

Behavioral economics

Lecture III - Heuristics and Biases

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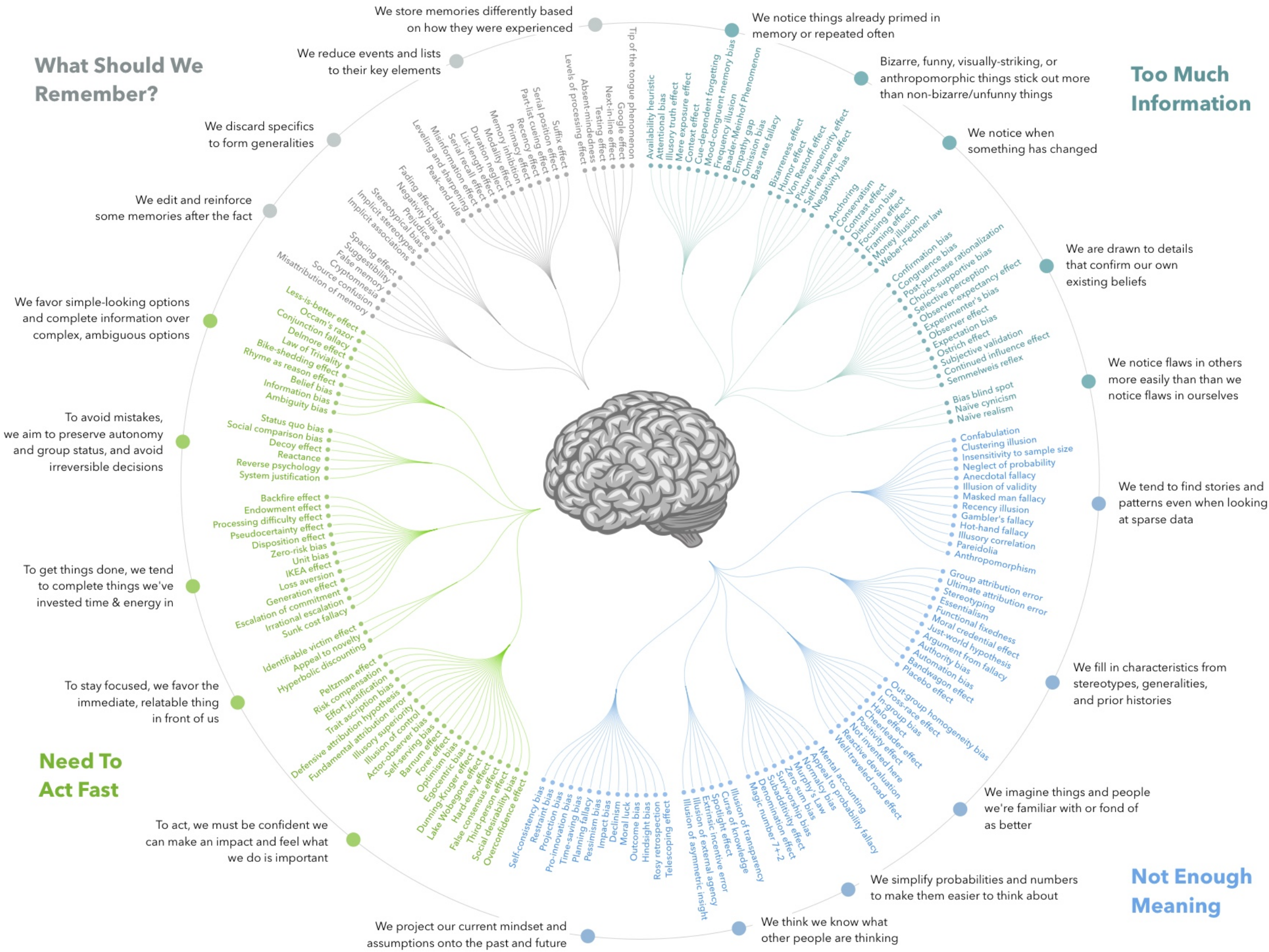
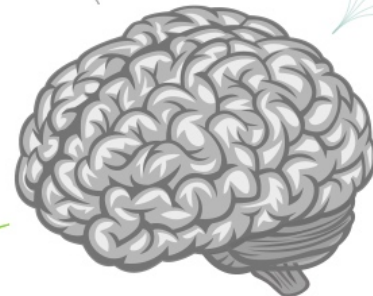
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References:

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

COGNITIVE BIAS CODEX





ACCURATE



NOISY



BIASED



BIASED & NOISY

Common types of judgment errors

- Imperfect application of past experiences (availability, representativeness, base-rate fallacy, generalization, conservatism....)
- Imperfect use of new information (confirmation bias, anchoring, illusion of control, insensitivity to sample size, affective forecasting...)
- Imperfect learning (hindsight bias, outcome bias,...)
- Narrative fallacies (illusory correlation, planning fallacy, survivorship bias...)
- Overconfidence/optimism

- 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

- 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.

- 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 is a professional boxer.
- B. Man works as an IT specialist.

- 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

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

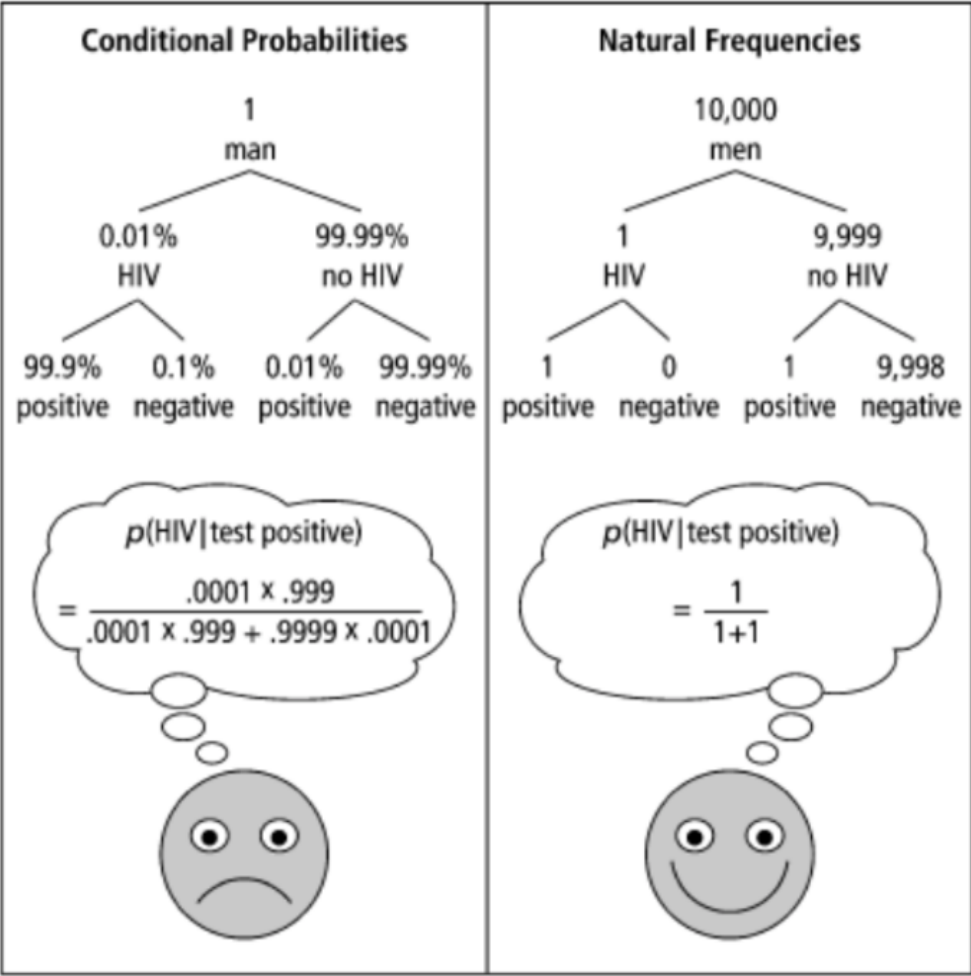


TABLE 8
Answers by 20 AIDS Counselors to the Client’s Question: “If One Is Not Infected With HIV, Is It Possible to Have a Positive Test Result?”

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”

Representativeness and base-rate fallacy

- 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.
- Interestingly, people tend to find it more natural to handle frequencies than probabilities. However, in experiments, less than half of the subjects use algorithms classified as Bayesian reasoning.
- While the neglected use of base-rate data has been amply studied and discussed, less attention has been bestowed on the likely case that, when the base-rate probability is high, there could be a tendency to overlook the specific symptoms. Judging from newspaper stories, a patient with indistinct symptoms of pneumonia may sometimes be misclassified as having the flu at times when almost everyone else seems to be affected by it. In finance, undue attention to the base rate may occur when the majority of stocks go up. Details about a specific firm are neglected and investors may believe in its stock without grounds. When, say, tech stocks fall, other stocks, including those for which there is good news, tend to join. When the majority of stocks go up, a positive effect spreads to stocks that may not deserve it because of bad news. This may be seen as the reverse of the base-rate fallacy. The base rate dominates the specifics.
- It is argued that people focus on the strength or extremeness of the available evidence with insufficient regard for its weight or credence. This mode of judgment yields overconfidence when strength is high and weight is low, and underconfidence when strength is low and weight is high. The strength of the evidence is inferred from aspects such as salience and extremity, whereas weight has to do with such factors as sample size.

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.
- This simple search heuristic turns out to have profound consequences. In the absence of evidence to the contrary, people tend to behave as if they assumed that a given statement or hypothesis is true. This tendency in turn can lead to the confirmation bias, in which we search for and interpret evidence in a way that supports the conclusions we favored at the outset. It can also explain the power of anchoring, in which some irrelevant initial hypothesis or starting point holds undue sway over our judgments. In addition, positive hypothesis testing can inspire overconfidence, leading us to believe too strongly in the accuracy of our own beliefs. Finally, positive hypothesis testing can trigger the hindsight bias, in which we too quickly dismiss, in retrospect, the possibility that things could have turned out differently.

Confirmation bias

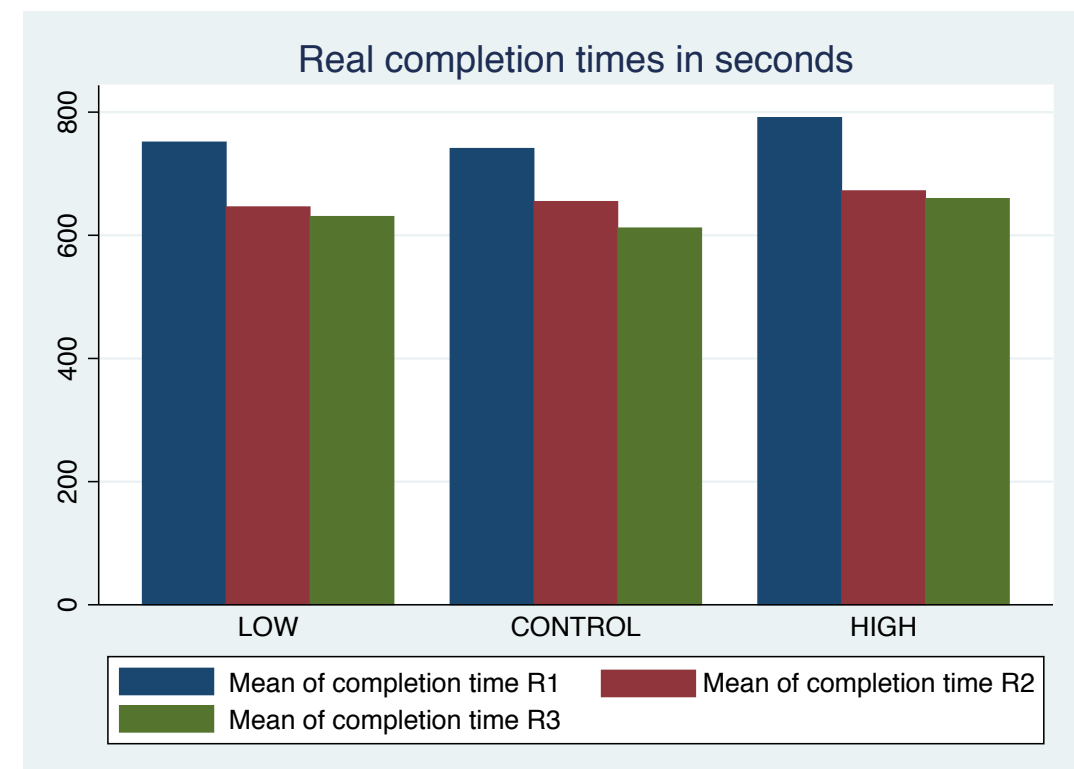
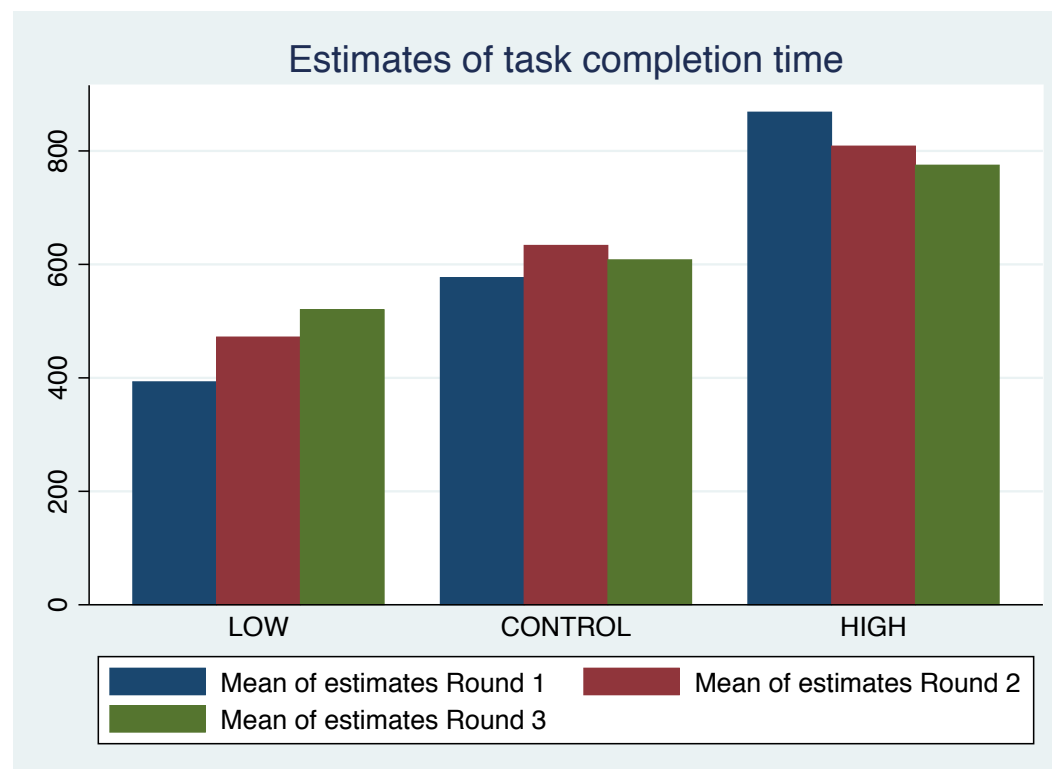
- Confirmation bias is a cognitive bias that refers to the tendency for people to seek out, interpret, and remember information in a way that confirms their existing beliefs and hypotheses, while at the same time disregarding or rationalizing away information that contradicts them.
- When we encounter information that is consistent with our beliefs, we usually accept it with an open mind and a glad heart. There are two reasons that we fall prey to the confirmation trap. The first has to do with the way the human mind is designed to retrieve information from memory. The mere consideration of certain hypotheses makes information that is consistent with these hypotheses selectively accessible. Indeed, research shows that the human tendency to entertain provisional hypotheses as true even makes it possible to implant people with false memories.
- We also succumb to the confirmation trap due to how we search for information. Because there are limits to our attention and cognitive processing, we must search for information selectively, searching first where we are most likely to find the most useful information. Therefore, people search selectively for information or give special credence to information that allows them to come to the conclusion they desire to reach. Exposing relevant empirical evidence in a social dispute often does not lead to narrowing of disagreement but rather to an increase in polarization.
- 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.

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

Anchoring and adjustment

- 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.



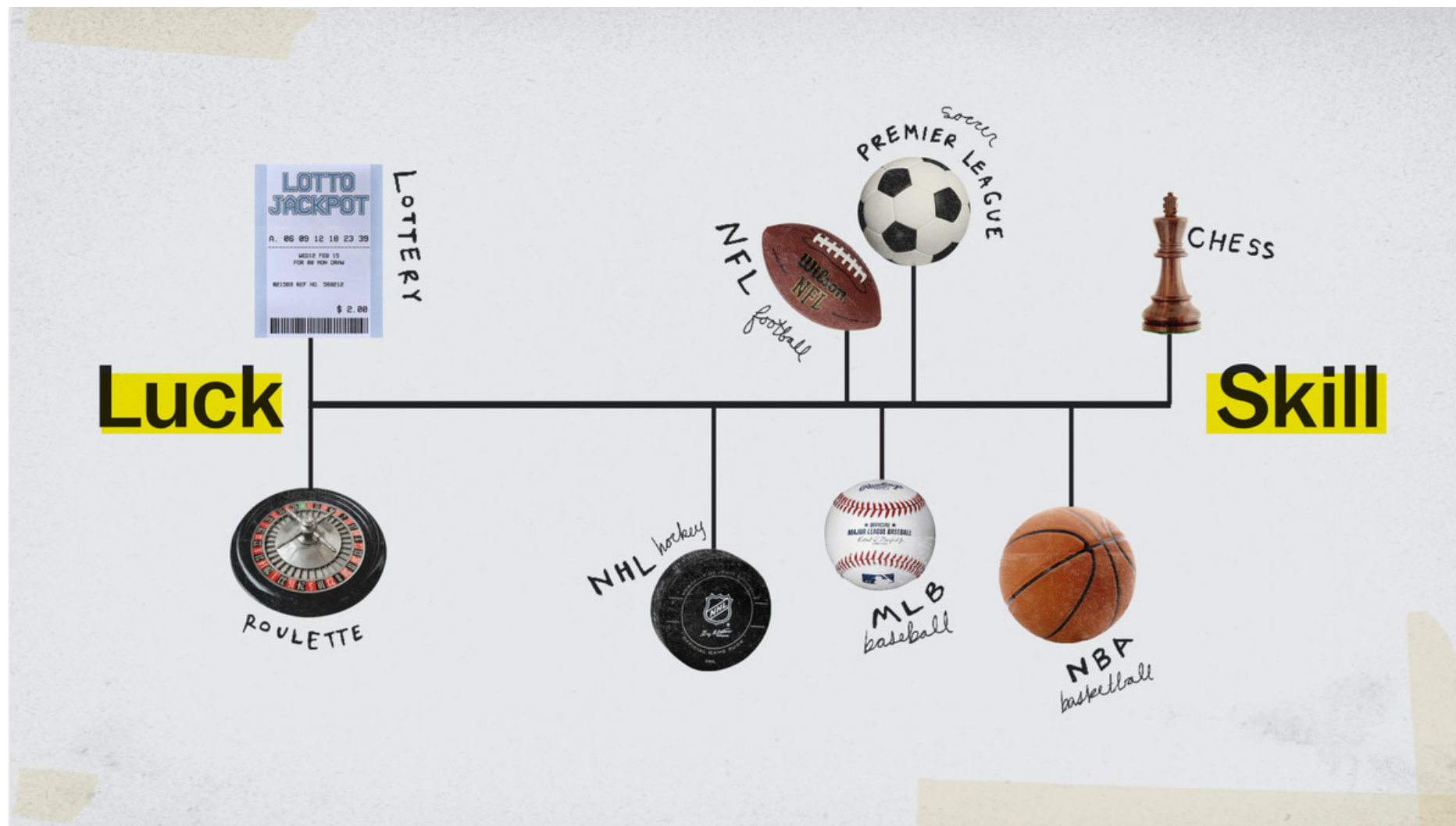
- A group of depressive kids underwent an experimental treatment in which each kid drank 1 liter of Coca-Cola each day. After two months it was found that the kids felt on average significantly better. Should we recommend Coca-Cola as a treatment for children depression?

Regression towards mediocrity

- Regression towards the mean is a statistical phenomenon that occurs when an extreme value of a variable is likely to be followed by a value that is closer to the average or mean of the distribution. It is a result of the fact that extreme events or observations are usually not as extreme when they happen again. In other words, extreme values are likely to be followed by less extreme values.
- For example, if a student scores very high on a test, it is unlikely that they will score as high on the next test. Similarly, if a stock has a very high return one year, it is unlikely to have a similarly high return the next year.
- This concept is important in many fields, such as finance, sports and medicine. In finance, it is used to model stock prices, in sports is used to predict future performance of a team or player and in medicine to understand the effect of a treatment. It is also important to note that it is not a "law" but a statistical tendency that can be affected by many factors, such as changing conditions or new information.

Regression towards mediocrity

- success = talent + luck
- great success = a little more talent + a lot of luck



- A study focusing on kidney cancer found that this type of cancer is **most prevalent** in rural, sparsely populated villages, in which there is also a very high unemployment rate.
- What could be the reason?

- A study focusing on kidney cancer found that this type of cancer is **least prevalent** in rural, sparsely populated villages, in which there is also a very high unemployment rate.
- What could be the reason?

- It is a well known fact that the most intelligent women tend to marry less intelligent men on average. Why?

Narrative fallacies

- Narrative fallacies arise inevitably from our continuous attempt to make sense of the world. A great example is a survivorship bias.
- The explanatory stories that people find compelling are simple; are concrete rather than abstract; assign a larger role to talent, stupidity, and intentions than to luck; and focus on a few striking events that happened rather than on the countless events that failed to happen. Any recent salient event is a candidate to become the kernel of a causal narrative. We humans constantly fool ourselves by constructing flimsy accounts of the past and believing they are true.
- You build the best possible story from the information available to you, and if it is a good story, you believe it. Paradoxically, it is easier to construct a coherent story when you know little, when there are fewer pieces to fit into the puzzle. Our comforting conviction that the world makes sense rests on a secure foundation: our almost unlimited ability to ignore our ignorance.
- The most coherent stories are not necessarily the most probable, but they are plausible, and the notions of coherence, plausibility, and probability are easily confused by the unwary. This is a trap for forecasters and their clients: adding detail to scenarios makes them more persuasive, but less likely to come true.
- Statistics produce many observations that appear to beg for causal explanations but do not lend themselves to such explanations. Many facts of the world are due to chance, including accidents of sampling. Causal explanations of chance events are inevitably wrong.

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.

- https://www.youtube.com/watch?v=nisSeC81u2M&ab_channel=TED