EFR summary

Introduction to Behavioral Economics, FEB12015X

2024-2025

Lectures week 1 to 6

Details

Subject: Introduction to Behavioral Economics

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Date of publication: 11.04.2025

Introduction to Behavioural Economics - Week 1

What is behavioural economics?

In the course Microeconomics we have learned about the Homo Economicus.
The Homo Economicus is a traditional neoclassical economic agent. The economic agent:

- doesn't have any cognitive barriers to achieving and processing information (no limited rationality)
- maximises its expected utility
- knows how to deal with odds
- has consistent time preferences
- is egoistic and only cares about his own payoff.

The Homo Economicus however isn't a homo sapien. And the thing we are really interested in is us, humans. Behavioral economics enriches economics with insights of psychology. The challenge in this is making models realistic but also workable.
Models can be:

- **normative** - describes how people **should make** decisions.
- **descriptive** - describes how people **really make** decisions

In Neoclassical economics, descriptive models are normative. This means that people make the decisions they should make. In behavioral economics, this isn't the case.

Experiments in Economics

Let's now look at the different vocabulary used in economics experiments
.
Correlation: a mutual relationship or connection between two or more things.
Causation: the relationship between cause and effect; causality.
It is important to note that **correlation doesn't equal causation**.

Experiments in economics to study causation can make use of a **control group** and a **treatment group.** The **control group has no treatment** and is purely to compare the group with a treatment to see if there is any difference.

These experiments can be done in a **lab**, which is a controlled environment, for example, making people fill in a survey in a computer room on campus. It is also possible to do **field** experiments, these are in a natural environment. You lose a bit of control when executing a field experiment instead of a lab experiment.

There is also a difference between the methods of applying treatments.
Between-subjects means that every subject is in exactly 1 treatment.
Within-subjects means that every subject is in multiple treatments.

Most of the time, there is a payoff to the subjects in research. Most of the time, economists want to make use of **real incentives**: payment via their decisions made in research. It is also possible to pay off a **flat fee**: this is a fixed amount for participation.

Economists also have to choose between making use of **deception** versus **no deception**. Most of the time, economists want to make use of no deception. A short example of deception in a behavioral economics experiment is the "anchoring effect". In one experiment, participants are shown a random number (like the last two digits of their phone number) before being asked to estimate the price of a bottle of wine. Those who saw a higher number tended to give a higher estimate, even though the number shown was irrelevant. This demonstrates how irrelevant information can deceive participants into making biased economic decisions.

Most of the time, **economists use no deception and real incentives.**

Preferences in economics

In Microeconomics, we have learnt that people make decisions based on preferences and achievability, i.e., the budget curve and utility curve.

A **weak preference**, $x \succcurlyeq y$, means that x is at least as good as y.
A **strict preference**, $x \succ y$, means that x is better than y.
Indifference, $x \sim y$, means that x is just as good as y.
These relations are called **preference-relations**.

Preference conditions: I will denote the relation, for example, a weak preference or strict preference as R
complete: for every x, y -> xRy or yRx (or both).
transitive: for every x, y, z -> if xRy, yRz then xRz.
reflexive: for every x applies that xRx.
symmetrical: for every x, y -> xRy and yRx.

When a preference relation is **complete and transitive,** we call it a **weak order**. The weak preference, $\succcurlyeq$, is a weak order. You can check this for yourself by filling in the weak preference for R in the preference conditions.

Ordinal utility u:

- can be written as v(x)=f(u(x)) in which v(x) is a strictly increasing function. V reflects u.
- higher utility is preferred.
- differences in utility have **no meaning**.

Cardinal utility u:

- can be written as v(x)=f(u(x)) in which v(x) is a strictly increasing linear function. V reflects u.
- higher utility is preferred.
- a bigger difference in utility **for the same person means a stronger preference**.

Pareto: when 1 person is better off all other things being held equal, this is a **better outcome**. This works for ordinal and cardinal utility.

Utilitarianism: $W = \Sigma U_i$ in which W means welfare.
We will learn in this course that utility as a function helps us with decisions under uncertainty, decisions over time, and decisions in a social context.

Revealed preference refers to assessing utility based on the choices individuals make. By observing their decisions, you can uncover their underlying preferences.
Pitfalls of revealed preference:

- **Projection bias** occurs when people assume their current preferences will remain the same in the future.
- **Duration neglect** means that people tend to overlook the length of an activity when evaluating their experience.

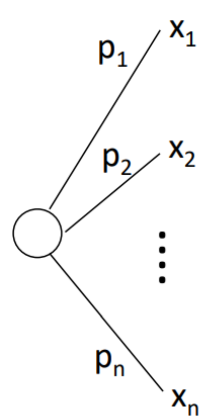
- **Peak-end rule** suggests that people judge experiences by their most intense moments and how they ended.
- **Diversification bias** happens when people believe they desire more variety in the future than they actually do.

Introduction to Behavioural Economics - Week 2

Risk and uncertainty

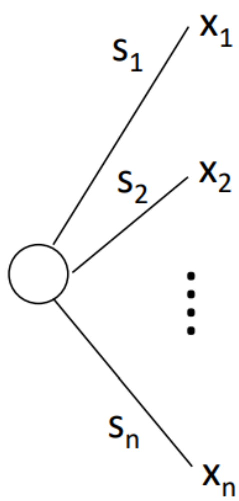
Uncertainty is when we don't know the exact odds of the outcomes (**states of the world)** are.
Risk is when we do know the exact odds of the outcomes (**states of the world)** are. When tossing a coin we deal with risk. When we go outside for a walk and have to decide to bring an umbrella we deal with uncertainty.

We can describe dealing with risk via **lotteries**. Lotteries are described as: $L=(P_1:X_1, \dots, P_n:X_n)$. In which P stands for the chance and X for the outcome. This is illustrated below.



$$\boxed{L = (p_1: x_1, \dots , p_n: x_n)}$$

When we want to describe uncertainty, we work with different **acts**. Each act describes a state of the world. This is illustrated below. Keep in mind that the odds aren't given.



$$A = (s_1 : x_1, \ldots , s_n : x_n)$$

Working with risk

We can calculate the **expected value** of a lottery via the following formula: $EV(L)=P_1X_1 + \ldots + P_nX_n$

As we saw in microeconomics, **expected utility** isn't the same as expected value. Expected value of a lottery is calculated as follows: $EU(L)=P_1U(X_1) + \ldots + P_nU(X_n)$

Keep in mind that the utility in expected utility is cardinal. Expected utility is part of traditional economics.

St. Petersburg paradox:

A fair coin is flipped until we get heads.

If it takes n flips, you receive €2^n (2 to the power of n).

Now follows the question: How much are you willing to pay to play this game?

If humans made decisions based on expected value, people would like to pay an infinite amount of money to play this game. You can check this yourself. When working with expected utility, this isn't the case. Take, for example, $u(x)=\ln(x)$.

Therefore, it provides expected utility a better explanation in some cases.

Risk attitudes:
- **Risk averse**: $(1:\ EV(L)) \succ L$
- **Risk neutral**: $(1:\ EV(L)) \sim L$
- **Risk prone**: $(1:\ EV(L)) \prec L$

Let's say we have a lottery, L=(p:A, 1-p:B), and we remove all risk to get (1:EV(L)). Then we change the expected value until the utility of playing the lottery equals the **Certainty equivalent CE(L)**, i. e. $L = (p: A,\ 1 - p: B) \sim (1:\ CE(L))$, then:
- Risk averse: CE(L) < EV(L)
- Risk neutral: CE(L) = EV(L)
- Risk prone: CE(L) > EV(L)

We also know that for risk aversion, there is concave utility, for risk neutrality there is linear utility, and for risk proneness, there is convex utility.

The **sure thing** principle says that if we remove X and Y of two lotteries in which $P_1X=P_2Y$, the preference of which lottery to choose stays the same.

Violations of expected utility

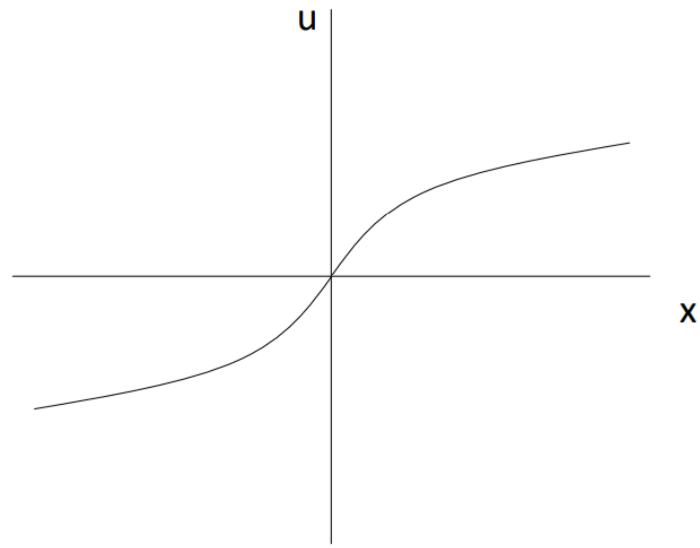
Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:
- A: If program A is adopted, 200 people will be saved.
- B: If program B is adopted, there is a 1/3 probability that 600 people will be saved and a 2/3 probability that no people will be saved.

Which of the two programs would you favor
- C: If program C is adopted, 400 people will die.
- D: If program D is adopted, there is a 1/3 probability that nobody will die and a 2/3 probability that 600 people will die.

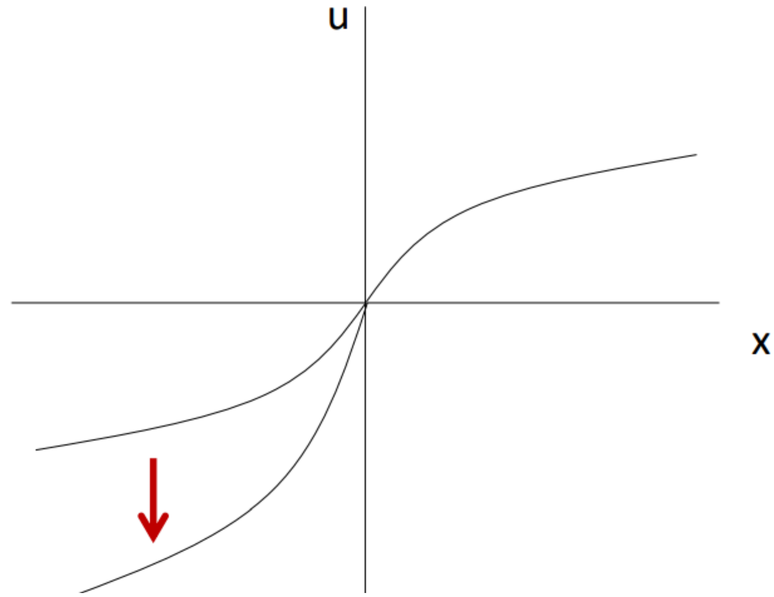
Which of the two programs would you favor?

In a lot of cases, people prefer program A over B and program D over C. This is inconsistent with expected utility since program A is the same as program C and Program B is the same as Program D. Therefore, the preferences should be the same.

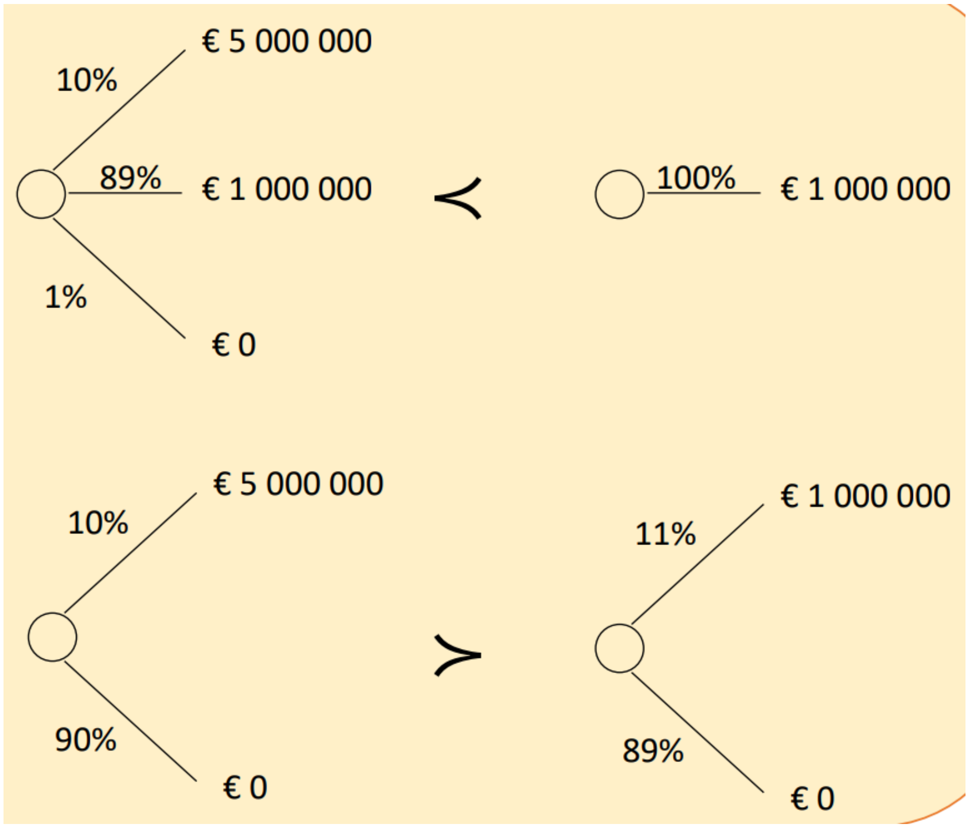
This can be explained via the **prospect theory**. Prospect theory says that people base their decisions partly on their **reference points**. When reading the programs in the Asian Disease hypothesi,s we change our expectations, because in program A and B the program is described in amounts of people saved, while in program C and D the program is described in amounts of deaths.
We assume that people have **diminishing sensitivity**: utility is concave for gains and convex for losses. This is illustrated below in the vertical line is the reference point.



The **Reflection effect** means that risk attitudes are the opposite for gains as for losses. Risk attitudes are risk aversion for gains and risk proneness for losses.
Loss aversion means that losses weigh heavier than gains. This is illustrated below:



Another example of a violation of expected utility and of the sure thing principle is the **Allais paradox**, which is illustrated below:



Mathematically, the violation is illustrated as follows:

$A \prec B \Rightarrow EU(A) < EU(B)$

$\Rightarrow 0.89\ u(1mln) + 0.10\ u(5mln) + 0.01\ u(0) < u(1mln)$

$\Rightarrow 0.10\ u(5mln) + 0.01\ u(0) < 0.11\ u(1mln)$

$\Rightarrow 0.10\ u(5mln) + 0.01\ u(0) + 0.89\ u(0) < 0.11\ u(1mln) + 0.89\ u(0)$

$\Rightarrow 0.10\ u(5mln) + 0.90\ u(0) < 0.11\ u(1mln) + 0.89\ u(0)$

$\Rightarrow EU(C) < EU(D) \Rightarrow C \prec D$

The Allais paradox is consistent with the **certainty effect**: people give too much weight to outcomes which are 100% certain.

Decision making under uncertainty

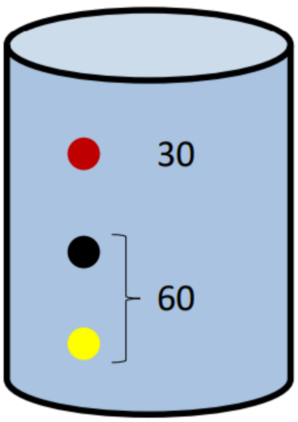
In this course we learn about a few methods of making decisions under uncertainty. Since we don't know the odds of the different states of the world, we are not gonna use expected utility or expected value.

- **Maximin** is when you choose the alternative with the highest minimal utility.
- **Maximax** is when you choose the alternative with the highest maximal utility.
- **Minimax-regret** is when you choose the alternative with the lowest maximum regret level.

Maximin, maximax and minimax-regret don't account for the odds of the states of the worlds. Therefore, there is also the method of **Subjective Expected Utility**: set subjective odds to all the states of the world and then use expected utility. This is consistent with the sure thing principle.

Violations of expected utility under uncertainty

The **Ellsberg paradox** is illustrated below:



I	100	0	0
II	0	100	0
III	100	0	100
IV	0	100	100

Lots of people would prefer bet 1 over bet 2 and bet 4 over bet 3. This is inconsistent with expected utility. This is mathematically written below:
EU(I) = P(R)*u(100) + P(B)*u(0) + P(Y)*u(0)
EU(II) = P(R)*u(0) + P(B)*u(100) + P(Y)*u(0)
⇒ I > II means that P(R)*u(100) + P(B)*u(0) > P(R)*u(0) + P(B)*u(100)

EU(III) = P(R)*u(100) + P(B)*u(0) + P(Y)*u(100)
EU(IV) = P(R)*u(0) + P(B)*u(100) + P(Y)*u(100)
⇒ IV > III means that P(R)*u(0) + P(B)*u(100) > P(R)*u(100) + P(B)*u(0)
Which is inconsistent. The Ellsberg paradox is consistent with **ambiguity aversion**: people don't like when odds aren't certain and therefore, the certainty effect occurs.

Introduction to Behavioural Economics - Week 3

Discounted utility

The time when you make a decision is called the **decision time**. t=0 means today.
The time of consumption is called the **consumption time**.
The difference between the consumption time and the decision time is called the **temporal distance**.

Let's say we want to set up a discounted utility function:

- We have a series of payoffs: $x = (x_0 + x_1 + ... + x_n)$
- Now let's transform these in a series of utility levels with the utility function $u_i = u(x_i) \Rightarrow u = (u_0 + u_1 + ... + u_n)$.
- Now let's put these utility levels into a discounted utility function: $DU(x) = u(x_0) + D(1)u(x_1) + ... + D(n)u(x_n)$

Now let's go over a bit of notation:

- $x = (x_0 + x_1 + ... + x_n)$ gives x_i on time i.
- $x = (s: x,\ t: y)$ gives x on time s and y on time t.

Impatience

Impatience means that people prefer to receive positive utility as quick as possible. This gives that for every $x > 0$ and $s < t$ => $(s: x) \succ (t: x)$.
If we substitute impatience into the discounted utility model we get that **D(t) is a declining function**. Since the "weight" added to each payoff decreases the further into the future, i.e. a payoff of x now is preferred above a payoff of x in the future. This implies that impatience for negative utility is the other way around. You prefer to receive this negative utility further into the future.

There can be multiple reasons for impatience:

- **Interest on financial markets**: 100 euros now is objectively worth more than 100 euros in the future.

- **Risk and uncertainty**: The future is full of risk and uncertainty. Risk averseness can make you impatient.
- **Pure time preferences**: we add more weight to the present than the future.

It is also found that impatience for example, influences people's BMI, their job choices, and lifestyle choices like the choice to consume alcohol or cigarettes.

Is impatience constant or decreasing?

Constant impatience:
For every σ applies that: if $(s: x) \succcurlyeq (t: y)$ then $(s + \sigma : x) \succcurlyeq (t + \sigma : y)$.
In other words, this means that if you procrastinate all options with the same amount of time, the preferences won't change.

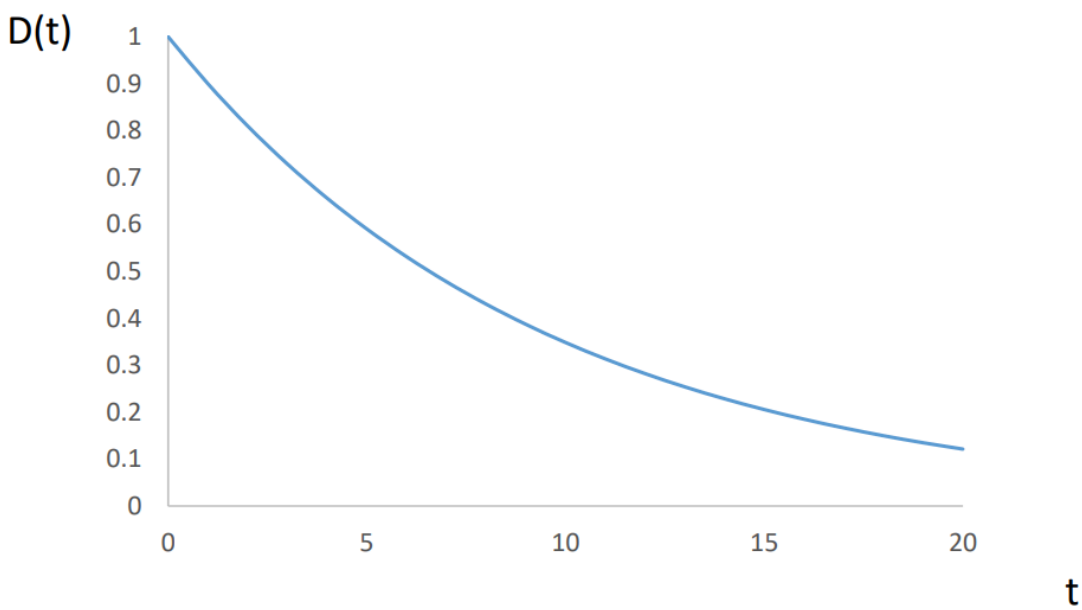
Decreasing impatience:
For s<t, $x \prec y$, and every σ : if $(s: x) \sim (t: y)$, then $(s + \sigma: x) \preccurlyeq (t + \sigma: y)$.
In other words, this means that there is higher impatience for the present than for the far future.

Time consistency

Constant impatience leads to **time consistency**.
Time consistency means that preferences don't change over time. If we keep consumption constant but change the time of decision, the preferences should stay the same.

Exponential discounting

Exponential discounting gives a discounting function of $D(t) = \delta^t \; with \; 0 < \delta \leq 1$
In this discounting function δ is the **discount factor** and $\delta = \frac{1}{1+r}$ in which r is the **discount rate**. We can see that a higher discount rate leads to a lower discount factor.
An example of an exponential discounting function with delta = 0.9 is given below:



Keep in mind that a person who has an exponential discounting function has **constant impatience** and therefore **consistent time preferences**.

Quasi-hyperbolic discounting

Quasi-hyperbolic discounting is described as follows:

- D(0)=1
- $D(t)=\beta\delta^t$ IF t>0 (thus not equal to zero). And $0 < \delta \leq 1,\ 0 < \beta < 1.$
- In this β is the **present-bias** parameter.

For quasi-hyperbolic discounting there is constant impatience if all payoffs are gained in the future, but there is decreasing impatience if you get your payoff today.

Rational discounting

We assume that time consistency is **rational**. In that case exponential discounting is rational. Although we don't really know which δ is rational. If someone has an extreme preference for the present, it might not be "rational".

People who know they don't make rational choices (not time consistent), for example by saying they will study in one hour, but won't when the time is there. Those people can commit themselves with **self-commitment**: they commit themselves to a choice in the future. For example by saying they will study and if they don't, they will have to pay 25$ to a friend of theirs.

Violations of discounted utility

The **magnitude effect** says that bigger payoffs are discounted less than smaller payoffs. This means that for bigger payoffs there is a smaller discount rate.

The **sign effect** means that losses are discounted less than gains. You could combine this with prospect theory to get around this.

Another possibility is that there is **utility of anticipation**: you might want to go to the dentist today because you get negative utility of the anticipation of having to go to the dentist in a week.

Or you might prefer improvement. An example of this is that you might prefer this week to receive 50 dollars and next week 100 dollars instead of this week 100 dollars and next week 50 dollars. An explanation of this could be that receiving 50 dollars after 100 dollars feels like a loss and receiving 100 dollars after 50 dollars feels like a gain.

Or you might **prefer variation**:
DU(A) = D(0)u(It) + D(1)u(Th)
DU(B) = D(0)u(It) + D(1)u(It)
Lots of people would prefer A since there is more variation.

DU(C) = D(0)u(Th) + D(1)u(Th)
DU(D) = D(0)u(Th) + D(1)u(It)
In this case lots of people would prefer D since there is more variation.

$A \succ B \text{ implies that } C \succ D$. You can check this yourself.

Another example is that lots of people **prefer to spread**. This can also lead to inconsistencies in the discounted utility model.

It is also good to think about if we can predict future utility.

Introduction to Behavioural Economics - Week 4

Strategic interaction

In the course game theory and mathematics, we learned that combining a person's own **utility payoffs** and **expectations of strategies of the other players** lead to a person's **strategy**.

There are two types of games we learned about:

- **Simultaneous games**: Both players make their decisions at the same time. We learned that rational players move towards a **Nash equilibrium**.
- **Sequential games**: Players make choices in turns. We learned that rational players move towards a **subgame-perfect equilibrium**.

In this course we will only look at one-shot games (not repeated games). On top of that we will only look at games with complete information.

In reality we see that people might deviate from the equilibriums. This has two possible reasons:

- **Limited strategic reasoning**: People might not be able to fully grasp a game and find the nash-equilibrium. Therefore they probably won't play the nash equilibrium.
- **Social preferences**: The utility of players depends on their own payoff and the payoff of other people.

Both of these types can directly influence ones strategy or indirectly via expectations that other people might have limited strategic reasoning or social preference.

Limited strategic reasoning in the Guessing Game

We are now gonna look at limited strategic reasoning in the **Guessing Game**.
The Guessing Game goes as follows: players ($n>2$) give a number between 0 & 100.
You win if your number is closest to 2/3 (or p with $0<p<1$) of the average of all

numbers chosen. The payoff is a flat fee. When there is a draw the payoff is divided equally over the winners. The losers don't receive a payoff.

We will see that the only Nash equilibrium is that everyone chooses 0.

We will use iterative elimination of dominated strategies: We know for sure that the average * 2/3 won't be above 66.66%. This is because if everyone chooses 100 the average will be 66.66%. Let's now say that everyone will choose under 66.66% we know that the average can't be higher than 66.66*2/3. Therefore no one will pick any number above this 66.66*2/3. We can repeat this problem until infinity where we will reach 0.

Elimination of the **Nth order dominated strategy** means that you play $100 * p^n$

In reality, we see that people don't play the Nash equilibrium. The average in reality is often around 35%. This is because of the limited strategic reasoning of people, or the expectations of limited strategic reasoning of other people.

A model that might explain this is that there are **Level-K players**. A level-k player plays the kth order domination. Therefore, level-0 players play any number between 0 and 100. And every level-1 player plays $100 * p$. Every level-2 player plays $100 * p^2$. This will go on till Level-∞ players who will play 0. In reality, we see that those people don't exist.

Social considerations in games

The **Ultimatum game**:

- Fase 0: Proposer receives S
- Fase 1: Proposer offers x to respondent
- Fase 2: Responder accepts or rejects the offer.
- Payoffs: in case of accept: (S-x, x). In case of reject: (0, 0)

You can try to apply **backwards induction** as you have learned in the mathematics course to see what the subgame perfect equilibria are.
Answer: #1: (S_P, S_R)=(x, A) if x>0 and (x, R) if x<0. #2: (S_P, S_R)=(x, A) with x=0.

In reality we see that responders offer way more than the maximum of 0.01 cent in the subgame perfect equilibria. This can't be explained by strategic reasoning, since it is a very simple game. It can be explained by Social preferences:

- Proposers only gain utility from their own payoff and expect that responders will reject a low offer.
- Proposers also derive utility from the payoff of others.

The **Dictator game**:
- Fase 0: Proposer receives S
- Fase 1: Proposer offers x to the responder
- Payoff: (S-x, x)

The subgame perfect equilibrium is where x=0. Because there is no risk of rejection. In reality we see that the x offered is often lower than the x offered in the Ultimatum game. But we must conclude that if x>0, the proposer also derives utility from the payoff of others.

The **Trust game:**
- Fase 0: Proposer receives S
- Fase 1: Proposer sends x to the responder
- Fase 2: Researcher ups x to (1+r)x
- Fase 3: Responder sends y to the proposer.
- Payoffs: (S-x+y, (1+r)x-y)

The subgame perfect nash equilibrium is x=0 and y=0. It is a **tragedy** when r>1: Their situation could improve for both of them if they commit to x=S, y=(1+r)X/2.

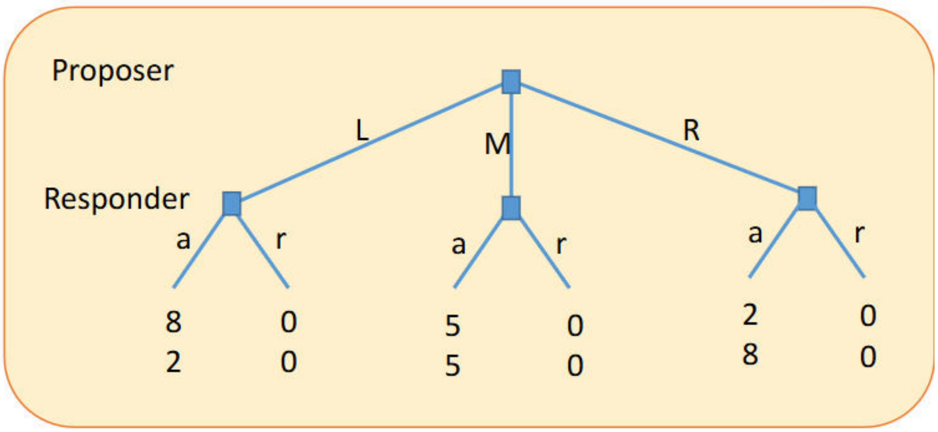
In reality we see that x on average equals S/2. and y equals on average 0.95x

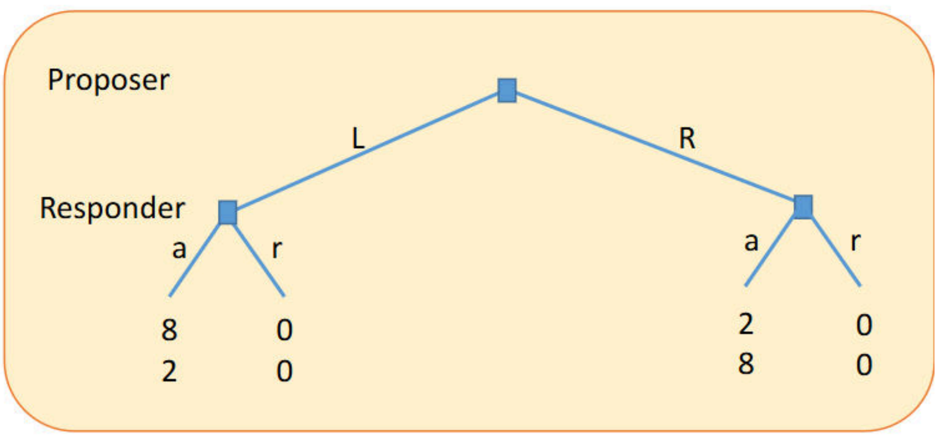
The **Public good game:**
Fase 0: Player i starts with endowment e.
Fase 1: Player i contributes x_i to the public good.
The public good is then multiplied by M: Σx_i. This will give the payoff: $\pi_i = e - x_i + m\Sigma x_i$.
The Nash equilibrium is where no one invests any money in the public good. Although if m>1 this isn't pareto efficient. In reality we see that people invest between 0.4e and 0.6e.

Social preferences

Let’s now look at different kinds of social preferences:

- **Altruism:** for given x, u(x, y) rises when y rises.
- **Envy**: for given x, u(x, y) decreases when y rises.
- **Rawlsian preferences**: for given x, u(x, y) rises when min(x, y) rises.
- **Inequality aversion**: for given x, u(x, y) rises when |x-y| decreases.





Altruism, envy, Rawlsian preferences and inequality aversion expect that L is accepted/rejected the same amount on the game on top as the game on the bottom. Although in reality we see that L is rejected more in the game on top. This can be explained by **Reciprocity**: reward players with good intentions and punish people with bad intentions.

Outcome fairness: we receive utility to the final allocation of payoffs.
Process fairness: We receive utility to how we got to the final allocation of payoffs.

Introduction to Behavioural Economics - Week 5

Decision making under certainty

The **opportunity cost** is the sacrificed value (or utility) of the best not-chosen alternative.
Mathematically this is given by: $C(a_i) = \max\{u(a_1), u(a_2), ..., u(a_{i-1}), u(a_{i+1}), ..., u(a_n)\}$.
Note that $u(a_n)$, so utility of the chosen alternative is not considered for the opportunity cost.

An example: Let's say that stock will gain 1000 Euros next year and that real estate will gain 900 next year. The opportunity cost of buying stock is 900. The **economic profit** of buying stock is the profit by buying stock - opportunity cost, so 1000-900=100.

Often, we ignore/overlook opportunity costs. This might be because there are so many options in real life, and it is hard to know how high the costs are. Keep in mind that failing to take opportunity costs into account is irrational because that makes you able to choose an alternative that doesn't have the highest utility.

Sunk costs are costs that are beyond recovery at the time when a new decision is made. Therefore, they shouldn't impact your decision. Although many people do involve them in their decision making.
Sunk cost fallacy: the idea that a company or person is more likely to continue with a project if they have already invested a lot of time, effort, or money in it, even when continuing is not the best thing to do.

A classic experimental example: People are more likely to invest 1 million in a (patent) race they have lost when they already have invested 9 million, then when they have invested nothing.

An example of why people believe in the fallacy is that people feel a need to justify decisions made in the past. Continuing to invest satisfies this need.

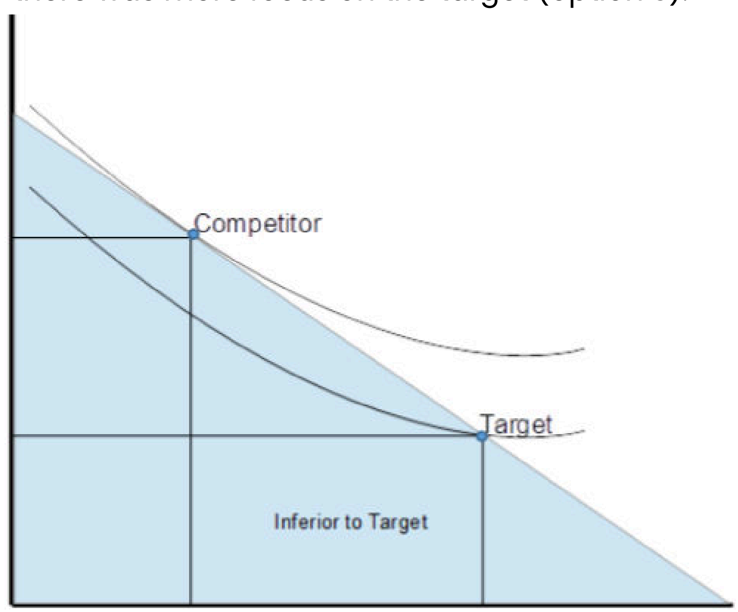
Decoy effect

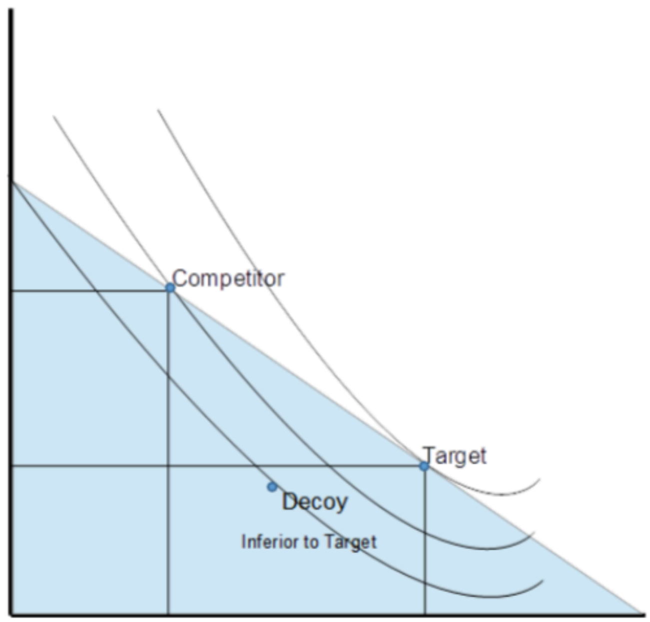
	Economist.com offer	Price
Option 1	Web subscription	59
Option 2	Print subscription	125
Option 3	Print + web subscription	125

This is a famous example of the decoy effect by the Economist. When presenting only option 1 and 3, most people choose 1. However, when presented with all options (with an extra irrelevant option), most people choose option 3. This is a preference reversal and is irrational. The introduction of this inferior product shouldn't change your mind.

The **Expansion condition**: if you choose x from {x, y}, and if you don't prefer z over x or y, then you must also choose x from {x, y, z}.
In reality people sometimes change their preferred option when given an irrelevant alternative. This irrelevant alternative is called a **decoy**.

Below are two illustrations of how the budget curve changed after the decoy was added, because there was more focus on the target (option 3).





Other forms of the decoy effect are the:

- **Compromise effect**: people's tendency to choose an alternative that represents a compromise or middle option in the menu. For example choosing a 1.5 liter bottle of Coca Cola instead of 1 or 2 liter.
- **Extremeness aversion**: a tendency to avoid options at the extremes of the relevant dimension.

Loss aversion

Standard economics prediction of a loss is the same as it's prediction of a gain. As we saw in the prospect theory that people value losses larger than a similar gain. This is called loss aversion. The reference point plays a very important role.

The **endownment effect**: a circumstance in which an individual values something which they already own more than something in case they do not yet own it.

Netflix gives the first month free, so that you get used to Netflix in your everyday life. Then you need to decide if you will continue paying for Netflix. People will now value Netflix more than when they didn't own it. Therefore they will continue paying for their Netflix. This is the endowment effect.

Experienced traders, for example firms, suffer less from the endownment effect. Or when you are asked to trade your 20$ bill for another 20$ bill you should be indifferent. In these cases the endowment effect doesn't hold.

Heuristics and biases

A **Heuristic** is a "rule of thumb". This is efficient for our brain, but sometimes it can lead to predictable mistakes.

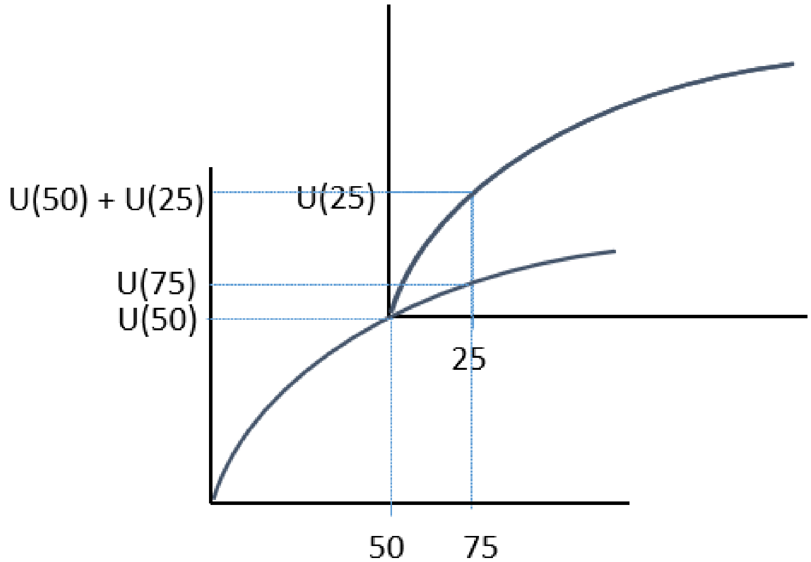
The **fundamental attribution error**: in contrast to interpretations of their own behavior, people place undue emphasis on internal characteristics of the agent, rather than external factors, in explaining other people's behavior.

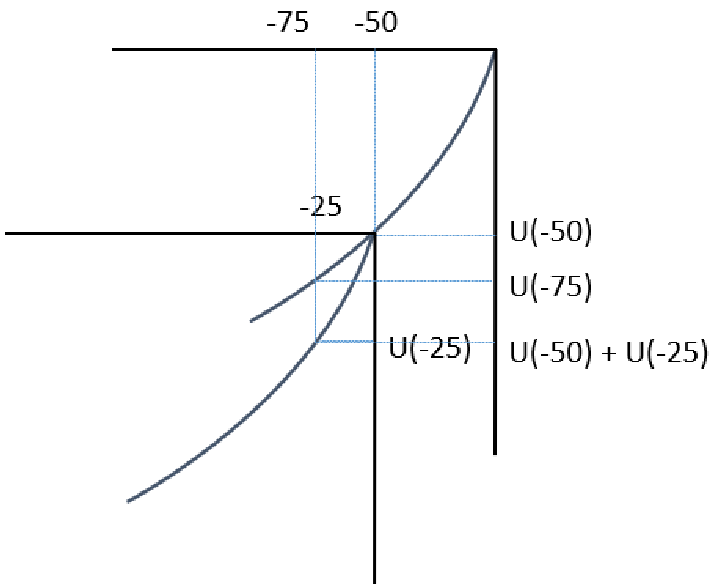
Adjustment: when done under time pressure, subjects estime the outcome of the math question 1*2*3*4*5*6*7*8 lower than the outcome of 8*7*6*5*4*3*2*1. The reason for this could be because subjects only have time to calculate the first three or four numbers they might not adjust enough upward.

An **anchor**: initial value or estimate. When people have to make an estimation under uncertainty, an anchor can influence the person making the estimation.

Diminishing sensitivity & Mental accounting

According to the prospect theory utility function with diminishing sensitivity to gains and losses it matters wheter you **integrate** or **segregate** gains and losses. You should prefer to segregate (split up) the gains and integrate the losses. This is illustrated below for gains and losses:





Mental accounting: people divide money in seperate categories. It is as if individuals open a mental account when they incur a payment and close the mental account when the benefits arrive.

- **Time mental accounting**: people 'open' and 'close' different mental accounts, based on timing. **End-of-the-day-effect**: in racetrack betting people are more willing to bet on longshots at the end than at the start of the betting day.
- **Mental accounting and budgeting**: people have different budgets and money reserved for different things. One budget is not spent on another. **House money effect**: people tend to take more risks with money they just won than with "their own" money.

Introduction to Behavioural Economics - Week 5

Heuristics

Heuristic: “a rule of thumb”. This can sometimes lead to predictable mistakes.

Representativeness

Representativeness: estimating the probability that some outcome was the result of a given process by reference to the degree to which the outcome is representative of that process.
We will look at various representativeness heuristics.

Law of small numbers: People exaggerate the degree to which small samples resemble the population from which they are drawn.

Example:
A certain town is served by two hospitals. In the larger hospital, about 45 babies are born each day, and in the smaller hospital, about 15 babies are born each day. As you know, about 50% of all babies are boys. However, the exact percentage varies from day to day. Sometimes, it may be higher than 50%, sometimes lower.

For a period of 1 year, each hospital recorded the days on which more than 60% of the babies born were boys. Which hospital do you think recorded more such days?
a) The larger hospital
b) The smaller hospital
c) About the same (that is, within 5% of each other)

The right answer is B. This is easier to see if say that there are 10000 baby’s born in the large hospital and 1 baby in the small hospital. The change that there will be a day on which more than 60% of the babies born were boys is in the large hospital almost 0% and in the small hospital 50% (either a boy or a girl is born).

The gambler's fallacy: thinking that the departure from the average behaviour of some system will be corrected in the short term.
For example: Thinking that throwing 6-6-6-6-6-6 is more unlikely than throwing 5-4-3-5-3-2

The opposite of this is **regression to the mean**: failing to understand that over repeated tests, the tendency of an unlikely outcome tends to return to 'normal' over repeated tests.

Base rate neglect: failing to take the base rate of an event into account.

Example: Consider Steve. Steve can be characterized as follows:
• Steve is very precise
• Steve is not afraid to speak in public
• Steve has a strong sense of justice
Estimate the likelihood of Steve's job
• Administrative personnel
• Jurist (lawyer)
• Electrician
• Day care assistant

CBS.nl: administrative personnel is the greatest sector whereas jurist is the smallest sector. So, Steve most likely is administrative personnel. But, Steve's character most resembles the stereotype of a lawyer.

Availability

Availability heuristic: assessing the probability that some event will occur based on the ease with which the event comes to mind (the easier it comes to mind, the higher the probability given to it). We will look at various forms of the availability heuristic.

Retrievability of instances: when people are asked to come up with instances of an event, they place more weight on things that are more salient.

For example: when asked about their greatest fears, many people report it to be 'dying due to an act of terrorism'. This makes sense, given that acts of terrorism are all in the news because it is so horrible to die because of it. However, people are way more likely to die of a heart attack. So, in that sense, they should fear this more.

Effectiveness of a search set: the availability heuristic can lead to false predictions when people search for 'sets' in their minds.

An example of this is when people are asked whether there are more words that start with the letter R or more words that have R as the third letter. Most people tend to say there are more words that start with R, because those words come to mind more easily. This is an example of the availability heuristic since in reality, there are actually more words with R as the third letter.

Imaginability: when, instead of relying on their memory, people predict something based on how they can generate a rule in their mind (i.e., their imagination).

For example, how many groups of 2 people can be formed out of a class of 10 people? And, how many groups of 8 people can be formed out of a group of 10 people? It is easier to imagine groups of 2 people in your mind and therefore people think there are more groups of 2 people to be formed. In reality it is exactly the same amount (for every group of 2, automatically the rest forms a group of 8).

Confirmation bias

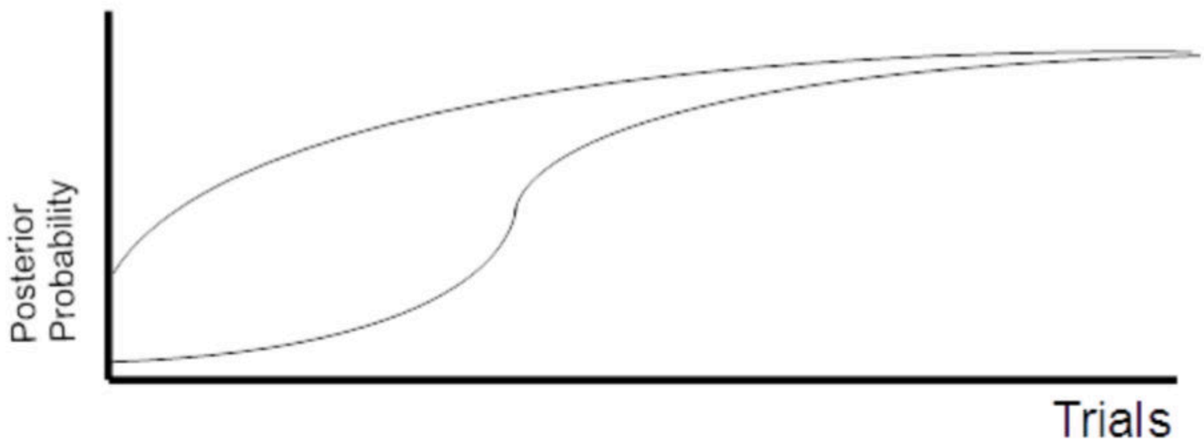
Bayesian updating:
Let's say that we throw a coin, and we want to test if it is 'unfair'.
H: the coin is unfair (i.e. it will only show 'heads')

Without seeing evidence, we believe the coin is fair. That is, we think there is only a 1% probability that the coin is unfair: $P(H) = 0.01$. If we flip the coin once and it turns up heads, then either:

- the evidence is consistent with our hypothesis, and thus $P(E|H) = 1$.
- or, the coin can still be fair. This means that $P(E|-H) = 0.5$.

As true rational economist, we take this evidence into account and update our beliefs. As long as we keep flipping heads we keep updating our beliefs.

In the image below you can see that regardless of the starting percentages of our hypothesis we will end up in the same belief if we keep flipping heads long enough.



Confirmation bias: a tendency to interpret evidence as supporting prior beliefs to a greater extent than warranted.

Rational people come to the same conclusion after seeing some amount of evidence. This is independent of initial beliefs. In reality however, this is not always the case: People interpret the same evidence in a different way.

Adjustment

Conjunction fallacy: overestimating the probability of a conjunction (a string of events, all of which have to happen). People tend to use the probability of one event as an 'anchor', and then adjust downward insufficiently.

Disjunction fallacy: underestimating the probability of a disjunction (a string of events, one of which have to happen). Disjunction fallacy: underestimating the probability of a disjunction (a string of events, one of which have to happen).

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