UNIT – II
UNDERSTANDING THE HUMAN

Introduction

- The human - central character in any discussion of interactive systems
- The human, the *user*, is the one whom computer systems are designed to assist
- The requirements of the user should therefore be our first priority
- In this chapter we will look at areas of human psychology coming under the general banner of *cognitive psychology*

Input - Output Channels

- A person’s interaction with the outside world occurs through information being received and sent: input and output
- In an interaction with computer, user receives information that is output by computer and responds by providing input to computer
- User’s output become computer’s input and vice versa

Input - Output Channels

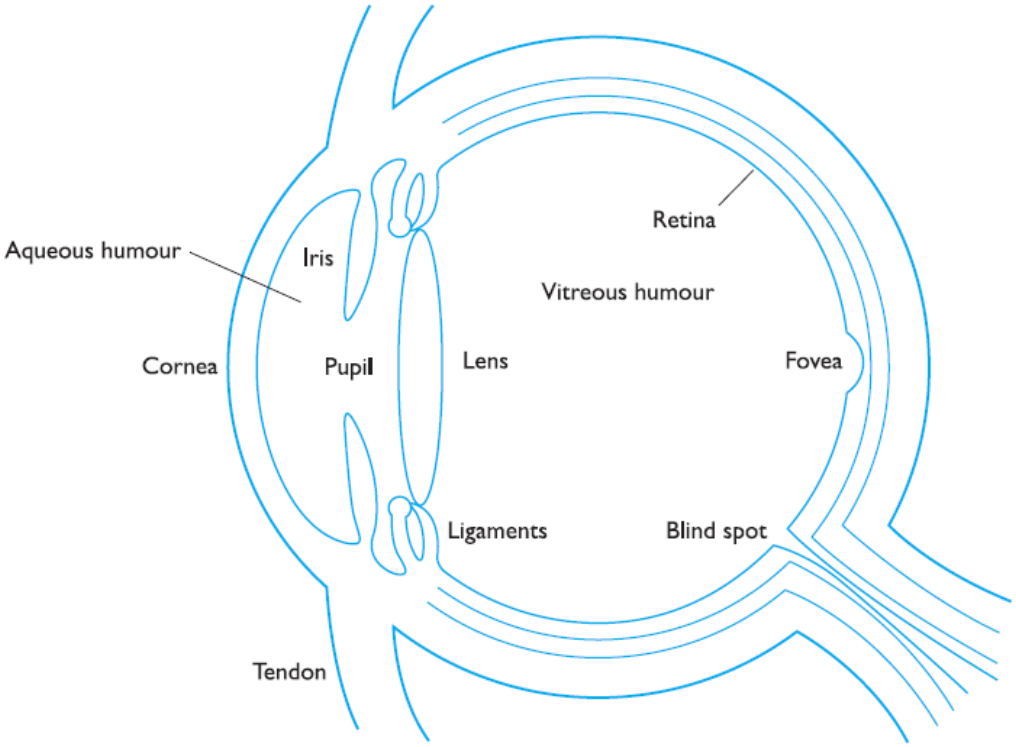
- Input in human occurs mainly through the senses
- Output through the motor control of the effectors
- There are five major senses: sight, hearing, touch, taste and smell
- Out of these, first three are most important to HCI
- Similarly there are number of effectors, including the limbs, fingers, eyes, head and vocal system
- In the interaction with computer, fingers play primary role, through typing or mouse control

VISION

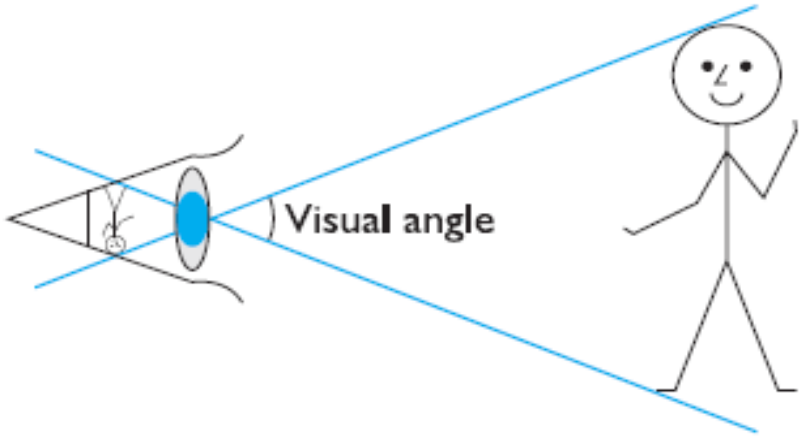
- Human vision is a highly complex activity but it is the primary source of information for the person
- Visual perception can be divided into two stages:
  - Physical reception of stimulus from the outside world
  - Processing and interpretation of that stimulus
- Vision begins with light
- Eye is a mechanism for receiving light and transforming it into electrical energy

VISION – Human Eye

- Light is reflected from objects and their image is focused upside down on the back of the eye

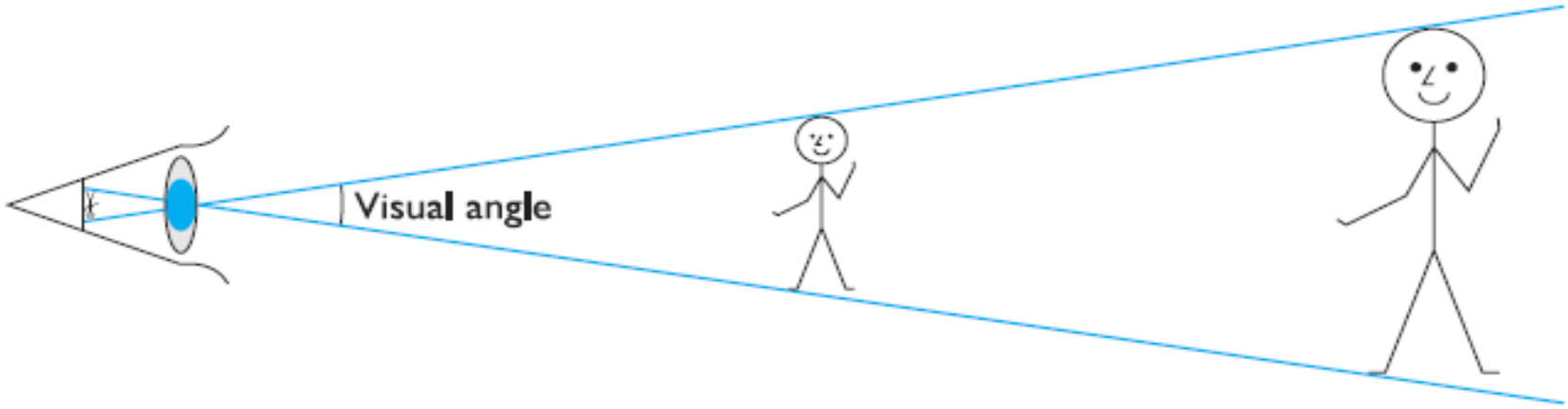


VISION – Human Eye



Objects of the same size at different distances have different visual angles

Objects of different sizes and different distances may have the same visual angle



HEARING – Human Ear

- As vision begins with light, hearing begins with vibrations in the air or *sound waves*
- Ear receives these vibrations and transmits them through various stages to the auditory nerves
- Ear comprises three sections
  - Outer Ear
  - Middle Ear
  - Inner Ear

HEARING – Human Ear

- Outer ear is the visible part of the ear
- It has two parts
  - Pinna - Structure that is attached to the sides of head
  - Auditory Canal – Structure in which sound waves are passed to the middle ear
- Middle ear is a small cavity connected to the outer ear by the *tympanic membrane* or ear drum and to the inner ear by the *cochlea*
- Sound is changes or vibrations in air pressure

HEARING – Human Ear

- It has a number of characteristics
- Pitch - frequency of the sound
- Low frequency produces a low pitch as well as for high
- Loudness is proportional to amplitude of the sound; the frequency remains constant
- Human ear can hear frequencies from 20 Hz to 15 kHz
- Auditory system performs some filtering of sounds received, allowing us to ignore background noise and concentrate on important information

HEARING – Human Ear

- Sound can convey notable amount of information
- Rarely used in interface design, usually as warning sounds and notifications
- Exception is multimedia which may include music, voice commentary and sound effects

TOUCH - Haptic Perception

- Less important than sight or hearing
- Provides vital information about environment
- Experience of users of *virtual reality* games
- Skin contains three types of sensory receptor:
  - *Thermoreceptors* respond to heat and cold
  - *Nociceptors* respond to intense pressure, heat and pain
  - *Mechanoreceptors* respond to pressure, concerned in relation with HCI

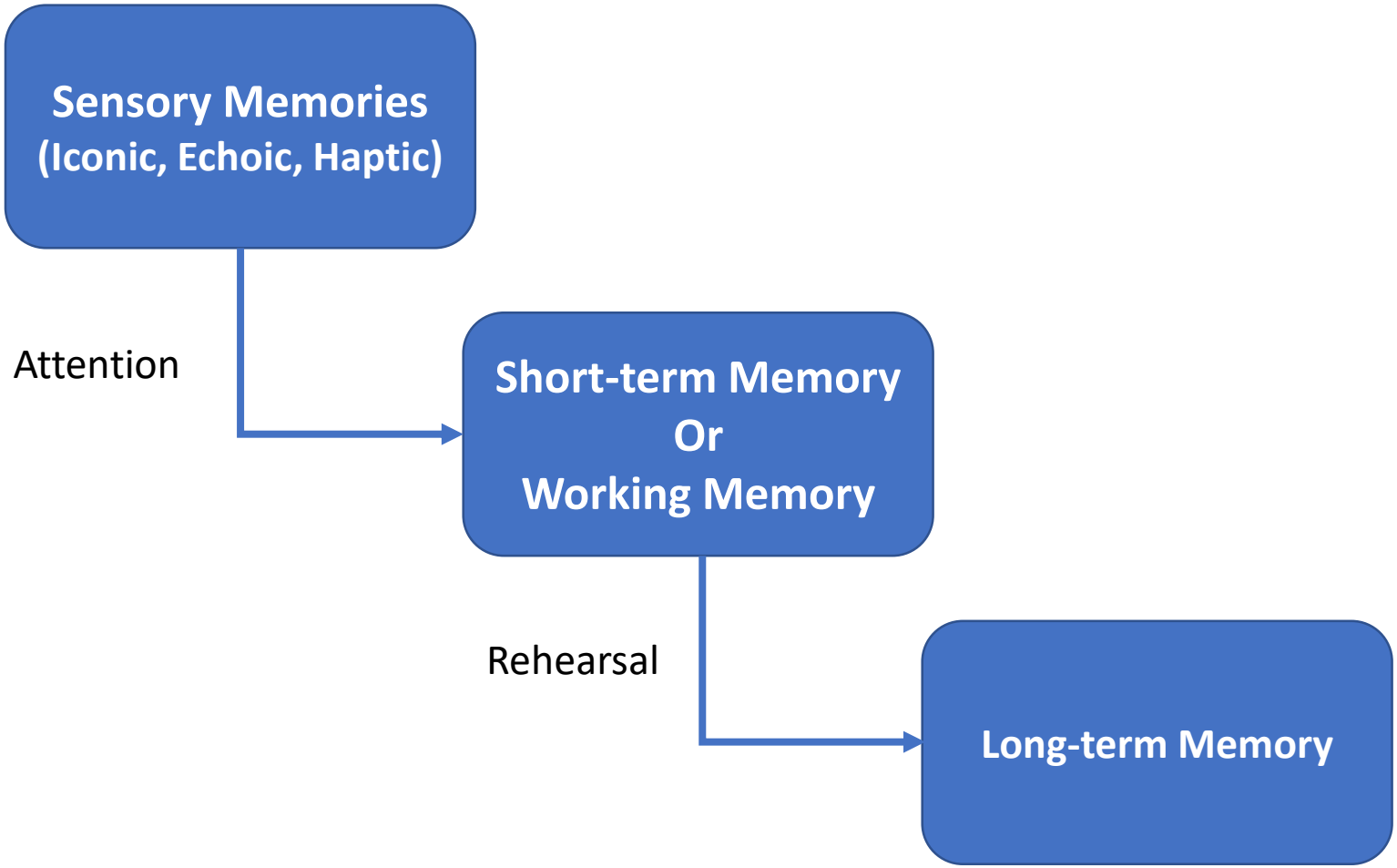
TOUCH - Haptic Perception

- Two kinds of mechanoreceptor which respond to different types of pressure
- *Rapidly adapting mechanoreceptors* respond to immediate pressure as the skin is indented
- Also react more quickly with increased pressure
- However, they stop responding if continuous pressure is applied
- *Slowly adapting mechanoreceptors* respond to continuously applied pressure

Human Memory

- Have you ever played the memory game?
- Such games rely on our ability to store and retrieve information
- This is the job of our memory system
- Much of our everyday activity relies on memory
- As well as storing all our factual knowledge, our memory contains our knowledge of actions or procedures

Human Memory



Sensory Memory

- Act as buffers for stimuli received through senses
- Exists for each sensory channel
  - *Iconic Memory* for Visual Stimuli
  - *Echoic Memory* for Aural Stimuli
  - *Haptic Memory* for Touch
- These memories are constantly overwritten by new information coming in on these channels
- Information is passed from sensory memory into short-term memory by attention

Sensory Memory

- Attention is the concentration of the mind on one out of a number of competing stimuli or thoughts
- It is clear that we are able to focus our attention selectively
- This is due to the limited capacity of our sensory and mental processes
- If we did not selectively attend to the stimuli coming into our senses, we would be overloaded

Short-term Memory

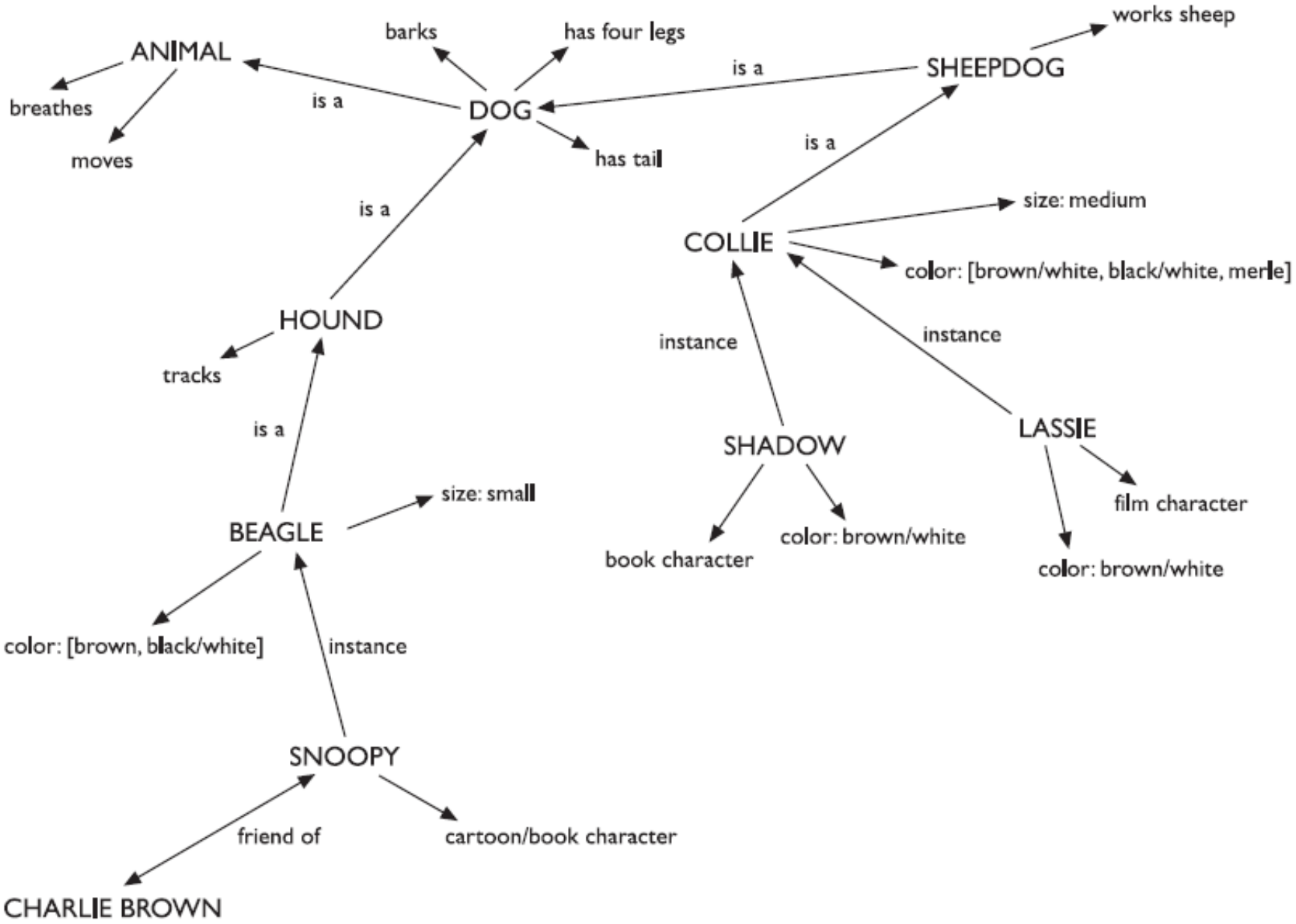
- Acts as ‘scratch-pad’ for temporary recall of info
- Used to store information which is only required quickly
- Can be accessed rapidly, in the order of 70 ms
- Also decays rapidly means information can only be held there temporarily in the order of 200 ms
- Also has limited capacity

Long-term Memory

- If short-term memory is our working memory, long-term memory is our main resource
- Store factual information, experiential knowledge, procedural rules of behavior i.e. everything that we ‘know’
- Differs from short-term memory in number of significant ways
  - Huge capacity
  - Relatively slow access time of approx. tenth of a second
  - Forgetting occurs more slowly in long-term memory

Long-term Memory

- Information is placed from working memory through rehearsal
- Two types of long-term memory
  - Episodic Memory - Represents our memory of events and experiences in serial form
  - Semantic Memory - structured record of facts, concepts and skills that we have acquired


ANIMAL
breathes
moves
is a
barks
has four legs
DOG
has tail
is a
SHEEPDOG
works sheep
is a
COLLIE
size: medium
color: [brown/white, black/white, merle]
is a
HOUND
tracks
is a
BEAGLE
size: small
color: [brown, black/white]
instance
SNOOPY
friend of
cartoon/book character
CHARLIE BROWN
instance
SHADOW
book character
color: brown/white
instance
LASSIE
film character
color: brown/white

Human Emotions

- Till now we saw about human perceptual and cognitive abilities
- But human experience is more complex than this
- Our emotional response to situations affects how we perform
- For example, positive emotions enable us to think more creatively to solve complex problems
- Whereas negative emotion pushes us into narrow, focused thinking

Human Emotions

- Problem may be easy to solve when we are relaxed, will become difficult if we are frustrated or afraid
- So what are the implications of this for design?
- In situations of stress, people will be less able to cope with complex problem solving or managing difficult interfaces
- Whereas if people are relaxed they will be more forgiving of limitations in the design
- This doesn’t give an excuse to design bad interfaces

Individual Differences

- Till now we discussed humans in general
- Made the assumption that everyone has similar capabilities and limitations
- And can therefore make generalizations
- To an extent this is true: psychological principles and properties apply to the majority of people
- But all users are not same
- Should be aware of individual differences during designs

Individual Differences

- Differences may be long term such as gender, physical capabilities and intellectual capabilities
- And shorter term that include the effect of stress or weakness on user
- These differences should be taken into account in our designs

Psychology and Design

- We saw how humans receive, process and store information, solve problems and acquire skill
- In order to apply psychological principle in design, we need to understand its context in both terms,
  - Where it fits in the wider field of psychology
  - Details of the actual experiments
- Fortunately, principles and results from research in psychology have been refined into
  - Guidelines for Design
  - Models to Support Design
  - Techniques for Evaluating Design