Introducing Cognition

- Includes :

  1. Structure of Human Brain

  2. Brain and Mind

  3. Theories of Mind (including Computational Theories)

  4. Cognitive Processes and Models

  5. Cognitive Architectures

  6. Cognitive Systems

1 : Structure of Brain

Mind Definition 1

- *Oxford English Dictionary (OED) – Definition 17*
- Mental or psychical being or faculty.
- The seat of a person's **consciousness, thoughts, volitions, and feelings**.
- The system of cognitive and emotional phenomena and powers that constitutes the subjective being of a person.
- Also the incorporeal subject of the psychical faculties, the spiritual part of a human being.
- The soul as distinguished from the body.

Mind : Definition 2

- 'MIND' according to the *Oxford English Dictionary (OED)*

- 18. In more restricted applications.

- The **cognitive or intellectual powers**, as distinguished from the will and emotions. Often contrasted with *heart*.

- Note several features of "mind" as per OED

- Mind is essentially identified with the *conscious mind*.

- Mind is subjective.

- The mind is incorporeal, and is to be distinguished from the body. This leads to the mind–body problem.

- Definition 18 describes the *rational mind*, a deliberative mind.

Mental States Vs Brain States (Mind – Body Problem)

- General features of Mental States :
1. Some mental states are caused by states of the world
2. Some mental states cause actions
3. Some mental states cause other mental states
4. Some mental states are conscious
5. Some mental states are about things in the world
6. Some kinds of mental states are systematically correlated with certain kinds of brain states
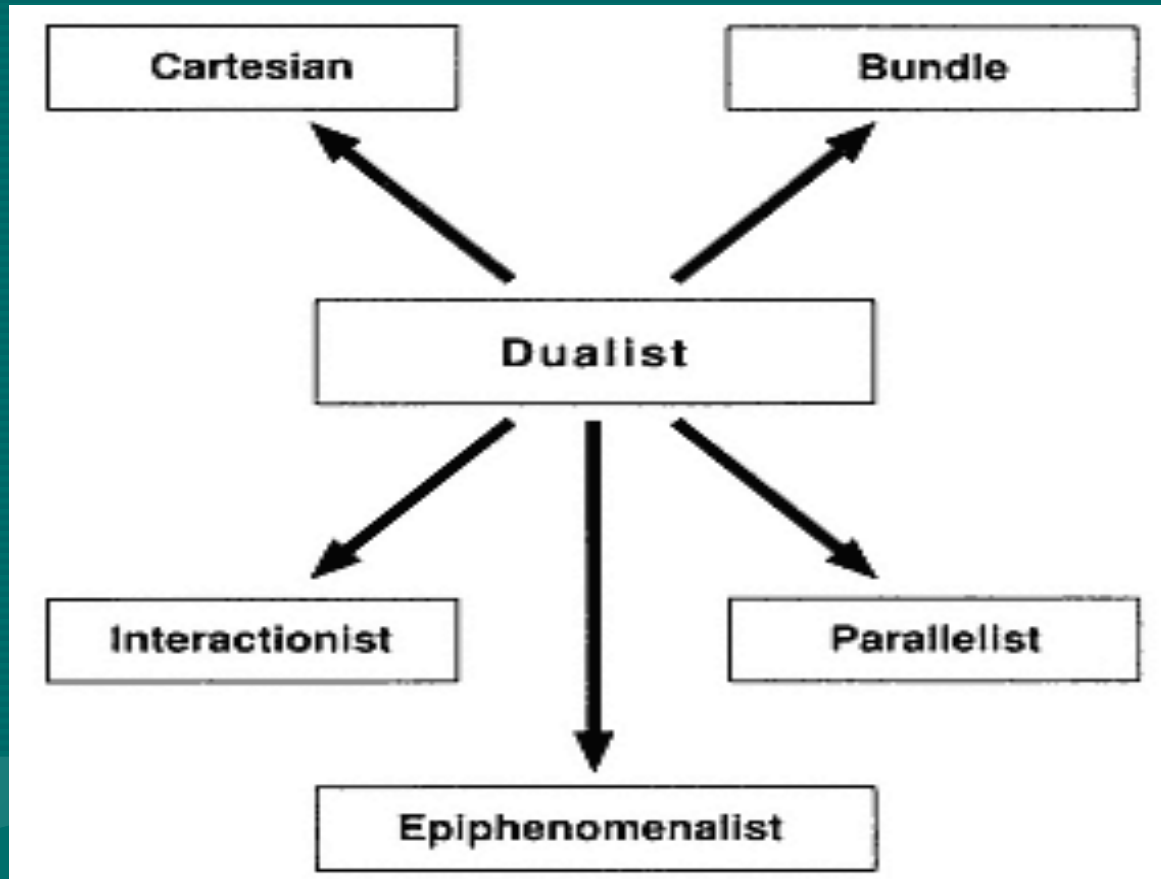
Varieties of Mind
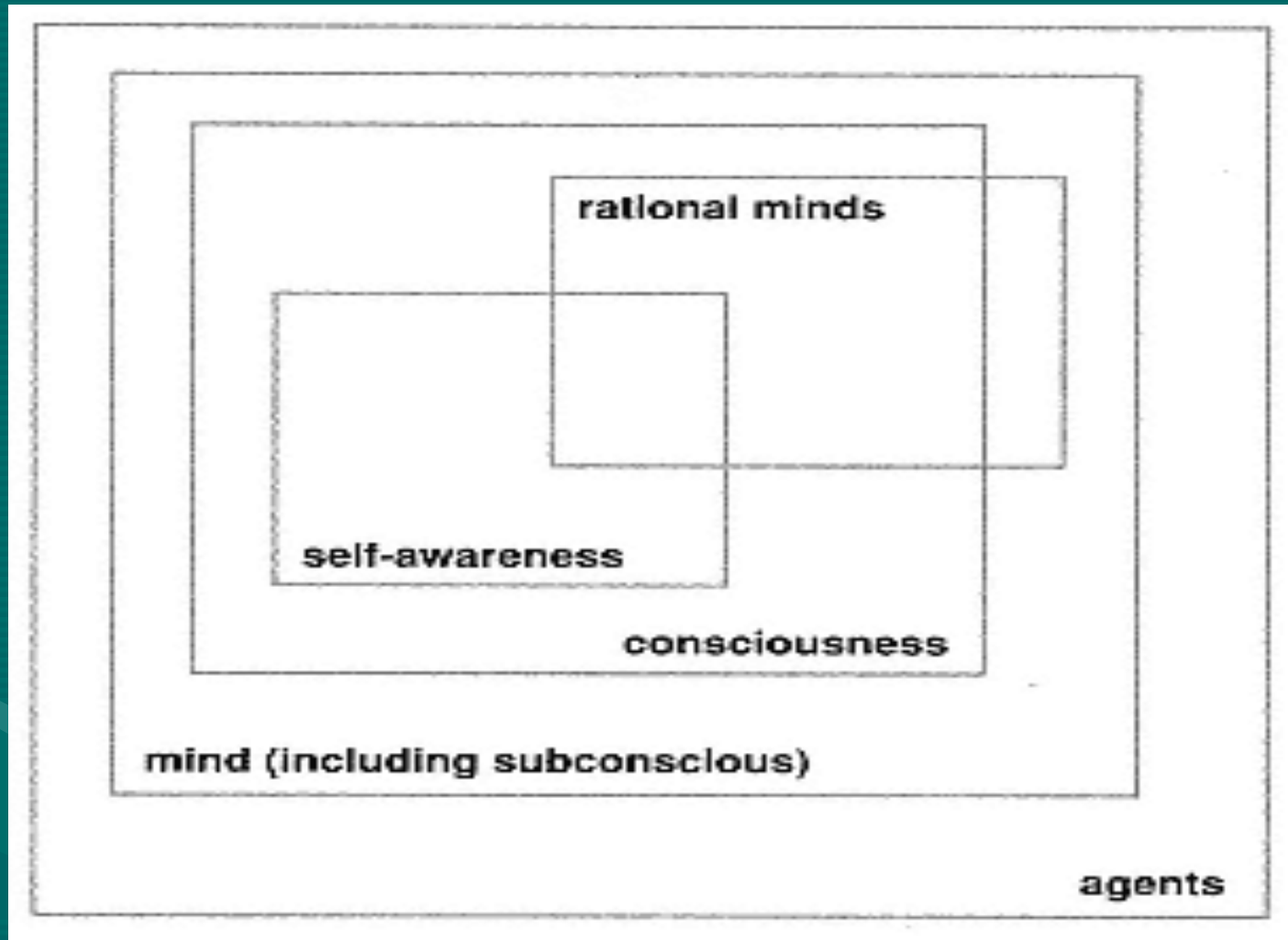
Theories of Mind
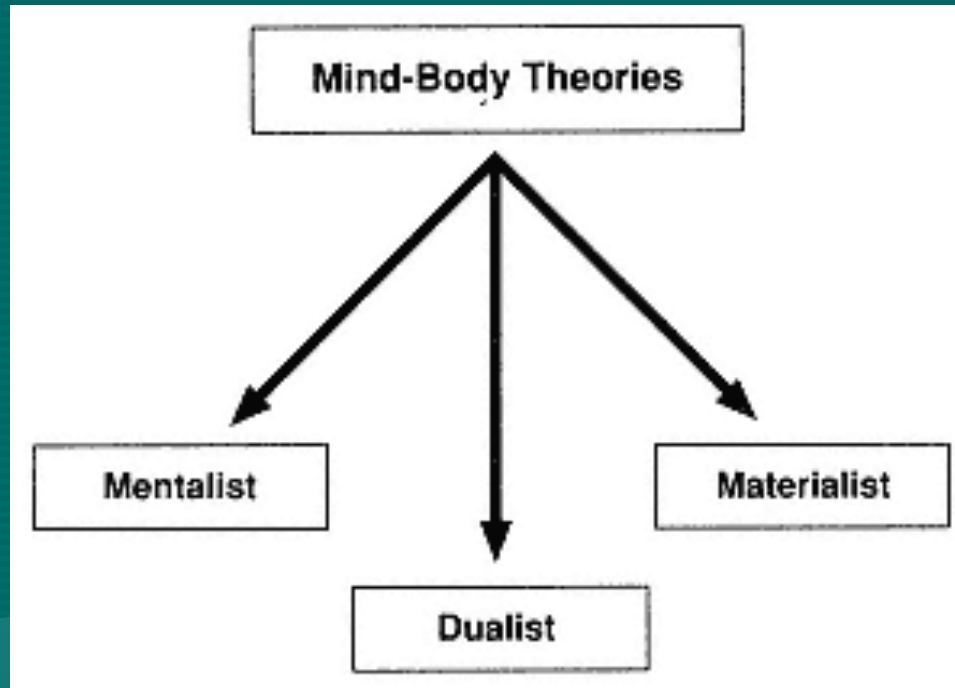
Theories of Mind

Theories of Mind (*various types of dualism*)

- *Cartesian duality* postulates mind and body as substances, one extended and material, the other unextended and spiritual.
- Hume, who looked around and said he couldn't find anything like mind, only bundles of perceptions. That's the *bundle theory*, partitioning the mind into bundles while leaving the physical world intact.
- *interactive duality*, which says that the mind affects the body and the body affects the mind.
- *Parallel duality* holds that the mind and body run in parallel, with neither having anything to do with the other.
- *epiphenomenalist view* that the body affects the mind but not conversely.

Materialist theories of Mind
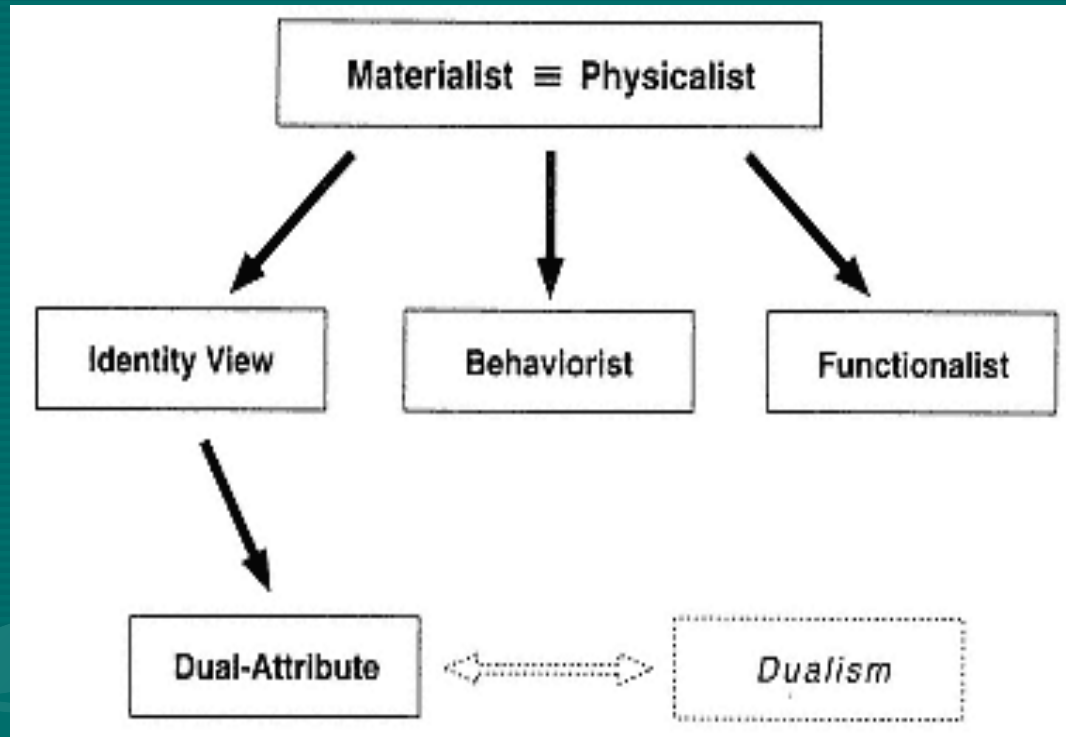
Materialist theories of Mind

- *Behaviorism* maintains that mind is nothing more than sophisticated overt behavior.

- the *identity view*, which identifies mental events with physical processes in the nervous system. There is only one substance, the physical, but mental happenings are allowed to interact causally with the physical body.

- Minsky adopts the *functionalist* view when he proclaims: "as far as I'm concerned, the so-called problem of body and mind does not hold any mystery: *Minds are simply what brains do*" (1985, p. 287). The functionalists view mind, the software, running on brain, the hardware.

Brain States and Mental States

- **Identity Theory** claims that mental states are the physical states of brain (claims an identity between the mental states and certain physical brain states)

- Compare it to **Property Dualism** which claims that mental states are (non-physical) properties of the brain

- Australian Philosopher J J C Smart gave two analogies : Mental states are brain states in the same way that Water is H_2O, and lightning is an atmospheric electrical discharge.

- **Token Identity and Type Identity :** If you are invited by The present President of India on a dinner, you are also invited by Pranab Mukherjee; The present President of India and Pranab Mukherjee are token identical. But,water and H_2O and lightning and atmospheric electrical discharge are type identities.

Brain States and Mental States

- **Identity Theory** claims that there is a type identity between mental states and brain states. Hence every type of mental state is identical to a brain state (however, the converse is not true).

- Identity theory : Explanation to six features of mental states (explains 3 features; 2 more may be explained but not the consciousness feature)

- 1. Some Mental states are caused by states of world : My belief that there is a cup of coffee in front of me (mental state) identical to a brain state caused by seeing the cup of coffee

- 2. Some Mental states cause actions and 3. Some mental states cause other mental states can be explained easily.

Brain States and Mental States

- Some mental states are about things in the world and some kinds of mental states are systematically correlated with certain kinds of brain states can be explained to some extent.

- Arguments against : Multiple realizability :Pain in Human beings realized through C-fiber firings whereas in Squids through d-fiber firings : So Pain (mental state) is not identical to C-fiber firing

- Restricted Type Identity : Human Pain and Squid Pain

Brain States and Mental States: Functionalism

- According to Functionalism To be in Mental State M is to have an internal state which does the M-job (or M-task), philosophically, mental states are occupants of characteristic causal roles

- E.g. Carburetors made up of Brass and Other alloy, and antibiotic medicine (Penicillin and Erythromycin) does the same function (role)

Theoretical models

- Individual Cognition Models : It is a fundamental function required by the mind

- Social Cognition Models : It is one component of social intelligence (to understand and predict others behaviour)

- SELF Vs Others' debates (Theory of Mind)

Cognitive Processes (Individual)

- Understanding Brain Systems

- Modelling Brain (Mind) Systems (Processes)

- Simulating Brain Systems

Cognitive Processes (Social)

- Modelling Group (Society or Organization) of Individuals (Agents)

- Multiplayer Game Playing (Competitive and/or Collaborative)

- Cooperative and Collaborative System Development (Human – Human, Human – Machine, Machine – Machine)

Emotion Analysis Research

- It presents the approach for affect prediction in terms of valence, arousal and dominance based on facial expression and physiological signals.

- It also predicts the correlation between emotion dimensions and demonstrates significantly improvement in performance.

- A set of evaluation metrics are also proposed to show the usefulness of metrics in affect recognition.

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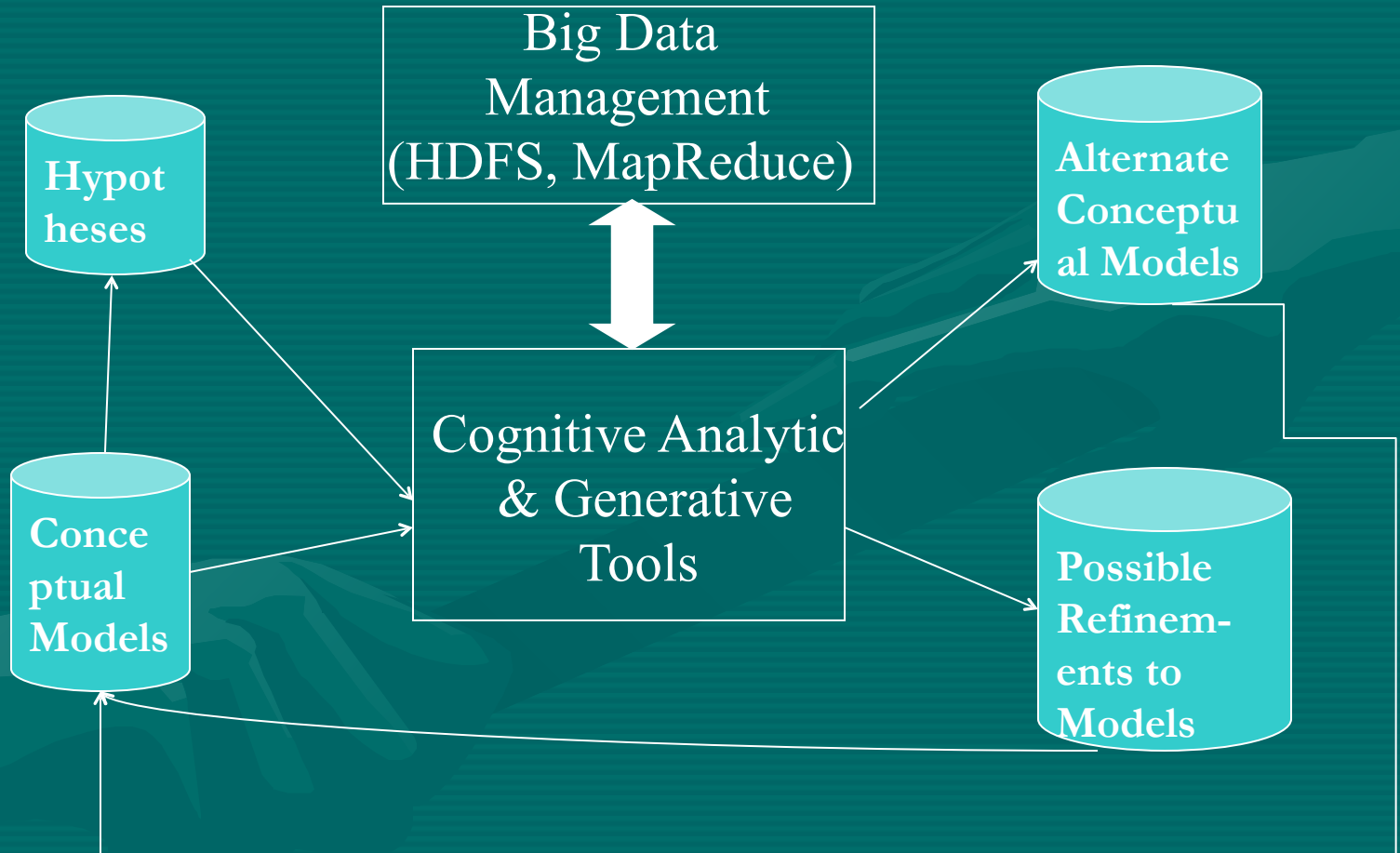
Cognitive System Development

- **Creating a Platform** to Collect/Generate (with experiments) Data, Analyze (developing new techniques) and Develop Systems(with human-like capabilities)
Huge Real-time Data in Indian Situations (Indian Languages) is lacking

- **Knowledge Discovery** through Cognitive Learning Algorithms and Tools
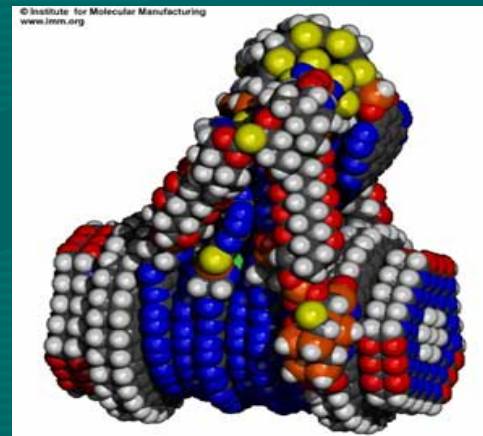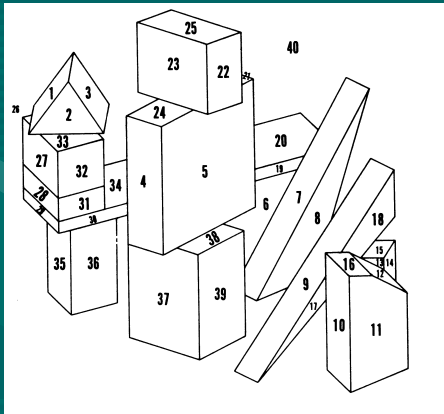
Knowledge Discovery through Cognitive Learning

Data Types	Applications	Emerging Research
Genomics and sequence data	Genomics and sequence analysis and visualization	Knowledge discovery
Electronic health Records	Healthcare decision support	Association mining and Clustering; Hypothesis testing
Sensor and network content	S&T innovation	Domain-specific mathematical and analytical models
Social media	Recommender systems	Social network analysis

Questions ?