

Lecture 10

## Cognitive Frameworks- Part II

**Kashif Sajjad Bhatti**

**Assistant Professor**

**IIU, Islamabad**

# In Today's Lecture

- Learning
- Thinking
  - Reasoning
  - Problem-solving
- Skill acquisition

# What goes on in the mind?

perceiving..  
thinking..  
remembering..  
learning..

understanding others  
talking with others  
manipulating others

planning a meal  
imagining a trip  
painting  
writing  
composing

making decisions  
solving problems  
daydreaming...

## Learning

- Learning Considered in terms of
  - Procedural
    - How to use a computer based application?
  - Declarative
    - Using a computer based application to understand a topic

# Learning

- Learning Involves
  - Understanding concepts & rules
  - Memorization
  - Acquiring motor skills

## Learning



# How do people learn?

What People prefer



- Learning through doing

# How do people learn?

What People do not prefer



- Following instructions in manual

## How do people have problem learning difficult stuff?

Concrete experience of Physical world



Difficult to relate

High level abstraction

## How to help users to learn?

- GUI and direct manipulation interface
- Training wheels approach
  - Restrict to basic functions (Novice users)

# How to help users to learn?

- Use interactive technologies
  - Web
  - Multimedia
  - Virtual Reality

## Dynalinking

- “Process of linking and manipulating multimedia representation at interface”

## **Reading, Speaking and Listening**

- 3 forms of language processing
  - Reading, Speaking and Listening
- Have similar properties
  - Have similar meaning of words

“Computers are wonderful operation”

## **Reading, Speaking and Listening**

- Ease of modes differ depending on
  - Person
  - Task
  - Context



## **Difference between language processing modes**

- Written Language -----Permanent
- Listening -----Transient
- Reading -----Quicker
- Speaking/Listening -----Slower
- Listening -----Easier
- Reading/speaking -----Harder

## **Difference between language processing modes**

- Written Language -----Grammatical/formal
- Spoken Language -----Often ungrammatical/less formal
- Personal Preferences
- Disabilities affect language processing

## **Incorporating Language processing in applications**

- Interactive books/ web sites
- Speech recognition systems
- Speech output systems
- Natural Language systems
- Interfaces for people with language processing disabilities

## **Design Implications**

- Length of speech-based menus
  - short
- Intonation of Artificially generated-speech
  - accentuate

# Design Implications

- Customizing Interfaces
  - For disability affected people

## Thinking

- Involve conscious process
  - Aware of oneself
  - Making decisions
  - Looking at different options

# Reasoning

- Process by which we use the knowledge we possess to draw conclusions or infer something new about the domain of interest

## Deductive Reasoning

- Derive the logically necessary conclusion from the given premises
- Example
  - It is Friday then she will go to work
  - it is Friday
  - Therefore she will go to work

# Inductive Reasoning

- Generalizing from cases we have seen to infer information about cases we have not seen

## Inductive Reasoning



# Abductive Reasoning

- Reason from a fact to the action or state that caused it
- Example
  - Salman drives fast
  - Salm has an accident
  - >> fast driving causes accident

# Problem Solving

- “Process of finding a solution to an unfamiliar task”
- 3 theories of problem solving
  - Gestalt
  - Problem Space theory
  - Analogy in Problem Solving

# Gestalt Theory

- Gestalt Theory
  - Problem-Solving is
    - Productive
    - Reproductive

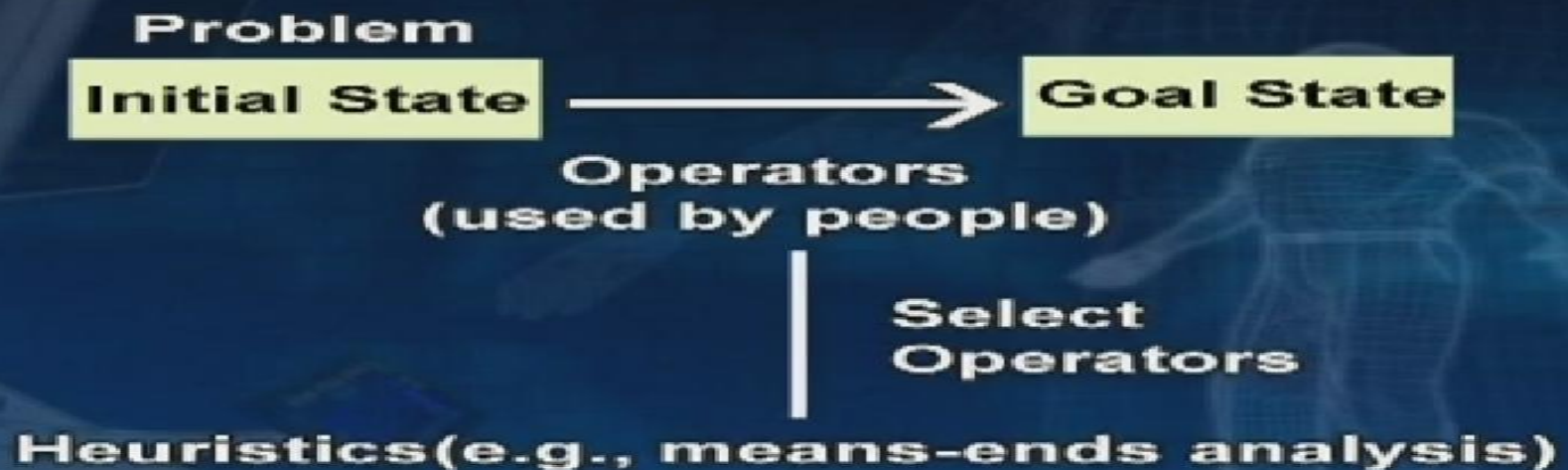
# Gestalt Theory

- Productive problem solving
  - Involves
    - Insight
    - Restructuring of problem

# Problem Space Theory



# Problem Space Theory





# Means Ends Analysis

- Example: move desk from North wall to window



# Means Ends Analysis

- Initial State : Desk at North Wall
- Goal State : Desk at Window
- Difference : Location of Desk

# Means Ends Analysis

- Available Operators
  - Push desk
  - Drag desk
  - Carry desk

## Means Ends Analysis

Decide to :

**Carry Desk**



**To carry must be light**



**Desk is heavy**



**Make desk light (sub goal)**  
Remove drawers etc.



**Make desk light (sub goal)**

## **Domain 1**

- Doctor has to treat a patient of cancer.
- High dose of radiation is required to destroy cancer cells
- Healthier cells can also be destroyed.

### **SOLUTION?**

## **Domain 2**

- General who wants to attack the castle

# Skill Acquisition

- Examine Skill Acquisition within context of Problem Space Theory

## Skill Acquisition

Initial State



# Skill Acquisition

Goal State



Experts remember chunks of information in STM (board configuration)

## ACT Model

- **Basic Level**
  - The learner uses general-purpose rules which interpret facts about a problem. This is slow and demanding on memory access.
  - The learner develops rules specific to the task.
  - The rules are tuned to speed up performance.