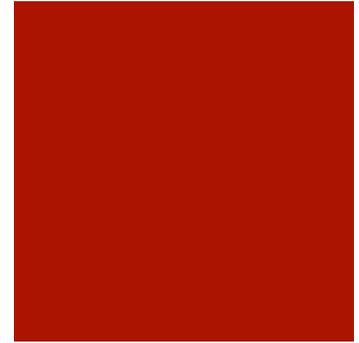




Twin Studies & Heritability

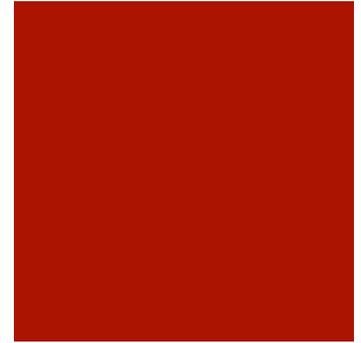
Natalie To
San Jose State University

Twins Studies & Heritability



- Twin studies reveal the importance of environmental and genetic influences of individuals in a sample
- Twin studies still are means to study behavioral genetics
 - Investigate the environmental and genetic backgrounds of a many traits like aggression, intelligence, schizophrenic, alcohol dependence, obesity, etc.
- Heritability – the proportion of observable differences (phenotypic variation) in a trait between individuals within a population that is due to genetic differences

The Classic Twin Study

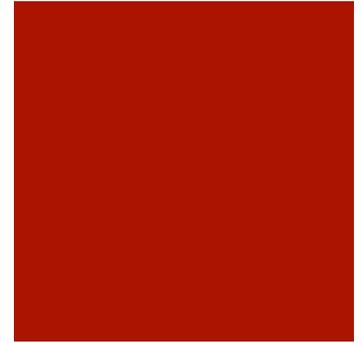


- Sir Francis Galton
 - Behavioral genetics pioneer
 - Eugenics movement
 - Study the role of genes and environment on human development and behavior

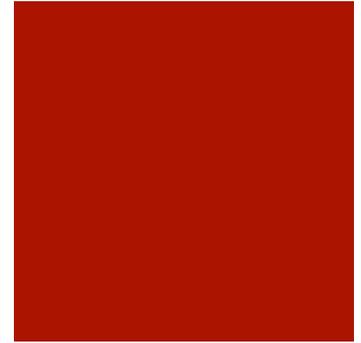
- “Twins have a special claim upon our attention; it is, that their history affords means of distinguishing between the effects of tendencies received at birth, and those that were imposed by the special circumstances of their after lives”

The Classic Twin Study

- Monozygotic (MZ) “identical” twins share 100% of their genes
- Dizygotic (DZ) “fraternal” twins share 50% of their genes

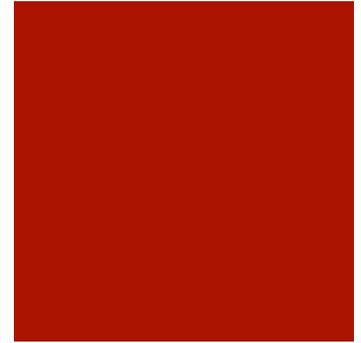


The Use of Twin Studies



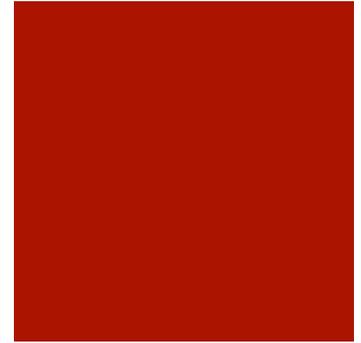
- Assessing the variance of a behavior (phenotype) in a large group, and attempting to estimate how much of this is due to:
 - Heritability (A)
 - Shared environment (C)
 - Unshared environment (E)

ACE Model



- Estimates the relative influence of genes and environment on a characteristic
- The total sum of differences
- What proportion of variance in a trait is heritable
- Carried out using a structural equation model
- $r_{MZ} = A + C$
- $r_{DZ} = .5A + C$
- $E = 1 - r_{MZ}$

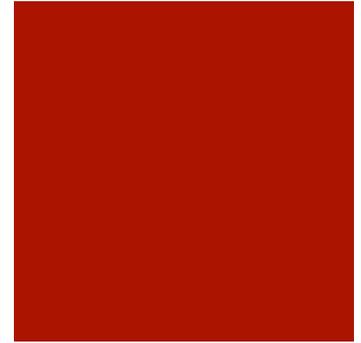
Variations of Modern Twin Studies



- Twins-reared-apart design
- Longitudinal studies of twins
- Combining classic twin studies with molecular genetics research

Study Design

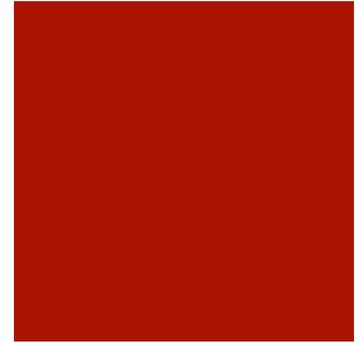
- Assumptions
 - Random mating
 - Equal environments
 - Gene-environment interaction
 - Genetic mechanisms
 - Additive genetic mechanisms
 - Dominant genetic mechanisms
 - Epistatic mechanisms



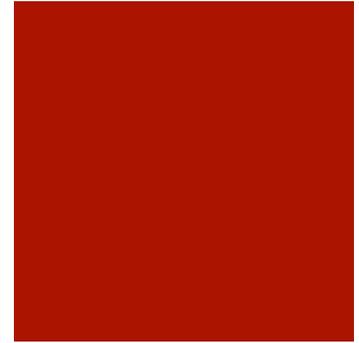
Concordance

- Concordance measure expresses the similarity of twins for dichotomous traits such as the presence or absence of a disease
 - If both twins carry the disease, they are concordant
 - If only one twin carries it, they are discordant

The rate of concordance in identical twins is an important indicator of heritability



Advantages & Limitations



- Researchers can estimate the proportion of variance in a trait attributable to genetic variation vs. the proportion that is due to a shared or unshared environment
- It does not allow the researcher to consider the effects of both environment and gene-environment interaction simultaneously
- Cannot be generalized to the general population

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