Behavioral economics

Lecture V - **Decision-making under risk**

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References:

- Cartwright, E. (2018). Behavioral economics. Routledge.Chicago

Decision number	Option A	Option B
1	2 points with 30% probability 1 point with 70% probability	3 points with 30% probability 0 points with 70% probability
2	2 points with 40% probability 1 point with 60% probability	3 points with 40% probability 0 points with 60% probability
3	2 points with 50% probability 1 point with 50% probability	3 points with 50% probability 0 points with 50% probability
4	2 points with 60% probability 1 point with 40% probability	3 points with 60% probability 0 points with 40% probability
5	2 points with 70% probability 1 point with 30% probability	3 points with 70% probability 0 points with 30% probability
6	2 points with 80% probability 1 point with 20% probability	3 points with 80% probability 0 points with 20% probability

Choice with risk

- Economic choices are almost always made with some uncertainty as to what the outcome will be. A person buys groceries without knowing for sure how tasty they will be. He buys a new car without knowing how it will perform or how long it will last, a plane ticket without knowing whether the plane will be delayed, house insurance because he does not know whether his house will be burgled, and he invests in shares without knowing whether they will increase or decrease in value. In the last lecture we saw that uncertainty can lead to choice arbitrariness and all the consequences that entails. In this lecture we will look in more detail at some other important consequences of risk.

- Before we get started there is one distinction that needs to be explained. We say that someone faces a situation of risk if they know what could happen and how likely it is. An example would be someone who bets $10 on the toss of a coin; they know that there is a 50:50 chance it could be heads or tails, and, if it's heads, they win $10 and, if it's tails, they lose $10. We say that someone faces a situation of uncertainty if they do not know some of the possible outcomes or how likely they are. An example would be someone booking a plane ticket, who is unlikely to know all the possible delays or problems that could happen to change their experience of the flight.

- Most of the situations we face are ones of uncertainty. Even the toss of a coin could be biased in many different ways. It is more difficult to model situations of uncertainty than ones of risk, however, and without knowing the consequences of risk we cannot get very far thinking about uncertainty. It is traditional, therefore, to focus on situations of risk which makes our task manageable.

- Imagine, I offer you to play a game, which goes as follows. We will toss a coin. If it lands on heads, you win 100 euros. If it lands on tails, you win 200 euros. How much euros (maximum) would you offer me to play this game?

Expected Value Hypothesis

$EV = P(H) \times V(H) + P(T) \times V(T)$

$EV = 0.5 \times 100 + 0.5 \times 200$

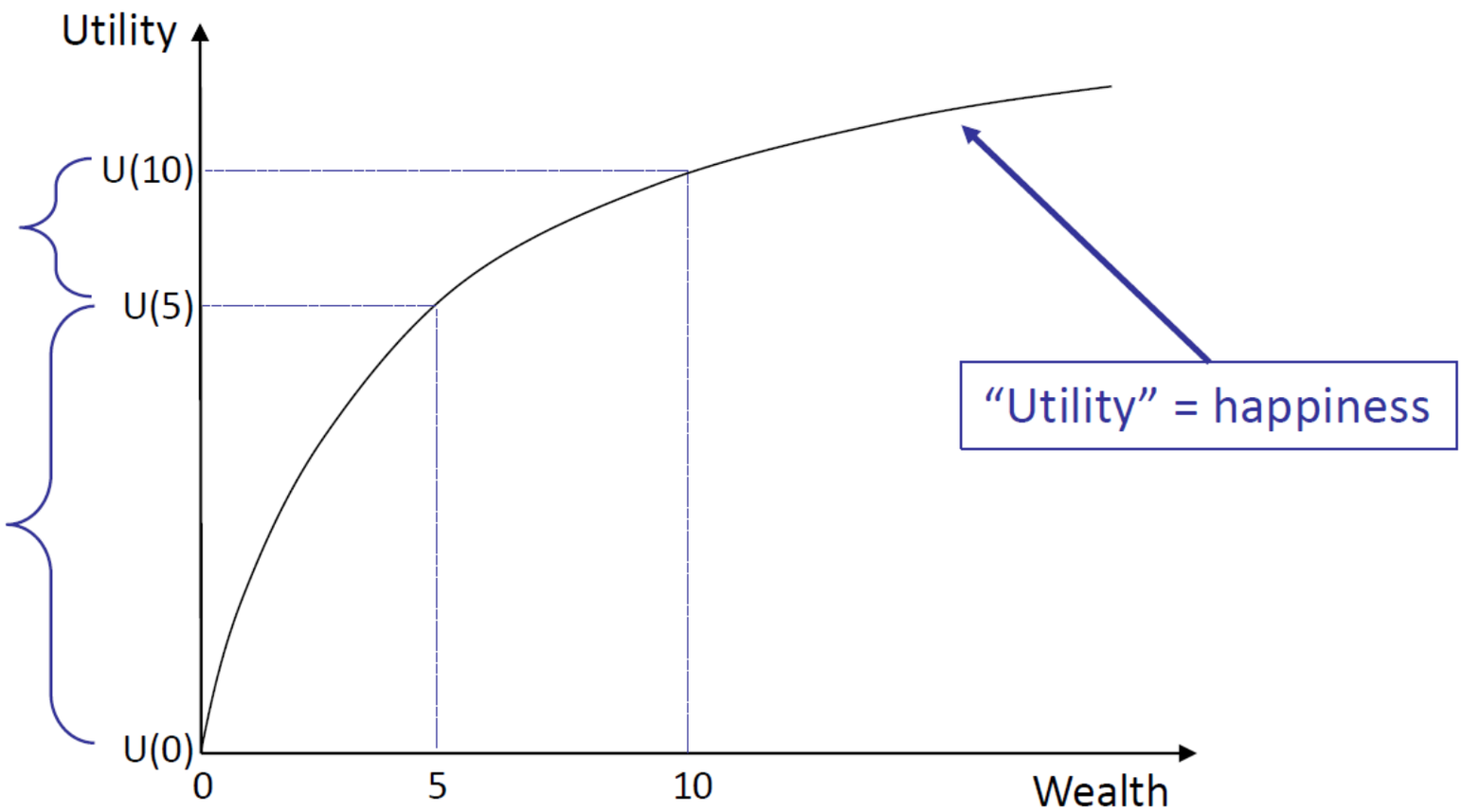
$EV = 50 + 100$

$EV = 150$

Would you pay 150 euros to play?

Utility of Money

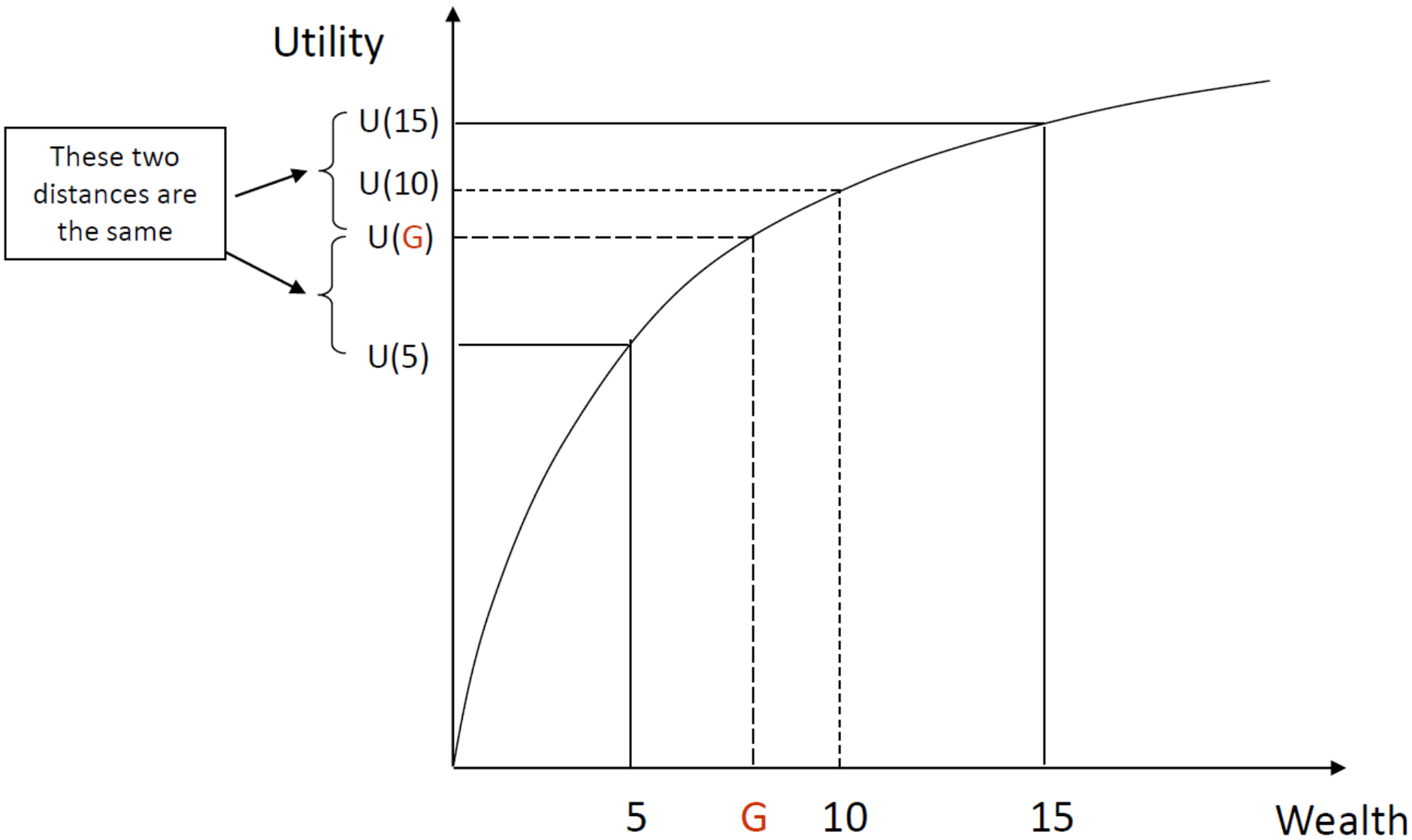
See the Lecture: Utility of Money



Implications of the graph:

- More money is undoubtedly better than less: U(10) > U(5), *BUT*
- The incremental (marginal) value of an additional dollar gets smaller as our wealth increases: U(5) – U(0) > U(10) – U(5)

Risk Aversion



$$\underbrace{U(G) = \tfrac{1}{2}\,U(5) + \tfrac{1}{2}\,U(15)}_{\text{The probability-weighted sum of the utilities for each outcome...}} \quad \underset{\text{...Is less than...}}{<} \quad \underbrace{U(\tfrac{1}{2} \times 5 + \tfrac{1}{2} \times 15) = U(10)}_{\text{...the utility of the expected value of the outcomes}}$$

Risk preferences

- The prospect that gives the highest expected utility will depend on the shape of the utility function.
- Someone is risk-averse if they prefer a certain amount of money to a prospect with the same expected value; they would rather avoid risk.
- Someone is risk-loving if they prefer a risky prospect to the expected value of the prospect for sure; they would prefer risk.
- Someone is risk-neutral if they are indifferent between risky prospect and the certain prospect with same expected value.

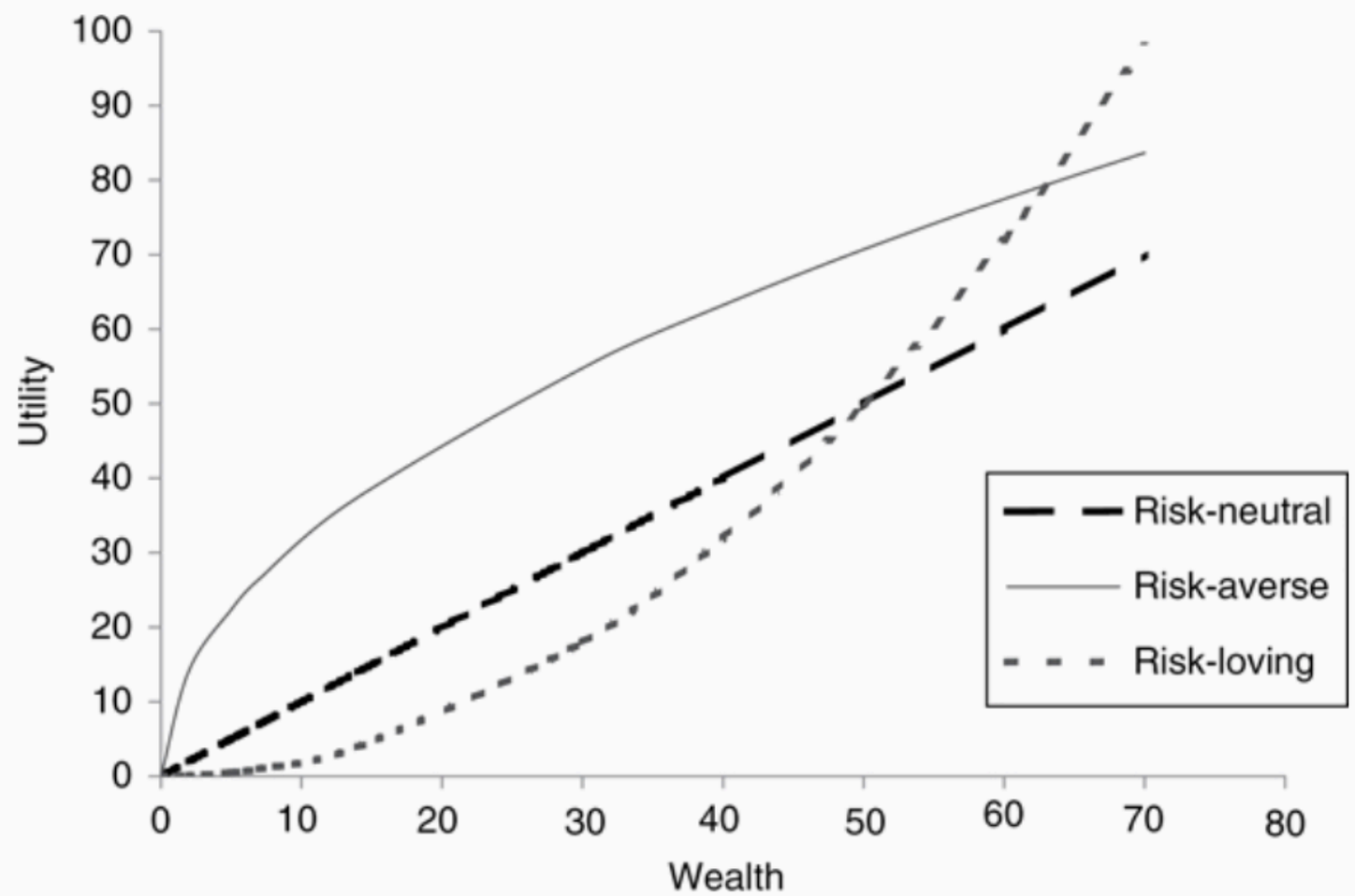


Figure 3.1 Three possible utility functions: one is concave, which would imply Alan is risk-averse, and one convex, which would imply Alan is risk-loving.

The problem with the Expected Utility hypothesis

	Yesterday	Today
Your wealth	1 million	2 million
Your friend's wealth	3 million	2 million

- Do you feel the same as your friend?
- Here is where the psychology enters the picture!
- Prospect Theory – Kahneman & Tversky (1979), Econometrica!

More on Risk Aversion

Please choose between Option A ($50 for certain) and Option B (an equally weighted gamble of either $100 or $0). Which do you prefer?

Option A

$50	For certain

Option B: flip a coin

$0	If heads
$100	If tails

Please choose between A & B

What happens if we increase the stakes a little?

Option D

$500	For certain

Option D: flip a coin

$0	If heads
$1,000	If tails

Please choose between C & D

Risk-Seeking Behavior

Now suppose that you have been kidnapped. Your (rather unusual) kidnapper tells you that you can choose between the following two options to obtain your freedom. (Assume that you have sufficient financial resources to make good on your agreement in either case):

Option A

Pay the kidnapper $500

Option B

Toss a fair coin

- Pay $0 if Heads
- Pay $1,000 if Tails

Loss Aversion

Here's a different type of game. In this situation, you aren't choosing between gambles with different levels of risk – you are choosing whether to play the gam at all.

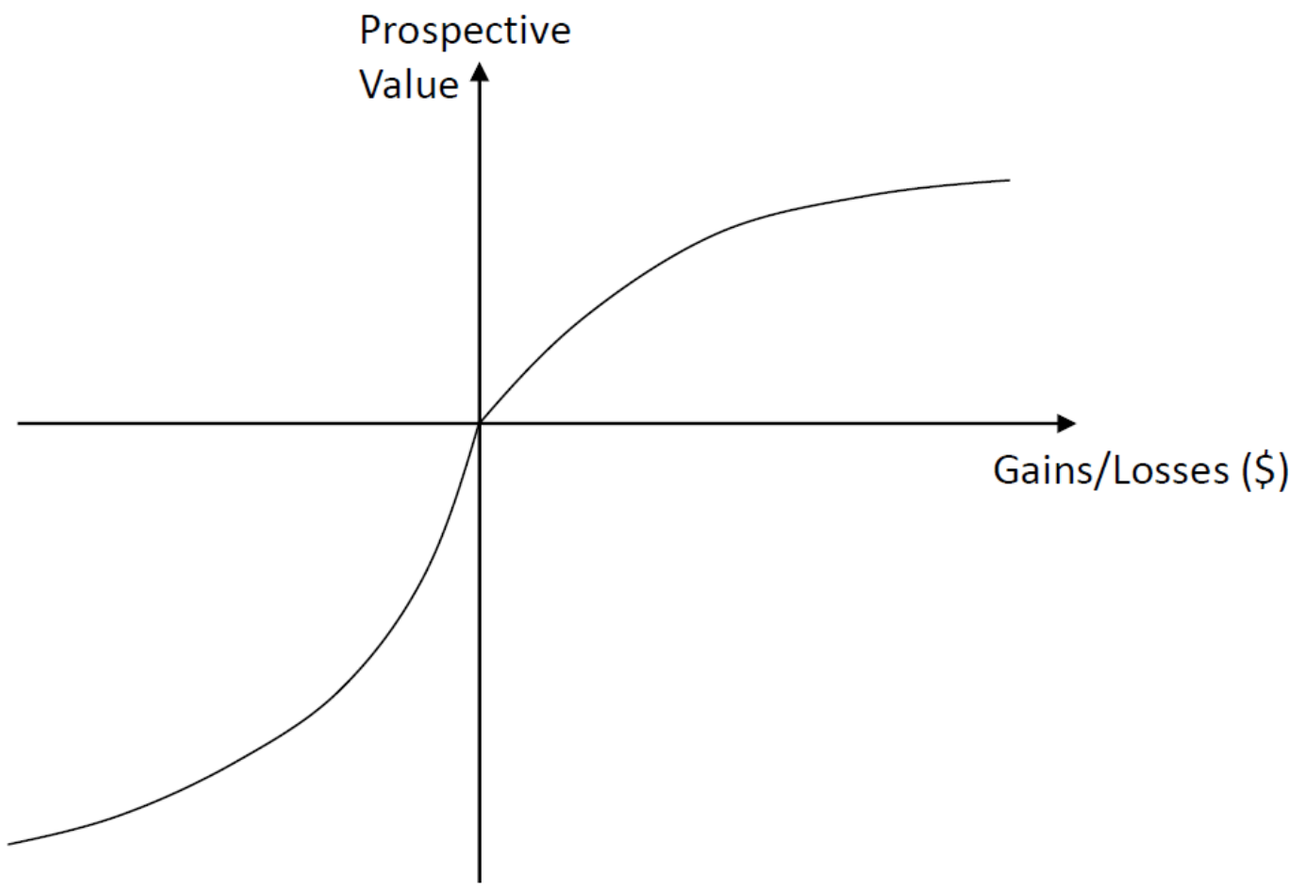
In this game, you toss a fair coin: if it lands Heads, you *win* $2,000; but if it lands Tails, you *lose* $1,000. Would you like to play this game? If you DO choose to play, you may play it only *once*.

Would you like to play this game?

WIN $2,000	If heads
LOSE $1,000	If tails

Do you want to play this game?

Prospect Theory



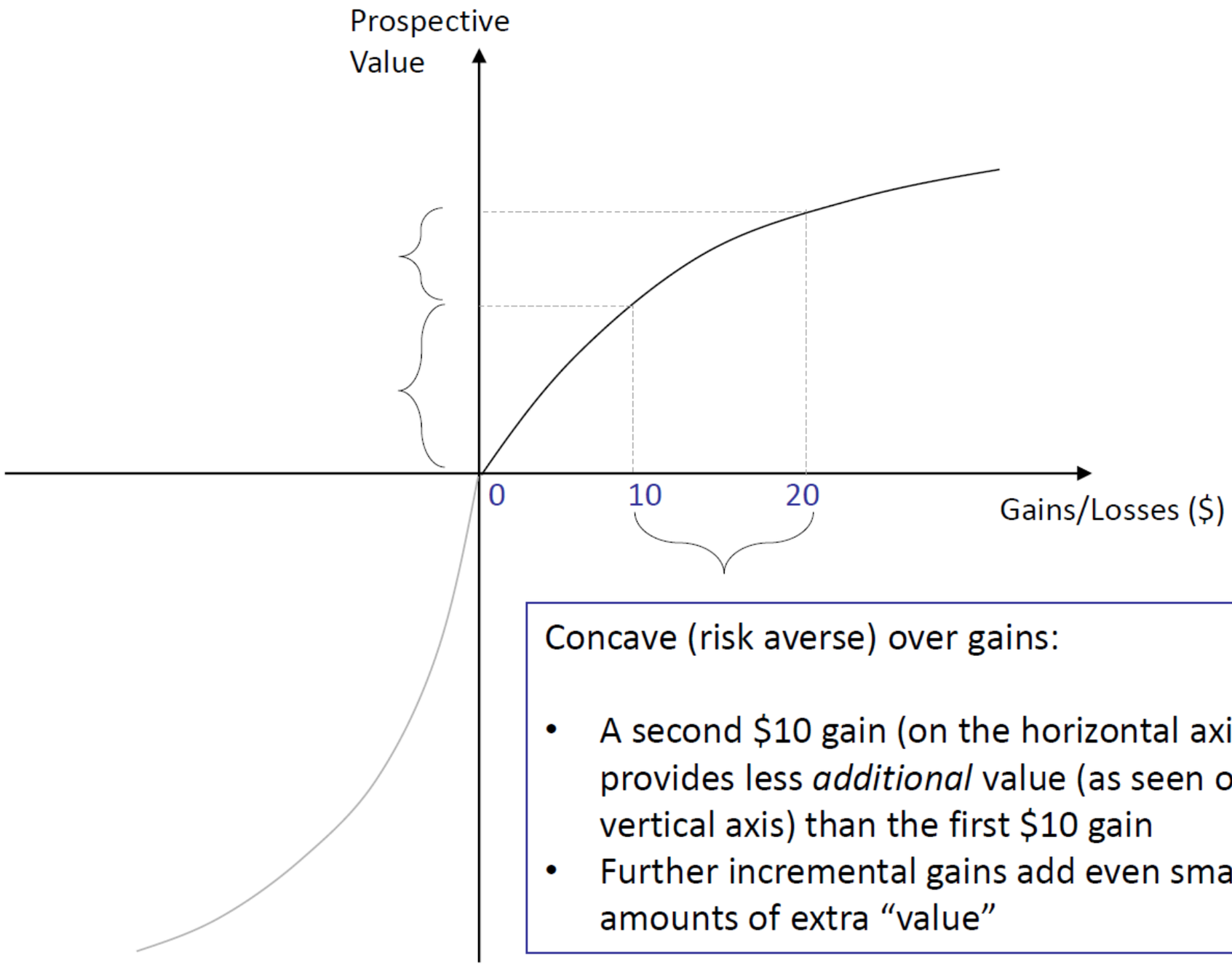
We will use the "Prospect Theory"* utility function as a more realistic model of how we respond to gains and losses:

- risk aversion over gains (just like expected utility)
- risk *seeking* over losses (*unlike* expected utility)
- loss aversion (*unlike* expected utility)

*Proposed by psychologists Daniel Kahnemann & Amos Tversky in the 1970s
Provides insights on human behavior that are not reflected in expected utility theory

Prospect Theory

Risk Averse over Gains



Concave (risk averse) over gains:

- A second $10 gain (on the horizontal axis) provides less *additional* value (as seen on the vertical axis) than the first $10 gain
- Further incremental gains add even smaller amounts of extra "value"

Note: graph is not precisely to scale

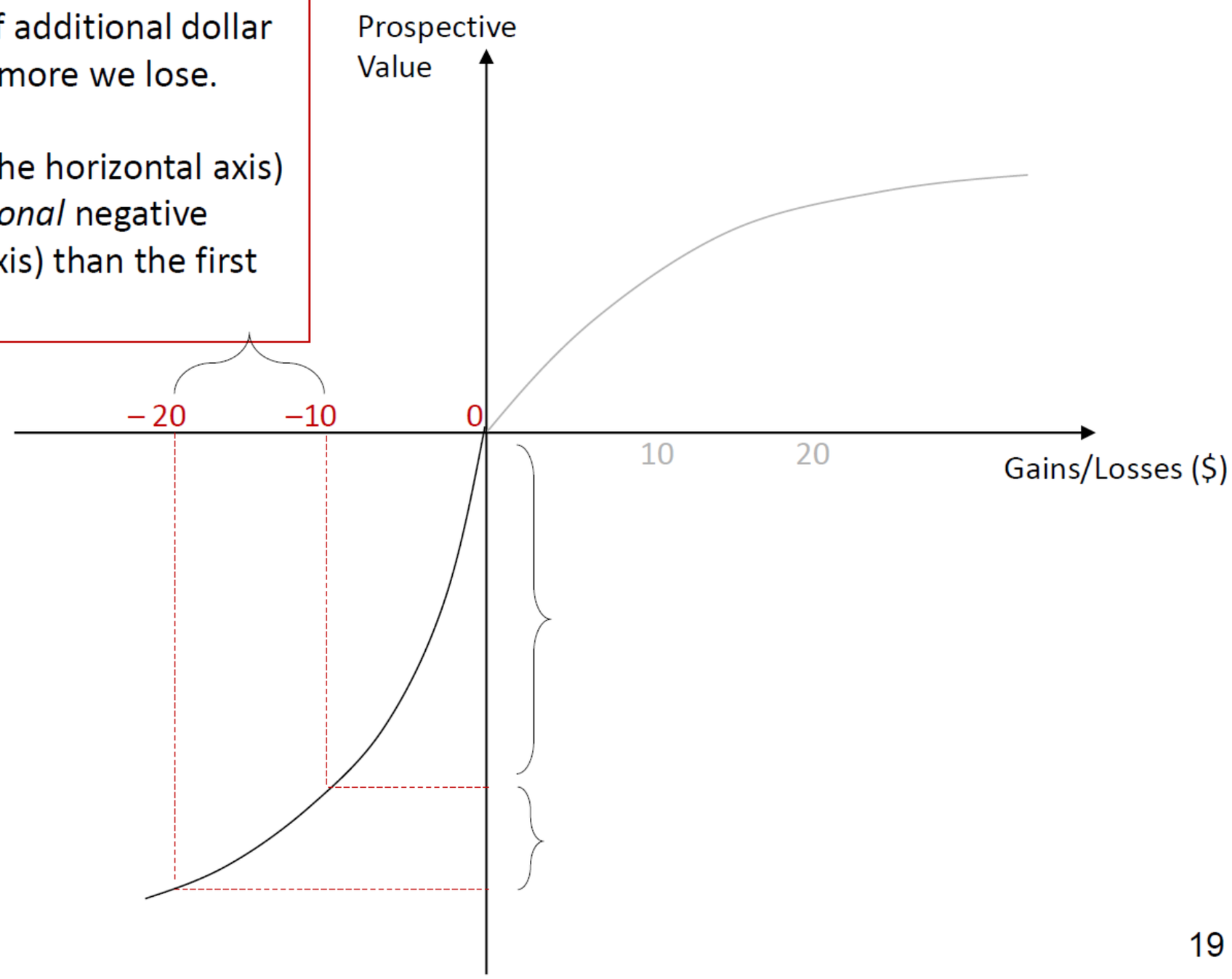
Prospect Theory

Risk Seeking over Losses

Convex (risk *seeking*) over losses:

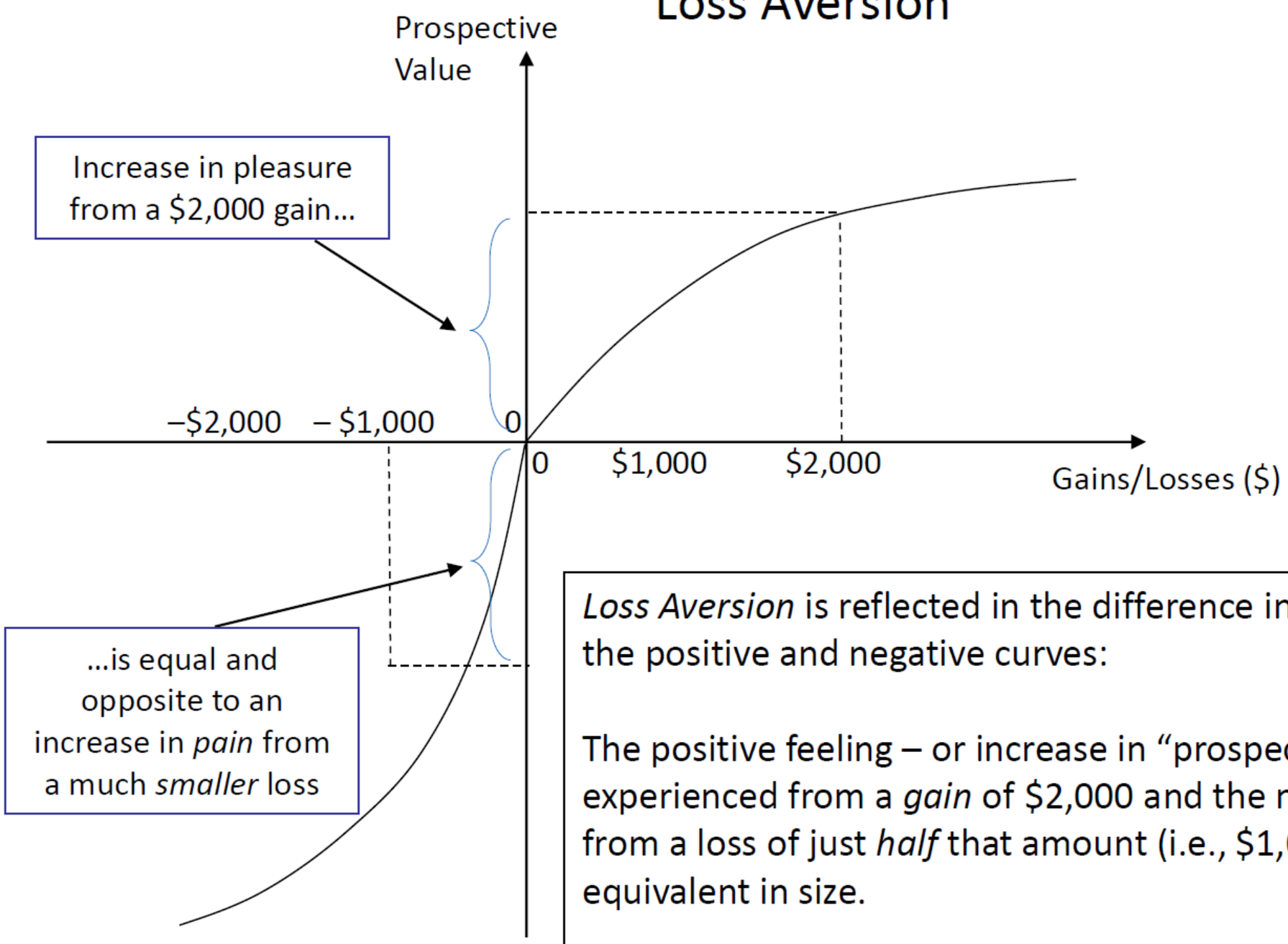
The *incremental* pain of additional dollar losses gets smaller the more we lose.

A second $10 loss (on the horizontal axis) translates to less *additional* negative value (on the vertical axis) than the first $10 loss.



Prospect Theory

Loss Aversion



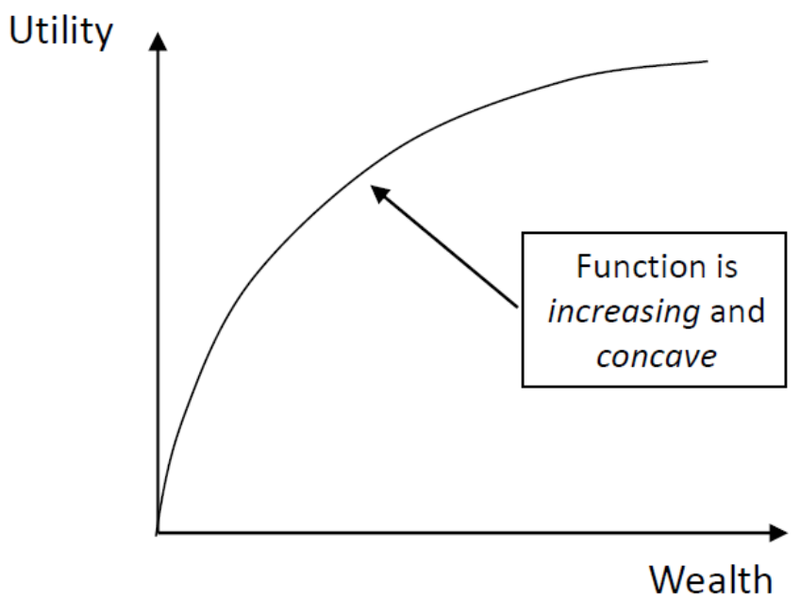
Loss Aversion is reflected in the difference in the *slopes* of the positive and negative curves:

The positive feeling – or increase in "prospective value" – experienced from a *gain* of $2,000 and the negative feeling from a loss of just *half* that amount (i.e., $1,000), are equivalent in size.

Equivalently, we can say that we feel greater pain from a loss than we feel pleasure for an equal-sized gain

Expected Utility (EU) versus Prospect Theory (PT)

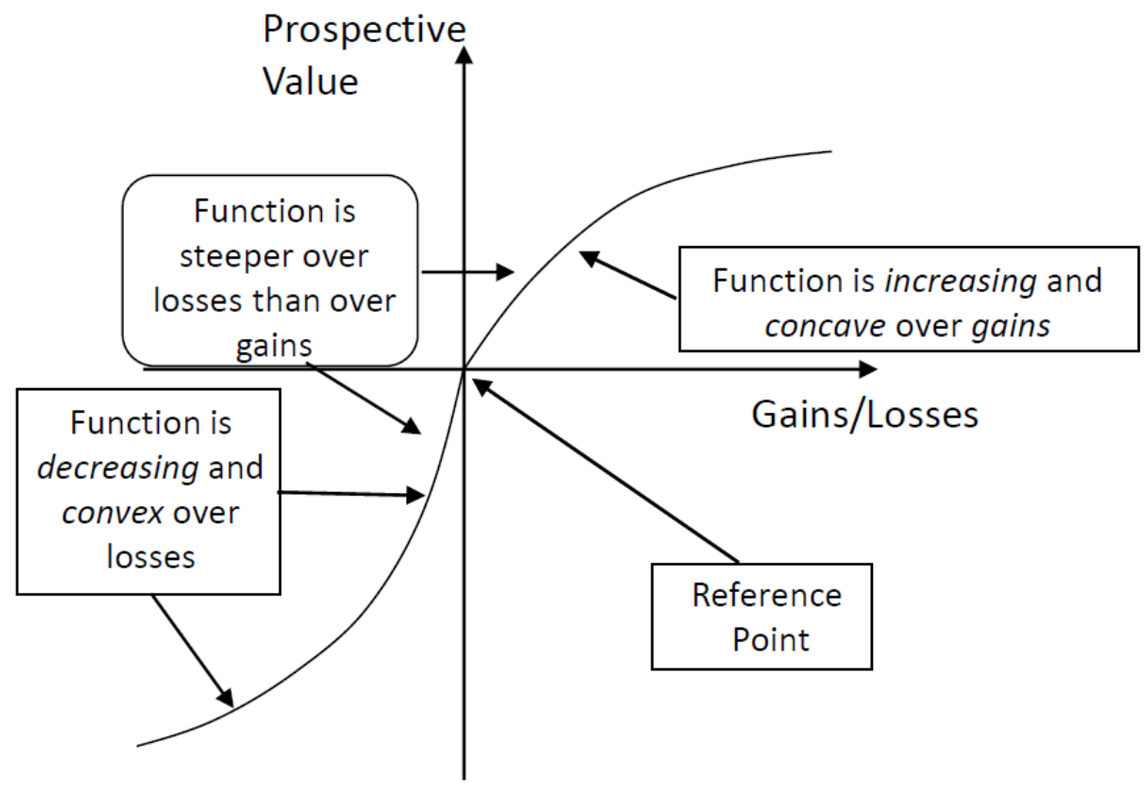
Expected Utility Theory



- Utility is measured as a function of absolute wealth
- Marginal (incremental) utility decreases as wealth increases (risk aversion)

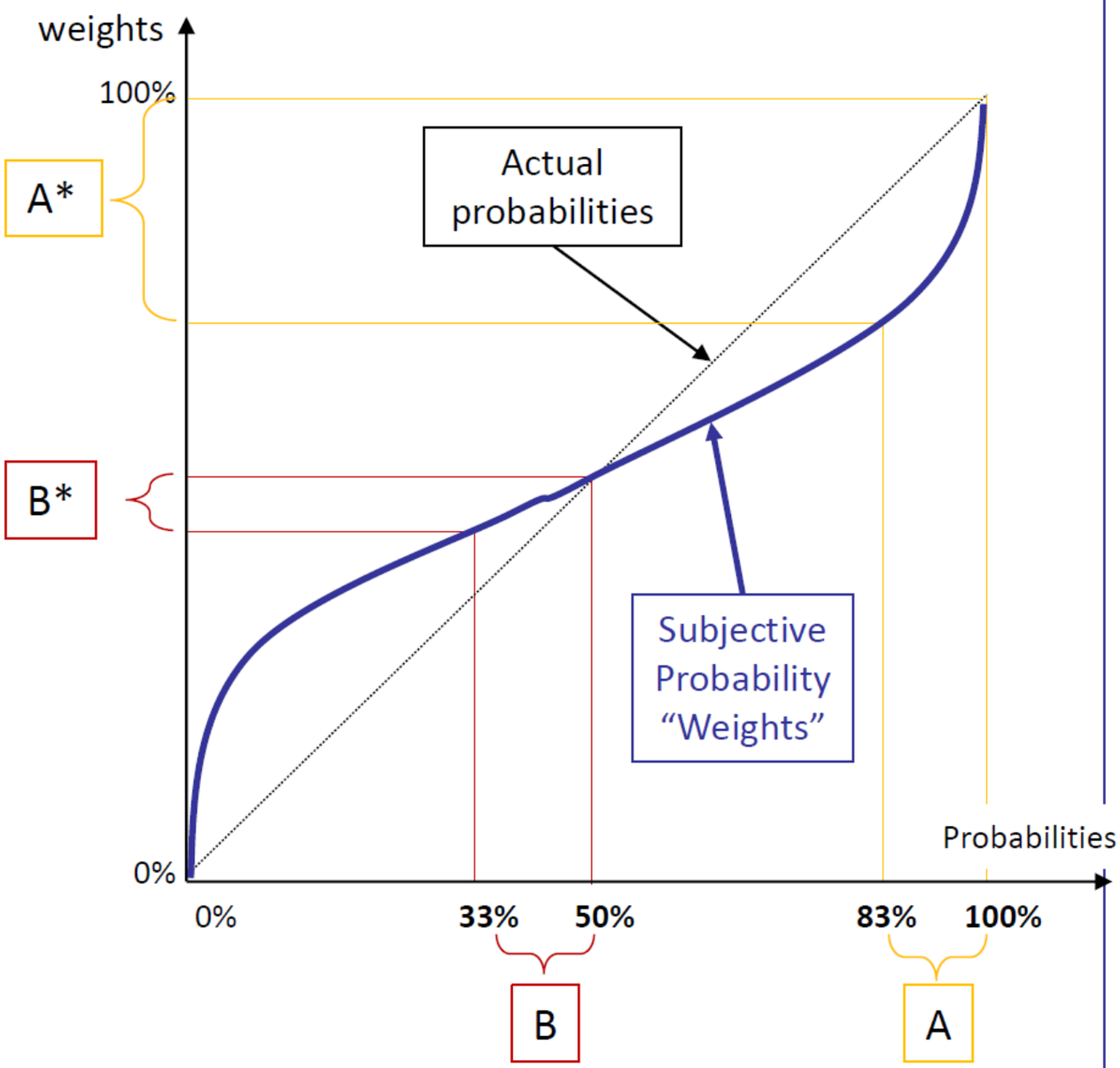
See the Lecture: Expected Utility vs. Prospect Theory

Prospect Theory



- Value is measured over gains and losses relative to a reference point
- Marginal (incremental) value decreases over gains but increases over losses (risk aversion for gains, risk seeking for losses)
- Value function is steeper over losses than over gains (loss aversion)

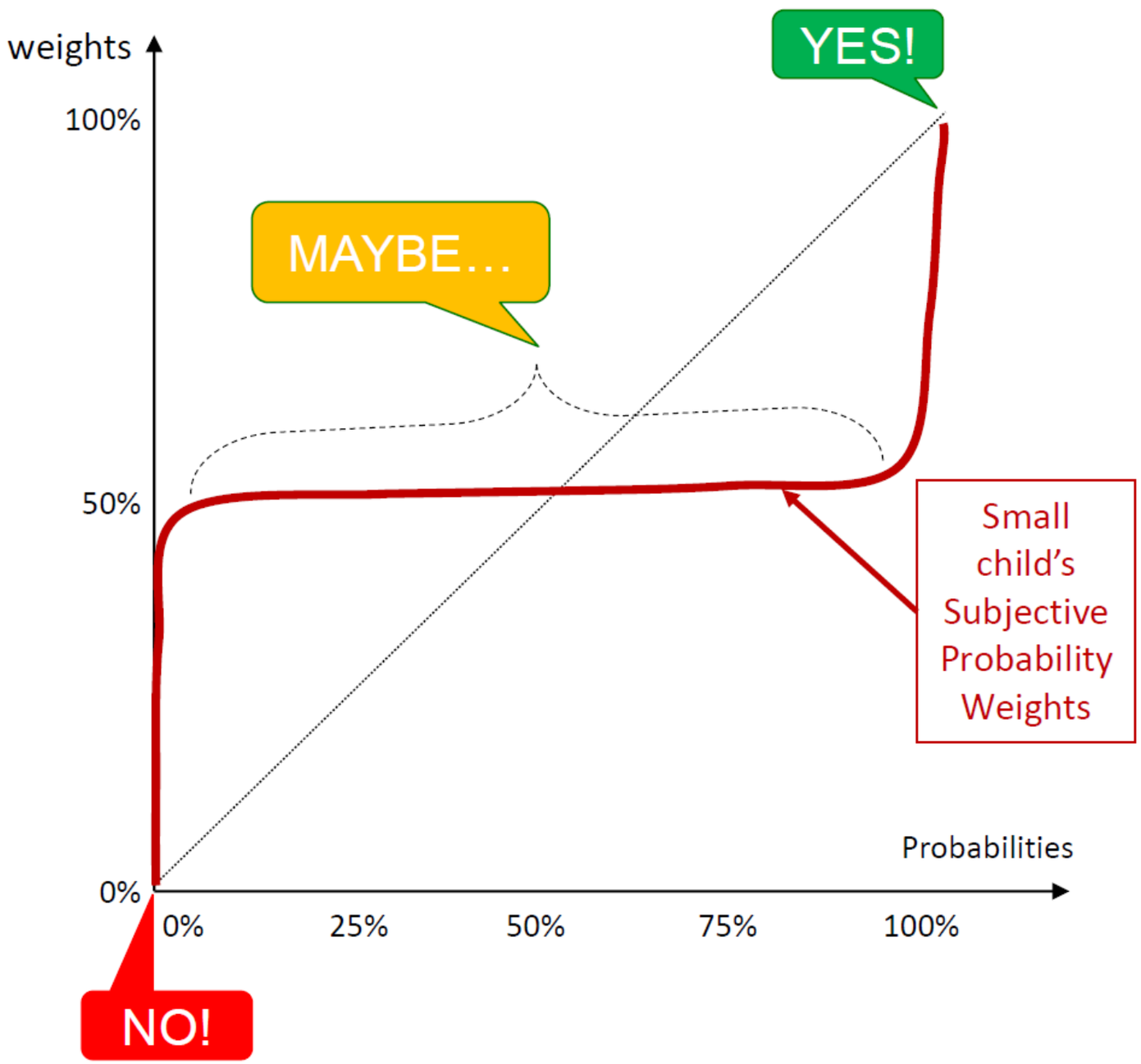
Probability Weighting Function



On this graph, "true" probabilities are on the horizontal axis, while our "subjective weight" interpretation is reflected in the dark blue curve, with values on the vertical axis.

- Look at the *actual* change in probability from 100% to 83% (marked A on the horizontal). This probability decrease of 1/6 (17%) takes us from *certain* death to merely *probable* with the removal of one bullet from the fully loaded gun. Our *subjective* response (A* on the vertical axis) to this change is noticeably larger than the objective probability change.
- Our emotional response to the change from certainty to probability is also significantly greater than our response to the change from 50% to 33% probability (distance B* on the vertical), even though it has the same 17% reduction B in true probability terms.

Subjective Probability & the Certainty Effect



Further examination of the graph helps us to see, more broadly, that we tend to be more sensitive to probability changes that take us from *certainty* to *probability*, than we are to probability changes in the middle of the range.

At the extreme, imagine the small child's weighting function: when asking for a treat (an icecream; an afternoon at the park) she understands the responses "yes" and "no", corresponding to 100% (certainly) and 0% (certainly not). All other probabilities are viewed generically as "maybe."

Probability Weighting: Glossary of characteristics

See the Lecture: Probability Weighting

- We tend to *overweight* low probability events, especially events that are especially "front of mind" or "salient" to us at a particular time (think fear of flying following 9/11)

- We tend to *underweight* high probability events, especially those that are sufficiently common that they tend not to be reported in the media (think automobile accidents)

- We tend to be less sensitive to changes in probability in the middle of the range (e.g., 30% to 40%) than changes that move us from probability to certainty (10% to 0%, or 90% to 100%): the *Certainty Effect*

Disappointment and regret

Fourfold Patter for Risk Aversion or Risk Seeking

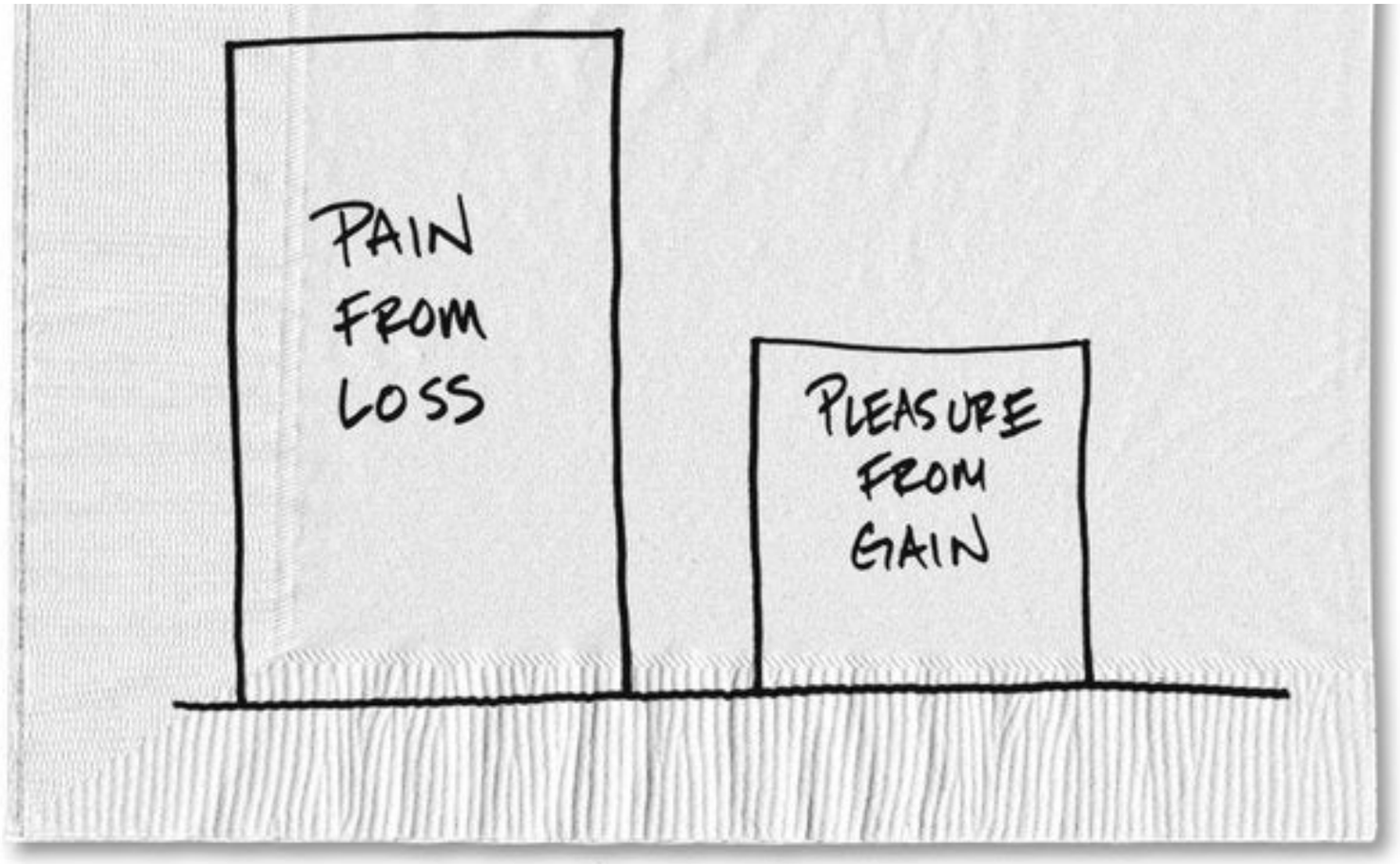
	Significant Gains	Significant Losses
High Probability	**Risk Averse** (under-weigh potential benefit) Fear of dissapointment Take unfavorable settlement Refuse preventative care Science Denialism?	**Risk Seeking** (under-weigh potential harm) Desperate to recoup loss Reject favorable settlement Continue gambling Seek risky pseudoscience
Low Probability	**Risk Seeking** (over-weigh potential benefit) Hope for large gain Reject favorable settlement Start gambling Supplements, acupuncture, Chiropractic?	**Risk Averse** (over-weigh potential harm) Fear of large loss Take unfavorable settlement Buy insurance Unwarranted diagnostic testing

Table 3.23 The fourfold pattern of risk attitudes in litigation.

	Low probability	Medium to high probability
Gains	**Risk-loving** (scenario C) Will go to court unless offered a generous settlement	**Risk-averse** (scenario B) Happy to settle out of court
Losses	**Risk-averse** (scenario A) Happy to settle out of court	**Risk-loving** (scenario D) Will go to court unless offered a generous settlement

Loss aversion

- “The concept of loss aversion is certainly the most significant contribution of psychology to behavioral economics” Daniel Kahneman
  - Endowment effect
  - Sunk-cost fallacy
  - Not enough risk seeking
  - Status Quo Bias
  - Disposition Effect
  - Framing



Negativity bias

- The negativity bias, is the notion that, even when of equal intensity, things of a more negative nature (e.g. unpleasant thoughts, emotions, or social interactions; harmful/traumatic events) have a greater effect on one's psychological state and processes than neutral or positive things.

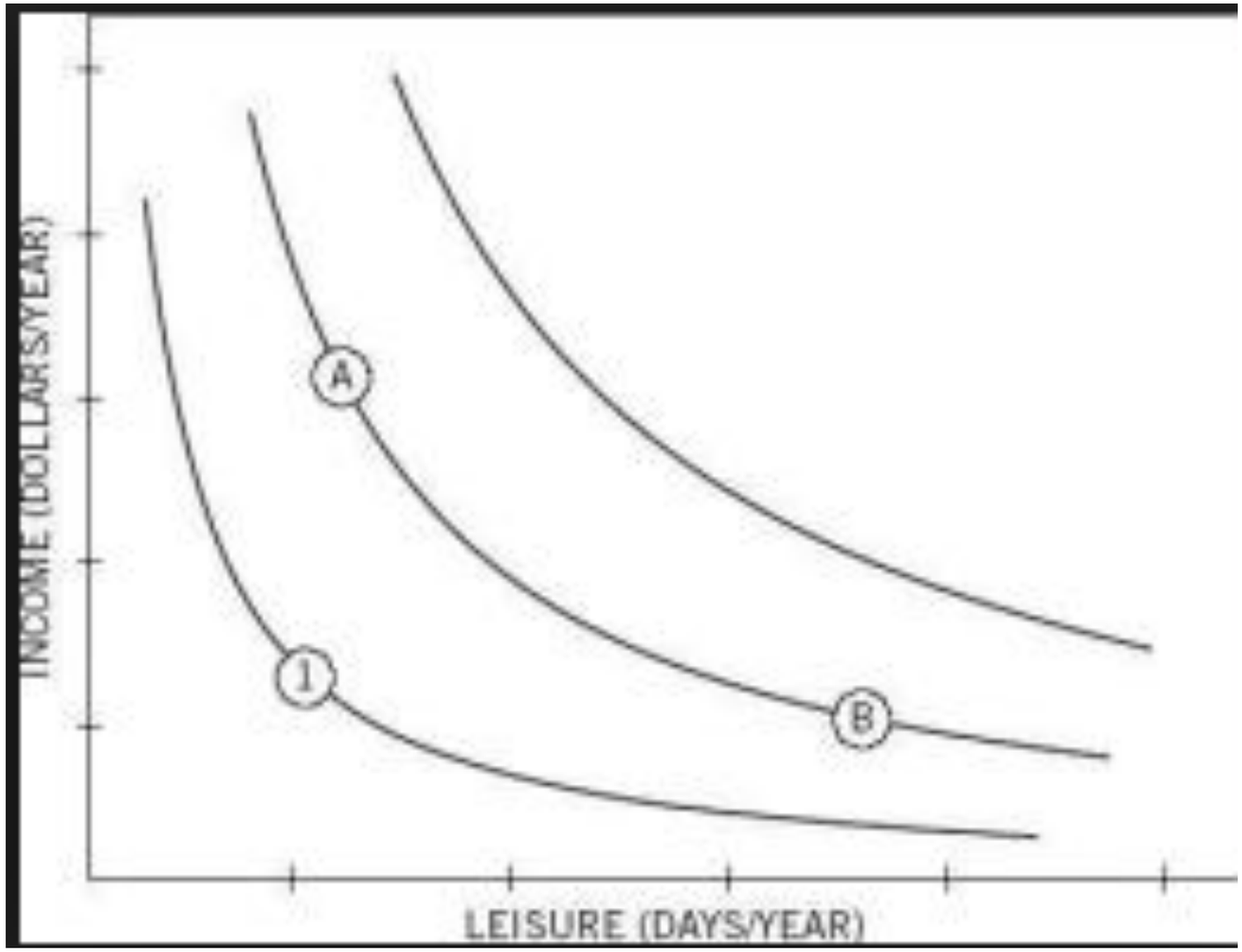
- In other words, something very positive will generally have less of an impact on a person's behavior and cognition than something equally emotional but negative.

- The negativity bias has been investigated within many different domains, including the formation of impressions and general evaluations; attention, learning, and memory; and decision-making and risk considerations.

Not enough risk taking

- Imagine you all are managers in the same company. Every one of you faces the following investment opportunity?
  - 50% chance of gaining 2 million EUR
  - 50% chance of losing 1 million EUR
  - Would you take it or leave it?
- How about a big picture…. How would your CEO feel about your prospects?

Status quo bias (the power of current state and defaults)



- If you're faced with many options to choose from and you can't devote time and energy to think them through, or you aren't sure what to do with them, what's generally the best thing to do? Don't change anything.

- We should generally assume people will stick with the status quo. That's true whether it's a deep-seated historical status quo or one that is arbitrarily chosen and presented as the status quo: to change is to risk loss .

Sunk-Cost fallacy

- The Sunk Cost Fallacy describes our tendency to follow through on an endeavor if we have already invested time, effort, or money into it, whether or not the current costs outweigh the benefits.

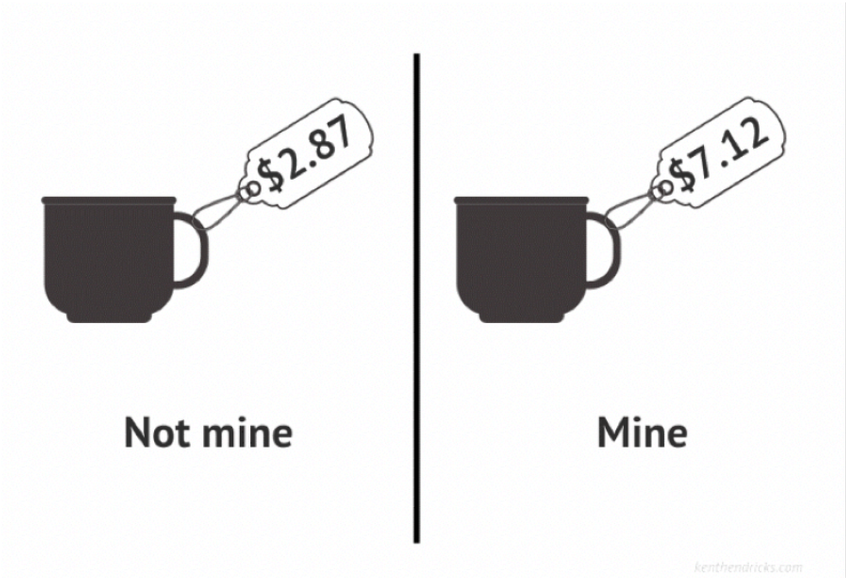
- In economic terms, sunk costs are costs that have already been incurred and cannot be recovered. It therefore should not be a factor in our current decision-making, because it is irrational to use irrecoverable costs as a rationale for making a present decision. If we acted rationally, only future costs and benefits would be taken into account, because regardless of what we have already invested, we will not get it back whether or not we follow through on the decision.

- The sunk cost fallacy means that we are making irrational decisions because we are factoring in influences other than the current alternatives. The fallacy affects many different areas of our lives leading to suboptimal outcomes.

- These outcomes range from deciding to stay with a partner even if we are unhappy because we've already invested years of our lives with them, to continuing to spend money renovating an old house, even if it would be cheaper to buy a new one because we've already invested money into it.

- https://www.theguardian.com/money/1999/nov/26/workandcareers1

The endowment effect



- The endowment effect is the finding that people are more likely to retain an object they own than acquire that same object when they do not own it.

- The endowment theory can be defined as "an application of prospect theory positing that loss aversion associated with ownership explains observed exchange asymmetries.”

- This is typically illustrated in two ways. In a valuation paradigm, people's maximum willingness to pay (WTP) to acquire an object is typically lower than the least amount they are willing to accept (WTA) to give up that same object when they own it—even when there is no cause for attachment, or even if the item was only obtained minutes ago. In an exchange paradigm, people given a good are reluctant to trade it for another good of similar value.

Disposition Effect

Game 1: you are given $30,000. It's yours to keep. Then you are asked to choose between the following two possibilities:

(A) Receive an additional $10,000 for sure
(B) Toss a coin: if it comes up Heads, you get an additional $20,000; if tails, you get nothing.

Game 2: you are given $50,000. Then you are asked to choose between the following two possibilities:

(C) A guaranteed *loss* of $10,000
(D) Toss a coin: if it comes up heads, you lose $20,000; if tails, you lose nothing.

If you picked (A) in the first game, and (D) in the second, you are in very good company: this pair is the most commonly selected combination

Note, however, that the outcomes in the combination (A) and (C) are identical: in both cases, you walk away $40,000 richer.

Similarly, (B) and (D) are identical: together, they generate a 50% chance of either $30,000 or $50,000.

This preference "switch" is known as the **Disposition Effect**. Why do so many people "flip" their preferences? If they selected (A) in Game 1, why not stick with (C) (which has identical outcomes in all scenarios) in Game 2?

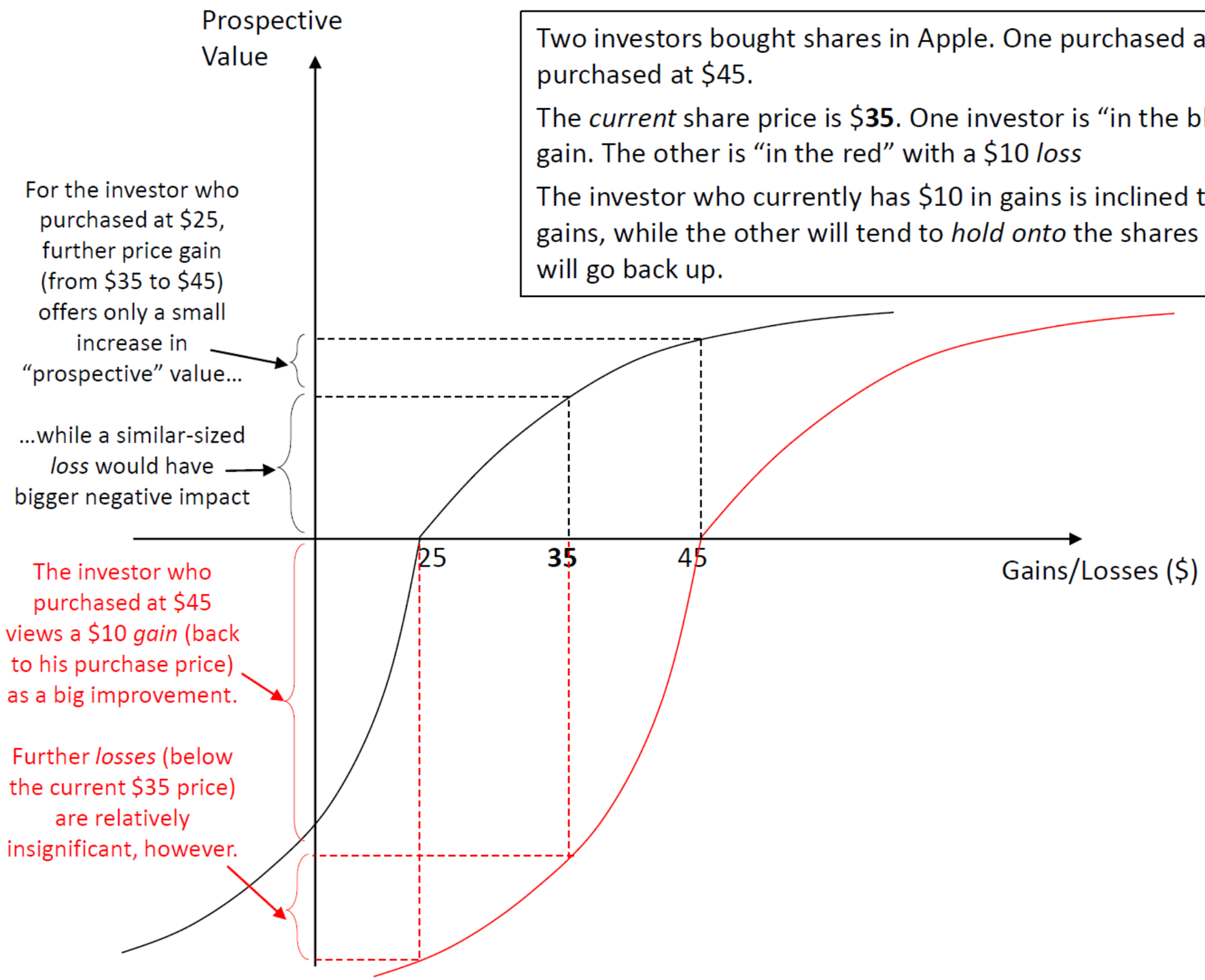
Prospect Theory

Reference Points

Two investors bought shares in Apple. One purchased at $25, the other purchased at $45.

The *current* share price is $**35**. One investor is "in the black", showing $10 gain. The other is "in the red" with a $10 *loss*

The investor who currently has $10 in gains is inclined to *sell* to realize these gains, while the other will tend to *hold onto* the shares in the hope that they will go back up.



Loss Aversion and Change Management

Change from business perspective	Change from people perspective
Identification of a need/opportunity	Awareness
Project definition	Desire
Designing a solution	Knowledge
Craftin and testing of the solution	Ability
Solution implementation	Reinforcement

Loss Aversion and Change Management

- For a group or organization to change, all the individuals within that group or organization must change. This means that to affect change in our organizations, businesses and communities, we must first understand how to affect change one person at a time.

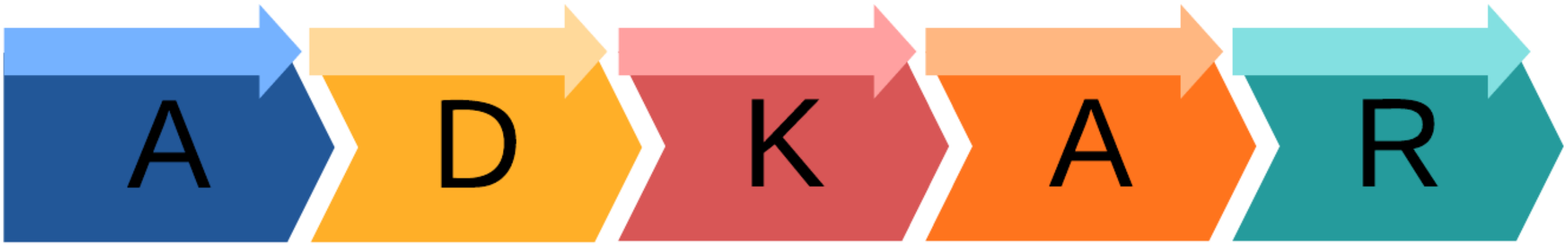
- Awareness of the business reasons for change. Awareness is a goal or outcome of early communications related to an organizational change.

- Desire to engage and participate in the change. Desire is a goal or outcome of sponsorship and resistance management.

- Knowledge about how to change. Knowledge is a goal or outcome of training and coaching.

- Ability to realize or implement the change at the required performance level. Ability is a goal or outcome of additional coaching, practice and time.

- Reinforcement to ensure that change sticks. Reinforcement is a goal or outcome of adoption measurement, corrective actions, and recognition of successful change.



Awareness

- Announce the change to employees well ahead of time.
- Explain your reasoning behind the change, including current pain points and potential ROI of the new solution.
- Give employees an opportunity to ask questions and make suggestions.

Desire

- Gauge employees' reactions to the change.
- Identify champions.
- If employees are resistant or indifferent, address their concerns or show them how the change benefits them personally.

Knowledge

- Provide training or coaching to show what employees need to do after the change takes place.
- Address any skill gaps.
- Offer resources, such as process flowcharts, that employees can reference later on.

Ability

- Schedule practice runs before the change is fully implemented.
- Monitor performance immediately following the change and provide constructive feedback.
- Set reasonable goals and metrics at the start.
- Adjust processes as necessary.

Reinforcement

- Monitor the change over time to ensure it fulfills your desired outcome.
- Use positive feedback, rewards, and recognition to encourage employees to keep following the new process.