

# Behavioral economics

## Lecture 4 - **Bias**

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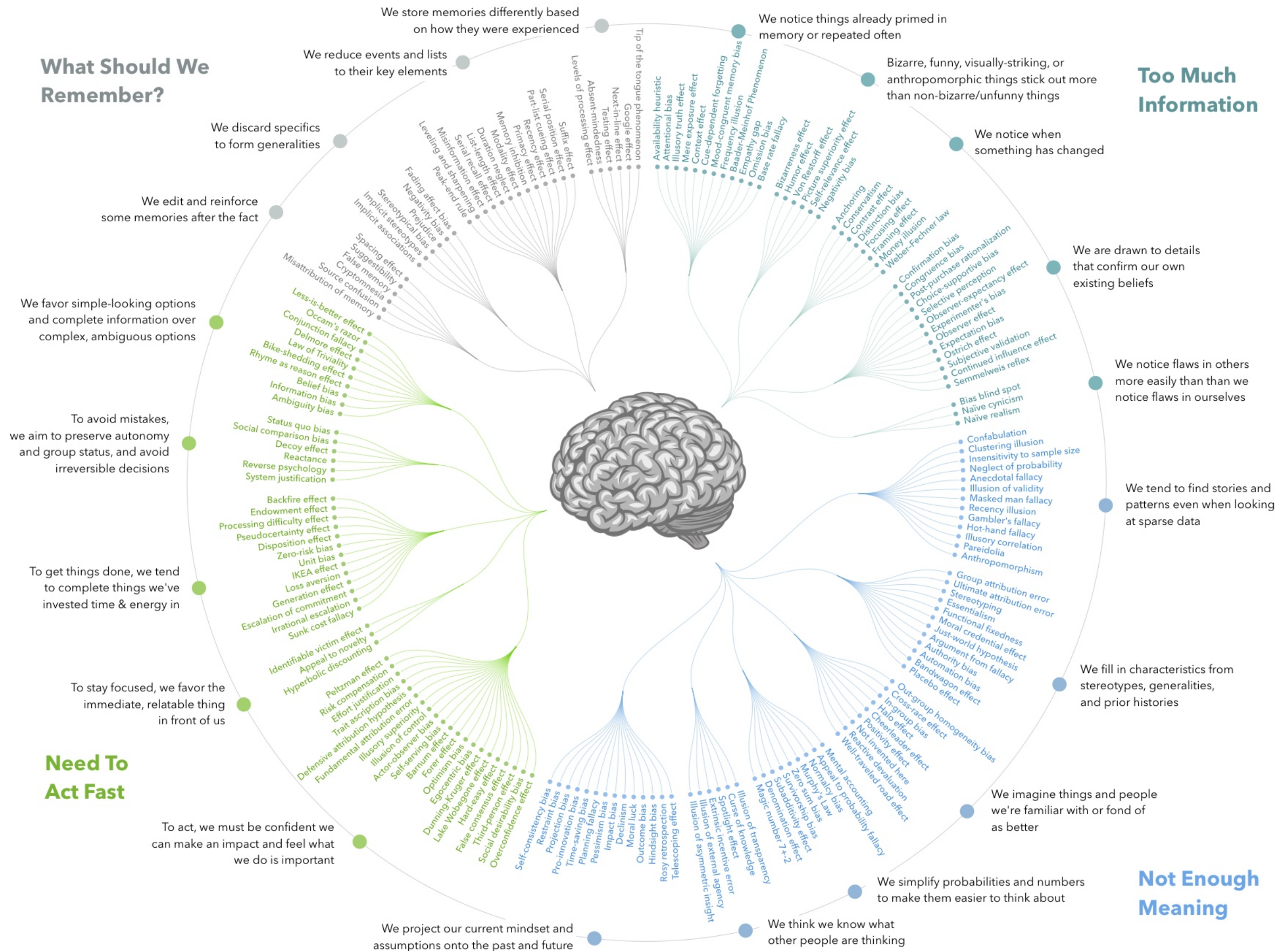
### References:

- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, 185(4157), 1124-1131.

# Bias

- People who are asked a difficult question use simplifying operations, called heuristics. In general, heuristics, which are produced by fast, intuitive thinking, also known as System 1 thinking, are quite useful and yield adequate answers. But sometimes they lead to biases, which we have described as systematic, predictable errors of judgment.
- Judgment biases are often identified by reference to a true value. There is bias in predictive judgments if errors are mostly in one direction rather than the other. For instance, when people forecast how long it will take them to complete a project, the mean of their estimates is usually much lower than the time they will actually need. This familiar psychological bias is known as the planning fallacy.
- Often, though, there is no true value to which judgments can be compared. Given how much we stressed that statistical bias can be detected only when the true value is known, you may wonder how psychological biases can be studied when the truth is unknown. The answer is that researchers confirm a psychological bias either by observing that a factor that should not affect judgment does have a statistical effect on it, or that a factor that should affect judgment does not.

# COGNITIVE BIAS CODEX





**ACCURATE**



**NOISY**



**BIASED**



**BIASED & NOISY**

# Bias

- Bill is thirty-three years old. He is intelligent but unimaginative, compulsive, and generally lifeless. In school, he was strong in mathematics but weak in social studies and humanities.
- The following is a list of eight possibilities for Bill's current situation. Please go over the list and select the two that you consider most probable.
  - Bill is a physician who plays poker as a hobby.
  - Bill is an architect.
  - Bill is an accountant.
  - Bill plays jazz as a hobby.
  - Bill surfs as a hobby.
  - Bill is a reporter.
  - Bill is an accountant who plays jazz as a hobby.
  - Bill climbs mountains as a hobby.

# Bias

- Now, go back over the list and select the two categories where Bill most resembles a typical person in that category. You may pick the same or different categories as before.

# Bias

- Most people pick the same categories as highest in probability and in resemblance. Multiple experiments have shown that people give identical answers to the two questions. But similarity and probability are actually quite different.
- Now, consider the following similar problems:
  - Linda is thirty-one years old, single, outspoken, and very smart. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and she participated in antinuclear demonstrations. Rank the following two descriptions in order of the probability (likelihood) that they describe Linda:
    - A. Linda works in a bank.
    - B. Linda works in a bank and is active in the feminist movement.
  - During your walk around the city center you meet a young man with strong, sporty figure and big muscles. Which of the following is more probable?
    - A. Man works as an IT specialist.
    - B. Man is a professional boxer.



# Bias

- You may be tempted to pick answers B, but logic won't allow it. The probability that Linda works in a bank must be higher than the probability of her being a feminist banker. Remember Venn diagrams! If Linda is a feminist and works in a bank, she is certainly a banker. Adding detail to a description can only make it less probable, although it can make it more representative, and thus a better “fit,” as in the present case.
- The theory of judgment heuristics proposes that people will sometimes use the answer to an easier question in responding to the harder one. So, which question is more easily answered: “How similar is that young man to a typical boxer” or “How probable is it that young man is a boxer?” By acclamation, the similarity question is easier, which makes it likely that it was the one that people answer when asked to assess probability.



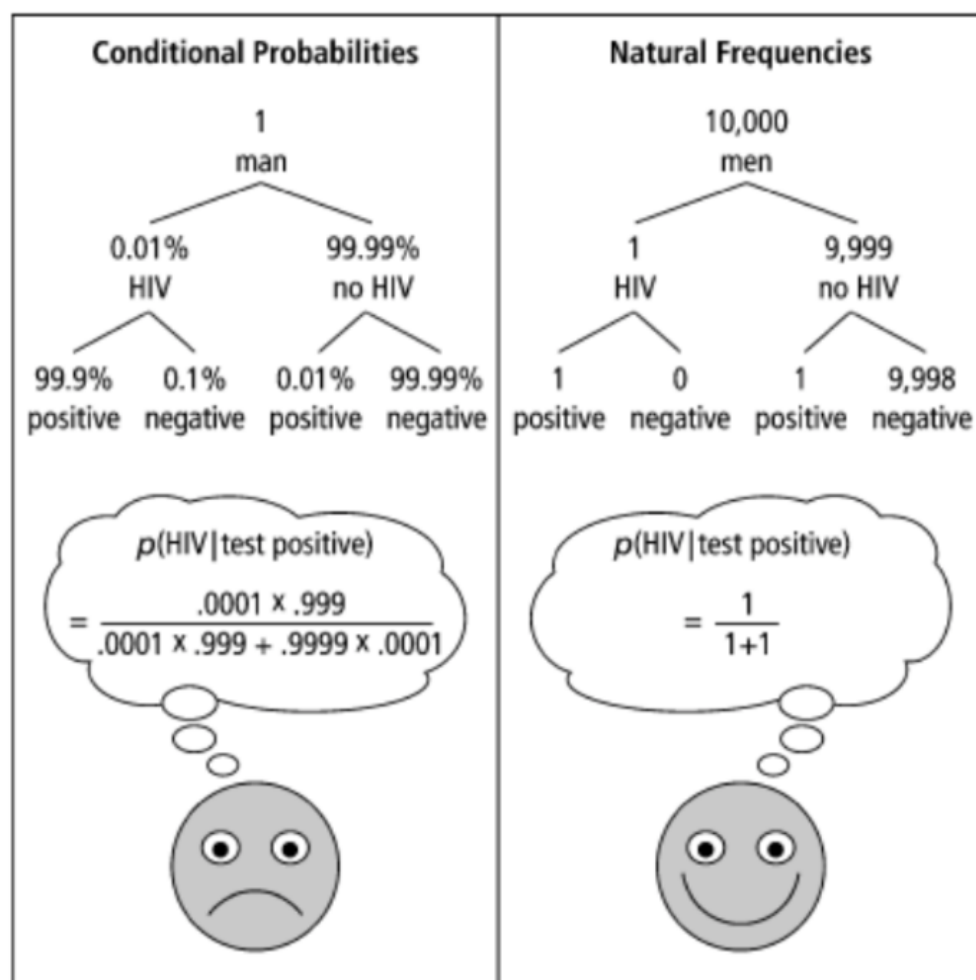
# Representativeness and base-rate neglect

- The representativeness heuristic is a cognitive bias that refers to the tendency for people to make judgments and decisions based on how similar something or someone is to a prototype or stereotype, rather than based on all of the available information.
- In a typical study, subjects are asked to predict the field of study of a graduate student or the profession of someone on the basis of a brief sketch that highlights personality traits characteristic of a stereotype. As it happens, the subjects' judgments are greatly influenced by the degree of similarity between the description and the stereotype. This is the case even when the participants are made familiar with the base rates, that is, the actual frequencies of professionals in the population.
- An event is judged probable to the extent that it represents the essential features of its parent population or of its generating process. It means, among other things, that people in situations of uncertainty tend to look for familiar patterns and are apt to believe that the pattern will repeat itself.

- It is estimated that 1 out of 10 000 heterosexual man is infected by HIV. Let's assume, that HIV test shows the correct diagnosis with 99,99% rate. What is the probability that a man who tested HIV positive is actually positive?

# Bayesian updating vs. natural frequencies

$$P(H_1 | E) = \frac{P(E | H_1) P(H_1)}{P(E | H_1) P(H_1) + P(E | H_2) P(H_2)}$$



**TABLE 8**

*Answers by 20 AIDS Counselors to the Client's Question: "If One Is Not Infected With HIV, Is It Possible to Have a Positive Test Result?"*

1 "No, certainly not"	11 "False positives never happen"
2 "Absolutely impossible"	12 "With absolute certainty, no"
3 "With absolute certainty, no"	13 "With absolute certainty, no"
4 "No, absolutely not"	14 "Definitely not" . . . "extremely rare"
5 "Never"	15 "Absolutely not" . . . "99.7% specificity"
6 "Absolutely impossible"	16 "Absolutely not" . . . "99.9% specificity"
7 "Absolutely impossible"	17 "More than 99% specificity"
8 "With absolute certainty, no"	18 "More than 99.9% specificity"
9 "The test is absolutely certain"	19 "99.9% specificity"
10 "No, only in France, not here"	20 "Don't worry, trust me"

- Which of the following causes more deaths?
  - A. Sharks
  - B. Coconuts

- Please rank order the following causes of death in the United States between 1990 and 2000, placing a 1 next to the most common cause, 2 next to the second most common, etc.

\_\_\_ Tobacco  
\_\_\_ Poor diet and physical inactivity  
\_\_\_ Motor vehicle accidents  
\_\_\_ Firearms (guns)  
\_\_\_ Illicit drug use

- Now estimate the number of deaths caused by each of these five causes between 1990 and 2000.

# Availability

- Substitution of one question for another is not restricted to similarity and probability. Another example is the replacement of a judgment of frequency by an impression of the ease with which instances come to mind. For example, the perception of the risk of airplane crashes or hurricanes rises briefly after well-publicized instances of such events. In theory, a judgment of risk should be based on a long-term average. In reality, recent incidents are given more weight because they come more easily to mind. Substituting a judgment of how easily examples come to mind for an assessment of frequency is known as the availability heuristic.
- The substitution of an easy judgment for a hard one is not limited to these examples. In fact, it is very common. Answering an easier question can be thought of as a general-purpose procedure for answering a question that could stump you. Consider how we tend to answer each of the following questions by using its easier substitute:
  - Do I believe in climate change?
    - Do I trust the people who say it exists?
  - Do I think this surgeon is competent?
    - Does this individual speak with confidence and authority?
  - Will the project be completed on schedule?
    - Is it on schedule now?
  - Is nuclear energy necessary?
    - Do I recoil at the word nuclear?
  - Am I satisfied with my life as a whole?
    - What is my mood right now?

# Availability

- The availability heuristic is a cognitive bias that refers to the tendency for people to estimate the likelihood of an event based on how easily examples of it come to mind. People tend to overestimate the probability of rare events that are vivid, striking, or emotionally charged, and that they can easily bring to mind, while they tend to underestimate the probability of common events that are less memorable or less emotionally charged.
- The availability heuristic is often used to explain why people overestimate the likelihood of rare events, such as plane crashes or shark attacks, because these events tend to receive a lot of media coverage and are therefore highly available in people's memories. Similarly, people tend to overestimate the occurrence of things that are easily retrievable in memory as they are more likely to be used as a basis for judgement.
- This bias can lead to distorted judgments and decisions, especially when people rely on their intuition and do not take the time to consider the actual probabilities of different outcomes. The availability heuristic can be countered by gathering more information and by using statistical reasoning.



# Positive Hypothesis Testing

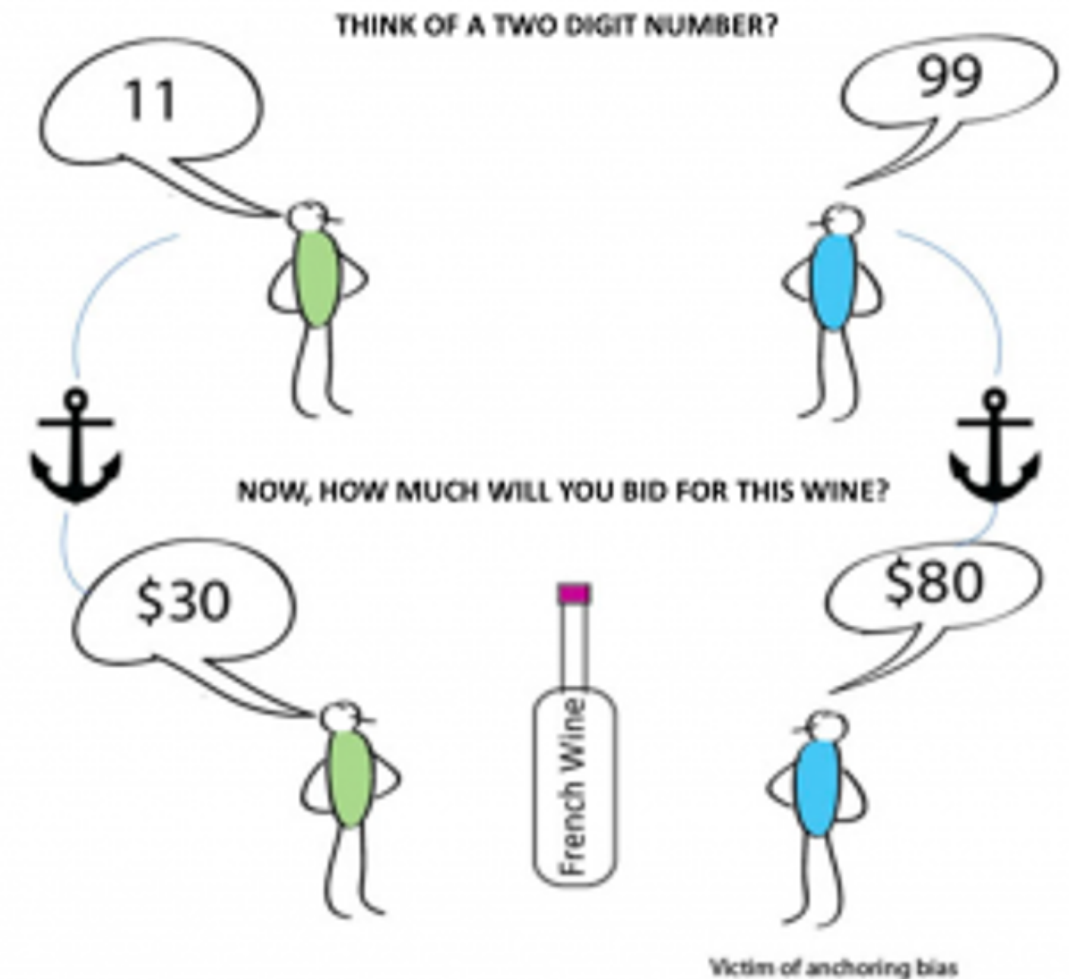
- Consider your response to the following questions:
- 1. Is marijuana use related to delinquency?
- 2. Are couples who marry under the age of twenty-five more likely to have bigger families than couples who marry at an older age?
- In assessing the marijuana question, most people typically try to remember several marijuana users and recall whether these individuals were delinquents. However, a proper analysis would require you to recall four groups of people: marijuana users who are delinquents, marijuana users who are not delinquents, delinquents who do not use marijuana, and non-delinquents who do not use marijuana.
- The same analysis applies to the marriage question. A rational assessment of whether those who marry young are more likely to have large families than those who marry later would include four groups: couples who married young and have large families, couples who married young and have small families, couples who married older and have large families, and couples who married older and have small families.
- Indeed, there are always at least four separate situations to consider when assessing the association between two events, assuming that each one has just two possible outcomes. However, our everyday decision making commonly neglects this fact. Instead, we intuitively use selective data when testing hypotheses, such as instances in which the variable of interest (e.g., marijuana use or early marriage) is present.

# Confirmation bias

- We often start the process of judgment with an inclination to reach a particular conclusion. When we do that, we let our fast, intuitive System 1 thinking suggest a conclusion. Either we jump to that conclusion and simply bypass the process of gathering and integrating information, or we mobilize System 2 thinking —engaging in deliberate thought—to come up with arguments that support our prejudgment. In that case, the evidence will be selective and distorted: because of confirmation bias and desirability bias, we will tend to collect and interpret evidence selectively to favor a judgment that, respectively, we already believe or wish to be true.
- Once you become aware of the confirmation trap, you are likely to find that it pervades your decision-making processes. When you make a tentative decision (to buy a new car, to hire a particular employee, to start research and development on a new product line, etc.), do you search for data that support your decision before making the final commitment? Most of us do. However, the search for disconfirming evidence will provide the most useful insights.
- The psychologist Paul Slovic terms this the affect heuristic: people determine what they think by consulting their feelings. We like most things about politicians we favor, and we dislike even the looks and the voices of politicians we dislike. That is one reason that smart companies work so hard to attach a positive affect to their brand. Professors often notice that in a year when they get high marks for teaching, students also give the course material a high rating. In a year when students don't like the professor so much, they give a low rating to the identical assigned readings. The same mechanism is at work even when emotion is not involved: regardless of the true reasons for your belief, you will be inclined to accept any argument that appears to support it, even when the reasoning is wrong.

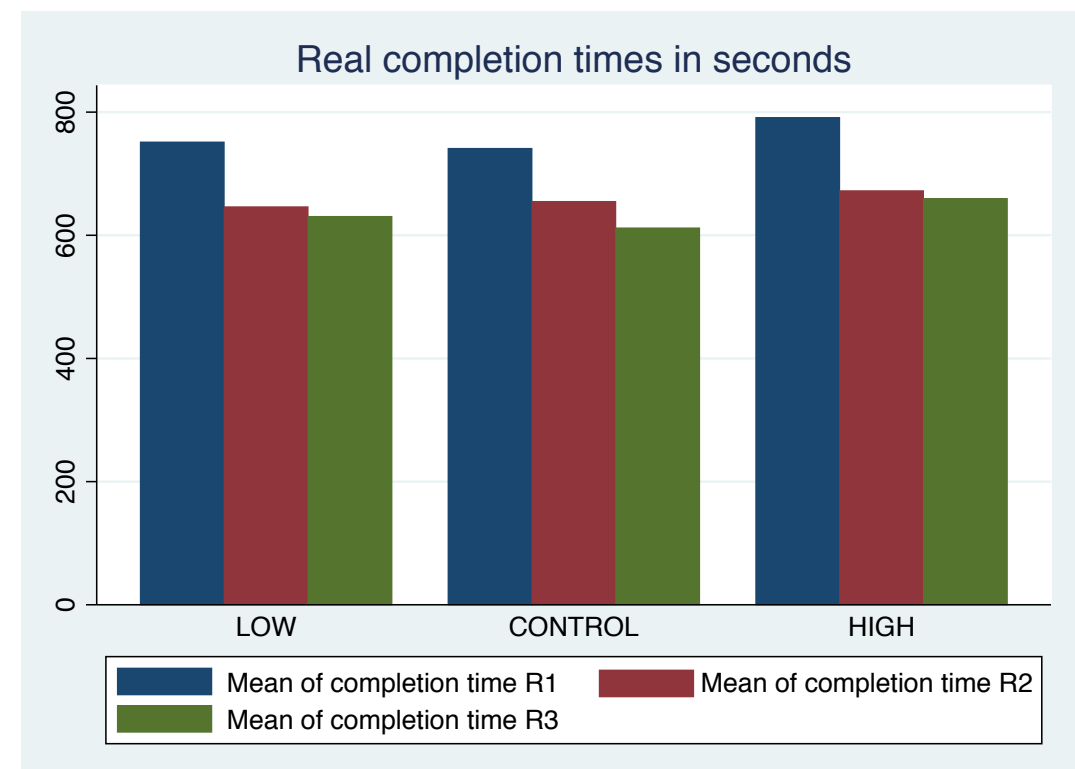
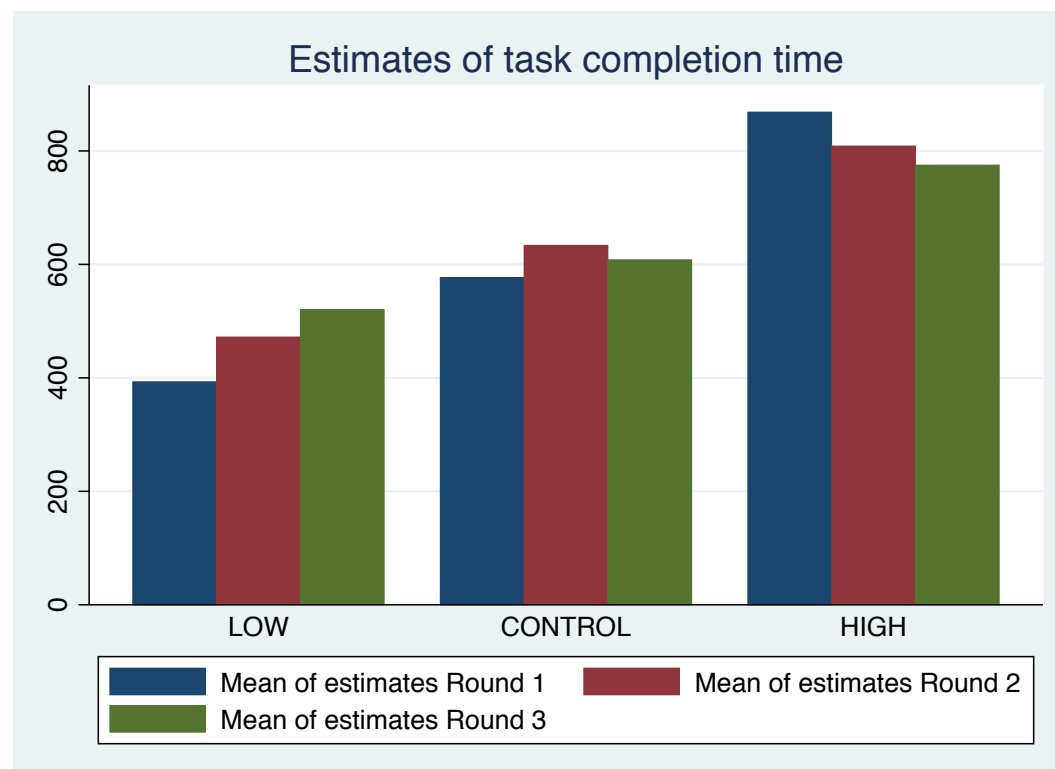
# Anchoring

- A subtler example of a conclusion bias is the anchoring effect, which is the effect that an arbitrary number has on people who must make a quantitative judgment. In a typical demonstration, you might be presented with a number of items whose price is not easy to guess, such as an unfamiliar bottle of wine. You are asked to jot down the last two digits of your Social Security number and indicate whether you would pay that amount for the bottle. Finally, you are asked to state the maximum amount you would be willing to pay for it. The results show that anchoring on your Social Security number will affect your final buying price. In one study, people whose Social Security numbers generated a high anchor (more than eighty dollars) stated that they were willing to pay about three times more than those with a low anchor (less than twenty dollars).
- Clearly, your Social Security number should not have a large effect on your judgment about how much a bottle of wine is worth, but it does. Anchoring is an extremely robust effect and is often deliberately used in negotiations. Whether you're haggling in a bazaar or sitting down for a complex business transaction, you probably have an advantage in going first, because the recipient of the anchor is involuntarily drawn to think of ways your offer could be reasonable. People always attempt to make sense of what they hear; when they encounter an implausible number, they automatically bring to mind considerations that would reduce its implausibility.



# Anchoring

- Anchoring bias is a cognitive bias that refers to the tendency for people to rely too heavily on the first piece of information they receive (the "anchor") when making subsequent judgments and decisions. This bias occurs because people tend to use the anchor as a reference point, and then adjust their estimates or judgments based on that initial value, rather than considering all of the relevant information.
- Due to the anchoring in the first place, the later adjustments are usually insufficient. Consequently, different starting points yield different estimates that are biased toward the initial values.
- For example, if someone is asked to estimate the price of a car and the salesperson provides an initial high price as an anchor, the person may adjust their estimate to a lower price, but still higher than the actual price of the car. In negotiations, the anchor can be used by setting the first offer, so the other party may adjust their expectations and accept a better deal for the anchor-setter.



# Excessive Coherence

- Read a description of a candidate for an executive position. The description consists of four adjectives, each written on a card. The deck of cards has just been shuffled. The first two cards have these two descriptors:
- Intelligent, Persistent.
- It would be reasonable to suspend judgment until the information is complete, but this is not what has happened: you already have an evaluation of the candidate, and it is positive. This judgment simply happened. You had no control over the process, and suspending judgment was not an option.
- Next, you draw the last two cards. Here is the full description now:
- Intelligent, Persistent, Cunning, Unprincipled.
- Your evaluation is no longer favorable, but it did not change enough.

# Excessive Coherence

- For comparison, consider the following description, which another shuffling of the deck could have produced:
- Unprincipled, Cunning, Persistent, Intelligent.
- This second description consists of the same adjectives, and yet—because of the order in which they are introduced—it is clearly much less appealing than the first. The word Cunning was only mildly negative when it followed Intelligent and Persistent, because we still believed (without reason) that the executive’s intentions were good. Yet when it follows Unprincipled, the word Cunning is awful. In this context, persistence and intelligence are not positives anymore: they make a bad person even more dangerous.
- This experiment illustrates excessive coherence: we form coherent impressions quickly and are slow to change them. In this example, we immediately developed a positive attitude toward the candidate, in light of little evidence. Confirmation bias—the same tendency that leads us, when we have a prejudgment, to disregard conflicting evidence altogether—made us assign less importance than we should to subsequent data. (Another term to describe this phenomenon is the halo effect, because the candidate was evaluated in the positive “halo” of the first impression.)

# Hindsight/Outcome bias

- In hindsight, people consistently exaggerate what could have been anticipated in foresight. They not only tend to view what has happened as having been inevitable, but also to view it as having appeared “relatively inevitable” before it happened. People believe that others should have been able to anticipate events much better than was actually the case. They even misremember their own predictions so as to exaggerate in hindsight what they knew in foresight.
- Hindsight depends on memory, and memory is fallible. Retrieving memories is a constructive process. Memory traces are deficient because of errors in impressions, limitations in storage capacity, and interference in recall processes. While this does not mean that memories are always incorrect, it points to the need for caution. Looking back, one tends to find patterns in random events and seemingly useful explanations. One aspect of the relationship between confidence and hindsight is the “knew-it-all-along effect.”
- Events that the best-informed experts did not anticipate often appear almost inevitable after they occur. Financial punditry provides an unending source of examples. Within an hour of the market closing every day, experts can be heard on the radio explaining with high confidence why the market acted as it did. A listener could well draw the incorrect inference that the behavior of the market is so reasonable that it could have been predicted earlier in the day.
- CEO with (random) success: Flexible, Methodological, Decisive.
- Same CEO with (random) failure: Confused, Rigid, Authoritarian



**TABLE 2-2 Summary of the Twelve Biases Presented in Chapter 2**

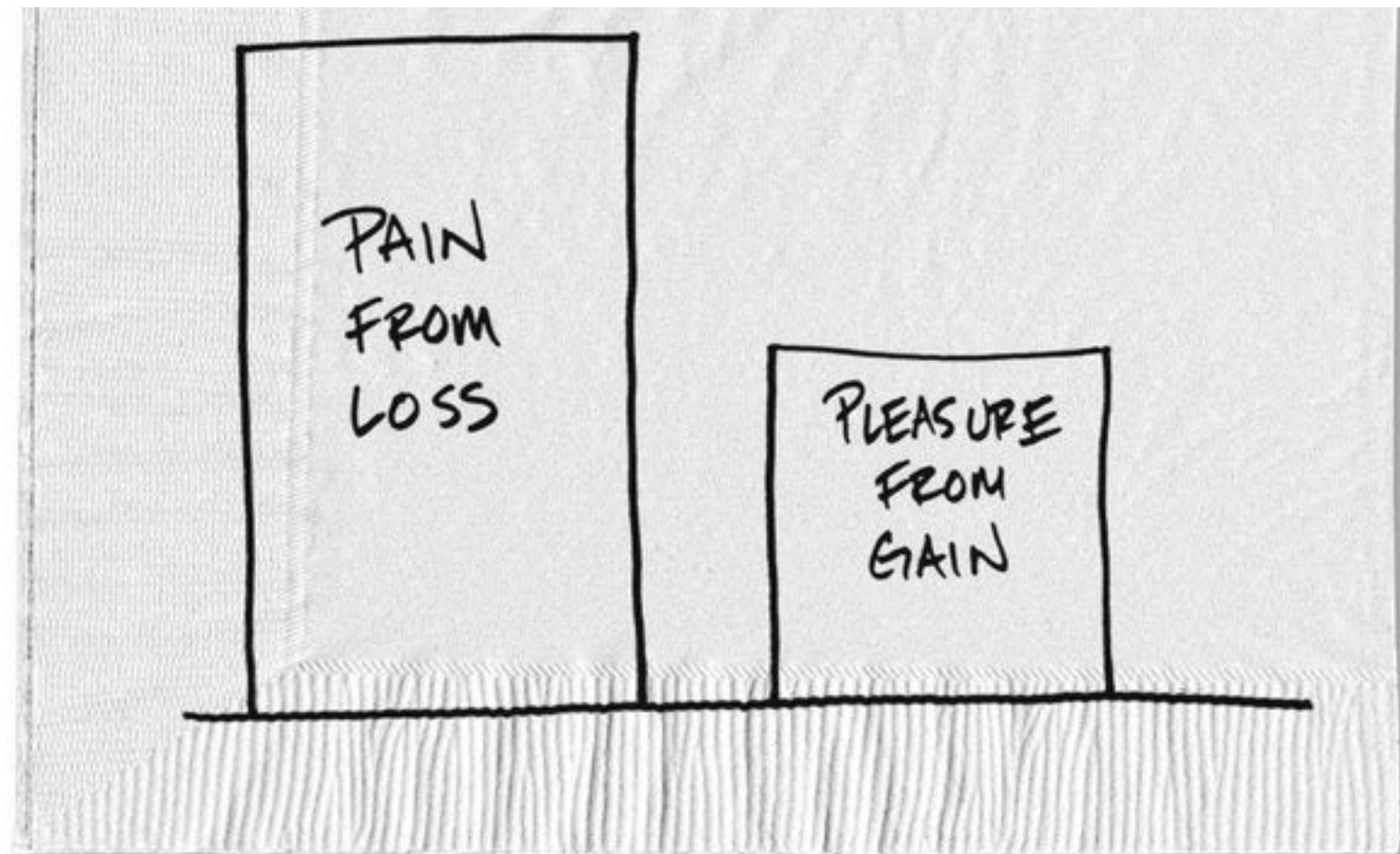
Bias	Description
<i>Biases Emanating from the Availability Heuristic</i>	
1. Ease of recall	Individuals judge events that are more easily recalled from memory, based on vividness or recency, to be more numerous than events of equal frequency whose instances are less easily recalled.
2. Retrievability	Individuals are biased in their assessments of the frequency of events based on how their memory structures affect the search process.
<i>Biases Emanating from the Representativeness Heuristic</i>	
3. Insensitivity to base rates	When assessing the likelihood of events, individuals tend to ignore base rates if any other descriptive information is provided—even if it is irrelevant.
4. Insensitivity to sample size	When assessing the reliability of sample information, individuals frequently fail to appreciate the role of sample size.
5. Misconceptions of chance	Individuals expect that a sequence of data generated by a random process will look “random,” even when the sequence is too short for those expectations to be statistically valid.
6. Regression to the mean	Individuals tend to ignore the fact that extreme events tend to regress to the mean on subsequent trials.
7. The conjunction fallacy	Individuals falsely judge that conjunctions (two events co-occurring) are more probable than a more global set of occurrences of which the conjunction is a subset.
<i>Biases Emanating from the Confirmation Heuristic</i>	
8. The confirmation trap	Individuals tend to seek confirmatory information for what they think is true and fail to search for disconfirmatory evidence.
9. Anchoring	Individuals make estimates for values based upon an initial value (derived from past events, random assignment, or whatever information is available) and typically make insufficient adjustments from that anchor when establishing a final value.
10. Conjunctive- and disjunctive-events bias	Individuals exhibit a bias toward overestimating the probability of conjunctive events and underestimating the probability of disjunctive events.
11. Overconfidence	Individuals tend to be overconfident of the infallibility of their judgments when answering moderately to extremely difficult questions.
12. Hindsight and the curse of knowledge	After finding out whether or not an event occurred, individuals tend to overestimate the degree to which they would have predicted the correct outcome. Furthermore, individuals fail to ignore information they possess that others do not when predicting others’ behavior.

# 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.

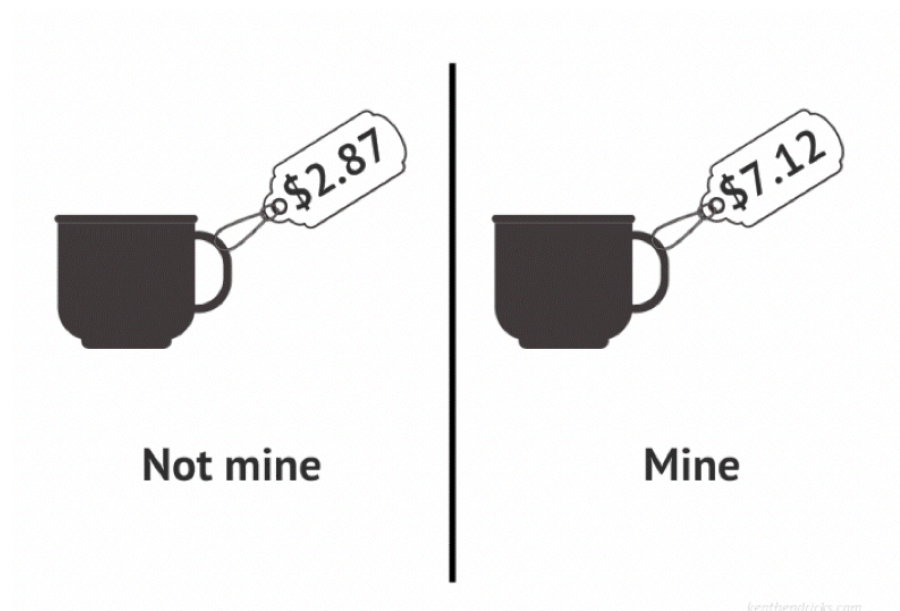
# Loss aversion

- “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



# 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.



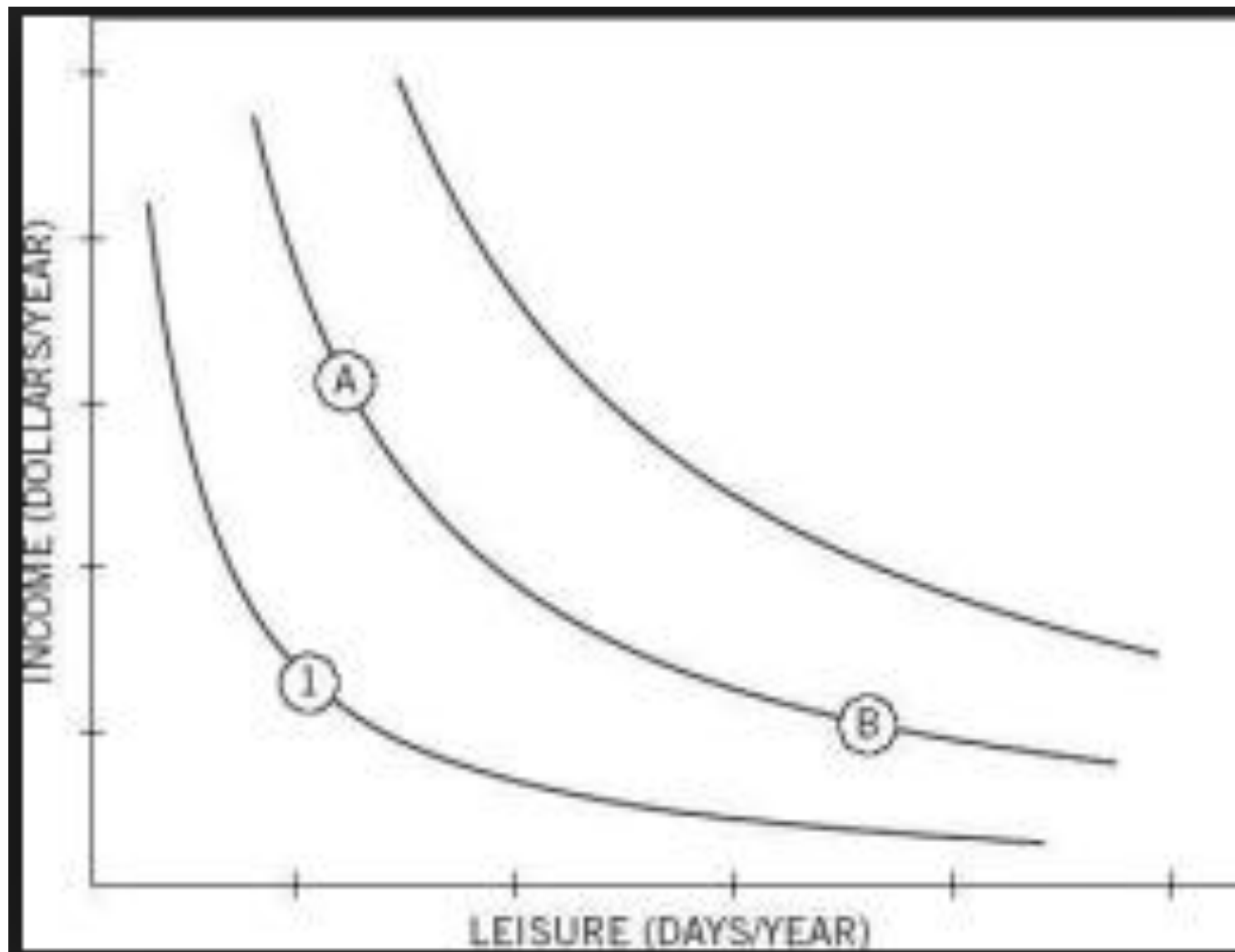
# Sunk-Cost fallacy

- 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>

# 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.