Heuristics and Biases
(Tversky and Kahneman 1974)

Heuristics are used to reduce mental effort in decision making, but they may lead to systematic biases or errors in judgment.

1. Representativeness heuristic
2. Availability heuristic
3. Anchoring and adjustment
4. Decision framing
5. Prospect theory

Representativeness Heuristic
Used to judge membership in a class
Judge similarity to stereotypes

- People are insensitive to prior probability of outcomes
  They ignore preexisting distribution of categories or base rate frequencies

- People are insensitive to sample size
  They draw strong inferences from small number of cases

- People have a misconception of Chance: Gambler’s Fallacy
  They see a ‘normal’ event and think it ‘rare’:
  they think chance will ‘correct’ a series of ‘rare’ events

- People have a misconception of Regression:
  They see a ‘rare’ event and think it ‘normal’:
  they deny chance as a factor causing extreme outcomes


Representativeness Examples (1)

Susan is very shy and withdrawn, invariably helpful, but with little interest in people, or in the world of reality.
A meek and tidy soul, she has a need for order and structure, and a passion for detail.

Is Susan a Librarian, a Teacher, or a Lawyer?

Representativeness Examples (2)

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 anti-nuclear demonstrations.

Is Linda a Bank Teller?
Is Linda a feminist Bank Teller?
Availability Heuristic

Used to judge likelihood or frequency of event, occurrence

People tend to be biased by information that is easier to recall: they are swayed by information that is vivid, well-publicized, or recent

People tend to be biased by examples that they can easily retrieve: they use these search examples to test hypotheses

People tend to correlate events that occur close together

---

Availability Examples

Consider these pairs of causes of death:
- Lung Cancer vs Motor Vehicle Accidents
- Emphysema vs Homicide
- Tuberculosis vs Fire and Flames

From each pair, choose the one you think causes more deaths in the US each year.

<table>
<thead>
<tr>
<th>Causes of Death</th>
<th>People’s Choice</th>
<th>Annual US Totals</th>
<th>Newspaper Reports/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung Cancer</td>
<td>43%</td>
<td>140,000</td>
<td>3</td>
</tr>
<tr>
<td>Vehicle Accidents</td>
<td>57%</td>
<td>46,000</td>
<td>127</td>
</tr>
<tr>
<td>Emphysema</td>
<td>45%</td>
<td>22,000</td>
<td>1</td>
</tr>
<tr>
<td>Homicides</td>
<td>55%</td>
<td>19,000</td>
<td>264</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>23%</td>
<td>4,000</td>
<td>0</td>
</tr>
<tr>
<td>Fire and Flames</td>
<td>77%</td>
<td>7,000</td>
<td>24</td>
</tr>
</tbody>
</table>

(Combs & Slovic 1979, see also Kristiansen 1983)
Anchoring and Adjustment

Used to estimate value or size of quantity
Start from initial value and adjust to final estimate

People are influenced by an initial anchor value
anchor may be unreliable, irrelevant
adjustment is often insufficient

People overestimate probability of conjunctive events
People underestimate probability of disjunctive events

Anchors may be qualitative:
people form initial impressions that persist and are hard to change


Anchoring Example

Real estate agents
All inspected house
Given 10-page information pack: features, footage, prices of other houses in area, ...

<table>
<thead>
<tr>
<th>Given asking price</th>
<th>$119,900</th>
<th>Predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appraisal value</td>
<td>$114,204</td>
<td></td>
</tr>
<tr>
<td>Listing price</td>
<td>$117,745</td>
<td></td>
</tr>
<tr>
<td>Purchase price</td>
<td>$111,454</td>
<td></td>
</tr>
<tr>
<td>Lowest acceptable offer</td>
<td>$111,136</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Given asking price</th>
<th>$149,900</th>
<th>Predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appraisal value</td>
<td>$128,754</td>
<td></td>
</tr>
<tr>
<td>Listing price</td>
<td>$130,981</td>
<td></td>
</tr>
<tr>
<td>Purchase price</td>
<td>$127,318</td>
<td></td>
</tr>
<tr>
<td>Lowest acceptable offer</td>
<td>$123,818</td>
<td></td>
</tr>
</tbody>
</table>

Changed asking prices swayed valuations 11-14%
Effects of asking price remarkably large,
given that so much other information on the house was given.

(Northcraft and Neale 1987)
Bayesian Example (1)

- Probability of disease in population is 0.5%
- 10,000 tests are done each year
- Test is 98% accurate
- You tested positive
- What is your chance of actually having the disease?

Bayesian Example (2)

```
  10,000
  /   \
50    9,950
```

Framing Example (1)

A rare disease has broken out, which is expected to kill 600 people. There are two possible programs to combat it, but they cannot both be used. The consequences of each are known:

A. 200 saved with certainty
B. 600 saved with a probability of .33

Which would you choose? Why?

A rare disease has broken out, which is expected to kill 600 people. There are two possible programs to combat it, but they cannot both be used. The consequences of each are known:

A. 400 die for certain
B. 600 die with a probability of .67

Which would you choose? Why?

Framing Example (2)

Which would you choose:
A. Sure gain of $10,000
B. 50% chance of getting $20,000

Which would you choose:
A. Sure loss of $10,000
B. 50% chance of losing $20,000
### Framing Effects & Prospect Theory

**If decision is framed in terms of gains:**
People are RISK AVOIDERS. They protect a smaller gain rather than gamble on a larger gain.

**If decision is framed in terms of losses:**
People are RISK TAKERS. They will gamble riskily rather than accept a smaller loss.

- People prefer 50% chance of $20K loss - $20K + $10K
- Negative Value of $20K Loss < 2 x (Negative Value of $10K Loss)
- People prefer sure gain of $10K

---

### Prospect Theory

**Weighting Function**
- People regard extremely probable events as certain and extremely improbable events as impossible
- Events that are very probable (but not extremely so) are given too little weight
- Events that are very improbable (but not extremely so) are given too much weight

**Value Function**
- For value levels above the reference point, the value function is concave downward
  -> For gains, people are risk avoiders
- For value levels below the reference point, the value function is concave upward
  -> For losses, people are risk lovers

(Kahneman & Tversky 1979, 1992)
Custody Case (1)

Imagine that you are serving on the jury of an only-child custody case following a messy divorce. The facts of the case are complicated by ambiguous economic, social, and emotional considerations, and you choose to base your decision entirely on the following observations. To which parent would you **AWARD** custody of the child?

<table>
<thead>
<tr>
<th>Parent A</th>
<th>Parent B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average income</td>
<td>Above average income</td>
</tr>
<tr>
<td>Average health</td>
<td>Minor health problems</td>
</tr>
<tr>
<td>Average working hours</td>
<td>Lots of work-related travel</td>
</tr>
<tr>
<td>Stable social life</td>
<td>Extremely active social life</td>
</tr>
<tr>
<td>Reasonable rapport with child</td>
<td>Very close relationship with child</td>
</tr>
</tbody>
</table>

Custody Case (2)

Imagine that you are serving on the jury of an only-child custody case following a messy divorce. The facts of the case are complicated by ambiguous economic, social, and emotional considerations, and you choose to base your decision entirely on the following observations. To which parent would you **DENY** custody of the child?

<table>
<thead>
<tr>
<th>Parent A</th>
<th>Parent B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average income</td>
<td>Above average income</td>
</tr>
<tr>
<td>Average health</td>
<td>Minor health problems</td>
</tr>
<tr>
<td>Average working hours</td>
<td>Lots of work-related travel</td>
</tr>
<tr>
<td>Stable social life</td>
<td>Extremely active social life</td>
</tr>
<tr>
<td>Reasonable rapport with child</td>
<td>Very close relationship with child</td>
</tr>
</tbody>
</table>
The Value of a Good Frame

Guarding Against Biases

- Be aware of cognitive biases
- Adopt multiple perspectives
- Act as Devil’s Advocate
  Question assumptions, check inferences
- Consider the improbable or the unpopular
- Make incremental decisions
  Collect feedback, use real options approach
- Use probability and statistics
- Use frameworks and models
  Derived from theory or developed by experts
Real Options Example

Static View

Build Plant?

Demand?

Yes

EV = $50,000

High 1/4

$1 M

Medium 1/2

- $100,000

Low 1/4

- $1 M

No

$0

Real Options Approach

Build Plant?

Demand?

Yes

EV = $300,000

Expand?

High 1/4

$2 M

Expand?

$1 M

Scale Back?

Low 1/4

$100,000

Low 1/4

- $1 M

No

$0


Industry Competitiveness Model

Potential Entrants

Threat of New Entrants

Bargaining Power of Suppliers

Suppliers

Industry Competitors

Rivalry among existing firms

Bargaining Power of Buyers

Buyers

Threat of Substitute Products or Service

Substitutes