Evolution, Genetics and Behavior

steven j. barnes

- Give an example of an interaction between genes and environment that has an effect on behavior.
- It is important to distinguish between the development of individuals and the development of individual differences. Explain.
- Explain heritability estimates and how they are often misinterpreted.
- Explain the difference between heredity and heritability.

Learning Goals

Some behaviours play an obvious role in evolution (e.g., food-finding ability, avoiding predators, etc.), others play a less obvious role.

Evolution & Behaviour

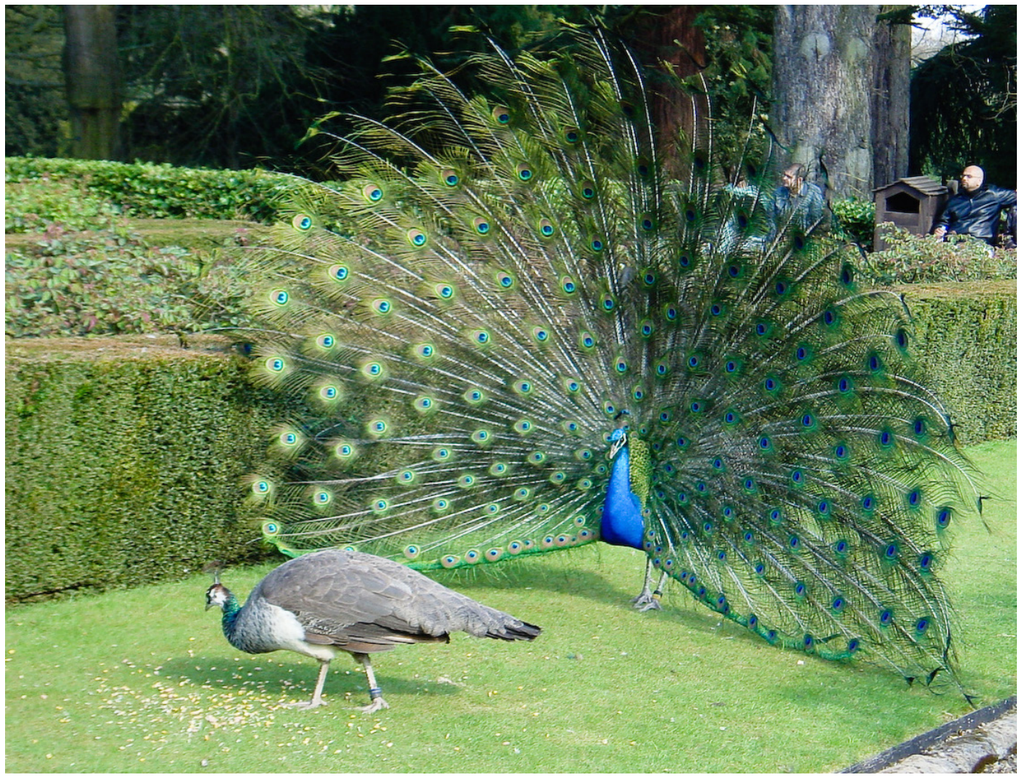
One less-obvious example is social dominance.

For example, in some species, dominant males copulate more than nondominant males.

from Pinel (2003)

Another less obvious example is courtship display.

An intricate series of courtship displays precedes copulation in many species.



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An intricate series of courtship displays precedes copulation in many species.

Courtship displays are thought to promote the evolution of new *species*.

[A *species* is a group of organisms that is reproductively isolated from other organisms; isolation can result from a geographic barrier or a behavioural barrier.]

We talked previously about how the nature-nurture debate is rather pointless. We will now look at an example of how genetic factors and experience interact to direct behavioural development within the lifespan of an individual.

Interaction of Genes & Experience

Recall: The nurture side of the nature-nurture debate was epitomized by the North American behaviourists. In the early 30's, Robert Tryon's work stood in sharp contrast to the dominant viewpoint that behaviour develops largely through learning.

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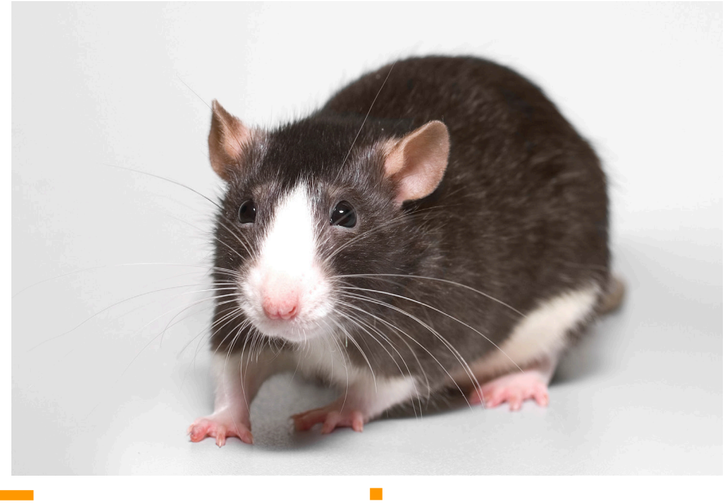
Tryon tried to selectively breed a behaviour that was commonly studied by the behaviourists: Maze-running in laboratory rats.



Interaction of Genes & Experience

Tryon started with a large heterogeneous group of laboratory rats. He trained each of them to run a complex maze.

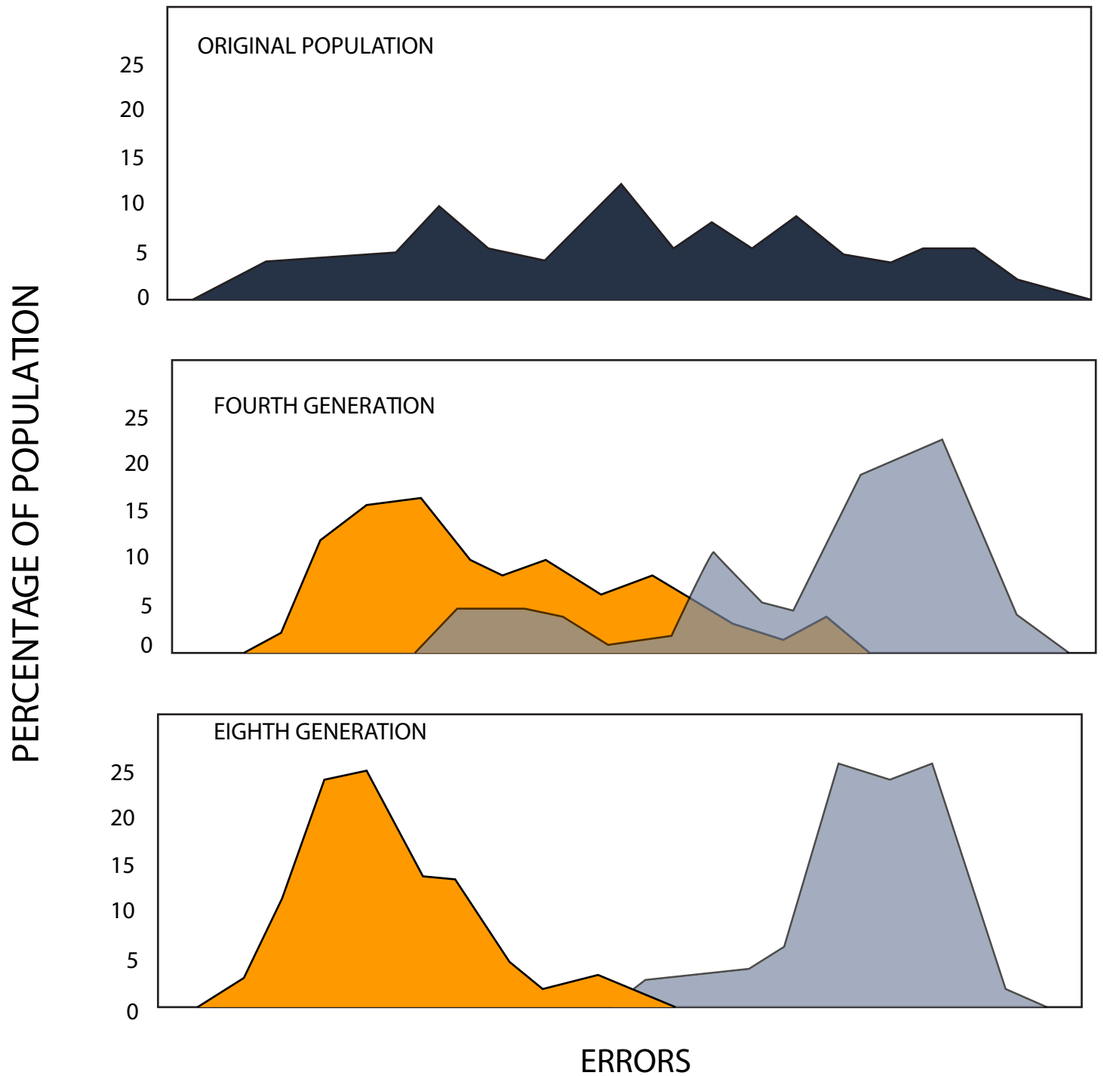
Interaction of Genes & Experience

Tryon started with a large heterogeneous group of laboratory rats. He trained each of them to run a complex maze.

Then, he mated the best female maze runners with the best male maze runners (maze bright). And he also mated the worst male maze runners with the worst female maze runners (maze dull). In each of the offspring of these maze bright and maze dull rats he continued to only mate the brightest and the dullest, respectively. He did this for 21 generations.

Interaction of Genes & Experience

By the 8th generation there was no longer much overlap in the maze running abilities of the maze bright vs. maze dull rats.



From Pinel (2003)

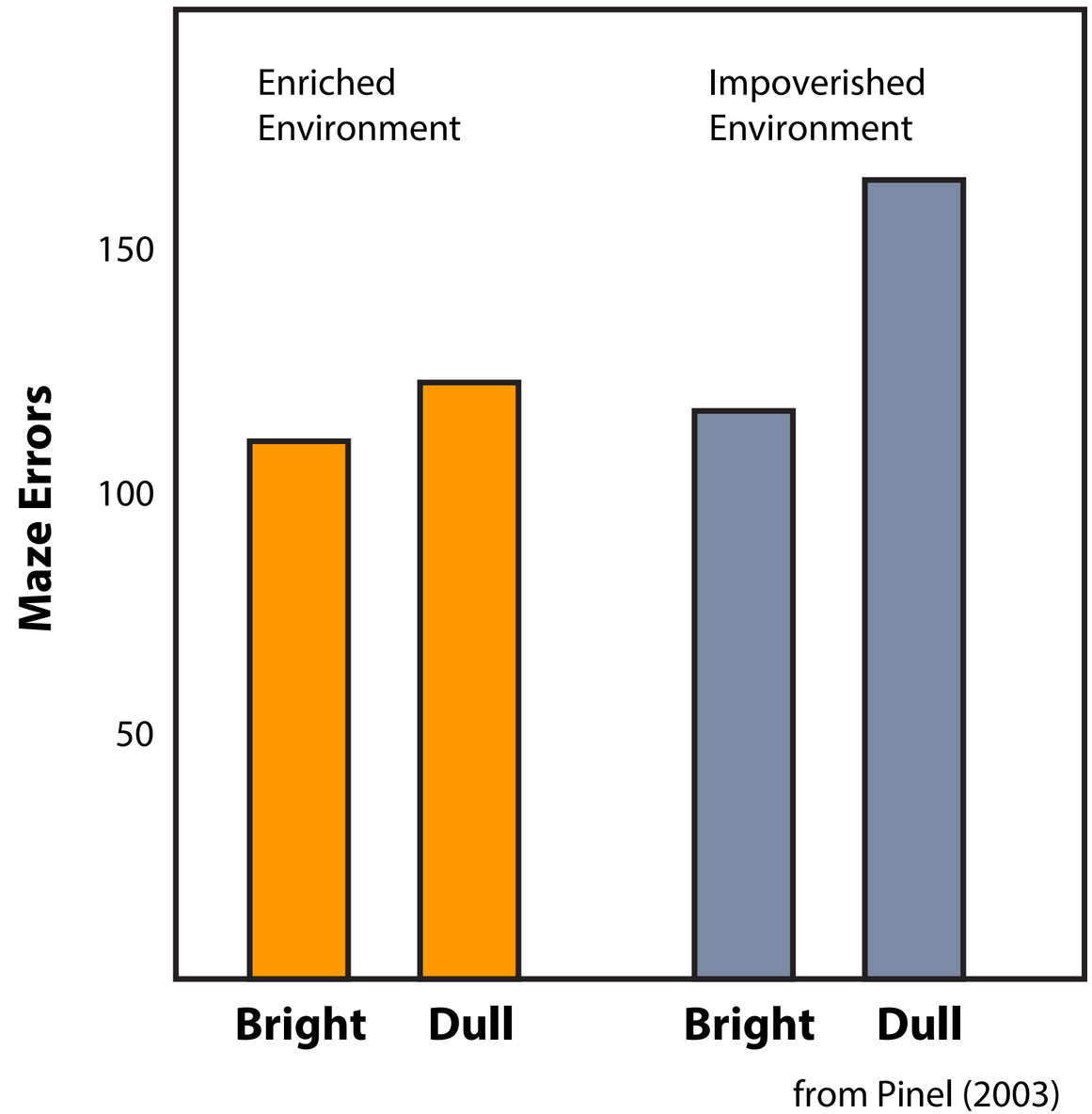
Interaction of Genes & Experience

Tryon's selective breeding experiments illustrate that genes can clearly influence behaviour. However, this should not be taken to imply that experience does not.

In 1958, Cooper and Zubek published a study of Tryon's maze bright and maze dull rats. They reared rats from both populations in one of two environments:

1. An impoverished environment.
2. A less impoverished ("enriched") environment.

Interaction of Genes & Experience



from Pinel (2003)

Interaction of Genes & Experience

In Individuals

Music is the product of an interaction between the musician and the instrument. We cannot ask what proportion of that music is from the instrument and what proportion is from the musician.

Likewise: The intelligence of an individual is the product of an interaction between that individuals genes and their environment. We cannot ask what proportion of their intelligence is due to their genes and what proportion is due to their environment.

In Groups

Now lets say we have many musicians and we measure the quality of their music.

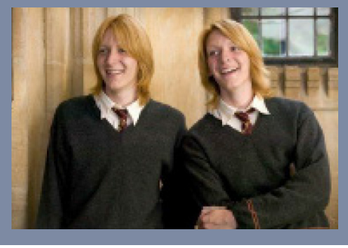
We can now ask:
What proportion of the difference between these musicians is due to differences between their instruments and what proportion is due to differences between their musical skills.

In Groups

Now lets say we have many individuals and we measure their intelligence.

We can now ask:
What proportion of the difference between these individuals is due to differences between their environments and what proportion is due to differences between their genetic inheritances.

In order to assess the relative contributions of genes and environment to the development of differences in some trait, behavioural geneticists study individuals with known genetic similarity. For example, they might compare monozygotic twins to dizygotic twins.

	Monozygotic (MZ) Twins 	Dizygotic (DZ) Twins) *same sex 
Environment	**same**	**same**
Genetics	**same**	**different**

Genetics of Human Psychological Differences

Heritability Estimates

"Heritability estimate for some trait is 70%"

This is a numerical estimate of the proportion of the variance observed on a trait that was due to genetic variation within a particular study.

It would be wrong to conclude that the trait in question is 70% genetic.

Heredity vs. Heritability

Heredity = All traits and tendencies that are inherited from one's biological ancestors.

Heritability = How much of the diversity in a particular trait in a given population is due to genetic inheritance?

Heritability Estimate = A descriptive statistic derived from a sample taken from a population of interest (range = 0 to 1; often expressed as a percentage).

Fundamental Distinctions