PERSPECTIVES ON KNOWLEDGE, SCIENCE AND TECHNOLOGY

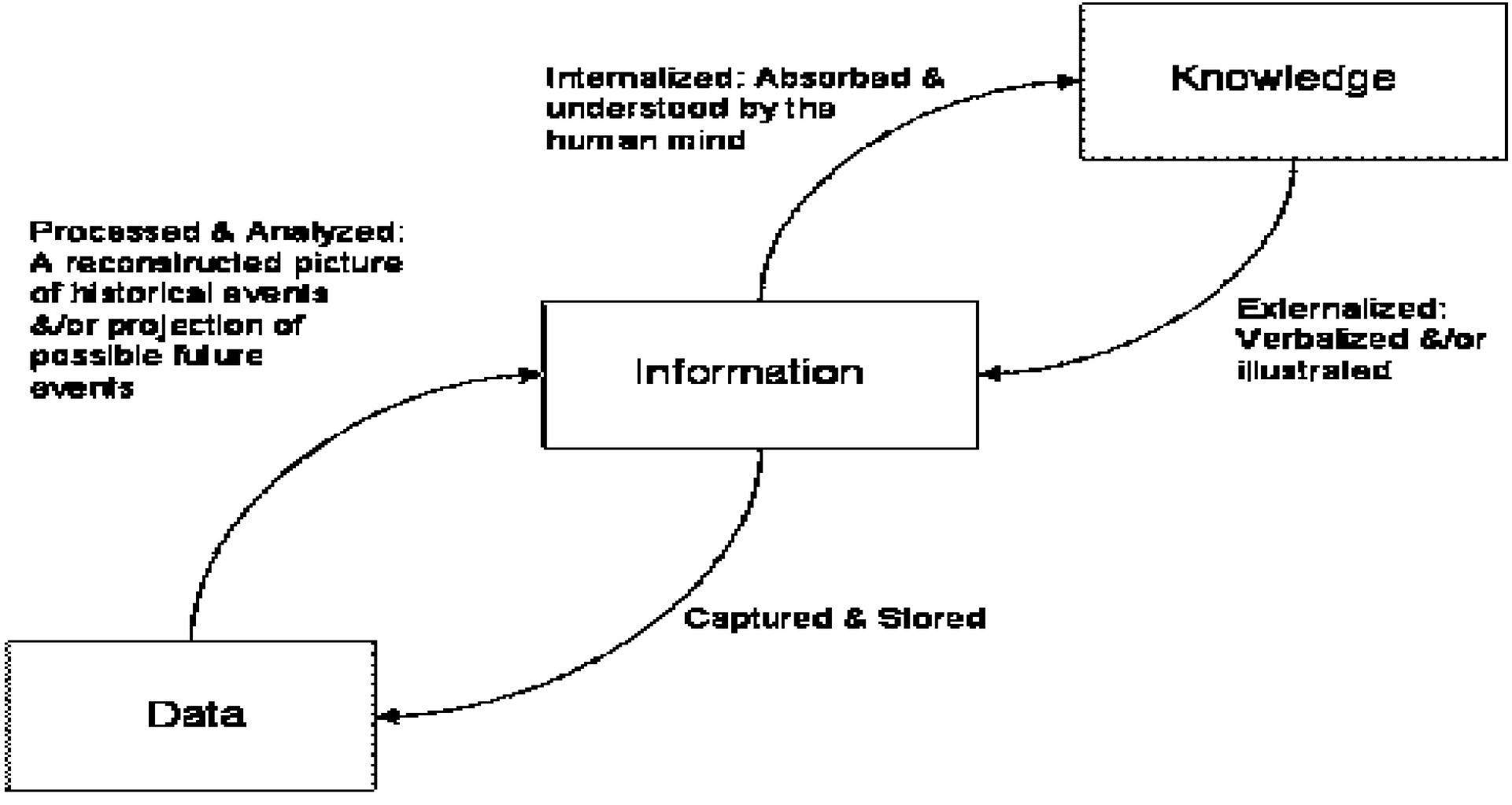
UNIT 3

KNOWLEDGE

- **Definition 1:** justified true belief. Can be justified by facts.
- **Definition 2:** information in context. Coherent with a larger system (rational) and can be useful in decision making and problem solving (pragmatic).
- **Definition 3:** understanding based on experience.
- **Definition 4:** capacity for effective action.

Human knowledge is encoded and communicated in a natural language (e.g. English, Hindi). Knowledge helps us to solve problems.

KNOWLEDGE SYNTHESIS



Data, Information, and Knowledge

- **Data:** Unorganized and unprocessed facts; static; a set of discrete facts about events
- **Information:** Aggregation of data that makes decision making easier
- **Knowledge** is derived from information in the same way information is derived from data; it is a person's range of information

DATA

Data is a set of unorganized information; a quantification or measurement of the real world by a set of variables.

Data are recorded as:

- **Symbols** include words (text/verbal), numbers, diagrams and images(still/video) which are the building blocks of communication.
- **Signals** include sensor/sensory readings of light, sound, smell, taste and touch.

CHARACTERISTICS:

1. Raw materials of information
2. Distinct piece of information
3. Data must be disorganized or unprocessed

INFORMATION

Information is a message that contains relevant meaning, implication, or input for decision and/or action. Information comes from both

- *current(communication)*
- *historical(processed data) sources.*

Information must:

1. be something
2. provide new information
3. be true
4. be about something

CHARACTERISTICS:

- Resultant version of some data
- Always be processed or organized
- It is the context in which data is taken

KNOWLEDGE

Knowledge is information put into a specific context.

Knowledge is the:

1. cognition or recognition (know-what)
2. capacity to act (know-how)
3. understanding (know-why)

CHARACTERISTICS:

- General awareness or possession of information, facts, ideas, truths or principles.
- Clear awareness or explicit information e.g. of a situation or fact.
- All the information, facts, truths and principles learned throughout time.
- Familiarity or understanding gained through experience or study.

TYPES OF KNOWLEDGE

- Episodic knowledge
  - Refers to our biological memory reflecting not only what happened, but also where and when it happened.
  - It means that the memories of our childhood days, our first day in school or cell phone number of our loved ones are all example of episodic knowledge.
- Semantic knowledge
  - In contrast to episodic knowledge, deals with memories and information that are not tied to our personal biographies.
  - The organized knowledge about facts,
  - concepts and generalizations including their
  - associations form part of our semantic knowledge.

Types of semantic knowledge

DECLARATIVE KNOWLEDGE - deals with the statement of truth, it also deals with what we know about the world.

PROCEDURAL KNOWLEDGE- is the knowledge about how things are to be done.

CONDITIONAL KNOWLEDGE- if the declarative knowledge accounts for knowing *what* and
procedural knowledge accounts for knowing *how* then,
conditional knowledge account for knowing *when.*

Varieties and Types of Knowledge

- **A posteriori**: “from the latter”. Extends from experience or empirical evidence- Operant Conditioning
- **A priori**: from causes to the effect- Classical Conditioning
- **Dispersed knowledge**: information about a topic is fragmented with no single source of truth.
- **Domain knowledge**: describes the knowledge, skills and abilities of experts in a particular field.
- **Empirical knowledge**: stems from quantitative and qualitative observations, measurements and experiments.
- **Encoded knowledge**: represented as data such a document, database etc
- **Explicit knowledge**: can be articulated in a natural knowledge such as French or Japanese.

contd

- **Known unknown**: knowing that you don't know is a form of knowledge that is useful in decision making.
- **Meta knowledge**: knowledge about knowledge such as bibliographic data.
- **Procedural knowledge**: it is often difficult to encode or make explicit.
- **Propositional knowledge**: statements of fact.
- **Situated knowledge**: highly specific knowledge
- **Tacit knowledge**: few individuals achieve mastery of a particular skill

Knowledge can also be divided into:

- **MENTAL KNOWLEDGE**: knowledge on the surface which pieces things together but never knows the whole and never knows the depths.
- **SUBLIMINAL KNOWLEDGE**: instinct in animals. knowledge that perceives everything and remembers everything ,even when we are not mentally conscious.e.g. Greek scholar and uneducated servant.
- **SUPRAMENTAL KNOWLEDGE**: it is always knowledge of the whole, not just the parts and it automatically sees the solution to any problem. Moving to the supramental consciousness is long and difficult path. It is a path of yoga.

• INTUITIVE KNOWLEDGE

Sir Aurobindo defines intuition as reason without the influence of the senses. Intuition is a direct knowledge, a direct experience of something else.

Different types of intuition:

1. **Spiritual intuition**: the surface personality surrenders to the psychic and the psychic surrenders to the supramental. If we have sincerity and purity of consciousness, we can always know intuitively which things are true and which are false.
2. **Mental intuition**: mental intuition is with a little bit of vital enthusiasm. E.g. Einstein discovered in his intuition the relationship between mass and energy. While Archimedes, the ancient Greek philosopher, was bathing, he suddenly figured out the relationship between the mass of water in his bathtub and the weight of his body which was displacing the water.
3. **Vital intuition:** if someone knows who is calling on the phone even before they pick up the receiver, that is vital intuition.
4. **Physical intuition:** animals have physical intuition. It is a natural sense that tells them what is good for them to eat. They can also sense danger approaching.

SCIENCE

Science is the knowledge we get from study, experiment and observation

We use **science** to make our lives **easier**

Technology & Society

What is Technology?

Technology is the application of scientific knowledge of materials & processes to benefit people.

Technology can be

1. Any human made object
1. Knowledge or skills needed to operate a human – made object
1. A system of people & objects used to do a particular task

Understanding the Social Construction of Technology

- Both technical processes and social processes shape technological development.
- **Thus, what we think of as 'technology' is produced through many factors, including:**
  - Behaviors of individuals and groups
  - Economy and markets
  - Consumer needs and wants

How is technology shaped?

- The development of technology is affected by society and its changing values, politics, and economics.

A. Social Forces that Shape Technology

- If consumers fail to buy a product, companies usually will not spend additional money on that type of technology.
- People will support the development of technologies that agree with their personal values, directly and indirectly.

B. Economic Forces that Shape Technology

. Federal Government

- One way in which funds are allocated for research and development of technology is through the federal government.

Private Industries

- Industries budget a portion of their profits for research and development.

C. Responsible Technology

Environmental Issues

- Sometimes the consequences of technology are known, but the benefits are perceived to outweigh the risks.
- Sometimes the benefits of technology are known immediately, but the consequences are not known for a period of time.

Consumers and voters have a responsibility to weigh the benefits and consequences of technology.

- Example: The Chernobyl Accident → The worst technological accident in modern times occurred on April 26, 1986, at the Chernobyl nuclear power plant in the Ukraine.

→ An accumulation of radioactive fallout in the upper layers of soil has destroyed important farmland.
→ Groundwater and surface waters were contaminated.

Moral and Ethical Issues

- Ethical issues in science pose questions and establish rules about how scientific hypotheses should be tested and how society should use scientific knowledge.

Ethics help scientists establish standards that they agree to follow when they collect, analyze, and report data.

What is the Nature of Human Knowledge?

- **Positivism** – accepts as knowledge only that which can be verified by the scientific method (objective / rational).

- **Social construction theory** – knowledge stems from the interpretations, beliefs and meanings shared by groups of people (subjective).

Engineers

A researcher responsible for bringing technology to the Consumer is called an Engineer.

Technological problems often create a demand for new scientific knowledge.

The Essence of Your Engineering Career

- Engineering is one of the most important professions in society.
  - As engineers we *don't just build things and develop processes*.
  - We build things and make processes *in order to better society*.
- In order to make society better we have to reflect constantly on the products and processes that we make.

Social Responsibility

- One main connection between ethics and engineering comes from the impact that engineered products and processes have on society.

- Engineers have to think about designing, building, and marketing products that benefit society.

- Social Responsibility requires taking into consideration the needs of society.

Typical Ethical Issues that Engineers Encounter

- Safety
- Acceptable risk
- Compliance
- Confidentiality
- Environmental health
- Data integrity
- Conflict of interest
- Honesty/Dishonesty
- Societal impact
- Fairness
- Accounting for uncertainty, etc.

Professional Responsibility

- Ethics has a second connection with engineering.
- It comes from the way in which being socially responsible puts duties and obligations on us individually.
- Ethics fits into engineering is through professional responsibility.

Professional Obligations

- Engineers shall be guided in all their relations by the **highest standards of honesty and integrity.**
- Engineers shall at all times **strive to serve the public interest**.
- Engineers shall **avoid all conduct or practice that deceives the public**.
- Engineers **shall not disclose, without consent, confidential information concerning the business affairs or technical processes** of any present or former client or employer or public body on which they serve.
- Engineers **shall not be influenced in their professional duties by conflicting interests**.
- Engineers **shall not attempt to obtain employment or advancement or professional engagements by untruthfully criticizing other engineers** or by other improper or questionable methods.
- Engineers **shall not attempt to injure maliciously or falsely, directly or indirectly the professional reputation, prospects, practice or employment of other engineers.**
- Engineers **shall accept personal responsibility for their professional activities**.
- Engineers **shall give credit for engineering work to those to whom credit is due and will recognize the proprietary interests of others.**

Role-Responsibilities

ROLE	RESPONSIBILITY
Friend	Look out for the interests of your friend.
Athlete	Play your sport in a professional manner.
Employee	Perform the duties of your job.
Parent	Look after your children and their interests
Citizen	Follow the laws of the country in which you live.