

# ***CULTURE- LOGIC AND COGNITION***

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BY:

DR. SWETA SINHA

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COGNITIVE SCIENCE ON

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# LAYOUT OF THE LECTURE

- ❑ INTRODUCTION
- ❑ CULTURE: What is Culture; Cultural Transmission; Cultural Biases
- ❑ CULTURE AND COGNITION; Examples of Cultural Influences
  - Language
  - Perception and Thinking
  - Emotions
  - Morality
- ❑ LOGIC- Meaning; Types; Logic and Machines
- ❑ CONCLUSION



# OBJECTIVE



- ❑ TO DEVELOP THE UNDERSTANDING THAT COGNITION **CANNOT SOLELY** BE UNDERSTOOD THROUGH EMPIRICAL STUDIES
- ❑ IN ORDER TO UNDERSTAND COGNITION AND ITS PROCESSES HOLISTICALLY A **BALANCED APPROACH** BETWEEN SCIENCE AND HUMANITIES IS ESSENTIAL
- ❑ MAN IS A SOCIAL ANIMAL SO EACH ACT IS A MANIFESTATION OF A **CHAIN OF SOCIO-PSYCHOLOGICAL EVENTS** THAT PRECEDE THE ACTION
- ❑ THUS, **SYNCHRONOUS** STUDIES ARE **ERROR PRONE**

# INTRODUCTION

- HIGH LEVEL COGNITION IS ONLY POSSIBLE DUE TO LANGUAGE
- LANGUAGE IS POSSIBLE ONLY DUE TO COGNITION
- LANGUAGE AND COGNITION TOGETHER BUILD KNOWLEDGE
- KNOWLEDGE IS GAINED THROUGH
  - A) *DIFFERENTIATION*
  - B) *SYNTHESIS*



# CONTD....

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- Differentiation 
  - Concept
  - Emotions
- 
- Synthesis 
  - Form
  - Meaning
- Conceptual Content of culture (can be borrowed among cultures)
- Emotional Content – Cannot be borrowed

# What is Culture?

- Culture is that complex whole which includes knowledge, belief, art, law, morals, customs and any other capabilities and habits acquired by man as a member of society.  
- Edward Tylor (1871)
- Culture is the man-made part of the environment.  
- Herskovits (1948)
- Culture is a well organized unity divided into two fundamental aspects- a body of artifacts and a system of customs.  
- Malinowski (1931)



# Contd....

- **Cultural Transmission**
- Culture is socially transmitted.
- Memes (Dawkins, 1976)
- **Manner of transmission**
- Cultural items are transmitted from one generation to another are referred to as memes (just like genes).
- Transmission is not only unidirectional and vertical.
- Bidirectional; Horizontal.

# Contd...

- Mode of transmission:
- When observing a model, there are two things one might copy: *the means* and *the end*.
- Emulation (Tomasello, 1996)  
End oriented; not always successful
- Imitation

Observers perform actions by looking at other people's actions, humans are good at it, starts immediately after birth.



- Types of cultures: *Dynamic* and *Traditional*.
- *Dynamic cultures are open to changes.*
- Transmission depends on the type of the culture as well as the *bias*.
- Content bias- something which is exciting or interesting is passed on easily. Ex: a story which is interesting or a recipe which is tasty is passed on through generations.
- Context bias- our tendency to acquire socially transmitted traits as a function of who is transmitting rather than what is getting transmitted.

- Context bias is of two types:

those *based on frequency*  
(conformist/ non- conformist)

those based on *who is modeling the trait*  
(conformist/ non- conformist)

Copying the majority helps in cultural cohesion and communication



# Examples of Cultural Influence:

- A. Language:
- Signifier- Signified/ Referent- Reference
- Meaning vary across cultures
- Sapir – Whorf hypothesis (1956)
- Language influences thought and language is a direct manifestation of cultural influence.
- Language- thought- culture interrelated and together form concepts.
- Concepts construct knowledge.
- The process of forming concepts is cognition.

# Contd...

- B. Perception and Thinking
- Researches on cognitive styles.
- Witkin (1950)
- Field- dependent psychological processing and field-independent psychological processing.
- Berry (1966) used this to investigate cultural variations.
- Hunters and gatherers are good at differentiating objects in complex scenery.



- **Individualistic cultures** (value autonomy and disvalue dependency) and **collective cultures** (motivated by duties to others)
- Nisbet et al. (2001) – members of individualist and collectivist cultures have measurably different cognitive styles.
- Different attitude in problem solving
- (*I* am the cause of problem Vs. *You and I both* are the causes of the problem.

- C. EMOTIONS
- Emotions help us to cope with extraordinary situations.
- Emotions come into existence through social learning.
- *Elicitor* of the emotions- *appraisal* of that elicitor.
- Feelings differ cross- culturally.
- Anger (high mental arousal state in West, sullen brooding in Malay)
- Public expression of negative emotion is discouraged in Japan.



- D. Morality
- Moral relativism
- Morality is highly sensitive to environmental variables.
- Morality describes the principles that govern our behavior. It is a system of behavior with regards to right or wrong.
- ***Moral identity*** determines our ***moral responsibility*** guiding our ***moral actions*** setting ***moral standards***.

# LOGIC

- Logic is the study of arguments.
- The aim is to come up with an account or theory of when *premises* of an argument make the conclusion more likely to be true, if the premises are true.

*(a premise is an assumption that something is true)*

- An argument requires a set of (at least) two declarative sentences (or propositions) known as the **premises** along with another declarative sentence (or "proposition") known as the conclusion.



# Examples:

- Statement:
- Moon is Earth's satellite.

Premise 1: Earth is a planet.

2. Moon revolves around the Earth.

**Validity of the statement : True.**

- If you are not man you are a woman.

Premise 1: *You* are a human.

2. There are only two genders: man and woman.

**Validity of the statement: ?**

- Now that third gender is being recognized, the premises for this statement which were true in earlier centuries will not hold true now.

**So, the statement is falsifiable.**

- Logic is concerned with the relation between the premises of an argument and the conclusion.
- because arguments or pieces of reasoning are a way that we can persuade someone to accept a conclusion,
- This is how knowledge is passed on.....



- There are three types of argument: *deductive*, *inductive* and *abductive*.
- *Deductive logic* is the main type of logic that logic teachers have focused on historically.

Conclusion follow from premises. If premises are true, conclusion would be true. Strong relation between premises and conclusion.

- Inductive Logic:

Example: Chair in the drawing room is red.

Chair in the bedroom is red.

Chair in the dining room is red.

Conclusion: All the chairs in the house are red.

High *probability* for the conclusion to be true depending on the premises.

*Probabilistic relation* between argument and conclusion.



- Example:
- Children in the house yell loudly when they play.  
Children are yelling in the house.  
Children must be playing in the house.

- *Abductive logic* is based on the best guess.
  - There is a set of events and based on that the conclusion is made on the basis of the *best guess*.
  - Example:
    - The patient visits the doctor and tells her about wheezing problem.
    - Wheezing becomes rampant in cold season
    - The doctor concludes that the patient suffers from asthma triggered by cold.
- The guess is backed by some sort of experience or pre-obtained knowledge.*



# Classical Logic

- Permits conclusion which are either true or false.
- Boolean logic is an example (0 or 1).
- Modern computers work on Boolean logic.
- Boolean- named after 19<sup>th</sup> century mathematician George Boole/ all the algebraic values are reduced to 1 or 0.
- Human and animals do not operate on this scheme.

# Fuzzy Logic

- Fuzzy Logic (FL) is a method of reasoning that resembles human reasoning.
  - It is important in decision making.
  - *Computer- based output*
  - Yes
  - No
  - 
  - 
  -
- Human- based Output*
- Certainly Yes
  - Possibly Yes
  - Cannot Say
  - Possibly No
  - Certainly No



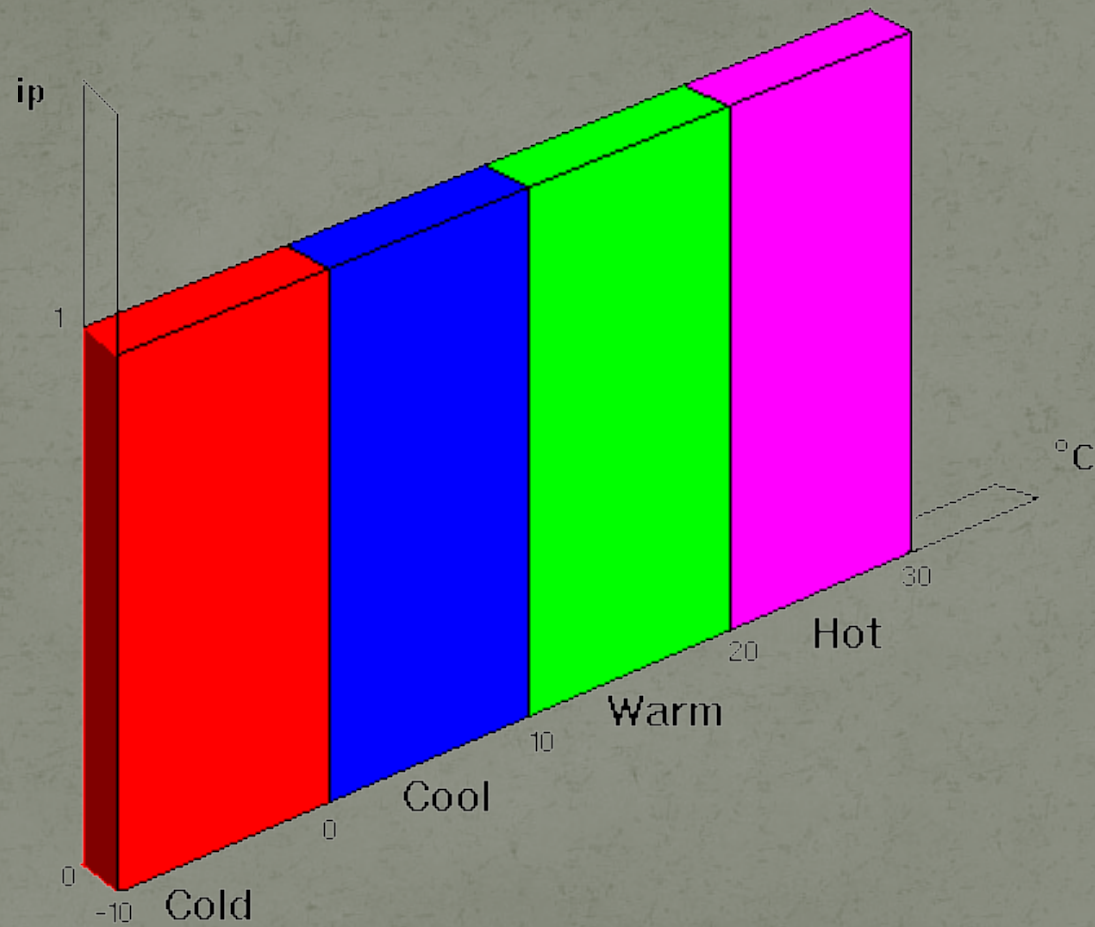
- Dr. Lotfi Zadeh of University of California gave this concept in 1960s.
- It is an approach in computing based on the **'degree of truth'** rather than the usual true/false.
- Partial truth and the value of 'truthfulness' varies from completely true to completely false.

# Empty/ Full ?



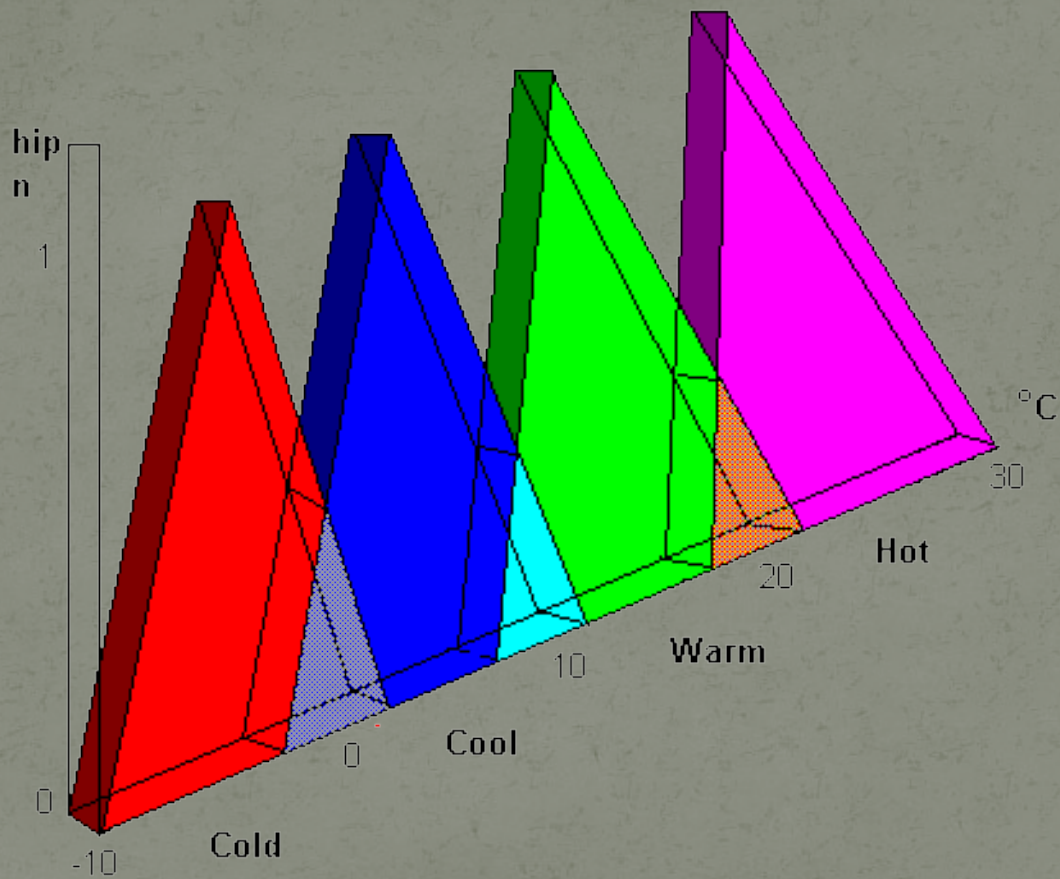


- Transitions in real world are smooth and many a times unnoticeable.
- Bivalent Set Theory can be somewhat limiting if we wish to describe a 'humanistic' problem mathematically. For example, Fig . below illustrates bivalent sets to characterize the temperature of a room.



**Bivalent Sets to Characterize the Temp. of a room**





**Fuzzy Sets to characterize the Temp. of a room.**

- COLD----- WARM-----HOT
- Comparative values
- Variables are expressed as
  - A. Mathematically using integral values (0 – 1)
  - B. Linguistically using adjectives or adverbs.
- People do not require precise numerical input yet they are capable of highly adaptive control.



- It requires some numerical parameters in order to operate such as what is considered significant error and significant rate-of-change-of-error, but exact values of these numbers are usually not critical unless very responsive performance is required in which case empirical tuning would determine them.
- It uses an imprecise but very descriptive language to deal with input data more like a human operator.

# Why Use FL?

- FL offers several unique features:
- 1) It is inherently robust since it does not require precise, noise-free inputs.
- FL is not limited to a few feedback inputs and one or two control outputs, nor is it necessary to measure or compute rate-of-change parameters in order for it to be implemented. Any sensor data that provides some indication of a system's actions and reactions is sufficient.
- inexpensive and imprecise thus keeping the overall system cost and complexity low.



# Why Use FL?

- Define the control objectives and criteria: What am I trying to control? What do I have to do to control the system? What kind of response do I need? What are the possible (probable) system failure modes?
- Determine the input and output relationships and choose a minimum number of variables for input to the FL engine (typically error and rate-of-change-of-error).

- break the control problem down into a series of IF X AND Y THEN Z rules that define the desired system output response for given system input conditions.
- Test the system, evaluate the results, tune the rules and membership functions, and retest until satisfactory results are obtained.



# Linguistic Variables

- In 1973, Professor Lotfi Zadeh proposed the concept of linguistic or "fuzzy" variables.
- The sensor input is a noun, e.g. "temperature", "displacement", "velocity", "flow", "pressure", etc. Since error is just the difference, it can be thought of the same way.
- The fuzzy variables themselves are adjectives that modify the variable (e.g. "large positive" error, "small positive" error, "zero" error, "small negative" error, and "large negative" error). As a minimum, one could simply have "positive", "zero", and "negative" variables for each of the parameters.

- Thus, FL is
- A type of logic that recognizes more than simple true and false values. With fuzzy logic, propositions can be represented with degrees of truthfulness and falsehood.
- Example: For example, the statement, *today is sunny*, might be 100% true if there are no clouds, 80% true if there are a few clouds, 50% true if it's hazy and 0% true if it rains all day.



- Applications:
- Facial Pattern Recognition
- Washing machines
- Air conditioners
- Unmanned helicopters and aircrafts
- Optimization of power systems
- Driverless cars----- ?

# Conclusion

- Cognition is a mental phenomena.
- The mental processes are as much external as internal.
- External factors influence cognition in a variety of ways.
- Language, culture, thought and cognition are intertwined.
- Studying one aspect opens up the other aspect.
- Cognitive studies can be successful by a holistic approach considering the elements of internal processes as well as external processes.
- Only then the cognitive abilities can be replicated in machines.



***THANK YOU***

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