# Experimental economics

Lecture III - **Heuristics and Biases**

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

# Common types of judgment errors

- Imperfect application of past experiences (availability, representativeness, base-rate fallacy, generalization, conervativism….)

- 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

- 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.

- Which of the following causes more deaths?

  - A. Sharks

  - B. Coconuts

# Availability

- The availability heuristic explains a large number of everyday experiences. It is employed whenever a person estimates probability or frequency by the ease with which instances or associations can be brought to mind. More recent events are easy to recall; instances of large classes are recalled better and faster than instances of less frequent classes; likely occurrences are easier to imagine than unlikely ones; and associative connections are strengthened when two events frequently occur together.

- For example, a subordinate who works in close proximity to the manager's office is likely to receive a more critical performance evaluation at year-end than a worker who sits down the hall, because the manager will be more aware of the nearby subordinate's errors. Similarly, a product manager will base her assessment of the probability of a new product's success on her recollection of the successes and failures of similar products in the recent past.

- We distinguishe between (1) experience-based, (2) memory-based, and (3) imagination-based availability.

- Experience-based availability means that people rely on what they have seen or heard. They neglect the fact that their samples probably have been small and biased. If unemployed workers answer a question about how many workers are unemployed, or social workers about how many families need social relief, they tend to overestimate the numbers. They derive their estimates from their own experience, which involves frequent contacts with the relevant groups, and they are likely to exaggerate the actual number.

- Memory-based availability depends on the ease with which memories can be brought to mind. It is related to factors such as (a) how intense initial attention was, (b) the salience of the impression, (c) its vivacity, (d) its familiarity to the subject, and (e) spatial and temporal propinquity.

- Imagination-based availability arises as a consequence of how easy it is to imagine something. For example, the stock price of a company seems more apt to go up when the firm announces a new sales contract, even though the value of the contract may be insignificant in relation to total sales volume.

- 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

$$P(H_1 \mid E) = \frac{P(E \mid H_1)\,P(H_1)}{P(E \mid H_1)\,P(H_1) \;+\; P(E \mid H_2)\,P(H_2)}$$
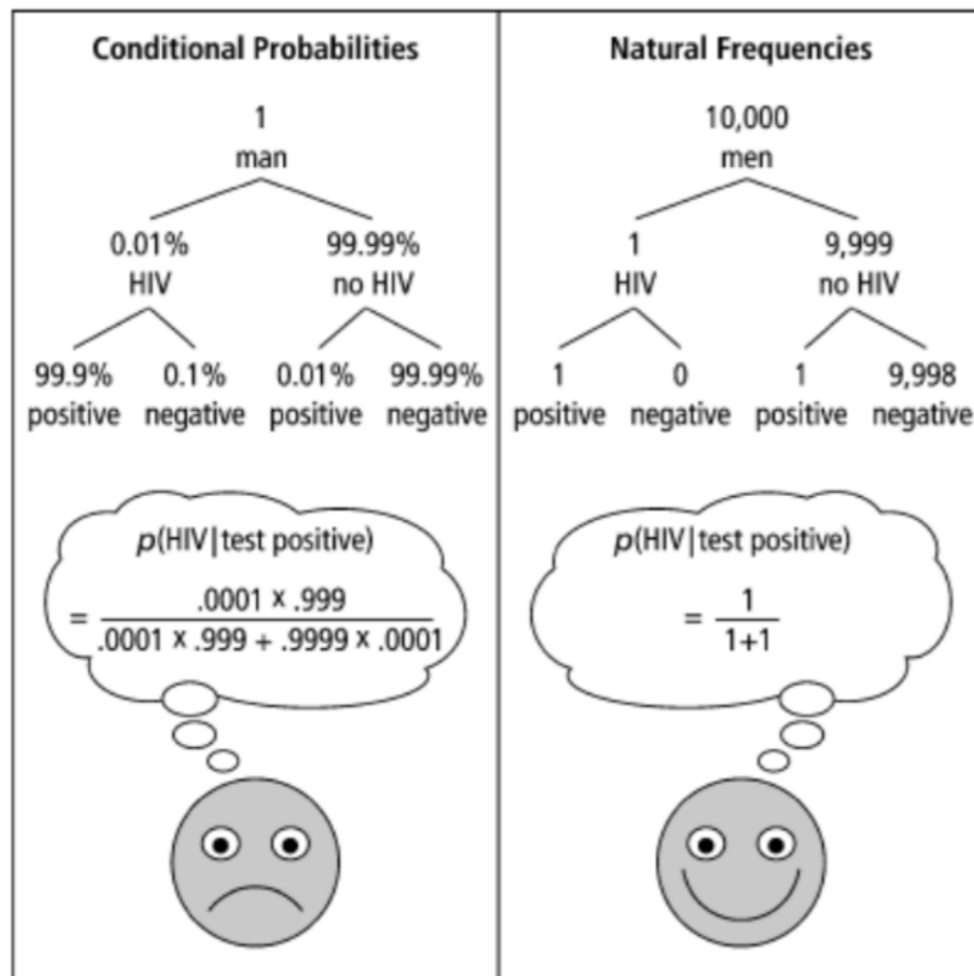


**TABLE 8**

*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" |

# Representativness and base-rate fallacy

- People have a tendency to neglect base rate or statistical information in favor of similarity judgments. 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. This is the so-called base-rate fallacy.

- This heuristic is often equated with the heuristic of representativeness: 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.

# Generalization and conservativism

- Generalization is a kind of inference about the unknown. What is known to be true about the known members of a class of objects is assumed to be true of all members including those not yet observed. The converse is "discrimination." In this case, differences, especially minor ones, are attended to.

- Delays in reactions to information have been attributed to conservatism. The concept involves slow updating of models in the face of new evidence.

- The representativeness heuristic (which encapsules high confidence in judgments) has been held to be inconsistent with conservatism (which is sometimes labeled underconfidence). The question then arises under what circumstances overconfidence occurs and under what circumstances conservatism prevails.

- 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.

# Emotions and affect

- Both positive and negative effects of emotions or moods can influence behavior. We can distinguish between moods that are immediate or anticipatory, especially related to intertemporal choices involving risk or uncertainty. This is a different mechanism than immediate moods, which might be quite mild, but still influence choices at the time of the decision. The affect heuristic is an example of the latter, and affective forecasting is an example of the former; both are ways that moods may impact investor decisions.

- The affect heuristic concept emanates from an ongoing debate as to whether an affective reaction can precede and rule out cognitive evaluation altogether or delay it. If there is a primary affective reaction, people may be more ruled by emotions than is generally assumed in rationality discussions. For example, a strongly threatening stimulus leads to attempts to distance oneself as quickly as possible without really thinking until it is too late.

- An overall, readily available affective impression is an easy escape from weighing the pros and cons or retrieving from memory any relevant examples. This holds especially when the required judgment or decision is complex or the recourse to mental resources is limited. The affect heuristic is a mental shortcut similar to availability and representativeness.

- People also base many decisions on affective forecasts: predictions about their emotional reactions to future events influence their choices, including regrets for being "wrong." Affective forecasts often display an impact bias, meaning that people overestimate the intensity and duration of their emotional reactions to future events. People fail to anticipate how quickly they will make sense of things that happen to them in a way that speeds emotional recovery. This is especially true when predicting reactions to negative events.

- Emotions often signal the priorities - Descartes' error (Antonio Damasio)

# Confimation bias

- We tend to seek out, notice, and remember information already in line with our existing thinking. 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.

- Our colleage Dick Thaler has identified a business opportunity to help managers avoid the confirmation trap. Thaler's idea is to form two new consulting firms. One of them, called "Yes Person," would respond to all requests for advice by telling the clients that all their ideas are great. In fact, to speed service and ensure satisfaction, Yes Person would allow clients to write the consulting report themselves if they liked. The other consulting firm, called "Devil's Advocate," would disapprove of any plans currently being considered by a client. Reports by Devil's Advocate would consist of a list of the top ten reasons the client should not pursue the plan under consideration.

- Which consulting style would be more useful to the client? Thaler insists that Devil's Advocate would provide a much more important service than Yes Person, and it is hard to disagree. In reality, however, consulting engagements often bear a closer resemblance to the Yes Person format than to that of Devil's Advocate, in part because consulting firms know that clients like to hear how good their ideas are. Our desire to confirm our initial ideas is so strong that we will pay people to back us up! When pressed, Thaler conceded that he wouldn't start either consulting firm, since neither could succeed. After all, he pointed out, no client would ever hire Devil's Advocate, and Yes Person already has too much competition from established consulting firms.

# Anchoring and adjustment

- Anchoring bias means that people make estimates by starting from an initial value that is subjected to adjustment before the final answer is arrived at. The initial value may be given by the formulation of the problem or partial calculation.

- 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.
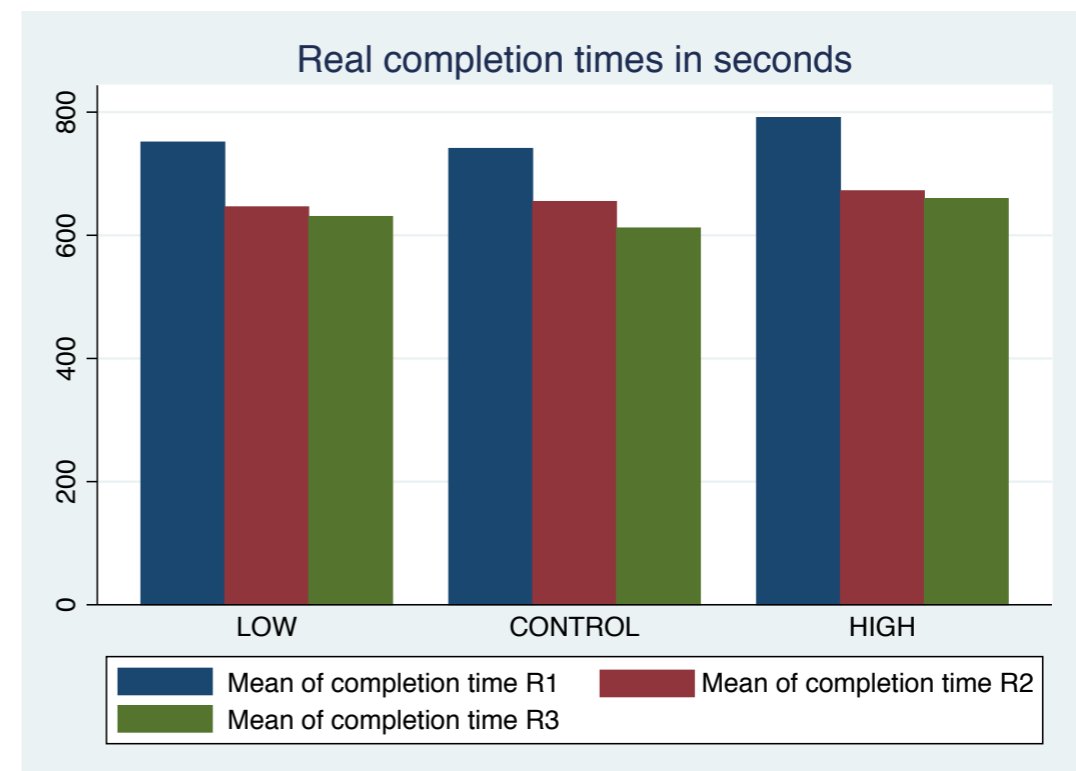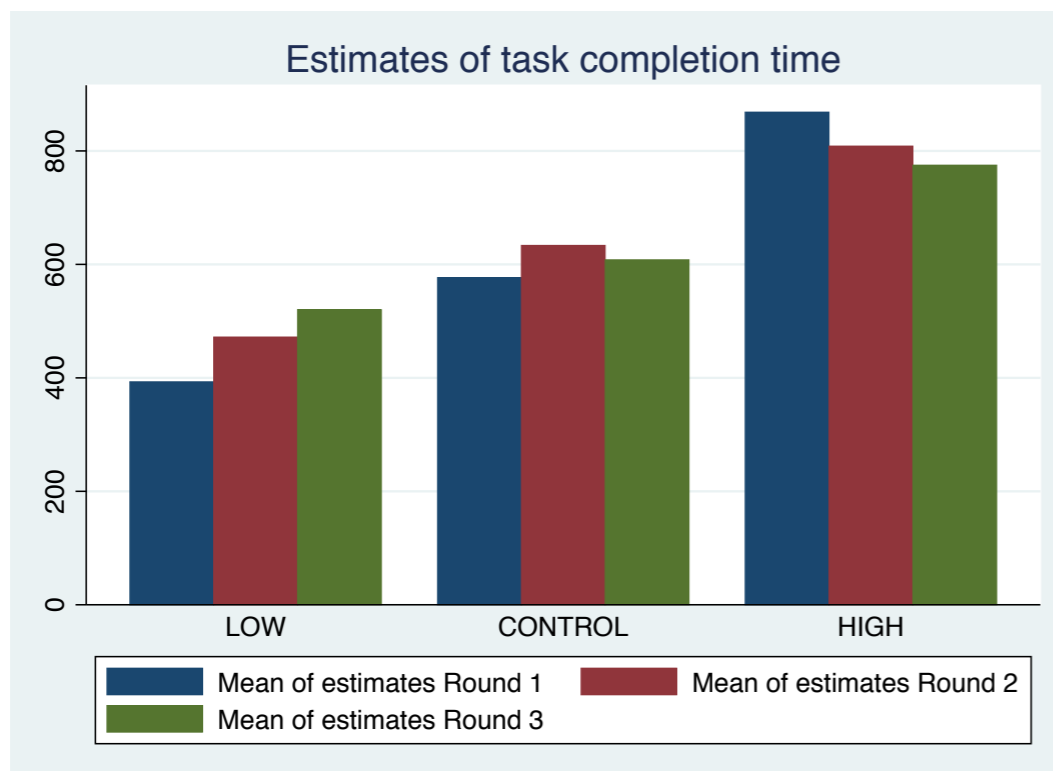
# Positive Hypothesis Testing

- 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 famiilies, 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.

# 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

- 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

- success = talent + luck

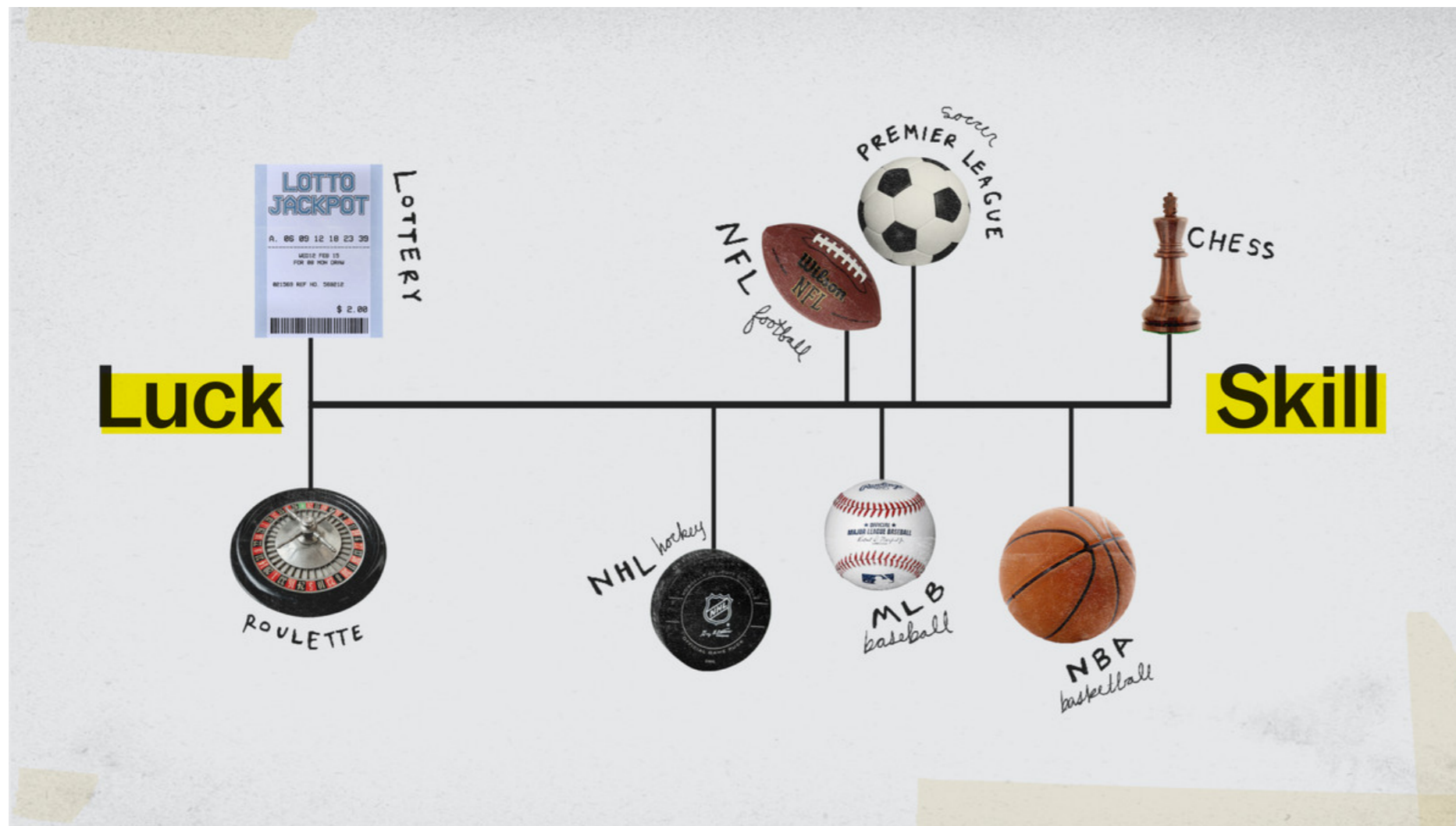- great success = a little more talent + a lot of luck

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

| Bias | Description |
|------|-------------|
| *Biases Emanating from the Availability Heuristic* | |
| 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. |
| *Biases Emanating from the Representativeness Heuristic* | |
| 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. |
| *Biases Emanating from the Confirmation Heuristic* | |
| 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. |