Decision Making Process

Perception of current state

- Recognition of problem, opportunity, source of dissatisfaction
- Framing of problem situation and deciding how to decide

Search

- Search for alternatives (look for solutions)
- Generate alternatives (create, enact alternatives)

Evaluation

- Explore and evaluate options
- Outcomes, consequences, effects

Choice

- Select an option to implement
- Basis for making choice and factors influencing choice

Implementation – Outcome – Learning

Levels	Perception	Search	Evaluation	Choice	Actors
Individual	• Search using accessible, familiar sources • Evaluation and choice based on habit, intuition, past experience				Individual …

Levels	Perception	Search	Evaluation	Choice	Actors
Individual	• Search using accessible, familiar sources • Evaluation and choice based on habit, intuition, past experience				Individual …
Group	• **Search requires information sharing among group members** • **Evaluation and choice influenced by group norms, openness, cohesiveness, …**				**Group members and roles, leaders**

Levels	Perception	Search	Evaluation	Choice	Actors
Individual	• Search using accessible, familiar sources • Evaluation and choice based on habit, intuition, past experience				Individual …
Group	• Search requires information sharing among group members • Evaluation and choice influenced by group norms, cohesiveness, openness, …				Group members, leaders
Organization	• **Organization identifies problems to work on** • **Search guided by rules, routines** • **Evaluation and choice based on criteria and premises defined by organization**				**Designated actors, stakeholders, regulators, leaders**

Levels	Perception	Search	Evaluation	Choice	Actors
Individual					
Group					
Organization					

Uncertainty grows as consequentiality increases

Goals and interests becomes increasingly complex, diffused, contested

Information seeking and use intensifies

Heuristics and Biases

(Kahneman and Tversky 1977, Kahneman 2003)

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

1

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

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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.

Which is more likely:

Susan is a Librarian

Susan is a Teacher

Susan is a Lawyer

Tversky, Amos, and David Kahneman. 1974. Judgment Under Uncertainty: Heuristics and Biases. *Science* 185:1124-1131.

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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.

Which is more likely:

Linda is a Bank Teller

Linda is a Feminist Bank Teller

Tversky, Amos, and David Kahneman. 1974. Judgment Under Uncertainty: Heuristics and Biases. *Science* 185:1124-1131.

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Representativeness Examples (3)

Scenario 1.
An all-out nuclear war between US and Russia.

Scenario 2.
A situation in which neither country intends to attack the other side with nuclear weapons, but an all-out nuclear war between US and Russia is triggered by the actions of a third country such as Iran or North Korea.

Which scenario is more likely?

Plous, Scott. 1993. The Psychology of Judgment and Decision Making.

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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

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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.

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

(Combs & Slovic 1979,
see also Kristiansen 1983)

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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

Tversky, Amos, and David Kahneman. 1974. Judgment Under Uncertainty: Heuristics and Biases. *Science* 185:1124-1131.

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Anchoring Example

103 students at Berkeley asked to estimate the population of Chicago:

Is the population of Chicago more or less than 200,000?

What is the population of Chicago?

Is the population of Chicago more or less than 5 million?

What is the population of Chicago?

With the low anchor, the median estimate was 600,000.

With the high anchor, the median estimate was 5.05 million.

(Karen Jacowitz, Kahneman 1995)

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Medical Text 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?

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Sensitivity and Specificity of Medical Tests

	Test result +ve	Test result –ve	
Person has disease	a	c	Sensitivity = a/a+c
Person does not have disease	b	d	Specificity = d/b+d
	Positive predictive value = a/a+b	Negative predictive value = d/c+d	

Sensitivity is the "true positive rate," equivalent to a/a+c.

Specificity is the "true negative rate," equivalent to d/b+d.

PPV is the proportion of people with a positive test result who actually have the disease (a/a+b)

NPV is the proportion of those with a negative result who do not have the disease (d/c+d).

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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. 1/3 probability that 600 are saved
2/3 probability that no one is saved

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:

C. 400 die for certain

D. 2/3 probability that 600 die
1/3 probability that no one dies

Which would you choose? Why?

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Framing Example (2)

Which would you choose:

A. Sure gain of $10,000

B. 50% chance of getting $20,000

Which would you choose:

C. Sure loss of $10,000

D. 50% chance of losing $20,000

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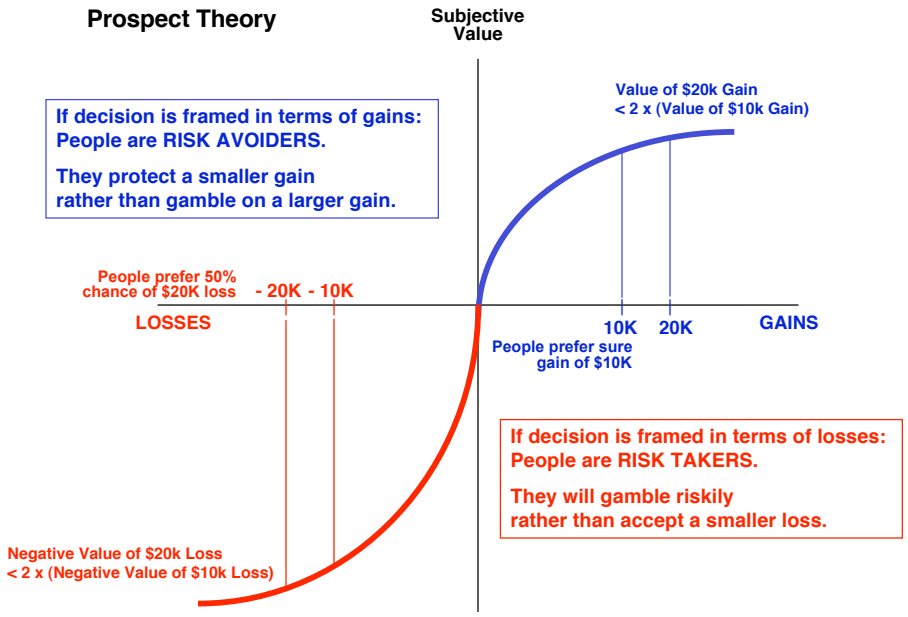
Prospect Theory



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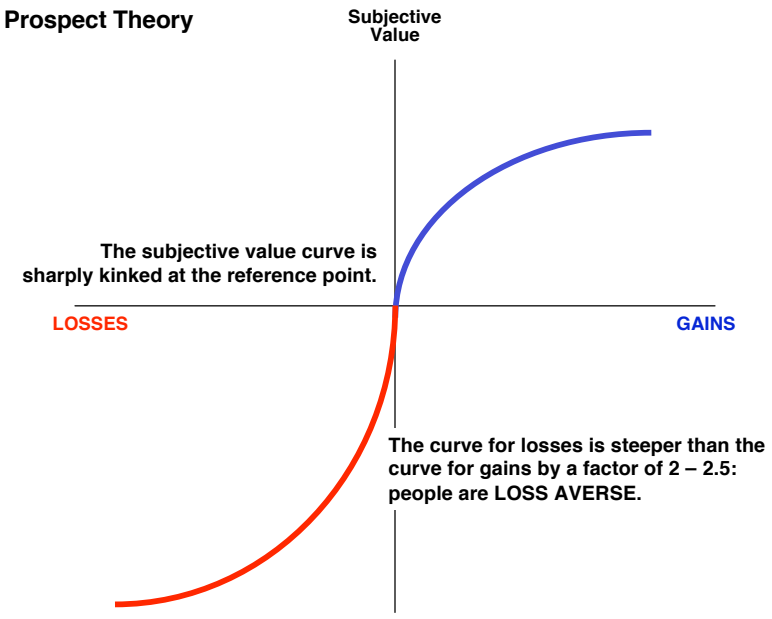
Prospect Theory



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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?

Parent A	Parent B
Average income	Above average income
Average health	Minor health problems
Average working hours	Lots of work-related travel
Stable social life	Extremely active social life
Reasonable rapport with child	Very close relationship with child

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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?

Parent A	Parent B
Average income	Above average income
Average health	Minor health problems
Average working hours	Lots of work-related travel
Stable social life	Extremely active social life
Reasonable rapport with child	Very close relationship with child

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Three Mile Island

After the accident at Three Mile Island, 42 scientists who had publicly advocated or opposed nuclear power development before the accident were asked if they would now change their position on nuclear energy. None of the scientists indicated a change.

Opponents of nuclear energy	Proponents of nuclear energy
Tended to see the accident as a near catastrophe, symptomatic of the inability of corporations and regulators to manage reactors in a safe manner.	Emphasized that no one was killed; that the radiation release was relatively small; and that therefore the safety system worked.

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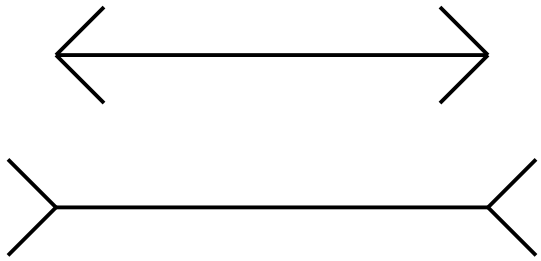
The Value of a Good Frame



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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

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