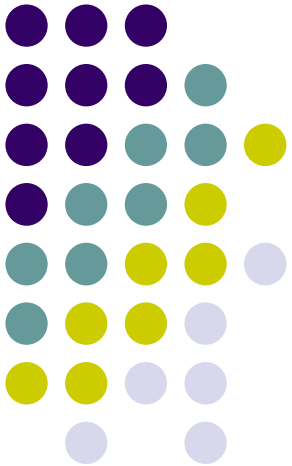
Cognition and Intelligence

Chapter 8



Problem Solving

- Problem solving is an _____ aspect of intelligent thinking
- Problem solving refers to active efforts to discover what must be done to _____ a goal
- Problems can be _____ into three basic types:
  - Inducing structure
  - _____.
  - Transformation

Types of Problems

- Problems of _____ structure
  - Discover relationships
  - Series completion and analogy problems
- Problems of _____.
  - Need to use criteria to arrange problem
  - Anagrams
- Problems of _____.
  - Carry out _____ to reach a goal
  - Hobbits and orcs problem
  - Water jar problem

A. Analogy

What word completes the analogy?

Merchant : Sell : : Customer : _____

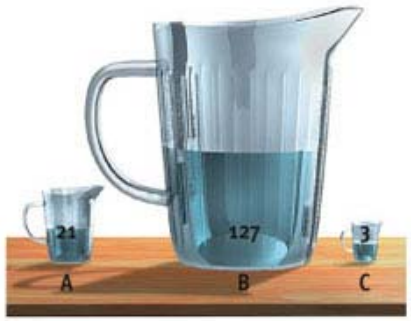
Lawyer : Client : : Doctor : _____

B. String problem

Two strings hang from the ceiling but are too far apart to allow a person to hold one and walk to the other. On the table are a book of matches, a screwdriver, and a few pieces of cotton. How could the strings be tied together?

C. Hobbits and orcs problem

Three hobbits and three orcs arrive at a river bank, and they all wish to cross onto the other side. Fortunately, there is a boat, but unfortunately, the boat can hold only two creatures at one time. Also, there is another problem. Orcs are vicious creatures, and whenever there are more orcs than hobbits on one side of the river, the orcs will immediately attack the hobbits and eat them up. Consequently, you should be certain that you never leave more orcs than hobbits on either river bank. How should the problem be solved? It must be added that the orcs, though vicious, can be trusted to bring the boat back! (From Matlin, 1989, p. 319)



D. Water jar problem

Suppose that you have a 21-cup jar, a 127-cup jar, and a 3-cup jar. Drawing and discarding as much water as you like, you need to measure out exactly 100 cups of water. How can this be done?

E. Anagram

Rearrange the letters in each row to make an English word.

RWAET

KEROJ

F. Series completion

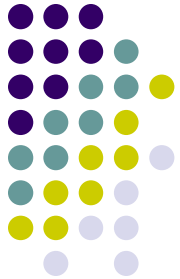
What number or letter completes each series?

1 2 8 3 4 6 5 6 ____

A B M C D M ____

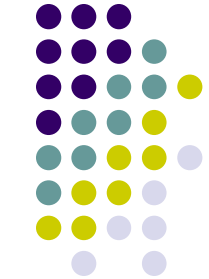
Figure 8.1 Six standard problems used in studies of problem solving

Obstacles to Problem Solving



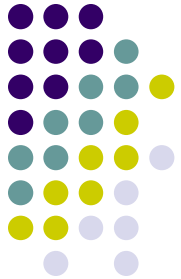
- _____ Information
  - Focus on the wrong information
- Functional _____.
  - Tendency to think about objects in familiar ways
- _____ Set
  - Old patterns of problem solving or information interfere with current thinking
- Assuming Unnecessary _____.

Obstacles: _____ Information

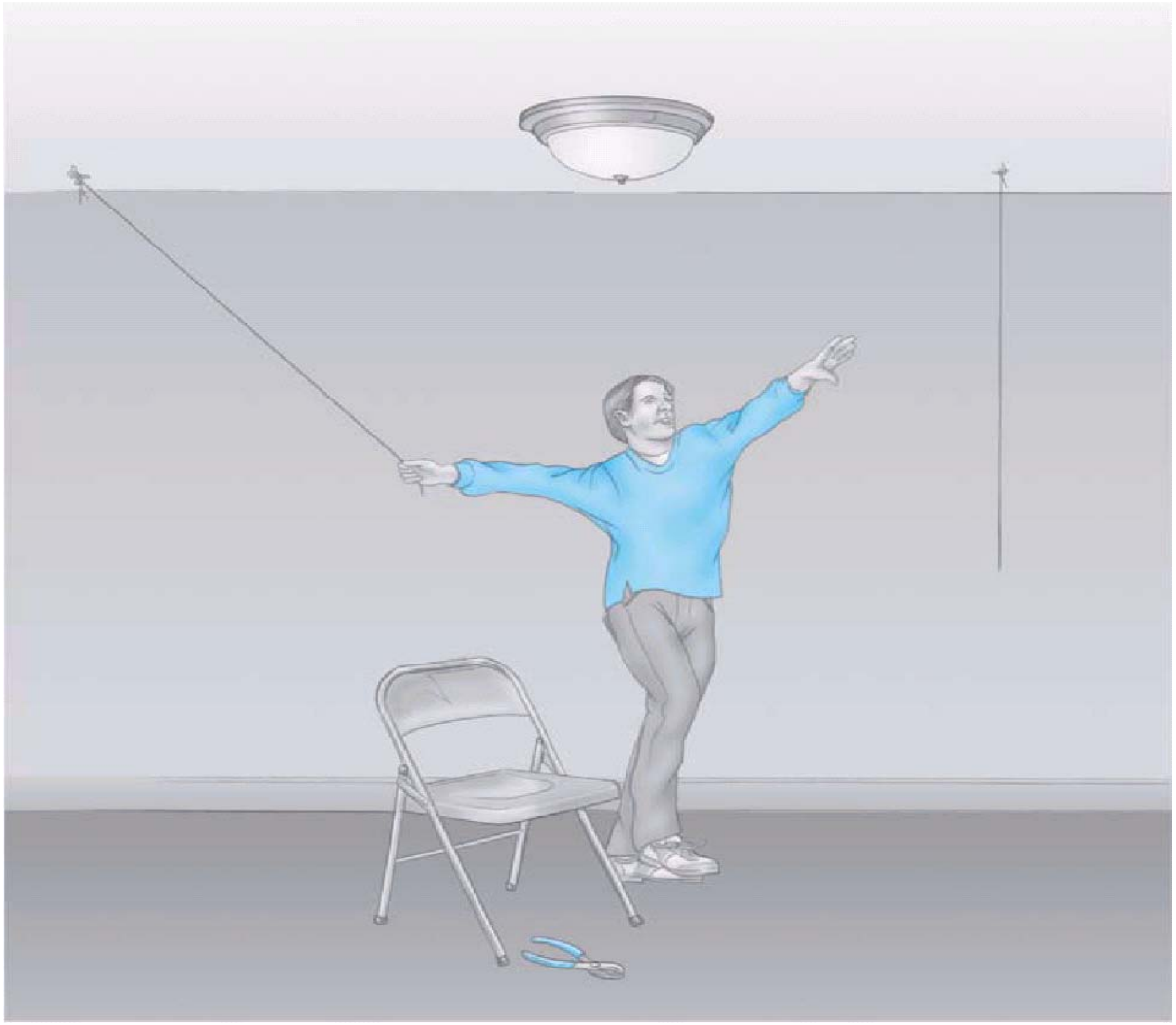


- One of the first steps in problem solving is to determine what the _____ is
- Attending to _____ information interferes with setting the problem up in the first step
  - Example: In the Thompson family there are five brothers, and each brother has one sister. If you count Mrs. Thompson, how many _____ are there in the Thompson family?

Obstacles: _____Fixedness

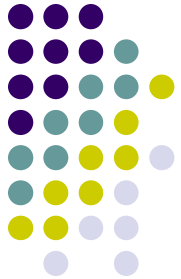


- Rachel’s car breaks down while she is driving through the desert. She is terribly thirsty. She finds several soda bottles in the trunk but no bottle opener.



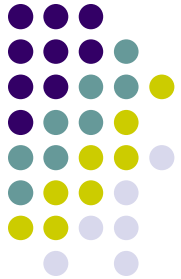
Two-string problem. As hard as Sebastian tries, he can't grab the second string. How can he tie the two strings together?

_____ sets



- Tendency to solve problems using procedures that have _____ before on similar problems
- Very _____!
- But not helpful if the problem requires a ____. solution…
  - When Matt's flashlight hasn't worked in the past, he's just shaken it to get it to work again. One day when it doesn't come on, he shakes it, but it still doesn't work. He would be subject to mental set if he keeps shaking it without checking whether it needs new batteries.

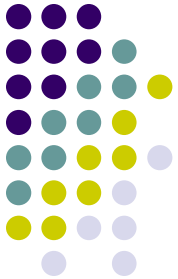
Set Example



- Number Puzzle: In this puzzle try to figure out the pattern for the order of numbers. Why are these numbers arranged in this order?

  8, 5, 4, 9, 1, 7, 6, 3, 2, 0

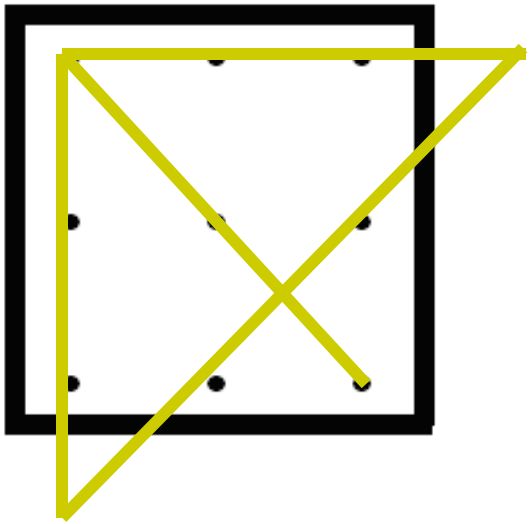
_____ constraints



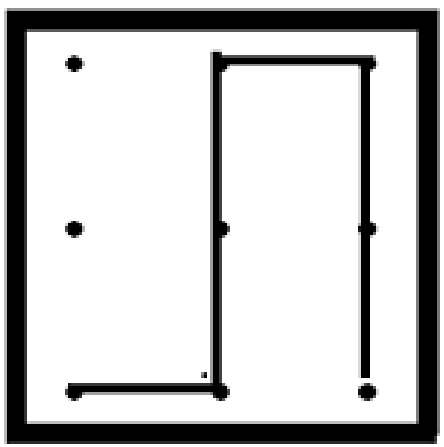
- Imposing _____ that don't actually exist
- These _____ are not part of the problem, but are _____ by the problem solver
- Example: nine-dot problem

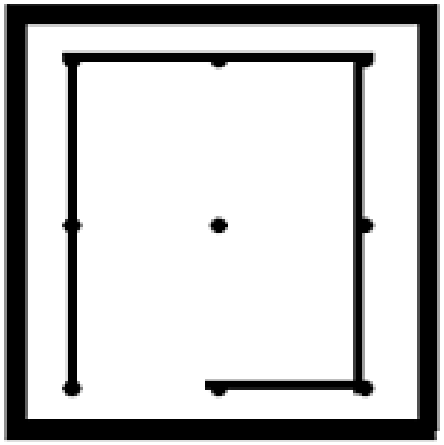
NINE DOT PROBLEM

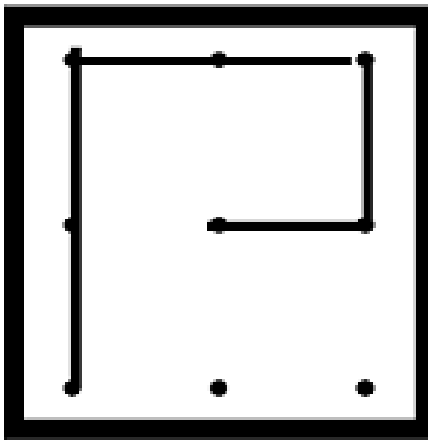
Connect the nine dots with four straight lines without removing your pen from the page.



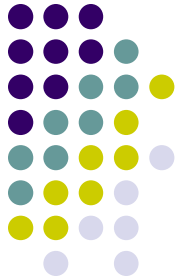
Some attempted but incorrect solutions appear below.







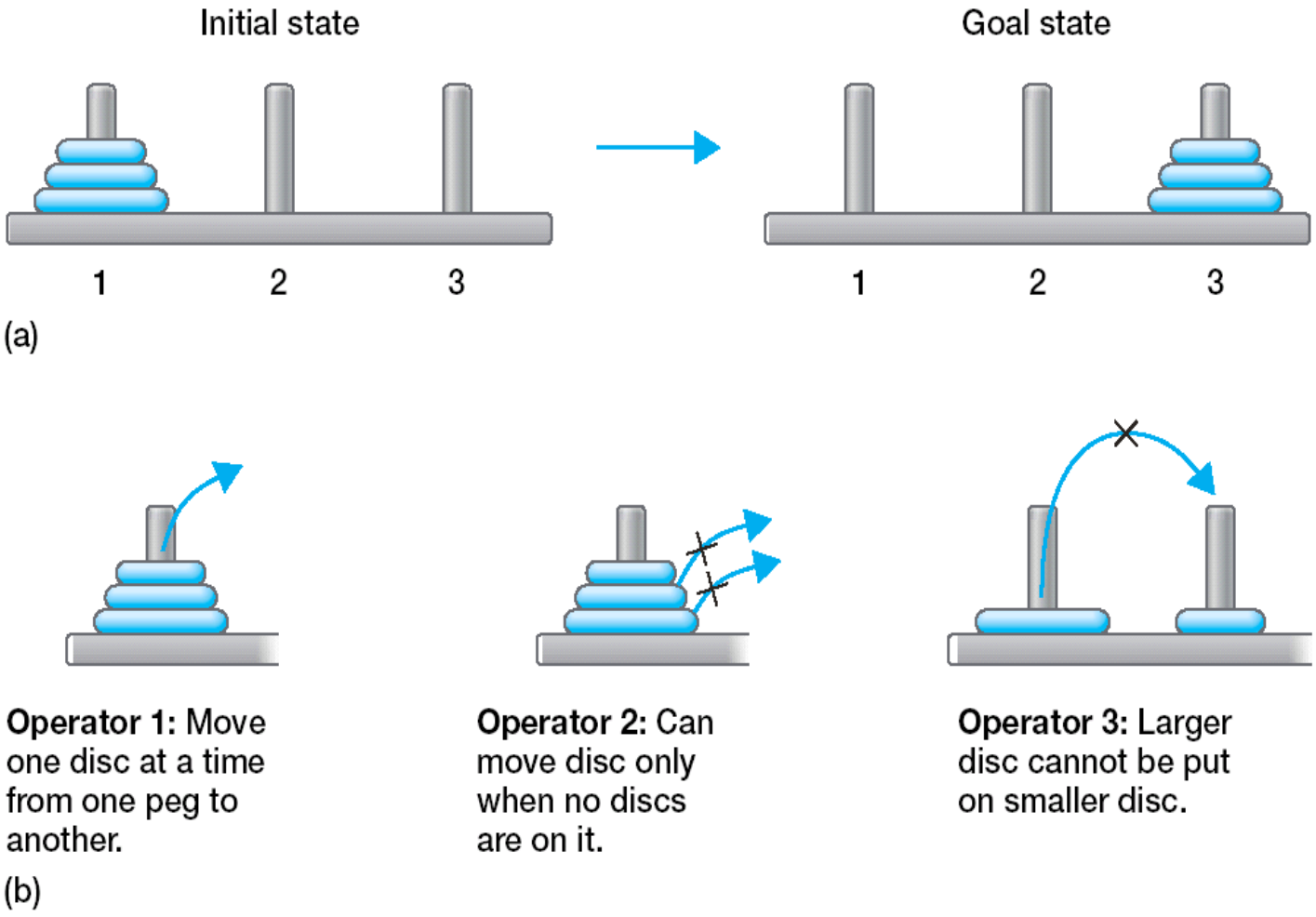
_____ to Problem Solving



- **_____-and-error**
  - Keep trying until you figure out the solution
  - Works if there are _____ possible solutions
- **_____.**
  - **Guaranteed solution (math problems)**
- **_____: shortcuts**
  - Forming _____.
  - Searching for analogies
  - Changing the _____ of a problem

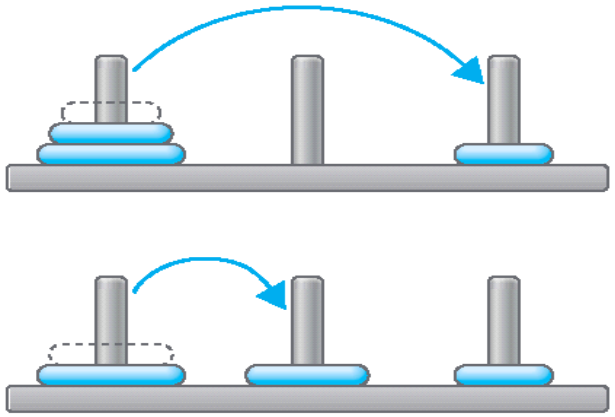
_____: Forming Subgoals

- _____: using intermediate steps to solve a problem
- Working both forward and backward
- Example: Tower of Hanoi Problem

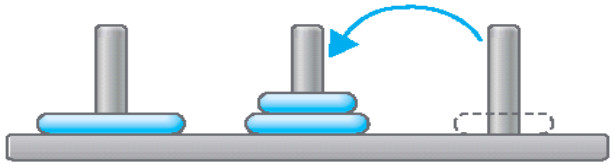


(a) Initial and goal states for the Tower of Hanoi problem.
(b) Operators that govern the Tower of Hanoi problem.

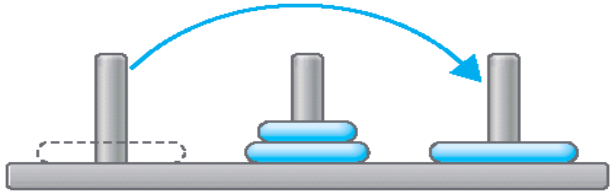
Initial steps in solving the Tower of Hanoi problem, showing how the problem can be broken down into subgoals.



(a) **Subgoal 1:** Free up large disc.



(b) **Subgoal 2:** Free up third peg.



(c) **Subgoal 3:** Move large disc onto third peg.

Heuristics: _____.

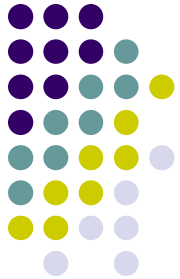
- _____: A relationship between two similar situations, problems or concepts.
- Examples:

  Merchant is to Sell as Customer is to ___.

  _____ memory is like RAM in a computer.

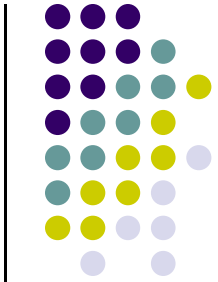
  A useful heuristic is to find a similar or related situation and build an analogy
  - Often difficult to see the relationship

_____: Changing the Representation of the Problem



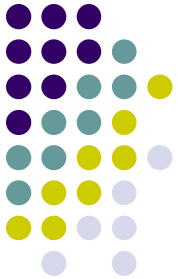
- Your representation of the problem is how you see the problem
- You might represent a problem _____, mathematically, _____.
  - Make lists, use a table, equations, diagrams
- Often helps to _____ how you represent problem

Culture, _____ Style, and Problem Solving



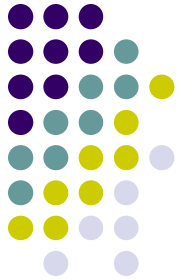
- _____ differences exist in problem solving and may be due to environmental constraints
- Field _____ – rely on external frames of reference
- Field _____– rely on internal frames of reference
  - Western education inspire field independence
- Holistic vs. _____ cognitive styles

Making Choices: Heuristics in Judging _____.



- The _____ heuristic
  - Overestimating the improbable
- The _____heuristic
  - The tendency to ignore base rates
  - The _____fallacy
  - The _____fallacy

_____: The Availability Heuristic



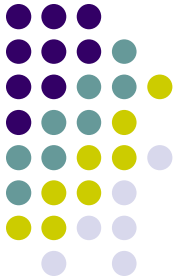
- Tendency to judge the _____of an event by how easy it is to think of examples or instances
- _____of odds of dying in plane accident, _____of odds of dying in car accident
- Are there more words in the English language that begin with K or have K as their third letter?

a. There are more words that begin with K (easier to think of examples)

b. There are more words that have K as their third letter

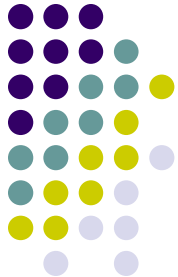
c. Both “a” and “b” are about the same (within 5% of each other).

Probabilities: Overestimating the _____.



- Exaggerating the _____.
  - We choose the option that best fits with our beliefs, regardless of their actual probabilities
    - Example of the _____heuristic

Probabilities: _____Heuristic



- Basing estimated _____of an event on how similar it is to the _____event

_____: Base predictions on similarity to other events or situations (but we may ignore other relevant information such as the actual frequency of events)

Assume that all families with exactly six children are surveyed in a city. In 100 of these families the exact order of births of boys (B) and girls (G) was G-B-G-B-B-G. What is your guess as to the number of families in which the exact order of birth was each of the following? Estimate a number for each of the following (adapted from Kahneman & Tversky, 1973):

1. **G-G-B-G-B-B**
2. **B-B-B-B-B-B**
3. **G-B-B-G-B-G**
4. **B-B-B-G-G-G**

For each of these possibilities, the expected number of families is 100.

Statistically, all four alternatives are equally likely (50% B, 50% G)

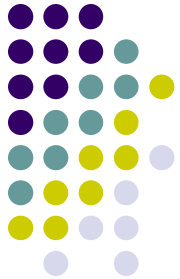
Sex of previous births doesn't affect sex of next birth.

_____: Which birth orders "look" random?

Most people misunderstand how randomness works.

They expect things to "even out" in the short run.

_____Heuristic: Base Rates



- When people use the representative heuristic they often _____**base rates**
- People often feel they can “beat the odds” because the _____base rates

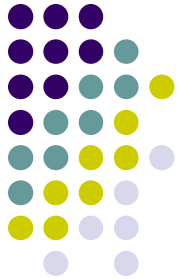
Imagine that you just met a man named Steve. Steve is very shy and withdrawn, invariably helpful, but with little interest in people or in the world of reality. A meek and tidy soul, he has a need for order and structure and a passion for detail. Which statement about Steve is more likely (adapted from Kahneman & Tversky, 1973):

a. Steve is a retail salesperson (3,964,680 in the United States)
b. Steve is a librarian (139,460 in the United States)
c. Both "a" and "b" are equally likely (within 5% of each other)

Approximately 28.4 retail salespersons for every librarian. Steve is much more likely to be a retail salesperson. But Steve's description fits our stereotype of librarians.

Data from the Bureau of Labor Statistics (2000) survey

_____Heuristic: Conjunction Fallacy



- The probability of being in a subcategory cannot be higher than the probability of being in the _____category
- Steve is articulate, _____, power-hungry wheeler-dealer.
  - Do you think it's more likely that he is a college teacher,
  - or a college teacher who is also a politician ?

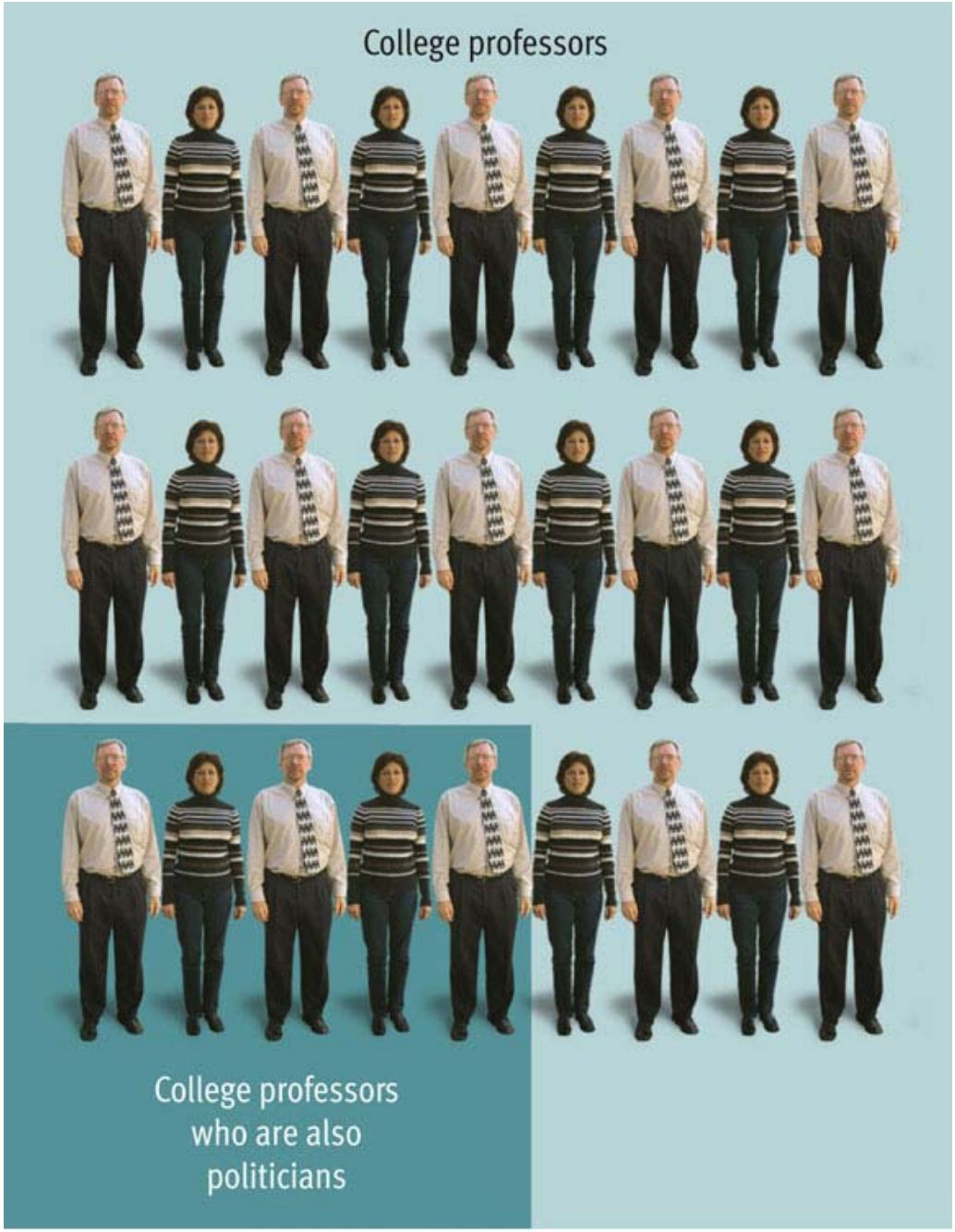


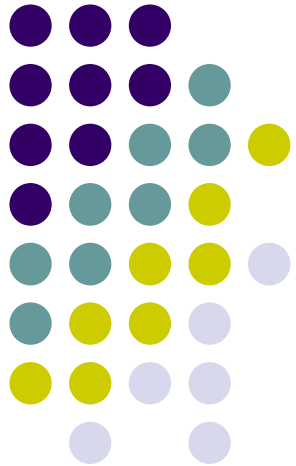
Figure 8.13 The conjunction fallacy

Probabilities:

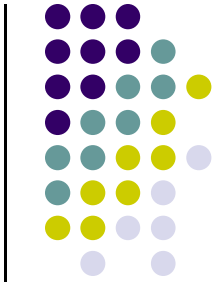
_____Fallacy

- Belief that the odds of a chance event occurring increase if the event hasn't occurred _____.
- _____in slots and roulette
- Example of the _____heuristic

Intelligence

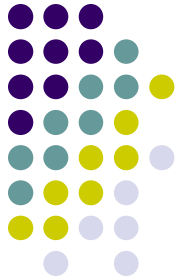


Defining Intelligence



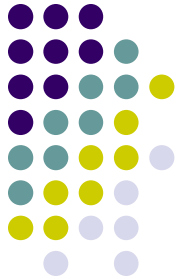
- Intelligence
  - Defined as the ability to _____from experience, acquire knowledge, think abstractly, act _____, or adapt to changes in the environment
- _____Factor
  - General intellectual ability _____by theorists to underlie specific mental _____.

Measuring Intelligence: Psychometric _____.



- _____= measurement of mental abilities, traits, & processes
- Includes:
  - _____tests
    - Measure skills and knowledge that have been taught
    - Example: SAT
  - _____tests
    - Measure ability to acquire skills or knowledge

History of Standardized _____.

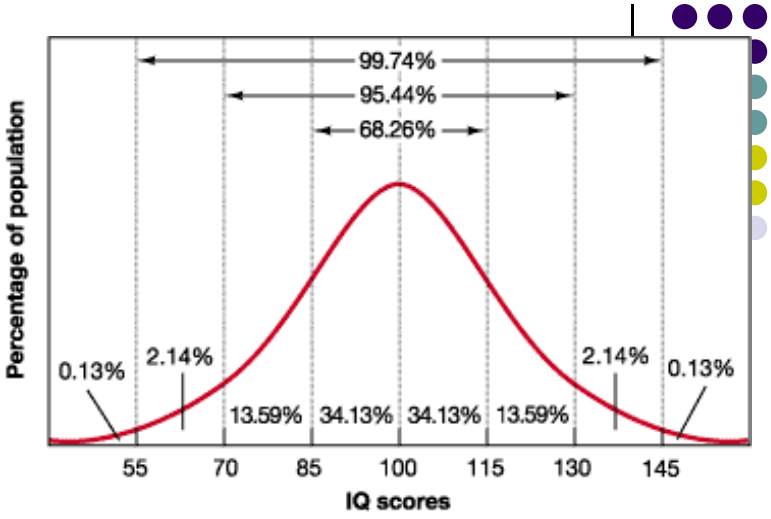


- Adolph _____(1796-1874)
  - Measured the height & chest circumference of Scottish soldiers
  - First to argue for an “average man” using normal distributions
- Sir Francis Galton (1822-1911)
  - First to apply _____measurement to intelligence
  - First to argue that intelligence of the population should be normally distributed
- Alfred Binet (1857-1911)
  - Developed widely used standardized tests of intelligence using trial-and-error method
    - “Normal” children and _____children
  - Test stayed popular because it predicted _____in school (to some degree)

The _____of Intelligence Testing

- **Lewis Terman** (1916)
  - _____Intelligence Scale
  - Intelligence Quotient (IQ) = _____x 100
- **David** _____(1955)
  - Wechsler Adult _____Scale

IQ Scores



- "_____distributed"
  - Bell-shaped curve
- Very high and very low scores are rare
- 68% of people have IQ between 85-115
  - Two standard _____from the mean
- _____% of people have IQ between 55-145

Learning Objective 6

Extremes of Intelligence: Mental Retardation

- Diagnosis based on **IQ and _____testing**
  - IQ 2 or more _____below mean
  - Adaptive skill deficits
  - Origination before age _____.
- 4 levels: mild, moderate, severe, _____.
  - Mild most common
- Causes:
  - _____vs. biological

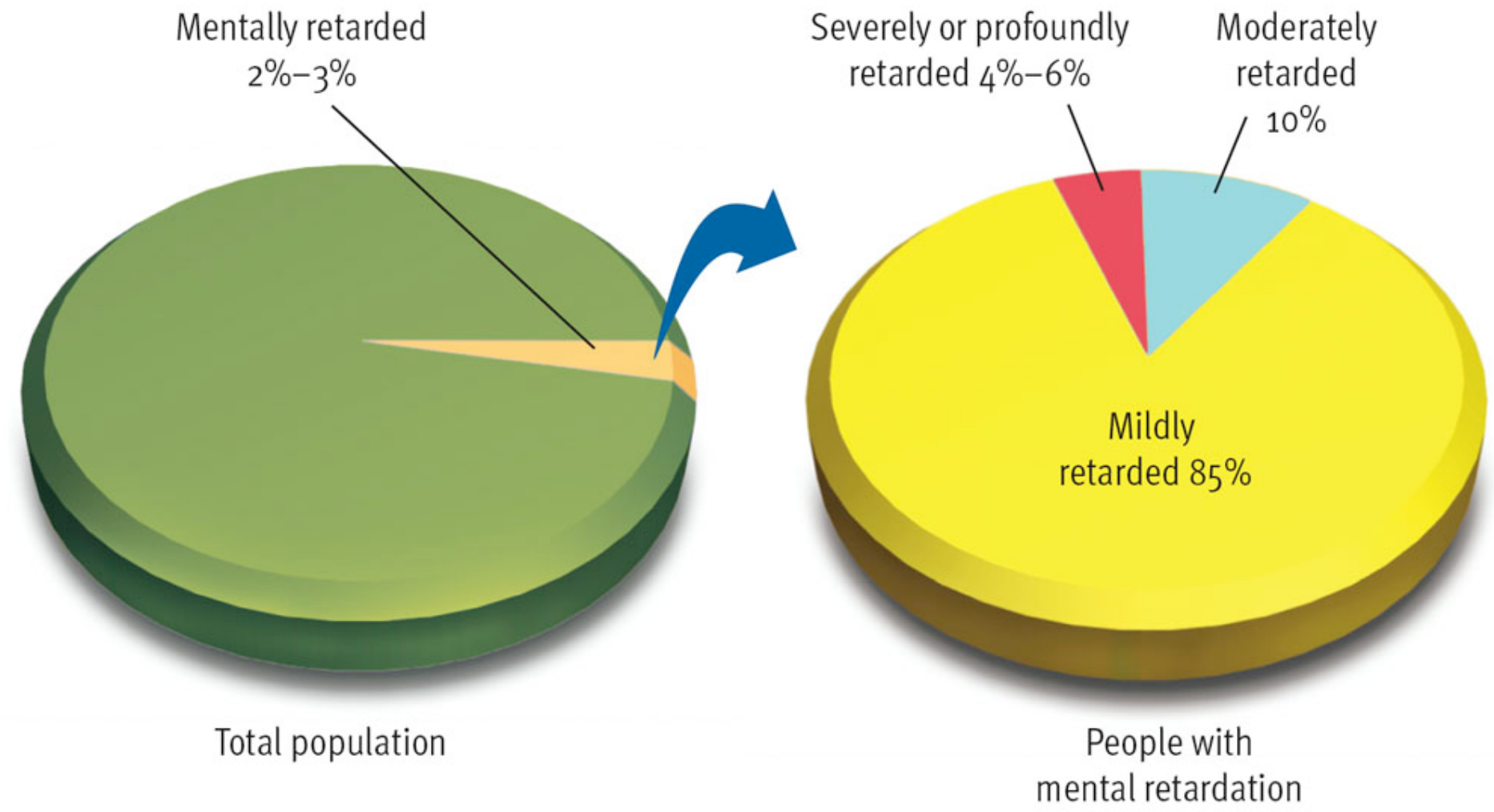


Figure 9.10 The prevalence and severity of mental retardation

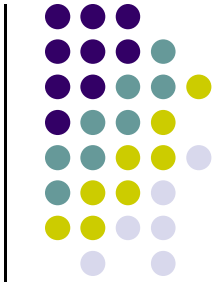
Extremes of Intelligence: Giftedness

- _____**issues** – ideals vs. practice
  - IQ 2 SD above mean standard
  - _____, leadership, special talent?
- _____– weak, socially inept, emotionally troubled
  - Lewis Terman (1925) – largely contradicted stereotypes
  - Ellen Winner (1997) – _____vs. profoundly gifted

Extremes of Intelligence: _____.

- **_____and high achievement** – beyond IQ
  - Renzulli (2002) – intersection of _____factors
  - Simonton (2001) – drudge theory and inborn talent

Test Differences



- _____type
  - Different tests for different ages
- But, there are also multiple tests
  - _____-Binet
  - Weschler _____Intelligence Scale (WAIS)
  - Weschler Intelligence _____for Children (WISC)

Weschler Test Performance Tasks

Picture arrangement
(Arrange the panels to make a meaningful story)

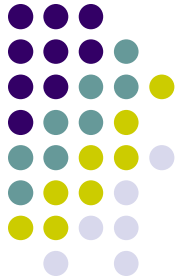
Object assembly
(Put together a jigsaw puzzle)

Digit symbol
(Using the key at the top, fill in the appropriate symbol beneath each number)

Picture completion
(Supply the missing feature)

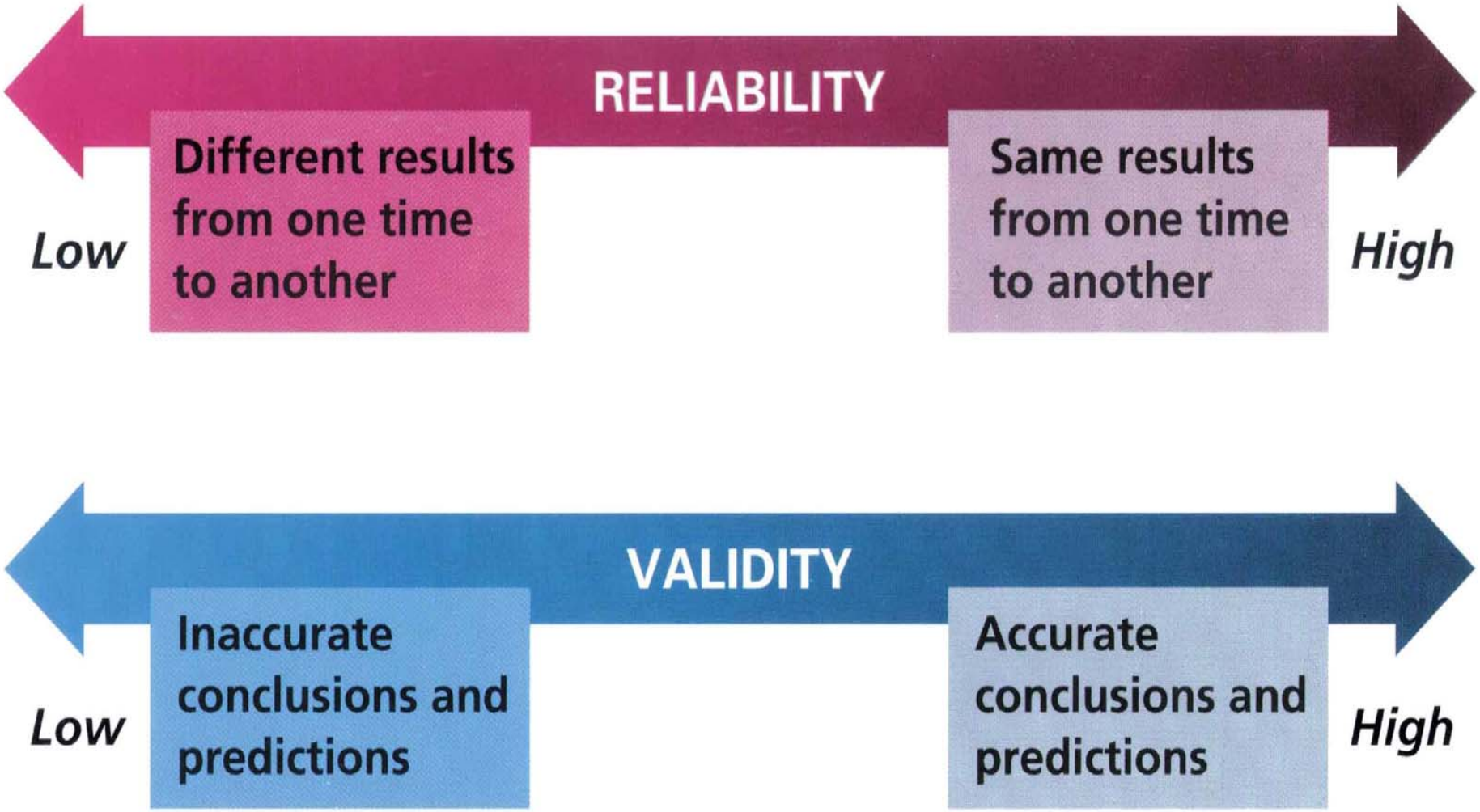
Block design
(Copy the design shown, using another set of blocks)

What Makes a Good IQ Test?

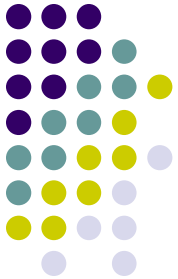


- _____.
  - Is the measurement consistent?
  - Results must be repeatable and stable
  - Low _____before age 7
- _____.
  - Does the test _____what you think it measures?
  - Affects the ability to make inferences about the test

Test Reliability and Validity

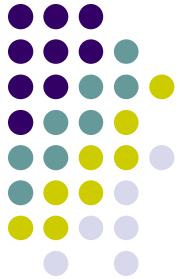


_____Fair Tests



- Was this a "_____" test?
- Elements of a culture _____test:
  - Items are not reliant on information that is exclusive to a particular group
  - Based more on "_____" ability

Can IQ Be _____?



- Traditional IQ tests favor _____, white, city-dwelling individuals
- Different cultures may have different problem-solving _____.
- Different cultures stress (and therefore, teach) different types of _____.
  - Child in New York city, living in a city loft
  - Child in the Appalachian mountains, living on a farm

_____and _____as Determinants of Intelligence

- _____.
  - Twin and adoption studies
  - _____estimates
- _____.
  - Adoption studies
  - Environmental deprivation and enrichment
  - The _____effect
    - IQ scores increase every generation
- **Interaction**
  - The concept of the reaction range

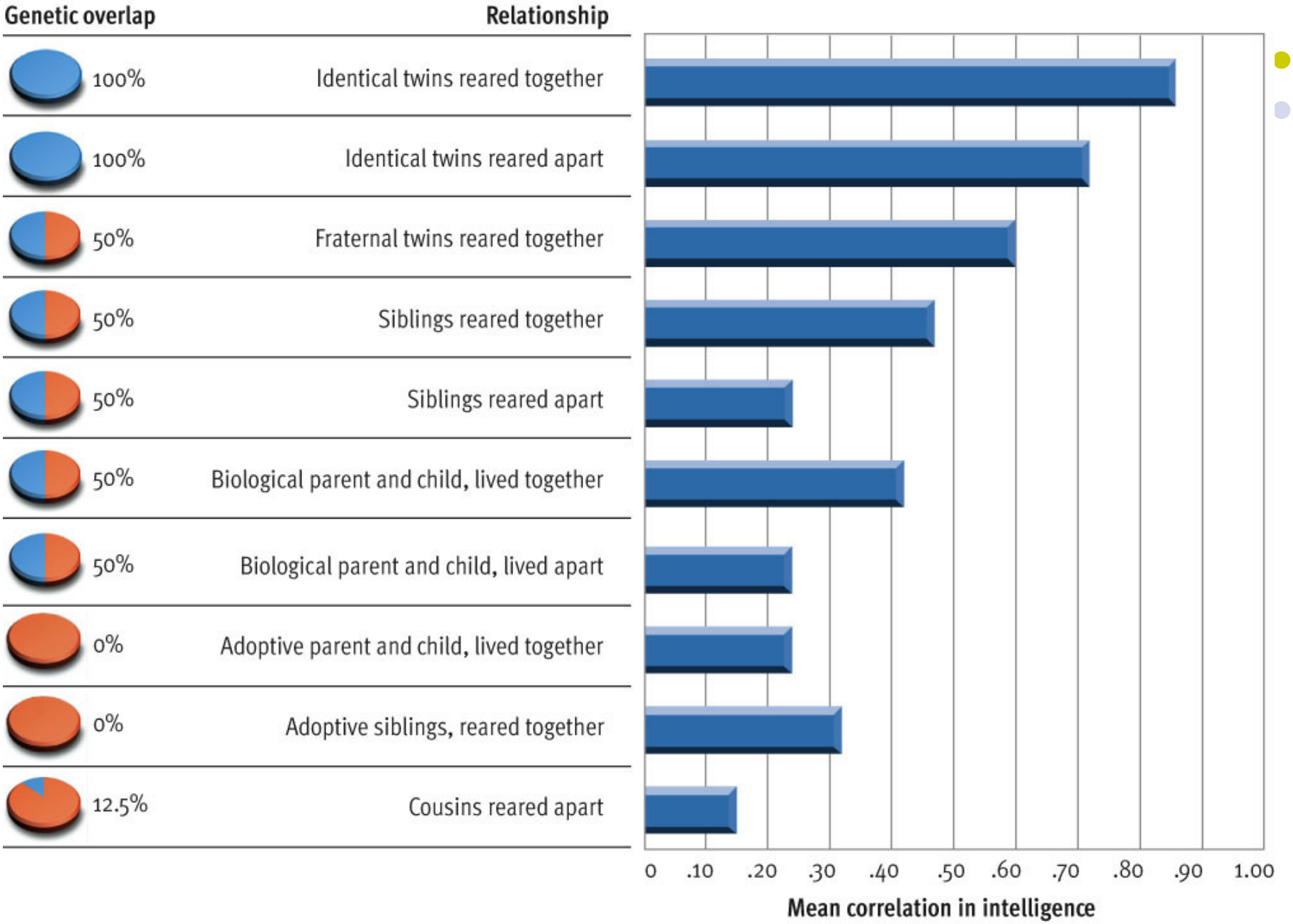


Figure 8.19 Studies of IQ similarity

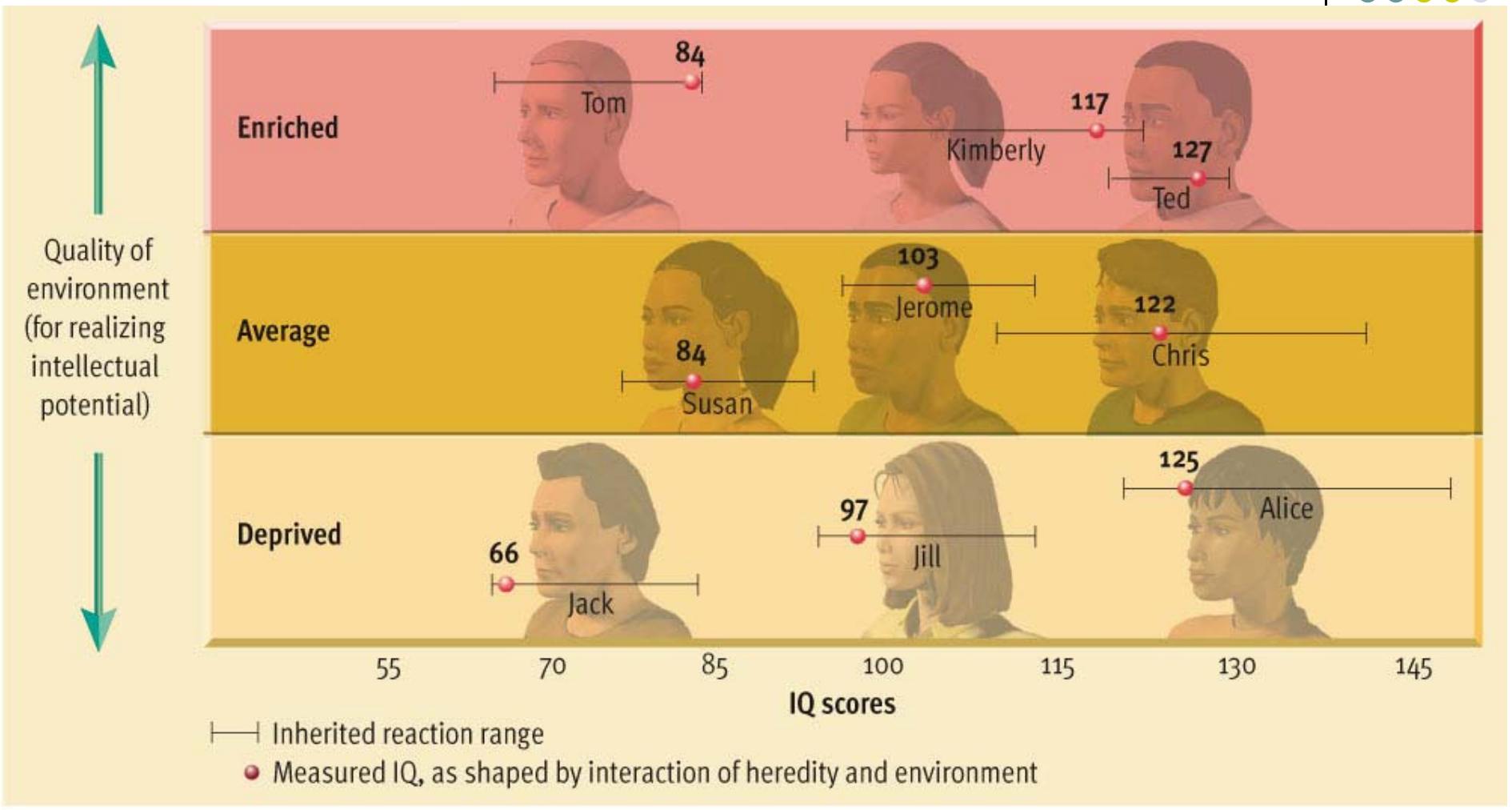
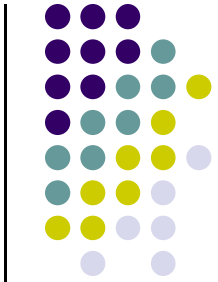


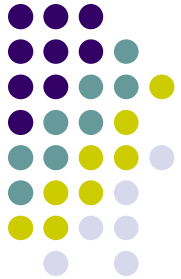
Figure 8.21 Reaction range

Variables _____IQ Scores



- Expectations for performance
- _____stereotypes
  - Stereotype threat
    - Doubt felt about _____due to negative stereotypes
    - Have been shown effects on performance of African Americans, _____, low income populations, _____, & the elderly
  - Negative stereotypes can _____performance
  - Positive stereotypes can _____performance

Measuring _____: Cognitive Approaches



- Emphasize _____strategies
- Includes _____domains of intelligence
  - Started with _____multiple intelligences
    - Bodily-kinesthetic, intrapersonal, interpersonal, linguistic, logical-mathematical, musical, naturalist
  - _____intelligence (EQ)

Sternberg's _____Theory

- _____intelligence
  - Internal strategies, including problem recognition & evaluation of problem-solving strategies
  - Requires metacognition
- _____intelligence
  - Ability to transfer skills to new settings
- _____intelligence
  - Practical application of intelligence
  - Adaptation to an environment