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Social Science Research Methods

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Overview

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- Theories of Scientific Progress
- Explanation, Causation and Unification
- Justification of Evaluative Standards
- Scientific Realism
- Descriptive Philosophies of Science
- The New Experimentalism
- Scientific Laws
- Some Key Themes of Contemporary Philosophy of Science
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- Some Questions to Ponder

Summary[3]

- Greek Philosophy of Science
  - Aristotle
  - Pythagoras
  - “Saving the appearances”
  - Deductive Systematization
  - Atomism
- Medieval Philosophy of Science
  - Methods of Resolution and Composition
  - First and Second Prerogatives
  - Methods of Agreement and Difference
  - Ockham’s Razor
- Seventeenth Century
  - Galileo
  - Bacon
  - Descartes
  - Newton

Summary[3]

- New Science and Scientific Method
  - Locke – Generalizations that are at best probable
  - Leibnitz - Two-way commerce between scientific theories and metaphysical principles
  - Hume – Constant conjunction only: no necessary connection
  - Kant – Transcendental Idealism – sensation structured by categories & principles
  - Herschel – Context of Discovery and Context of Justification
  - Whewell – History of Science and Consilience of Inductions
  - Myerson – Empirical Laws v. Causal Laws
  - Duhem – Representation not explanation
  - Campbell – Axiomatic theories v. application to experience
  - Hesse – Analogy
  - Harre – Centrality of models consistent with intuition of scientists
- Inductivism
  - Mill – Methods of Agreement, Difference, Concomitant Variation, Residues
  - Jevons – Hypothetico-Deductive view

Summary[3]

- Mathematical Positivism
  - Berkeley – Laws of mechanics are computational devices
  - Mach – Principle of Economy
    - "the completest possible presentment of facts with the least possible expenditure of thought"
- Conventionalism
  - Duhem – Disconfirmation of conjunctions of premises
  - Poincare – Using laws as conventions
- Falsifiability
  - Popper
- Logical Reconstructionism
  - Subsumption under general laws
  - Operationalism – Bridgman
  - Deductive Pattern – Hempel & Oppenheim
  - Theory Replacement – Nagel

Orthodoxy Challenged

- Paul Feyerabend
  - Observation reports are parasitic on theories
  - "The interpretation of an observation-language is determined by the theories which we use to explain what we observe, and it changes as soon as those theories change"
  - The contrast "observable – non-observable" is a context-dependent contrast

Orthodoxy Challenged

- Duhem-Quine Thesis (again)
  - It is misleading to speak of the “empirical content” of an individual statement
  - Any statement can be retained as true provided that sufficiently drastic adjustments are made elsewhere in the system
  - There is no sharp boundary between synthetic statements whose truth is contingent upon empirical evidence and analytic statements whose truth is independent of empirical evidence

Orthodoxy Challenged

- Covering-Law Model
  - The explanation of individual events is an instantiation of either
    - The deductive-nomological (DN) pattern, or
    - The inductive-statistical (IS) pattern
  - Bromberger's 'flagpole' example
  - Neither pattern is sufficient
  - Is either one necessary?

Orthodoxy Challenged

- Non-statement view
  - Frederick Suppe
    - A theory is a non-linguistic entity which is related to, but different from, a set of linguistic formulations
    - It describes a replica, an idealized physical system

Orthodoxy Challenged

- Goodman's New Riddle of Induction
  - "All emeralds are green" is a law-like generalization
  - "All emeralds are grue" is an accidental generalization
  - Positive instance seem to support both
  - We need to look at the past track-record for successful predicates
    - Projectibility based on entrenchment
  - Confirmation is not just an exclusively logical relation between sentences

Orthodoxy Challenged

- Feyerabend's Incommensurability Thesis
  - Examples of reduction cited by orthodox theorists do not satisfy their own conditions for reduction
  - High level theories are observationally incommensurable
  - There is no theory-independent observation language with respect to which theories may be evaluated
  - It is not always possible for a theory to agree with all the facts in its domain
  - "Philosophy of science is a subject 'with a great past'"

Orthodoxy Challenged

- Feyerabend is self-consciously anarchistic
  - Can his thesis of freedom of choice in scientific method be sustained within a research community?
  - He may be right, at least, in the claim that there is no universal, unchanging, privileged single scientific method

Theories of Scientific Progress

- Thomas Kuhn
  - ‘Normal Science’
    - Increasing precision
    - Extending scope
    - Determining the value of universal constants
    - Formulating quantitative laws
    - Deciding which alternatives are most satisfactory

Theories of Scientific Progress

- Thomas Kuhn
  - ‘Revolutionary Science’
    - Falsification is not relevant to paradigm rejection
    - Emergence of a viable competing paradigm
    - No paradigm-independent language for observations
    - Abandonment of one paradigm and adoption of another by a critical mass of scientists
    - Gestalt shift
    - Kuhn eventually conceded his use of ‘paradigm-shift’ was equivocal

Theories of Scientific Progress

- What is a paradigm (Chalmers)?
  - General theoretical assumptions and laws
  - Techniques for their application
  - Very general metaphysical principles that guide work within the paradigm
  - General methodological principles

Theories of Scientific Progress

- Criticisms of Kuhn
  - Just a form of relativism?
  - Ambivalent on progress through revolution in science
  - Is it a purely descriptive account or a theory of scientific development?
  - Changed the meaning of paradigm in *Postscript*?

Theories of Scientific Progress

- Imre Latakos
  - Scientific Research Programmes
    - Continuity important
    - Research programmes more important than individual theories
    - Progressive v. degenerative research programmes
    - Hard-core assumptions v. protective belt
    - Methodological rules (negative or positive heuristics) tell us what research paths to avoid or what paths to pursue
    - Contrary to Duhem and Kuhn, Latakos insisted that there are rules of appraisal for sequences of theories
    - Novel predictions as a measure of progress

Theories of Scientific Progress

- Imre Latakos
  - Scientific Research Programmes
    - Is this approach historically accurate?
      - Hard cores?
      - Methodological decisions?
    - ‘Natural’ predictions rather than ‘novel’ predictions?
    - Must all science be like the physics of the last 300 years?
    - Must progress in social science be like progress in natural science?

Theories of Scientific Progress

- Larry Laudan
  - Science as a problem-solving activity
  - Progress is:
    - More problems solved
    - Resolution of anomalies
    - Restoring conceptual harmony among supposedly conflicting theories

Explanation, Causation and Unification

- Wesley Salmon's Causal Model
  - Lack of causal relatedness is why DN pattern is subject to 'flagpole' countercase and IS pattern cannot account for leukemia
  - A cause is an event by which structure is produced and propagated
    - Conjunctive fork
      - Atomic bomb - leukemia correlation
    - Interactive fork
      - Direct physical interactions; e.g. collisions

Explanation, Causation and Unification

- Peter Railton's Deductive-Nomological-Probabilistic Model
  - A DN argument for the probability of an event
  - A causal account of the underlying mechanism
  - Specific information about the actual occurrence of the event

Explanation, Causation and Unification

- Philip Kitcher
  - ‘Explanatory success’ explains ‘causal relatedness’ and not *vice versa*

Confirmation Theory

- Bayesianism
  - A quantitative theory of confirmation
  - P(h|e) = P(e|h) * P(h) / P(e)
  - P(h|e) – P(h) measures degree of evidential support
  - What do these probabilities mean?
    - Frequencies – objective interpretations
    - Logical relations between hypotheses and statements
    - Subjective rational beliefs (most Bayesians adopt this)
  - Bayesianism is a theory of *inference*

Explanation, Causation and Unification

- Bayesianism
  - How do we evaluate P(e)?
  - P(e) = P(e|h)* P(h) + P(e|~h) * P(~h)
    - But what, in fact, are the alternatives to h?
  - If prior probabilities are totally subjective they can hardly be used to choose between competing theories
  - Sufficiently strong priors cannot be overturned by evidence!
  - How can we gain access to private degrees of belief?
  - No account of what counts as appropriate scientific evidence

Explanation, Causation and Unification

- Clark Glymour
  - A theory of inference is not a theory of scientific explanation
  - Old evidence is discounted
  - ‘Bootstrapping’ – one part of a theory is invoked in support of another
    - E.g. Newton’s Principia

Explanation, Causation and Unification

- Comparative Confirmation
  - Goodman
    - Instances known prior to formulation of hypothesis may not confirm it
  - Latakos
    - Hypothesis should imply the evidence
    - There should be a competing ‘touchstone’ hypothesis that either implies the contrary of the evidence, or implies neither the evidence nor its contrary

Explanation, Causation and Unification

- Theory Appraisal
  - Kuhn
    - Consistency
    - Agreement with observations
    - Simplicity
    - Breadth of scope
    - Conceptual integration
    - Fertility

Justification of Evaluative Standards

- Latakos's Incorporation Criterion
  - Incorporation with excess context
    - A criterion of theory-replacement that applies also to sequences of methodologies
  - Kuhn argued that it was circular
- Laudan
  - Theories should be evaluated by their ability to reconstruct 'standard cases' of progress agreed by the scientific elite of the day

Justification of Evaluative Standards

- Normative naturalism
  - Evaluative standards and procedures arise within the practice of science, and are to be assessed in the same way that scientific theories are assessed – by reference to claims about the world

Justification of Evaluative Standards

- Otto Neurath's 'boat' image
- Willard Van Orman Quine's 'Field of Force' image
- Are there inviolable principles (Latakos & Laudan v. Dudley Shapere)
- Laudan's 'Reticulational' model
  - Theories, methodological principles and cognitive aims reciprocally interrelated

Scientific Realism

- Truth Realism
  - Scientists should formulate true theories that depict the structure of the universe
  - Our record of progress indicates that the universe has a structure largely independent of human theorizing and that our theories have provided an increasingly more accurate picture of that structure

Scientific Realism

- Entity Realism
  - The entities posited by certain scientific theories do indeed exist in reality
    - Mars
    - X-ray stars
    - Neutrinos?

Scientific Realism

- Instrumentalism
  - Theories are merely calculating devices – it is the statements about observations that are true or false
- Bas von Fraassen's Constructive Empiricism
  - Theories are 'empirically adequate' or not

Scientific Realism

- Arthur Fine's Natural Ontological Attitude
  - Accept science as it is
  - Accept its certified results as knowledge-claims on a par with the findings of common sense
  - Leave open questions about the nature of truth

Scientific Realism

- Realists
  - ‘No miracle’ argument
- Anti-realists
  - ‘Pessimistic Meta-Induction’
    - Most highly regarded theories have been amended or discarded
    - So it is probable that our current high-level theories are also false

Scientific Realism

- Structural Realism
  - John Worrall
    - No claims for the truth or approximate truth of entire theories, or for the existence of unobserved entities
    - Isomorphism between mathematical forms of theories and the structures of physical systems

Scientific Realism

- Global anti-realism
  - Weak thesis: no language engages the world
- Correspondence theories of truth
- Anti-realism
  - The content of a scientific theory is nothing more than the set of claims that can be substantiated by observation and experiment
- Scientific realism
  - Science aims at true statements about what there is in the world and how it behaves, at all levels

Scientific Realism

- Conjectural realism
  - This is the aim of science even though we have not achieved it
- Structural realism
  - Science attempts to characterize the structure of reality, and has made steady progress, at least approximately
  - This progress refines the structures attributed to reality but may replace the representations

Descriptive Philosophies of Science

- Gerard Holton
  - “. . . the messages of more recent philosophers, who themselves were not active scientists, are essentially impotent in use . . .”
  - Thematic principles of basic commitments:
    - Explanatory principles
    - Directive principles
    - Evaluative standards
    - Ontological assumptions
    - High level substantive hypotheses

Descriptive Philosophies of Science

- Emphasis on experimental practice
- Stephen Toulmin's descriptive model of Conceptual Evolution
- Cohen's criticism of the Evolutionary Analogy
- Michael Ruse – Epigenetic rules
  - Science directed by rules encoded in humans as a result of evolutionary adaptation
- Is the (descriptive) philosophy of science subsumed under the history of science?

The New Experimentalism

- Experimentation has a life of its own
  - You can show how it is to be done and exhibit its results – in this sense it can be theory-independent
- Deborah Mayo
  - A claim can only be said to be borne out by experiment if it has been severely tested by experiment – in such a way that it would be unlikely to pass the test if it were false

The New Experimentalism

- Experimental results can be substantiated and experimental effects produced by an array of strategies involving practical interventions, cross-checking, and error control and elimination in a way that can be independent of high level theory
- Thus we can give an account of progress in science that construes it as the accumulation of experimental knowledge
- Problems emerge in attributing significance to scientific results that goes beyond the conditions in which they were produced, without relying on theory

Scientific Laws

- Laws as regularities
  - Humean approach
- Laws as characterizations of powers or dispositions
  - Ontological reluctance?
- Non-causal laws
  - Thermodynamics

Key Themes of Contemporary Philosophy of Science

- Theory-ladenness of Observations
- Incommensurability of Theories
- Under-determination of Theory by Data: Duhem-Quine Thesis
- Positivism
- Falsifiability (Popper)
- Paradigm Shifts (Kuhn)

Some Philosophical 'isms'

- Dualism
  - The physical and the mental are two distinct categories of reality
- Realism
  - There is an external world independent of mind to which our true statements correspond
- Monism
  - There is only one basic category of reality
- Idealism
  - All reality is in the mind
- Materialism
  - All reality is material in character
- Immaterialism
  - Objects are mere collections of qualities

Some Philosophical 'isms'

- Phenomenalism
  - Physical objects should be analyzed in terms of sensations or perceptions
- Atomism
  - The basic components of reality are atoms
- Platonism
  - Forms or Ideas exist independently of human knowledge of them
- Nominalism
  - Only particulars are real (not universals)
- Reductionism
  - Any claim of the form "All A's are merely B's"
- Constructivism
  - Things ordinarily regarded as independent of human thought are really the product of human thinking

Some Philosophical 'isms'

- Skepticism
  - Humans cannot attain knowledge
- Rationalism
  - Reason is the source of all knowledge
- Empiricism
  - Experience is the source of all knowledge
- Instrumentalism
  - The purpose of a scientific theory is prediction
- Scientific realism
  - Entities required by successful scientific theories are real and the theories are true
- Naïve realism
  - The world is as it appears to our senses

Some Philosophical 'isms'

- Foundationalism
  - Knowledge rests on a small set of certain truths
- Positivism
  - A commitment to (empirical) natural science as the best – or only – means of attaining genuine knowledge
  - Came to the fore in the work of Auguste Comte
  - Frequently qualified in some way; e.g., Logical Positivism

Some Questions to Ponder

- What is a scientific law?
- What makes it a *law*?
- Who or what should obey scientific laws, and why?
- Does social science have scientific laws too?
- Is “Time pressure causes auditors to make more mistaken decisions” a *law*?
- What is a cause?