

Cognitive Psychology

Lecture 13: Judgment, Decisions, and Reasoning

Outline for today

- Judgment
- Decision-making
- Reasoning

Making Judgments

- **Decisions:** the process of making choices between alternatives
- **Reasoning:** the process of drawing conclusions
- **Judgment:** the process of evaluation

- **** Decisions** are based on **judgments** we make, and applying judgments can involve various **reasoning** processes
 - E.g., "Should we invite John to the party? (decision).. John is a nice guy (judgment), therefore we should invite him to the party (reasoning – decision-making)"

Making Judgments

- **Inductive reasoning:** Reasoning and reaching conclusions based on evidence
 - One, primary mechanism involved in making judgments
- Conclusions are probabilistic
 - Conclusions reached are suggested with various degrees of certainty
 - I will have some degree of certainty in my conclusion based on the strength of evidence
- E.g.,
 - Observation: 1. John planted one tree last summer
 - Observation: 2. John has planted trees every summer since he was a teenager
 - Conclusion: Therefore, John cares about the environment

Making Judgments

Inductive Reasoning

- Factors that influence the strength of the argument
 - Representativeness of observations
 - Number of observations
 - Quality of observations

Making Judgments

Inductive Reasoning

- Used to make scientific discoveries
 - Hypotheses and general conclusions
- Used in everyday life
 - Anytime we make a prediction about what *will happen* based on observation about what *has happened* in the past we are using inductive reasoning

Making Judgments

Potential Sources of Errors in Judgments

- We often use shortcuts to help us reach conclusions quickly
 - In order to decide whether I should order something from Amazon versus Target I don't tally up all the times it was late/early etc.
- Often we use **heuristics** (“rules of thumb”)
 - Likely to provide the answer, but are not foolproof
 - In comparison, we could instead use an **algorithm**
 - Time-consuming but will eventually lead us to the right answer

Making Judgments: sources of errors

- **The availability heuristic**

- Events that are more easily remembered (more easily "available" to us) will be judged as more probable events than are less easily remembered

- E.g.,

- "Which are prevalent in English, words that begin with the letter **R** or words in which **R** is the third letter?"
 - 70% say words that begin with **R** or more frequent
 - 3x as many "R as the 3rd letter" versus "R as the 1st letter"

Making Judgments: sources of errors

- **The availability heuristic**
- E.g.,

<i>Cause A</i>	<i>Cause B</i>
Homicide	Appendicitis
Auto–train collision	Drowning
Botulism	Asthma
Asthma	Tornado
Appendicitis	Pregnancy

Table 13.1: Causes of Death

MORE LIKELY	LESS LIKELY	PERCENT PICKING LESS LIKELY
Homicide (20)	Appendicitis	9
Drowning (5)	Auto–train collision	34
Asthma (920)	Botulism	41
Asthma (20)	Tornado	58
Appendicitis (2)	Pregnancy	83

Source: Adapted from S. Lichtenstein, P. Slovic, B. Fischhoff, M. Layman, & B. Combs, Judged frequency of lethal events, *Journal of Experimental Psychology: Human Learning and Memory*, 4, 551–578 (1978).

Making Judgments: sources of errors

- **The availability heuristic**

- Can lead us to wrong conclusions when less frequent events stand out in our memory

Making Judgments: sources of errors

- **The availability heuristic**

- **Illusory correlations:** When we believe there to be a correlation between two events, when none exists
- Sometimes we expect two things to be related, which biases us to believe there is in fact a correlation where none exists
- **Stereotypes:** oversimplified generalization about a group or class of people that often focuses on the negative

Making Judgments: sources of errors

- **The availability heuristic**

- **Illusory correlations** and **stereotypes**

- These are thought to be related to the availability heuristic
 - Selective attention to stereotypical behaviors might be more “available”, creating and/or reinforcing illusory correlations and stereotypes
 - This could be due to our prior beliefs, expectations, etc.
 - It could happen while we are encoding the events, or retrieving them

Making Judgments: sources of errors

- **The representativeness heuristic**

- We make judgments based on resemblance, and ignore other information like **base rates**
- We will judge A to belong to class B, if the the properties of A closely resemble the properties we usually associate with B

- E.g.,

- “We randomly pick one male from the population of the United States. That male, Robert, wears glasses, speaks quietly, and reads a lot. Is it more likely that Robert is a librarian or a farmer?”

Making Judgments: sources of errors

- **The representativeness heuristic**
 - **Base rate**: relative proportion of classes in the population
 - Given descriptive (previous slide) and base rate information, we will typically ignore the base rate
 - If only given base rates, we will use them to make our judgment.

Making Judgments: sources of errors

- **The representativeness heuristic**

- “In a group of 100 people, there are 70 lawyers and 30 engineers. What is the chance that if we pick one person from the group at random that the person will be an engineer?”
- “Jack is a 45-year-old man. He is married and has four children. He is generally conservative, careful, and ambitious. He shows no interest in political and social issues and spends most of his free time on his many hobbies, which include home carpentry, sailing, and mathematical puzzles.”
- **Given both, people greatly increase their estimate (above the base rate)**

Making Judgments: sources of errors

- **The representativeness heuristic**

- Another characteristic of the representativeness heuristic is that we make judgements based on resemblance and ignore the conjunction rule
 - Known as **the conjunction fallacy**
- “Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in antinuclear demonstrations. Which of the following alternatives is more probable?”
 - 1. Linda is a bank teller.
 - 2. Linda is a bank teller and is active in the feminist movement.

Making Judgments: sources of errors

- **The representativeness heuristic**

- Another characteristic of the representativeness heuristic is that we make judgements based on resemblance and ignore the conjunction rule
- The **conjunction rule**: probability of two events cannot be higher than the probability of the single constituents
- E.g., The probability that Ann has a *red* corvette, cannot be higher than the probability that Ann has a corvette

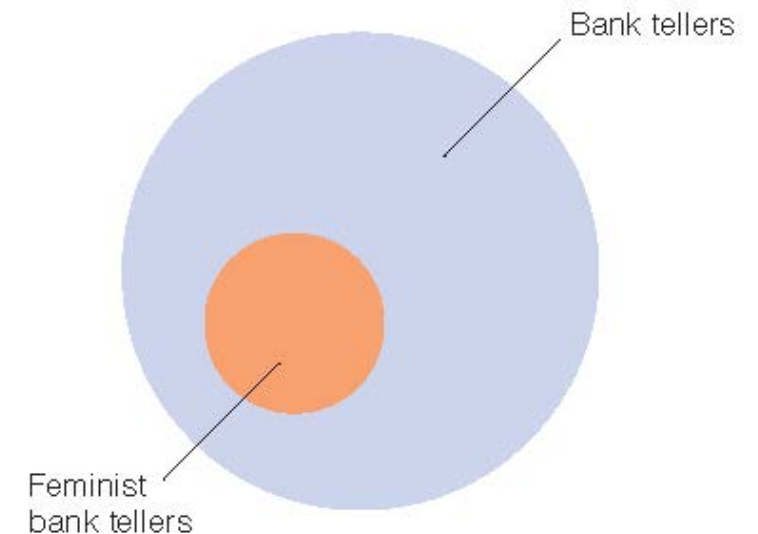


Figure 13.1 Because feminist bank tellers are a subset of bank tellers, it is always more likely that someone is a bank teller than a feminist bank teller. © Cengage Learning

Making Judgments: sources of errors

- **The representativeness heuristic**

- Another characteristic of the representativeness heuristic is that incorrectly assume that small samples are representative

- E.g.,

- A certain town is served by two hospitals. In the larger hospital about 45 babies are born each day, and in the smaller hospital about 15 babies are born each day. As you know, about 50 percent of all babies are boys. However, the exact percentage varies from day to day. Sometimes it may be higher than 50 percent, sometimes lower. For a period of 1 year, each hospital recorded the days on which more than 60 percent of the babies born were boys. Which hospital do you think recorded more such days?
 - The larger hospital?
 - The smaller hospital?
 - About the same

Making Judgments: sources of errors

- **The representativeness heuristic**
 - Another characteristic of the representativeness heuristic is that incorrectly assume that small samples are representative
- As sample sizes increase, the more representative it will be of the general population (**the law of large numbers**)
 - On any given day, a sample of 45 will more likely have 50% gender than a small sample of 15

Making Judgments: sources of errors

- **Preconceptions, attitudes, and judgments**
- **Confirmation bias:** The confirmation bias: tendency to selectively look for information that conforms to our hypothesis and overlook information that argues against it
 - E.g., we more readily seek out confirming evidence and not disconfirming evidence
 - E.g., we tend to disregard evidence that does not confirm our beliefs
- **Myside bias:** tendency for people to generate and evaluate evidence and test their hypotheses in a way that is biased toward their own opinions and attitudes
 - A specific case of confirmation bias

Making Judgments: sources of errors

- **Preconceptions, attitudes, and judgments**
 - **Confirmation bias**
- Example:
 - “You will be given three numbers which conform to a simple rule that I have in mind. . . . Your aim is to discover this rule by writing down sets of three numbers together with your reasons for your choice of them. After you have written down each set, I shall tell you whether your numbers conform to the rule or not. When you feel highly confident that you have discovered the rule, you are to write it down and tell me what it is.”
 - Numbers: 2, 4, 6
- This problem is difficult, because in order to figure out the rule you need to provide numbers that disconfirm your hypothesis

Making Decisions

- Expected utility theory
 - People are rational
 - If they have all relevant information, they will make a decision that results in the maximum expected utility
- Utility: outcomes that are desirable because they are in the person's best interest
 - Maximum monetary payoff

Making Decisions

- Advantages for utility approach
 - Specific procedures to determine the “best choice”
- Problems for utility approach
 - Not necessarily money, people find value in other things
 - People simply do not always make decisions that maximize the outcome

Making Decisions

- Problems for utility approach
 - People simply do not always make decisions that maximize the outcome
- Example 1:
 - They choose the big bowl (7% chance) over the small (10%) even knowing the odds because they “felt” like they had better chance

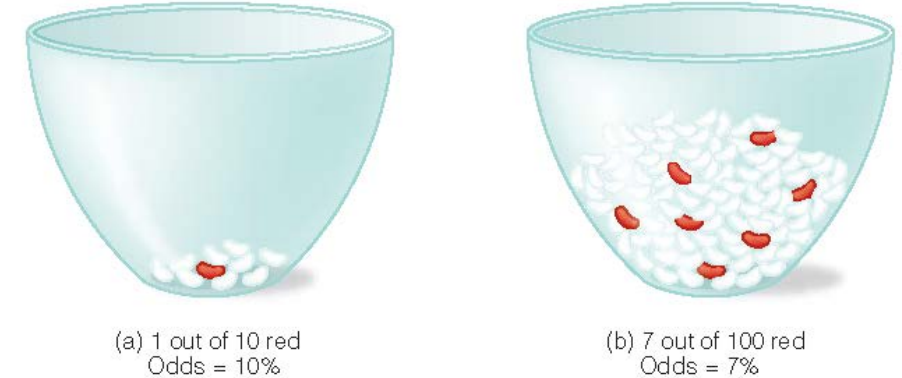


Figure 13.2 Denes-Raj and Epstein (1994) gave participants a choice between randomly picking one jelly bean from (a) a bowl with 1 red bean and 9 white beans or (b) a bowl with 7 red beans and 93 white beans (not all of the white beans are shown in this picture). Participants received money if they picked a red bean. (Source: Based on V. Denes-Raj & S. Epstein, *Conflict between intuitive and rational processing: When people behave against their better judgment*, *Journal of Personality and Social Psychology*, 66, 819–829, 1994.)

Making Decisions

- Problems for utility approach
 - People simply do not always make decisions that maximize the outcome
- Example 2:
 - It is well-known that the odds of being killed in a car accident are far greater than a plane.
 - Yet, after 9/11 decrease in air travel, and increase in driving
 - According to one calculation, the number of people killed in car accidents by avoiding flying was higher than the total number of passengers killed on the four hijacked planes (Gigerenzer, 2004)

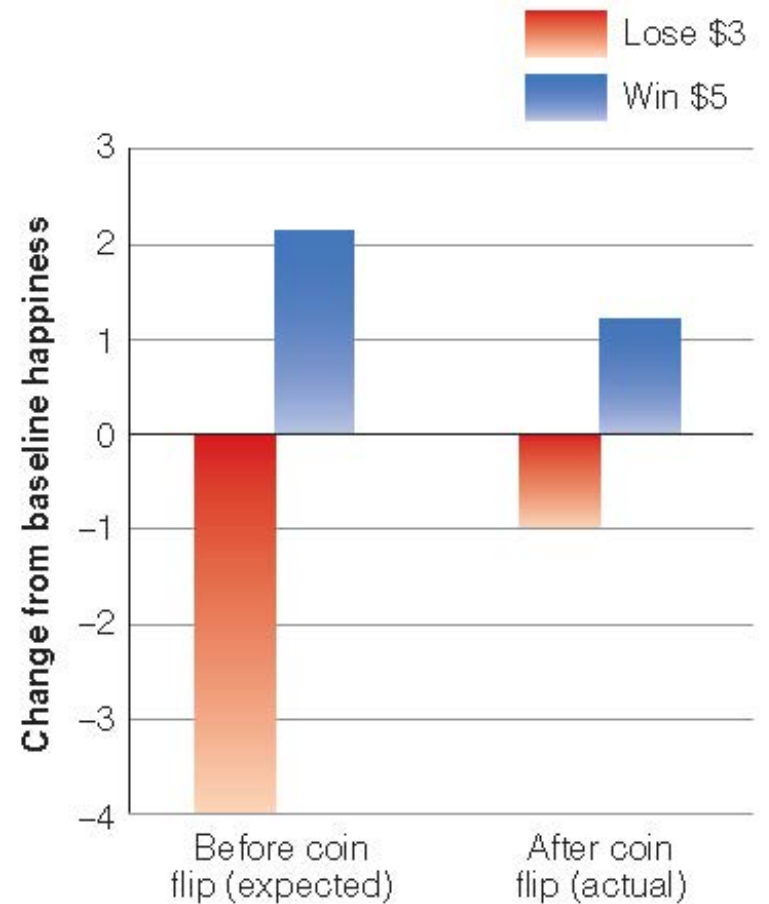
Making Decisions

- Problems for utility approach
 - People simply do not always make decisions that maximize the outcome
 - Example 3: deal or no deal
- 1/5 for $> 80,000$ OR 80,000?
- Post (2008)
 - People tend to be cautious if they've had good luck up til the deal
 - People tend to be risky if they've had bad luck up til the deal
 - Possibly to avoid negative feelings, and trying to "beat the odds"

21 BRIEFCASES OPENED (NO LONGER IN PLAY)		5 BRIEFCASES REMAINING (STILL IN PLAY)
\$0.01	\$5,000	\$100
\$1	\$10,000	
\$5	\$25,000	\$400
\$10	\$75,000	
\$25	\$100,000	\$1,000
\$50	\$200,000	
\$75	\$400,000	\$50,000
\$200	\$500,000	
\$300	\$750,000	\$300,000
\$500	\$1,000,000	
\$750		

Making Decisions

- **Emotions affect decisions**
- **Expected emotions**
 - Emotions that people *predict* that they will feel concerning an outcome
 - People often inaccurately predict their emotions
- Causes **risk aversion**
 - People believe that losing \$100 would feel very bad, but gaining \$100 would only feel slightly pleasant



Making Decisions

- **Emotions affect decisions**
- **Incidental emotions:** Emotions that are not specifically related to decision-making
 - May be related to one's general disposition or personality, some recent experience, or one's general environment or surroundings
 - Can affect one's overall decision making processes

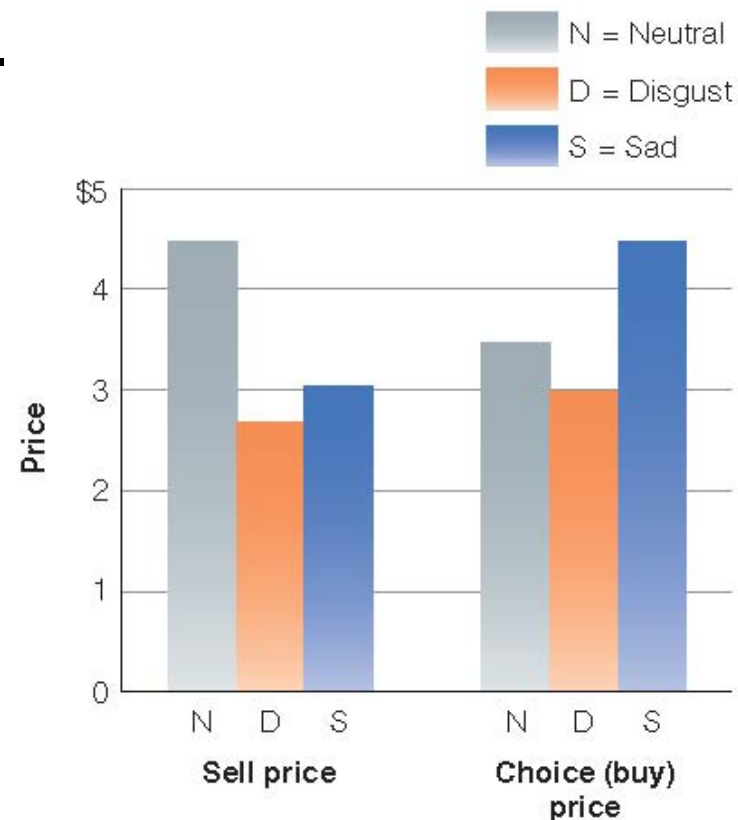
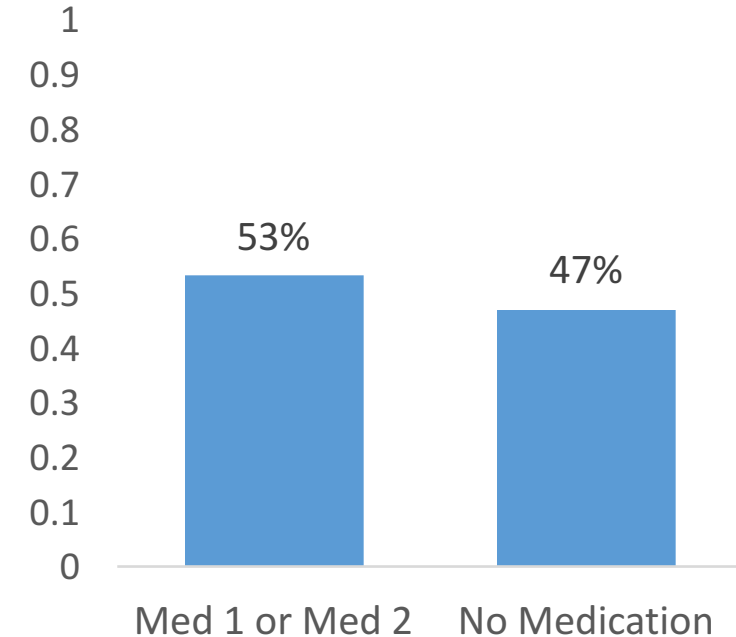
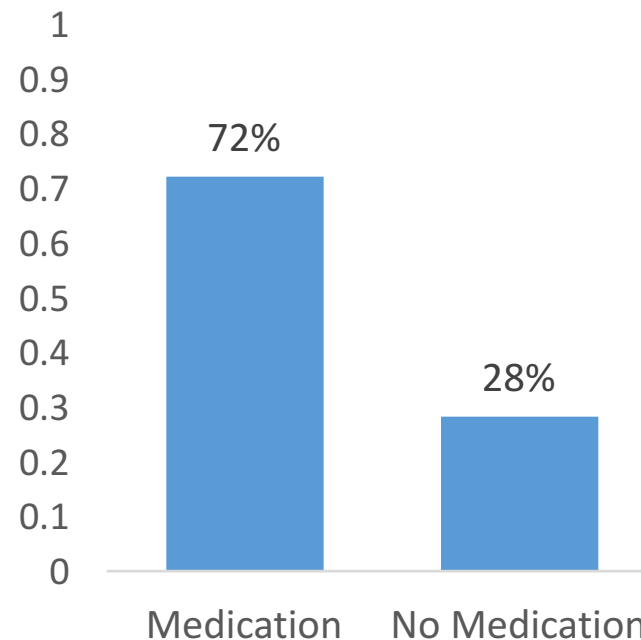


Figure 13.5 How incidental emotions affect decisions regarding setting prices to sell or buy an item. (Source: Based on data from J. S. Lerner, D. A. Small, & G. Lowenstein, *Heart strings and purse strings: Effects of emotions on economic transactions*, *Psychological Science*, 15, 337–341, 2004).

Making Decisions

Context can affect decisions

- E.g., The number of options
- A more difficult decision can lead to no decision
- Given a case and asked physicians whether they would prescribe arthritis medication
- Group1: Med vs. no Med
- Group2: Med 1 vs Med 2 vs no Med



Making Decisions

Context can affect decisions

- E.g., The immediately prior experience
- Given a test case and asked physicians whether they should perform a caesarian section
- If given a non-serious case first, they perceived the test case as more dangerous

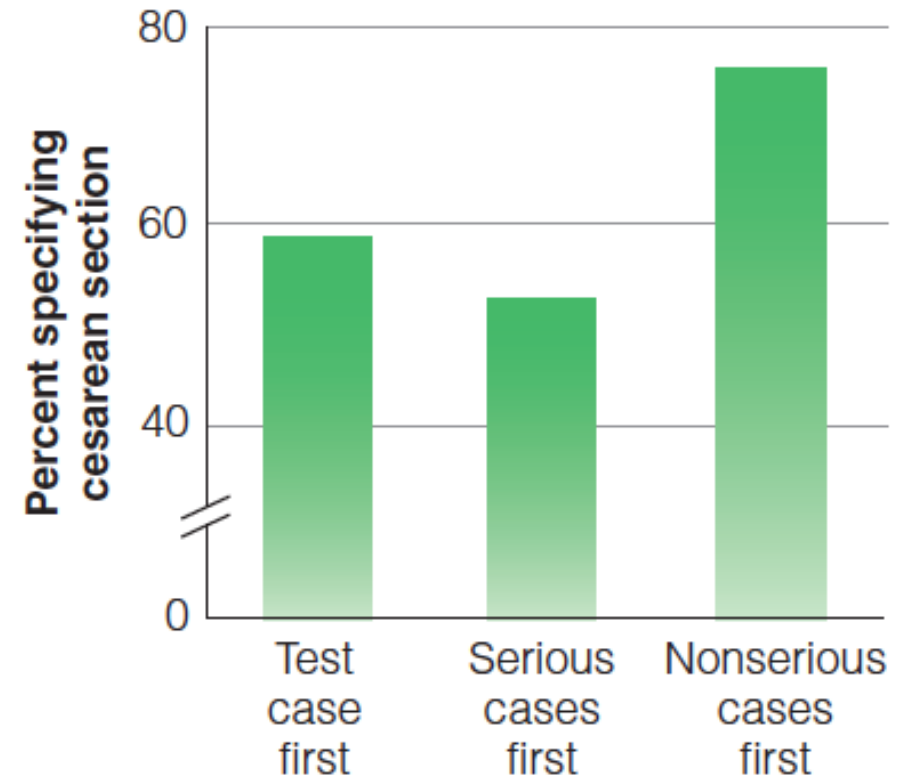


Figure 13.6 The effect of context on decision making. The likelihood

Making Decisions

Decisions depend on how choices are presented

- Opt-in procedure
 - Active step to be organ donor
- Opt-out procedure
 - Organ donor unless request not to be
- Status quo bias
 - The tendency to do nothing when faced with making a decision
- Counties that have opt-out procedures have a 99% consent rate versus 28% in the US (opt-in)

Making Decisions

Decisions depend on how choices are presented



- Risky decisions
 - Risk-aversion strategy used when problem is stated in terms of gains
 - Risk-taking strategy when problem is stated in terms of losses

Making Decisions

Decisions depend on how choices are presented



WHAT WOULD YOU DO?

Imagine that the United States is preparing for the outbreak of an unusual disease that is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows:

- If Program A is adopted, 200 people will be saved.  72%
- If Program B is adopted, there is a 1/3 probability that 600 people will be saved, and a 2/3 probability that no people will be saved.  28%

Which of the two programs would you favor?

Now consider the following additional proposals for combating the same disease:

- If Program C is adopted, 400 people will die.  22%
- If Program D is adopted, there is a 1/3 probability that nobody will die, and a 2/3 probability that 600 people will die.  78%

Which of these two programs would you pick?

Making Decisions

- **Framing effect:** decisions are influenced by how a decision is stated
 - Can highlight one aspect of situation
 - Tversky and Kahnemann (1981)
 - When situations are framed in terms of gains, people tend toward a risk-aversion strategy
 - When situations are framed in terms of losses, people tend toward a risk-taking strategy

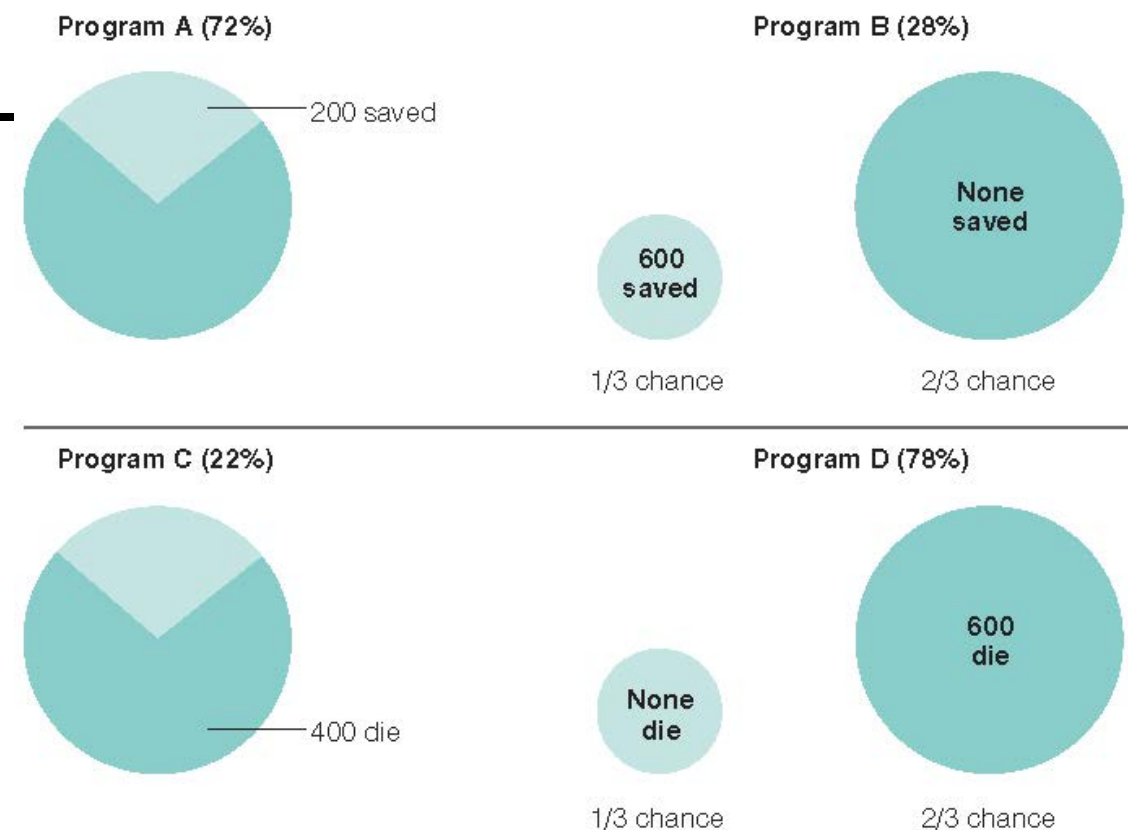


Figure 13.7 How framing affects decision making. These pie charts diagram the conditions set forth for Programs A, B, C, and D in the text. Note that the number of deaths and probabilities for Programs A and B are exactly the same as for Programs C and D. The percentages indicate the percentage of participants who picked each program when given choices between A and B or between C and D. (Source: Based on A. Tversky & D. Kahneman, *The framing of decisions and the psychology of choice*, Science, 211, 453–458, 1981.)

Deductive Reasoning

- Determining whether a conclusion *logically follows* from premises
- **Syllogism**
 - Two statements called premises
 - Third statement called conclusion
- **Categorical syllogism**
 - Describe relation between two categories using *all*, *no*, or *some*

Deductive Reasoning

- **Syllogism** is valid if conclusion follows *logically* from its two premises
- If two premises of a valid syllogism are true, the syllogism's conclusion must be true
 - Do not confuse “validity” with “truth”
 - Example: Valid, but not true

Syllogism 2

All birds are animals. (All A are B)

All animals have four legs. (All B are C)

All birds have four legs. (All A are C)

Deductive Reasoning

- Many errors in evaluation
 - Belief bias: The tendency to think that a syllogism is valid if its conclusions are believable

Syllogism 3

All of the students are tired. (All A are B)

Some tired people are irritable. (Some C are D)

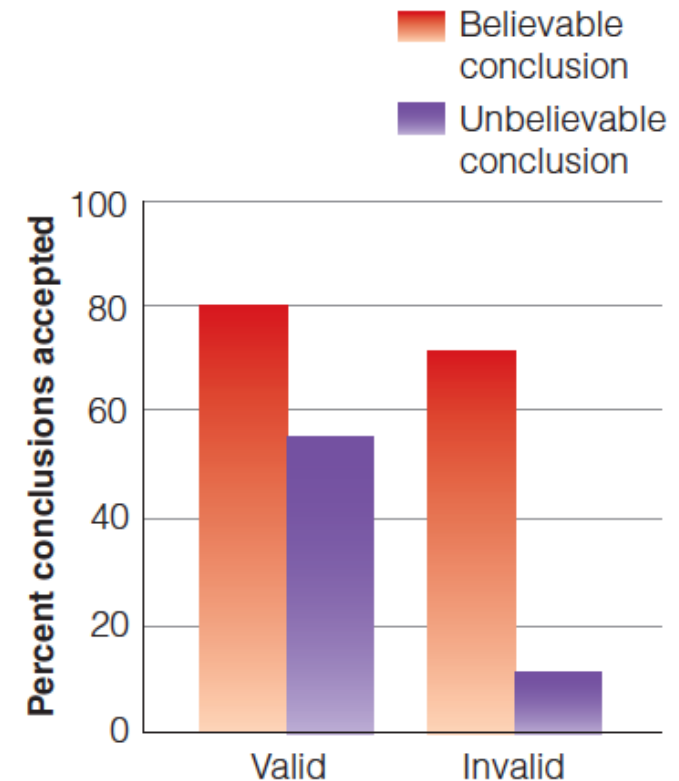
Some of the students are irritable. (Some A are D)

Syllogism 4

All of the students live in Tucson. (All A are B)

Some people who live in Tucson are millionaires. (Some C are D)

Some of the students are millionaires. (Some A are D)



Deductive Reasoning

- **Conditional syllogisms**

- “If p , then q ”
- 1. If I study (p), then I’ll get a good grade (q)
- 2. I studied (p)
- Therefore,
- I got a good grade

Table 13.4: Four Syllogisms That Begin With the Same First Premise
First premise of all syllogisms: If p , then q .

SYLLOGISM	SECOND PREMISE	CONCLUSION	IS IT VALID?	JUDGED CORRECTLY?
Syllogism 1: <i>Modus ponens</i>	p	Therefore, q	Yes	97%
Syllogism 2: <i>Modus tollens</i>	Not q	Therefore, not p	Yes	60%
Syllogism 3	q	Therefore, p	No	40%
Syllogism 4	Not p	Therefore, not q	No	40%

Deductive Reasoning

- **Wason four-card problem**
- Effect of using real-world items in a conditional-reasoning problem
- Determine minimum number of cards to turn over to test: *if there is a vowel on one side, then there is an even number on the other side*



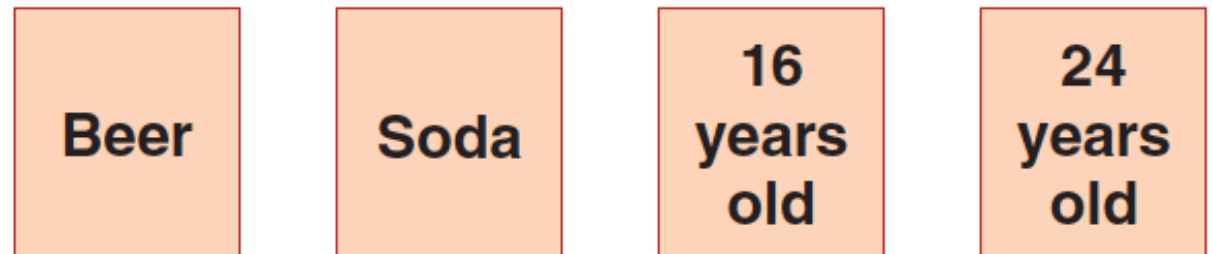
If vowel, then even number.

Figure 13.13 The Wason four-card problem (Wason, 1966). Follow the directions in the demonstration and try this problem. (Source: Based on P. C. Wason, *Reasoning*, in B. Foss, Ed., *New horizons in psychology*, pp. 135–151, Harmondsworth, UK: Penguin, 1966.)

Deductive Reasoning

Wason four-card problem

- Falsification principle: to test a rule, you must look for situations that falsify the rule
- Most participants fail to do this
- When problem is stated in concrete everyday terms, correct responses greatly increase
- “If a person is drinking beer, then or she must be over 19 years old”
- Which cards do you have to turn over?



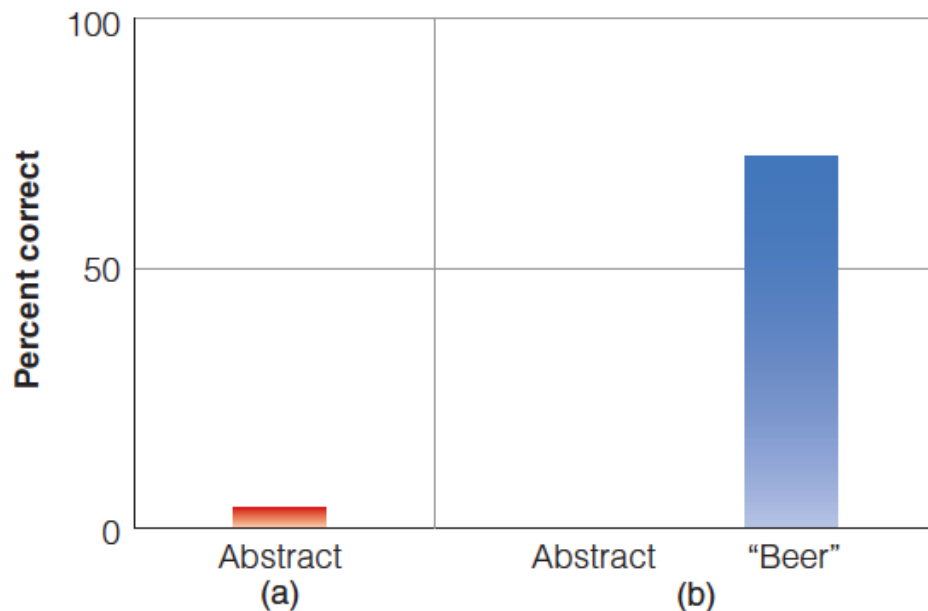
If drinking beer, then over 19 years old.

Figure 13.15 The beer/drinking-age version of the four-card problem. (Source: Based on R. A. Griggs & J. R. Cox, *The elusive thematic-materials effect in Wason's abstract selection task*, British Journal of Psychology, 73, 407–420, 1982.)

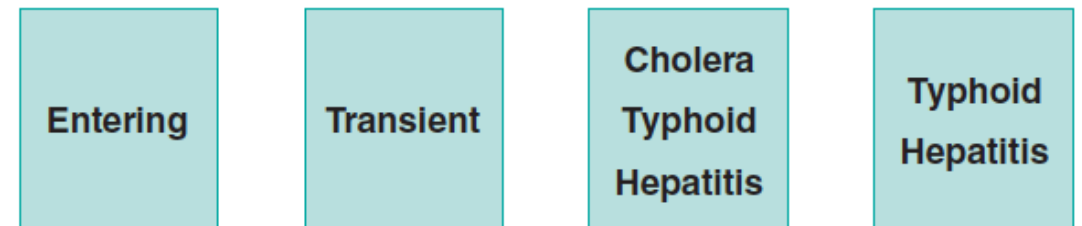
Deductive Reasoning

Wason four-card problem

- Permission schema: if A is satisfied, B can be carried out
 - Used in the concrete versions but not abstract
 - People are familiar with rules



62% when normal vs. 91% as permission to enter



If entering, then cholera is listed.

Figure 13.17 Cholera version of the four-card problem.
(Source: Based on P. W. Cheng & K. J. Holyoak, *Pragmatic reasoning schemas*, *Cognitive Psychology*, 17, 391–416, 1985.)

Deductive Reasoning

Wason four-card problem

- Alternative explanation: Evolutionary principles of natural selection
 - Wason task governed by built-in cognitive program for detecting cheating
 - In contrast to permission schema
- Social Exchange Theory
 - An important aspect of human behavior is the ability of two people to cooperate in a way that is beneficial to both of them

Deductive Reasoning

- Cosmides and Tooby (1992)
 - Created unfamiliar situations using the Wason task where cheating could occur
 - Can't use our "permission schemas"
 - Participants did well, when trying to catch cheaters
 - Evidence against permission schema