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Problems of Human Factors in Project Decisions

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Modern economics has recognised that humans do not behave rationally

Traditional economics relies on some fundamental assumptions:

- **Markets are efficient,**
  - **laws of supply and demand act quickly to regulate prices,**
  - **opportunities for arbitrage are limited**
  - **all money is fungible**
- **People are rational actors, they make decisions to optimise their long term well being.**

Exceptions to these rules are "Supposedly Insignificant Factors" (SIF's).

- Modern economists (notably Richard H. Thaler and Cass R. Sunstein) have recognised that these assumptions do not hold
- This gives rise to significant anomalies, where economic theory does not work or cannot alone explain human behaviour.

- Projects are examples of human economic activity and also exhibit these anomalies.
- Recognising these anomalies and the reasons for them can help us control projects better.

Econs and Humans – “The Odd Couple”

Felix – Econ

Rational – disciplined, seeking to optimise his long term happiness

Oscar – Human

Irrational – poor impulse control, lives for the moment

Examples of irrational behaviour

Four key effects:

- Endowment Effect and Loss Aversion: people value things they already have more highly than things that are available but not yet owned

- Narrow Framing and Short Termism: people don't consider the wider context or the long term consequences in their decisions, leading to inconsistency

- Mental Accounting: people are reluctant to write-off sunk costs or trade-off between separate issues – they do not always treat money as fungible

- Acquisition and Transactional Utility: apart from the value people experience from a thing, they also perceive value from the transaction itself, e.g. a bargain or a rip-off.

Endowment Effect: people value things they already have more highly than things that are available but not yet owned

Felix and Oscar are both wine enthusiasts.

They both have bottles in their cellar that they purchased long ago for $ 10 that are now worth over $ 100. In fact, a local wine merchant is willing to buy some of the older bottles at current prices.

Endowment Effect: people value things they already have more highly than things that are available but not yet owned

Oscar occasionally drinks one of those bottles on a special occasion, but he would never dream of paying $ 100 to acquire one.

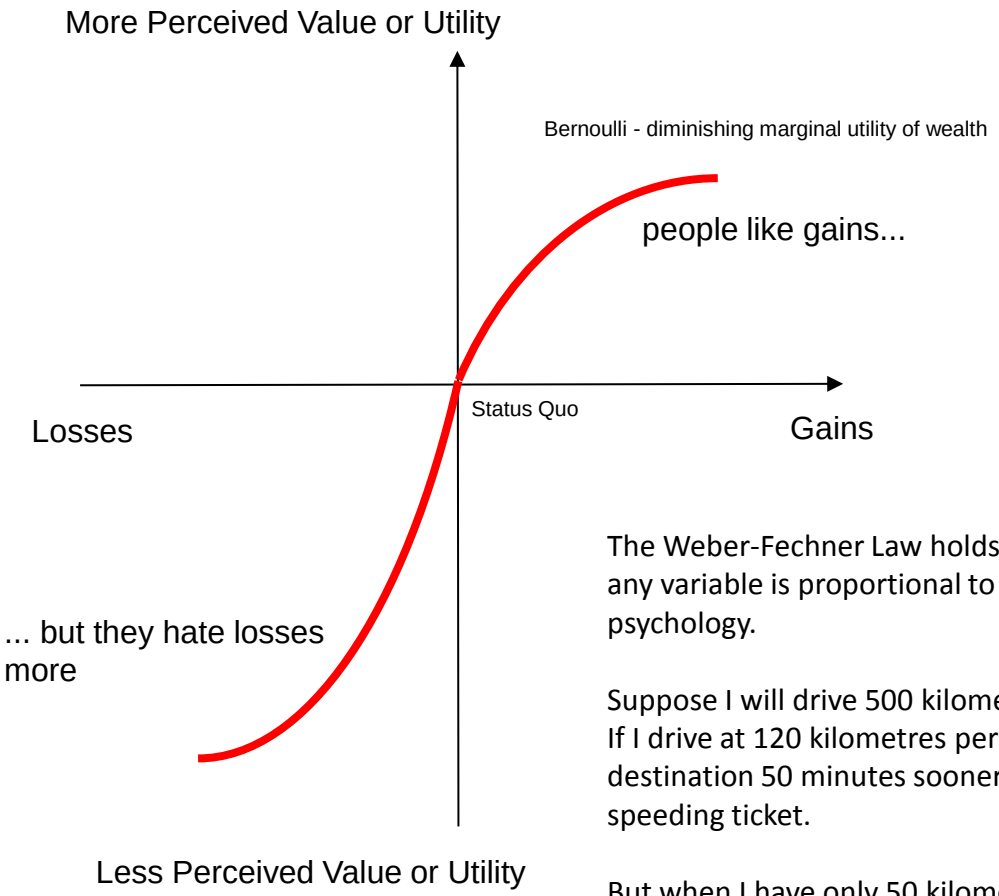
He also would not sell any of his bottles.

Felix thinks this is illogical. If he is willing to drink a bottle that he could sell for $ 100, then drinking it has to be worth more than $ 100. But then, why wouldn't he also be willing to buy such a bottle that cost anything close to $ 100?

Felix asks Oscar, "What do you think a bottle would have been worth if you dropped it?"

Oscar values the wine he owns more than the wine he could buy and even more than the cash he could sell it for.

Value Function



The Weber-Fechner Law holds that the Just-Noticeable Difference (JND) in any variable is proportional to the magnitude of that variable - from basic psychology.

Suppose I will drive 500 kilometres today. How fast should I drive?
If I drive at 120 kilometres per hour instead of 100, we will get to our destination 50 minutes sooner, which seems like enough time saved to risk a speeding ticket.

But when I have only 50 kilometres left to go, I will only save 5 minutes by driving faster. That doesn't seem worth it. So, should I be gradually slowing down as I get closer to my destination?

Rationally, we should have a consistent policy for the whole trip.

…but maybe wine enthusiasts are all a bit eccentric?

Endowment Effect: the value of life

Let a six-year-old girl with brown hair need thousands of dollars for an operation that will prolong her life until Christmas, and the post office will be swamped with nickels and dimes to save her. But let it be reported that without sales tax the hospital facilities of Massachusetts will deteriorate and cause a barely perceptible increase in preventable deaths— not many will drop a tear or reach for their checkbooks. Thomas Schelling, "The Life You Save May Be Your Own."

Merryn Lacy and her mum Jenny

The mother of a brave four-year-old girl with a rare form of childhood cancer has appealed for help to raise more than £120,000 for her daughter's specialist treatment in the US.

Raising money for

Solving Kids' Cancer

Solving Kids' Cancer

Charity Registration No. 1135601

Donations are paid into Solving Kids' Cancer's general funds for our charitable activities. We fund the next generation of innovative research into neuroblastoma, sarcomas and brain tumours; support families facing childhood cancer; and facilitate access to clinical trials

Read more about my charity

Hospital mortality = "statistical life,"

Small girl = "identified life."

Thousands of "unidentified" people die every day for lack of simple things like mosquito nets, or clean water.

We feel invested in a life as soon as it is identified.
The better we get to know someone (like a friend or relative) , the more invested we become.

Endowment Effect: the value of a statistical life

If safety engineers tell us that widening the central reservation will cost £42m and save 1.4 fatal accidents per year over 30 years then is it worthwhile?

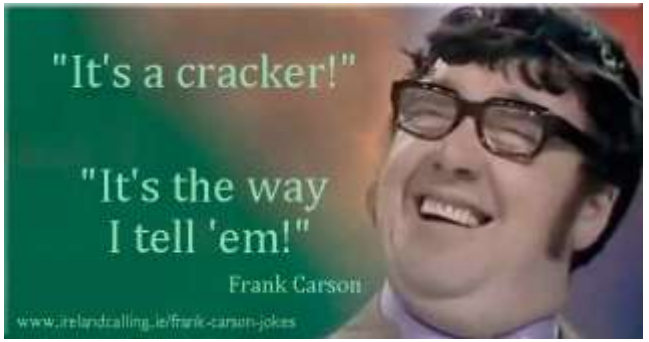
42/(1.4 x 30) = £1m per fatal accident saved.

Matching occupational mortality rates to readily available data on wages by occupation, Thaler and Rosen estimated how much people had to be paid to be willing to accept a higher risk of dying on the job.
This is now typically used by governments to determine the value of a statistical life,

… about $7 million or £5 million.

Question: what is the correct foreign exchange rate in these circumstances?

Endowment Effect: the value of life - It's the way you ask 'em!



"willingness to pay" - how much you would pay to reduce your probability of dying next year by some amount, say by one chance in a thousand?

"willingness to accept" - how much cash you would demand to increase the risk of dying by the same amount?

This is the subject of the experiment.

Scenario A: Willingness to Pay

Suppose by attending this conference you have exposed yourself to a rare fatal disease. If you contract the disease you will die a quick and painless death sometime next week.

The chance you will get the disease is 1 in 1,000.

We have a single dose of an antidote for this disease that we will sell to the highest bidder. If you take this antidote the risk of dying from the disease goes to zero.

What is the most you would be willing to pay for this antidote?

(If you are short on cash we will lend you the money to pay for the antidote at a zero rate of interest with thirty years to pay it back.)

Scenario B: Willingness to Accept

Scientists are doing some research on a rare fatal disease. They need volunteers who would be willing to simply walk into a room for five minutes and expose themselves to a 1 in 1,000 risk of getting the disease and dying a quick and painless death in the next week.

No antidote will be available.

What is the least amount of money you would demand to participate in this research study?

Endowment Effect: the value of life

To put these numbers in some context, a fifty-year-old person faces a roughly 4-in-1,000 risk of dying each year.

Felix says the answers should be nearly equal. For a fifty-year-old answering the questions, the trade-off between money and risk of death should be the same when moving from a risk of 5 in 1,000 (. 005) to .004 (as in the first version of the question) than in moving from a risk of .004 to .005 (as in the second version).

In previous repeated experiments with humans typical answers ran along these lines:

I would not pay more than $ 2,000 for the antidote (A) but would not accept less than $ 500,000 for volunteering to be infected(B).

In fact, in version B many respondents claimed that they would not participate in the study at any price.

Endowment Effect: experiment results

In our experiment today we had these results:

	Scenario A: Willingness to Pay	Scenario B: Willingness to Accept
Min. Value	0	1K
Avg. Value	74K	780M
Max. Value	500K	10Bn
No. of responses	14	16 (3 said never)

Endowment Effect: the value of life

Remember, a fifty-year-old person faces a roughly 4-in-1,000 risk of dying each year.

So Oscar is facing a .004 chance of dying in the next year. Suppose he gives the answers from the previous slide:

$ 2,000 for scenario A and $ 500,000 for scenario B.

The first answer implies that the increase from .004 to .005 only makes him worse off by at most $ 2,000, since he would be unwilling to pay more to avoid the extra risk.

But, his second answer said that he would not accept the same increase in risk for less than $ 500,000.

Clearly, the difference between a risk of .004 and .005 cannot be at most $ 2,000 and at least $ 500,000!

Economic theory is not alone in saying the answers should be identical. Logical consistency demands it.

Anomalies in Project Control

One example of where the Endowment Effect influences decision making in projects is in the down selection of options. Decision makers frequently delay down selection because they are reluctant to lose options, even when maintaining the options past their “sell-by date” will cost them more.

Often decision makers are more ready to accept existing risk than they are willing to pay to mitigate it, …

… while they are unwilling to take new risk even when the potential rewards are large.

Decision Architecture

We can influence Oscar and help him make better decisions by recognising his behaviour and structuring the decision for him – this is the **Decision Architecture.**

- Recognise that people experience the Endowment Effect
- Make the relative costs of choices more explicit and objective
- Use this to illustrate the consequences – long term risk and opportunity cost, relative to the status quo
- Create decision points where the choice is brought to a head
- Make it clear what the cost will be if the decision is delayed beyond the decision point

Examples in Project Controls: Time Value Inconsistency

All familiar with the principal of discounted cash flows for investment appraisal

Rational economic theory

Paul Samuelson's "Discounted Utility Model" - constant exponential rate (standard) or variable rate (discount faster in the short term and slower in the long term?)

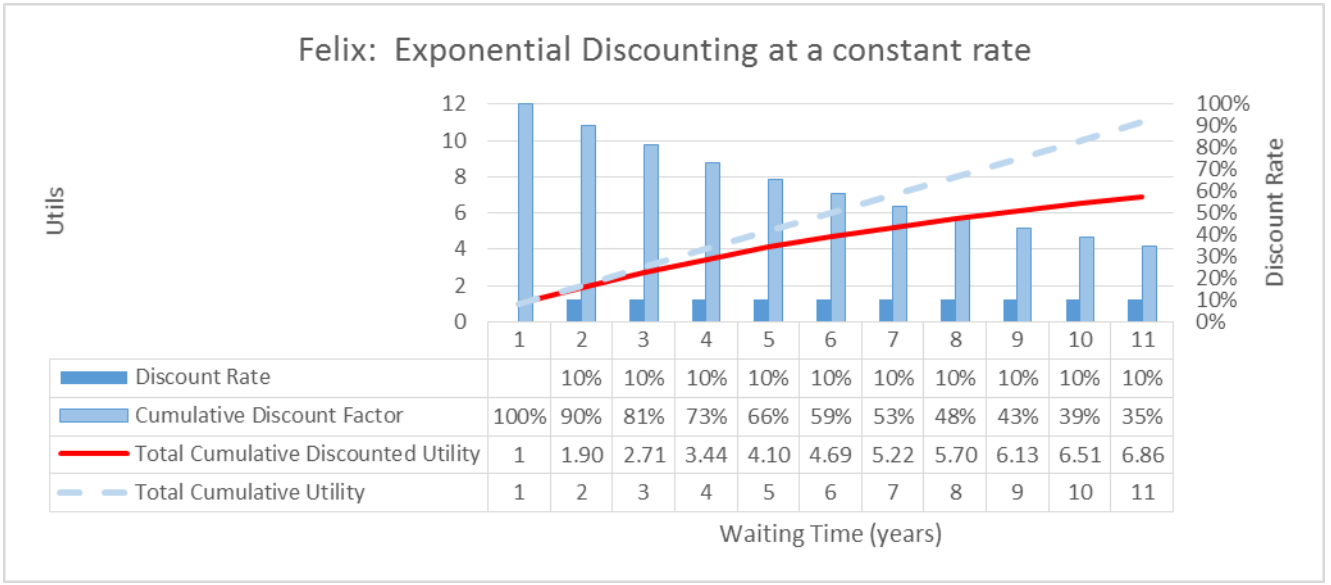
Suppose there is the chance to watch a ball game.

If the game is watched tonight, it would be worth 100 “utils”.

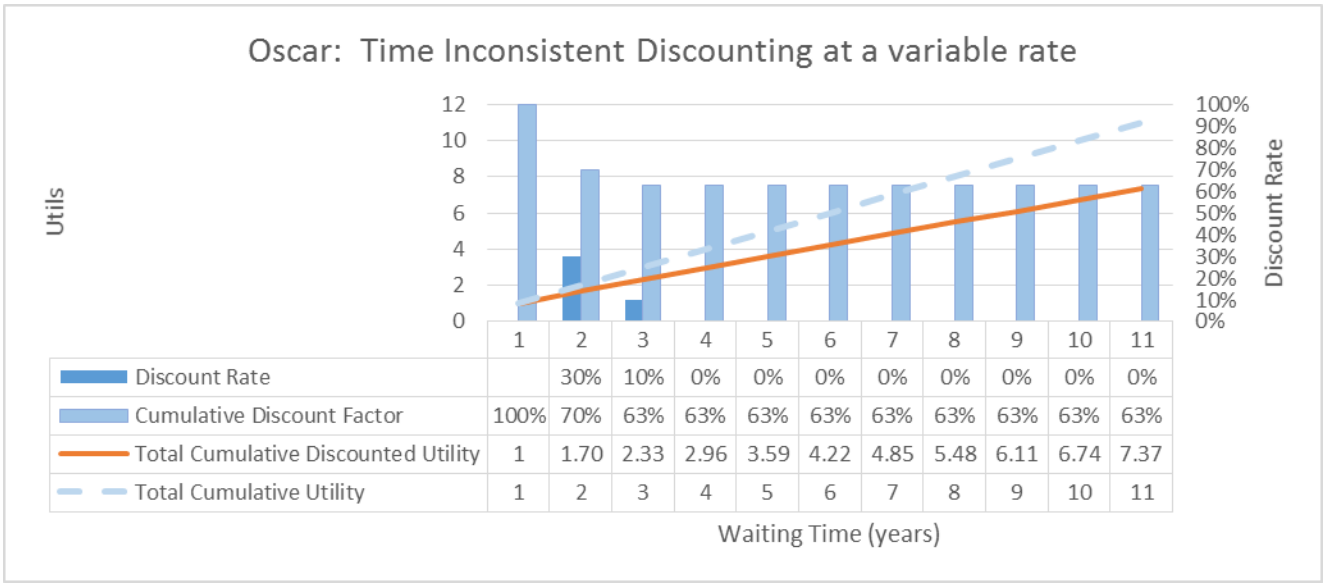
Felix discounts at a constant exponential rate of 10% per year.
For him that game would be worth 100 utils this year, 90 next year, then 81, 72, and so forth.

Oscar discounts at a hyperbolic or variable rate.
He also values that game at 100 today, but at only 70 the following year, then 63 in year three or any time after that.
Oscar discounts anything that he has to wait a year to consume by 30%, the next year at 10%, and then he stops discounting at all (0%). Oscar finds waiting at the beginning more painful because it seems longer.

Examples in Project Controls: Time Value Inconsistency



	1	2	3	4	5	6	7	8	9	10	11
Discount Rate		10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Cumulative Discount Factor	100%	90%	81%	73%	66%	59%	53%	48%	43%	39%	35%
Total Cumulative Discounted Utility	1	1.90	2.71	3.44	4.10	4.69	5.22	5.70	6.13	6.51	6.86
Total Cumulative Utility	1	2	3	4	5	6	7	8	9	10	11



	1	2	3	4	5	6	7	8	9	10	11
Discount Rate		30%	10%	0%	0%	0%	0%	0%	0%	0%	0%
Cumulative Discount Factor	100%	70%	63%	63%	63%	63%	63%	63%	63%	63%	63%
Total Cumulative Discounted Utility	1	1.70	2.33	2.96	3.59	4.22	4.85	5.48	6.11	6.74	7.37
Total Cumulative Utility	1	2	3	4	5	6	7	8	9	10	11

Examples in Project Controls: Time Value Inconsistency

Now our odd couple have an option to acquire ball game tickets:

Either, Option A: First Round tickets this year
Or, Option B: Quarter Final Tickets next year
Or, Option C: Tickets for the Final in two years

Let us say that, if the games were all for this year's tournament, the utilities they would assign to them are as follows:

Option A: 100
Option B: 150
Option C: 180

But in order to go to their favourite option C, the final, they have to wait two years. What will they do?

Examples in Project Controls: Time Value Inconsistency

Felix is an Econ and discounts at a constant rate of 10% pa.

He would choose to wait two years and go to the final.

The value he puts right now on going to the final in two years (its "present value")

= 146 ((100-10%)^2 = 81% of 180),

which is greater than the present value of A (100) or B (135, i.e. 90% of 150).

Furthermore, after a year has passed, if Felix is asked whether he wants to change his mind and go to option B, the quarterfinal, he will say no, since 90% of the value of C (162) is still greater than the value of B (150).

This is what it means to have time-consistent preferences. Felix will always stick to whatever plan he makes at the beginning, no matter what options he faces.

Examples in Project Controls: Time Value Inconsistency

What about Oscar who experiences "present bias" and discounts at a changing or "hyperbolic" rate, 30% for the first year, 10% for the next year and 0% thereafter?

When first presented with the choice, he would also choose option C, the final. Right now he values:

A = 100,

B = 105 (70% of 150)

C = 113 ((90% x 70%) = 63% of 180).

But unlike Felix, when a year passes, Oscar will change his mind and switch to B, the quarterfinal, because waiting one year discounts the value of C by 30% to 126, which is less than 150, the current value of B.

He is time-inconsistent and makes inconsistent and apparently irrational decisions – and he never gets to see the final.

Time value inconsistency in government and business

Shareholding - Shares, and influence over company decisions, can be bought and sold at very short notice, corporate financing
→ emphasis on short term results

Government Financing – incentive to back projects that return good news in the short term, or at specific times in the political cycle, e,g, just before an election → non-linear discounting of future benefits

Media Attention – fickle media coverage causes short term reactions to headlines, and yesterday's news is forgotten when the next juicy headline comes along → priorities go in and out of fashion

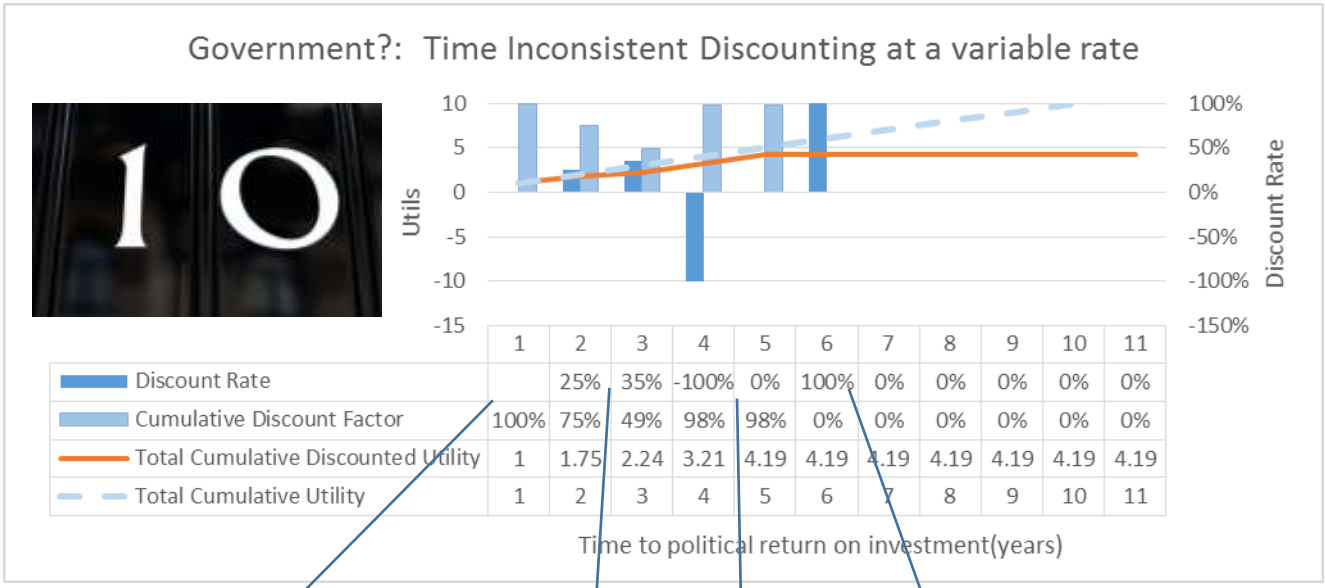
Long term projects – need to report healthy earned value leads to exaggeration of progress and denial of remaining risk, even though the truth must come out eventually – "but maybe we will all be in a different job (or retired) by then?"

→ instability in the world economy, poor forecasting and inconsistent management, inability to invest for the long term, e.g. environmental policy

Time value inconsistency in government

Consider a new government that has just won an election to serve a new 5 year term. From the perspective of their first year in office their utility for good outcomes might look something like this:

Now imagine you are taking a 10 year acquisition programme for approval with significant up front investment in development and production before the system enters service.



Timing is everything.

It is the culture of a society which has the greatest influence on its sense of time.

When Zhou Enlai, the Chinese prime minister was asked in the 1970s what he thought of the impact of the French revolution, he replied "it's too early to tell".

Decision Architecture

We can influence Oscar and help him make better decisions by recognising his behaviour and structuring the decision for him – this is the **Decision Architecture.**

- Recognise that people's time preferences for non-financial outcomes are not the same as discounted cash flows
- Understand his actual time preferences – don't just assume they are exponential (constant).
- Use this to illustrate the consequences – time inconsistency
- Remind him of this when he is tempted to change his mind
- If he is reluctant to invest today for the long term, perhaps he will be more willing to commit now to invest more tomorrow – "save more tomorrow"

By understanding his behaviour we can help him get to see the final.

Summary

Real world is full of Humans, not Econs

- Endowment Effect and Loss Aversion
- Narrow Framing and Short Termism
- Mental Accounting
- Acquisition and Transactional Utility

When we simply apply rational economic theory and optimisation models to projects

- we do not get reliable forecasts of what will happen
- we shouldn't be surprised when leaders do not take our advice.

By considering the reality of human behaviour

- we can better forecast what people will actually do,
- and we can help decision makers to make better decisions

Recommended Reading

Ariely, D. “Predictably Irrational: The Hidden Forces that Shape Our Decisions”

Thaler, R.H., “Misbehaving: How Economics Became Behavioural”

Thaler, R.H. & Sunstein, C.R., “Nudge: Improving Decisions About Health, Wealth and Happiness”

Back up slides