Causation and Metaphysiscs in Bio

KU Leuven CLPS, 7.12.2018

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Outline

1. Causation in evolution by natural selection
2. Signs of a metaphysics of science debate
3. A core metaphysical question: casual composition
4. Connecting metaphysics of science to philosophy of science – in search of a dialectic?

The take-home: It's high time to foster healthy collaboration between metaphysicians of science and philosophers of biology.

Generalization Warning

Causation in Evolution

What is Evolutionary Fitness?

How should we understand the property of fitness in evolving systems? What is it a property *of*, and is it a *causal* property?

ROBERT N. BRANDON

ADAPTATION AND EVOLUTIONARY THEORY*

There is virtually universal disagreement among students of evolution as to the meaning of adaptation. (Lewontin, 1957).

Much of past and current disagreement on adaptation centers about the definition of the concept and its application to particular examples: these arguments would lessen greatly if precise definitions for adaptations were

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THE PROPENSITY INTERPRETATION OF FITNESS*

SUSAN K. MILLS AND JOHN H. BEATTY†

Indiana University

The concept of "fitness" is a notion of central importance to evolutionary theory. Yet the interpretation of this concept and its role in explanations of evolutionary phenomena have remained obscure. We provide a *propensity* interpretation of fitness, which we argue captures the intended reference of this term as it is used by evolutionary theorists. Using the propensity interpretation of fitness, we provide a Hempelian reconstruction of explana-

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Rethinking the Propensity Interpretation:
A Peek Inside Pandora's Box[1]

JOHN BEATTY[a] and SUSAN FINSEN[b]

[a] *Department of Ecology and Behavioral Biology, University of Minnesota, Minneapolis, MN 55455, U.S.A.*
[b] *Department of Philosophy, California State University at San Bernadino, San Bernardino, CA 92407, U.S.A.*

Introduction

Over the past ten years, the propensity interpretation of fitness has attracted a number of proponents[2] and a few, persistent detractors.[3] Here, two previous supporters turn critics, to acknowledge and reframe some old problems, and to introduce some additional difficulties. We are not sure whether a radically revised interpretation of fitness is necessary. But it does seem to us that certain gross oversimplifications of the propensity interpretation deserve more serious attention.

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CHAPTER FIFTEEN

The Two Faces of Fitness

ELLIOTT SOBER

What is Evolutionary Fitness?

Fitness as a property of:

- genes or traits
- individual organisms
- groups
- populations

And at each level, either causal or non-causal.

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THE JOURNAL OF PHILOSOPHY

VOLUME XCIX, NO. 2, FEBRUARY 2002

TWO WAYS OF THINKING ABOUT FITNESS
AND NATURAL SELECTION*

The concept of fitness is, Philip Kitcher[1] says, "important both to informal presentations of evolutionary theory and to the mathematical formulations of [population genetics]" (*ibid.*, p. 50). He is absolutely right. The difficulty is to harmonize these very different

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The Two Faces of Fitness

ELLIOTT SOBER

Causation in Evolution

Where is the causal action in evolutionary theory? Are natural selection, genetic drift, and other components of the evolutionary process *causal*? If not, *what are they*?

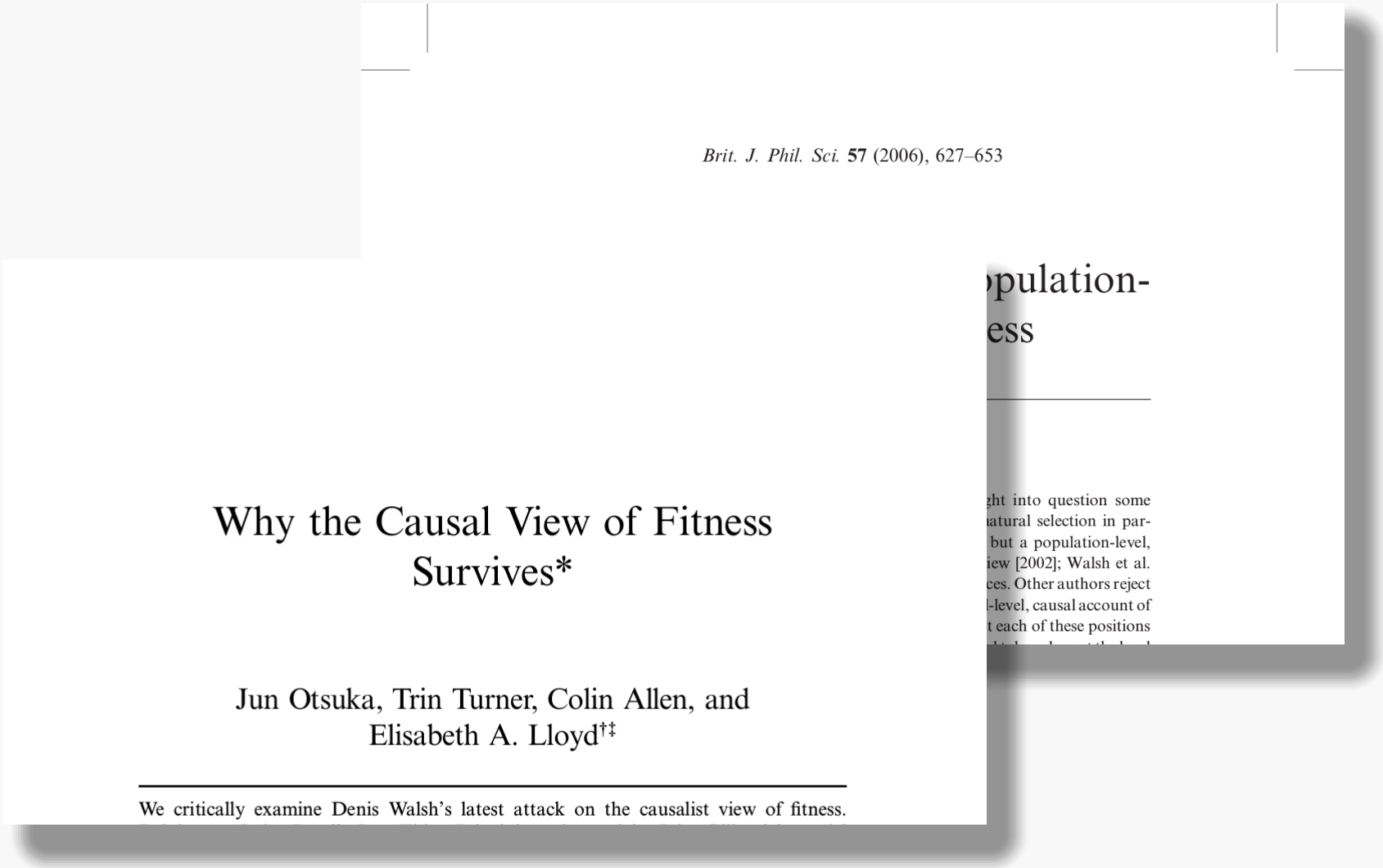
Brit. J. Phil. Sci. **57** (2006), 627–653

Natural Selection as a Population-Level Causal Process

Roberta L. Millstein

ABSTRACT

Recent discussions in the philosophy of biology have brought into question some fundamental assumptions regarding evolutionary processes, natural selection in particular. Some authors argue that natural selection is nothing but a population-level, statistical consequence of lower-level events (Matthen and Ariew [2002]; Walsh et al. [2002]). On this view, natural selection itself does not involve forces. Other authors reject this purely statistical, population-level account for an individual-level, causal account of natural selection (Bouchard and Rosenberg [2004]). I argue that each of these positions



Brit. J. Phil. Sci. **57** (2006), 627–653

Why the Causal View of Fitness Survives*

Jun Otsuka, Trin Turner, Colin Allen, and Elisabeth A. Lloyd†‡

We critically examine Denis Walsh's latest attack on the causalist view of fitness.

Brit. J. Phil. Sci. **57** (2006), 627–653

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A New Foundation for the Propensity Interpretation of Fitness

Charles H. Pence and Grant Ramsey

ABSTRACT

The propensity interpretation of fitness (PIF) is commonly taken to be subject to a set of simple counterexamples. We argue that three of the most important of these are not counterexamples to the PIF itself, but only to the traditional mathematical model of this propensity: fitness as expected number of offspring. They fail to demonstrate that a new mathematical model of the PIF could not succeed where this older model fails. We then propose a new formalization of the PIF that

Biol Philos (2016) 31:459–482
DOI 10.1007/s10539-016-9528-0

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AREA REVIEW

A critical review of the statisticalist debate

Jun Otsuka[1]

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Philos Theor Pract Biol (2017) 9:1

Four Pillars of Statisticalism

Denis M. Walsh,* André Ariew,† Mohan Matthen‡

Over the past fifteen years there has been a considerable amount of debate concerning what theoretical population dynamic models tell us about the nature of natural selection and drift. On the causal interpretation, these models describe the causes of population change. On the statistical interpretation, the models of population dynamics models specify statisti-
cal parameters that explain, predict, and quantify changes in population structure, *without*

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Propensity Interpretation of Fitness

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Causation in Evolution

causalism: At least some of the "factors" of evolution, like natural selection and genetic drift, are causal.

statisticalism: Those processes are merely epiphenomenal, tallied for theoretical convenience; the only truly causal events occur in the lives of individual organisms.

Well, how did I get here?

A Metaphysics Debate?

The Arguments

- Causal efficacy of a “sorting” process
- Subdividing series of coin tosses
- Lack of “selection” in outcomes of a biased coin

The Arguments

- apple carts
- Newtonian gravitation
- centers of mass
- pharaoh's laborers
- scatter plots
- smoking
- heart disease
- painkillers
- race cars
- **coin flips**

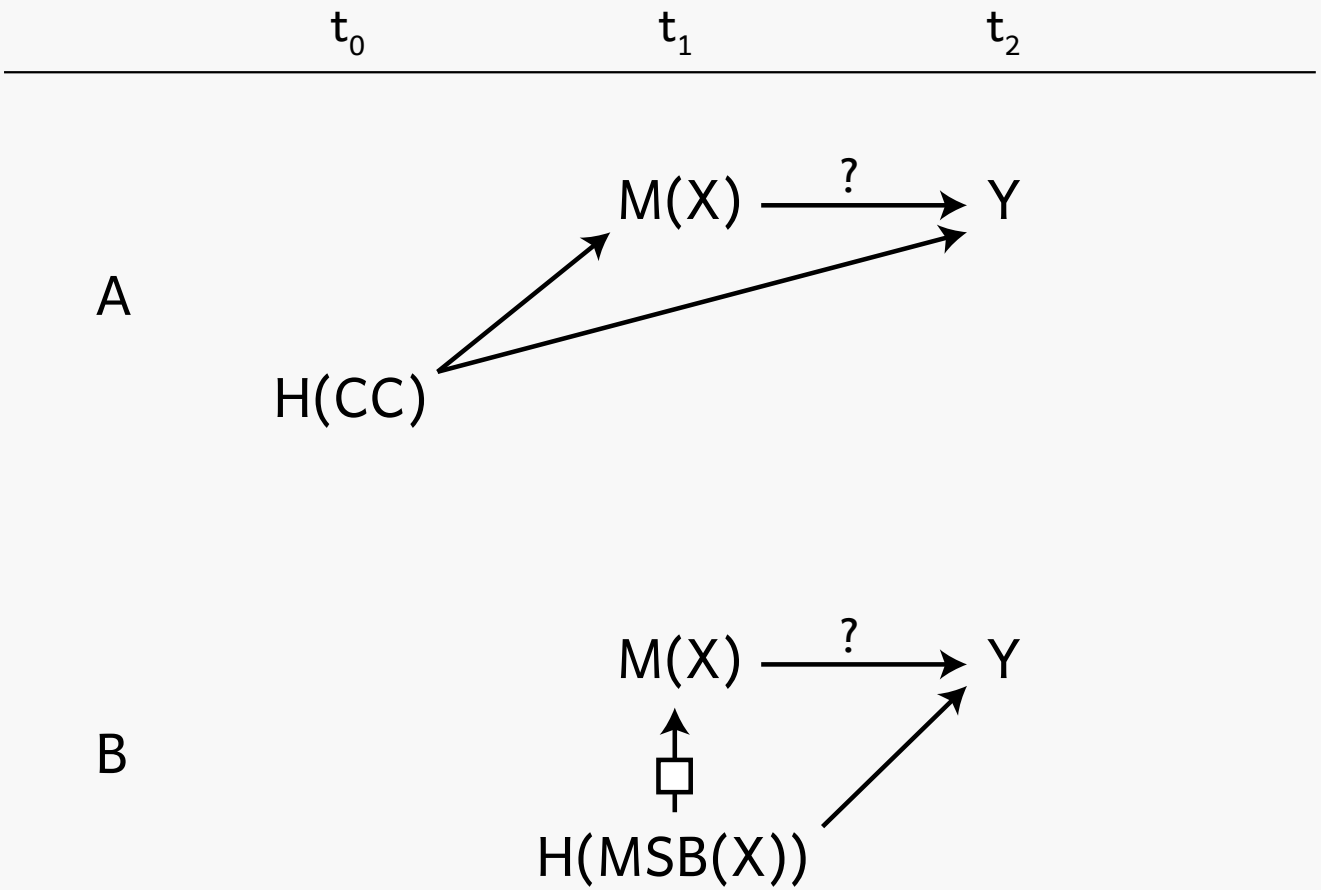
Where did the biology go?

A Metaphysical Problem

What's a Causal Process?

Setting aside for the sake of time: It's not clear that all parties to the debate agree about the definition of a causal process.

Supervenience and Multi-Level Causation



after figure 5, Shapiro and Sober (2007)

Causal Composition

When do causes operating at a lower level compose to form a causal process operating at a higher level?

Causal Composition

A paradigmatic *metaphysics of science question*.

Where and how has it been dealt with in the literature?

Making Connections

This is hard!

Biology is exceptionally messy. So what do we do? So far, authors tend to either:

1. produce simplified cases to "read off" the metaphysics from the biology, or
2. turn to detailed examples extracted from biological practice.

“Reading Off”

Attempts to infer from simplified biological cases to metaphysical conclusions usually

1. smuggle in metaphysical assumptions (e.g., definition of a causal process, theory of causation), and/or
2. evaluate a highly limited array of metaphysical options.

“Reading Off”

Not surprising! Biological cases are *just too complex* to have an “intuitive” metaphysical reading.

“Reading Off”

Not surprising! Biological cases are *just too complex* to have an “intuitive” metaphysical reading.

We’re likely just to amplify preexisting hunches.

Biological Examples

A number of great biological case studies have been deployed. Why hasn't this worked?

In Search of a Dialectic

Common practice elsewhere in philosophy of science: Movement back and forth, from metaphysical positions, to simplified scientific cases, to complex scientific cases.

CONCEPTS OF FORCE

A STUDY IN

THE FOUNDATIONS OF DYNAMICS

Max Jammer

CONCEPTS OF FORCE

A STUDY IN

THE FOUNDATIONS

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Philosophy of Science

September, 1973

THE MEANING AND STATUS OF NEWTON'S LAW OF INERTIA AND THE NATURE OF GRAVITATIONAL FORCES*

J. EARMAN AND M. FRIEDMAN

University of Minnesota and Harvard University

A four dimensional approach to Newtonian physics is used to distinguish between a number of different structures for Newtonian space-time and a number of different formulations of Newtonian gravitational theory. This in turn makes possible an in-depth study of the meaning and status of Newton's Law of Inertia and a detailed comparison of the Newtonian and Einsteinian versions of the Law of Inertia and the Newtonian and Einsteinian treatments of gravitational forces. Various claims about the status of Newton's Law of Inertia are critically examined including these: the Law of Inertia is not an empirical law but a definition; it is not a law *simpliciter* but

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Newtonian Forces

Jessica Wilson

ABSTRACT

Newtonian forces are pushes and pulls, possessing magnitude and direction, that are exerted (in the first instance) by objects, and which cause (in particular) motions. I defend Newtonian forces against the four best reasons for denying or doubting their existence. A running theme in my defense of forces will be the suggestion that Newtonian Mechanics is a special science, and as such has certain *prima facie* ontological rights and privileges, that may be maintained against various challenges.

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The British Journal for the Philosophy of Science

VOLUME XIV November, 1963 No. 55

UNIVERSAL AND DIFFERENTIAL FORCES*

BRIAN ELLIS

IN his book *Space and Time* Reichenbach[1] makes a distinction between universal and differential forces. The distinction is roughly this.

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dialectica Vol. 63, N° 4 (2009), pp. 555–589

DOI: 10.1111/j.1746-8361.2009.01213.x

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The Metaphysics of Forces

Olivier Massin†

Abstract

This paper defends the view that Newtonian forces are real, symmetrical and non-causal relations. First, I argue that Newtonian forces are *real*; second, that they are *relations*; third, that they are *symmetrical* relations; fourth, that they are *not species of causation*. The overall picture is anti-Humean to the extent that it defends the existence of forces as external relations irreducible

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CAUSAL EXPLANATION AND THE REALITY OF NATURAL COMPONENT FORCES

BY

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Grazer Philosophische Studien
63 (2002) 53-77

CAUSAL POWERS, FORCES,
AND SUPERDUPERVENIENCE

Jessica M. WILSON
University of Michigan

Summary

Horgan (1993) proposed that "superdupervenience" – supervenience preserving physicalistic acceptability – is a matter of robust explanation. I argued against him (1999) that (as nearly all physicalist and emergentist

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In Search of a Dialectic

Common practice elsewhere in philosophy of science: Movement back and forth, from metaphysical positions, to simplified scientific cases, to complex scientific cases.

Almost entirely absent from the philosophy of biology.

An Appeal

1. Let's recognize that we're actually doing metaphysics of science!

An Appeal

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It's okay to admit it.

An Appeal

2. Let's go do good metaphysics of science!

An Appeal

2. Let's go do good metaphysics of science!

Where does the general question of causal composition crop up in other sciences? What metaphysical tools can we bring to bear to try to solve it?

An Appeal

3. Let's find other places in philosophy of biology where the same thing might be happening.

An Appeal

3. Let's find other places in philosophy of biology where the same thing might be happening.

Species? Probability/chance?

Questions?

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