

## **Heuristics and Biases in Project Management**

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As we go about our lives, whenever we make decisions, whether they are relatively important, “what strategies or tactics should we use to reduce project cost?”, or relatively trivial, “is No-Name peanut butter really a better bargain than the brand-name version?”, we are forced to assess probabilities or essentially make bets, which is not an easy task. We often apply rules of thumb or heuristics when we make judgments about probabilities of future events. In many cases, using these rules will help us make good decisions. However, depending upon the situation, this type of decision making can lead to faulty judgments or biases. In this paper we will focus on a few common heuristics and biases which affect project management: availability, anchoring, representativeness, and others.

### **How Project Managers Became “Gamblers”**

There is a problem that pervades our society: we have all become pathological gamblers. We are not referring to those of us who spend all of our spare time in casinos in the vague hope that they will win their retirement nest egg – the opposite outcome is almost nearly always the case. Rather, we are referring to how we must gamble during the course of our everyday lives. If you drive or are a passenger in a car, there is a probability that you will be involved in an accident. Take your clothes to the dry cleaner and there is probability that your shirt will be damaged; you buy chicken in the supermarket and there is a probability you would get salmonella or some other unpleasant condition. In fact, there are whole industries whose revenue and profits dwarfs those of the Las Vegas casinos that are all based on gambling: investments and insurance. When we invest our money, what we are actually doing is gambling that certain stocks or mutual funds will provide us with a certain returns. And unless we are willing to watch the value of our savings evaporate over time due to inflation, we are left with few options but to place a bets using one or multiple financial instruments. In our society, this type of gambling is both a respectable profession and a source of great personal wealth. Professional gamblers earn much higher amount of money than people who actually produce the goods. 15 of the 120 richest people in the world made their fortune in investment, finance, gaming, or leveraged buyouts - industries whose are based on gambling (Forbes 2017).

Perhaps, what is most interesting is that this type of gambling has in some specific cases become mandatory; you must bet on something or face possible legal consequences. The most common example is car insurance which you must have before you can drive on public roads. As this is the case and we don't have any other but to gamble, let's learn how to improve our gambling skills. In this paper we will learn about common mistakes which all people, including project managers, make when people make their choices under uncertainties.

### **Availability Heuristic**

Let's imagine that you are an IT project manager and tasked with selecting new laptop computers for your organization. You reviewed all the product sheets for Dell, Toshiba, HP, and other laptop brands: performance, price, reliability, memory, etc. After a detailed analysis, you decided that Toshiba is a best brand for your organization. However, the day before you are

planning to issue your recommendation, you met a friend in a local pub. After you mention your plans to recommend Toshiba, he gave you a funny look and then said: “Don’t do it, I bought a Toshiba and after only three months the hard drive failed and I lost all of my data. This is a terrible computer”. You become slightly flummoxed and you start to rethink your proposed recommendation of Toshiba laptops, perhaps Dell might be the better choice. Here is the problem. You did your analysis using comprehensive information about each laptops; however, after a chance meeting at the pub, you are now thinking of ignoring the results of your analysis because now your assessment of the reliability of certain brands of computers is skewed (Schwartz 2005). In reality, your friend describes only one single case with a particular Toshiba computer and does not reflect any statistical data about the quality and reliability of said laptop.

Here are some other common examples:

- When avid smokers are asked why they do not try to get rid of their habit despite overwhelming evidence that smoking is harmful, they may answer that they aren’t worried because they know someone who smoked all of their life and lived until a ripe old age 95 years when they were unfortunately run over by a bus.
- You decide to take a vacation in Mexico and during your research to find the perfect vacation locale, you discover that Mexico has beautiful beaches, world class hotels, and good security in the tourist areas. However, just as you were in the process of selecting your Mexican vacation destination, you see headline in the news that US tourist had been robbed in Acapulco. You become extremely worried and think about cancelling your vacation.
- You are planning to start developing a database application to need to select a platform. You know only four companies that develop software applications similar to the one you are planning to develop. Three of them are using Oracle and only one is using Microsoft SQL Server, so you decide on using the Oracle platform.

What is the common theme in all of these examples? In all of these situations you are making a bet. If you smoke, you are betting that you will be one of the luck few whose lifespan will not be shortened by the habit. If you purchase a computer, you are betting that it will be reliable. Unfortunately, most people don’t perform this type of detailed analysis for most real life issues in which the extra effort would be very beneficial. One of the main reasons we don’t is because it takes a lot of mental effort and energy. In addition, our ability to perform a truly rational analysis is limited because:

- a) the information we have may be limited,
- b) our minds have basic cognitive limitations, and
- c) there is only a finite amount of time that we have to make decisions.

Therefore instead of using detailed analysis, we rely on simplified mental strategies or “rules of thumb” to guide our decisions. In the psychology of judgment and decision making these rules of thumb are called *heuristics*. In many cases, heuristics lead to good decisions; however, they often cause inconsistencies and predictable biases.

The behaviors we describe for car buying and smoking are examples of one such heuristic: *availability* (Tversky and Kahneman, 1973). According to this heuristic, people make judgments about the probability of certain events based on how easily the event is brought to their mind.

When people bet or take other risks, they have to determine the probability of some type of event occurring. And they often do it incorrectly:

- Medical statistics are a reliable way to estimate the life span of smokers vs. non-smokers. But a couple of examples of smokers we know who lived until the age of 95, can cause us to disregard the medical statistics usually override this statistical information and as a result we may significantly reduce the probability of experiencing a shorter lifespan because of smoking.
- When you read about one instance of a robbery in Acapulco you didn't read about the hundreds of thousands successful vacations and happy tourists. To make matters worse, because there are no images of the actual robbery, you tend to make them up, enhance them with images you might have seen in movies: lots of violence, blood, incompetent local police in cahoots with organized crime. Now the previous images in your mind of a relaxing vacation on the beach are replaced with the images of an imagined crime scene. No wonder you are thinking of canceling your trip to Acapulco.
- You know about only four organizations that are developing software similar to the application you have planned; however there are probably dozens if not hundreds of companies involved in similar development. You are making a decision based on very limited number of samples.

In all of these situations, people judge the frequency of an event based on something that is easy to remember or imagine, but not actual data. Essentially we replace statistics with imagination.

Here is another example of the availability heuristic. Let's compare two different descriptions of potential oil drilling failure due to low quality of seismic data.

If high quality seismic data is not purchased, there is an increased chance that the well we drill will be dry and we will incur some losses.	If high quality seismic is not purchased, a \$ 3.6 million well may be dry. Moreover, we will have wasted at least 17 business days drilling plus three more days on rig mobilization. In addition, we will miss the opportunity to drill wells in a different field. We estimate that our income after taxes will be 10% lower if this well is dry.
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Which version of the event will sound more realistic to the management? If you are like most managers, you picked the second. It is more vivid, has more details, and therefore looks more probable. Vivid events are easily brought to mind and since we can recall them better, it affects our estimation of probabilities. Lawyers, police officers, and politicians often use the availability heuristic and paint vivid descriptions of a process or an event when trying to convince us that their version of the events is the truth. Experienced project managers are also aware that they can sway senior management or project stakeholders by painting vivid pictures; for example, a project failure if additional resources are not provided.

The availability heuristic is in great evidence in project management. For example, when we estimate project cost, duration, or resources, we are doing it based on previous instances of similar projects or tasks. Because very few organizations keep an actual lessons learned database, project managers or schedulers are often left with only their own memory to try and recall these previous projects. They imagine what could happen in their projects and based on this, estimate the probability of future events. Sometimes they are able to perform quite accurate assessments, but if they only remember extreme events (successes or failures), or events associated with vivid details, their estimates can be skewed.

So, how you mitigate the negative impact of availability heuristic? The choice engineering - type suggestion is to collect as many samples of reliable information and include it to the analysis. For example, if you estimate probability of a risk “delay with receiving payment” ask your accounting department to check records of previous payments – have they been delayed or not. If you don’t obtain this information, you may base your judgment based on recent payment delay or a remarkable delay which involved a huge sum of money.

### **Anchoring**

Do you know how much this seemingly simple purse cost (Figure 1)? The price usually starts at about US \$5,000, but can reach 5 and sometimes 6 digit prices. It is a “Birkin” bag by Hermes. Allegedly, the waiting list for a Birkin is over two years; however, Hermes will sell a Birkin to “regular” customers without putting them through the agony of a waiting list. Hermes claims that only few hundred bags are produced per year and that they are sold only at Hermes stores and never online. The bags are often constructed using exotic animal skins and studded with diamonds. By being so exclusive, Birkin became a must have accessory for celebrities (Tonello 2009).



*Figure 1. Birkin Bag*

How does Hermes determine the price for their bag? Normally, we determine a price for a product by comparing it to similar products. For example, while at a farmer’s market you see that most producers charge \$1 for a pound of apples. As you wander amongst the many fruit sellers, you discover one stall that is selling what appear to be higher quality apples for \$2 per

pound. You also know that apples normally range in prices from \$1 to \$2 depending on the type, quality, and season. Now you can compare the \$1 and \$2 apples and decide whether the difference in quality, type, etc. makes it worthwhile to pay an extra \$1. In your analysis, you leave out supply and demand, net present value or expected value, you just use a mental shortcut by comparing the prices of apples with a reference point. This is a simple and effective analytical process. In the case of Birkin bags, the situation is not so simple. There are no readily available reference points to help determine what the cost should be for a Birken bag. Therefore, Hermes is free to ask for any price when they first introduce the bag and at that point, the price becomes the anchor that will be used to determine the prices of all Birkin bags. People commonly rely on anchors, or one particular piece of information or reference point to make decisions. If this anchor is set up incorrectly or arbitrarily, it may lead to wrong decisions. This effect is called the *anchoring heuristic* (Tversky and Kahneman 1974).

Here is another example. In 1993, federal regulators forced public companies to disclose their compensation to senior management, which at that time was 131 times as much as the average worker. In 2008, the average CEO's combined compensation was 369 times greater than the average worker (Ariely 2009). The underlying reason for such growth is the anchoring heuristic. After CEO compensation started to be disclosed, every board began comparing the salary of their CEO and others in a similar position, which might not be the correct reference or anchor point to use. Remember, the main argument for enormous CEO salaries is that other CEOs have a similar level of compensation. Obviously, boards do not want a bad CEO: so they find the "normal" compensation in their industry and add 10-30% to attract the best candidates.

Anchoring often manifests itself in estimation of project costs, resources, or duration. For example, we estimate that a project would take 20 days based on experience with a similar project, but this reference point may be not applicable to the current project. Now, even if we add contingency time to perform probabilistic analysis (e.g. 15 to 25 days duration): the result still will be incorrect.

Here is another outcome related to anchoring. Project managers often compare project performance against benchmarks. In many cases this is a good practice; however, incorrect benchmarks can give incorrect insights into the actual performance of projects. For example, a project manager may discover that administrative costs for similar projects were around 10% of the project cost. With this in mind, he or she may start to reduce the project's administration expenses without a clear idea how administrative expenses for the previous project were calculated and whether these numbers are applicable for this specific case.

Another bias related to anchoring is called the *focusing effect* (Schkade and Kahneman 1998). The focusing effect occurs when decision-makers place too much importance on one aspect of an event or process. Here is a question for you: do you think the senior manager of your company has a good life? If you focus solely on your manager's salary and perks the answer may be yes. However, you might not know that the manager has a wife and two teenage daughters who spend thousands on perfume, a very critical live-in mother-in-law, a leaky basement, and a slipped disk. He may be a very unhappy man for reasons that have nothing to do with his employment.

The problem with the anchoring heuristic is it is very difficult to overcome. One suggestion is to use more than one reference point during your analysis of an issue. When you buy a Dooney & Bourke bag, try to assess prices using not just Gucci as a reference, but also bags that you can find at Walmart. When you think about project cost, use more than one as a reference.

## Representativeness and Stereotypes

Take a look at Figure 2. Where do you think that this international snowboarding competition is taking place: Aspen, Chamonix, or Whistler? In fact, it is a ski resort in Dizin, north of Teheran. What, a ski resort in Iran you say? In fact, your reaction would probably be shared with the majority of people who read this paper – perhaps because there are no plans to translate this to Persian, but most likely because most of us associate Iran with a warm climate. Also when we think about Iran, we always recall pictures associated with some political events rather than snowboarding. Therefore, in our minds, we have categorized Iran as a warm place; warm places don't have ski resorts so the idea that the picture was taken in Iran would not occur to most of us. We made an incorrect decision because we place Iran in a very narrow category.



*Figure 2. Where is this ski resort?*

We like to organize information so it is easy to understand: we create classifications, hierarchies, assign attributes to almost everything we encounter. In most cases this strategy works very well and is an efficient analytical technique. The problem occurs if we incorrectly categorize information and judgments that are based not on the real properties of the thing (object, person or a process), but rather on the properties of the category or group to which we have assigned it. This is the mistake we made when we passed judgment on the Iranian ski report.

Remember that most objects are hard to classify. Moreover, people are often uncomfortable with how certain goods or things are categorized. For example, to what type of categories should vehicles like the Mercedes-Benz R-Class belong (Figure 3)? Daimler markets it as a multi-purpose vehicle (MPV), but for most people it is a station wagon on anabolic steroids. Without a doubt it is a good family vehicle, but partially because it is hard to classify, sales of the R-class were sluggish (Mercedes-Benz USA 2010).



*Figure 3. Mercedes-Benz R-Class*

Cars are not the only things we tend to classify. We tend to classify pretty well everything that we happen across, including people. In our minds, we create certain categories and when we meet people with who have certain attributes we then we try to fit them into these categories, though sometimes it has the same result as trying to fit a square peg into a round hole. Captain Holly Graf was a commander of the Japan-based guided missile cruiser U.S.S. Cowpens (Thompson 2010). She had all attributes to place her in the commander category: she was very knowledgeable, experienced, outspoken, and decisive, all necessary attributes when commanding a large navy ship. Because of these attributes, she was promoted into the rank of commander. Unfortunately, people who classified her as a commander type and then promoted her to the position ignored one other important attribute required by leaders: people skills. It turns out Commander Graf had none. After numerous complaints regarding her handling of subordinates and other ranking officers, she was removed from her position as a captain of a billion-dollar warship for "cruelty and maltreatment" of her 400-member crew. According to the Navy inspector general's report and the accounts of officers who served under her command, Holly Graf was the closest thing the U.S. Navy had to a female Captain Bligh. Inspector general's report stated that she repeatedly verbally abused and assaulted her crew.

Our mistakes in classification lead us to create stereotypes or develop prejudices. For example, we may classify suppliers from small companies as generally unreliable and low quality. While this may be true in some cases, it is also true that because of these prejudices we may ignore good suppliers and overpay large companies that may also have problems with quality. We often judge people skills based on their job title or job description. For example, project managers often think that software engineers may not able to work with clients because it is not part of

their job description. As a result, they hire business analysts to perform tasks that most software engineers could do just as well.

But here is much less trivial consequence of our attempt to classify things. People make judgment about probabilities and risks based on the category this object, person, or process represents. This heuristic is called *representativeness*. Representativeness can lead to a number of mental mistakes. Here is the question for you:

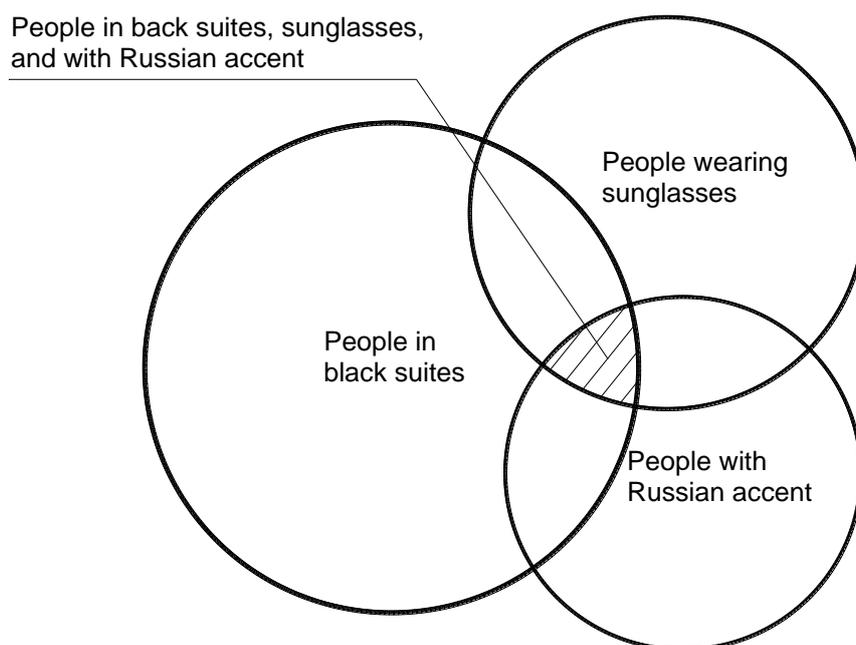
A Russian spy Ivan Petroff infiltrated the White House disguised as a rat exterminator and stole a top-secret document: a list of Washington DC's approved escort agencies. Three people actually witnessed Ivan Petroff inside the White House. Whose description of the Russian spy is most probable:

- a) White House bartender Mick Mousy described the exterminator as a big guy in a black suit.
- b) White House taxi driver Mohamed Toscanini described the exterminator as a big guy in black suit and sunglasses.
- c) White House secret service agent Bert Bigneck described the exterminator as a big guy in black suit and sunglasses, who spoke with Russian accent.

Correct answer is a). The more general a description, the more probable the description is.

- Number people in black suits is greater than
- Number of people in black suits and sunglasses is greater than
- Number of people in black suits, sunglasses, and a Russian accent.

The probability of the three events occurring together (in "conjunction") is always less than or equal to the probability of either one occurring alone. Therefore, the more detailed description, such as "exterminator was a big guy in black suit and sunglasses, who spoke with Russian accent" is less probable (Figure 4). This effect is called the *conjunction fallacy* (Tversky and Kahneman 1983).



Here is another effect related to representativeness heuristic. This effect is called *Ignoring Regression to Mean* – the tendency to expect extreme events to be followed by similar extreme events. Let us imagine that your team is consistently underestimating the cost of projects. However, two of your latest cost estimations were very accurate. You start to believe that you are now on a winning streak. The reality is that unless the quality of your project management has mysteriously improved or you have new process that is expected to improve your forecasts, you should not expect to change your chances that all future project cost estimation will be accurate. A similar situation can occur if you suddenly experience a sudden growth in your investment: a 10% return for the last quarter after 6% for the past few years. Time to buy that vacation home, right? No, unfortunately, we have to disappoint you: 10% is probably an aberration.

To mitigate the negative effect of representativeness try to think about different methods categorize objects or events. For example, you have to estimate how long it would take to develop a software user interface. This particular task could belong to different categories:

- User interface development
- Development using a particular tool
- Capabilities of particular programmer or particular team

By approaching this task from multiple viewpoints, you can make your estimates based on similar projects for each different category.

### ***Some Other Heuristics and Biases***

The list of heuristics biases is quite extensive. For the sake of brevity, we have provided a list of biases that are most in project management.

**Confirmation bias.** People tend to confirm preconceptions or hypotheses, independent of whether they are true or not.

**Ignoring base rate frequencies.** People assess the probability of something based on evidence without taking sufficient account of the "base rate" or "prior probability" of the evidence.

**Illusion of control.** People often believe that they are in control of situation; although, in reality, they are not. You have probably heard about telekinesis or the direct influence of mind on a physical system, in which a system or object is manipulated in a way that cannot be entirely accounted for by the mediation of any known physical energy: bending spoons, moving objects. Many instances of telekinesis can be attributed to the illusion of control (Bösch, Steinkamp, and Boller 2006). Similar to mediums and other participants in paranormal activities, project managers often believe that they are in control of situations when in reality they are not.

**Omission Bias.** People have a tendency to judge harmful actions as worse than equally harmful omissions. What would be better: to observe a potential problem in a project and do nothing or actually be part of the problem? The result will be the same: the project will be behind schedule. This bias often manifests itself when people are making decisions regarding safety and security. People sometimes think that result of not reporting a potential safety violation is not as bad as actually breaking safety rules.

**Optimism bias or planning fallacy.** People tend to be over-optimistic about the outcome of planned actions.

**Overconfidence.** People tend to overestimate the accuracy of their predictions.

**Publication bias.** People have a tendency to report results that confirm expectations differently from results that are negative or inconclusive. This is very common phenomena in research and development projects. Negative results or results which do not confirm the original hypothesis are also valuable and should be reported in the same manner as positive results.

**Status Quo Bias.** People tend not to change an established behavior unless the incentive to change is compelling.

**Zero risk bias.** Sometimes people feel better if they completely eliminate risk rather than mitigate it.

**Loss aversion.** People tend to strongly prefer avoiding losses versus acquiring gains.

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