

CHALLENGES FOR FEMINIST PHILOSOPHY OF PHYSICS

STANDPOINT THEORY, PRACTICAL AIMS, AND THE OBJECTIVITY OF HUMAN- INSENSITIVE SCIENCE

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MOTIVATING QUESTIONS

- Are feminist epistemologies privileged epistemic standpoints for theoretical physics
 - ▶ if yes, then when?
 - ▶ if no, then what can produce strong(er) objectivity?
- How can we arrive at normative feminist critiques in theoretical physics?

BEST CASE THEORISTS

Not all physics applies here

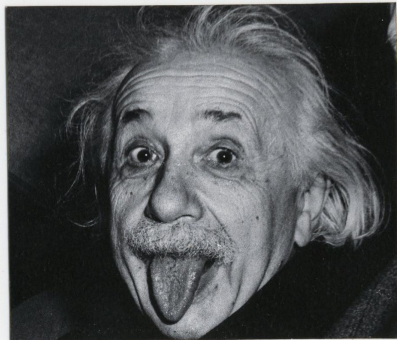
- very specific applications and motivations
- Inductive risk: eg accuracy vs portability
- contextual values: easy of use, cost, accuracy, safety
- pluralism: more diverse fields, grounded in practical aims



WORST CASE SCIENTISTS

Focus on the case which has been least successful in producing actionable critiques

- 'Human insensitive' research
- ambiguous at best applications
- Reductionism, simplicity, fundamentality, global understanding
- Enlightenment specter: 'Gentleman's science'



STANDPOINTS

- All knowledge is developed from within some individual's perceptions
- Social privilege distorts perspective
- *relevant* socially marginalized perspectives → more epistemic authority on a topic

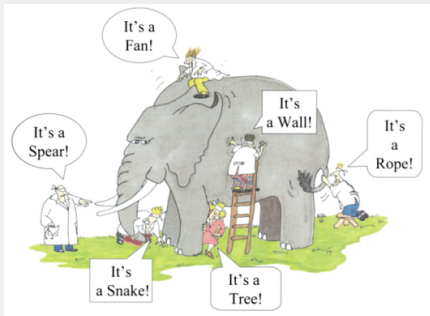


Figure: (Hennessy 2018)

KEY DISCLAIMERS

- Epistemic standpoints are conceptual frameworks for evaluating the world, not identities
- *privileged standpoints* are always privileged for a specific kind of knowledge because of identifiable advantages
- We should expect a *predictive assignment*, not only a reconstruction or compatibility of a standpoint and an type of knowledge

STANDPOINT AND SCIENTIFIC OBJECTIVITY

Conventional scientific objectivity: science is objective when carried out by unbiased observers who do not allow social-cultural beliefs to affect their research

Harding: weak objectivity treats science as a "value-free, disinterested, impartial, Archimedean arbiter of conflicting agendas," (Harding 1991)

- This is not believable
- Science is always for a definite goal, *for the benefit of a group*
- 'gentleman's science' is a project of domination and subfusion

HARDING'S CRITIQUE OF WEAK OBJECTIVITY

“If values and interests that can produce the most critical perspectives on science are silenced through discriminatory social practices, the standard, narrowly conceived conception of scientific method will have not an iota of a chance of maximizing either value- neutrality or objectivity. Such a conclusion has the effect of turning equity issues into scientific and epistemological issues, not only moral and political ones.”(Harding 1991)

STRONG OBJECTIVITY

“feminist theory about science must be seen as inside the process of science, where it can help scientists explain the social conditions in both scientific institutions and the surrounding society that tend to encourage empirically more adequate beliefs; identify background assumptions that tend to distort the results of research; conceptualize and design research in ways that avoid powerful cultural biases; interpret and select data to produce the most reliable evidence for and against hypotheses.” (Harding 1991)

- Strong objectivity: Adopt epistemic frameworks from the social sciences to probe the practices of research: esp. feminist standpoints

BUT PHYSICS!!

“The support of “pure science” might more reasonably be seen as a make-work welfare program for the middle classes in the service of elites.” (Harding 1991)

- cognitive values and social environment
- Methodological limitations
 - ▶ formalism require interpretations, metaphors (Harding 1991, Bug 2003)
 - ▶ Constitutive beliefs: Reductionism (Whitten 2012), superficial reliance on the context of justification (Harding 1991)
- Bias to impractical research (Whitten 2012) and/or dubious technological justifications (Harding 1991)

PERCEPTION, PEDAGOGY, AND PRACTICE

- Typical understanding of: public perception → pedagogy → practice
- imperfect agreement between pedagogy, public perception, and practices
 - ▶ eg. discussion, collaboration, alternative accounts integral in theoretical physics
 - ▶ collaboration and social cohesion, marginalization and chilly climates (Urry 2008)
- cognitive values: disagreement on whether to critique the assignment of masculinity (Urry 2008) or their perpetuation in physics (Bug 2003 reading Rosser)
- Historical trends and motivations guide scientific research
”(Harding, Longino)

FORMALISM: THE PROBLEM

Mathematical formalism (usually) need interpretation(s)

- assignment of theoretical constructs to phenomena 'eg field interactions' → particle collisions
- physical processes and theories understood through analogies to human concepts
- Gedankenexperiments
- This account: agnostic to measurement/model/theory realism vs compatablism or other anti-realism commitments

RETHINKING ANALOGIES, ANALOGY MULTIPLICITY

- theoretical constructs are stable not universal
 - ▶ particle vs excitation of a field
- theories have multiple interpretations and methodologies
 - ▶ QM: density matrix formalism, textbook approach, operator algebras
 - ▶ QIT: generalizations (GPT), specializations (hidden variable models)
 - ▶ Competing derivations of QFT: path integral formulation, second quantization
- realist interp: convergence or translatability give increased confidence in theoretical constructs
- gedankenexperiments and metaphors are contested questionably sincere

RETHINKING ANALOGIES: ADVANTAGED STANDPOINTS?

- The context of justification allows for alternative constitutive values to be assigned
- What is lost is determinist connection between the commitments of a theory developers and the analogies settled by consensus
- analogy pluralism and translatable insulates against subjective bias

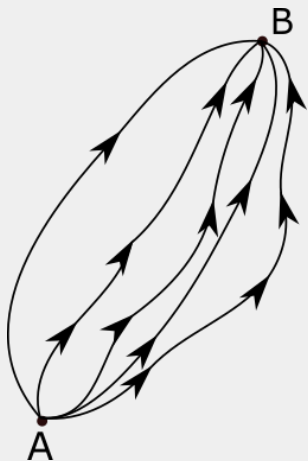


Figure: Path Pluralism or classical path dominance

- Reductionist hypothesis: all natural processes reduce to a simple set of relations governed by simple, mathematical relations
- minimize assumptions, constants, complexity
- usually the priority, fundamentality, hierarchy position of 'fundamental' research is questioned (Anderson 1974, Whitten 2012)

RETHINKING REDUCTIONISM

- Critique reductionism ↔ fundamentality
- Reductionism as 'first order approximation'
- less reductionist disciplines usually study emergent properties of broadly reductionist phenomena

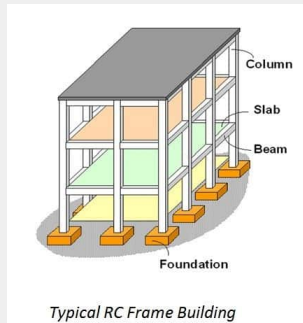


Figure: Reductionism as framing to study emergent behaviour

CONSTITUTIVE BELIEFS: HIERARCHY

- Hierarchy in science still ranks relative merit of a field
- relies on relative 'practical merit' of a discipline

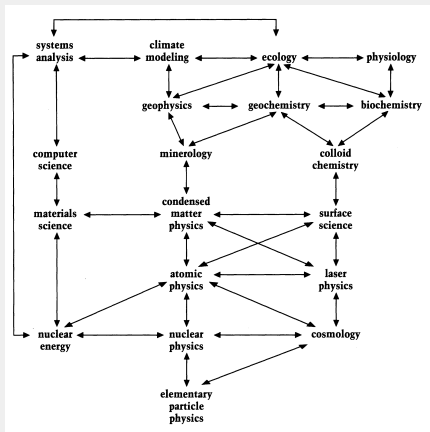


Figure: Hierarchical ranking of physics (Whitten 1996)

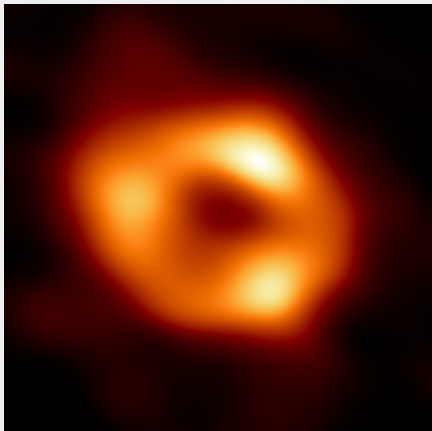
TECHNOLOGICAL JUSTIFICATIONS AND FUNDING SOURCES

- Theorists disvalue work for industrial/near-term applications
- Curiosity, wonder through empirical knowledge
- The public seems to agree
- Yet most funding relies on some technological promises



TECHNOLOGICAL JUSTIFICATION: WHY ISN'T THEORY ART?

- Funding structures represent have enormous social force
- physicists don't perceive any agency to change this
- reconsider theoretic work's pedagogical and social aims



TENTATIVE CONCLUSIONS

- standpoint theoretic case for feminist values in physics practices usually on:
 - ▶ cognitive biases
 - ▶ methodological limitations
 - ▶ reliance of practicality of science
- analogies: tools for epistemic pluralism
 - ▶ context of justification: allows for plurality of contextual values
 - ▶ reductionist hypothesis: scaffolding to support more detail-oriented research
 - ▶ feminist theory as a privileged epistemic standpoint: 'externally' helpful

NORMATIVE CLAIMS

- rethink analogies and reductionism
- abandon practicality commitment: theorist as artist
 - ▶ public patronage
 - ▶ decoupling of physics from tech funding
 - ▶ reliance on strong social systems which can support expensive artistic/scientific endeavors
- abstract theory research reliant on robust social systems
- theorists obliged to the material labor which supports their work (Prescod-Weinstein 2021)