



# The Nature-Nurture Question

## Instructor Manual

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The Nature-Nurture Question module covers core content such as behavioral genetics, the utility of adoption and twin studies as well as introducing the heritability coefficient and gene-environment interaction.

## Learning Objectives

- **Relevant APA Learning Objectives (Version 2.0)**
  - Describe key concepts, principles, and overarching themes in psychology (1.1)
  - Develop a working knowledge of psychology's content domains (1.2)
  - Describe applications of psychology (1.3)
  - Use scientific reasoning to interpret psychological phenomena (2.1)
  - Demonstrate psychology information literacy (2.2)
  - Build and enhance interpersonal relationships (3.2)
  - Adopt values that build community at local, national, and global levels (3.3)
- **Content Specific Learning Objectives: The Nature-Nurture Question**
  - Understand what the nature-nurture debate is and why the problem fascinates us.
  - Understand why nature-nurture questions are difficult to study empirically.
  - Know the major research designs that can be used to study nature-nurture questions.

- Appreciate the complexities of nature–nurture and why questions that seem simple turn out not to have simple answers.

## Abstract

People have a deep intuition about what has been called the “nature–nurture question.” Some aspects of our behavior feel as though they originate in our genetic makeup, while others feel like the result of our upbringing or our own hard work. The scientific field of behavior genetics attempts to study these differences empirically, either by examining similarities among family members with different degrees of genetic relatedness, or, more recently, by studying differences in the DNA of people with different behavioral traits. The scientific methods that have been developed are ingenious, but often inconclusive. Many of the difficulties encountered in the empirical science of behavior genetics turn out to be conceptual, and our intuitions about nature and nurture get more complicated the harder we think about them. In the end, it is an oversimplification to ask how “genetic” some particular behavior is. Genes and environments always combine to produce behavior, and the real science is in the discovery of how they combine for a given behavior.

## Class Design Recommendations

The Nature-Nurture Question module can be taught over a single class period. Please also refer to the Noba PowerPoint slides that complement this outline.

First class period (50-75 min):

- Introduce the nature-nurture question and related concepts
  - What does this debate refer to and why are we so fascinated by it?
  - Explain the concepts of behavioral genetics, adoption and twin studies, quantitative genetics, and the heritability coefficient
  - Show video of twins separated at birth
  - Conduct class activity: Striking similarities among strangers
- Describe what have we learned about nature-nurture so far.

- Gene-environment interaction
  - Example: Phenylketonuria

## Module Outline

### The Introduction of the Nature-Nurture Question

What is it and why are we so fascinated by it?

- We have always been intrigued by the fact that humans are born with some innate characteristics, while others are acquired. Sometimes we have control over our actions, other times it seems that we do not. For instance, we might wonder if the amount we can drink is fixed by nature or completely under our control. How about honesty and religiosity? We have grappled with these questions for a long time and also debated about how to empirically answer them.
- In non-human animals, scientists often examine the nature vs. nurture question in breeding studies. In the past, research has been conducted on puppies born to aggressive and nonaggressive dogs, half raised by biological parents and the other half raised by nonaggressive, non-biological parents. Then, scientists have examined whether nature or nurture is a more important determinant of behavior or if a combination of the two forces is at work.
- **Behavioral genetics** is a field devoted to understanding how genes and environments interact and shape behavior. In humans, **adoption studies** have been used as a tool to compare adopted children to their adoptive and biological parents. Often, scientists also conduct **twin studies** to study human families. Twin studies involve the comparison of the similarities between monozygotic (twins that have the exact same DNA) and dizygotic (twins that share 50% of their genetic material) siblings. Together, these two methods constitute a larger discipline called **quantitative genetics**. As a result of this scientific discipline, scientists have been able to come up with a **heritability coefficient**, a number ranging from 0-1 that indicates the genetic influence on a particular trait. The caveat that we might

emphasize to students is that though heritability coefficients are computable, interpreting them may not be as straightforward.

## What Have We Learned about Nature-Nurture?

- There is no simple answer. What we know about genetic influence is that the more biologically related people are, the more similar they are on various traits (e.g., height, weight, intelligence, political attitudes, etc.) The chapter summarizes it best when it states, “No gene can develop in a vacuum, and without genes the environment has nothing to work on”. Both genes and environment play a significant role in shaping traits.
- The **gene-environment interaction** or GxE refers to how genetic differences affect behavior under particular environmental conditions. Are there conditions in which a trait can be influenced by the environment? Consider **phenylketonuria**, a metabolism error caused by a single gene that stops the body from metabolizing phenylalanine (a building block for proteins in the body). If untreated, it can cause mental retardation and death. However, it is easily remedied by changing the diet to omit foods that contain phenylalanine.
- Though phenylketonuria is caused by a single gene, it is important to emphasize to the students that genetic influence on behavior is usually spread out over many genes, each contributing small effects; the same can be said of environmental effects. As such, the question of nature vs. nurture cannot always be indexed by a single number (i.e., heritability coefficient). There are many questions that can be asked about the relationships between genetics, environment and behavior. The challenge is to resist the urge to oversimplify these relationships.

## Difficult Terms

**Adoption study**

**Behavioral genetics**

**Gene-environment interaction**

A gene-environment interaction is when environmental effects on behavior are conditional upon a person's genetic makeup. Alternatively, the term could also refer to situations in which environmental factors affect the influence of genes on behavior.

**Heritability Coefficient**

## Phenylketonuria

Phenylketonuria (PKU) is a genetic condition, in which there are higher levels of phenylalanine (i.e., an amino acid - a building block of proteins) in the blood. If PKU remains untreated, phenylalanine can build up to toxic levels, causing mental retardation and even death.

## Quantitative Genetics

Scientific and mathematical methods for inferring genetic and environmental processes based on the degree of genetic and environmental similarity among organisms.

## Twin studies

## Lecture Frameworks

### Overview

The nature vs. nurture question is a highly debated subject that we still grapple with today. Is our behavior more impacted by biological or environmental influences? In other words, is our personality a result of a predetermined genetic code passed on through the generations or has it been shaped by our experiences? Start the lecture by introducing this question. Then, delve into specific concepts (i.e., behavioral genetics, adoption and twin studies, etc.). A great way to end the class would be to talk briefly about what we know about nature-nurture debate so far!

### First Class Period:

- Discussion/warm-up
  - This debate has been around for a long, long time. Rene Descartes, a philosopher from ages ago, endorsed the nativist perspective, which states that we are born with some degree of innate knowledge. John Locke, on the other hand, subscribed to the idea of tabula rasa ("blank slate"), which suggests that we are shaped entirely by our experiences – this is known as empiricism. Ask your students if they subscribe to either of these views and why?
- Lecture: Refer to slides for the following:
  - To cover the field of behavioral genetics.

- To talk about adoption and twin studies, quantitative genetics and the heritability coefficient.
- Special Topic: Twins Separated at Birth as Part of a Secret Scientific Study
  - Studies of twins reared together and apart are some of the most powerful tools that behavioral geneticists, psychologists and other scientists have to analyze the relative contributions of heredity and environment to the makeup of individual human nature. Usually, however, these studies are retrospective in nature because it is considered unethical to separate siblings by law. Unfortunately, this is a video of twins Paula Bernstein and Elise Schein who were separated at birth as part of an unethical secret scientific study and reunited years later as adults.
  - Video link: <https://www.youtube.com/watch?v=1gwnzW4jOMI>. Play the video from 2:35-7:30s. The video touches upon the nature vs. nurture question, emphasizing the nature part of the debate (i.e., similarities between the separated twins) and is a perfect segue into the in-class activity, which offers a different perspective.
- Activity: Striking Similarities Among Strangers
  - The video that students have just seen really emphasizes the nurture part of the debate. This activity (see Activities and Demonstrations section) offers some food for thought as it introduces the idea that it is not impossible for even complete strangers to find random and strange similarities with one another. Taken together, the video and the activity should emphasize to students that it is not nature over nurture (or vice versa). We are complex creatures - both biological/genetic and environmental forces shape our personalities.
- Lecture: Refer to slides for the following:
  - Go over some discoveries made by researchers in the field.
- Talk about gene-environment interaction and give phenylketonuria as an example.

## Activities & Demonstrations

### Striking Similarities among Strangers: In-Class Activity

## Time

10-15 minutes

## Materials

You will need to make a handout for your students (see next page).

## Directions

- Tell your students to pair up with someone near them (it has to be someone they do not know) and give them the handout below. The goal of this activity is to see how many similarities the two students can find with one another.
- Make sure to let them know that it's fine to be different in a lot of ways and that this exercise is about finding similarities. If there are an odd number of students, then pair up with one student yourself.
- Conducting this activity after showing students the following video will work best: <https://www.youtube.com/watch?v=1gwnzW4jOMI> (see Lecture Frameworks for more details).

## Discussion

- The activity provides a different vantage point (and an excellent opportunity for discussion). If two strangers try to get to know each other, can they too find random unexpected similarities with one another? And if two strangers can find similarities with one another, then could that also mean that biological forces may not be behind every similarity that siblings or twins share? Could it be possible that cultural climate and environmental influence may also play a role?
- In the video, the twins talk about how despite being separated for most of their lives, they nevertheless share a lot of similarities, which suggests the importance of genetics in personality and behavior.

[Adapted from Randy Smith's Instructor Manual for the David Myers' Introductory Textbook]

**Handout: Similarities Questionnaire**

|                             | Alike | Different |   | Alike | Different |
|-----------------------------|-------|-----------|---|-------|-----------|
| Politics                    |       |           | Cigarette brand                             |       |           |
| Music                       |       |           | Toothpaste brand                            |       |           |
| Religion                    |       |           | Coffee brand                                |       |           |
| Clothes                     |       |           | Newspapers read                             |       |           |
| Jobs Held                   |       |           | Favorite magazines                          |       |           |
| Job goals                   |       |           | Any special or unusual talents or abilities |       |           |
| Sports                      |       |           | Pets owned                                  |       |           |
| Hobbies                     |       |           | Family members (names, age, interests)      |       |           |
| Favorite subjects in school |       |           | Educational interests (major)               |       |           |
| Subjects you dislike        |       |           | TV programs                                 |       |           |
| Favorite foods              |       |           | Habits                                      |       |           |
| Foods you dislike           |       |           | Personality traits                          |       |           |
| Favorite colors             |       |           | Vacation-activity preferences               |       |           |
| Weather preferences         |       |           | Social preferences (outgoing vs. shy)       |       |           |
| Car preferences             |       |           | Marital status                              |       |           |
| Sleeping habits             |       |           | Handedness                                  |       |           |
| Reading tastes              |       |           | Grade point average.                        |       |           |
| Talents                     |       |           | Major illness (age of occurrence)           |       |           |
| What bugs you?              |       |           | Sensitivity to drugs                        |       |           |
| Chewing gum brand           |       |           | Favorite movies                             |       |           |

Source: Adapted from a questionnaire by W. Joseph Wyatt

**Outside Resources**

Web: Institute for Behavioral Genetics



<http://www.colorado.edu/ibg/>

## Evidence-Based Teaching

Miller, D. B. (1988). The Nature-Nurture Issue: Lessons from the Pillsbury Doughboy. *Teaching of Psychology*, 15(3), 147–149.

Miller offers a way to teach a concept that has plagued scientists' minds for centuries: nature vs. nurture. He illustrates the complex interaction between genes and environment through the use of a cooking metaphor; flour represents the genome and other ingredients represent environmental influences. The ingredients (i.e., the environment) interact with flour (i.e., genes) in different ways to produce different foods (i.e., different developmental trajectories). The demonstration can be presented to the students on PowerPoint slides or in a more dramatic-real life demonstration.

Telzer, E. H., Humphreys, K. L., Shapiro, M., & Tottenham, N. (2012). Amygdala Sensitivity to Race Is Not Present in Childhood but Emerges over Adolescence. *Journal of Cognitive Neuroscience*, 25(2), 234–244.

This article provides evidence for the belief that racism is not an innate reaction. In fact, nature interacts with nurture to influence race perceptions. Using fMRI, Telzer and colleagues found that children do not show differential activity in the amygdala to different races (i.e., African American faces vs. European American faces) until adolescence, suggesting social environments play a role in developing neural biases to race. Additionally, the findings of the article suggested that when children were exposed to racial diversity, the amygdala's response to African American faces was attenuated. This suggests the importance of intergroup interactions at a young age.

## PowerPoint Presentation

This module has an associated PowerPoint presentation. Download it at

[https://nobaproject.com//images/shared/supplement\\_editions/000/000/112/The%20Nature-Nurture%20Question.pptx?1416603182.](https://nobaproject.com//images/shared/supplement_editions/000/000/112/The%20Nature-Nurture%20Question.pptx?1416603182)

## About Noba

The Diener Education Fund (DEF) is a non-profit organization founded with the mission of re-inventing higher education to serve the changing needs of students and professors. The initial focus of the DEF is on making information, especially of the type found in textbooks, widely available to people of all backgrounds. This mission is embodied in the Noba project.

Noba is an open and free online platform that provides high-quality, flexibly structured textbooks and educational materials. The goals of Noba are three-fold:

- To reduce financial burden on students by providing access to free educational content
- To provide instructors with a platform to customize educational content to better suit their curriculum
- To present material written by a collection of experts and authorities in the field

The Diener Education Fund is co-founded by Drs. Ed and Carol Diener. Ed is the Joseph Smiley Distinguished Professor of Psychology (Emeritus) at the University of Illinois. Carol Diener is the former director of the Mental Health Worker and the Juvenile Justice Programs at the University of Illinois. Both Ed and Carol are award-winning university teachers.

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