COMING TO TERMS WITH CHANCE IN EVOLUTION

Louisiana State University, 2/3/2014

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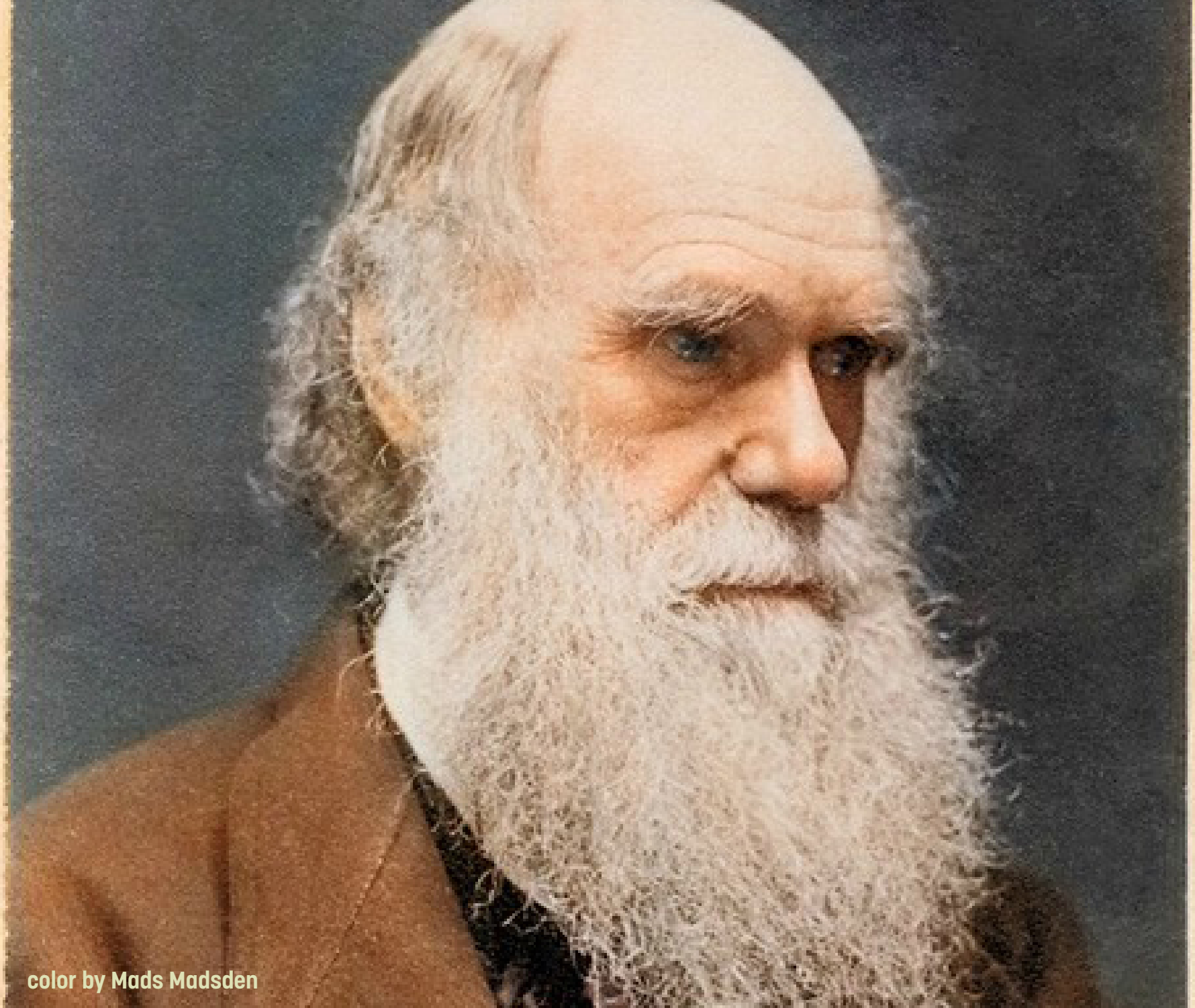
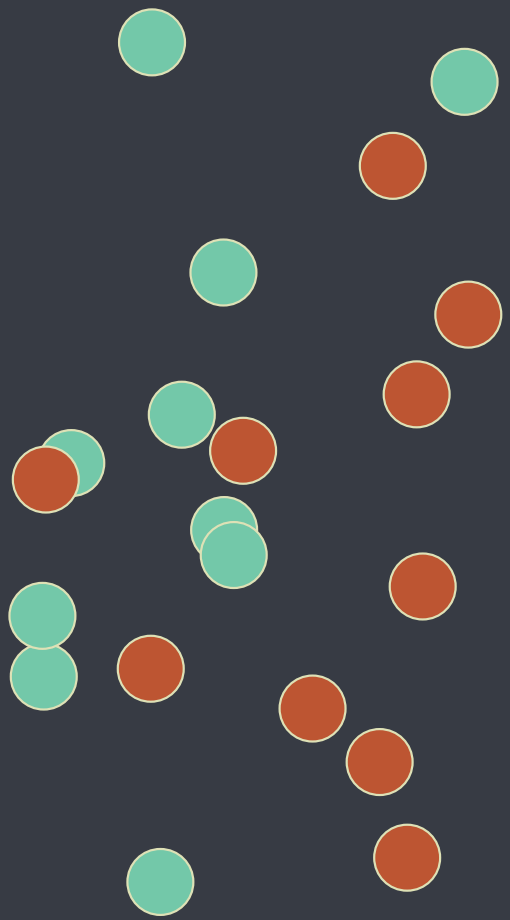
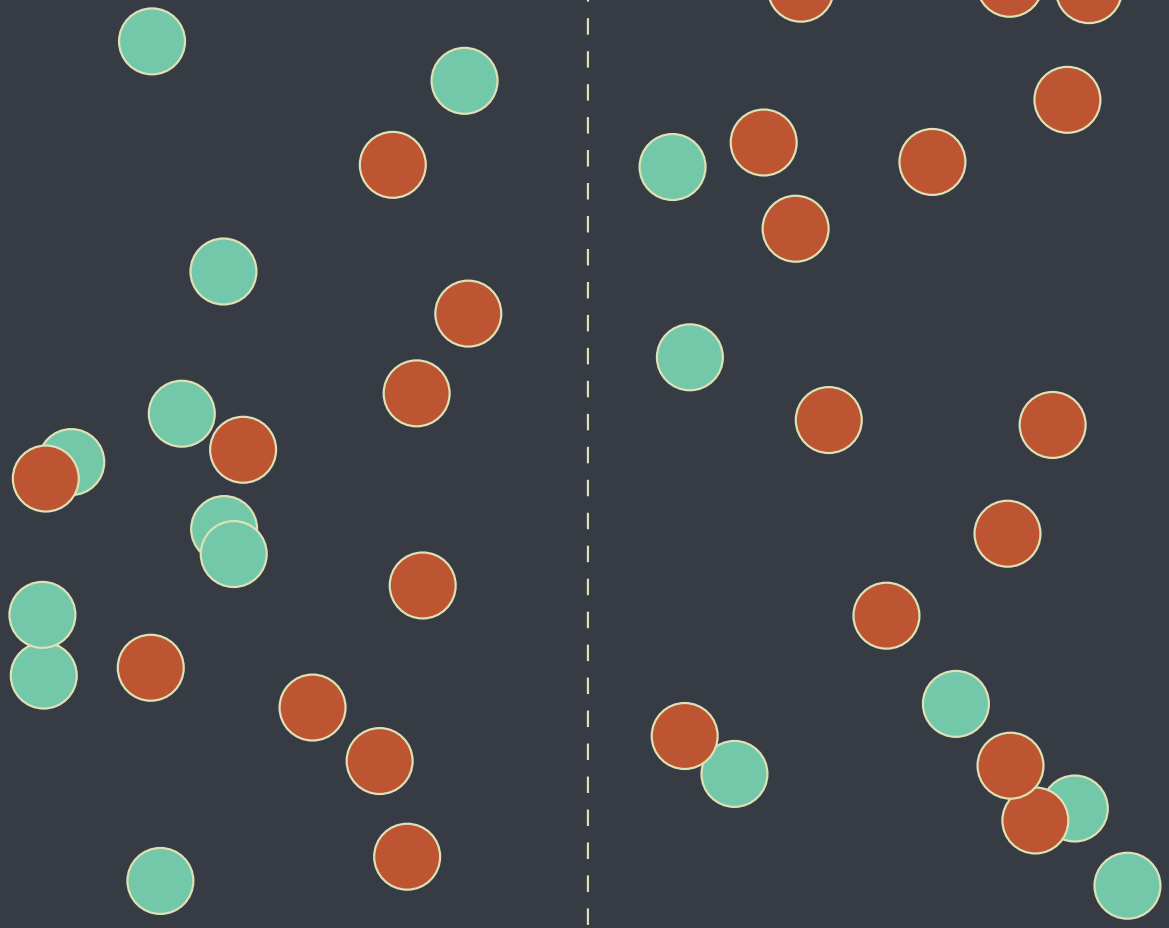
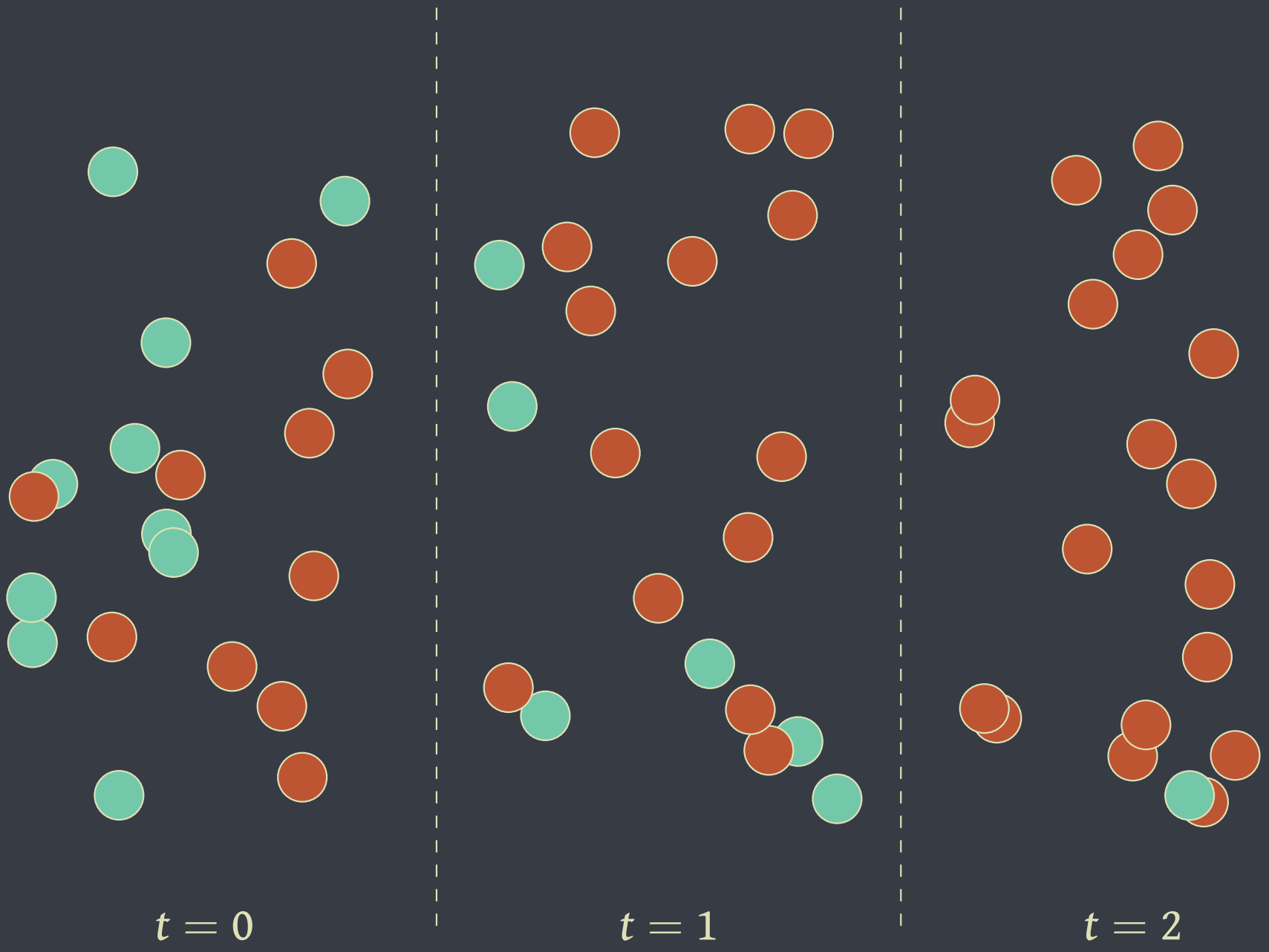

color by Mads Madsden

NATURAL SELECTION

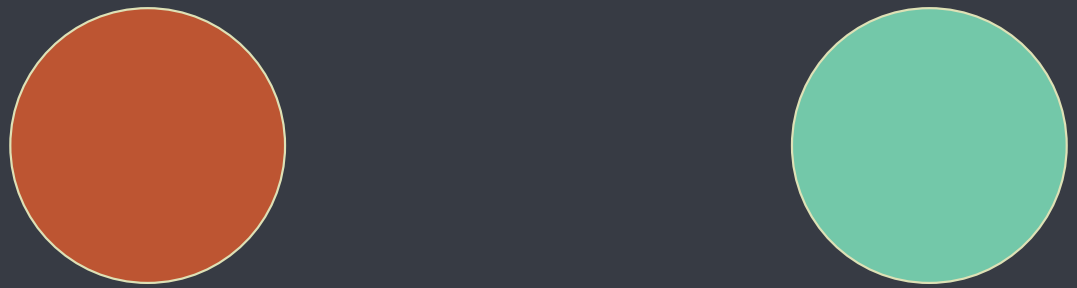


$t = 0$


$t = 0$
$t = 1$


$t = 0$
$t = 1$
$t = 2$

FITNESS



Orange organisms leave more offspring than teal organisms.

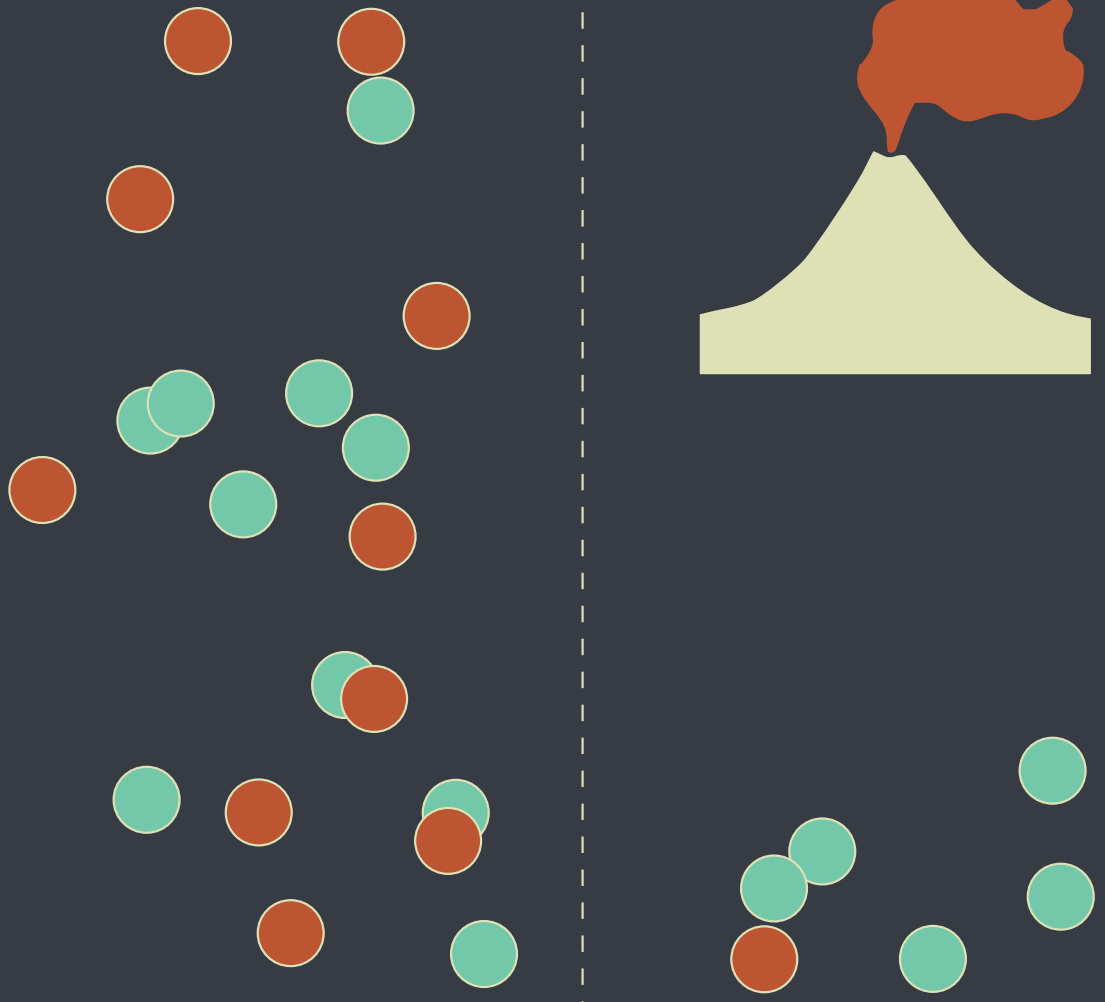
Orange organisms leave more offspring than teal organisms.

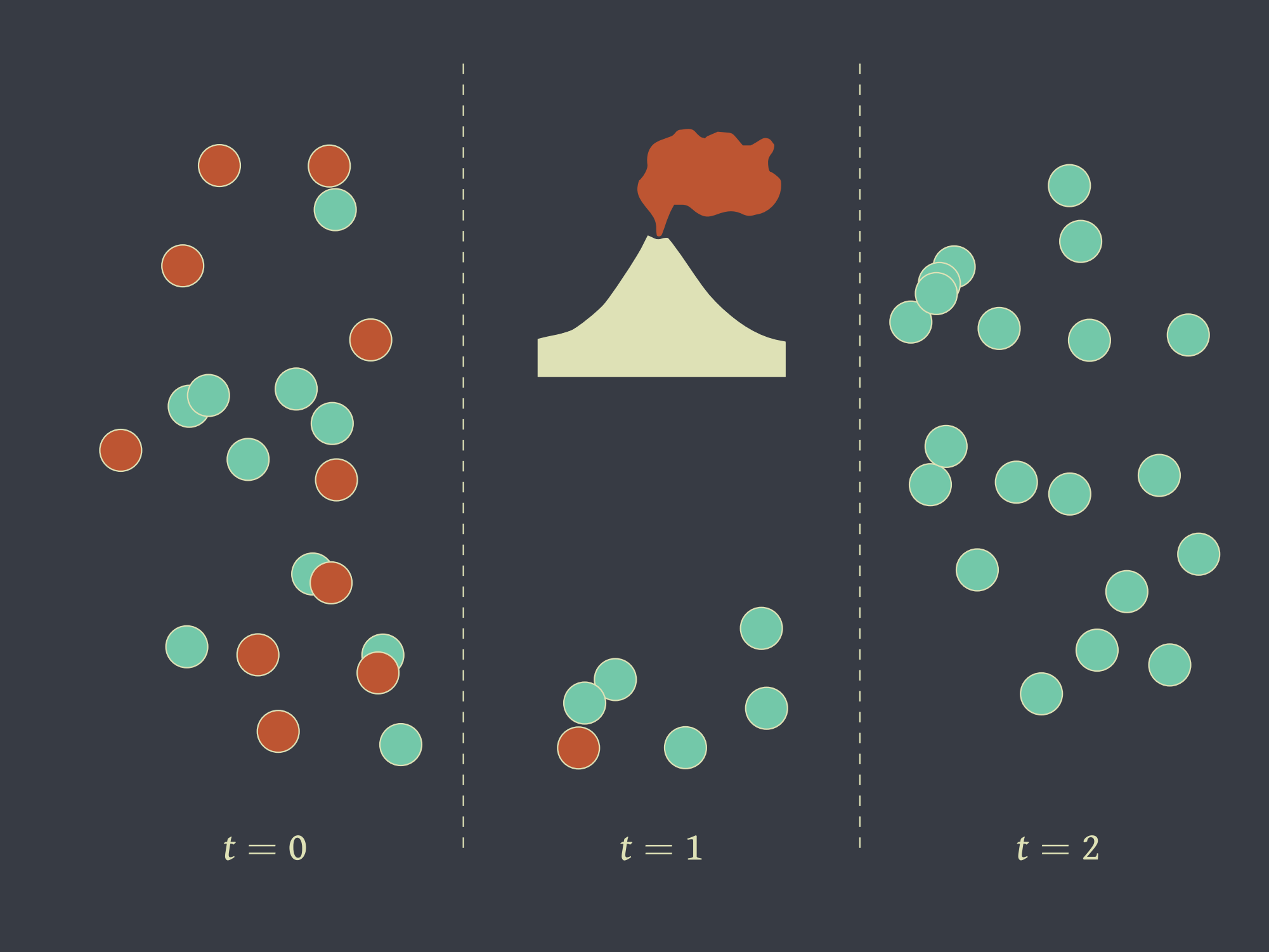
A circle: *the tautology problem*

Orange organisms will probably (are disposed to) leave more offspring than teal organisms.

GENETIC DRIFT

$t = 0$


$t = 0$
$t = 1$


$t = 0$
$t = 1$
$t = 2$

THE GOALS

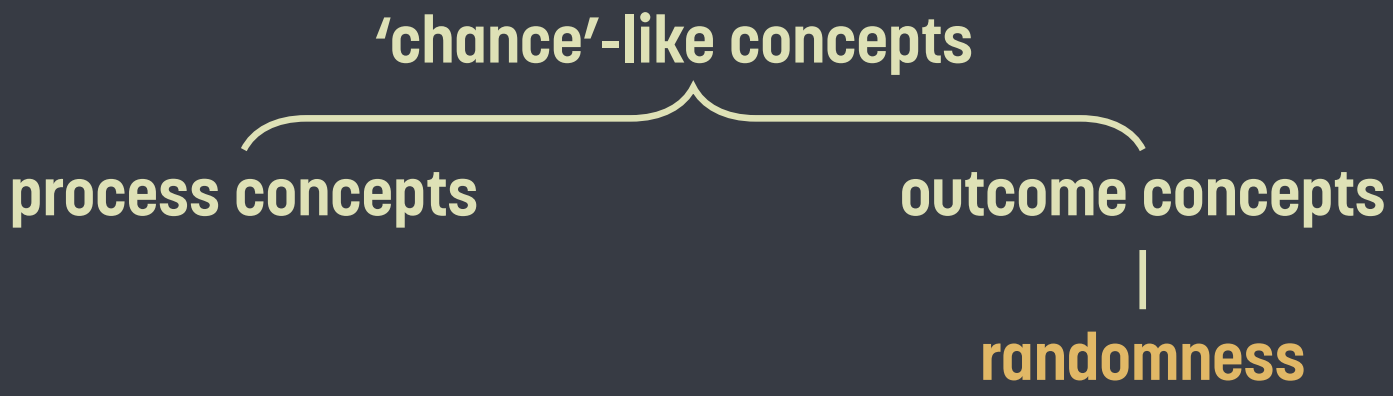
Distinguish four notions of chance in evolution

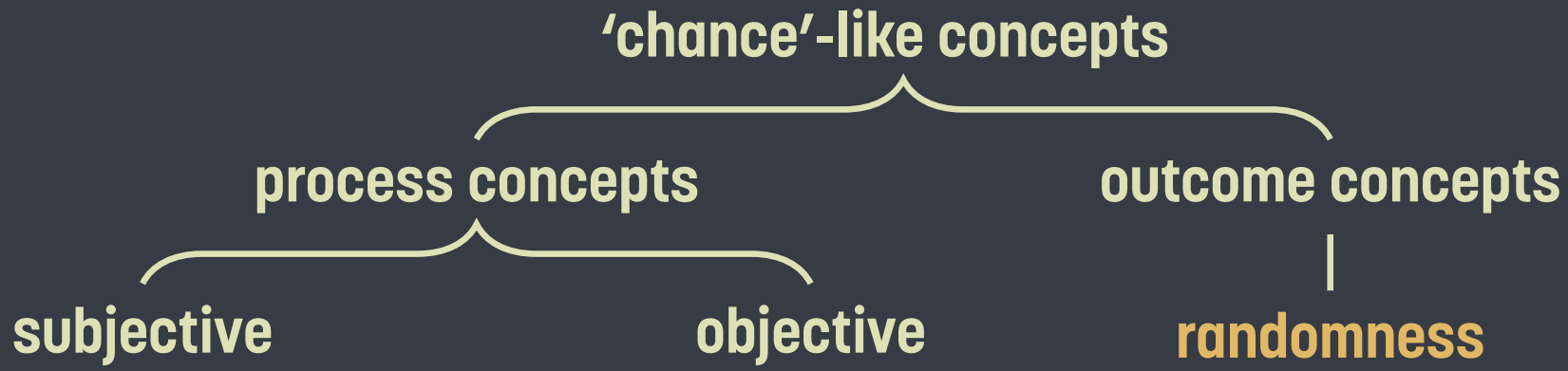
Show that conflation of all four leads to problems – then fix the problems

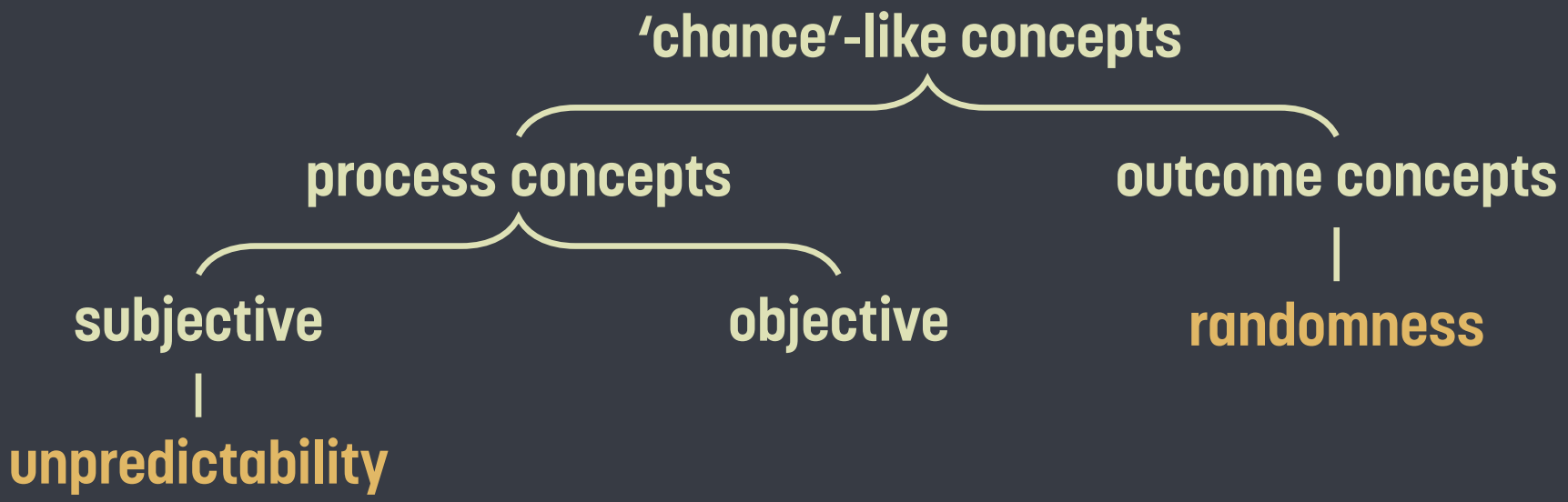
FOUR CONCEPTS OF CHANCE

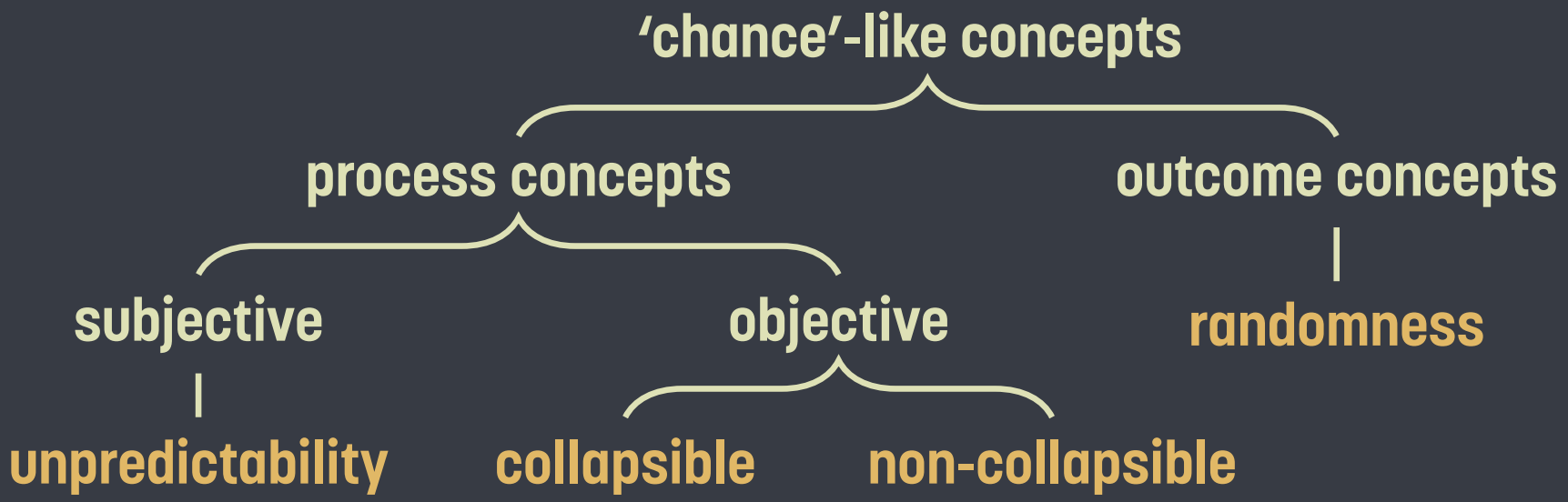
‘chance’-like concepts


‘chance’-like concepts
process concepts
outcome concepts


'chance'-like concepts
process concepts
outcome concepts
randomness


'chance'-like concepts
process concepts
outcome concepts
subjective
objective
randomness


'chance'-like concepts
process concepts
outcome concepts
subjective
objective
randomness
unpredictability


'chance'-like concepts
process concepts
outcome concepts
subjective
objective
randomness
unpredictability
collapsible
non-collapsible

$$\Pr(\,\textbf{heads} \mid \textbf{coin flipped}\,) = 0.5$$

$$\Pr(\text{heads} \mid \text{coin flipped}) = 0.5$$

$$\Pr(\text{heads} \mid \Omega) = 0 \text{ or } 1$$

$$\Pr(\text{heads} \mid \Omega) = x$$

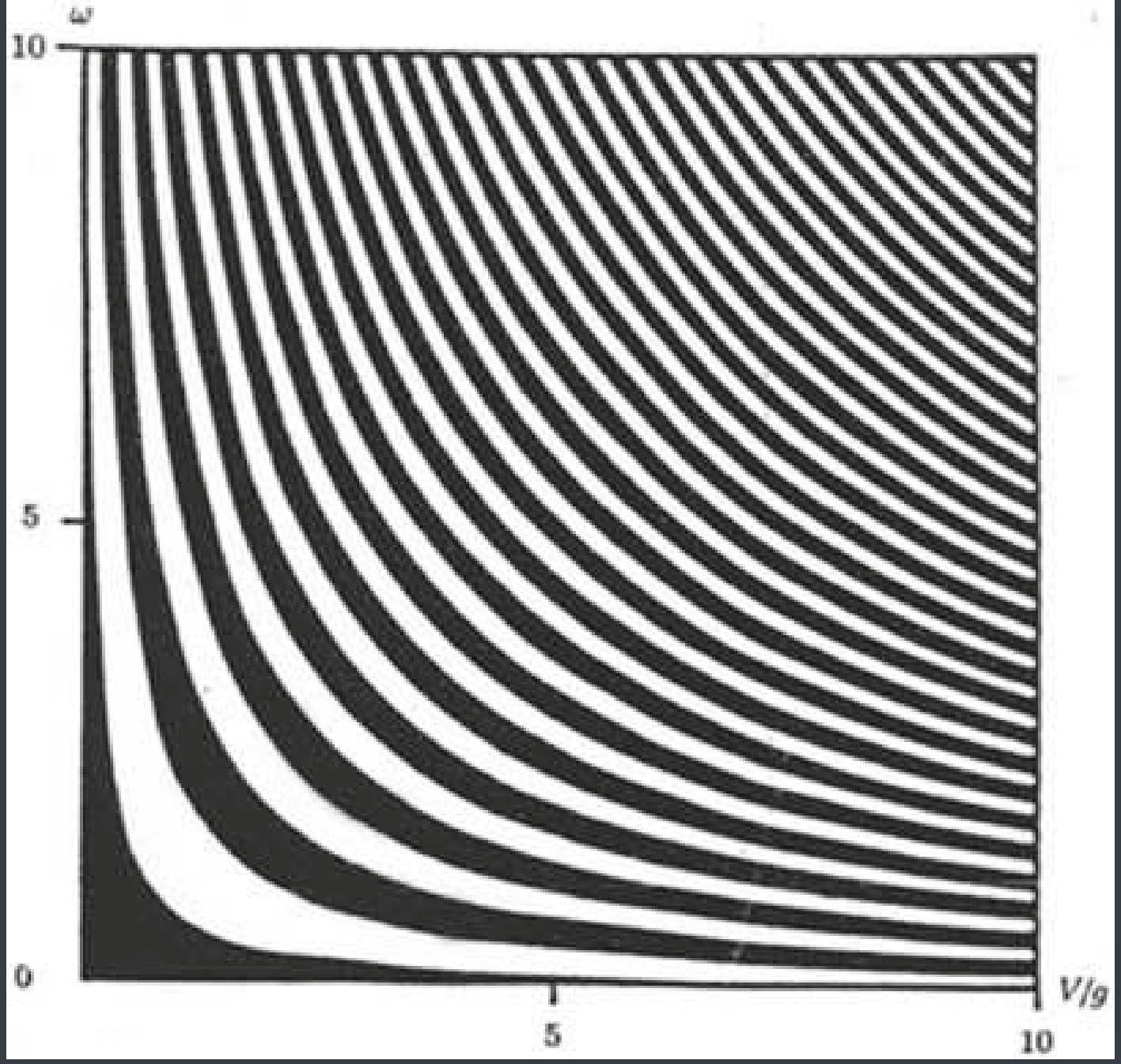
$$\Pr(\text{heads} \mid \text{coin flipped}) = 0.5$$

$$\Pr(\text{heads} \mid \Omega) = 0 \text{ or } 1$$

↖ **COLLAPSIBLE**

$$\Pr(\text{heads} \mid \Omega) = x$$

↖ **NON-COLLAPSIBLE**



from Diaconis (1998)

randomness

unpredictability

collapsible objective chance

non-collapsible objective chance

SOLVING PROBLEMS

Philosophy of Science

September, 1996

THE INDETERMINISTIC CHARACTER OF EVOLUTIONARY THEORY: NO "NO HIDDEN VARIABLES PROOF" BUT NO ROOM FOR DETERMINISM EITHER*

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Duke University

In this paper we first briefly review Bell's (1964, 1966) Theorem to see how it invalidates any deterministic "hidden variable" account of the apparent indeterminacy of quantum mechanics (QM). Then we show that quantum uncertainty,

BC: Natural selection is chancy because genetic drift is chancy.

“drift clearly is a stochastic or probabilistic or indeterministic phenomenon” (BC, 324)

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“the inferences we can make” about drift (BC, 322); what drift “can predict” or “cannot predict” (BC, 323)

“if one is a realist…then one should conclude that [evolutionary theory] is fundamentally indeterministic” (BC, 336)

(P1) Drift is unpredictable.

(P2) Drift is an autonomous statistical law.

(C1) Drift is chancy (*a fortiori* from P1 and P2).

(P3) Natural selection and drift are "inextricably connected" (BC, 324).

(C2) Natural selection is objectively chancy (from C1 and P3).

Why fix this?

(P1*) Drift exhibits collapsible objective chance.

(P2) ~~Drift is an autonomous statistical law.~~

(C1*) Drift is chancy (*a fortiori* from P1 ~~and P2~~).

(P3) Natural selection and drift are "inextricably connected" (BC, 324).

(C2) Natural selection is objectively chancy (from C1* and P3).

Why think this is right?

Why think this is right?

- The “hidden variables” argument
- Brandon’s other work on drift

Is Indeterminism the Source of the Statistical Character of Evolutionary Theory?*

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Barbara L. Horan
Philosophy Program, Georgia Southern University

Alex Rosenberg
Department of Philosophy, University of Georgia

We argue that Brandon and Carson's (1996) "The Indeterministic Character of Evolutionary Theory" fails to identify any indeterminism that would require evolutionary theory to be a statistical or probabilistic theory. Specifically, we argue that (1) their demonstration of a mechanism by which quantum indeterminism might "percolate up" to the biological level is irrelevant; (2) their argument that natural selection is indeterministic because it is inextricably connected with drift fails to join the issue with determinism; and (3) their view that experimental methodology in botany *assumes* indeterminism is both

“Are the probabilities employed in the theory [subjective] or not?” (GHR, 146)

GOOD: unpredictability

“Ungrounded probabilistic propensities are not mechanisms; they are admissions that there is no mechanism operating....” “[P]ure probabilistic propensities are viewed as an uncomfortable but unavoidable conclusion in quantum mechanics.” (GHR, 154)

BAD: non-collapsible objective chance

THE TAKE-HOME

BC conflate unpredictability, non-collapsible, and collapsible objective chance

GHR conflate unpredictability and non-collapsible objective chance

Most importantly: we can fix BC's argument, if we resolve this conflation

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A New Foundation for the Propensity Interpretation of Fitness

Charles H. Pence and Grant Ramsey

Studies in History and Philosophy of Biological and Biomedical Sciences 42 (2011) 475–485

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"Describing our whole experience": The statistical philosophies of W. F. R. Weldon and Karl Pearson

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ABSTRACT

There are two motivations commonly ascribed to historical actors for taking up statistics: to reduce complicated data to a mean value (e.g., Quetelet), and to take account of diversity (e.g., Galton). Different motivations will, it is assumed, lead to different methodological decisions in the practice of the statistical

A New Foundation for the Propensity Interpretation of Fitness

Charles H. Pence and Grant Ramsey

Pearson, *Biometrika* 5:1 (1906)

If we want to make a statement about the stature of Englishmen, we must find a way of describing our whole experience ... so that we can easily remember and communicate to others how many men of any given height we find among a thousand Englishmen. We must give up the attempt to replace our experiences by a simple average value and try to describe the whole series of results our observation has yielded.

Weldon 1906, p. 94

QUESTIONS?

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