

Biology Meets Metaphysics?

The Causalist/Statisticalist Debate

PhiloSTEM-3, April 14, 2012

Charles H. Pence

charles@charlespence.net

University of Notre Dame
Program in the History and Philosophy of Science
Department of Philosophy



The Big Picture

- A large and contested debate in the philosophy of biology

The Big Picture

- A large and contested debate in the philosophy of biology
- Two factual goals:
 - What's it about, and what's the common ground?

The Big Picture

- A large and contested debate in the philosophy of biology
- Two factual goals:
 - What's it about, and what's the common ground?
 - What's really at stake?

The Big Picture

- A large and contested debate in the philosophy of biology
- Two factual goals:
 - What's it about, and what's the common ground?
 - What's really at stake?
- Two normative claims:
 - The debate has focused on a general metaphysical issue that is neither more readily solved in the biological context nor sheds new light on biological questions

The Big Picture

- A large and contested debate in the philosophy of biology
- Two factual goals:
 - What's it about, and what's the common ground?
 - What's really at stake?
- Two normative claims:
 - The debate has focused on a general metaphysical issue that is neither more readily solved in the biological context nor sheds new light on biological questions
 - The biologically interesting issue raised has been mostly ignored

Common Ground

- Individual-level events: causal

Common Ground

- Individual-level events: causal
 - X has offspring, X dies of malnutrition, X is eaten by a predator

Common Ground

- Individual-level events: causal
 - X has offspring, X dies of malnutrition, X is eaten by a predator
- Theoretical apparatus for describing selection and drift: statistical

Common Ground

- Individual-level events: **causal**
 - X has offspring, X dies of malnutrition, X is eaten by a predator
- Theoretical apparatus for describing selection and drift: **statistical**
 - Selection coefficients, fitness values, broad-sense heritabilities

Two Major Issues

1. What's the relationship between individual-level events and the statistical descriptions of selection and drift?

Two Major Issues

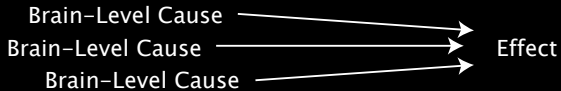
1. What's the relationship between individual-level events and the statistical descriptions of selection and drift?
2. How should we define selection and drift?

Epiphenomenalism

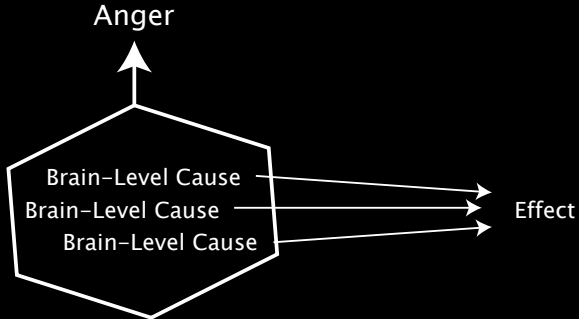
Brain-Level Cause → Effect

A diagram illustrating the concept of epiphenomenalism. It consists of the text "Brain-Level Cause" on the left, a horizontal arrow pointing to the right, and the text "Effect" on the right. The arrow is a simple white line with a white arrowhead pointing towards the right.

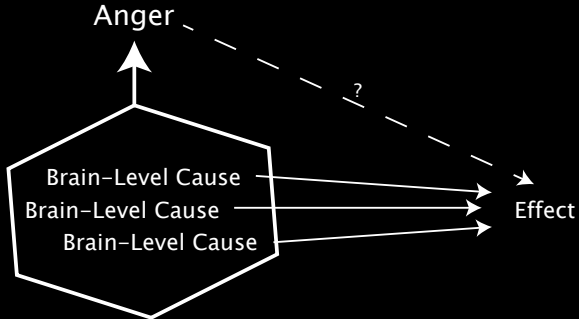
Epiphenomenalism



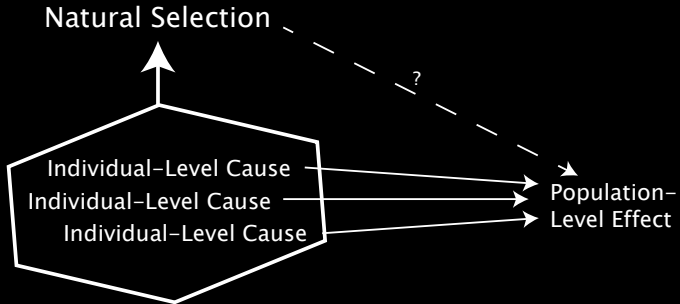
Epiphenomenalism



Epiphenomenalism



Epiphenomenalism in Selection



What's Wrong?

- No engagement with biology in this debate

What's Wrong?

- No engagement with biology in this debate
 - Arguments: coin flips, race cars, apple carts, etc.

What's Wrong?

- No engagement with biology in this debate
 - Arguments: coin flips, race cars, apple carts, etc.
 - Impact on our understanding of how selection and drift work not explored

What's Wrong?

- No engagement with biology in this debate
 - Arguments: coin flips, race cars, apple carts, etc.
 - Impact on our understanding of how selection and drift work not explored
- Obscures the fact that we disagree on the definitions of natural selection and genetic drift
 - Makes the question overall that much more difficult to answer

Process vs. Product

- Are selection and drift processes, or outcomes (products)?

Process vs. Product

- Are selection and drift processes, or outcomes (products)?
 - Causalists: selection and drift* are processes

Process vs. Product

- Are selection and drift processes, or outcomes (products)?
 - Causalists: selection and drift* are processes
 - Statisticalists: selection and drift are outcomes

The Definitions

- Selection as a process: Natural selection is a sampling process that discriminates between organisms on the basis of fitness (or merely physical) differences

The Definitions

- **Selection as a process:** Natural selection is a sampling process that discriminates between organisms on the basis of fitness (or merely physical) differences
- **Selection as an outcome:** Natural selection is what happens when there is a population change that is predicted and explained by trait fitness

The Definitions

- **Selection as a process:** Natural selection is a sampling process that discriminates between organisms on the basis of fitness (or merely physical) differences
- **Selection as an outcome:** Natural selection is what happens when there is a population change that is predicted and explained by trait fitness
- **Drift as a process:** Genetic drift is a sampling process that does *not* discriminate between organisms on the basis of fitness differences

The Definitions

- **Selection as a process:** Natural selection is a sampling process that discriminates between organisms on the basis of fitness (or merely physical) differences
- **Selection as an outcome:** Natural selection is what happens when there is a population change that is predicted and explained by trait fitness
- **Drift as a process:** Genetic drift is a sampling process that does *not* discriminate between organisms on the basis of fitness differences
- **Drift as an outcome:** Genetic drift is what happens when a population outcome deviates from our expectations (which are set by trait fitness values)

Drift as Process and Outcome

- Processes that don't discriminate between organisms on the basis of fitness differences (see Beatty, 1992):

Drift as Process and Outcome

- Processes that don't discriminate between organisms on the basis of fitness differences (see Beatty, 1992):
 - Neutral genetic variation

Drift as Process and Outcome

- Processes that don't discriminate between organisms on the basis of fitness differences (see Beatty, 1992):
 - Neutral genetic variation
 - Sampling of gametes to form offspring (in sexual organisms)

Drift as Process and Outcome

- Processes that don't discriminate between organisms on the basis of fitness differences (see Beatty, 1992):
 - Neutral genetic variation
 - Sampling of gametes to form offspring (in sexual organisms)
 - Splitting of recently-isolated breeding groups (without regard to traits, a.k.a the founder effect)

Drift as Process and Outcome

- Processes that don't discriminate between organisms on the basis of fitness differences (see Beatty, 1992):
 - Neutral genetic variation
 - Sampling of gametes to form offspring (in sexual organisms)
 - Splitting of recently-isolated breeding groups (without regard to traits, a.k.a the founder effect)
 - More broadly: Wright's shifting-balance theory

Drift as Process and Outcome

- Processes that don't discriminate between organisms on the basis of fitness differences (see Beatty, 1992):
 - Neutral genetic variation
 - Sampling of gametes to form offspring (in sexual organisms)
 - Splitting of recently-isolated breeding groups (without regard to traits, a.k.a the founder effect)
 - More broadly: Wright's shifting-balance theory
- The definitions again:
 - **Drift as a process:** Genetic drift is a sampling process that does *not* discriminate between organisms on the basis of fitness differences
 - **Drift as an outcome:** Genetic drift is what happens when a population outcome deviates from our expectations (which are set by trait fitness values)

Drift as Process and Outcome

- Processes that don't discriminate between organisms on the basis of fitness differences (see Beatty, 1992):
 - Neutral genetic variation
 - Sampling of gametes to form offspring (in sexual organisms)
 - Splitting of recently-isolated breeding groups (without regard to traits, a.k.a the founder effect)
 - More broadly: Wright's shifting-balance theory
- The definitions again:
 - **Drift as a process:** Genetic drift is a sampling process that does *not* discriminate between organisms on the basis of fitness differences
 - **Drift as an outcome:** Genetic drift is what happens when a population outcome **deviates from our expectations** (which are set by trait fitness values)

Where does that Leave Us?

- The causalist/statisticalist debate has focused primarily on the issue of **epiphenomenalism** in selection and drift. But this issue:

Where does that Leave Us?

- The causalist/statisticalist debate has focused primarily on the issue of **epiphenomenalism** in selection and drift. But this issue:
 - Doesn't seem to be biological

Where does that Leave Us?

- The causalist/statisticalist debate has focused primarily on the issue of **epiphenomenalism** in selection and drift. But this issue:
 - Doesn't seem to be biological
 - Doesn't tell us anything about selection and drift

Where does that Leave Us?

- The causalist/statisticalist debate has focused primarily on the issue of **epiphenomenalism** in selection and drift. But this issue:
 - Doesn't seem to be biological
 - Doesn't tell us anything about selection and drift
- There's also a difference between process and product notions of selection and drift. This issue:

Where does that Leave Us?

- The causalist/statisticalist debate has focused primarily on the issue of **epiphenomenalism** in selection and drift. But this issue:
 - Doesn't seem to be biological
 - Doesn't tell us anything about selection and drift
- There's also a difference between process and product notions of selection and drift. This issue:
 - Is genuinely biological

Where does that Leave Us?

- The causalist/statisticalist debate has focused primarily on the issue of **epiphenomenalism** in selection and drift. But this issue:
 - Doesn't seem to be biological
 - Doesn't tell us anything about selection and drift
- There's also a difference between process and product notions of selection and drift. This issue:
 - Is genuinely biological
 - Points us to interesting (and real-world!) corner cases where these two definitions come apart

Questions?

`charles@charlespence.net`