26:010:557 / 26:620:557
Social Science Research Methods

Dr. Peter R. Gillett

Associate Professor

Department of Accounting & Information Systems

Rutgers Business School – Newark & New Brunswick

Overview

- Summary[3]
- Logical Reconstructionism (a reminder)
- Orthodoxy Attacked
- 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
- Some Philosophical ‘isms’
- Questions
- 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
  - 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
- Conventionalism
  - Duhem – Disconfirmation of conjunctions of premises
  - Poincare – Using laws as conventions
- Falsifiability
  - Popper
- Logical Reconstructionism
  - Operationalism – Bridgman
  - Deductive Pattern – Hempel & Oppenheim
  - Theory Replacement – Nagel

Inductivism

- William Jevons
  - Hypothetico-Deductive view
    - First, a hypothesis must be shown not to be inconsistent with other well-confirmed laws
    - Then, the consequences must be shown to agree with what is observed

Mathematical Positivism

- George Berkeley
  - Laws of mechanics are mere computational devices, with no reference to what occurs in nature
  - There is no distinction between ‘primary’ and ‘secondary’ qualities – because there are no ‘primary’ qualities
  - Absolute Space is meaningless

Mathematical Positivism

- Ernst Mach
  - Took a similar view to Berkeley
  - Principle of Economy
    - "the completest possible presentment of facts with the least possible expenditure of thought"
  - Sought to reconstitute Newtonian Mechanics from a phenomenalist point of view

Conventionalism

- Pierre Duhem
  - Disconfirmation
    - When the conclusion of a prediction is disconfirmed, then the *conjunction* of its premises is falsified
    - This is the conjunction of the laws and the conditions
    - To restore agreement with observations, the scientist is free to alter any one of the hypotheses that occur in the premises
    - In particular, any one hypothesis may be retained by modifying the others – this is to attribute to that hypothesis the status of a non-defeasible convention
    - cf. Bacon's 'Instances of the Fingerpost'

Conventionalism

- Henri Poincare
  - When a scientist holds a scientific law to be true independently of any appeal to experience, this is not because scientific laws are invested with necessity, but is an implicit decision to use the law as a convention that specifies the meaning of a concept
  - If a law is true a priori, it is because it has been stated in such a way that no empirical evidence can count against it

Falsifiability (1)

- Karl Popper
  - Proper empirical method is continually to expose a theory to the possibility of being falsified
  - Auxiliary hypotheses should only be added if they increase the degree of falsifiability
  - A test is a serious attempt at refutation
  - Acceptability of a law or theory is determined by the number, diversity and severity of tests it has passed
  - The history of science is a sequence of conjectures, refutations and revisions
  - A well corroborated theory has demonstrated fitness to survive – but this conveys no epistemological benefit: Popper's suggestion of a "whiff of inductivism" has been criticized

Logical Reconstructionism

- Philosophy of science emerged as a distinct academic discipline after the Second World War
- Norman Campbell hoped that a study of the foundations of empirical science would be as fruitful as the new development of axiomatic methods had been for mathematics
- The proper domain of the philosophy of science was recognized as the context of justification
- A hierarchy of levels was developed
  - Each level is an interpretation of the one below
  - Predictive power increases from base to apex
  - The ‘observational level’ is distinguished from the ‘theoretical’ level
  - Statements of the observational level provide a test-basis for statements of the theoretical level

Logical Reconstructionism

- Operationalism – Percy Bridgman
  - Scientific concepts must be linked to instrumental procedures that determine their values
  - This is what gives empirical significance to a scientific concept
  - If no operational definition can be specified, the concept is to be excluded from science
  - There are, however, some practical limitations
    - The need to ignore irrelevant factors
    - The need to accept some unanalyzed operations

Logical Reconstructionism

- The Deductive Pattern of Explanation
  - Carl Hempel and Paul Oppenheim
  - The deductive pattern of explanation of a phenomenon deduces the conclusion from General Laws and Statements of Antecedent Conditions (including boundary conditions and initial conditions)
  - Explanations based on statistical laws are not deductive; they can thus only provide (strong) inductive support

Logical Reconstructionism

- Nomic v. Accidental Generalizations
  - How can we tell when our explanations involve general laws, and when they involve only accidental generalizations?
  - General laws support counterfactual conditionals; accidental generalizations do not

Logical Reconstructionism

- Confirmation of Scientific Hypotheses
  - Hempel suggested that there are three phases in evaluating a scientific hypothesis
    - Accumulating observation reports
    - Ascertaining whether they confirm, disconfirm or are neutral towards the hypothesis
    - Deciding whether to accept, reject or suspend judgment on the hypothesis

Logical Reconstructionism

- Confirmation of Scientific Hypotheses
  - The Raven Paradox
    - Do black shoes and white gloves confirm that all ravens are black?
    - Hempel thinks so, and that our intuitions to the contrary are faulty
- Rudolf Carnap sought, instead, to formulate a theory of the *degree* of confirmation

Logical Reconstructionism

- The Structure of Scientific Theories
  - Post-war approaches were based on Campbell's distinction between an axiom system and its application to experience
  - What is needed is an adequate theory of confirmation

Logical Reconstructionism

- Theory Replacement
  - Emphasis on ‘growth by incorporation’
  - Ernest Nagel distinguished two types of reduction
    - Homogeneous reduction
      - ➔ A law is subsequently incorporated into a theory which utilizes substantially the same concepts (e.g., Galileo’s law reduced to Newtonian mechanics)
    - Deductive subsumption
      - ➔ A law is subsumed by a theory that lacks some of the concepts in which it is expressed (e.g., reduction of classical thermodynamics to statistical mechanics)
  - Nagel formulated conditions for reduction to succeed

Interlude

- At this stage, we leave the historical development of scientific ideas behind until later . . . and begin to look at Chalmer's review of some important idea themselves

Science as fact-based knowledge

- A widely held commonsense view
- Science is derived from the facts
  - Facts are given to careful unprejudiced observers via the senses
  - Facts are prior to and independent of theory
  - Facts constitute a firm and reliable foundation for scientific knowledge

Science as fact-based knowledge

- Seeing is believing
  - But visual experience is not determined solely by the object viewed
- Observable facts need to be expressed as statements
  - Statements do not enter the brain by means of the senses
- Why should facts precede theory?

Science as fact-based knowledge

- Observation statements are fallible
- Is observation private and passive or public and active
- Observable facts are objective but fallible
- We need not just facts, but relevant facts
- Experiment can be used to generate relevant facts

Science as fact-based knowledge

- Experimental results may be difficult to produce and require updating
- Circularity can arise in arguments that rely on experiment

Induction

- Deductive logic alone is not a source of new truths
- Induction is not logically valid
- General scientific laws invariably go beyond the finite amount of observable evidence that is available to support them, and thus cannot be proven

Induction

- What constitutes good inductive argument?
  - Many observations
  - Repeated under widely varied conditions
  - No counter-examples observed
  - This leads to a ‘Principle of Induction’
    - But:
      - ➔ How many instances?
      - ➔ What variations are superfluous?
      - ➔ ***No*** exceptions?

Induction

- How can knowledge of unobservables be incorporated by inductivists?
- How can exact laws be justified by inexact observations?
- The Problem of Induction – how is the Principle of Induction to be justified without circularity?
- Can we accept probability instead of truth?

Induction

- Immediate appeal derives from seeming to capture some commonly held intuitions about the special characteristics of scientific knowledge
  - Objectivity
    - Arising from observation, induction and deduction
  - Reliability
    - Follows from same things
- Still inductivism is at best in need of severe qualification and at worst thoroughly inadequate

Falsifiability (2)

- The Logical Positivists of the Vienna Circle advocated ‘verification’ as a test of scientific statements (as opposed to metaphysical statements devoid of meaning)
- Popper proposed ‘falsifiability’ instead
- It’s hard to verify a generalization: it’s relatively easy to falsify one
- Neither actual falsification nor practical falsifiability are required: it suffices for a theory to be falsifiable in principle

Falsifiability (2)

- More general statements or theories are more highly falsifiable (they have more potential falsifiers)
- Highly falsifiable theories should be preferred to less falsifiable ones, *provided they have not already been falsified*
- Theories should be clearly stated and precise

Falsifiability (2)

- Scientific progress
  - Problems
  - Falsifiable hypotheses
  - Rigorous testing
  - Elimination of failed theories and survival of others
  - New problems
- Significant advances come from bold, highly falsifiable conjectures

Falsifiability (2)

- Relative rather than absolute degrees of falsifiability
- Increasing falsifiability and ad hoc modifications (that introduce no additional falsifiability)
- Confirmation is still required
  - Significant advances may come from
    - Confirmation of bold conjectures
    - Falsification of cautious conjectures
- Boldness and novelty are relative to background knowledge

Falsifiability (2)

- Theory dependence of facts undermines inductivism
- Falsificationism recognizes that facts as well as theories are fallible
- Facts generating severe tests provide a stronger support than induction

Falsifiability (2)

- Some limitations
  - It is only the conjunction of observations, theories, and auxiliary conditions that must be rejected
    - Back to the Duhem-Quine thesis!
  - Historically, falsificationism is not how science has advanced
    - Consider, for example, the Copernican revolution
  - Other, non-scientific theories may also be falsifiable (e.g., astrology?)
    - But already falsified?

Falsifiability (2)

- Popper's introduction of 'dogmatism' in response to these criticisms is problematic

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
  - 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*?

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

Questions

?

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?