Descriptive theory

Violations of normative principles

systematic

Data driven

Once the systematic biases were identified,

a theory was constructed in order to explain/justify/describe those violations

3 types of Utility

Experienced utility

The experience itself

Predicted utility

Predictive judgment about the experience (based on memory)

Decision utility

The utility that is inferred from choices

→ They can conflict

A


B


3 types of Utility

Experienced utility
The experience itself

Predicted utility
Predictive judgment about the experience based on memory

Decision utility
The utility that is inferred from choices

→ We make very inaccurate predictions

- ❖ Unrepresentative memories
- ❖ Too essentialized
- ❖ Decontextualized
- ❖ Too abbreviated

3 types of Utility

Experienced utility ← Normative models

The experience itself

(ideally your decisions should agree with your experienced utility)

Predicted utility

Predictive judgment about the experience based on memory

Decision utility

The utility that is inferred from choices

→ Inconsistencies among these three types of utility

Bias in decisions under uncertainty

Systematic violations of the normative theory

→ Large use of hypothetical decisions

Bias in decisions under uncertainty

Situation X	Amount	Prob
Option 1	1.000	1.00
Option 2	1.000 5.000 0	.89 .10 .01

Bias in decisions under uncertainty

Situation Y	Amount	Prob
Option 3	1.000 0	.11 .89
Option 4	5.000 0	.10 .90

Bias in decisions under uncertainty

Situation X	Amount	Prob
Option 1	1.000	1.00
Option 2	1.000 5.000 0	.89 .10 .01

Situation Y	Amount	Prob
Option 3	1.000 0	.11 .89
Option 4	5.000 0	.10 .90

Bias in decisions under uncertainty

Allais paradox

	Ball numbers		
	1 (p = .01)	2-11 (p = .10)	12-100 (p = .89)
Situation X			
→ Option 1	1.000	1.000	1.000
Option 2	0	5.000	1.000
Situation Y			
Option 3	1.000	1.000	0
→ Option 4	0	5.000	0

Sure-thing principle

Bias in decisions under uncertainty

Allais paradox

	Ball numbers		
	1 (p = .01)	2-11 (p = .10)	12-100 (p = .89)
Situation X			
→ Option 1	1.000	1.000	
Option 2	0	5.000	
Situation Y			
→ Option 3	1.000	1.000	
Option 4	0	5.000	

Sure-thing principle

Bias in decisions under uncertainty

Allais paradox

	Ball numbers		
	1 (p = .01)	2-11 (p = .10)	12-100 (p = .89)
Situation X			
Option 1	1.000	1.000	
→ Option 2	0	5.000	
Situation Y			
Option 3	1.000	1.000	
→ Option 4	0	5.000	

Sure-thing principle

Bias in decisions under uncertainty

	Ball numbers		
	1	2-11	12-100
Situation X			
Option 1	1.000	1.000	1.000
Option 2	0	5.000	1.000
Situation Y			
Option 3	1.000	1.000	0
Option 4	0	5.000	0

$$.01\ u(1.000) + .10\ u(1.000) > .01\ u(0) + .10\ u(5.000)$$

$$.01\ u(1.000) + .10\ u(1.000) < .01\ u(0) + .10\ u(5.000)$$

They cannot be both true

Exercise

Create your own version of the Allais paradox

Prospect Theory

Kahneman & Tversky (1979)

Descriptive theory of decisions under uncertainty

How and why our choices deviate from the normative model of expected-utility theory

- Probability x utility (as in expected-utility theory)
- Probabilities are distorted
- Utility is considered as change from a reference point

Prospect Theory

PROBABILITY

We do not treat probabilities as they are stated
But we distort them according to a particular function

"π function"

→	30€	1.0	→	45€	.20
	45€	.80		30€	.25

$u(30) > .80\, u(45)$ They cannot be both true $.25\, u(30) < .20\, u(45)$

$.25\, u(30) > \boxed{.25\ .80}\, u(45)$? $.25\, u(30) < .20\, u(45)$

Prospect Theory

PROBABILITY

We do not treat probabilities as they are stated
But we distort them according to a particular function

"π function"

→

30€	1.0
45€	.80

→

45€	.20
30€	.25

CERTAINTY EFFECT

People's preferences are attracted by absolute certainty

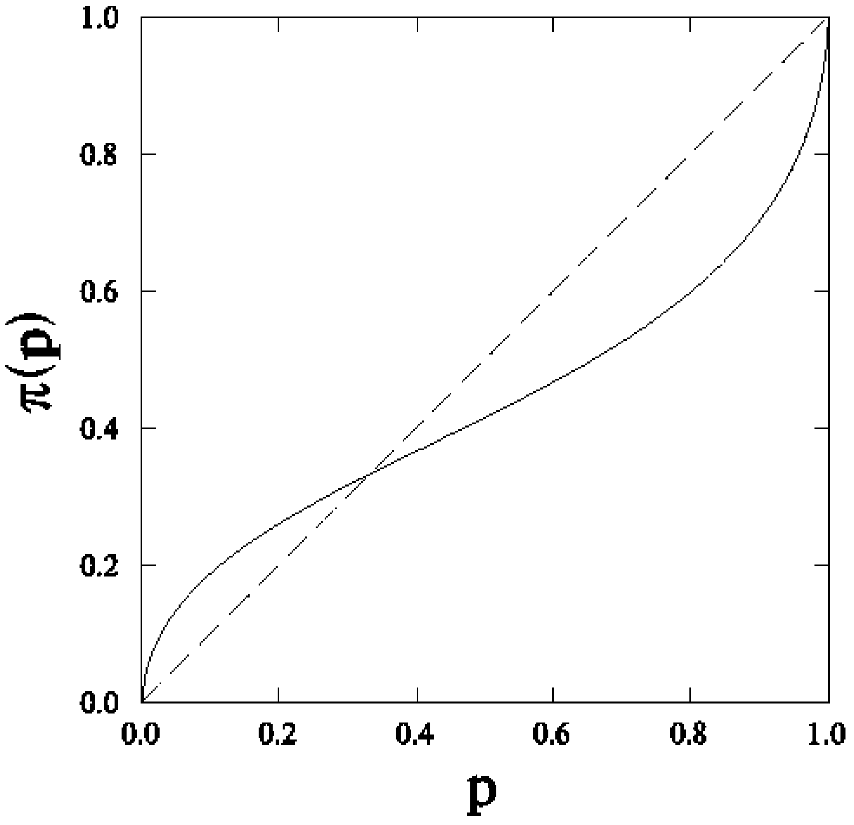
Prospect Theory

PROBABILITY

"π function"

From 0 to 0.1 > from 0.3 to 0.4

From 0.9 to 1 > from 0.3 to 0.4



People are more sensitive to changes in p near to natural borders (0 and 1)

Prospect Theory

PROBABILITY

Lottery with 10 tickets – prize 1.000€

How much would you pay for having 1 ticket?

… for a fourth ticket when you have already 3?

… and for the last one since you already have 9?

Prospect Theory

PROBABILITY

This is why we buy lottery tickets and flight insurance

Would you pay 1 € to buy a lottery ticket with a probability of .001 of winning 1.000€?

$$\pi(p)\ u(1.000) \quad > 1€$$

$$p\ u(1.000) < 1€ \qquad \boxed{.001 * 31.6 = .0316}$$

Prospect Theory

PROBABILITY

There is a threshold … extremely low probabilities are not considered at all

Would you wear seat belts?

Schwalm & Slovic (1982)

.00000025 of being killed in a car accident	**10%**
.01 of being killed in a car accident during the life time	**39%**

Prospect Theory

Kahneman & Tversky (1979)

Descriptive theory of decisions under uncertainty

How and why our choices deviate from the normative model of expected-utility theory

- Probability x utility (as in expected-utility theory)
- Probabilities are distorted
- Utility is considered as change from a reference point

Prospect Theory

Kahneman & Tversky (1979)

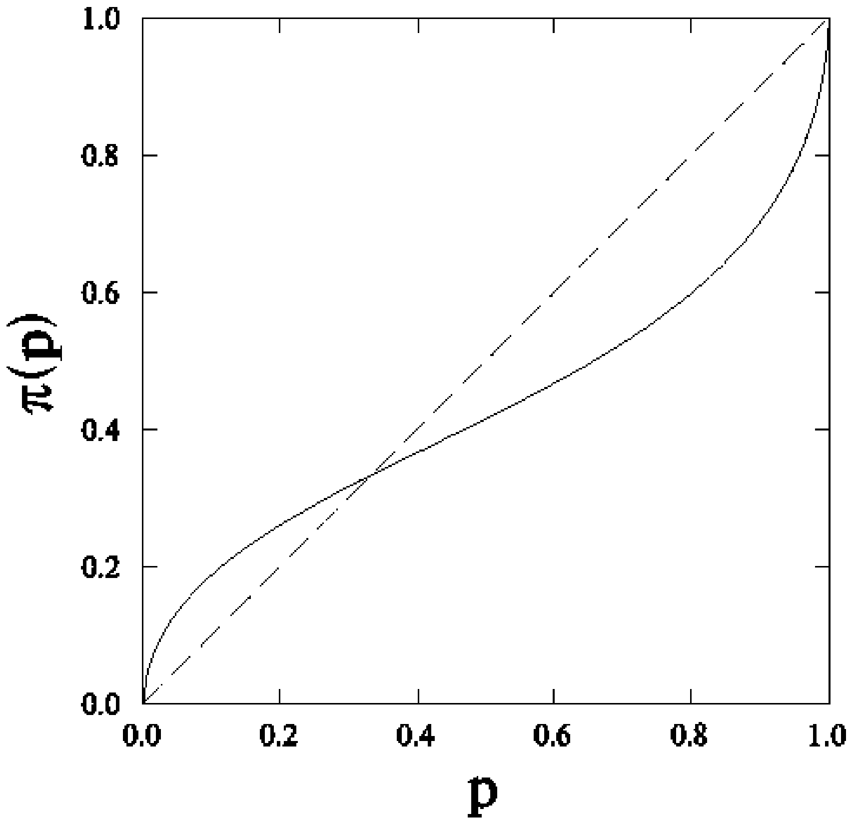
Descriptive theory of decisions under uncertainty

How and why our choices deviate from the normative model of expected-utility theory

- Probability x utility (as in expected-utility theory)
- Probabilities are distorted
- Utility is considered as change from a reference point

Prospect Theory

differences from expected-utility theory



Probability

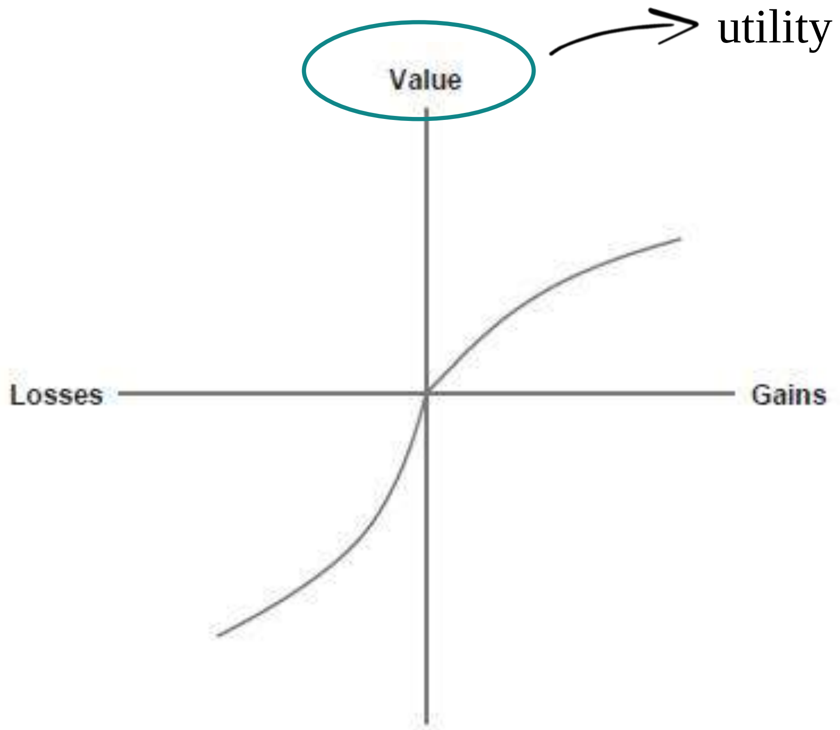
Prospect Theory

UTILITY

Changes from a reference point

(usually the current state)

Gains and losses are evaluated without regard to our total wealth



Losses are more serious than equivalent gains

LOSS AVERSION

G_1 [.5, +10] vs. [.5, -10]

G_2 [.5, +15] vs. [.5, -10]

G_3 [.5, +20] vs. [.5, -10]

Prospect Theory

UTILITY

Changes from a reference point

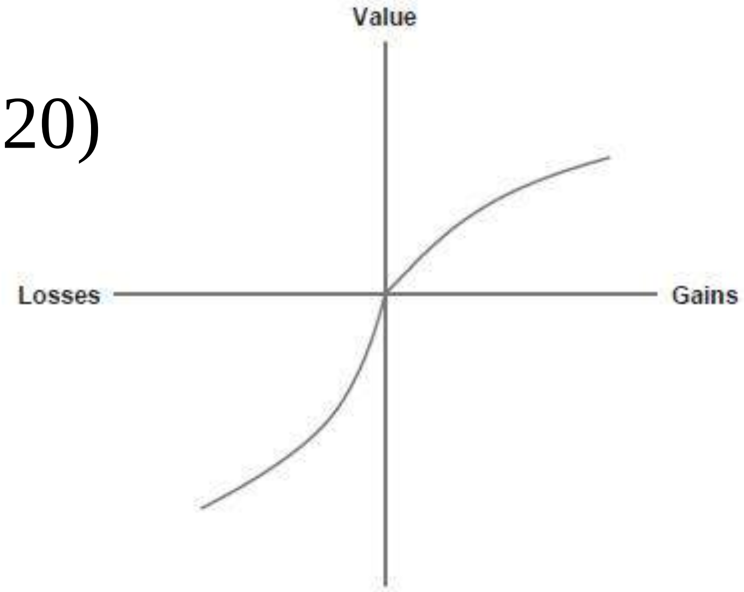
(usually the current state)

-10€ vs. (.5,-20€)

$\pi(1.00)v(-10) < \pi(.5)\ v(-20)$

Convex for losses

Risk seeking



Concave for gains

Risk averse

10€ vs. (.5,20€)

$\pi(1.00)v(10) > \pi(.5)\ v(20)$

Prospect Theory

UTILITY

Changes from a reference point

If the description changes the reference point,
the decision may change

Prospect Theory

UTILITY

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:

Program A: 200 saved

Program B: 600 saved, .33

Prospect Theory

UTILITY

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:

Program A: 400 die

Program B: 600 die, .67

Prospect Theory

UTILITY

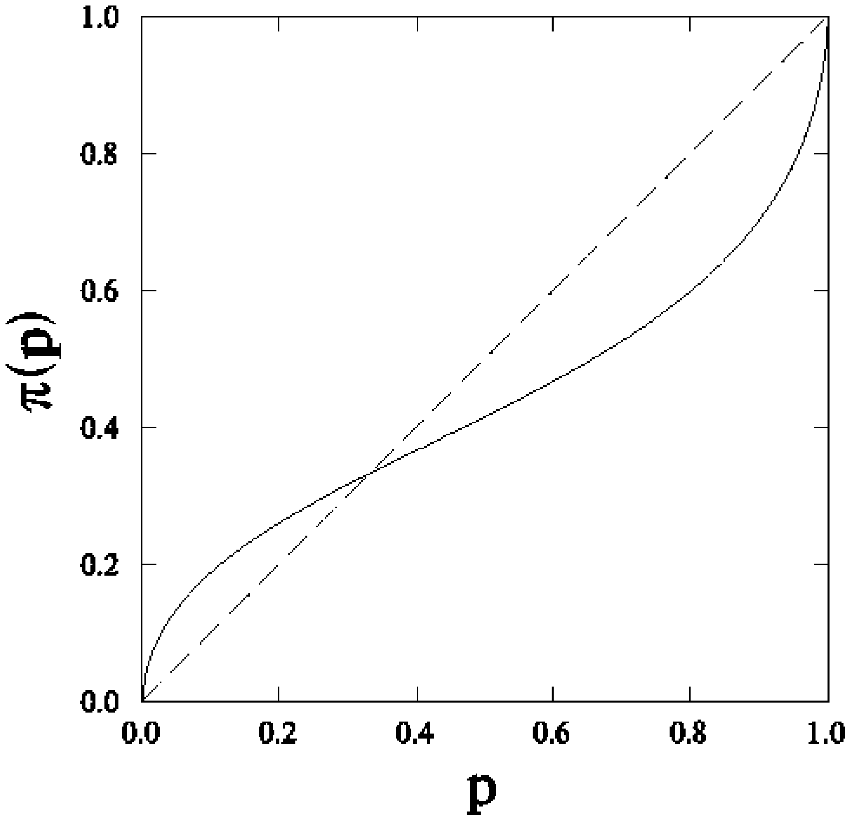
Classical example of framing effect – violation of the invariance principle

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:

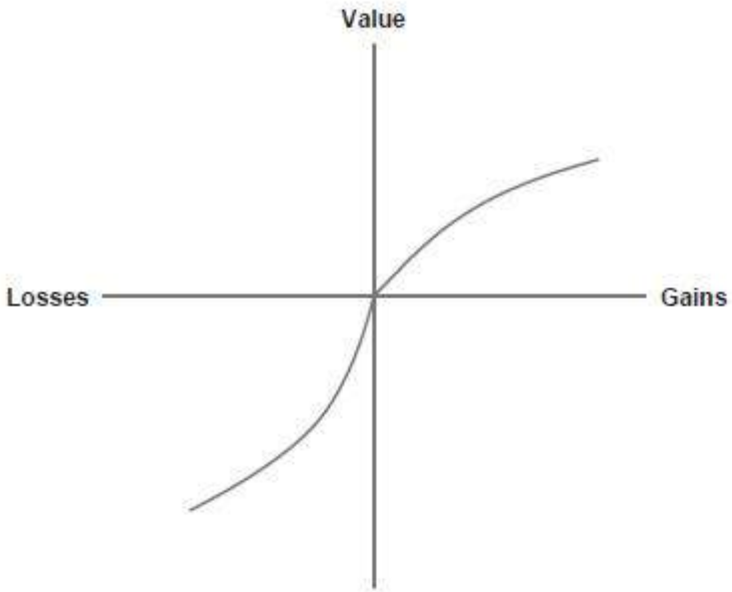
Program A: 200 saved	Program A: 400 die
GAINS	**LOSSES**
Program B: 600 saved, .33	Program B: 600 die, .67
$\pi(1)V(200) > \pi(.33)V(600)$	$\pi(1)V(400) < \pi(.67)V(600)$

Prospect Theory

differences from expected-utility theory



Probability



Utility

Exercise 1

Consider the following gambles

Gamble 1	Gamble 2	Gamble 3	Gamble 4
(30€)	(60€, .60)	(75€, .30)	(100€, .60)

… and rank them from the "best" to the "worst" one

Exercise 1

Calculate the expected utility of these gambles according to Expected Utility Theory

Utility function

$$u(X) = \sqrt{X}$$

(30€) (60€, .60) (75€, .30) (100€, .60)

… and rank them from the "best" to the "worst" one

Exercise 1

Calculate the expected value of these gambles according to Prospect theory

π function

$p=0 \quad \pi(p)=0$

$p=1 \quad \pi(p)=1$

$0<p<1 \; \pi(p)=.75p + .05$

Value function

$X \geq 0, v(X) = \sqrt{X}$

$X < 0, v(X) = -2\sqrt{(X)}$

(-30€) (-60€, .60) (-75€, .30) (-100€, .60)

… and rank them from the "best" to the "worst" one

Exercise 2

Generate 2 gambles

with the same expected **value** according the Expected Utility Theory

that largely differ in their EV according to the Prospect Theory

Exercise 3

Generate 2 gambles

with the same expected **value** according the Expected Utility Theory

that DO NOT largely differ in their EV according to the Prospect Theory