

# CHAPTER 1

## SCIENCE, HISTORY AND PSYCHOLOGY

### UNDERSTANDING SCIENCE

**Sir Isaac Newton (1642 – 1727)**

Saw science as search for small number of laws which 'predicted' natural phenomena (e.g. eclipses, appearance of comets etc.)

Developed math laws that described motion of planets

Proposed law of gravity

Studied optics

**Positivism – August Comte (1798 - 1857)**

## UNDERSTANDING SCIENCE - 2

**Positivism:** a theory that theology and metaphysics are imperfect modes of knowledge and that positive knowledge is based on natural phenomena & their properties and relations as verified by empirical science

**Goal is to describe, predict & control**

- Describe → observations & facts, develop mathematical laws to describe regularities
- Predict observations from laws
- Control

**No speculation about underlying mechanisms**

## SCIENTIFIC EXPLANATION

**1) Deductive-nomological approach**  
(covering-law model) Hempel & Oppenheim  
- 1948

**Explanandum** (events to be explained)  
could be derived from **explanans** (scientific laws + initial conditions)

**Iron law of explanation → no circularity**

- E.g. Reinforcement = that which strengthens responses
  - Reinforcement must be defined objectively from something measurable or controllable, e.g. reward or practice

## SCIENTIFIC EXPLANATION

### Explanation = prediction of past events

- “Predict” position of planets centuries ago from Newton’s laws + knowledge of current positions.

### Positivists did not propose explanations or mechanisms

- Don’t explain “why”
- Causality cannot be inferred from correlation (e.g. deducing height of flagpole from its shadow using geometry).

## SCIENTIFIC EXPLANATION - 2

### 2) Causal Approach – goal of science = understand causes, mechanisms leading to events

- In psych. discuss expectations, beliefs, motivation, & how they affect behavior
- Psych. explanations are not mathematical laws.
- Goal of science: understand causal structure of reality
- Science is **empirical** – based on observations & experimentation. Scientists test hypotheses.

## SCIENTIFIC EXPLANATION - 3

**Realism:** Are theoretical constructs real or merely useful fictions for making sense of observations?

- E.g. atoms; genes; memory stores; Freud's ego, id & superego

**Theories useful if they predict events even if hypothesized constructs are not real.**

- E.g. factor analysis: Are "factors" real or useful fictions?

## SCIENTIFIC EXPLANATION - 4

**Three types of scientific theories:**

- Syntactic approach: Theories = sentences (mathematical equations)
  - Received view
- Semantic approach: Theories = models of the world
  - E.g. computer simulations or physical models
- Naturalistic approach: pragmatic
  - Kuhn
  - Evolution analogy

## SCIENTIFIC THEORIES

### Syntactic approach

Logical Positivism – Received View on Theories:

- theory = sentences (axioms)
- e.g. Clark Hull (see Ch. 11)
- effective reaction potential = habit strength \* drive – inhibition

**Science could include hypothetical constructs (atoms, genes, drive, association strength, memory stores, inhibition)**

**Observation Terms (Protocol Sentences) = descriptions of observed phenomena**

## SCIENTIFIC THEORIES - 2

**Axioms – generalizations from observations; contain only theoretical terms (e.g. Law of Gravity, Hull's equations)**

**Theoretical terms defined operationally**

- E.g. drive = number of hours deprivation
- Reinforcement = number of repetitions or rewards

**Assumes theory and observation are independent but theories direct attention to relevant phenomena.**

- Significance of event determined by theory
- Perception influenced by expectations & values

## SCIENTIFIC THEORIES - 3

**Semantic approach:** Theories as models which apply to idealized & simplified world

(e.g. no friction when ball rolls down inclined plane, model of ship in wave tank, simulation of traffic flow at an intersection).

- PDP models of cognition, meteorological or economic models

**Make powerful predictions**

## SCIENTIFIC THEORIES - 4

**Naturalistic approaches to Science**

**Logical positivists stressed rational nature of science, one view of what science should be**

**Naturalistic approaches stress social nature of science, scientists as human beings.**

- Scientists not always rational
- Human reasoning is error prone
- Scientists have moral & cultural values
- Goals, values, standards in science change

**Anthropological or sociological approach to study of science**

- Examine values, assumptions, beliefs, practices etc



## **SCIENTIFIC CHANGE - NATURALISTIC ACCOUNTS**

**Thomas Kuhn: Science as social activity**

**Preparadigm stage**

- Contending schools,
- No agreement on goals, methods etc.
- Random fact gathering
- Not science

**Normal science – Paradigm (or blueprint)**

- Agree on goals, suitable subjects of study, methods, & properties of acceptable explanations
- Progress is gradual & continuous

## Scientific Change – 2 Naturalistic Accounts

### Thomas Kuhn cont' d

#### c) Anomaly & Crisis

Disagreement with paradigm, problems not soluble within paradigm, contending theories and approaches

#### d) Revolution – period of rapid & radical change

- e.g. cognitive revolution
- Old paradigm not satisfactory, new methods, new types of explanations, different problems to be studied.
- Younger scientists adopt new paradigm
- E.g replacement of Ptolemaic earth-centered view of universe by Copernican sun-centered concept.

#### e) Cycles of “normal” science and “revolutions”

## SCIENTIFIC CHANGE - 3

### Evolutionary Epistemology

- Natural selection of ideas (analogous to Darwin's natural selection of physical traits).
- Many different theories proposed, successful ideas survive and reproduce; unsuccessful ones die out.
- No revolutions; gradual evolution of theories.

## Scientific Change – 4

Sir Karl Popper (1902 – 1994)

When should a theory change?

Positivists stressed *confirmability* of theories;  
e.g. predict next comet.

But astrology, psychoanalysis offered  
confirmatory evidence & post hoc  
explanations of disconfirmations. (Freud –  
early 20<sup>th</sup> century)

*Demarcation criterion* – rule for distinguishing  
true science from pseudoscience.

## SCIENTIFIC CHANGE - 5

Scientific predictions were *falsifiable*; some possible  
outcomes inconsistent with the theory

- Higg's Boson

Pseudoscientific theories don't operationally define  
terms

Pseudoscientists offer post hoc explanations for  
negative findings.

- a good psychoanalyst or astrologer can  
always make the data fit the theory!

Theories never defeated by one experiment or a few

Theories compete with one another

Lakatos & Laudan – criterion for good theory is  
problem-solving success (and whether it generates  
new predictions)

## REDUCTION & REPLACEMENT

When theories clash → 2 possible outcomes

**Replacement** - some theories simply wrong - e.g. Ptolemaic view in which the earth was the center of the universe vs. Copernican theory

**Reduction** - two theories explain same facts, observations, but at different levels. One theory is broader.

- E.g. Mendelian genetics vs. molecular genetics (DNA).
- Ideal gas law ( $PV = nRT$ ) vs. kinetic theory (provides cause)
  - $P$  = pressure,  $V$  = volume,  $n$  = amount of material,  $R$  = a constant,  $T$  = absolute temperature

## REDUCTION & REPLACEMENT

Explanations tend to become more detailed, provide specific mechanisms (causes)

- e.g. Mendelian genetics vs DNA & RNA
- e.g. ideal gas law vs. kinetic theory of gases
- e.g. box models vs. PDP models

**Big Question in Psychology:** Can psychology be reduced to physiology?

## SCIENCE AS A WORLD VIEW

**Science seeks universal truths about the world**

- true for all times and places

**Science based on study of particular events.**

- E.g. Biologist studies a particular species; psychologist uses one or two memory tasks. Biologist trying to discover “laws” governing ecology; psychologist trying to understand how human memory works.

## SCIENCE AS A WORLD VIEW - 2

**Science based on observation and controlled experimentation - compare to religion (based on revelation & faith), philosophy (based on reason), & mathematics (based on formal proof)**

- Math “truths” not necessarily true of the world –
  - Different assumptions → different laws

**The goal of psychological research is to study human behavior carefully across such a wide range of circumstances that the circumstances fall away, revealing the universal mechanisms of human mind and behavior. (Leahey, page 22, 7<sup>th</sup> ed.)**

## THE VIEW FROM NOWHERE

Science searches for **universal & objective** knowledge--knowledge that exists independent of individuals knowing it & independent of scientists' values, culture, religious beliefs etc.

Thomas Nagel - wrote *The View from Nowhere*

- a) Perceptions are caused by actions of things upon us
- b) Other people or animals have different perceptions (e.g. colour- blind person, electric fish) or no perception (e.g. radiation, microbes).
- ▲ Therefore true nature of object (primary properties) is separable from physical properties as we perceive them (secondary properties).
  - Objects exist independently of our perceptions

## THE VIEW FROM NOWHERE - 2

c) Goal is to understand true nature of world.

We could possess "true knowledge" even without senses (provided we were rational & could understand mathematical & formal properties)

Descartes & Locke - distinguished between material and spiritual world (included the soul & consciousness).

Consciousness is subjective but science seeks objective knowledge

Scientific knowledge: with the soul or consciousness subtracted. No "point of view"

## UNDERSTANDING HISTORY

**Reasons versus causes** - e.g. murder investigation: **cause** of death (arsenic) vs. the **reason** for committing murder (motive).

**Causes**: sequence of mechanical events that are causally linked to phenomenon to be explained. (effects of arsenic)

**Reasons**: series of rational acts carried out with intention and foresight.

- Psychology requires both causes (physiological mechanisms) & reasons (motivation)

## UNDERSTANDING HISTORY - 2

→ **Whig history** - overestimates role of reasons (rather than causes), sees history as being rational

History = series of progressive steps leading to current state of enlightenment.

→ **Presentism** - present-day science is better than previous science. – achieved through reason

“New” history: Scientists are human and prone to error – not always rational, influenced by societal values, personal experiences, desire for fame or fortune. Science not completely rational activity.

## UNDERSTANDING HISTORY - 3

**Internalism**: Science is a self-contained discipline solving well-defined problems by use of rational scientific methods. (related to Whig history)

**Externalism**: Science seen as being influenced by political events, social values etc. (related to Zeitgeist theory)

## UNDERSTANDING HISTORY - 4

**Great Man View** of history: explain history in terms of thoughts, goals and actions of notable (*dead white*) men who “left their mark” on the world.

- Whiggish & internalist. Stresses progress through rationality.

## UNDERSTANDING HISTORY - 5

Zeitgeist view of history: Large impersonal forces determine history. People are passive. Great men reflect ideas of their times, or are forced to act in a certain way by events.

Kuhn's view is a Zeitgeist view: zeitgeist = paradigm

Zeitgeist history is Whiggish & internalist

## UNDERSTANDING HISTORY - 6

Zeitgeist view = Whig history – implies  
“predetermined” progressive course of events -  
“rationally necessary course”

Zeitgeist view - Externalist because course of history is determined not by Great Men but by social forces

“New” history, Zeitgeist view

Leahey believes that “history has no discernable direction”.

## HISTORIOGRAPHY OF PSYCHOLOGY

- Historiography: history and methodology of history.
- “Old” history - political, diplomatic & military. Mainly narrative, about “great men” .
- “New” history - Zeitgeist. Analytic rather than narrative. Tries to capture the lives, ideas, beliefs of ordinary people. More inclusive. Tries to “get inside the thought of the period to see issues as they appeared at the time.”
- 1st stage (before 1950): history of psychology, was written by (old) psychologists (e.g. Boring). “Great Men”
- After about 1950, get “new” history written by professional historians of science. Zeitgeist history.
  - Tries to get inside thoughts of the times

## What is a ‘mind’ ?

Was ‘mind’ discovered, invented or constructed?

Real things are either “**Natural kind**” (spatio-temporally universal features of nature, e.g. electrons X-rays) or artefacts (objects that have been created, like cars, money).

If minds are “natural kinds”, mental processes will map onto neurophysiological processes & they can be studied scientifically.

## What is a 'mind' ? - 2

If minds are natural artefacts (e.g. volcanos, mountains, clouds) human-made artefacts (e.g. bridges & buildings), they can be studied.

→ Psych not a natural science – bridges etc. not universal

**Alternative View: Minds evolved like wings or colour vision to help organisms survive**

**Minds are solutions to problems of survival.**

→ Minds are natural artefacts & real & can be studied scientifically (Compare to geology)

## What is a 'mind' ? - 3

Mind a **social construction** like “Greek gods” or “hysteria”

→ psychology is a history of construction and invention of ideas, and not a science.

→ “Mind” is an illusion.

- Mind, soul, ego, personality, etc don't refer to any real entity.

**If concept of “Mind” is a tool used to help describe and understand behaviour – we can study minds the way we study other social constructions (e.g. money, credit → economics).**

→ Psychology not natural science

## What is a 'mind' ? - 4

**“Mind” as social construction like Greek gods.  
Religious view of soul – immaterial, spiritual  
essence of person that survives death.**

**– other cultures have different notions of  
“mind” or “intellect”**

- Souls make us individuals - explains personality.
- Idea of “mind” developed from the idea of the “soul”
- For the Greeks, the soul distinguished between living creatures and nonliving objects.
- Possession of Mind linked to personhood; loss of one’s mind (e.g. psychosis, dementia) → loss of human rights.

**If ‘minds’ are immaterial, spiritual, we cannot  
study them scientifically.**

## What is a 'mind' ? - 5

**Two different ideas about the soul**

- 1) **Difference between living and nonliving things**
  - universal
- 2) **Essence of the person (personality, memories, identity)**
  - lives after death of the body
  - not universal

**Western ideas about soul or mind strongly influenced by  
Christian thought**

## QUIZ

1. What is positivism?
2. What is the deductive-nomological approach to science?
3. What are three types of scientific theories?
4. What is Popper's demarcation criterion and why is it important?
5. Why has science been described as the view from nowhere?
6. Distinguish between Whig history and new history, Great Man history and Zeitgeist history, internalist and externalist history.
7. Why is it important to understand whether mind is a natural kind, an artifact, or a social construction?

End of Lecture