

# Science of Psychology

PSY W1001 Section 2 MW  
8:40-9:55 Fall 2012



Wednesday, October 31  
Language and Thought  
Intelligence

# Announcements

- Exam postponed to November 12
  - Will include material through next Wednesday
- Make-up lecture will be scheduled
- Questions from last lecture?

# Prospect Theory

- People make decisions based on anticipated gains and losses
  - We want to avoid loss more than receive gains
- Pattern of risk aversion
  - Risk averse:
    - High probability of gains
    - Low probability of losses
  - Risk Seeking
    - Low probability gains
    - High probability of losses
- You need to sell some stock to pay bills. You have a stock in your portfolio that you purchased at \$100/share, but is now worth \$45/share. You have another stock that you purchased at \$100/share that is now worth \$145/share. Which stock do you sell?

# Prospect Theory

- People choose to take on a risk when evaluating potential losses and avoid risks when evaluating potential gains.
  - Choice 1:
    - (A) 100% chance to gain \$300
    - (B) 80% chance to gain \$400 ( $\$400 \times 80\% = \$320$ )
  - Choice 2:
    - (A) 100% of losing \$300
    - (B) 80% of losing \$400

# Heuristics continued

- There are 45 students in a classroom. 40 are engineering majors and 5 are nursing majors. Annie is a quiet, but competent young woman. She loves animals, and used to play “hospital” with her dolls.
- Which is more likely?
  - A. Annie is a nursing major
  - B. Annie is an engineering major

# Representativeness Heuristic

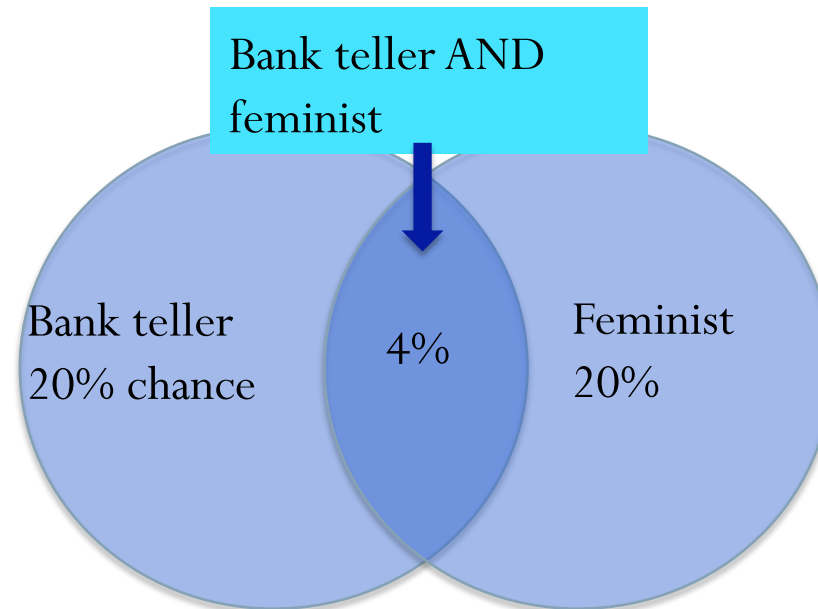
- Decision is biased to match expectation (and ignores probabilities)
  - 8 in 9 chance of engineer
  - 1 in 9 chance of nursing
- But, I bet you said it was more likely that she's a nursing major...

# Probability

- Try the following conjunction exercise:
- Linda is 28 years old. She is active in a number of women's rights groups. She volunteers in a shelter for battered women, and often participates in marches for abortion rights. Which is more likely:
  - (A) Linda is a bank teller
  - (B) Linda is a bank teller who is also a feminist?

# Conjunction Fallacy

- Conjunction fallacy: When people think that two events are more likely to occur together than either individual event (example of representative heuristic)
  - Linda is a bank teller.
  - Linda is a bank teller and a feminist.

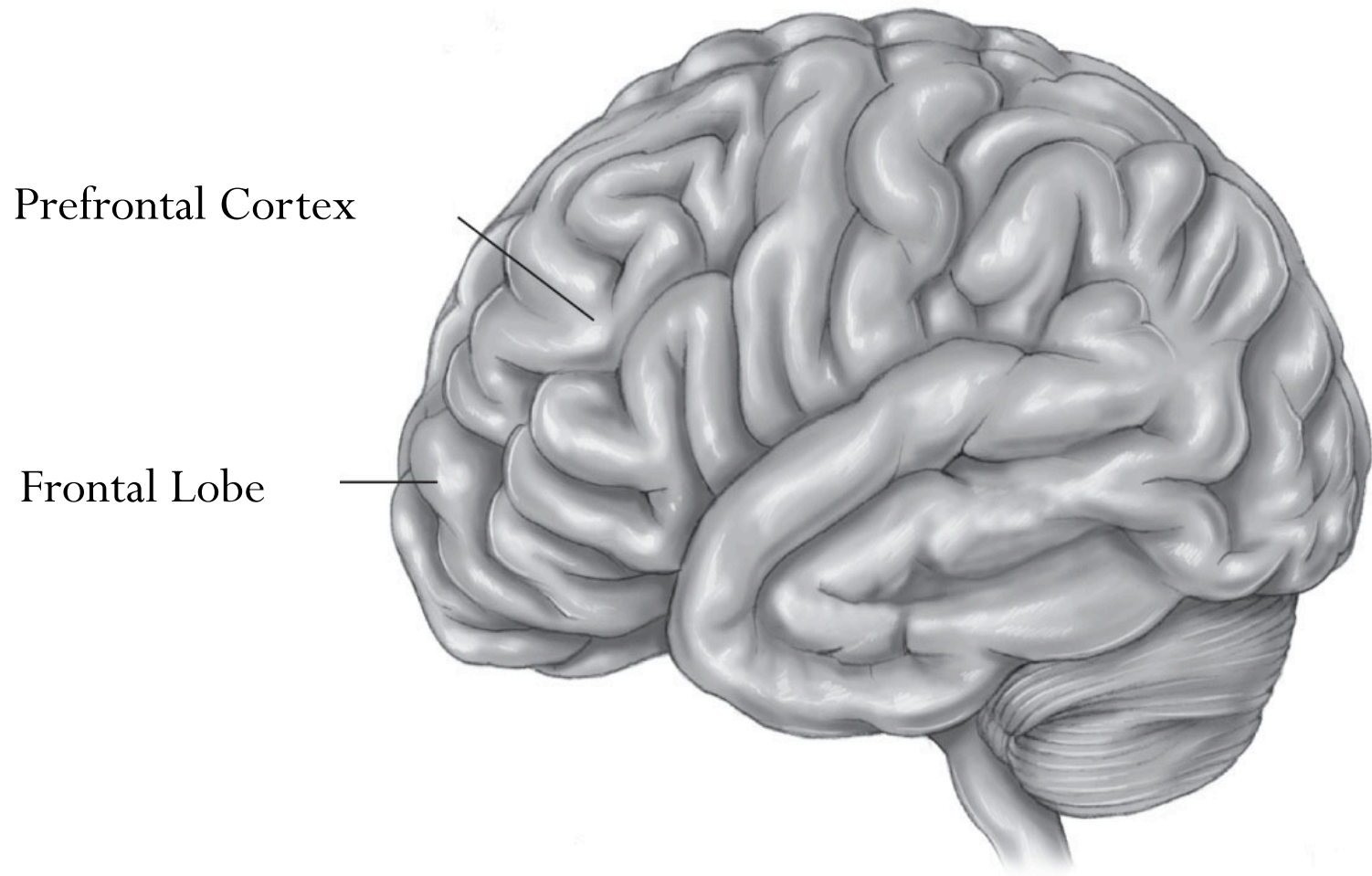




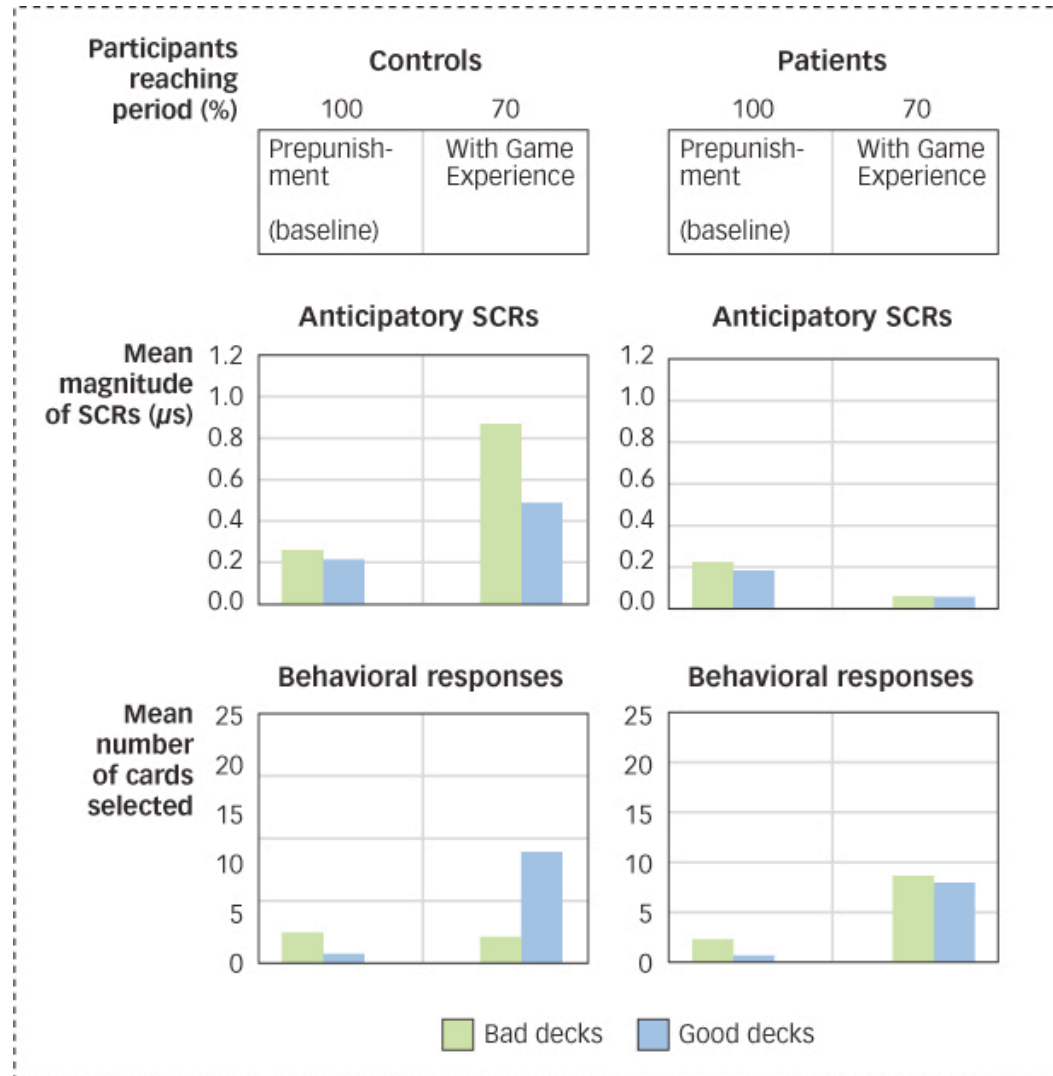
# Conjunction fallacy

- Tversky & Kahneman (1983) used the Linda probability task. The participants (83%) chose option B, Linda is regarded as “representative” of a feminist.
- Participants failed to use conjunctive rule.
  - But why?
- Because a conjunction of attributes makes for a more typical (similar) member of the category.

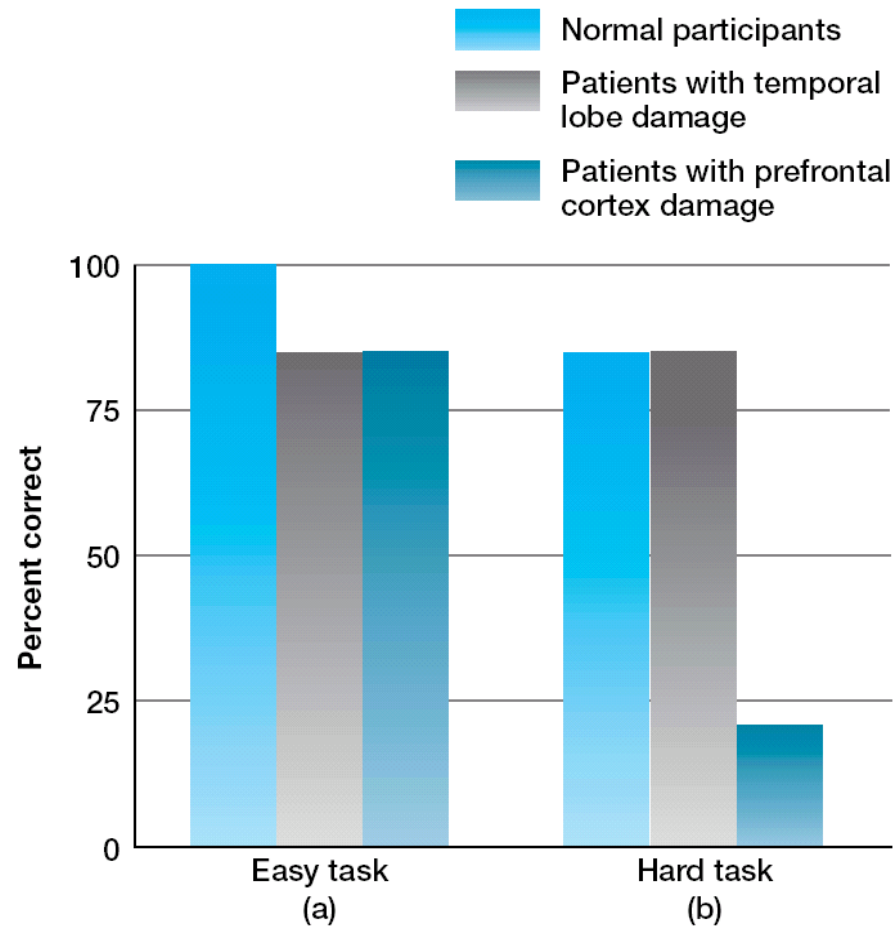
# Reasoning and the brain



# The Neuroscience of Risky Decision Making



# Reasoning and the brain



Effect of damage to the PFC on performance on a reasoning task




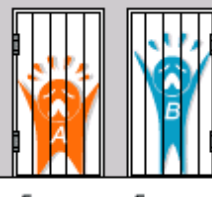


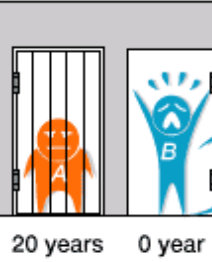

# Prefrontal cortex and risky behavior

- Neuroimaging and lesion studies
  - Prefrontal cortex
- Prefrontal damage
  - more risky decisions
  - Damage
    - poor performance on a gambling task
  - Activation
    - better task performance in healthy individuals

# Game Theory

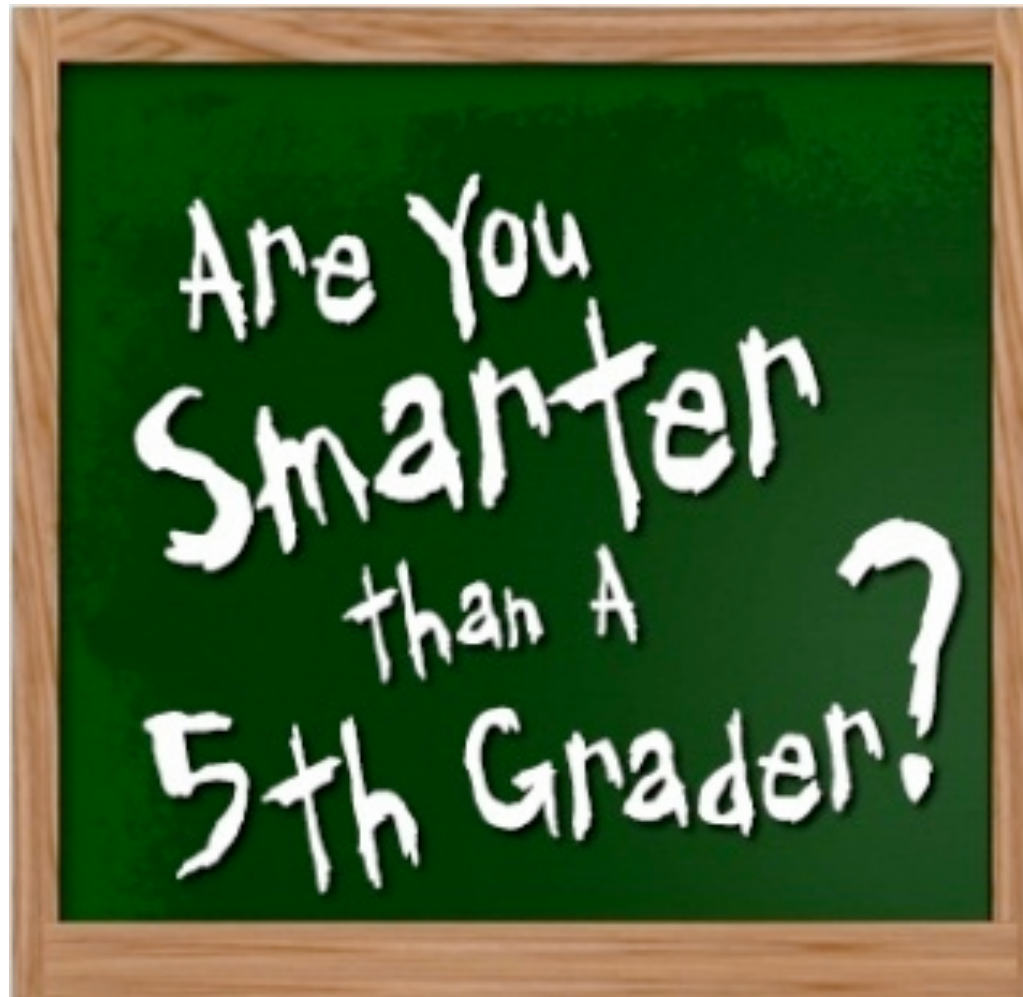
- How do you make decisions when others are also deciding on the same events?
  - Bluffing in poker
- Payoff matrix
  - If I make Decision A, what will the other person do, and what will the result be?
- Prisoner's dilemma
  - Rational decision is the worst outcome!
- Interesting intersection of psychology and economics

**Prisoners' dilemma**

		prisoner B	
		confess 	remain silent 
prisoner A	confess 	 5 years   5 years	 0 year   20 years
	remain silent 	 20 years   0 year	 1 year   1 year

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# Intelligence



# Defining Intelligence

- *“a hypothetical mental ability that enables people to direct their thinking, adapt to their circumstances, and learn from experiences.”*



# The Intelligence Quotient

- France and primary school education for children of ALL social classes
- Psychologist Alfred Binet
- Physician Theodore Simon
  - asked to develop tests to allow educators to develop remedial programs
  - goal of Binet and Simon was to measure aptitude (natural intelligence) separate from achievement

# The Intelligence Quotient

- Teachers could use test to estimate a child's mental level
- Compute average score of children of different age groups
- Find group whose average score was most like a given child's score, and that is the child's intelligence
  - 10 year old should score like other 10 year olds

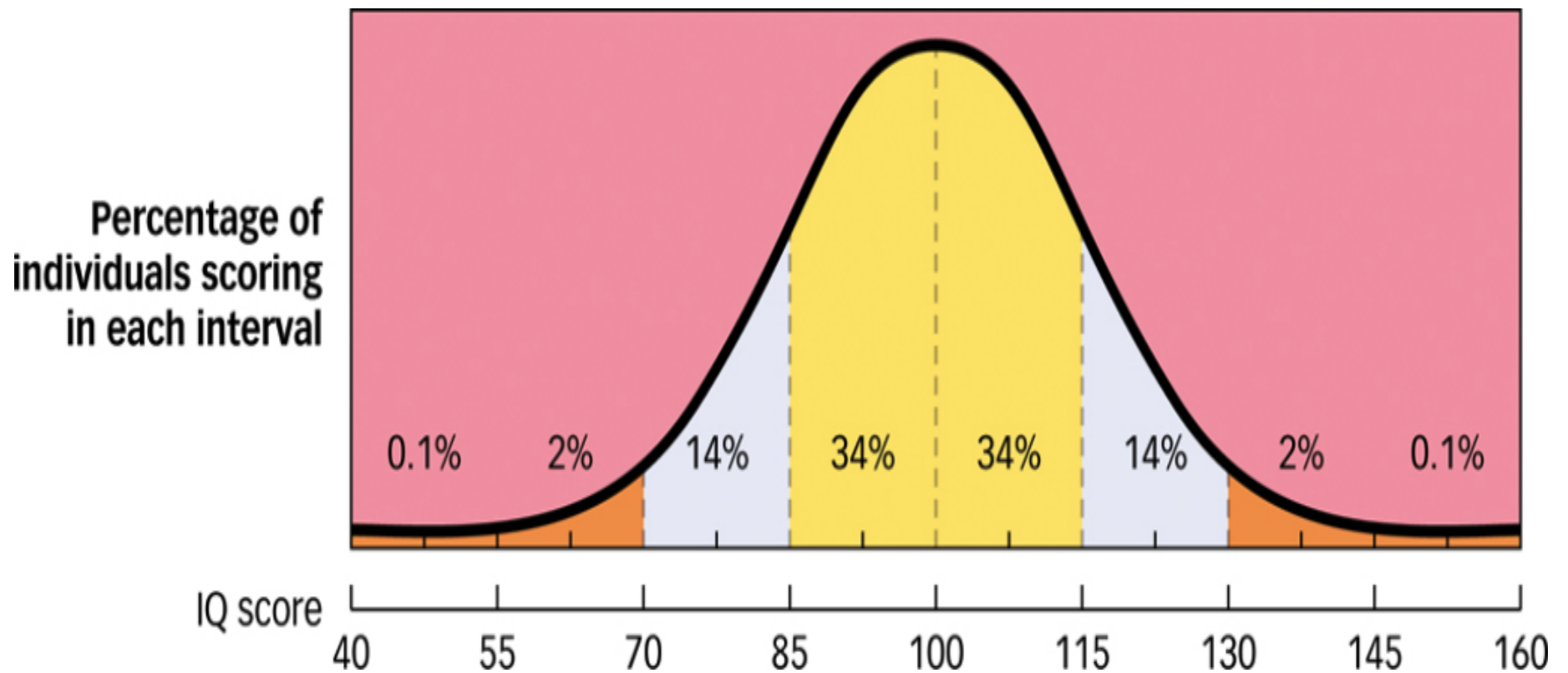
# Ratio IQ

- Stern (1914) mental level can be thought of as mental age
- Lewis Terman (1916) formalizes intelligence quotient or ratio IQ
- $(\text{mental age} / \text{physical age}) \times 100$
- Average IQ is 100
  - 10 year old with “mental age” of 8 year old
    - $(8/10) \times 100 = \text{IQ of } 80$
  - 10 year old with “mental age” of 12 year old
    - $(12/10) \times 100 = \text{IQ of } 120$

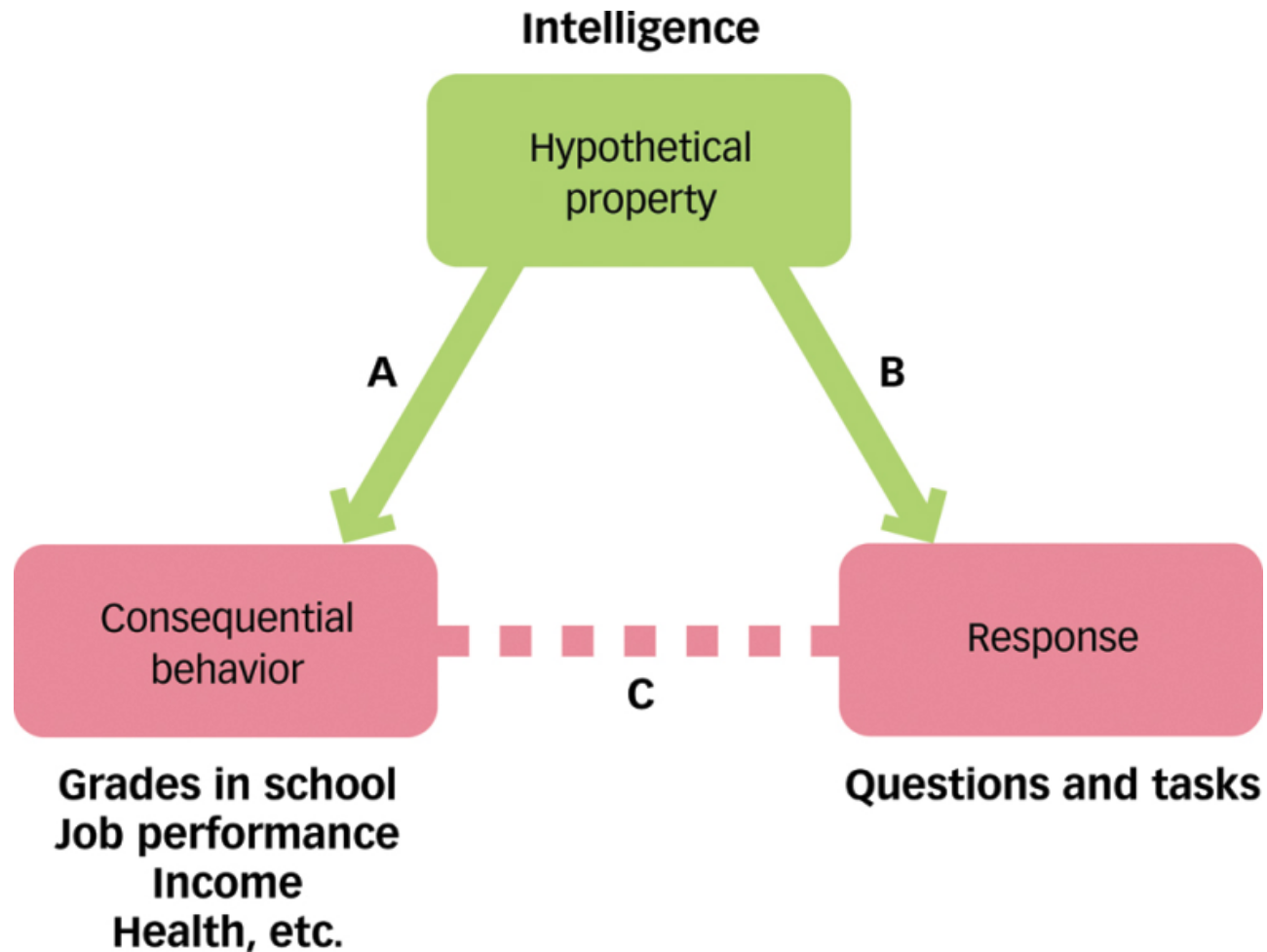
# More on calculating the IQ

- Deviation IQ
  - $(\text{individual score} / \text{average score of people in same age group}) \times 100$
- Age alone, then, does not increase IQ
  - I'm 50. If I'm the same mental age as a 25 year old then I would have an IQ of 200!!
    - $(50/25) \times 100 = \text{IQ of } 200$
    - (I'm smart, but not that smart!!)
  - Deviation IQ compares me to my age group
- Most researchers now compute ratio IQ for children and deviation IQ for adults

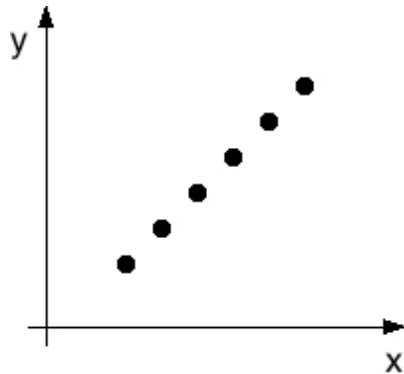
# IQ in the Population



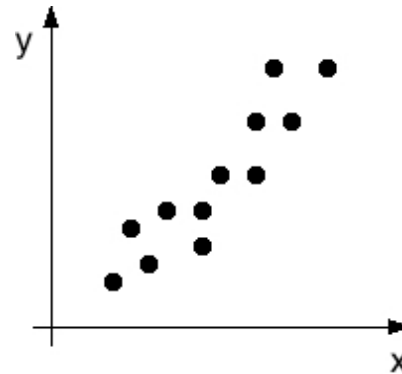
# The Logic of Intelligence Testing



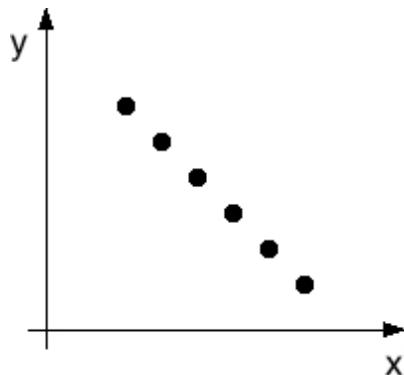
# Correlation Interlude



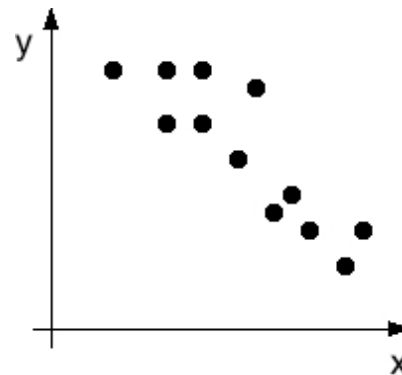
strong, positive correlation



weak, positive correlation



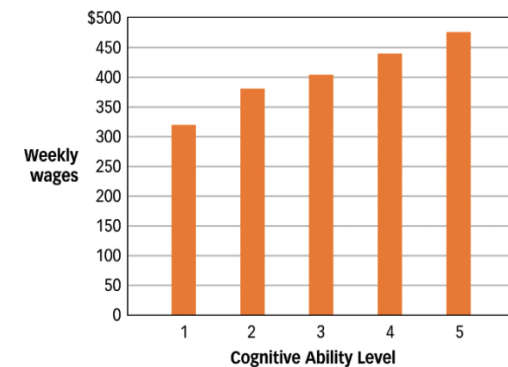
strong, negative correlation



weak, negative correlation

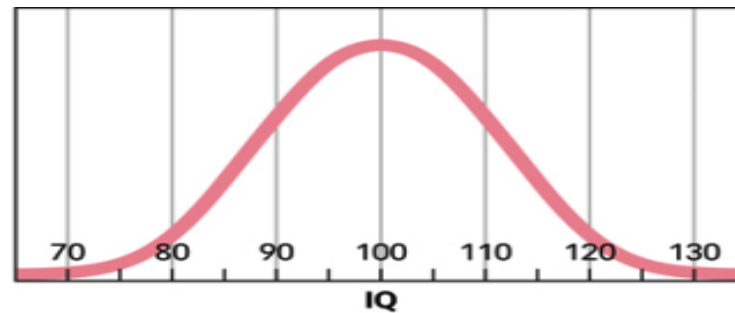
# Consequential Behaviors

- IQ scores predict school performance ( $r = .5$ )
- Correlates with job performance ( $r = .53$ )
- Correlates with income ( $r = .4$ )





# IQ and Life Outcomes



Population Percentages

<b>Total population distribution</b>	5	20	50	20	5
<b>Out of labor force more than 1 month out of year (men)</b>	22	19	15	14	10
<b>Unemployed more than 1 month out of year (men)</b>	12	10	7	7	2
<b>Divorced in 5 years</b>	21	22	23	15	9
<b>Had children outside of marriage (women)</b>	32	17	8	4	2
<b>Lives in poverty</b>	30	16	6	3	2
<b>Ever incarcerated (men)</b>	7	7	3	1	0
<b>Chronic welfare recipient (mothers)</b>	31	17	8	2	0
<b>High school dropout</b>	55	35	6	0.4	0

# The Nature of Intelligence

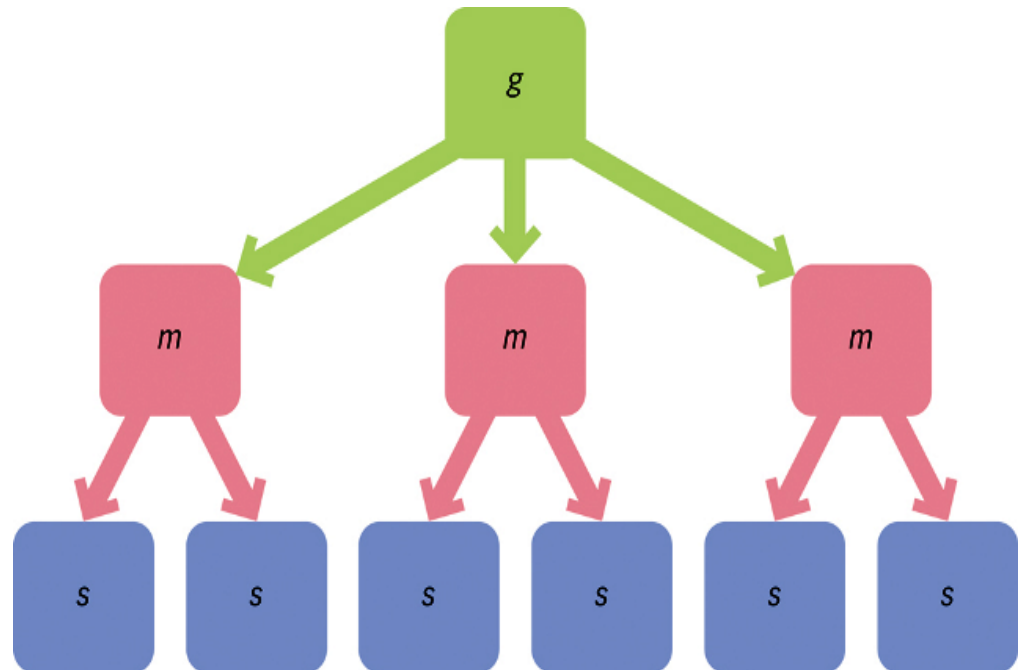
- Spearman and factor analysis
- Two-factor theory of intelligence
  - general ability (g)
  - task-specific skills (s)
- Thurstone —primary mental abilities

**Table 9.2** Thurstone's Primary Mental Abilities

Primary Mental Ability	Description
Word fluency	Ability to solve anagrams and to find rhymes, etc.
Verbal comprehension	Ability to understand words and sentences
Number	Ability to make mental and other numerical computations
Space	Ability to visualize a complex shape in various orientations
Memory	Ability to recall verbal material, learn pairs of unrelated words, etc.
Perceptual speed	Ability to detect visual details quickly
Reasoning	Ability to induce a general rule from a few instances

# Three-Level Hierarchy

- Three-level hierarchy
  - general factor
  - group factors
  - specific factors



# Middle-Level Abilities

- Hard to define what lies between general intelligence and specific abilities
- Some use a bottom-up approach
  - Start with responses on intelligence tests and look to see what “clusters” these responses form
- Some use a top-down approach
  - broad survey of human abilities and then look to see what these tests measure or do not measure

# Bottom-Up Approach

- Carroll (analysis of 500 studies)
- 8 independent middle-level abilities
  - memory and learning
  - visual perception
  - auditory perception
  - retrieval ability
  - cognitive speediness
  - processing speed
  - crystallized intelligence
  - fluid intelligence

# Top-Down Approach

- Analyze people's responses to questions on intelligence tests
- Sternberg—three kinds of intelligence
  - analytic intelligence
  - creative intelligence
  - practical intelligence

# Other Important Abilities

- Gardner believes standard intelligence tests fail to measure some important human abilities
- Prodigies and savants
  - linguistic
  - logical-mathematical
  - spatial
  - musical
  - bodily-kinesthetic
  - intrapersonal
  - interpersonal
  - naturalistic

# Intelligence and Genes

- Galton (1869) genealogical studies of eminent families
- *Hereditary Genius*
  - intelligence is inherited
- Monozygotic twins raised together (IQ correlation = .86)
- Dizygotic twins raised together (IQ correlation = .60)



# Intelligence and Genes

- Heritability coefficient
- Value can change depending on the group of people measured

**Table 9.3** Intelligence Test Correlations between People with Different Relationships

Relationship	Shared Home?	% Shared Genes	Correlation between Intelligence Test Scores ( <i>r</i> )
<b>Twins</b>			
Identical twins ( <i>n</i> = 4,672)	Yes	100%	.86
Identical twins ( <i>n</i> = 93)	No	100%	.78
Fraternal twins ( <i>n</i> = 5,533)	Yes	50%	.60
<b>Parents and Children</b>			
Parent-biological child ( <i>n</i> = 8,433)	Yes	50%	.42
Parent-biological child ( <i>n</i> = 720)	No	50%	.24
Nonbiological parent-adopted child ( <i>n</i> = 1,491)	Yes	0%	.19
<b>Siblings</b>			
Biological siblings (2 parents in common) ( <i>n</i> = 26,473)	Yes	50%	.47
Nonbiological siblings (no parents in common) ( <i>n</i> = 714)	Yes	0%	.32
Biological siblings (2 parents in common) ( <i>n</i> = 203)	No	50%	.24

Source: Plomin et al., 2001a, p. 168.

# Heritability Coefficient

- Heritability coefficient generally increases with the age of the sample measured
- Shared environment
- Nonshared environment
- Genes and environments interact

# Intelligence and Groups

- Some groups do outperform other groups on certain tests
- Do these differences reflect actual group differences in IQ?
- If so, what causes these differences?

# Intelligence and Groups

- Cultural bias in testing?
  - group differences in nonverbal skills
- Bias in testing situations?
- Experiential differences
- APA
  - *“Culturally based explanations of the Black/ White IQ differential have been proposed; some were plausible, but so far none has been conclusively supported. There is even less empirical support for a genetic interpretation. In short, no adequate explanation of the differential between the IQ means of Blacks and Whites is presently available.”*

# Changing Intelligence

- Intelligence can and does change
- But not—usually —dramatic change
- Relative intelligence
- Absolute intelligence
- Flynn effect
  - Are we getting smarter?

**Table 9.4** The Stability of Intelligence Test Scores over Time

Study	Mean Initial Age (Years)	Mean Follow-up Age (Years)	Correlation ( <i>r</i> )
1	2	9	.56
2	14	42	.68
3	19	61	.78
4	25	65	.78
5	30	43	.64–.79
6	50	70	.90

Source: Adapted from Deary, Whalley, Lemon, Crawford, Starr, 2000.

# Improving Intelligence

- Correlation between formal education level and IQ is high ( $r = .55$  to  $.90$ )
- Intelligence of schoolchildren declines in the summer
- Cognitive enhancers
  - methylphenidate (Ritalin)
  - Ampakines (boost glutamate)
  - Modafinil (dopamine reuptake inhibitor)

# Study Questions

- Expand on the first question from the previous lecture to include all of the heuristics and biases discussed and the influence of each on decision making.
- What is game theory?
- Using an example, define prospect theory
- What is the relationship of the prefrontal cortex to risky behavior?
- What is the IQ?
- What are the differences in mental tests of IQ?
- Explain how the bell curve relates to IQ.
- What are two important considerations in evaluating mental tests? What do you have to take into account for each?
- Give a definition of intelligence
- Was Binet measuring intelligence? Why or why not?
- Compare and contrast a ratio and a deviation IQ score.
- How did Spearman conceptualize intelligence?
- Do people with higher IQ's have better lives? Support your answer with data, not opinion.
- How does Sternberg conceptualize intelligence?
- How does Gardner conceptualize intelligence?
- How does culture influence the measure of intelligence?
- How do genes and the environment interact to affect intelligence?
- What is predicted by having a higher IQ? A lower IQ?

*\*Note: Lecture only included through slide 32. You are responsible for the information on the remaining slides and the corresponding study questions. See your textbook for more in depth explanations.*