

Chapter 7: IQ  
Chapter 3: Genes (pp 74 – 80)

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What is this?



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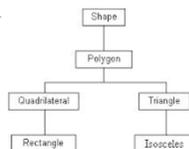
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Formal/Artificial vs Natural  
Categories/Concepts

- Categorize this geometric figure
- We use an algorithm and this is a **formal** category
  - Step by step guide to a solution: recipe or instruction manual.
- Categories can be hierarchical
- Superordinate: top of the category
- Subordinate:
  - Bottom level



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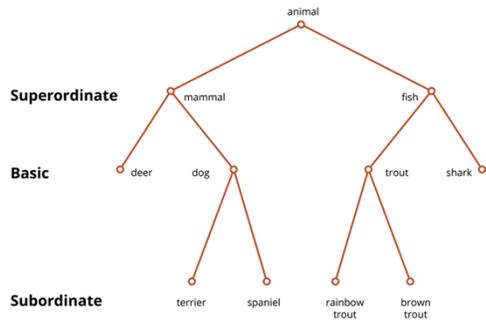
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A concept is a way to classify the world in your mind. The hierarchical model of concept classification includes three levels of concept: the most general is the **superordinate concept**, followed by the **basic concept**, and the most specific is the **subordinate concept**.



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Natural Categories  
Bird? Mammal?



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Is a penguin a bird? fish?  
mammal?



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**Concept Formation & Fuzzy Boundaries or natural categories**  
**Which are CUPS and which are BOWLS?**



**Is 5 a cup or bowl?**

**Which is the prototypical cup? (best example of the category)**

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**Schema**

- Schema (per text): is a mental construct consisting of a cluster or collection of related concepts.
  - Sounds like the definition of a category.
- Text says there are different types of schemas
  - Role schema: firefighter, librarian.
  - Event schema: aka **SCRIPT**: a set of behaviors that unfold in a particular order, like a routine.
    - You have a script for eating a meal at a restaurant, or showering, using an elevator.
    - Often automatic (more on this in chapter on memory).

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**Problem Solving**

- Trial and Error
  - Good if number of solutions is small
- Algorithms: a set of rules
  - Guaranteed a solution but you may not know the rules
- Insight: it just comes to you
- Heuristics: Rules of Thumb
  - Representative
  - Availability

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## Representative heuristic

- Steve is very shy and withdrawn, invariably helpful, but with little interest in people, or in the world or reality. A meek and tidy soul, he has a need for order and structure, and a passion for detail. Is Steve more likely a librarian or a truck driver?

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## Ignoring the base rate

- Let's assume a disease D affects 75% of gays and 25% of strait men and hence is 3 times higher in gays than straits.
- A man Pat is diagnosed with the disease. Is he most likely gay or straight?

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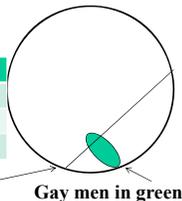
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- Base rate of gay men in America is about 4%.
  - We've drawn the diagram to show that the area of the green ellipse is 4% of the total circle.
  - If you know someone is below the line Is he more like in the green or not in the green?

	Strait	Gay
Total	96	4
Diseased	24	3
	25% of total	75% of total



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- In tossing a coin 6 times, which sequence is more likely:
- H-T-H-T-T-H or H-H-H-T-T-T

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### Availability heuristic

- Are there more words with K as first letter or K as third letter?
- In a course evaluation, assume I ask some students for 2 ways the course could be better and other are asked for 10 ways it could be better. Will the 2 groups give different evaluations? Which will give better evaluations?

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- We judge availability by the ease with which instances come to mind: divorce is judged more common if you know many who did.

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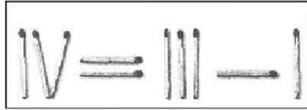
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### One Barrier to Problem Solving Functional Fixedness: getting hung up on wrong solution or become blind to alternatives

When we approach a problem we create a kind of mental model that is based on how we were taught to solve such problems. Below is an arithmetic problem using matchsticks to form Roman numerals and operators (+, -, and =). The equation is incorrect.



Incorrect Equation

**PROBLEM**

See if you can solve it by envisioning a solution in which only one matchstick is moved to create a correct equation. You can only move one matchstick once (but not remove it).

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### Confirmation Bias

- Seeking or paying most attention to evidence that SUPPORTS your beliefs and ignoring or minimizing evidence against your belief.
- Ex: therapist believes that children who have been abused draw big eyes and used positive instances to confirm



By Claro James - 3 years 7 months

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### Other Biases

- You are asked one of these two questions
  - Was Einstein's first visit to the US before or after 1939?
  - Was Einstein's first visit to the US before or after 1905?
- Then all are asked when Einstein first visited the US.
- What bias does this describe?
  
- You are very thirsty. You are offered either : a glass that is half full or a glass that is half empty. Which is better?
- What bias does this describe?

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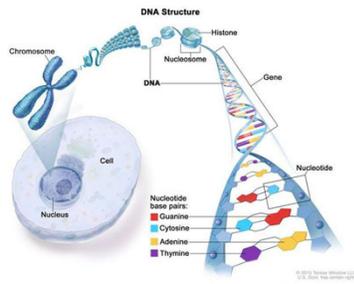
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## Genes



**A gene is a region of DNA that encodes function. A chromosome consists of a long strand of DNA containing many genes. A human chromosome can have thousands of gene.**

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- When a behavior/trait is caused by a single gene, concepts of dominance and recessive alleles are important

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### Terms:

- Autosome: a non-sex chromosome
- Allele: One variation of a gene (because a gene can have variations) (DD, Dd, dd)
- Genotype: your genetic make up
- Phenotype: how your genetic make up is expressed in the real world.
- Homozygous: both alleles are the same (DD, dd)
- Heterozygous: The alleles are different (Dd)
- Dominant Gene: You only need one copy of the mutated gene for the disorder to be expressed (Dd or DD)
- Recessive Gene: You need 2 copies for the disorder to be expressed. (dd)

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Another Autosomal Recessive Pattern

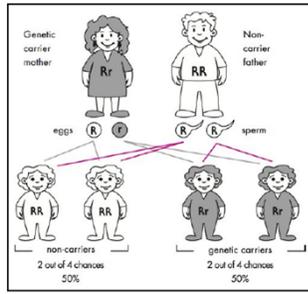


Figure 7.4: Autosomal recessive inheritance when only one of the parents is an unaffected genetic carrier for the condition. The faulty copy of the gene containing a recessive mutation is represented by 'r'; the working copy of the gene by 'R'.

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Recessive Disorders

- [https://www.google.com/search?sourceid=navclient&aq=&oq=recessive+disorders&hl=en-GB&ie=UTF-8&rlz=1T4GGLS\\_en-GBUS750US750&q=recessive+disorders+list&gs\\_l=hp\\_2.0l4.0.0.2.68711.....0.NK3.GZDLIBHo&gws\\_rd=ssl](https://www.google.com/search?sourceid=navclient&aq=&oq=recessive+disorders&hl=en-GB&ie=UTF-8&rlz=1T4GGLS_en-GBUS750US750&q=recessive+disorders+list&gs_l=hp_2.0l4.0.0.2.68711.....0.NK3.GZDLIBHo&gws_rd=ssl)

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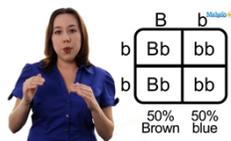
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Preimplantation Genetic Diagnosis (left pic)  
How to do a Punnett Square (right pic)




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- But most behaviors and traits that psychologist are interested in are caused by many genes. That makes it a bit harder to study.

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### Chapter 7: IQ & Twin Study Design

- Are any of these inherited?
  - Height
  - Weight
  - IQ
  - Smoking
  - Homosexuality
  - Divorce
  - Alcoholism
  - Criminality
  - Schizophrenia
  - Depression
  - Rape
  - Religiosity
- If they are, what does that mean?



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### The Role of Genetics

- It's fascinating how similar some identical twins can be
- We have a sense that genes influence physical stuff
  - Eye color
  - Hair color



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**Is a behavior heritable?  
Call in the Twin-Study Design**

- **MZ twins (Identical):** Share 100% of their genes
- **DZ twins (Fraternal)** Share on average 50% of their genes (like regular siblings)
- Assume that the influence that makes people similar (or different) comes only from either genes or environment.
- Assumption: The MZ twins' environment does not make them any more similar than the DZ twins' environment makes them similar

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- Measure MZ twins and DZ twins.
- Calculate correlation (or concordance) to get a measure of how similar they are.
- You get a number (R, for example) that indicates the similarity of MZ twins, and an R for DZ twins.
- If MZ twins are more similar than DZ twins (as evidenced by a higher correlation/concordance), then this difference must be due to the fact that MZ twins are more genetically alike than DZ twins are alike.



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- If genes had all the influence what would we expect the pattern of correlations to be like?
- **Answer:** MZ correlation should be = 1. DZ correlation should be half that.
- If genes had no influence, what would we expect the pattern of correlations to be like?
- **Answer:** The correlations between MZ twins should equal to the correlations between DZ twins.
- What is a consequence of violating the assumption that MZ and DZ twins are treated equally similarly?
- **Answer:** If the correlation for MZ > DZ, then we can't be sure it is due to genes, because now the environment could have made MZs more similar than DZs.

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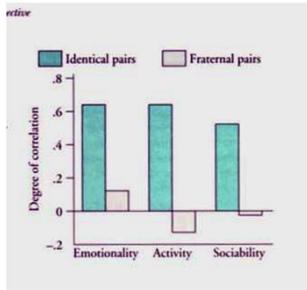
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### Results of Twin Studies of Personality Variables



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### Is Divorce Inherited?

- “Genetic Influence of Risk of Divorce” Psychological Science, 1992, 3(6), 368-373, McGue & Lykken.
- Stats:
  - Half of new marriages will end in divorce
  - 1/3 of all US children will experience break-up of parent’s marriage
  - Some will be unaffected, others will experience significant psychological problems.
  - Some kids actually begin having problems before the divorce that it is conflict (instead of divorce) that negatively impacts kids.

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- Family background is a robust predictor
  - Pope & Meuller (1979): If your parents divorced, you are more likely to divorce.
- How could environment contribute?
  - Social modeling
  - Social stigma of divorce is reduced and divorce might be more acceptable alternative if your parents have done it.
- Other Social Risk Factors for Divorce
  - A previous divorce
  - Premarital pregnancy
  - Unstable unemployment
  - Early age of marriage
- But the fact remains that most divorces carry none of these social risks.

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**Could there be a genetic component to divorce?**

- McGue & Lykken used Twin Study Design & mailed questionnaires to twins in the Minnesota Twin Registry receiving back responses from 3300 individual twins.

• Results:

	<u>Correlation</u>
MZ to MZ	.545
DZ to DZ	.157
Parent to Offspring	.165



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- “the odds of divorce increase nearly 6 fold if one has an MZ co-twin who is divorced, but less than 2 fold if one has a DZ co-twin or parent who is divorced.
- “If you have a divorced parent and a divorced MZ co-twin and you marry someone who also has divorced parents and a divorced MZ co-twin, your odds for divorce is 77.5%.
- If on the other hand, you have non-divorced parents and non-divorced MZ co-twin and marry a person also with non-divorced parents and a non-divorced MZ co-twin, your odds for divorce is 5.3% (1/15<sup>th</sup> as large)

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- Authors conclude: “The robustness and magnitude of the MZ-DZ difference in divorce concordance indicates a strong influence of genetic factors in the etiology of divorce.”
- Authors acknowledge that there is not single gene, but many genes that must contribute and remind us that “the data do not however, specify a mechanism that generates this association”.
- Are you surprised that there is a genetic component to divorce?
- What are possible mechanisms?

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### Is Alcoholism Inherited?

- Yes... If your close genetic relatives are heavy drinkers, the odds of you being a heavy drinker are greater than if you didn't have close genetic heavy drinking relatives.
- So something is inherited..But....What is it?
  - Sensation-Seeking as an example
  - Impulsiveness

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### How do Genes and Environment influence us?

- One model is a Diathesis Stress Model.
  - It is an example of a gene-environment interaction. (text 78-79)
  - Genes and the environment each independently contribute to a behavior/disorder
  - Explains why a life event affects some but not others.
    - Heavy drinking leads to alcoholism in some but not others
    - Abusive family leads to conduct disorder in some kids but not others
    - Stressful environment causes depression in some but not others

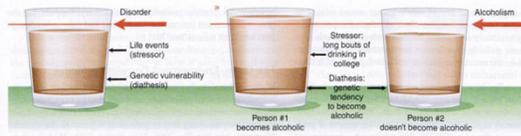


FIGURE 2.2 In the diathesis-stress model, the greater the underlying vulnerability, the less stress is needed to trigger a disorder.

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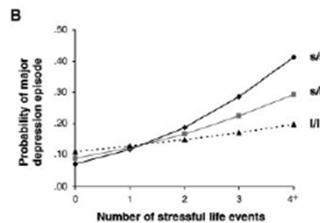
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### Example from Caspi (2003)

- Read from handout.
  - Why do some with bad crap in life get depressed and others don't? Genes play a role.
  - So stressful life experiences AND genes -- both contribute.




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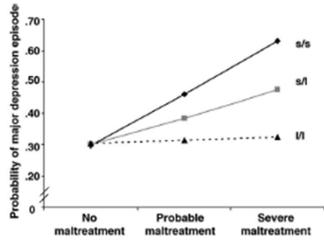
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Results of regression analysis estimating the association between childhood maltreatment (between the ages of 3 and 11 years) and adult depression (ages 18 to 26), as a function of 5-HTT genotype. Not ALL who had bad childhood get depression as an adult.




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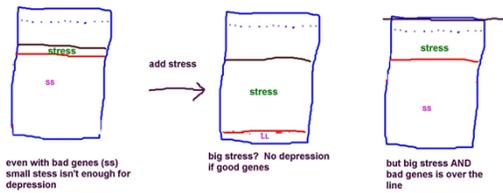
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Caspi as Diathesis-Stress  
ss are the bad alleles/genes, and ll are the good ones




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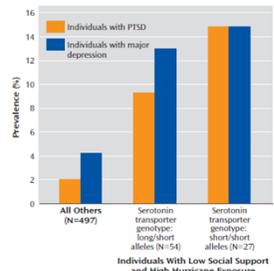
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Kilpatrick (2007) Genes and Hurricane Stress effects risk of PTSD and Depression

FIGURE 1. Prevalence of Posthurricane Posttraumatic Stress Disorder and Major Depression Diagnoses by Serotonin 5-HTT/PP Genotype, Level of Social Support, and Level of Hurricane Exposure in Adults Exposed to the 2004 Florida Hurricanes




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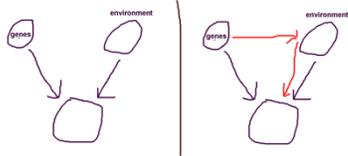
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### Gene Environment Correlations

- Marrying a mean man can increase risk of divorce (Environmental cause).
- But if you have "divorce genes", they also contribute.
- A diathesis-stress model would assume they are independent. We can get an estimate of how much influence each has (genes and environment).
- Let's say you have genes for being passive and dependent and can cause depression and divorce. (maybe like "learned helplessness")
- But what if these same passive genes cause you to marry mean dominating men? Now the environmental influence isn't all environment, but genes as well.
- So when genes cause environments, we could overestimate influence of environment and underestimate influence of genes.



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### Intelligence and Psychological Testing

- **Types of tests**
  - **Achievement Tests**
    - Measure how much you've learned in an area
      - Advantages: good predictor of how you'll do in similar situations because the best predictor or future behavior is past behavior
      - Disadvantage: Unfair if everyone didn't have the same opportunities to learn in the past
  - **Aptitude Tests**
    - Measures your potential for future learning
      - Advantage: Is fairer, because even if one came from a disadvantaged background, the focus is on your future ability
      - Disadvantage: Is hard to construct a test that isn't based on prior learning.

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### IQ is Inherited *History of the IQ Construct*

- **IQ tests are one of the most widely used tests today**
  - **Galton (late 1800s)**
  - **Binet (turn of the 20<sup>th</sup> century)**
    - Wanted a way to identify children who were poor learners so they could get special help.
    - He had a unique way of measuring IQ
    - $IQ = \text{mental age} / \text{chronological age} * 100$
- Assume a 9-year-old scores at the level of a 6 year old. What is his IQ?
- Answer:  $6/9 = 67$
- Assume a 12 year old scores at the level of an 8 year old. What is IQ?
- Answer:  $8/12 = 67$
- Assume a 30 year old scores at the level of a 20 year old. What is IQ?
- Answer:  $20/30 = 67$
- 48 Is there a problem here? Is one's deficit "worse" than the others?

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### History of the IQ Construct (cont)

- **Weschler in 1939 devised the first Adult IQ Test and changed the way we scored IQs.**
  - Is now based on a normal distribution
  - As an example of how we would assign an IQ score to a raw score, suppose you gave an IQ test to a group of 3<sup>rd</sup> graders. (see future slide)

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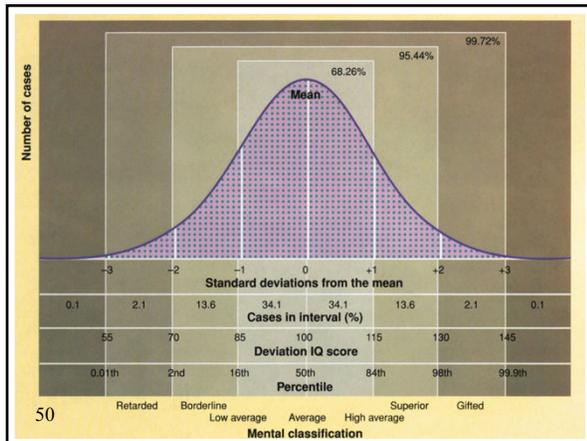
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- Assume you give an IQ test to a group of 3<sup>rd</sup> graders.

Here are their scores:

Score	Frequency (how many scored that score)
20	1
30	2
40	4
50	6
60	8
70	6
80	4
90	2
100	1

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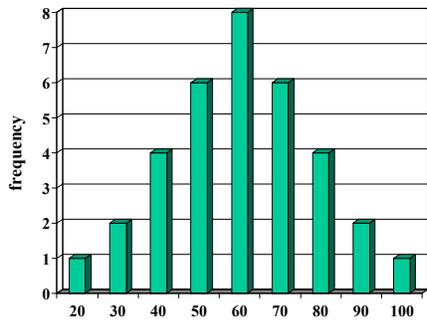
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Here is a frequency distribution of our 3<sup>rd</sup> graders' scores



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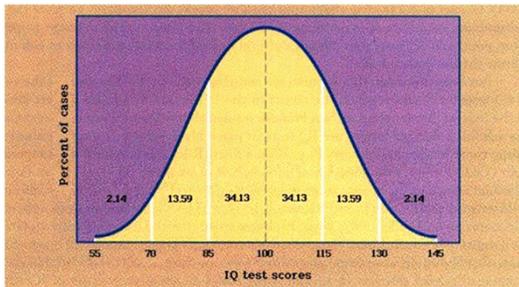
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The Normal Distribution of IQ Test Scores



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Subtests on the WAIS

Wechsler Adult Intelligence Scale (WAIS)

Test	Example
<b>Verbal scale</b>	
Information	On what continent is France?
Comprehension	Why are children required to go to school?
Arithmetic	How many hours will it take to drive 150 miles at 50 miles per hour?
Similarities	How are a calculator and a typewriter alike?
Digit span	Repeat the following numbers backward: 2 4 3 5 1 8 6
Vocabulary	What does audacity mean?
<b>Performance scale</b>	
Digit symbol	Shown:  Fill in:
Picture completion	Tell me what is missing:
Block design	Assemble blocks to match this design:
Picture arrangement	Put the pictures in the right order:
Object assembly	Assemble the pieces into a complete object:

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**Gardener's seven intelligences**

Intelligence	End-States	Core Components
Logical-mathematical	Scientist Mathematician	Sensitivity to, and capacity to discern, logical or numerical patterns; ability to handle long chains of reasoning
Linguistic	Poet Journalist	Sensitivity to the sounds, rhythms, and meanings of words; sensitivity to the different functions of language
Musical	Composer Violinist	Abilities to produce and appreciate rhythm, pitch, and timbre; appreciation of the forms of musical expressiveness
Spatial	Navigator Sculptor	Capacities to perceive the visual-spatial world accurately and to perform transformations on one's initial perceptions
Bodily-kinesthetic	Dancer Athlete	Abilities to control one's body movements and to handle objects skillfully
Interpersonal	Therapist Salesperson	Capacities to discern and respond appropriately to the moods, temperaments, motivations, and desires of other people
Intrapersonal	Person with detailed, accurate self-knowledge	Access to one's own feelings and the ability to discriminate among them and draw upon them to guide behavior, knowledge of one's own strengths, weaknesses, desires, and intelligences

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**Extremes of Intelligence**

- **Cognitively Disabled**
  - 4 Levels
    - Mild: 50-70 IQ: 85% of cognitively disabled are in this group. Might be able to reach 6<sup>th</sup> grade level. Can live independently if helped (Forest Gump)
    - Moderate 35-50: 10% fall here
    - Severe 20-35: only 4% fall here
    - Profound below 20 IQ points: only 1% fall here: Little or not speech, not toilet trained, need total care.
- **Gifted**
  - Most states require excellence in numerous areas: creativity, leadership, arts, athletics, general intelligence etc). But in reality, to get into gifted programs requires an IQ score, 2-3 standard deviations about the mean (> 130)

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**Heritability of IQ**

- **Most estimate that the heritability of IQ is between 50-70%.**
  - What does this mean? It means this:
    - If you pick any age group, you will find that not everyone has the same IQ - there is variability. If one asks "what is responsible for these differences? Or "what can explain these differences?" You could answer "genetic differences between people account for 50%-70% of that variability. In other words, We know that genetic differences between people "account for" 50%-70% of that variability in IQ scores.
- **2 important things to remember about "heritability"**
  - It is a group number and not an individual one.
  - Heritability isn't fixed. It can vary with different cultures and even over different times.

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### Heritability of IQ (cont)

- Reaction Range: is the upper and lower limits of IQ that genes allow.
- Reaction range captures the fact that we are not all born equal in terms of IQ potential.
- Genes set a limit to how high or low our IQ can be, and the environment determines whether we'll end up in the high end or the low end of our potential. This is the reaction range
- It is estimated to be between 20-25 points (see next slide)

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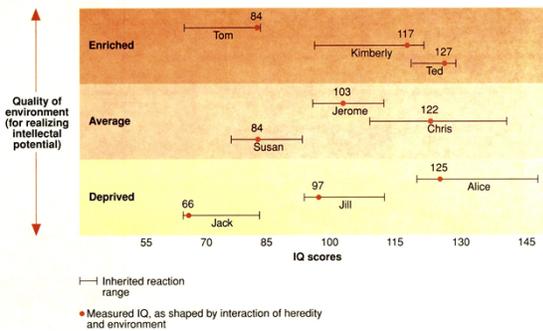
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### Reaction range




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### Cultural Differences in IQ scores

- There are cultural differences
  - Japanese children have the highest IQs in the world (mean = 111)
  - African Americans score (on average) 12-15 IQ points below white Americans.
- We must remember these are test score differences. Test scores are the operational definition of the construct we call intelligence.
  - Are IQ tests culturally biased?
    - Maybe some, but not enough to account for the 15 point average difference. The differences exist even if you take out those items that on the surface seem to be the most culturally biased.
    - A test is biased only if it predicts differently for one group as opposed to another. That isn't the case with IQ scores. IQ was designed to predict future school performance, and it does do that equally for all cultural groups.

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**Possible Explanations for Cultural Group Differences in IQ Scores**

- **Socioeconomic disadvantages**
  - Whites and minorities tend to be raised in different environments. Most minority groups have endured a history of economic discrimination and are over represented in lower social classes. Lower class children are more likely to come from large families, single parent families (less parental attention), exposed to fewer books, fewer learning supplies, less privacy for study, and get less parental assistance for learning, and may experience less pressure to work hard on intellectual pursuits, and more likely to attend schools that are underfunded and understaffed.
  - Even if race is factored out (look just at whites in different SES levels) you find whites in lower SES classes score 20-30 points below the highest SES classes.

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**Scientific Standards for Psychological Tests**

- **Standardization:** Lets you know how your score compares to others.
  - Involves controlling the administration and environment of testing.
  - Involves the collection & development of **Norms**.
- Assume you take an assertiveness scale and score a 7. If the test had been normed on 10 other people and their scores were: 2,3,4,7,9,10,12,14,14,15.  
You can tell where you stand. You fall into the \_\_\_\_ % tile.  
Assume they scored 3,4,7,9,10,12,14,14,15,18  
You fall into the \_\_\_\_\_ % tile.

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- Following slides are for Honor's class

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- Are IQ tests reliable?
  - Extremely so. Usually  $r = .9$
  - But anxiety and motivation can interfere
  - An IQ score should always be given with a confidence interval around it.
  - Ex: If your IQ is calculated to be 120, we might say "We are 67% sure your true score falls between 115 and 125".
- Are IQ tests Valid?
  - Yes, if used properly.
  - Remember why they were designed? So, we must ask, "Do they predict future success in school?"
  - $R = .5$  between IQ and grades
  - $R = .6 - .8$  between IQ and # of years in school

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- Does IQ predict career or job success?
  - Yes, in a sense. It does correlate with job status (see next 2 slides). The higher your IQ, the higher your job status.
  - But it doesn't predict performance within a profession.
    - I.e. it won't predict which lawyers or which doctors will excell.
    - Why not? Answer = because of restriction of range.

Example:

We know there is a correlation between height and weight

Imagine these weights:

Ted 110	Ted 145
Bill 150	Bill 150
Jim 200	Jim 155

Which is taller? Which is taller?

If you have \$1,000 to bet, which group would you rather place your bet on. Why?

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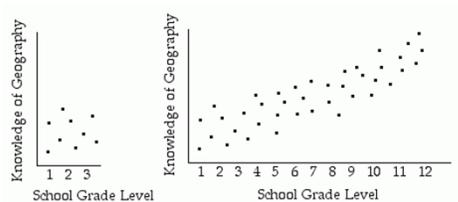
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Scatterplot shows Restriction of Range




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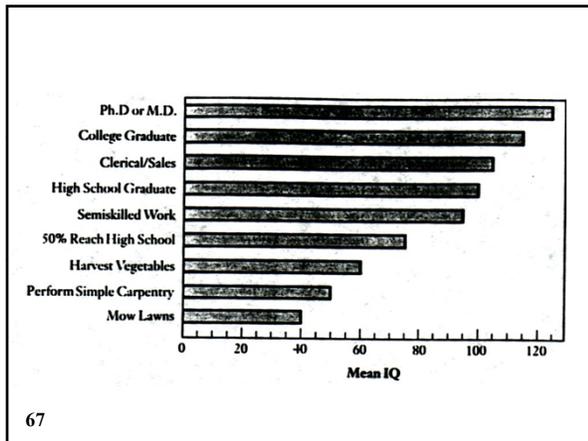
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OCCUPATIONAL GROUP	MEAN FULL SCALE IQ
1. Professional and technical	112.4
2. Managers and administrators, clerical workers, and sales workers	103.6
3. Skilled workers (craftsmen and foremen)	100.7
4. Semiskilled workers (operatives, service workers—including private household—farmers, and farm managers)	92.3
5. Unskilled workers (laborers, farm laborers, farm foremen)	87.1

follows:

YEARS OF SCHOOLING	MEAN FULL SCALE IQ
16+ (College graduate)	115.2
13-15 (Some college)	107.3
12 (High school graduate)	100.0
9-11 (Some high school)	96.4
8 (Elementary school graduate)	90.8
0-7 (Some elementary school)	82.5

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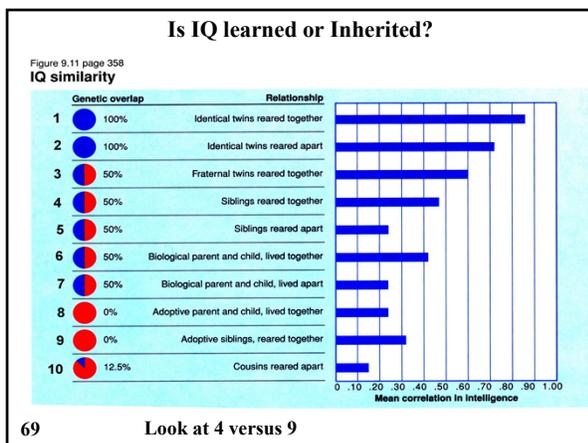
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Look at 4 versus 9

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