

# Reasoning and Decision Making



Logical reasoning types and errors in reasoning processes.

Concept formation and categorization; Judgment and decision making

# Reasoning

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- Reasoning is the use of information to reach conclusions. There are two main types of reasoning: deductive and inductive.
- People use a variety of methods to make decisions, including using a balance sheet and some types of heuristics.

# Deductive reasoning

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- In **deductive reasoning**, the **conclusion** is true if the premises are true.
- A **premise** is an idea or statement that provides the basic information that allows us to draw conclusions.
- In deductive reasoning, we usually start out with a general statement or principle and reason down to specifics that fit that statement or principle.

# Inductive reasoning

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- In **inductive reasoning**, we reason from individual cases or particular facts to reach a general conclusion.
- In inductive reasoning, the conclusion is sometimes wrong, even when the premises are correct.
- Even though inductive reasoning does not allow us to be certain that our assumptions are correct, we use inductive reasoning all the time.

# Reasoning and Logic

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- Two forms to be covered:
  - Syllogisms – a 3-statement logical form, the 1<sup>st</sup> two parts state premises or statements assumed to be true, and the 3<sup>rd</sup> part is a conclusion based on those premises
  - Conditional reasoning – a logical determination of whether evidence supports, refutes, or is irrelevant to the stated if-then relationship

# Syllogisms

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## □ Abstract:

- All members of category A are members of category B.
- All members of category B are members of category C
- Therefore, all members of category A are members of category C

## □ More concrete example:

- All psychology students are intelligent
- All intelligent people are rich
- Therefore all psychology students are rich

# Conditional Reasoning

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- An if – then statement where the if part is the antecedent and the then statement is the consequence
  - If the antecedent is true, the consequence is true, or
  - If the antecedent exists, the consequence exists

# Error in reasoning processes

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- i) **Belief-bias effect**—the tendency to be more likely to accept a “believable” conclusion to a syllogism than an “unbelievable” (Klauer et al., 2000).
- ii) **Hypothesis testing-** Most people come up with a hypothesis, then test only sequences that obey the rule. They don’t test sequences that could *disconfirm* the rule.



# Believability effects

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- ❑ Some college professors are intellectuals.
- ❑ Some intellectuals are liberals.
- ❑ Therefore, some college professors are liberals.
- ❑ This is NOT VALID reasoning, but it does sound believable!

# Hypothesis testing

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The number sequence “2, 4, 6” follows a rule. Guess what the rule is. Give me another three-number sequence to test your rule.

# Concept formation and categorization

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- ❑ **Concept formation:** The introduction of concepts that divide items into classes according to their shared properties (categorization).
- ❑ **Categorization** is the process in which ideas and objects are recognized, differentiated, and understood. It implies that objects are grouped into categories, usually for some specific purpose. Ideally, a category illuminates a relationship between the subjects and objects of knowledge.

# Types of concept:

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- (i) **Basic level concept** -- based on similarity of perceptual qualities (e.g., bird, flower).
- (ii) **Superordinate concept** -- groups of basic level concepts; **not** based on perceptual similarity (e.g. politician, tools).
- (iii) **Abstract concept** -- does not refer to individual entity, but to some property, relation or state (e.g., sameness, truth).

# Decision Making

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- Decision Making refers to the cognitive process resulting in the selection of a belief or a course of action among several alternative possibilities. Every **decision-making** process produces a final choice, which may or may not prompt action.

# Decision Making

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- Two types of decisions
  - Making choices (selecting among alternatives)
  - Taking chances (deciding amidst uncertainty)

# Heuristics leading to cognitive illusions

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- **Availability**: assess probability by the ease with which relevant examples come to mind
- In English, is the letter L more likely to come at the beginning of a word, or appear as the third letter of a word?
- *Correct answer = third letter*

# Representativeness heuristic

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- We expect results to be representative of the processes that generate them.
- “Heads–Tails–Heads–Heads–Tails” looks more random than “Heads–Heads–Tails–Tails–Tails,” even though both are equally probable.



# Framing effects

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- ❑ Store A sells meat that is 95% lean.
- ❑ Store B sells meat that is 5% fat.
- ❑ Most people would prefer to shop at Store A, even though the two sell the same thing.
- ❑ Positive frames cause you to set a different reference point than negative frames do.
- ❑ And in general, we take “losses” more seriously than “wins” of the same amount.

# Anchoring

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- ❑ Two groups of students estimate the answer to two problems:
- ❑ Group A estimates  $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8$
- ❑ Group B estimates  $8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$
- ❑ Not enough time to perform whole calculation, so groups typically perform the first 2 or 3 calculations and adjust upward from this anchor

# Other decision biases

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- ❑ **Sunk cost effects**: tendency to stick with a losing strategy because you've already invested so much in it
- ❑ **Illusory correlation**: we see relationships where there really are none, because of some prior association in our minds
- ❑ **Hindsight bias**: After the fact, we believe we "knew it all along"

# Utility models of decision making

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- Expected value combines information about the probabilities and values of possible outcomes of a risky decision.
- Example: A game in which you have  $1/10$  chance of winning \$10,  $3/10$  chance of winning \$5, and  $6/10$  chance of winning \$0.

# Expected utility

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- ❑ Expected value works with monetary values as outcomes, but what about other types of outcomes? Success/failure, relationships, jobs, etc.
- ❑ Concept of utility allows us to rate the positive and negative consequences of non-monetary outcomes, and plug them into a formula like that used in EV.

# Multiattribute Utility Theory

## (MAUT)

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- ❑ What if the choices differ on many dimensions?
- ❑ Example: Choosing a major
- ❑ Majors differ in many ways: your interest in them, the job market after graduation, the faculty, etc.
- ❑ How should one choose?

# Steps in MAUT

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1. Break the decision down into its important dimensions.
2. Determine the relative weight (importance) of each dimension.
3. List all of the alternatives.
4. Rank the alternatives along each dimension.
5. Multiply each ranking by the appropriate weight.
6. Choose the alternative with the highest value.

# Decisions under situations of certainty

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- You have all the necessary information to make a correct decision
  
- Frequently studied – decisions about physical differences
  - Our decisions about which stimulus is the brightest , smallest, heaviest, etc. depends upon factors other than the physical difference between them.
  - Example: The determination of which of 2 lights is brightest depends upon the physical difference, but also the absolute brightness of the light, the brightness of the background, and how long the lights were visible.



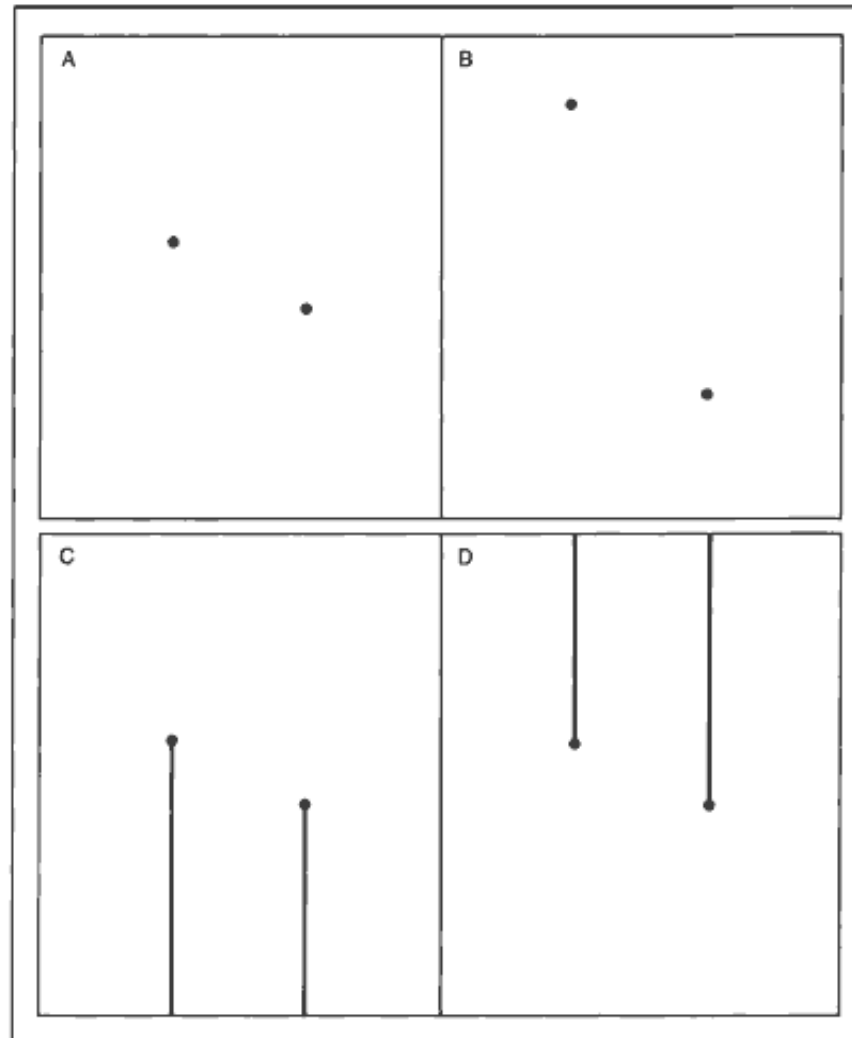
# Distance or discrimination effect

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- ❑ The greater the distance or difference between two stimuli being compared, the faster the decision about their differences
- ❑ Symbolic distance effect – comparisons between two symbols that represent two stimuli – like drawings
  - Differs from distance effects in that it requires semantic and other memory processes

# Examples

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# Judgment and decision making in situations of uncertainty

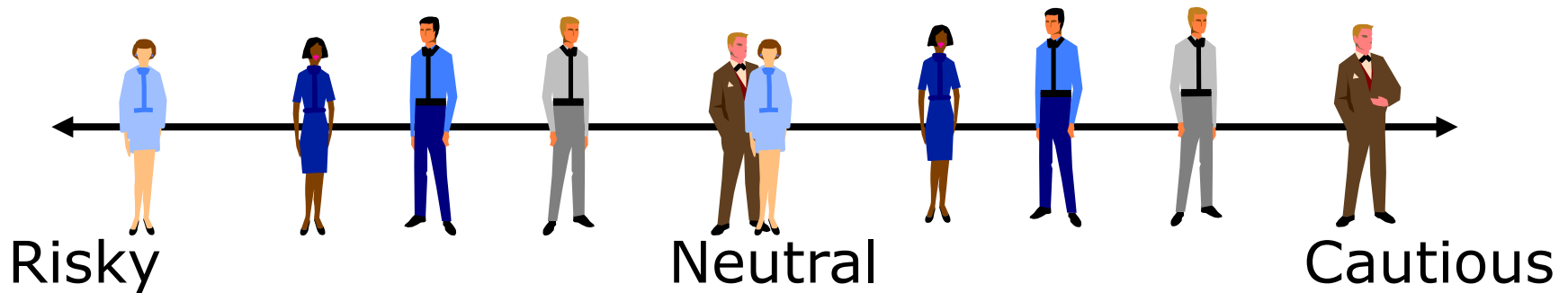
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- ❑ The individual is not given all the information necessary to be certain of the answer and has to use previously acquired knowledge
- ❑ Primary problem: lack of knowledge and misinterpretation

# Group decision making: frequent error

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***Group Polarization-*** *tendency to shift toward more extreme positions after group discussion*



Q1. Deductive reasoning involves which of the following?

**a. going from general to specific statements**

~~b. conclusions that add new information to what is given~~

c. going from specific to general statements

d. going from specific to specific statements

e. going from general statements to generating new information

Q 2. Which type of reasoning results in conclusions that contain new information?

**a. inductive reasoning**

b. deductive reasoning

c. invalid reasoning

d. both inductive and deductive reasoning

e. neither inductive nor deductive reasoning

□ Q3. The tendency to seek out information that supports our current beliefs is called:

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- a. a believability effect.
- b. a content effect.
- c. a confirmation bias.**
- d. syllogistic reasoning.
- e. false induction.

Q 4. When we assess probability by judging the ease with which relevant examples come to mind, we are using the heuristic of:

- a. representativeness.
- b. availability.**
- c. framing.
- d. hindsight.
- e. the law of small numbers.

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Q5. Because of the representativeness heuristic, we are likely to erroneously assume that which of the following sequences of coin flips is more probable?

- a. heads-heads-heads-heads-heads
- b. heads-tails-heads-tails-heads
- c. heads-heads-tails-tails-tails
- d. tails-tails-tails-tails-heads
- e. heads-tails-heads-tails-tails**