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PSY 110

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Artifact #1: Understanding How Genes and Behavior are Connected

Article Summary for Sec. 3.17:

In chapter three, section 3.17 cites an article called “Sources of Human Psychological Differences: the Minnesota study of twins reared apart.” The main focus of this article is set on the study of **monozygotic** and **dizygotic twins** who have been separated at a young age and raised apart from one another, living entirely separate lives. The study discussed throughout this article began in 1979, and since then has led to two different conclusions on the basis of behavioral **variation** between people: genetic factors employ an extensive influence on the **variability** of behavior and that the effects of being raised up in the same household are trivial for psychological traits (Bouchard et al., n.d., 2). Reaching these conclusions took decades, in which participants were required to take part in several hours of medical and psychological assessments consisting of systematic assessments of twins’ environments, IQ tests, life interviews, and the use of a “comprehensive mental ability battery.” Through these assessments, researchers observed the ways in which twins’ mental development are influenced by their surroundings. The sample in this study is composed of adult twins who were separated at a very early age and raised in different environments during their early stages of childhood, then brought back together as adults. After extensive observation, researchers in this study concluded that, “for almost every behavioral trait so far investigated, from reaction time to religiosity, an important fraction of the **variation** among people turns out to be associated with genetic

variation (6). When answering the question of why MZA twins are so similar, researchers examined the twins' **heritability** of traits and provided three conclusions: the IQ's of the adult MZA twins who took part in the four independent studies correlated roughly 0.70, supporting that genetic factors strongly affect IQ; the development of individual differences in psychological traits are not controlled by the institutions and practices of modern Western societies; and MZA twins' psychological trait similarity is due to their identical genomes making it more likely that their effective environments are similar. They view that most psychological variance most likely stems from learning through experience, though the genome guides the self-selection of the effective experiences. If this outlook is right, then environmentalist critics contend that the developmental experiences of MZ twins are more similar than DZ twins' developmental experiences. The study goes on to state, "...if the genome impresses itself on the psyche largely by influencing the character, selection, and impact of experiences during development--if the correct formula is nature via nurture--then intervention is not precluded even for highly heritable traits, but should be the more effective when tailored to each specific child's talents and inclinations."

Article Summary for Section 3.18 (#1):

In chapter 3, section 3.18 cites an article called "The Dunedin Multidisciplinary Health and Development Study: Overview of the first 40 years, with an eye to the future." The article discusses the ongoing, longitudinal study of the health, behavior, and development of a sample of New Zealanders. The subjects in this study were all born in Queen Mary Hospital in Dunedin, New Zealand between the years 1972 and 1973 (Poulton et al., 2015, 1). The study observed this pilot sample to find whether or not children born in unfavorable conditions performed as well as

their counterparts who were born in more favorable conditions. The study's research was conducted using basic strategies, which mainly involve testing for casual relations within the correlational design of the study. The sample of New Zealanders were studied at birth and evaluated every two years until they turned 15 years old. From that point on, the sample participants were re-assessed at 18, 21, 26, 32, 38, and most recently at 45. By assessing the participants periodically, the researchers were able to find that perinatal issues and external influences like childhood experiences, socioeconomic status, and parental qualities have relative impacts on children. Though the study has been going on for over 40 years, most of the original sample members are still participating in the study, which has allowed researchers to publish multiple reports that have found associations between many different factors and their effects on human behavior and well-being. While several factors influence how people turn out in their future, researchers in this study specifically pointed out that a specific form of the MAOA **gene** is found in violent people who were mistreated as children.

Assessment: How the Research is used in the Text:

In section 3.17, the author poses questions such as “What determines the kind of person you are?” and “What factors make you more or less bold, intelligent, or able to read a map?” (Gazzaniga, 2018, 111). These questions open up the discussion of **behavioral genetics**, or the study of how people's environment and **genes** link and impact psychological activity. The author acknowledges the generally accepted view that physical characteristics are controlled by **genes**, but introduces that the complex interactions of **heredity** of **genes** and the environment an individual is brought up in is what determines that person's behavior. To expand on the topic of **behavioral genetics**, the section delves into the differences between siblings and why those differences occur, acknowledging that many environmental

factors affect each sibling's individual life experience. To create a more comprehensive understanding of how human characteristics are influenced by environments, **monozygotic twins** (identical) and **dizygotic twins** (nonidentical) become the main focus of the section. As the author mentions throughout the section, figuring out what causes similarities and differences between siblings, especially twins, is difficult; however, the author includes that researchers use two methods to evaluate the degree of trait inheritance in twins: **twin studies** and **adoption studies**. **Twin studies** are used to compare similarities between twins to determine the genetic basis of specific traits, and the author provides a great example of how these studies work by including the article “Sources of Human Psychological Differences: The Minnesota Study of Twins Reared Apart” by Thomas Bouchard. Gazzaniga uses the study in this section to back up his statement that, “growing up in the same home has relatively little influence on many traits, including personality traits” (111). Gazzaniga is saying that being exposed to the same environment does not make siblings any more similar, and two biological siblings being raised together in the same household does not guarantee any similarity. As previously mentioned in my summary of the article, this study compares the **behavioral genetics** of **monozygotic twins** raised together with those who have been raised apart. Using a large sample of identical and nonidentical twins, the results indicate that identical twins are very likely to be similar in how they express their **genes**, whether they are raised together or not. Basically, these results conclude that **genetic variation**-the presence of differences in sequences of **genes** between individual organisms of a species- significantly contributes to people’s psychological differences.

In section 3.17, we know that the author explained **behavioral genetics** and how **genes** create the foundation for human traits, as well as how human characteristics are influenced by nature and nurture; however, in section 3.18, the author focuses more on how the expression of **genes** can be modified. Gazzaniga proposes a new question in this section, asking readers to consider how **gene expression** may be shaped by social/environmental circumstances during development. To provide a better understanding of **gene** modification, Gazzaniga cites Richie Poulton’s article called “The Dunedin Multidisciplinary Health and Development Study: Overview of the first 40 years, with an eye to the future.” In the section,

Gazzaniga includes that Poulton's study observed a large sample of New Zealanders from the day they were born until they reached the age of 26, in which scientists would then look into what factors predicted who in the study became violent criminals. Gazzaniga includes the article's discussion of mistreated children becoming violent, and the view that the enzyme monoamine oxidase (MAO) plays a crucial role in determining the likelihood of an individual becoming violent after mistreatment. He reports that low levels of MAO have been involved in hostile behaviors, specifically noting that young boys with low MAO succumb to the effects of early childhood maltreatment - making them more likely to be convicted of violent crimes than boys with high MAO **genes**. By including this information in the text, Gazzaniga provides an understanding to the question he proposed in the beginning of the section regarding how social and environmental conditions may influence **gene expression**. Gazzaniga also uses the New Zealand study to highlight that nature and nurture are entwined and both work together to affect human behavior; in this study, violent behavior is the product of clashing a young boy's low-level of MAO with parental mistreatment.

Conclusion:

I chose the topic of genetic expression for my artifact because, once I became more familiar with it, I realized that there was a lot I did not know about; because of this, I spent quite a bit of time trying to grasp a better understanding of how the study of genetic expression is related to the field of psychology. As someone who struggles with mental health issues and advocates for mental health awareness, I wanted to find more information on genetic expression and environmental factors in regards to mental illness. Before researching the topic, I was under the impression that the likelihood of someone struggling with mental illness was solely based on their genes, not necessarily the environment they are in. I looked into a few articles to become more knowledgeable on the matter, leading me to the understanding that a combination of genetic and environmental factors cause mental disorders in people. The more I read about the topic, the more questions began to form in my head. I found an article that discusses the possible

benefits of gene therapy in psychiatric patients called “Gene Therapy for Psychiatric Disorders” by Johannes Thome. Thome emphasizes that the application of gene therapy in humans cannot be considered until kinks are overcome, I thought the read was intriguing. Though it is currently only possible to use animal models to alter **gene expression** with gene-transfer techniques, the article inspired a new aspiration for my future career. My one goal in life has always been to graduate college and become a psychologist, nothing more and nothing less; however, reading about Thome’s research made me realize that I want to get more involved in regards to research. I want gene-transfer strategies to become a possible therapeutic option for people who are struggling with psychiatric disorders, and I hope that I find the opportunity to apply what I’ve learned from this artifact to help a strategy like this come to pass.

Glossary:

1. **Adoption studies** (*section 3.17*) - a research method in which genetically related family members who were adopted are compared with each other in order to tease apart genetic and environmental influences.
 - In the artifact, **adoption studies** is mentioned as one of two methods that are used to evaluate the degree of trait inheritance in twins. The Minnesota study utilizes **adoption studies** in its research, observing the similarities and differences between adopted twins reared apart.
2. **Behavioral genetics** (*section 3.17*) - the study of how genes and environment interact to influence psychological activity.
 - In the artifact, **behavioral genetics** is one of the main focuses of section 3.17. Gazzinga uses the section to explain what the term means and how **behavioral genetics** have provided information on how the mind, brain, and behavior are influenced by biology. He also uses the term to explain how behavioral geneticists go about conducting their studies by including Thomas Bouchard's study of twins reared apart, which focuses on how genes and environment interact to influence the similarities and differences between twin siblings.
3. **Dizygotic twins** (*section 3.17*) - also called fraternal twins, are twin siblings that result when two separately fertilized eggs develop in the mother's womb simultaneously; therefore, they are no more similar genetically than nontwin siblings.
 - In the artifact, the term **dizygotic twins** is used to refer to the fraternal twins that participated in the Minnesota study. Similarly to **monozygotic twins**, **dizygotic twins** raised apart are referred to as "DZA" twins and **dizygotic twins** raised

together are called “DZT” twins. Due to the limitations and small size of the DZA sample, the research in this article focuses more on MZA data results, but it is still important to understand the significance of **dizygotic twins** when looking at this artifact.

4. Genes (*first found in section 3.14*) - the units of heredity that help determine the characteristics of an organism.

- In this artifact, the sections and articles discussed focus on the role that **genes** play in how human behavior is expressed. More specifically, the material addresses how the combination of **genes** and environment interact to influence human traits.

5. Gene expression (*first found in section 3.14*) - whether a particular gene is turned on or off.

- In the artifact, the research discussed examines **gene expression** in twins and in individuals with differing levels of MAO. In the studies, researchers are looking at how environmental factors influence the ways that people express their genes, what causes differences and similarities in **gene expression**, and how that expression can be manipulated.

6. Heredity (*section 3.17*) - the transmission of characteristics from parents to offspring by means of genes.

- In the artifact, the term **heredity** refers to the passing of physical or mental characteristics from one generation to another. The term is specifically used in the text to observe the likelihood of someone having a trait based on the passing down of parental genetics.

7. Heritability (*section 3.17*) - a statistical estimate of the extent to which variation in a trait within a population is due to genetics.

- In the artifact, the Minnesota study's research observes the **heritability** of traits in MZA and MZT twins, such as the **heritability** of IQ in regards to IQ similarity in twins. Examining the **heritability** of traits between twins enabled researchers to find more answers to why MZA twins are similar by observing whether or not trait variation within the twin sample is due to genetics or environmental factors.

8. Monozygotic twins (*section 3.17*) - also known as identical twins, are twin siblings that result from one zygote (fertilized egg) dividing in two, therefore sharing the same genes.

- In the artifact, this term is used to refer to the identical twins that participated in the Minnesota study of twins reared apart. Additionally, in the study, researchers referred to **monozygotic twins raised apart** as "MZA" twins and **monozygotic twins raised together** as "MZT" twins. MZA and MZT twins are the focus of this article, as the purpose of this research was to find similarities and differences between twins.

9. Twin studies (*section 3.17*) - the comparison of similarities between different types of twins to determine the genetic basis of specific traits.

- In this artifact, the author explains that **twin studies** are one of two methods that are used to evaluate the degree of trait inheritance in twins. To show an example of this type of study, Gazzaniga references the Minnesota study of twins reared apart.

10. Variation (*section 3.17*) - the existence of qualitative differences in form, structure, behavior, and physiology among the individuals of a population, whether due to heredity or to environment.

- In this artifact, the term **variation** is mainly used in reference to the differences in the ways **genes** are expressed in a population. More specifically, the research cited in the sections look at the **variation** of different behaviors among their subjects to observe whether the **variation** is due to heredity or environmental factors.

References

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