

## Chapter 11 – Decision Making

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### Syllogism

- All men are mortal. (**major premise**)
- Socrates is a man. (**minor premise**)  
(therefore)
- Socrates is mortal. (**conclusion**)

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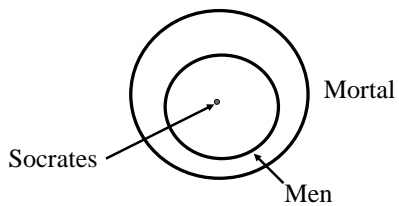
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### The Logic



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### An Abstract Syllogism

- All A are B. (**major premise**)
- All C are B. (**minor premise**)  
(therefore)
- All A are C. (**conclusion**)
  
- True or False?

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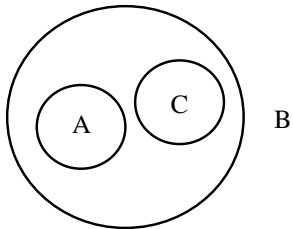
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### The Logic



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### A Concrete Syllogism

- All Liberals are human. (**major premise**)
- All Conservatives are human. (**minor premise**)  
(therefore)
- All Liberals are Conservatives. (**conclusion**)
  
- True or False?

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### Form vs Content

- All dogs are animals. (**major premise**)
- Some animals are pets. (**minor premise**)  
(therefore)
- Some dogs are pets. (**conclusion**)
  
- True or False?

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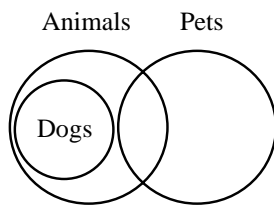
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### The Logic



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### Form vs Content

- All sharks are animals. (**major premise**)
- Some animals are pets. (**minor premise**)  
(therefore)
- Some sharks are pets. (**conclusion**)
  
- True or False?

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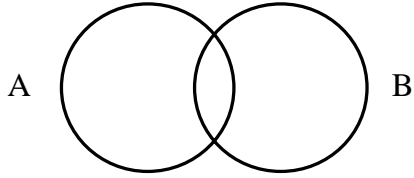
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Logic & Venn Diagrams



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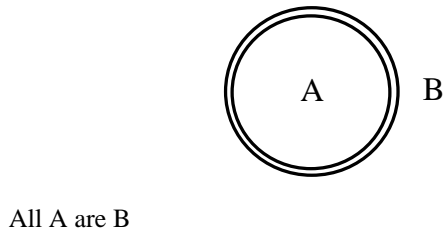
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Logic & Venn Diagrams



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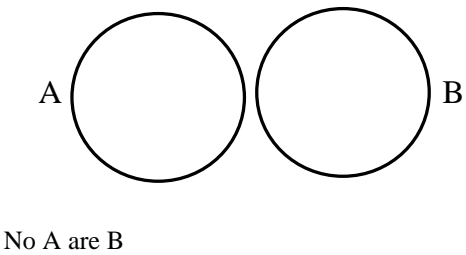
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Logic & Venn Diagrams



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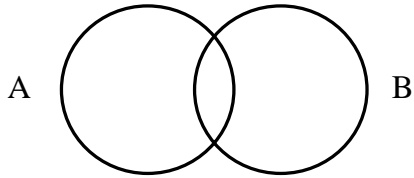
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## Logic & Venn Diagrams



Some A are B;  
Some A are not B

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## Conditional Reasoning

- A logical determination of whether the evidence supports, refutes, or is irrelevant to the stated relationship
- Conditional clause
  - antecedent (if clause)
  - consequent (then clause)
- Evidence

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## Example

- Conditional clause:
  - If it is raining, (antecedent)
  - then Dominique gets wet. (consequent)
- Evidence
  1. It is raining
  2. Dominique does not get wet
- Conclusion
  1. Therefore, Dominique gets wet (modus ponens)
  2. Therefore, it is not raining (modus tollens)

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## Definition

- **Judgment:** the processes we use to think about evidence, make inferences, and reach conclusions
- **Induction:** a situation in which one begins with specific facts/observations and draws some general conclusion from them
- **Deduction:** a situation in which one begins with some general statement and figures out what specific claims reasonably follow from it

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## Tversky & Kahneman

Daniel  
Kahneman

- pioneered the research on judgment under uncertainty
- emphasized the heuristics we use to process evidence and make judgments
- early work done at Hebrew University of Jerusalem

Amos  
Tversky

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## Accounts of Reasoning

- **Normative:** how things ought to go; what people should do
- **Descriptive:** how things are; what people actually do (do)
- **Heuristic:** a short cut; a strategy that risks error to gain efficiency (speed)
- **Algorithm:** a guaranteed route to an outcome, which may be more tedious and effortful

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- **Question:** Are there more words beginning with “r” (rabbit, rock, etc) or with an “r” in the third position (throw, care, etc)?

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### Availability Heuristic

- scan quickly through memory seeking relevant instances
- if instances come quickly to mind, they are likely to be frequent in experience
- availability or accessibility in memory serves as a proxy for frequency in experience
- but the organization of memory can create biases

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### Slovic, Fischhoff & Lichtenstein (1976)

- Subjects asked to estimate frequency of various causes of death.

Cause	S. estimate	Truth
Tornado	564	90
Fireworks	160	6
Asthma	506	1886
Drowning	1684	7380

(rates per 200million US residents per year)

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## Hindsight Bias

- “hindsight is 20/20”
- the “knew it all along” effect
- looking at a situation retrospectively (after the fact), we saw all the signs leading up to this particular outcome
  - going on 3<sup>rd</sup> (or 4<sup>th</sup>) and 1 in football
  - knowing the outcome of an experiment before it is conducted
  - knowing a relationship would fall apart

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## Confirmation Bias

- we are more alert and more responsive to evidence that confirms our beliefs/conclusions than to evidence that might challenge them
  - prejudices
  - hiring decisions

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## Anchoring

- people are influenced toward a possible anchor value, even if they should know better

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## Representativeness Heuristic

- assume that each member of a category is representative of that category (like the prototype?), and has all its traits
- also assume the reverse—if something has a lot of the traits of a category, it probably belongs to that category
- be willing to draw conclusions from a quite small sample: “seen one, seen ‘em all”
- the gambler’s fallacy...

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## Kahneman & Tversky (1973)

- Estimate the base rate of percentages of first-year graduate students in the following nine fields of specialization.
- Business Administration
- Computer Science
- Engineering
- Humanities and Education
- Law
- Library Science
- Medicine
- Physical and Life Sciences
- Social Science and Social Work

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## Kahneman & Tversky (1973)

Tom is of high intelligence, though lacking in true creativity. He has a need for order and clarity, and for neat and tidy systems in which every detail finds its appropriate place. His writing is rather dull and mechanical, occasionally enlivened by somewhat corny puns and by flashes of imagination of the sci-fi type. He has a strong drive for competence. He seems to have little feel and little sympathy for other people and does not enjoy interacting with others. Self-centred, he nonetheless has a deep moral sense.

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### Kahneman & Tversky (1973)

- How similar is Tom W. to the typical graduate student in each of the following nine fields
- Personality sketch of Tom W. was from senior year of high school and was based on projective tests like the Rorschach. Predict the likelihood the Tom W. is currently a graduate student in each field.

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### Kahneman & Tversky (1973)

- How likely is it that Tom is a comp. sci. student versus humanities student?
- 95% pick comp. sci.
- base rate estimations by other subjects had humanities as 3 times more likely
- Similarity judgments closely mirrored the likelihood judgments not base rate
- Despite projective tests are unreliable, and things change from high school to grad. school

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### Simulation Heuristic

- **Simulation:** mentally modeling a possible event, and basing likelihood on that model
- these heuristics can also work in combination with each other
- we prefer quicker heuristics to more certain statistics!

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## Decisions are Demanding

- Posner & Boies (1971)
- the dual task technique
  - secondary task measures resource demands or spare capacity (like a thermometer) of the primary task at various points
- primary task = letter matching (Aa, AA, AB)
- secondary task = turn off tone on some trials; short RT = low resources in primary task

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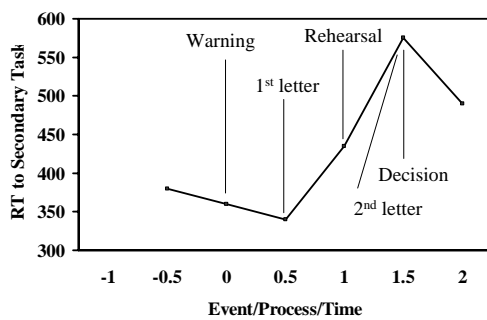
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## Capacity & Decision




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## A Process Account

<i>Task</i>	<i>Process</i>
1. wait	none?
2. warning	alerting
3. first letter	LTM retrieval
4. delay	WM rehearsal
5. second letter	a) LTM retrieval b) trace matching c) decision (response choice) d) motor output

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## Decision Making

- reasoning about choices
- each decision has **costs** (taking us farther from our goals) and **benefits** (moving us toward our goals; providing our values)
- we must weight the costs against the benefits
- **subjective utility**: the value of a given factor
- goal of making decision to maximize utility
- von Neumann & Morgenstern (1947)

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## Expected Utility

- **expected utility** = (Probability of an outcome) X (Utility of that outcome)
- lottery ticket = \$1
- likelihood of winning = 1 out of 14,000,000
- prize = \$2,000,000
- expected utility =  $(1/14M) \times (\$2M) = \$0.14$
- therefore, you are giving away 7.14 times what you can expect to receive each time!

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## Framing

- Assume yourself richer by \$300 than you are today. You must choose between
  - a sure gain of \$100
  - a 50% chance to gain \$200 or gain nothing
- Assume yourself richer by \$500 than you are today. You must choose between
  - a sure loss of \$100
  - a 50% chance to lose nothing or lose \$200

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### More Framing...

- Imagine that Canada is preparing for the outbreak of a new disease, which is expected to kill 600 people
- Two alternatives have been suggested in lab work  
A: 200 people saved  
B: 1/3 probability that all 600 people will be saved, but a 2/3 probability that none of the 600 will be saved
- Contrast this with these alternatives  
A: 400 will die  
B: 1/3 probability that no one will die but a 2/3 that all of the 600 will die

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### More Framing...

- You are going to see a play at a theatre, but discover upon arrival that you have lost your \$10 ticket. Will you buy a new one?
- You are going to the theatre to see a play, and discover that you have lost \$10. Tickets cost \$10. Will you buy one?

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### Framing

- phrasing of the decision affects our choice
- framing in terms of **losses** tends to make us **risk-seeking**
- framing in terms of **gains** makes us **risk averse**

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## How Do We Decide?

- utility theory: quantification and calculation
- social psychology: argument and justification
  
- social and emotional factors often win
- we like to be able to explain and justify our choices to others
- this is the descriptive theory

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## Tversky & Shafir (1992)

- You have the option of buying a highly desired vacation package after passing an exam. Do you do it?
- Most of us (~60%) will because we're **celebrating**
- But most of us (~60%) will also buy it after failing—**consolation**
- However, if we **don't know** how we did on the exam, only about **33%** of us will buy it
- Pass/fail information isn't relevant, but having some information so that we can justify it is obviously important

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## Normative Theory?

- need for reasonable choices, with integrity
- utility is not the only goal, or even necessarily the most important one
- what about moral decisions?
- justification is critical—need to make sensible and defensible decisions
- no accepted normative theory

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