

Basics of genetics

IIE 366: Developmental
Psychology
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Lecture 04

Simple genetics

- Some physical traits are explained by the properties of a single gene
 - E.g., sickle cell anemia
- Such traits tend to have little variability
- But this is not the way most traits operate
- Moreover, almost all behaviors are influenced by many different genes and environmental factors
- How do we study these more complex traits and behaviors?
- How do we connect them to their genetic basis?

Novelty seeking

- There is variation across people in their enjoyment of novel situations
- Characterized as a tendency to take risks



Genetic basis of novelty seeking

- There is some evidence that novelty seeking behavior is connected to a gene that influences a neural receptor protein that is sensitive to the *dopamine* neurotransmitter
 - DRD4
- Dopamine is known to be related to reinforcement in a wide variety of situations
 - Pleasure seeking
 - Drug addiction

Genetic methods

- We're going to complete an activity that demonstrates how these kinds of conclusions are drawn
- Privately answer the questions on the hand out.
- Do not write on the hand out itself, but on a separate piece of paper count up how many questions you answer "yes"

Survey results

- Now, write the number of "yes" responses on one of these sheets of paper
- Fold your sheet lengthwise and give it to me
- We will make a histogram of how often students say "yes" to the survey questions

Survey results

- Describe the distribution of scores
 - What is the average?
 - How do scores differ?

Differences

- Why are there differences across individuals?
- What factors would influence novelty seeking?
 - Genetics
 - Culture

Survey

- Is the survey an accurate way to measure novelty-seeking?
- What might be a better measure?
- Reliability?
- Validity?

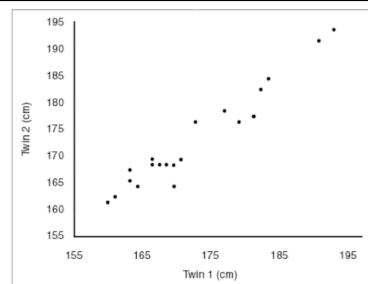
Traits / behaviors

- We know that height is related to genetic factors
 - Tall parents tend to have tall children
 - But there can be tremendous variation in heights
- We also know that environmental factors are important
 - Nutrition influences height
- Can variation in personality traits (like novelty-seeking) be explained in a similar way?

Twin studies

- Identical twins are genetically identical (monozygotic)
- If identical twins have a very similar trait, then it may be reasonable to look at the genetics as an explanation for the similarity.
- But how to factor out environmental factors?
 - Twins are usually raised by the same parents
 - Have similar experiences (e.g., schools, friends)
- Look for adopted-apart twins who live with different families

Height



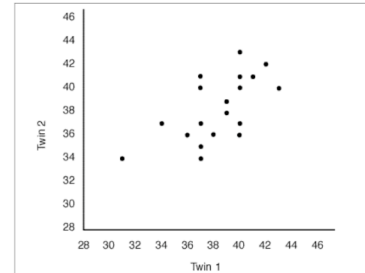
Fraternal twins

- Fraternal twins are not genetically identical (dizygotic)
- We can compare similarities between identical and fraternal twins
- What would you expect a height scattergram to look like for adopted-apart fraternal twins?
- What are the sources of variation?

Novelty-seeking behavior

Identical adopted-apart twins

Is there evidence for a genetic effect?

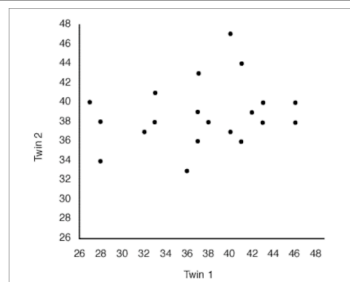


Novelty-seeking behavior

Fraternal adopted-apart twins

How does the data compare to the identical twins?

What do these differences mean?



Correlations

- Mathematical measurements of the relationship between twins for novelty-seeking find:
 - Identical twins $r=0.6$
 - Fraternal twins $r=0.23$
- Measures how *changes* in one twin can be related to *changes* in the other twin

Genetic effects

- Does this data suggest that there a genetic influence on novelty-seeking?
- What influence does the environment have?
- What would happen if the identical twins were adopted by *very* different families?

Genetic effects

- Is novelty-seeking behavior likely to be based on a single gene or multiple genes?
- Why?

Other behaviors

- What other behaviors are likely to be influenced by both genes and environment?
 - Happiness?
 - Depression?
 - Anxiety?
 - Drug abuse?
 - Intelligence?

Next time

- Genetics and development
- Heredity
- Interactions between genes and environment