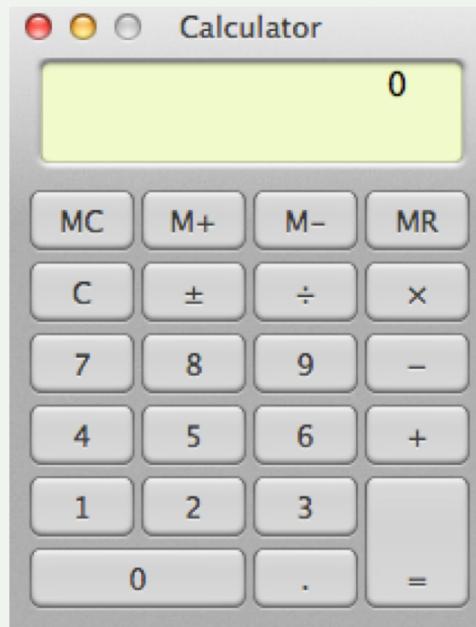
Ames Room



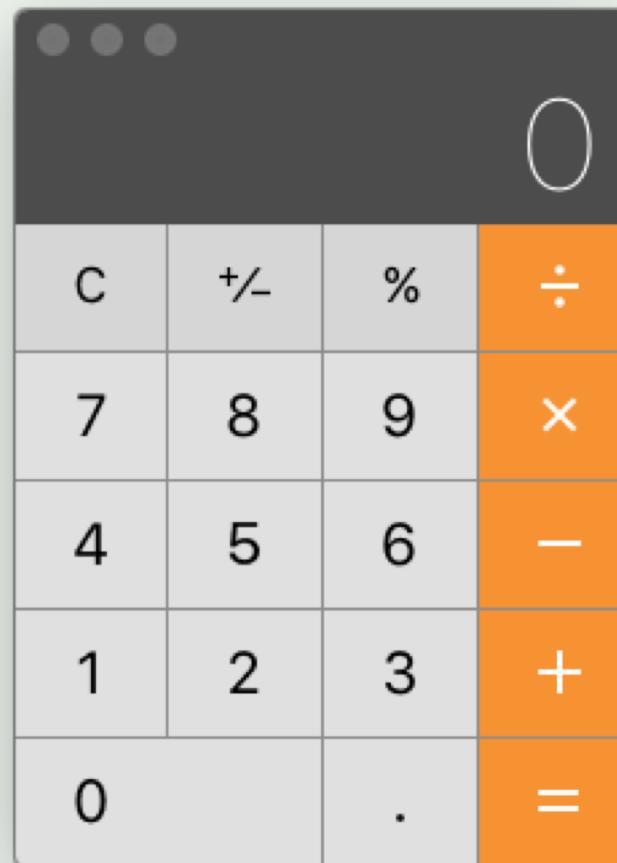
Depth Perception



Visual Perception: Shadows & Highlights



Depth?



Visual Perception

Size/Depth

- Brightness
- Colour

Colour perception is now where we start to leave HCI, and meander into Graphics...

Gamification

Use of game-design elements and game principles in non-game contexts.

Such as? Levels, rewards, reputation, tasks and competitions, leader boards, progress bars, ...

Why? to improve user engagement in a wide variety of settings.

Eg? Learning, loyalty programmes, exercise, nutrition, marketing, crowdsourcing, employee engagement

End of Lecture

What questions do you have?