# Human Computer Interfacing
# CSE - 476

## Introduction

Lecture # 2

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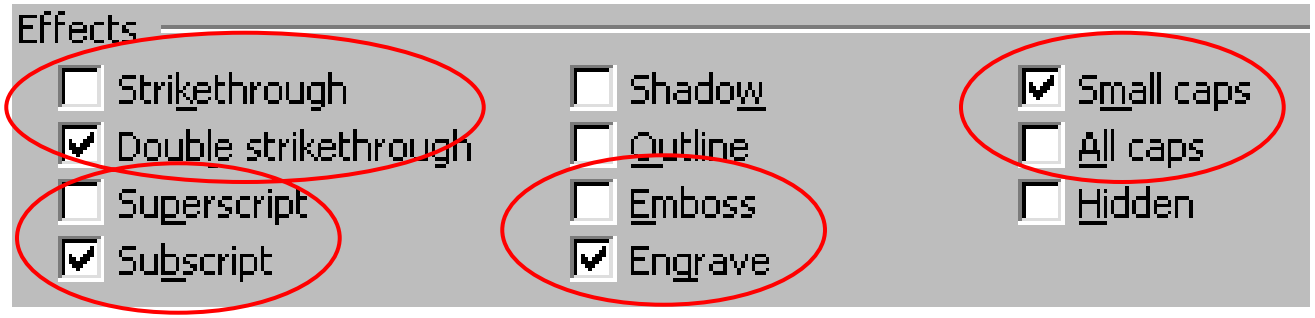
# Today's Interface Hall of Shame

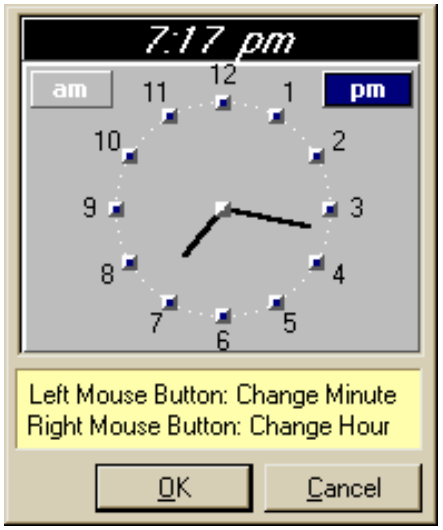
- Where does it come from?




- Microsoft Word
- Problem?
  - Four pairs of mutually exclusive options
  - Check boxes?

# Today's Interface Hall of Shame

- Software *Automate Pro*
- Interface: Entering schedule time for an event


- How would you enter the time?
- Click on Set time
- Use the special clock control

# Today's Interface Hall of Fame

- Useful solution to a very common problem

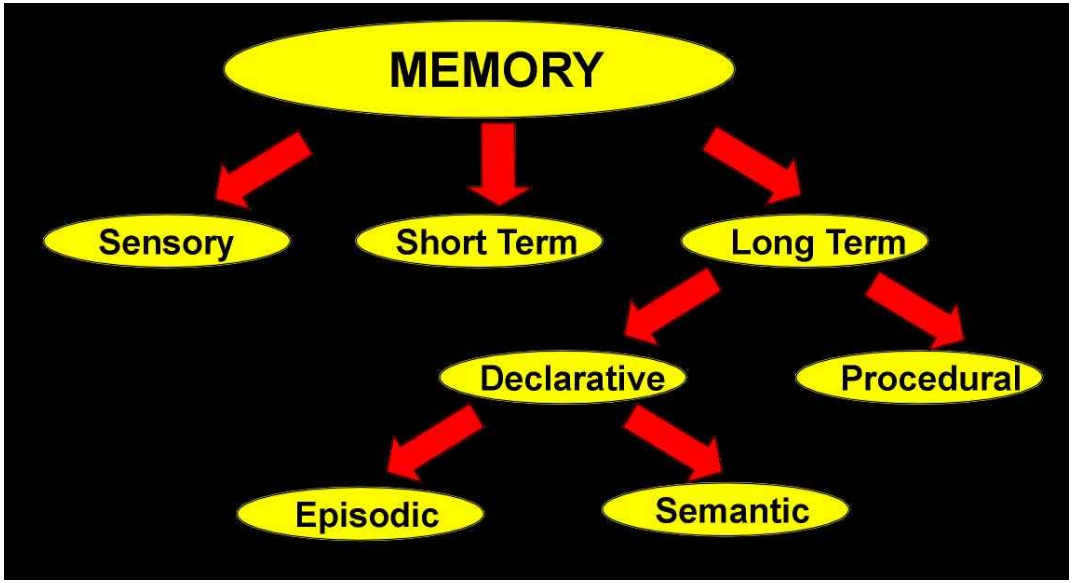

- Indicating that the state of the Caps Lock key may interfere with the processing of the password is a good idea

# Lecture Contents

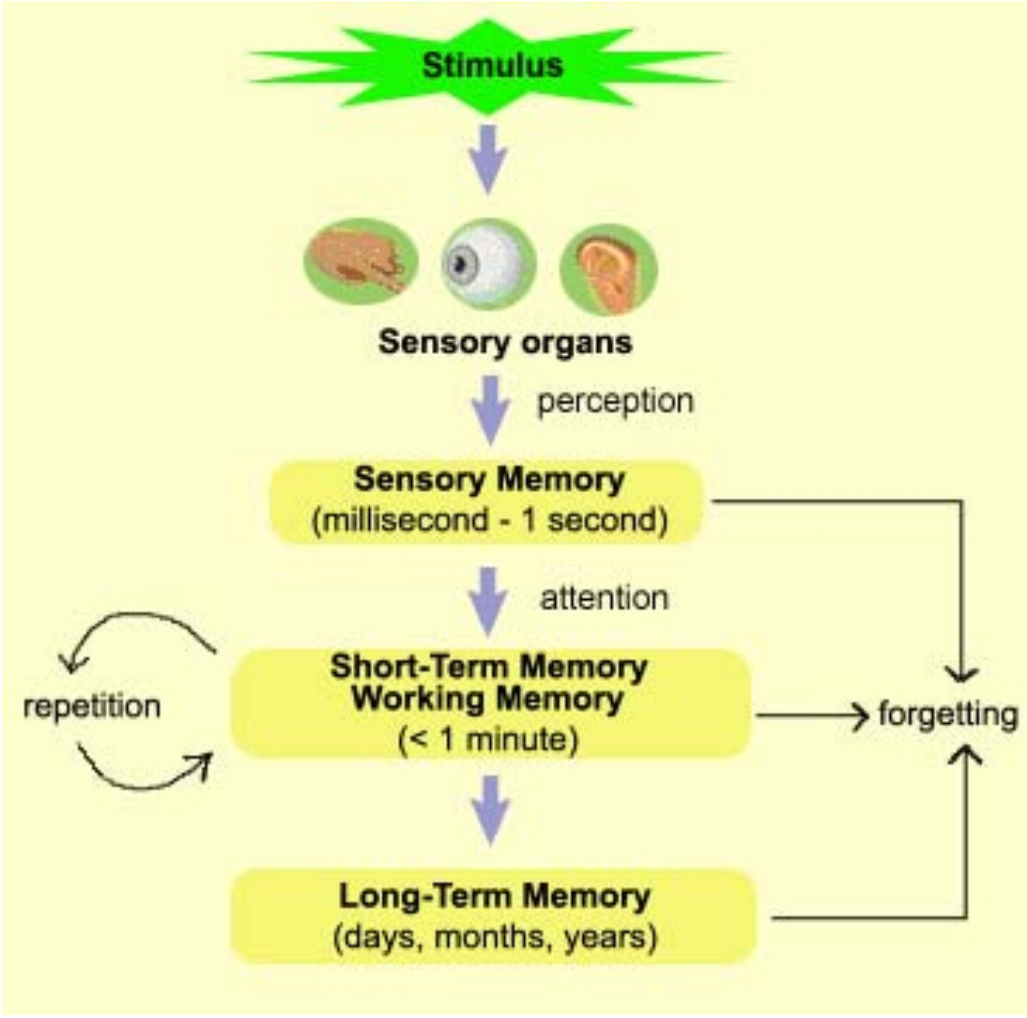
- Introduction
- Human
  - Input/Output Channels
  - Human Memory
  - Thinking

# Human Memory

- There are three types of memory functions
  - Sensory Memory
  - Short-term or working memory
  - Long-term memory



# Human Memory



# Sensory Memory

- Buffers for stimuli received through senses
  - Iconic memory: visual stimuli
  - Echoic memory: aural stimuli
  - Haptic memory: tactile stimuli
- Continuously overwritten
- From Sensory to Working memory
  - Attention: Concentration of mind on one out of a number of competing stimuli or thoughts
  - Example: Cocktail party phenomenon

# Short Term Memory

- Temporary recall of information
  - Reading a sentence, Performing an arithmetic operation etc.
  - Rapid access
  - Rapid decay
  - Limited capacity: 7± 2 chunks
  - Examples

212348278493202

00 44 112 245 8920

**Chunking Information can increase short term memory**

**Pattern Abstraction**

# Short Term Memory

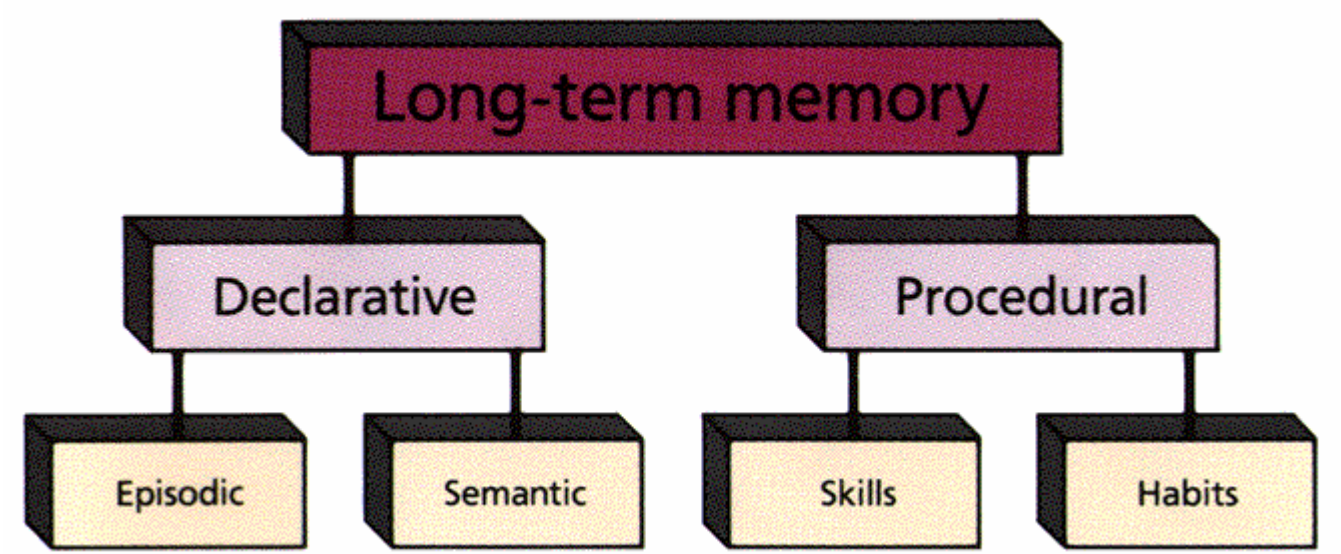
- Closure
  - Desire to complete or close the task in short term memory
- ATM Cash Machine
  - Closure
  - Flush out STM
  - Card/Cash ???

# Short Term Memory

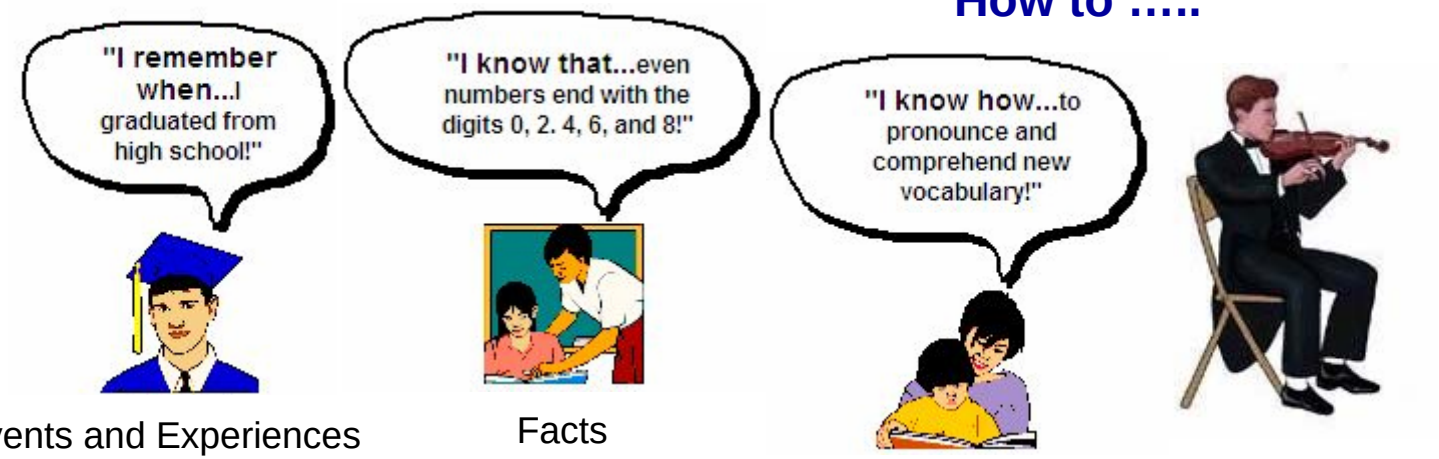
# Long Term Memory

- Repository for all our knowledge
  - Slow access ~ 1/10 second
  - Slow decay, if any
  - Huge or unlimited capacity

# Long Term Memory



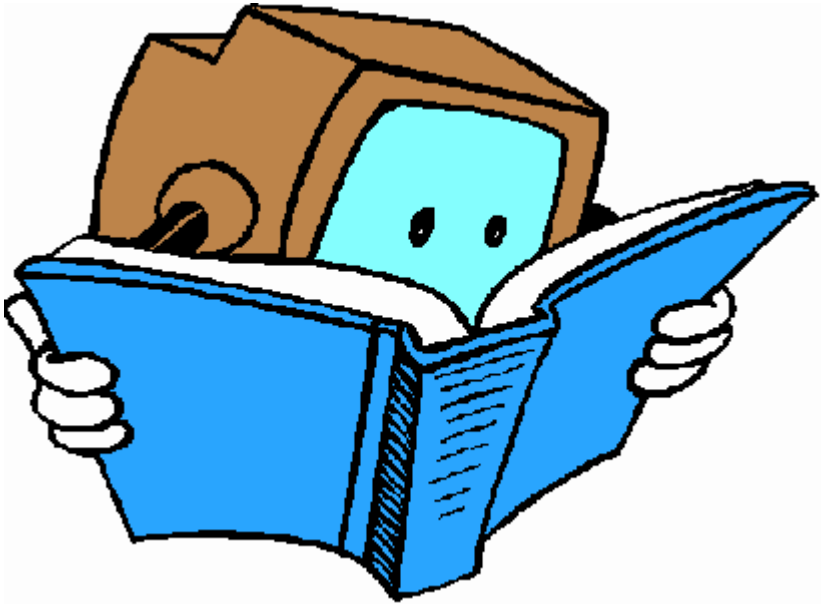

How to …..




Events and Experiences

Facts

# Reading Assignment

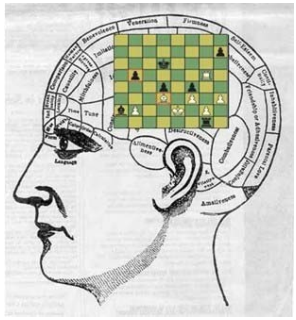


Long – term Memory structure

(HCI, Dix et al. Chapter 1)

# Long Term Memory - Processes

- Storage
- Forgetting
- Retrieval



# Long Term Memory - Storage

- Rehearsal
  - Information moves from STM to LTM
- Total time hypothesis
  - Amount retained proportional to rehearsal time
- Distribution of practice effect
  - Optimized by spreading learning over time
- Structure, meaning and familiarity
  - Information easier to remember

Past, Faith, Idea, Cold, Value, Courtesy, Logic, Quiet, Ambitious

Boat, Tree, Cat, Child, Gun, Plate, Home, Table, Computer, Spoon

# Long Term Memory - Forgetting

- Decay
  - Information is lost gradually but very slowly
- Interference
  - New information replaces old: retroactive interference
    - Recalling older telephone number
  - Old may interfere with new: proactive inhibition
    - Driving to old house

# Long Term Memory - Retrieval

- Recall
  - Act of reproducing a specific incident, fact or other item (from long term memory)
  - Recalling where you were last weekend, fill-in-the-blank on exams
- Recognition
  - Information provided gives knowledge/cue that it has been seen before
  - People are more likely to recognize a suspect in a police line-up than to provide an accurate description from recall memory
  - It is easier to answer multiple-choice questions than essay questions because the correct answer may be recognized

**People recognize more than they can recall**.

# Lecture Contents

- Introduction
- Human
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  - Human Memory
  - Thinking


- Thinking
  - Reasoning
  - Problem Solving

# Reasoning

Use the knowledge we have to draw conclusion or infer something new about the domain of interest

- Deductive Reasoning
- Inductive Reasoning
- Abductive Reasoning

# Deductive Reasoning

- Deduction:
  - Derive logically necessary conclusion from given premises

    e.g. If it is Friday then she will go to work

    It is Friday

    Therefore she will go to work.
  - Logical conclusion not necessarily true:

    e.g. If it is raining then the ground is dry

    It is raining

    Therefore the ground is dry

# Deductive Reasoning

- When truth and logical validity clash …

  e.g. Some people are babies

  Some babies cry

  Inference - Some people cry

- Correct?

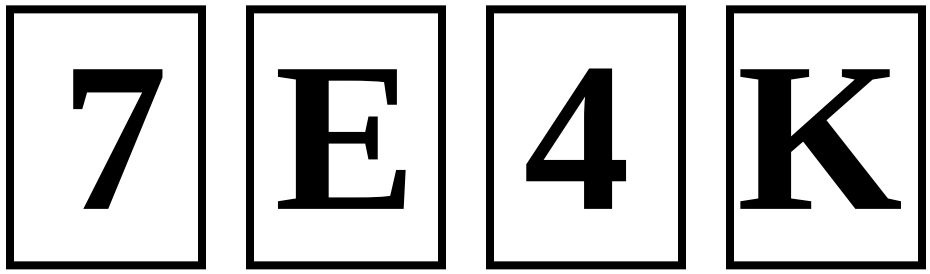
# Inductive Reasoning

- Induction
  - Generalize from cases seen to cases unseen

    e.g. All elephants we have seen have trunks
    therefore all elephants have trunks
- Unreliable
  - Can never prove it true
- … but useful!
- Humans not good at using negative evidence
  - e.g. Wason's cards.

# Inductive Reasoning

- Wason's Cards




If a card has a vowel on one side it has an even number on the other

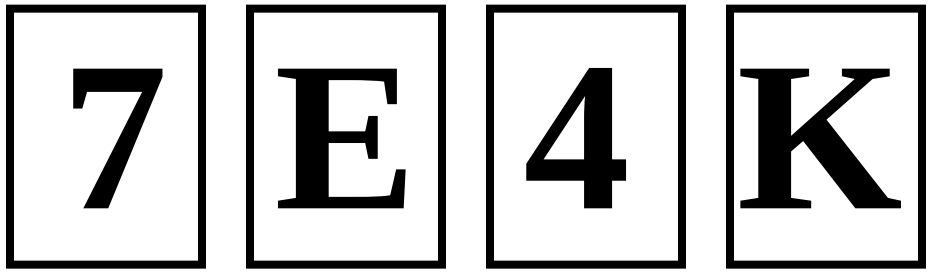
Is this true?

How many cards do you need to turn over to find out?

…. and which cards?

# Inductive Reasoning

- Wason's Cards
- Common Responses
  - Select E & 4: Positive Evidence
- Check Negative Evidences
  - Select E & 7




If a card has a vowel on one side it has an even number on the other

# Abductive Reasoning

- Reasoning from event to cause

  e.g. Sam drives fast when drunk.
  If I see Sam driving fast, assume drunk.

- Unreliable
  - May lead to false explanations

# Problem Solving

- Reasoning: Inferring new information from what is known
- Problem Solving: Finding solution to unfamiliar task using knowledge
- Several theories
  - Gestalt theory, Problem space theory
- Analogy
  - Mapping: Using knowledge of similar problems/domains
- Skill Acquisition
  - Driver, Player, Surgeon

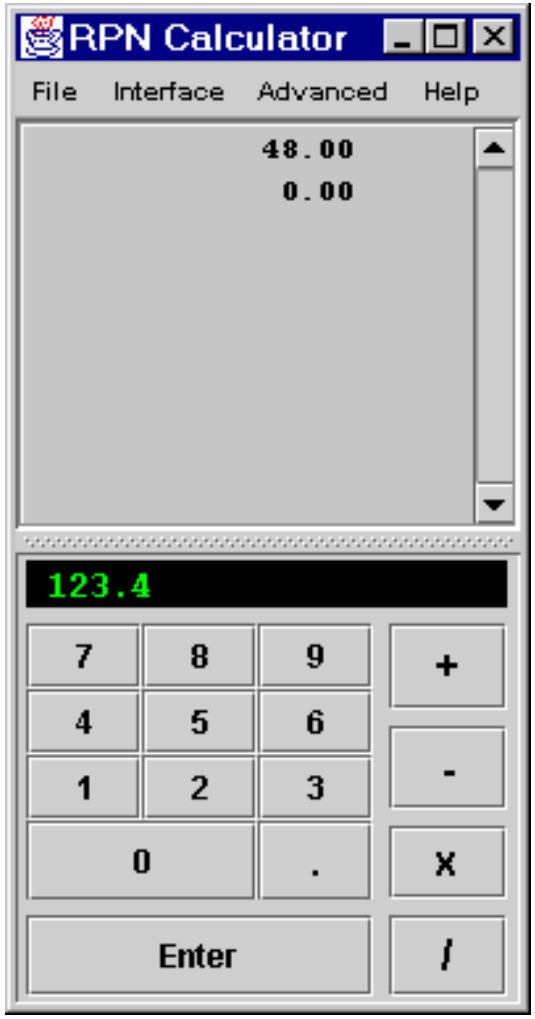
# Errors and Mental Models


- Two Types of Errors
- Mistakes
  - Errors in choosing an objective or specifying a method of achieving it
  - Causes: Incorrect understanding
  - Humans create mental models to explain behaviour
  - If the model is wrong (different from actual system) errors can occur
- Slips
  - Errors in carrying out an intended method for reaching an objective
  - Causes: Poor skill, inattention etc.
  - Changes in the skilled behaviour: Driving home, left/right hand traffic

# Emotion

- Implications for Interface Design
  - Stress will increase the difficulty of problem solving
  - Relaxed users will be more forgiving of shortcomings in design
  - Aesthetically pleasing and rewarding interfaces will increase positive affect

# Emotion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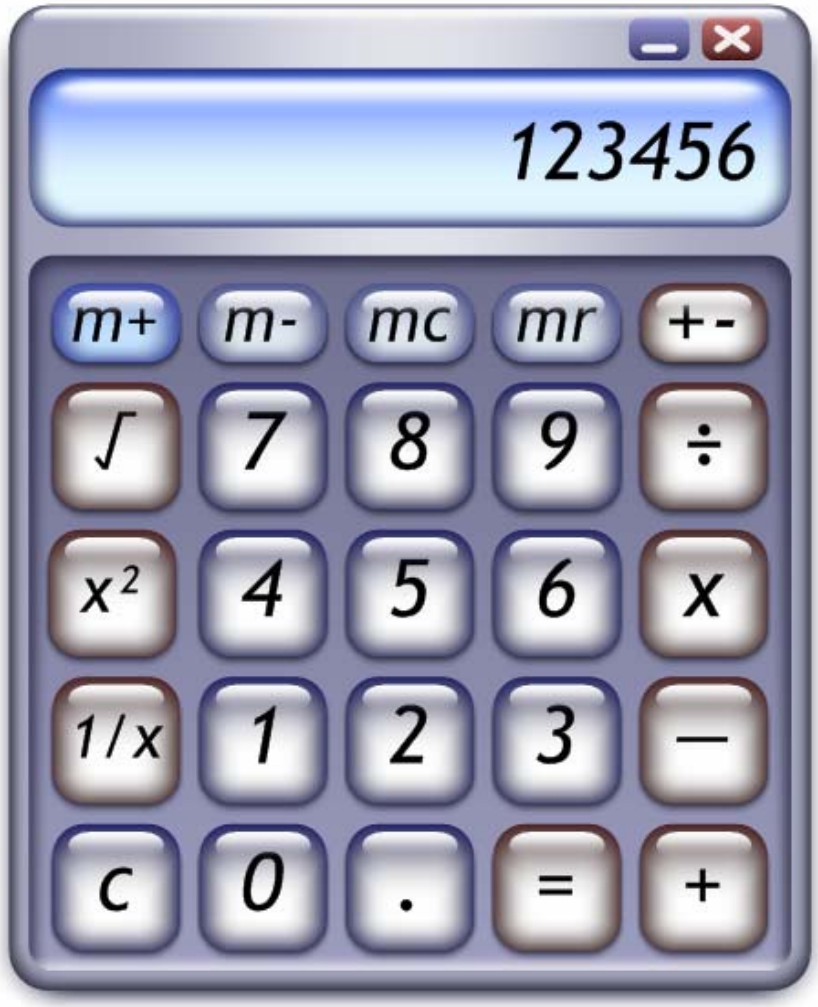
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# Individual Differences

- Long term
  - Gender, physical and intellectual abilities
- Short term
  - Effect of stress or fatigue
- Changing
  - Age
- Ask yourself
  - Will design decision exclude section of user population

# Summary

- Humans as information processors
- Input from environment (I/O)
- Store, manipulate and use information and reacting
- Information received through senses
- Stored in Memory (Short Term / Long Term)
- Use memory in reasoning and problem solving
- Recurrent familiar situations allow people to acquire skills in particular domain
- Can be error when changed.

# References

- Human Computer Interaction by Dix et al.
- User Interface Design and Implementation, Prof. Robert Miller - MIT
- User Interface Hall of Fame/Shame