Semantic Memory: Rules of the Game

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People hold on to information years after storing them

These contains knowledge relating to *definitions of words, arithmetic facts and procedures, historical, scientific and geographical knowledge to name a few*

The organization of the knowledge follows the metaphor of a book shelf

Information in memory consists of knowledge for specific events and *memory for general knowledge*

Endel Tulving (1972, 1983) argued that LTM contains two stores namely episodic and semantic which although are distinct but highly interactive.

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Episodic – Semantic distinction

Episodic – enables people to *travel back in time* and become consciously aware of witnessing or participating in events in earlier time

Semantic – contains general and world knowledge, arithmetic rules, past tense of verbs etc

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Episodic	Semantic
Personal Experience	Facts and Concepts
Remember “When”…	Remember “What”….
Temporally Organized	Meaning related Organization

Semantic memory models

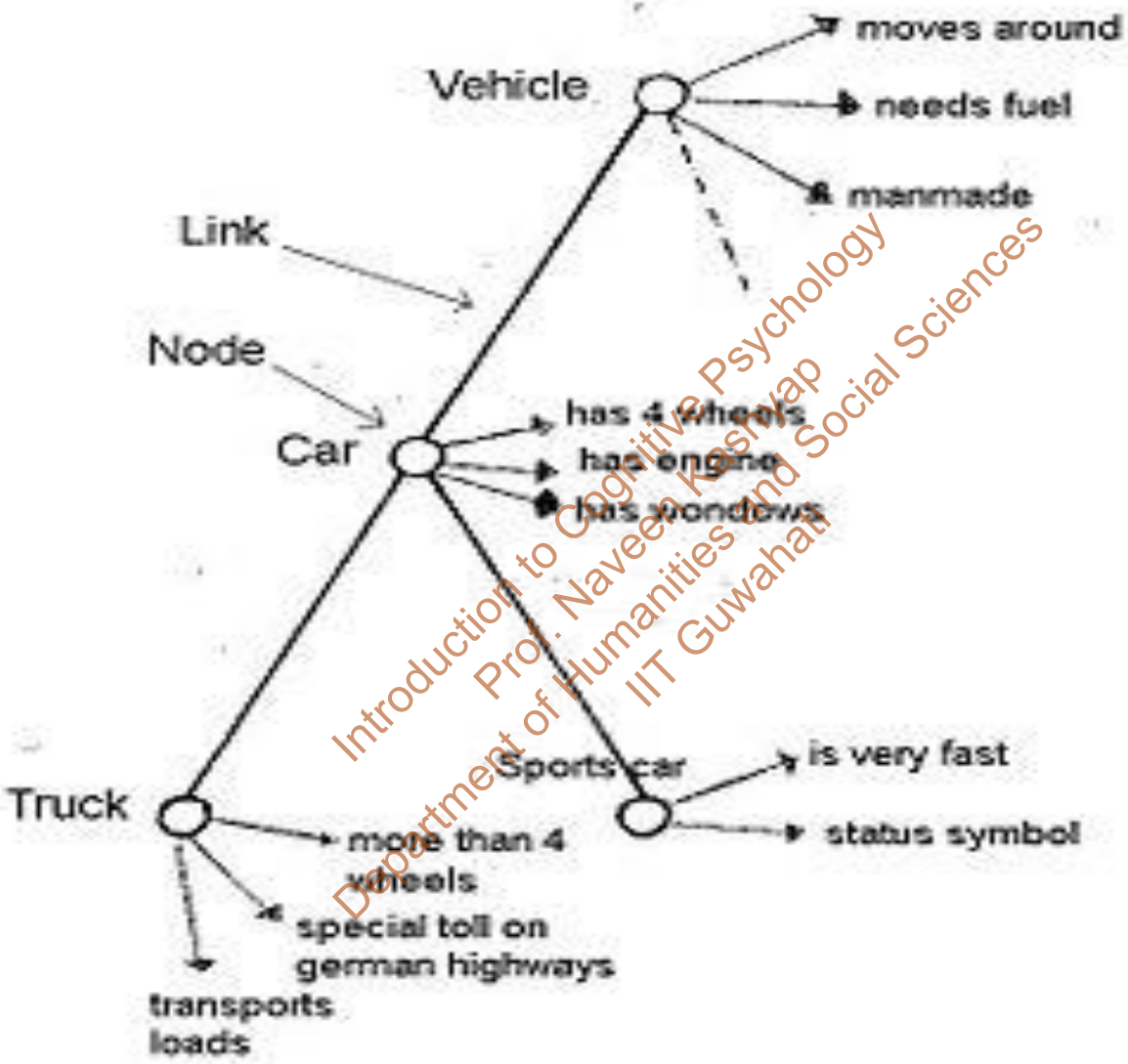
The Hierarchical Semantic Model

The model was proposed by ***Collins & Quillinan (1969).*** They tested the idea that semantic memory is analogous to a ***network of connected ideas.***

The Model consists of ***nodes*** (in this case words/concepts). Each node is ***connected to related nodes*** by means of ***pointers***.

*Thus the **node** that **corresponds to a given word/concept** together **with** the **pointers to other nodes** to which the **first node is connected**, constitutes the **semantic memory** for that **word/concept**. The **collection of nodes** associated with all the words & concepts is called **Semantic Network***

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Collins & Quillian (1969) tested the principle of cognitive economy with their model of semantic memory. They reasoned that the closer a fact is stored to a particular node, the less time it should take to verify the fact and property.

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T*hey reported that people took* ***less time to respond*** *to sentences whose* ***representations should span two levels*** *(****A canary is a bird****) than for those whose* ***representation should span three*** *(****A canary is an animal****).*

This model was called the ***hierarchical semantic network model of semantic memory.*** The nodes in this model are ***organized in hierarchy*** and most nodes have ***super ordinate and subordinate nodes***. Super ordinate nodes correspond to the category name for which the thing corresponds to the subordinate node was a member.

Meyer & Schvaneveldt (1971) reasoned that ***if related words*** are ***stored close*** by one another and are ***connected to one another*** in a semantic network, then *when ever one node is activated* or energized, ***energy spreads to the related nodes***. One reason for such a fact could be the concept of ***spreading activation***, the idea that ***excitation spreads along the connection of nodes in a semantic network***

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Limitations of HMSM

1) *Cognitive Economy*: Conrad (1972) found that people respond no faster to sentences such as “A shark can move” than to “A fish can move” or “An animal can move”.

2) *Hierarchical Structure*: Rips, Shoben & Smith (1973) showed participants were faster to verify “A pig is an animal” than to verify “A pig is a mammal” thus violating the hierarchical structure (animal-mammal-pig)

3) *Typicality Effect*: Rips (1973) found that responses to sentences such as “A robin is a bird” were faster than responses to “A turkey is a bird”. In general typical instances of a concept is responded to more quickly than atypical instances.

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The Feature Comparison Model

Smith, Shoben & Rips (1974) proposed an alternative to the HMSM called the ***feature comparison model*** of semantic memory.

Assumption: ***The meaning of any word or concept consists of a set of elements called features. Features come in two types***

1) ***Defining*** – *meaning that the* ***features must be present*** *in* ***every example*** *of the concept and*

2) ***Characteristic*** – *meaning the* ***features is usually but not necessarily present.***

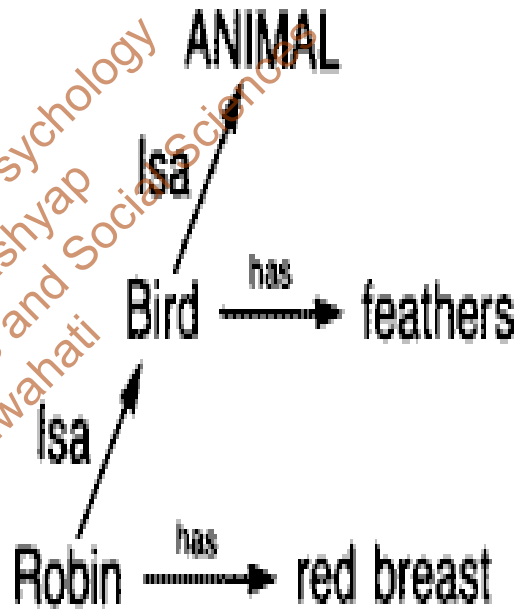
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Attribute or feature list model

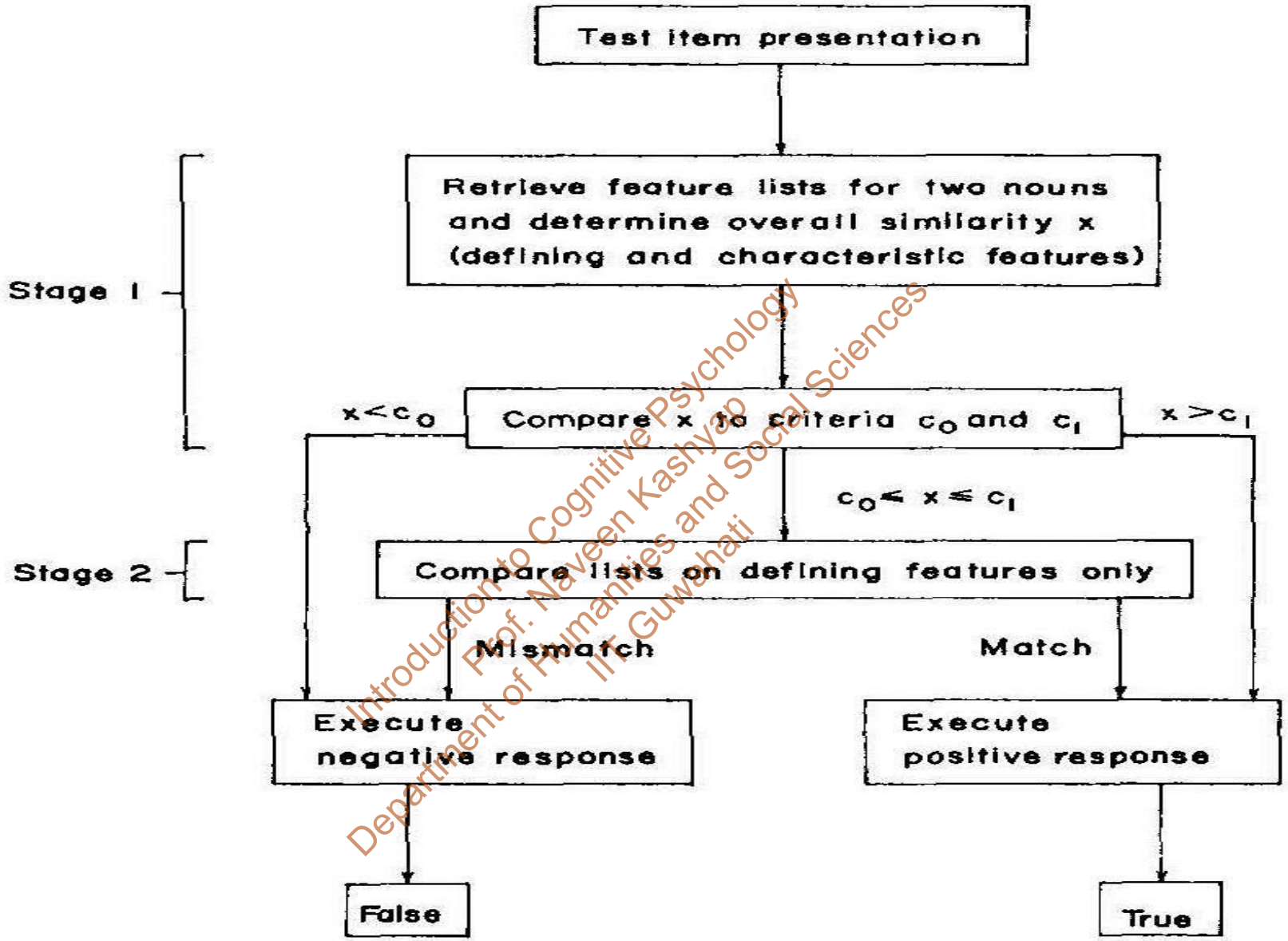
Robin
Physical object
Living
Animate
Feathered
Red-breasted
_____
_____
_____

Bird
Physical object
Living
Animate
Feathered
_____
_____
_____

Hierarchical network model



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FIGURE 3. A two-stage, feature comparison model for semantic categorization tasks. (See text for explanation.)

Feature Comparison model can explain shortcomings of the HMSM

1) *Typicality Effect*: Sentences like “A robin is a bird” are verified more quickly than “A turkey is a bird” because robin being more typical examples of birds are thought to share more characteristics feature with “bird” than do turkeys

2) *Category Size Effect*: The feature comparison model assumes that as categories grow larger they also become more abstract which lead to lesser defining features.

Criticisms:

1) There is no existence of defining features (suppose a bird has clipped wings. Will it no longer be a bird?)

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Other Network Models

Collins & Loftus (1975) presented an elaboration of the Collins & Quillian (1969) Hierarchical model that was the ***spreading activation model***

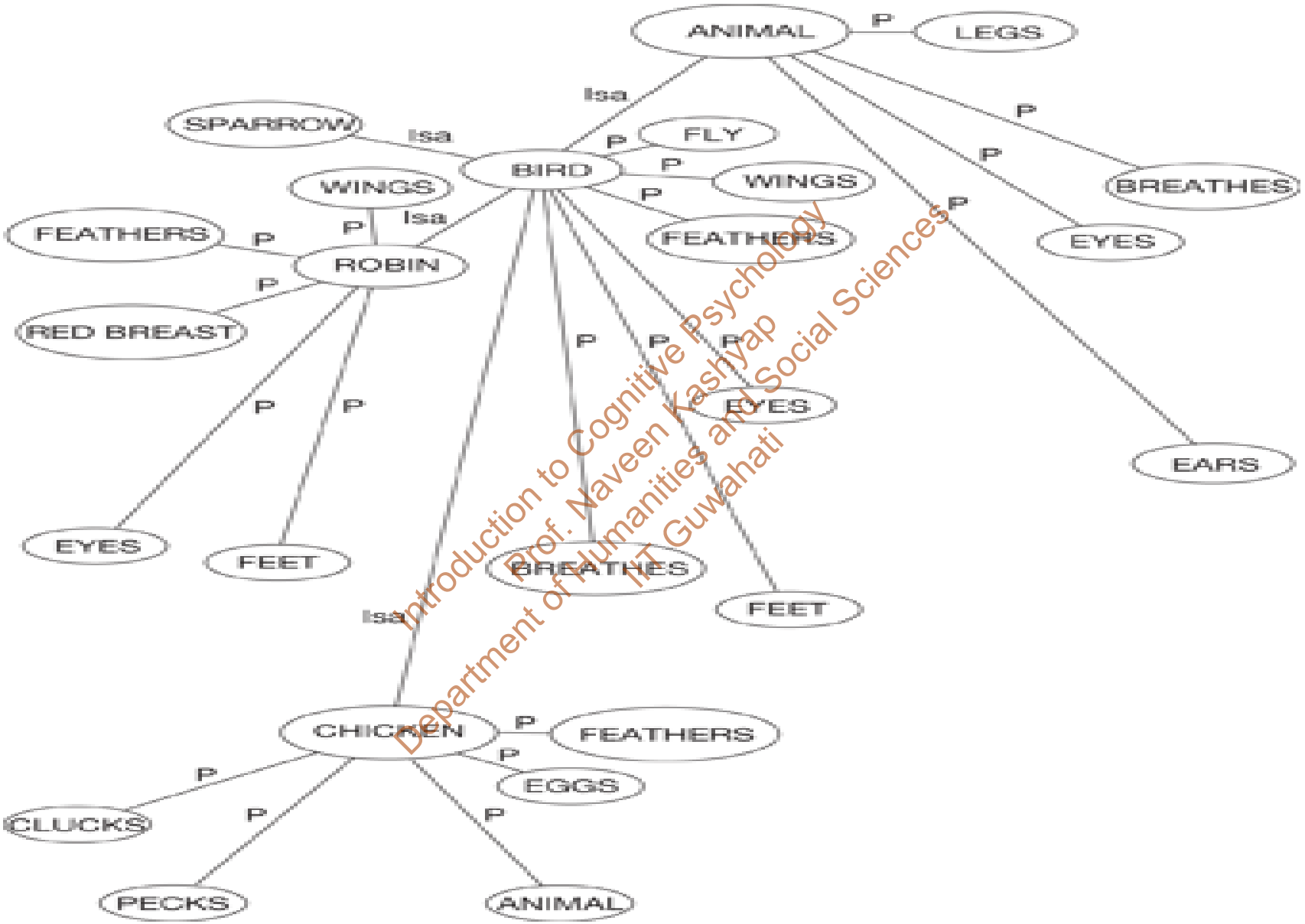
This model conceives of semantic memory as a ***network, with nodes in the network corresponding to concepts****. They also saw* ***related concepts as connected by paths in the network***

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They further asserted that ***when one node is activated*** the ***excitation*** of the node ***spreads down the paths or links*** to related nodes.

They believed that ***as activation spreads*** down the paths or links to related nodes. ***When activation spreads outwards***, it ***decreases in strength***, activating very related concepts a great deal but *activating distantly related nodes* only a little bit.

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In this model ***very similar concepts*** have ***many connecting links*** and are ***placed close to each other***. Each ***link/connection between two concepts*** is thought to have a certain ***weight or set of weights*** associated with it.

Criticism: The breadth of the model makes it difficult to make clear and strong predictions from the model regarding empirical findings.

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Anderson's ACT model

Proposed by ***John Anderson (1976, 83, 93)*** and called the ***adaptive control of thought*** model of memory (ACT, ACT-*, ACT-R). Based on ***analogies to computers***, ACT gives rise to ***several computer simulations*** of cognitive processing of different tasks.

Distinguishes among three types of memory systems:

- Declarative memory (information, facts)
- Working memory (information that is currently at a high level of activation)
- Procedural memory

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Declarative Memory

Anderson (1983) believed ***declarative memory stores information in networks that contain nodes***.

There are different types of ***nodes***, including those corresponding to ***spatial images or to abstract propositions***.

ACT model allows ***both for activation*** of any node and for ***spreading activation*** to connected nodes

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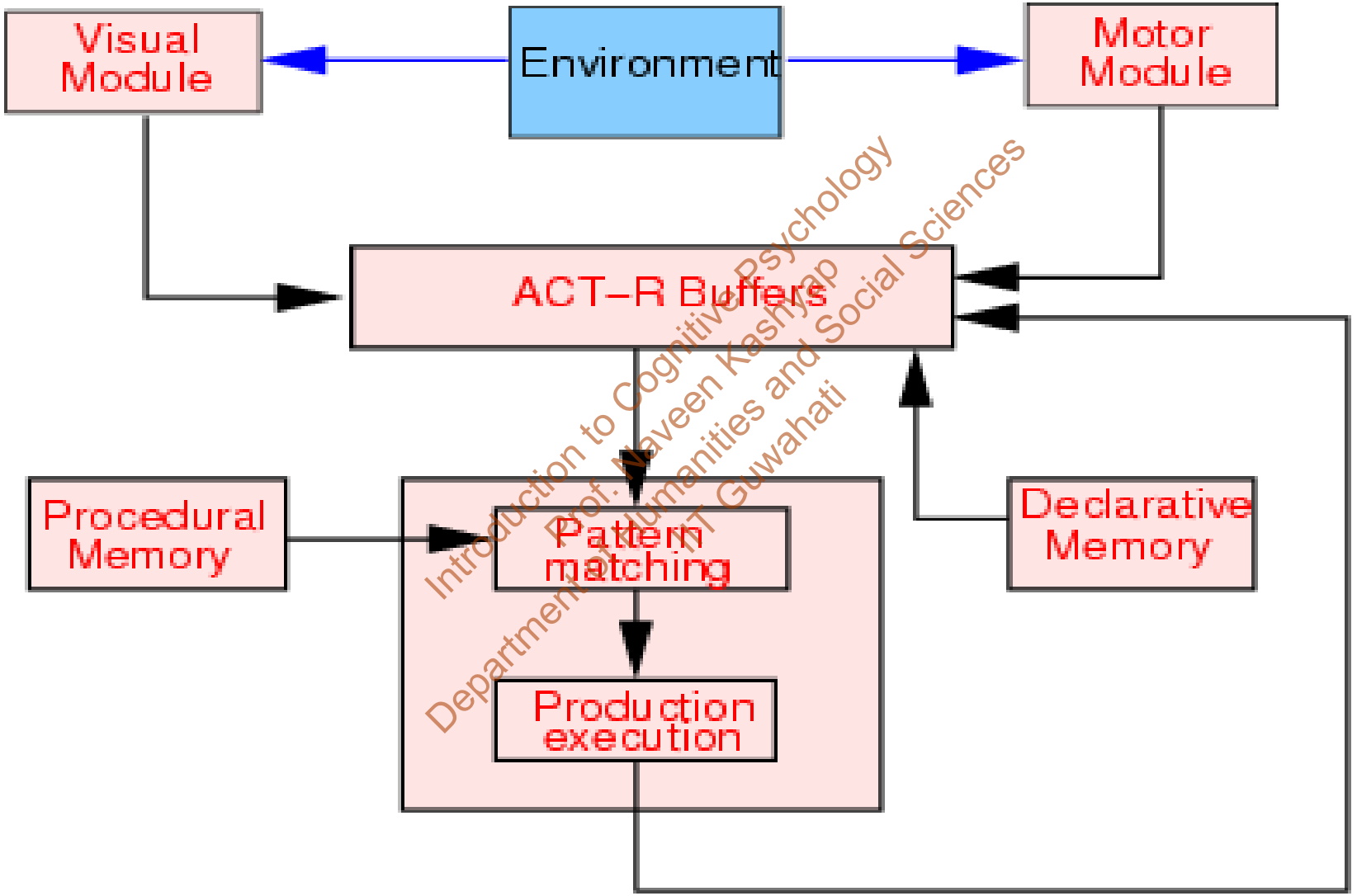
Procedural Memory

Representation is as a series of ***"production rules."***

If–then statements that tell ***how to perform*** a particular action

Production rules specify ***a goal to achieve***, one or ***more conditions*** that must be true for the rule to apply, and ***one or more actions*** that result from applying the rule

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Connectionist models

Model ***"learns"*** to develop patterns of activation through ***many trials*** with ***training examples (back propogation)***

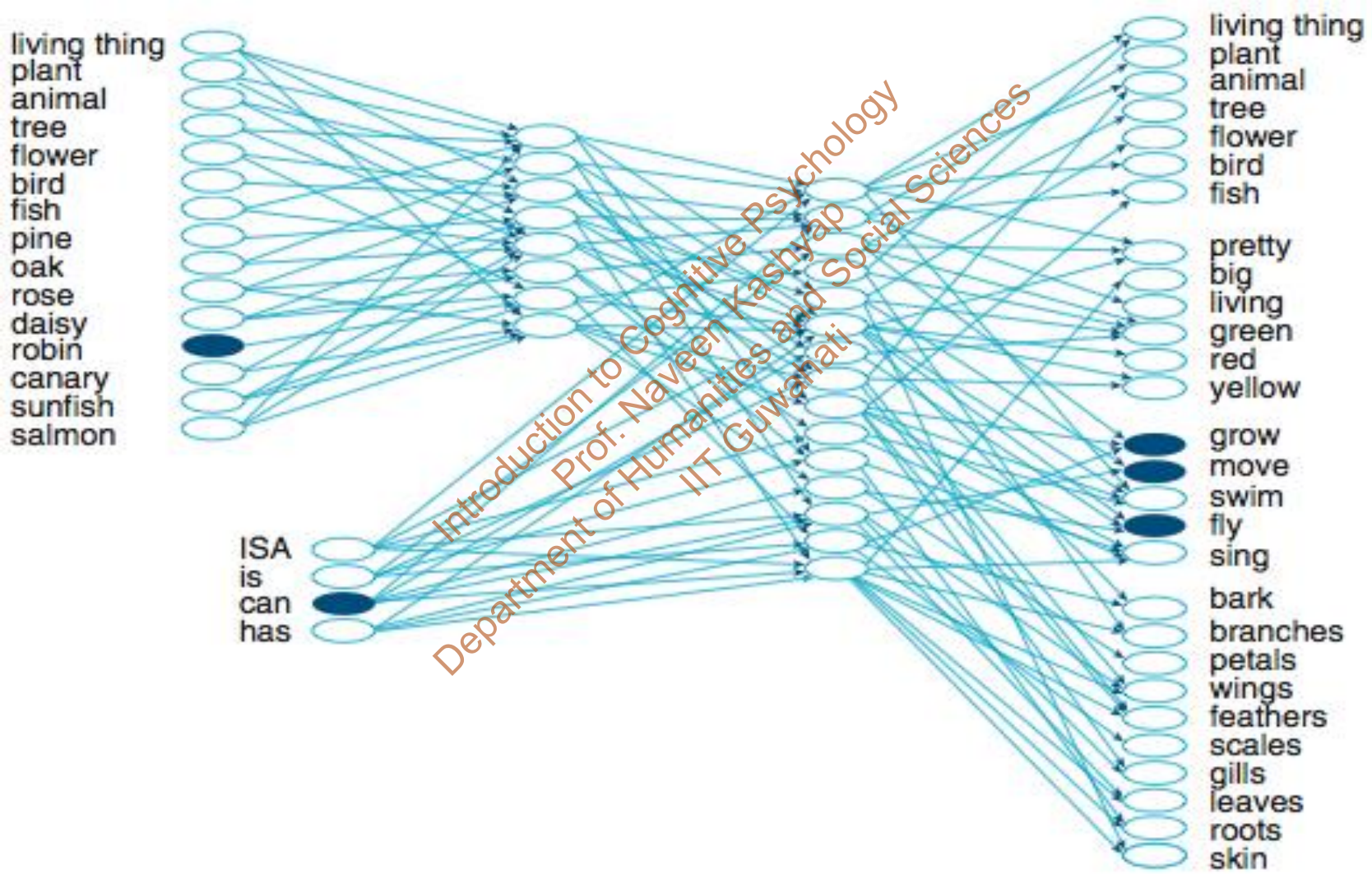
Initially, connections between nodes are set at ***random strengths*** (weights); ***experience*** leads these connections to be activated more or less strongly.

Training occurs by presenting a specific example to the network which then generates a particular output.

Training takes places in 'epochs'. Each epoch produces an output activation which is compared with correct target activation.

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A connectionist model for “robin”



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Schemata

Represents knowledge in Semantic Memory (Bartlett, 1932)

Schemata contains: *General Knowledge about world and Information about particular events*

Schema – *are large units of organized information which are used for representing concepts, situations, events actions in memory*

Rumelhart and Ortony (1977) – *fundamental building blocks of cognition, units or organized knowledge analogous to theories*

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Schemata – *packets of information that contain both variable and fixed part.*

DOG Schemata

Mammal, four legs (fixed part)

Breed, Size, Color, Temperament (variable part)

Schemata – *indicated relationship among various pieces of information*

Schemata – *connected to other schemata in a variety of ways*

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Schemata – *fills in default values of certain aspects of the situations which help us in making assumptions*

Schemata – *exists at all levels of abstraction; thus they can exist for small parts of knowledge and for very large parts*

Scripts – are schema for routine events (for example going to a restaurant)

Scripts – are used across variety of situations for figuring out unknowns (new city visit)

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Scripts – *help us make a number of inferences*

Scripts – *help us for order.*

Bower, Black and Turner (1979) showed that when information from a story is presented in jumbled up sequences people tended to recall the story in scripted order.

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