Reasoning and Decision Making

Learning Objective Topics

- Deductive vs. Inductive Reasoning
- Inductive Reasoning
  - Heuristics
- Utility and Emotions
- Neuroscience
  - Prefrontal Damage
  - Neuroeconomics
Reasoning and decision making

- Reasoning
  - Conclusions beyond info provided
  - Deductive reasoning
  - Inductive reasoning
- Decision making
  - Make choices
- Psychology research questions
  - Do people think logically?
  - How well can people evaluate problems?
  - How do we represent information?
  - What are the biases in reasoning?

Deductive Reasoning

- Syllogism
  - Two statements called premises
  - Third statement called conclusion
- Aristotle’s “perfect” syllogism
  - Premise 1: all A are B
  - Premise 2: all B are C
  - Conclusion: Therefore, all A are C
Deductive Reasoning

- Syllogism is valid if conclusion follows logically from its two premises
- Valid vs True
  - All mammals are warm-blooded.
  - Black dogs are mammals.
  - Therefore, black dogs are warm-blooded.
  - Valid?
  - True?

Syllogisms

- Valid?
  - All birds are animals.
  - All animals have four legs.
  - Therefore, all birds have four legs.
Syllogisms

- Valid?
  - People who have just run a marathon sweat profusely.
  - You are sweating profusely.
  - Therefore, you have just run a marathon.

Inductive Reasoning

- Conclusion based on what is PROBABLY true
- Premises are based on observation
- Example:
  - Observation: Wofford has canceled classes for an ice storm since I’ve been here.
  - Conclusion: Wofford will probably cancel classes for the upcoming ice storm.
  - What would make this a stronger argument?
- When have you used inductive reasoning?
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Heuristics

- What are heuristics?
- Availability Heuristic
- Representativeness Heuristic
Availability Heuristic

- Events more easily remembered
- judged as being more probable

- How likely is there to be violence in schools?
  - 1999 estimate of violence in schools was higher
  - What memory effect does this display?

Availability heuristic

- Are there more words that have K in the 1st position or 3rd?
- “What is more likely...” (e.g. diseases)
- Availability heuristic
  - How easily examples come to mind
  - Generally correct, but can lead to errors

<table>
<thead>
<tr>
<th>More Likely</th>
<th>Less Likely</th>
<th>Percent Picking Less Likely</th>
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<tbody>
<tr>
<td>Homicide (20)</td>
<td>Appendicitis</td>
<td>9</td>
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<td>Drowning (5)</td>
<td>Auto-train collision</td>
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<td>Asthma (920)</td>
<td>Botulism</td>
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<td>Appendicitis (2)</td>
<td>Pregnancy</td>
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Availability Heuristic

- Illusory Correlations
  - *How have illusory correlations led to stereotypes for you?*
  - Is it easy for people who go to law school to get jobs?

- Familiarity
  - Divorced individuals give higher estimated divorce rates

Reasoning problem

- Mary graduated from Georgetown University. She remained in the Washington, D.C., area for employment opportunities following graduation. She reads the newspaper every day, first absorbing the political section in its entirety. Mary has voted in every election (national and local) and has worked as a political activist since she turned 18. Is Mary more likely to become an elementary school teacher or a Supreme Court clerk?
  - Most people ignore the base rate
    - How many there are in the general population
The probability that A comes from B can be determined by how well A resembles properties of B
- Use base rate information if it is all that is available
- Use descriptive information if available and disregard base rate information

You are picking lottery numbers. Which outcome is more likely?
- 12345 or 35142
- 35142 judged as representative of “random”
  - People think that it’s more likely to occur
Representativeness heuristic

- Joseph is ambitious, power hungry, and a wheeler and dealer
  - Is it more likely that Joseph is a college professor or college professor and politician
- Conjunction Rule
  - Probability of being 2 things can not be higher than overall category

Representativeness heuristic

- Coin toss: what is the likelihood that I will get heads vs. tails?
- Let’s try it:
  - 1 toss
  - 10 tosses
  - 30 tosses
- Small-sample fallacy
  - Ignore law of large numbers: larger sample = more representative
  - Descriptions change reasoning
- Hospital example: larger hospital = more represented sample
Confirmation Bias

- Lord and coworkers (1979)
  - Had those in favor of capital punishment and those against it read the same article
    - Those in favor found the articles in favor more convincing
    - Those against found the articles against more convincing
  - When have you seen this?

Framing

- Quick survey
- What does this tell us about how to design surveys?
Framing: medical decisions

- Hospital physicians asked which form of treatment for patient with lung cancer (surgical or 6wk radiation)
- IV: prior information (framing)
  - “Of 100 people having surgery, 10 will die during treatment, 32 will have died by 1yr, and 66 will have died by 5yrs. Of 100 people having radiation therapy, none will die during treatment, 23 will have died by 1yr, and 78 will have died by 5yrs.”
  - “Of 100 people having surgery, 90 will be alive immediately after treatment, 68 will be alive after 1yr, and 34 will be alive after 5yrs. Of 100 people having radiation therapy, all will be alive after treatment, 77 will be alive after 1yr, and 22 will be alive after 5yrs.
- Results:
  - Framed in terms of dying: 44% choose radiation
  - Framed in terms of living: 18% choose radiation

Why are we imperfect?

- Why use heuristics?
- Less effort, less to remember
  - Economical
- Faster to answer
- Usually correct
  - Effective
- Reduce errors
  - Approximation
- Examples/Problems purposefully created to create “errors”
  - Help us understand cognitive process
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Decision making

- Utility approach
  - If have all information, will choose most desirable outcome
- BUT it is complicated what is valuable:
  - Not all pieces can be calculated
  - Potential for inaccurate mental simulations
  - Poor at predicting emotional reactions
TED Talk


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Prefrontal Cortex (PFC) Damage

- Interferes with ability to act in a flexible manner (important for problem-solving)
  - Perseveration: cannot switch from one pattern of behavior to another
- As reasoning problems become more complex, larger areas of the PFC are activated

Neuroscience of thinking

- Damage to PFC has effect on:
  - Planning and perseveration
  - Problem solving
  - Understanding stories
  - Reasoning
- Application: teenagers
Neuroeconomics

- Economic decision making problems

- Examine influence of emotion (and mood) on decisions
  - Expected emotions (predicted)
  - Immediate emotions: integral vs incidental
  - Emotion determines risk aversion (impact of loss greater than gain)

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Neuroeconomics

  - Ultimatum game (how to split $)
  - IV: human vs computer partner
  - Result: humans reject low offers b/c “unfair”
  - Brain activity: Anterior insula activation when rejected offer

  - View film (sad, disgust, neutral)
  - Decision conditions:
    - Sell: Set price to sell product
    - Choice: price willing to choose product instead of accepting $
  - Result: sad/disgust grps set price lower