Perspectives in Philosophy of Science

Realism, Anti-Realism, and Beyond

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Overview: Key Divisions in Philosophy of Science

- Realism vs. Anti-Realism
- Empiricism vs. Rationalism
- Cumulative vs. Revolutionary Progress
- Value-Free vs. Value-Laden Science
- Reductionism vs. Emergentism

We'll explore various perspectives through these lenses.

Realism vs. Anti-Realism: The Core Debate

Key Question: Do our best scientific theories truly describe an independent reality?

- **Realist Perspectives**:
  - Scientific Realism
  - Ontic Scientific Realism
- **Anti-Realist Perspectives**:
  - Instrumentalism
  - Constructive Empiricism
- **Mixed or Nuanced Perspectives**:
  - Critical Rationalism
  - Relativism
  - Pragmatism

Scientific Realism

Key Idea: Science aims to provide true descriptions of both observable and unobservable aspects of the world.
Main Proponents: Hilary Putnam (1926-2016), Richard Boyd (1942-2021)
Core Principles:

1. Scientific theories are approximately true descriptions of reality
2. Mature scientific theories' terms refer to real entities
3. Science makes progress by getting closer to the truth

View on Scientific Progress: Increasing approximation to truth about observable and unobservable reality
Popularity: Became dominant view in latter half of 20th century

Ontic Scientific Realism

Key Idea: Scientific theories reveal the fundamental structure of mind-independent reality.
Main Proponents: James Ladyman (1967-present), Steven French (1959-present)
Core Principles:

1. Scientific theories describe mind-independent reality
2. The ontology of fundamental physics reflects the true nature of reality
3. Emphasis on structural aspects of theories

View on Scientific Progress: Uncovering more of reality's fundamental structure
Popularity: Gained traction in late 20th and early 21st centuries, especially in philosophy of physics

Instrumentalism

Key Idea: Scientific theories are tools for prediction, not descriptions of reality.
Main Proponents: John Dewey (1859-1952), Pierre Duhem (1861-1916)
Core Principles:

1. Theories are instruments for making predictions, not truth claims
2. Agnostic about unobservables
3. Focus on empirical adequacy and practical utility

View on Scientific Progress: Development of more useful predictive tools
Popularity: Gained traction in early 20th century, remains influential in some circles

Constructive Empiricism

Key Idea: Science aims for empirical adequacy, not truth about unobservables.
Main Proponent: Bas van Fraassen (1941-present)
Core Principles:

1. Aim of science is empirical adequacy, not truth
2. Agnostic about unobservables
3. Accept/use theories without believing them to be true

View on Scientific Progress: Improving empirical adequacy of theories
Popularity: Gained attention as a middle ground between realism and instrumentalism since 1980s

Critical Rationalism

Key Idea: Scientific progress occurs through conjecture and refutation.
Main Proponent: Karl Popper (1902-1994)
Core Principles:

1. Falsificationism: theories should make risky predictions that can be tested
2. We can never verify theories, only falsify them
3. Scientific knowledge is always tentative

View on Scientific Progress: Through conjecture and refutation, eliminating false theories
Popularity: Gained prominence in mid-20th century, widely influential in philosophy of science

Relativism

Key Idea: Scientific knowledge and truth are relative to historical, cultural, or theoretical contexts.
Main Proponents: Thomas Kuhn (1922-1996), Paul Feyerabend (1924-1994)
Core Principles:

1. Scientific paradigms determine what counts as evidence and truth
2. Incommensurability between paradigms
3. Social and historical factors shape scientific knowledge

View on Scientific Progress: Through paradigm shifts, not cumulative growth
Popularity: Gained significant influence in 1960s-1970s, remains controversial

Pragmatism

Key Idea: Scientific theories should be judged by their practical consequences and problem-solving ability.
Main Proponents: Charles Sanders Peirce (1839-1914), William James (1842-1910), John Dewey (1859-1952)
Core Principles:

1. Truth is what works in practice
2. Scientific inquiry should focus on solving real-world problems
3. Theories are tools for prediction and control

View on Scientific Progress: Solving more complex problems and improving human condition
Popularity: Influential in late 19th and early 20th centuries, experiencing resurgence in contemporary philosophy of science

Empiricism vs. Rationalism in Philosophy of Science

- **Empiricist Leanings**:
  - Positivism: All knowledge from sensory experience
  - Constructive Empiricism: Focus on observable phenomena
  - Instrumentalism: Theories judged by empirical predictions
- **Rationalist Elements**:
  - Critical Rationalism: Emphasis on logical structure of theories
  - Scientific Realism: Rational inference to unobservables
  - Ontic Scientific Realism: Rational access to fundamental reality
- **Mixed Approaches**:
  - Pragmatism: Combines empirical testing with practical reasoning
  - Relativism: Emphasizes role of theoretical frameworks in shaping empirical observations

Views on Scientific Progress

- **Cumulative Progress**:
  - Positivism: Accumulation of verified knowledge
  - Scientific Realism: Closer approximation to truth
  - Ontic Scientific Realism: Uncovering more of reality's structure
- **Non-Cumulative or Revolutionary Progress**:
  - Relativism: Paradigm shifts (Kuhn)
  - Critical Rationalism: Eliminating false theories
- **Progress as Improvement**:
  - Instrumentalism: More useful predictive tools
  - Constructive Empiricism: Improving empirical adequacy
  - Pragmatism: Solving more complex problems

Reductionism vs. Emergentism

- **Reductionist Tendencies**:
  - Positivism: Unity of science, all reducible to physics
  - Some forms of Scientific Realism: Fundamental physical ontology
- **Emergentist or Anti-Reductionist Views**:
  - Some Ontic Structural Realists: Emergent properties at different scales
  - Pragmatism: Different levels of explanation for different purposes
  - Some Relativists: Irreducibility of different paradigms or frameworks
- **Mixed or Nuanced Positions**:
  - Contemporary Scientific Realism: Acknowledging emergent properties while maintaining reducibility in principle
  - Critical Rationalism: Focus on problem-solving rather than reduction

Key Debates in Philosophy of Science

1. **Realism vs. Anti-realism**: Do our best scientific theories truly describe an independent reality?
2. **Demarcation Problem**: What distinguishes science from non-science?
3. **Theory Choice**: How do scientists choose between competing theories?
4. **Induction Problem**: Can we justify inductive reasoning in science?
5. **Values in Science**: What role should values play in scientific inquiry?
6. **Reductionism vs. Emergentism**: Can all sciences be reduced to physics?
7. **Scientific Explanation**: What constitutes a good scientific explanation?