

# The Human

Unit 3

CC7 Human Computer Interaction

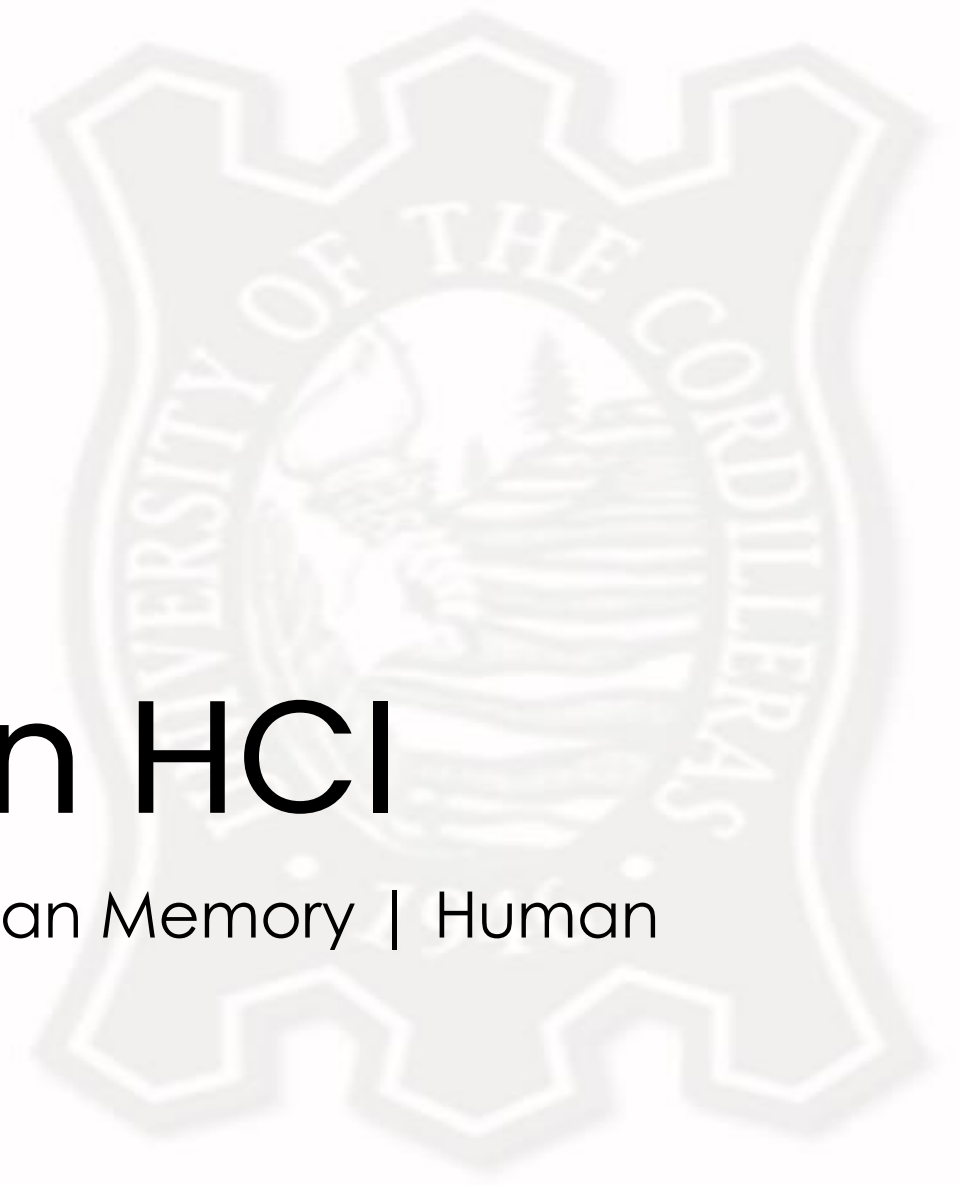
Arnemie Gayyed



# Table of Contents

- The role of humans in HCI
- Human error
- Human emotions





# Role of Humans in HCI

The Human | The Perceptual System | Human Memory | Human Thinking



College of  
Information Technology  
and Computer Science

CENTER OF EXCELLENCE  
in Information Technology

# The Human

- Human computer interaction starts with the human
- The central character is the human
- There is a need to understand:
  - Human capabilities
  - Human limitations
- There is a need to use a simplified model
- Select characteristics relevant to HCI:
  - Input-output channels (perceptual system)
  - Human memory
  - Human processing



# The Perceptual System

- **Sight**
- **Hearing**
- **Touch**
- Taste
- Smell



# The Perceptual System

## Visual Processing

- Involves transformation and interpretation of a complete image
- Expectations affect the way an image is perceived
- Compensates for movement, color and brightness
- Helps resolve ambiguities





# The Perceptual System

## Visual Processing

- Perception of size
- Familiarity
- Depth perception
- Color perception
- Reading



# The Perceptual System

## Visual Processing - Reading

- Perception and processing of text is a special case
- Stages:
  - Visual pattern of the word is perceived
  - Decoded with an internal representation of the language
  - Syntactic and semantic analysis
- Example: Reading “IL”





# The Perceptual System

## Visual Processing - Reading

- Adults read 250 words per minute
- Words are recognized by shape
- Removing word shape clues by using all caps is detrimental to reading speed and accuracy



# The Perceptual System

## Hearing

- Human beings can hear sounds from 20 Hz to 15 kHz
- Can distinguish frequency changes of less than 1.5 Hz at low frequencies
- Less accurate at high frequencies
- Can be selective
- Can convey a lot of information
- Not maximized in interface design



# The Perceptual System

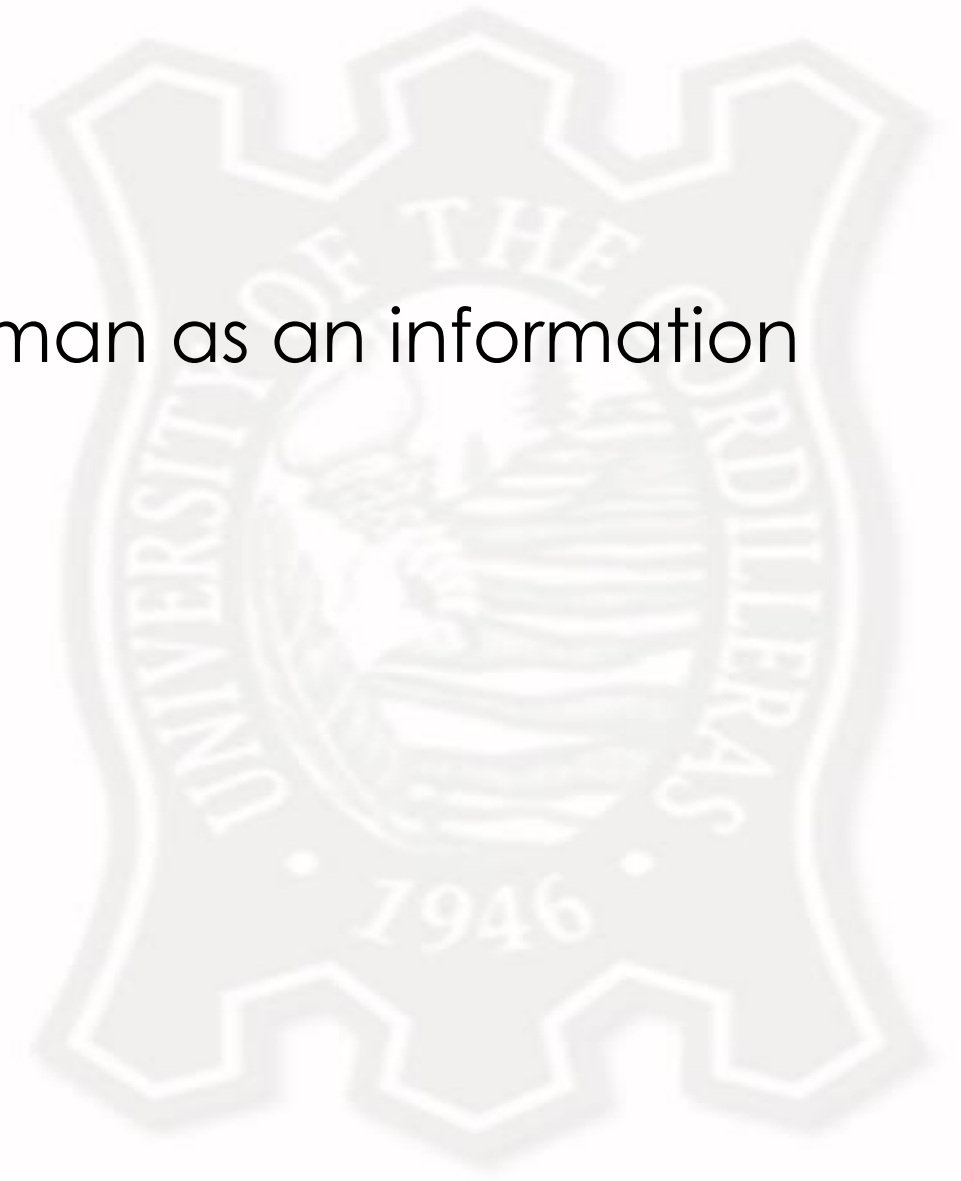
## Touch

- Haptic perception - important means of feedback
- If an object is seen but not felt, speed and accuracy of a response is reduced
- Complaint of VR users

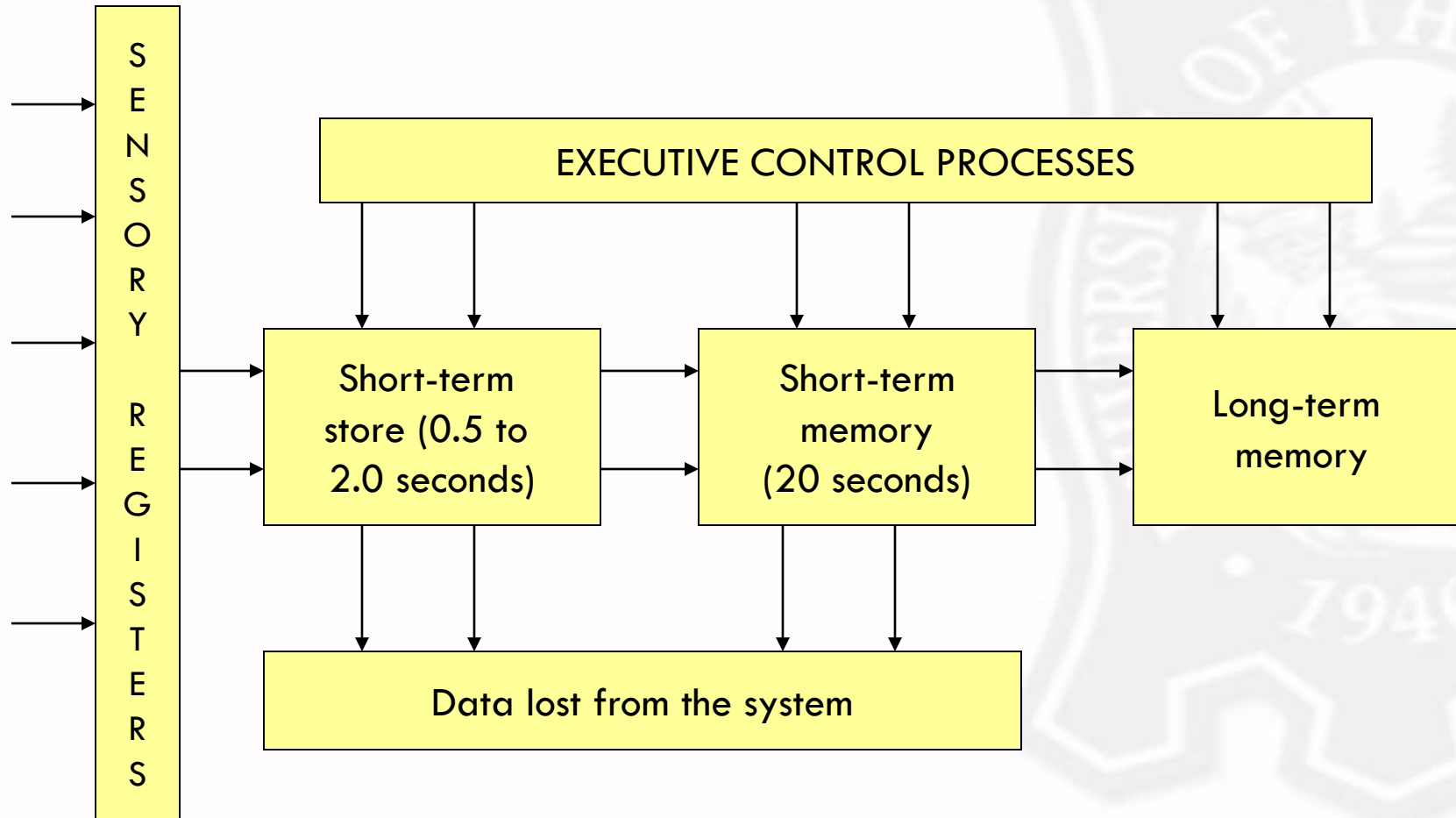


# Human Memory

- Second part of the model of the human as an information processor
- Three types:
  - sensory buffers
  - short-term memory
  - long-term memory



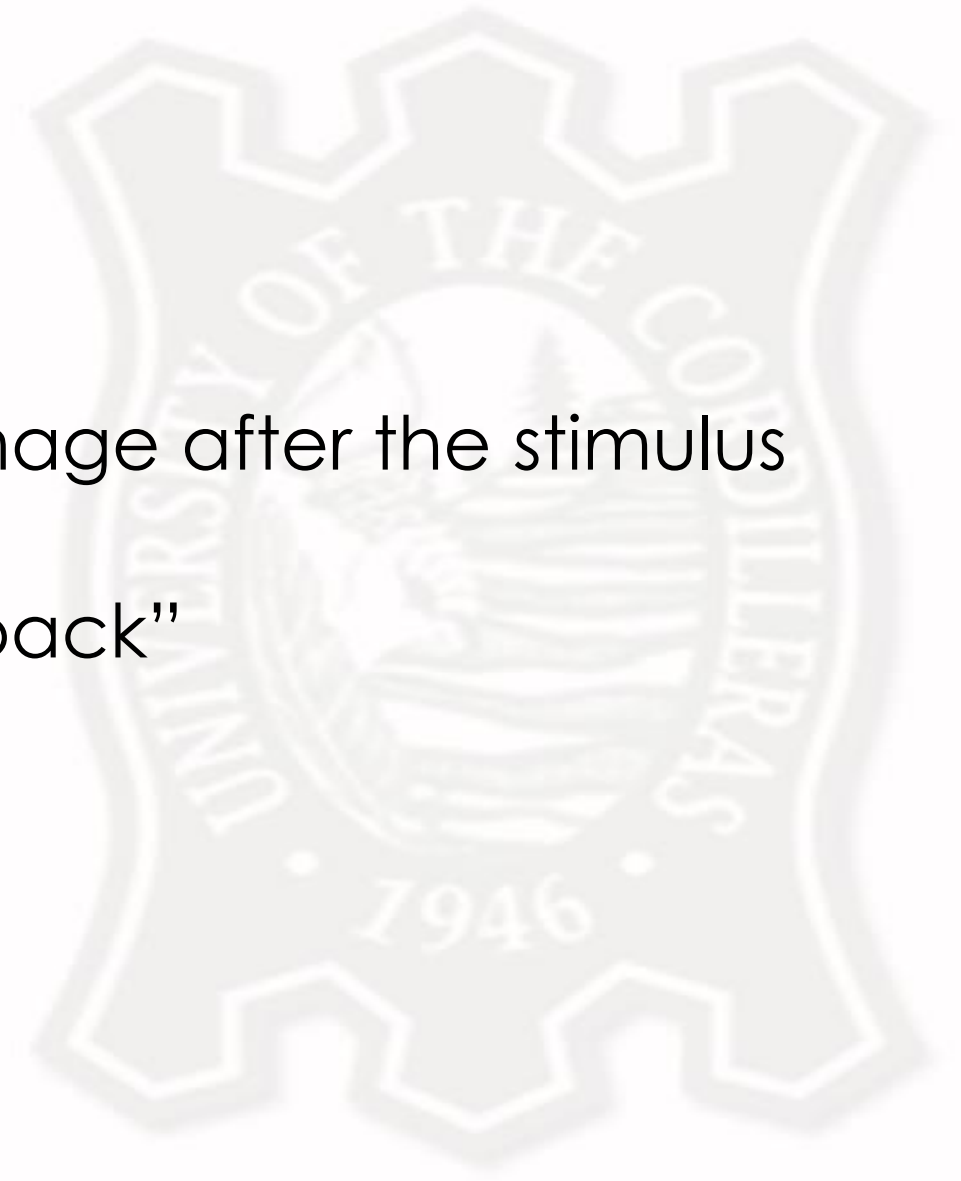
# Human Memory



# Human Memory

## **Sensory Memory**

- Iconic (visual) - persistence of the image after the stimulus has been removed
- Echoic (aural) - allows a brief “playback”
- Haptic - touch





# Human Memory

## Short-Term Memory

- Scratch-pad for temporary recall
- Used for information needed fleetingly
- Rapid access, limited capacity
- 7 +/- 2 chunks of information
- Patterns are useful memory aids



# Human Memory

## Long-Term Memory

- We store everything we “know” - factual information, experiential knowledge, procedural rules of behavior
- Huge, if not unlimited
- Relatively slow access time (1/10 second)
- Forgetting occurs more slowly



# Human Memory

## Long-Term Memory – Structure

- Episodic – memory of events stored sequentially; can reconstruct actual events
- Semantic – structure derived from facts, concepts, or skills; derived from episodic memory
- Can be organized to:
  - Semantic networks
  - Frames
  - Scripts
  - Production rules



# Human Memory

## Long-Term Memory – Structure (Organization)

- Semantic networks
  - Interconnections or associations among memories
  - Does not allow to model the complex objects or events composed of several activities
  - Example: what are the words currently associated with “dog”?



# Human Memory

## Long-Term Memory – Structure (Organization)

- Frames
  - Objects that contain slots or attributes
  - Attributes represent default, fixed or variable information
  - Example: dog
  - Fixed - Legs: 4
  - Default - Diet: Carnivorous, Sound: Bark
  - Variable – Size, Color



# Human Memory

## Long-Term Memory – Structure (Organization)

- Scripts
  - Represents default stereotypical information
  - Contains: entry conditions, results, props, roles, scenes, and tracks
  - Example:
    - Goal: To fill my mug with coffee
    - Entry conditions: My mug must first be empty
    - Results: My mug is full of coffee
    - Props: Mug, coffee machine, coffee
    - Roles:
      - Secretary makes the coffee
      - I fill my cup





# Human Memory

## Long-Term Memory – Structure (Organization)

- Production rules
  - Series of condition-action (if-then) statements
  - Examples:
    - IF it is raining THEN bring an umbrella
    - IF the high school is being dismissed THEN traffic will be horrible



# Human Memory

## Long-Term Memory – Processes

- Storing
  - Total time hypothesis - amount learned is proportional to amount of time spent
  - Distribution of practice effect - learning time is most effective if distributed over time
  - Information must be meaningful for it to be stored



# Human Memory

## Long-Term Memory – Processes

- Forgetting
  - Decay
  - Interference - old replaced by new or vice versa
  - Retroactive interference – new information replaces the old
  - Proactive inhibition – the old memory interferes with the new information



# Human Memory

## Long-Term Memory – Processes

- Remembering
  - Recall - reproduced from memory
  - Recognition - the info has been seen before



# Human Thinking

## Reasoning

- Process of deriving new information from what is known
- Types:
  - Deductive reasoning – two or more assertions that lead to a conclusion; mathematical certainty
  - Inductive reasoning - arriving at generalizations from observations we have seen about cases we have not seen
  - Abductive reasoning - formulation of hypotheses to explain a phenomena



# Human Thinking

## Problem Solving

- Process of finding a solution to an unfamiliar situation
- Three examples:
  - Gestalt
  - Problem space theory
  - Analogy in problem solving





# Gestalt

- People draw on previous experiences
  - Have insights
  - People as sense-makers
  - Restructure the problem
  - Theory lacked structure and support
  - Does not explain insight and restructuring
- The whole is greater than the some of its parts
  - People perform based on their understanding general principles of a situation
  - If we perform on memorized facts, we make stupid mistakes



# Problem space theory

- Problem is represented in terms of problem states
- Heuristics are employed to go from initial to goal state
- General problem solver works for well-structured domains
- Real-world problems are more complex



# Skill acquisition

- Ability to remember larger and larger chunks, e.g. chess players
- Novices - group problems according to superficial characteristics
- Experts - group according to conceptual similarities





# Human Error

Human v. Computer | Concept of Error | Types of Slips | Mistakes | Failure to Detect Errors



# Human v. Computer

## Human

- Result of millions of years of evolution
- Guiding principle was survival, not precision
- Robustness in the face of unexpected circumstances
- Ability to deceive

## Computer

- Less than 100 years old
- Reliable
- Consistent
- Based on mathematics



# Human v. Computer

## Human (Computation)

- Slow, complex
- Highly parallel
- Rapid change
- Error tolerant
- Forgiving

## Computer (Computation)

- Fast
- Not fault tolerant
- High speed
- Precise





# The Concept of Error

- The computer was given information it could not process
- Blame shifted on the human being
- Achieving a goal should be a cooperative endeavor
- Task is not to assess blame but to complete the task
- Types of Errors:
  - Slip – results from automatic behavior
  - Mistake – stems from conscious deliberation



# Types of Slips

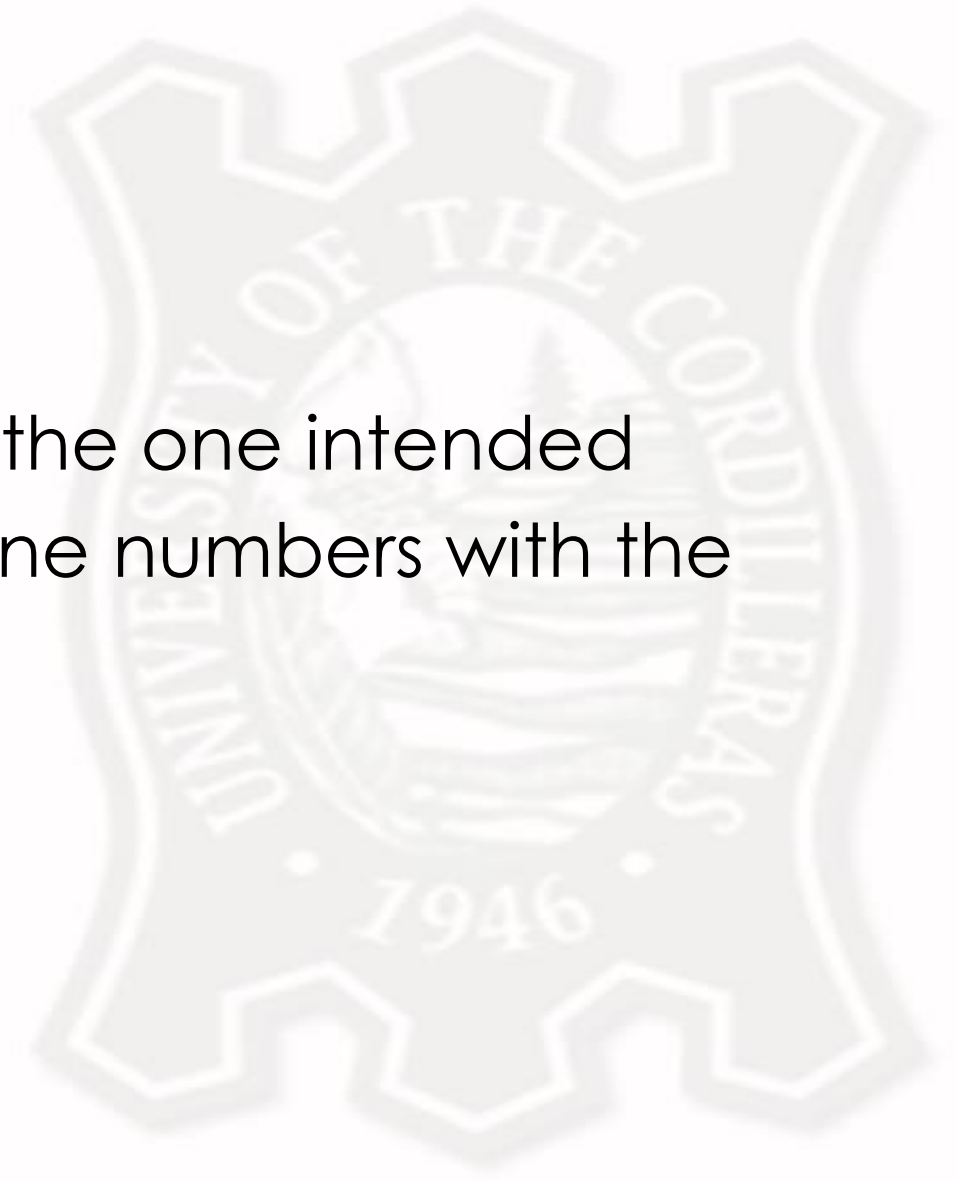
- Capture errors
- Description errors
- Data driven errors
- Association activation errors
- Loss of activation errors
- Mode errors



# Types of Slips

## Capture Error

- A frequently done activity captures the one intended
- Example: mistakenly dialing telephone numbers with the same prefix
  - 426-6001 - Ateneo trunk line
  - 426-6071 - DISCS direct line



# Types of Slips

## Description Error

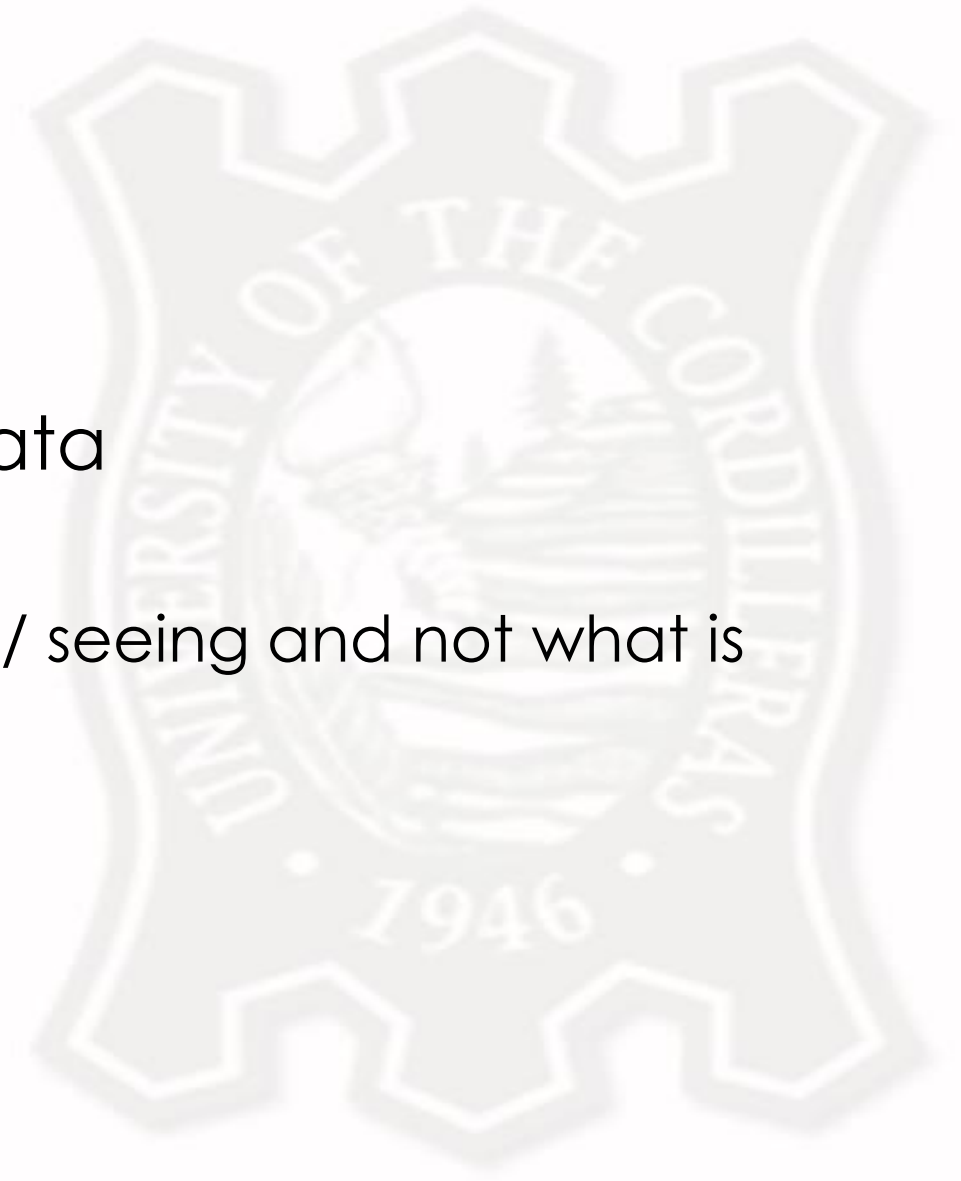
- An action is performed on the wrong artifact
- Example:
  - Bottles of shampoo and conditioner, especially if they have the same bottle design



# Types of Slips

## Data-Driven Error

- Triggered by the arrival of sensory data
- Examples:
  - Typing what you are thinking / hearing / seeing and not what is intended
  - Calling someone by the wrong name

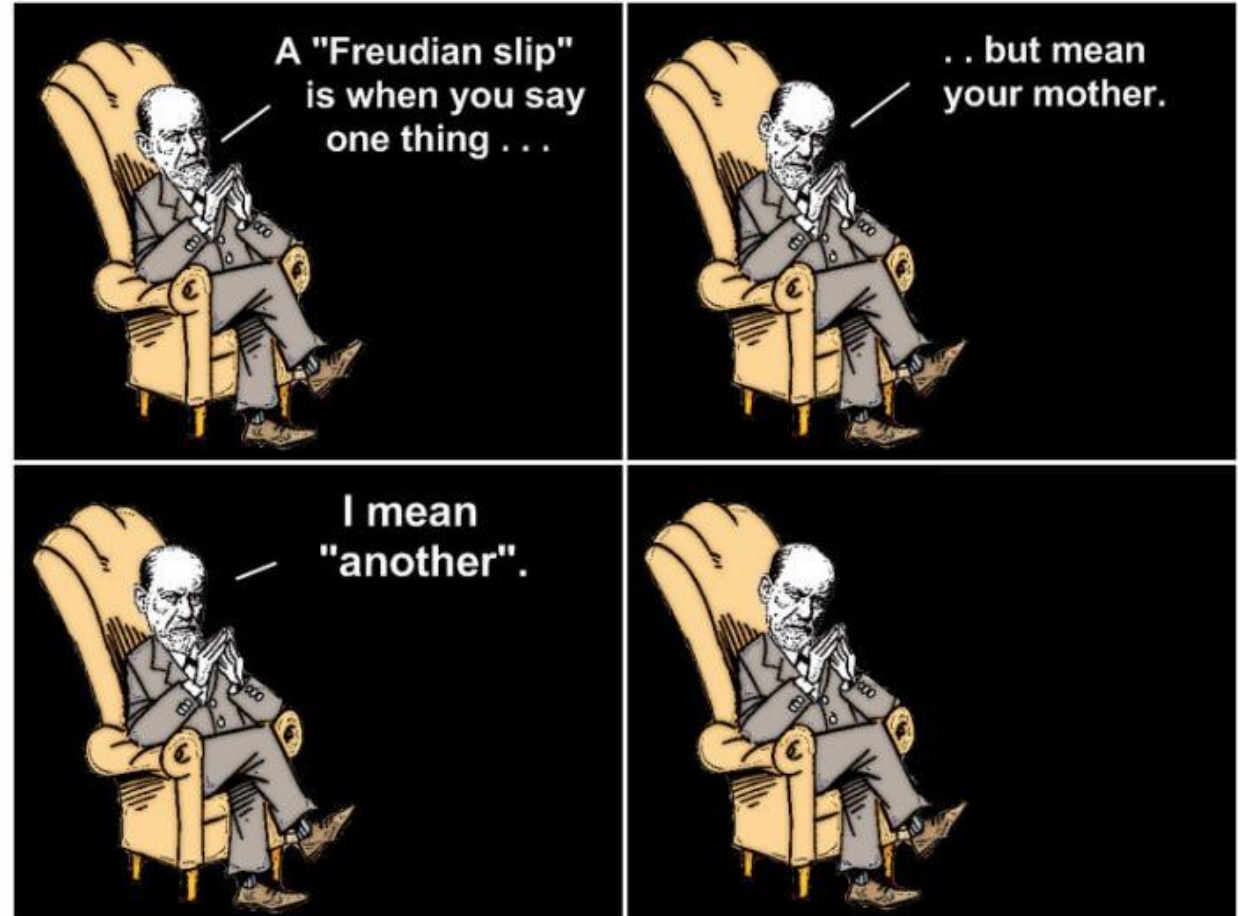




# Types of Slips

## Freudian Slips

- Verbal / memory mistake that usually reveals the subconscious
- Example:
  - A child calling their teacher “Mom” or “Dad”



# Types of Slips

## Loss of Activation Errors

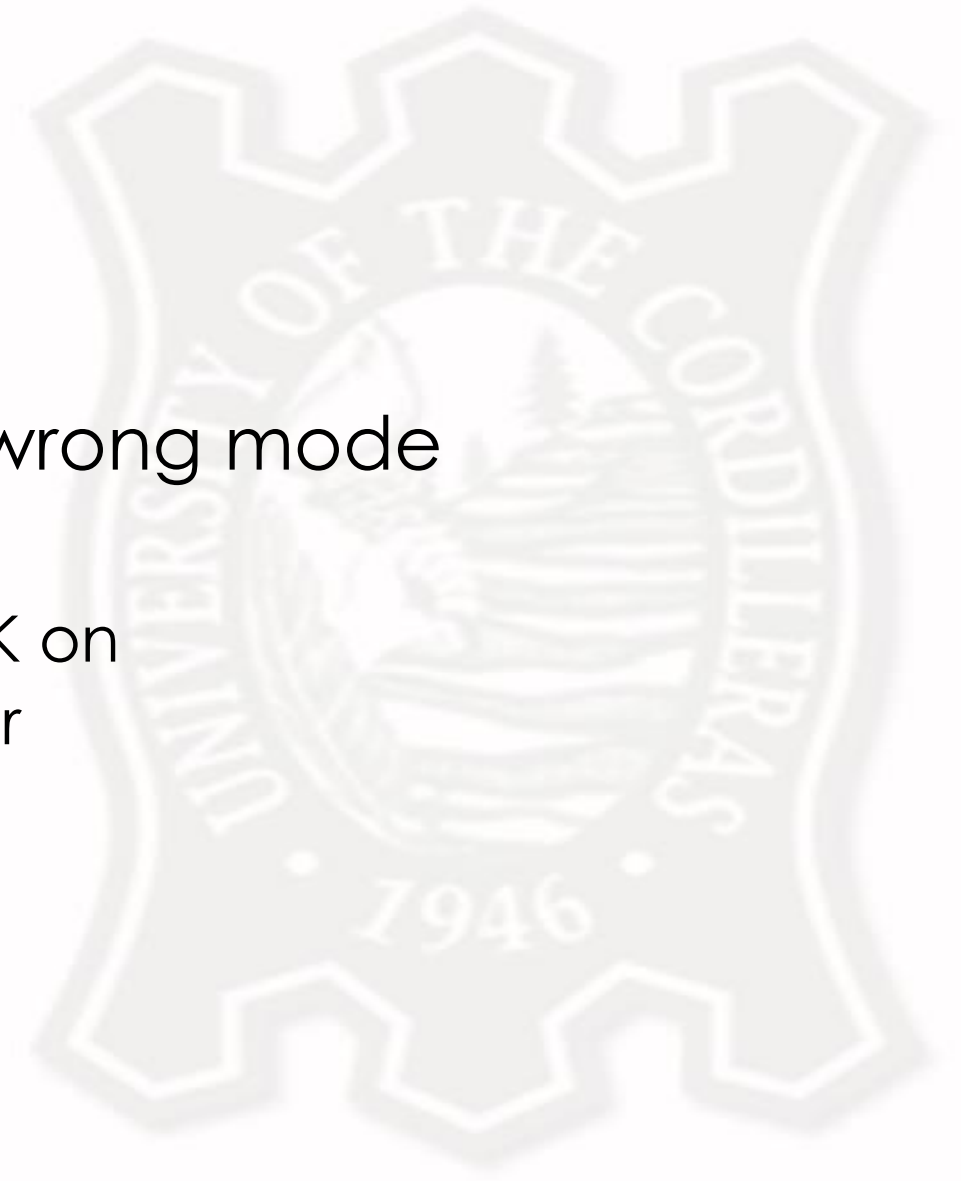
- Act of forgetting to do something
- Example:
  - Walking somewhere to get something but forgetting the moment you step into the destination



# Types of Slips

## Mode Error

- Action sequence performed in the wrong mode
- Examples:
  - Typing in the password with CAPS LOCK on
  - Using different tools as if it were another





# The Concept of Error

## Mistake

- Choice of inappropriate goals
- Poor decision, misclassifies a situation, or fails to take all factors into account
- Mental thought is not neat and orderly
- The disorder leads to creativity, discovery, and great robustness of behavior



# Failure to Detect Problems

- User's ability to detect errors is unreliable
- Relevance bias - people seek confirmatory evidence when evaluating a hypothesis
- Partial explanation - crude agreement between what the user expects and what he sees
- Overlap of model and world - mental model is partially consistent with the world





# Designing for Emotions

Why Emotions | Levels of Emotion-Based Processing

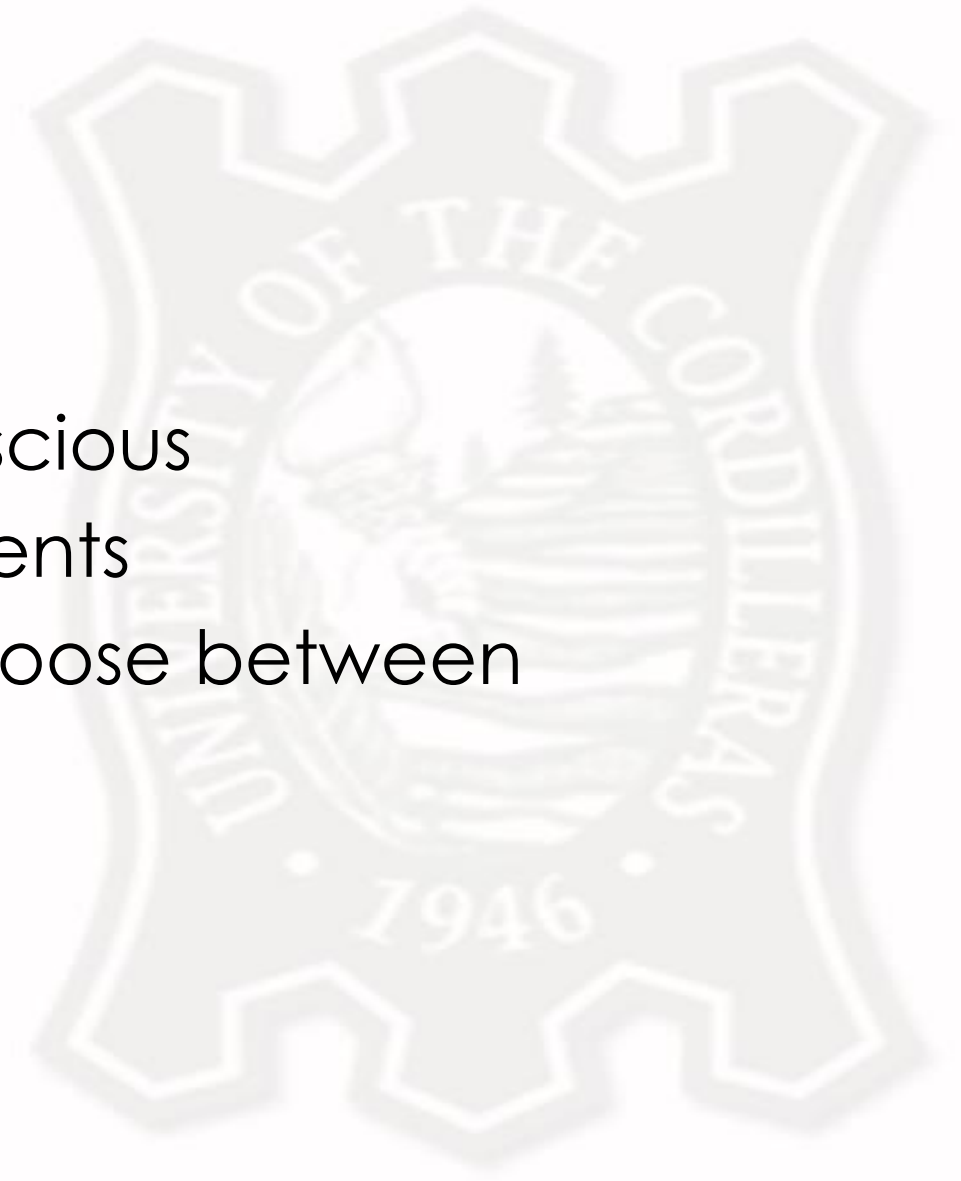


College of  
Information Technology  
and Computer Science

CENTER OF EXCELLENCE  
in Information Technology

# Why Emotions?

- Emotions makes the human smart
- Much of human behavior is subconscious
- Affective system helps make judgments
- People without emotions cannot choose between alternatives



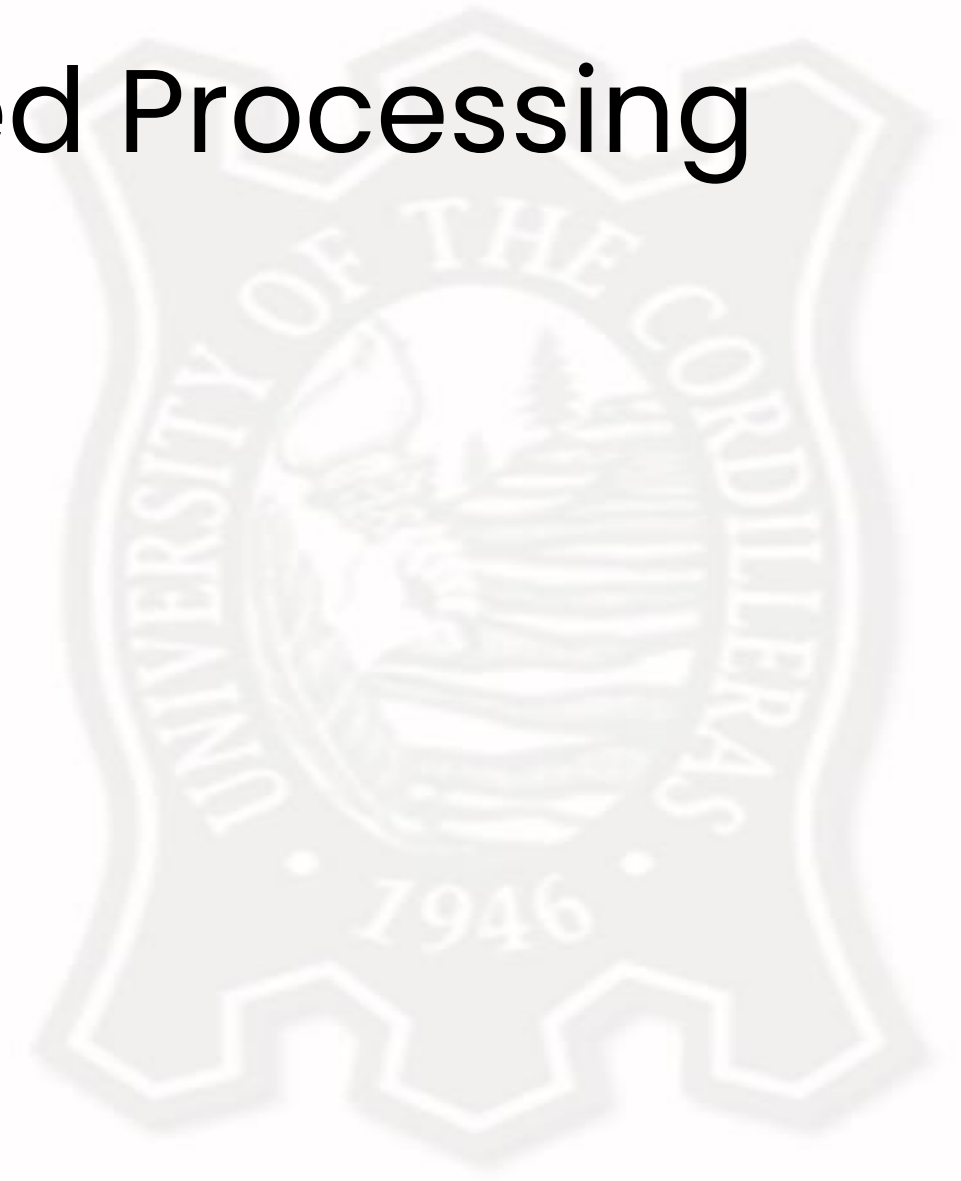
# Effects of Using Emotions for Design

- Broadening of thorough processes
- Greater creativity
- Greater imagination
- More tolerant of minor difficulties



# Levels of Emotion-Based Processing

- Visceral
- Behavioral
- Reflective



# Levels of Emotion-Based Processing

## Visceral

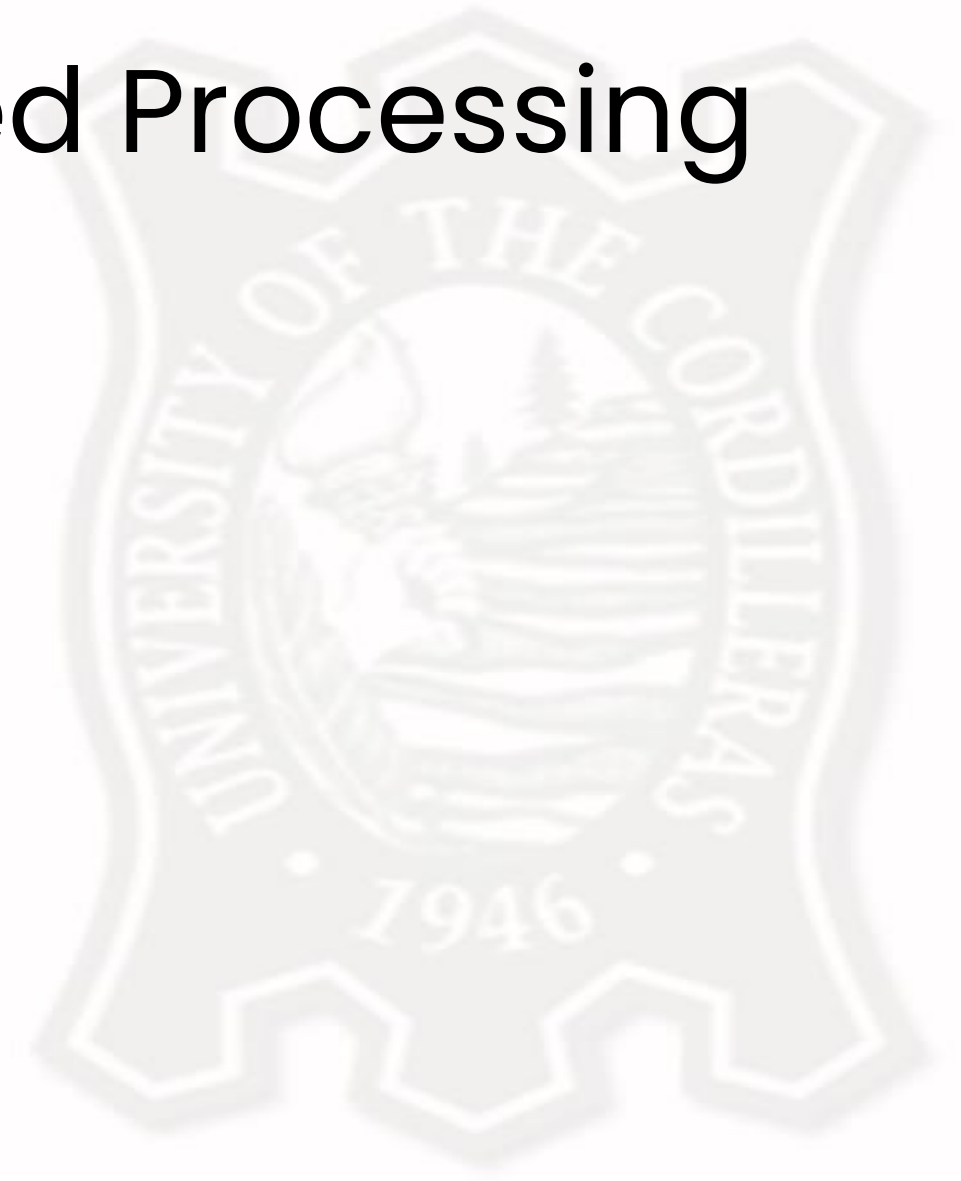
- Pre-conscious, pre-thought
- Appearance matters
- First impressions are formed
- Initial impact of the product (touch, feel, appearance)



# Levels of Emotion-Based Processing

## Behavioral

- Focuses on the use
- Experience with the product:
  - Function
  - Performance
  - Usability





# Levels of Emotion-Based Processing

## Behavioral



# Levels of Emotion-Based Processing

## Reflective

- Affected by culture, experience, education, and individual differences
- Can override the visceral and behavioral
- Sophistication vs. popularity
- Long-term relationships
- Consideration of the future



# Levels of Emotion-Based Processing



# Levels of Emotion-Based Processing

## **Working with the three levels:**

- Visceral - appearance
- Behavioral - pleasure and effectiveness of use
- Reflective - self-image, personal satisfaction, memories

