Questions?
Understanding Users

Understanding the user is critical to the success of any interactive system.

Two components:

1. Needs with respect to specific system being designed (e.g., expertise, tasks, procedures, context-of-use)
2. Fundamental human characteristics (e.g., vision, memory, cognition)
The Human

Unfortunately, there is no simple model to describe humans

A simplified view involves:

- Input/output
- Memory
- Processing (cognition, problem solving, learning, etc...)
The Human

Information i/o: perception
  visual, auditory, haptic (input)
  movement, voice (output)

Information stored in memory
  sensory, short-term, long-term

Information processed and applied
  cognition, problem solving, skill, error

Emotion/environment influence human capabilities

Each person is different
I/O: What is Perception?

Processing of sensory information in order to see, hear, taste, smell, or feel objects in the world

Vision most dominant form of perception

Understanding perceptual phenomenon important for proper visual designs

Impacts a number of design issues including:
- What elements are easily distinguishable
- What draws attention
Good Design?
Good Design?
Vision

Two stages in vision

1. Physical reception of stimulus
2. Processing and interpretation of stimulus
   Size and depth
   Color
   Patterns
The Eye: Physical Reception

Sensing begins at the retina, which has two type of sensors

Cones
Used to detect colour

Rods
Primarily for night vision & perceiving movement
Sense intensity or shades of gray
The Eye: Physical Reception

Center of retina (fovea) has the highest concentration of cones

IMPLICATION:
allows for high acuity of objects focused at center

Rods are mostly located in the periphery

IMPLICATION:
We are sensitive to motion in the periphery
Interpreting the Signal: Size and Depth

*Visual angle* indicates how much of the view the object occupies (relates to size and distance from eye)

*Visual acuity* is ability to perceive detail (limited)

Familiar objects perceived as constant size – law of *size constancy* (in spite of changes in visual angle when far away)

Cues like overlapping help perception of size and depth
Color Components – HSI Model

Color has three components

**Hue** is the property of the wavelength of light (i.e. color) such as red or yellow

**Intensity** is the amount of white or black in a color. Some hues are inherently lighter or darker

**Saturation** is the strength or purity of the hue in a color. The higher the saturation, the purer the color, i.e. red is more saturated than pink
Interpreting the signal - colour

Colour can improve user interfaces

Inappropriate use of colour can be detrimental

Seeing color depends on:
  the nature of light
  the interaction of light and matter
  the physiology of human vision
Interpreting the signal - colour

Process:

Light source (emitting a distribution of coloured wavelengths of light) strikes a coloured object

Object reflects light in another particular distribution of coloured wavelengths → received by the photoreceptors of the human eye

Sent as a stimulus to the brain, causing us to perceive colour
Interpreting the Signal -- Colour

Cones are responsible for colour processing:

- 3 types: red, green, blue
- Each is sensitive to a different band in the spectrum
- Other colors are perceived by combining stimulation

![Graph showing sensitivity vs wavelength with peaks at 430 nm, 530 nm, and 560 nm]
Colour: Sensitivity

Cones are unequally distributed (approx: 64% red, 32% green, 4% blue)

Center of retina (high acuity) has no blue cones

IMPLICATION: Disappearance of small blue objects you fixate on

Most sensitive to the center of the color spectrum

IMPLICATION: blues & reds must be brighter than greens & yellows

Shapes are detected by finding and contrasting edges

IMPLICATION: hard to deal with blue edges and shapes
Interpreting the signal - colour (sensitivity)

Focus:

Different wavelengths of light focus at different distances behind eye’s lens

i.e. red appears closer than blue (chromostereopsis)

Difficult to focus because one color is fuzzy when the other is in focus

Need for constant refocusing

IMPLICATION: Careful about color combinations
Interpreting the signal – colour

As we age:

- Lens becomes yellow:
- Absorbs the shorter wavelengths
- Sensitivity to blue is reduced

IMPLICATION: don’t rely on blue for text or small objects with aging populations
Colours Deficiency
(or colour-blindness)

Approximately 8% of human males, along with a rare sprinkling of females, have some form of colour blindness.

Most common is known as red/green colour blindness.
Ishihara Test for Colour Blindness
Use of Colour

Colour is an extremely valuable tool in design

But when using colour, we also need to exercise caution

- Cannot detect colour differences in the periphery
- Certain colours more easily detectable (e.g., blue has low sensitivity)
- Need to design for colour blindness
Use of Colour

If you use color in the interface, should also use clear, secondary cues to convey the information for those with deficiencies

Grey scale differentiation

Different graphics/labels associated with each colour
Use of Colour

People have emotional responses to color. E.g.,

- Red regarded as a "hot" color that provokes aggression
- Blues are cool and relaxing
- White suggests purity

There are also cultural differences

Examples?
Contrast

Useful for drawing attention, viewing detailed information

The larger the items, the less contrast needed

Examples of high contrast:
- Black on white
- Dark green on white
- White on purple

Examples of low contrast:
- Yellow on white
- Blue on black
Contrast

There are a number of tools available to test whether colour combinations provide sufficient contrast:

E.g., http://webaim.org/resources/contrastchecker/
Interpreting the signal – Patterns

Higher-level visual system capable of perceiving forms and patterns

Contrast help define object borders

Gestalt principles

Set of principles describing how our mind perceives wholes out of incomplete elements

Extremely useful in creating structure in an interface
Gestalt Principles of Perception

Proximity

Similarity

Continuity

Closure

Area

Symmetry
Proximity

Items that are closer together will appear to belong together as compared to items that are further away.
Similarity

Items that share basic visual characteristics will be seen as belonging together.

Basic characteristics include:
- Size
- Color
- Texture
- Orientation
Continuity

Visual system prefers continuous figures
Closure

We tend to see complete figures even when part of the information is missing.

Visual system will “fill in” the holes.
Area

The smaller of two overlapping figures is perceived as *figure* while the larger is regarded as *ground*.

*Figure*: element that is interpreted as object of interest

*Ground*: area on which figure rests
Symmetry

The greater the symmetry, the more we see relationships and ascribe meaning to the composition

Symmetrical, unconnected elements are integrated into one coherent object
Gestalt Principles

IMPLICATIONS - application for screen design:

Symmetry: objects should be laid out symmetrically if possible

Proximity: place items that are related close to one another.

   Distinguish between different groups by using whitespace

Similarity: use similar features on items if they are related, i.e. make all required fields on your forms stand out by using bold or underline
Both convey groupings, but the one on the right is much cleaner

Which design guideline does the one on the right implement?
Gestalt Principles Applied

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<th>Duration</th>
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### Gestalt Principles Applied

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Gestalt Principles Applied
Vision: Review

Humans perceive, store and process information
Vision is our dominant form of perception
Cones are responsible for colour vision
  Most colour processing happens at the fovea
  Some colours are more easily perceived than others
Rods are located in the periphery
  Can function are low levels of illumination
  Responsible for motion detection
Contrast helps with fine detail, border detection and to draw attention
Responses to colour are governed by individual differences (e.g., emotions, age, culture, colour blindness)
Gestalt principles help convey structure