

# Cognitive biases in entrepreneurship

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# Introduction

Entrepreneurs face a lot of external challenges, but the most challenging obstacles may be those played on them by their psyche.

From deciding to start a new venture to constantly tackling a lot of obstacles, entrepreneurs frequently find themselves in the midst of complex situations that require a lot of effort, both physical and mental. While we instinctively tend to believe that a lot of those decisions come from evaluating facts in a logical way and taking well-calculated risks, this is not always the case.

For instance, why do individuals start an entrepreneurial venture when evidence shows that more than half of the start-ups fail to be successful? What makes entrepreneurs different from non-entrepreneurs? What are the reasons for these failures if the individuals who started the venture made logical decisions based on facts? The answers to these questions may be hidden in the way the human mind works.

Humans are vividly complex. Logic is not the only component that comes to play while we make decisions and take actions. Emotions and biases come to play as well, sometimes in a significant manner. Why do we value something we own more compared to when someone else owns the same thing? Logically speaking, both have the same value. But cognitive biases trump pure rationality.

Cognitive biases are systematic errors in thinking that affect the decisions and judgments that people make. While everyone is prone to these errors, entrepreneurs do stand out because they take on an uncommon activity involving continuous risk-taking and fast decision-making. How do these biases impact entrepreneurs and entrepreneurship? This report is a small piece of the answer to his question, with an in-depth review of the most common cognitive biases and their impact on entrepreneurship.

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# Thinking like an entrepreneur

Entrepreneurs are people who take action. They continuously make efforts to convert their ideas and vision into profitable companies. In the absence of action, there would be no entrepreneurship. Entrepreneurs develop their ideas and products through new ventures, which implies that some parts of their cognition and behaviour affect this process of conception, launch, development and operation of new ventures [1].

To understand the underlying cognitive and behavioural factors that make entrepreneurs different from non-entrepreneurs, we can divide the process of entrepreneurship into key activities and study the cognitive and behavioural variables that affect each of these activities. These key activities may be broadly classified as follows:

## **Generating new ideas**

The US patent office applies the criteria that an idea must be new and potentially useful to be considered for a patent.

Generating new ideas stems from creativity—the ability to find an idea to create something useful from something non-obvious. Where do such ideas come from? Why are they indigenous to particular individuals? Finding answers to these questions can point out the cognitive factors that entrepreneurs possess which lets them find new ideas. Ways to grow these qualities in non-entrepreneurs could then be explored.

## **Recognizing opportunities**

New ideas are raw materials which can be used for new venture creation. Opportunities can be recognized in existing situations or created when none exists.

Regardless, the decision of a specific individual to pursue these opportunities is what makes them different from non-entrepreneurs.

For that, they have to find a business potential in the opportunity.



What are the cognitive factors that allow entrepreneurs to recognize this potential which is often missed by non-entrepreneurs? If we can understand why certain people recognize opportunities that others don't identify, this can provide key insights into how this process takes place and how it can be enhanced or reproduced [1].

### **Acquiring essential resources**

Another important factor for a successful new venture formation is gaining necessary financial, human, and informational resources. These resources help convert ideas and strategies into an actual operating business. As a result, entrepreneurs actively seek to obtain them. Not all entrepreneurs are successful in obtaining them. So, it makes sense to ask the question of why are some entrepreneurs successful in obtaining the resources they need [1].

# 1. Optimism bias

*Optimism bias is considered to be one of the reasons for motivation for entrepreneurs to start a new venture as they believe they can be successful regardless of the statistical fact that their business will survive is potentially low. It causes entrepreneurs to overestimate their success and other important facts like future sales and employees. It may also lead to overconfidence in entrepreneurs. Paradoxically, optimism bias can be beneficial in the sense that it is one of the major reasons why individuals become entrepreneurs in the first place.*

Optimism bias is a difference between a person's expectation and the actual outcome. If the outcome is worse than his/her expectation, then the bias is optimistic. Else if the outcome is better than the expectation, then the bias is pessimistic. Research shows that around 80% of humans exhibit an optimism bias [1] and hence, is an integral part of human nature. Optimism biases are also present in other animals, like birds and mice.

Interestingly, there is one group of humans who fail to show this cognitive bias—people suffering from depression. Studies show that people with mild depression show no bias when predicting future events while those diagnosed with severe depression tend to be more pessimistic and expect worse outcomes than they actually turn out [1].

Another interesting fact about this seemingly innocent bias is that it tends to bend facts or cause us to simply ignore them. It was experimentally found that if a person is provided with estimates better than his/her expectations, they will update their estimations substantially to match the new estimates. Whereas if a person was given estimates worse than his/her expectations, they do not update their expectations as much to match the estimates. Selectively updating beliefs in response to positive information produces optimism that is resistant to change [1], which can become a problem while making informed decisions that should be rooted in facts.

This selectivity is due to the failure of the frontal lobe regions to code errors in predictions, i.e, the difference between expectation and the factual estimate presented. When generally optimistic people are faced with statistics suggesting that they might encounter an adverse situation (more negative than they were expecting), their right inferior frontal gyrus exhibits reduced coding of information that calls for a negative update [1]. The higher the level of optimism, the weaker the activity.

On the other hand, when the statistics presented are better than what they expected, the prefrontal cortex code for it well in both highly optimistic as well as less optimistic individuals. To put it in simple words, for a normal healthy person, the brain responds well to facts that support their expectation while ignoring or paying not enough attention to facts or statistics that go against their expectations. However, the opposite is observed in people suffering from depression.

Now, a question might pop up. Since a healthy brain is functionally biased towards optimism, does that mean that it is optimal, that is, does such a bias help humans in some way?

From a rational point of view, it is evident that making decisions based on facts and statistics will result in better outcomes. But many sources of evidence point to the conclusion that optimism is more advantageous compared to unbiased predictions. It is said to be beneficial for physical health and one can easily understand why. Expecting positive things reduces stress and anxiety which are detrimental to health.

It was also observed that optimism promotes healthy activities like exercising. It was also seen that optimists have stronger immune systems, probably because of their healthy habits.

As with almost everything, optimism bias also comes with its share of disadvantages. Optimism bias has three forms: positive self-evaluation, over-optimism about future plans and events, and overoptimism due to the illusion of control bias [2]. Underestimation of risk due to over-optimism may result in reckless behaviour. For instance, extreme optimists are more likely to smoke than mild optimists. In addition, over-optimism by a group of people can be even more detrimental than over-optimism by an individual. For instance, the optimism bias has been named by several economists as one of the core causes of the financial downfall of 2008 [1].

Even so, optimism is necessary for a healthy, content life. Without an optimistic perception, one's future may look bleak (old age, sickness and death await everyone). Hence, it seems like the benefits of this bias outweigh its disadvantages.

## **What the optimism bias means for entrepreneurs**

Optimism bias is one of the prominent cognitive bias exhibited by entrepreneurs. It was found in a survey that even though only 25% of businesses survived for more than 5 years back then, 81% entrepreneurs believed that their chances of success were at least 70% while 33% believed that they will definitely succeed [2]. These results should be interpreted with a pinch of salt since entrepreneurs may talk positively to encourage others such as potential investors and employees to believe that they will succeed. However, many pieces of research [2] have pointed to the fact that most new entrepreneurs tend to be over-optimistic and have over positive self-evaluations.

Moreover, over-optimism may cause overconfidence which will lead to incorrect estimations of prospective risks which may not end well.

Hence, optimism bias causes individuals to dip their feet into entrepreneurial activities with an expectation of success. The tendency of new and existing entrepreneurs to have over-optimistic expectations possibly explains why individuals enter and persist in self-employment even in the light of unfavourable statistics [7-9].

Studies [3] show evidence that entrepreneurs are extensively influenced by over-optimism. Individuals step into new venture creation by overestimating their success and if they are successful in actually establishing a business, they tend to overestimate their future sales and employees. Another interesting point is that Cassar et al (2009) [3] also shows a link between management activities and overly optimistic expectations in that managerial decisions that are encouraged to be adopted in uncertain situations are associated with optimism bias in entrepreneurs.

Presence of over-optimism in entrepreneurs may be due to rational choices made over noisy data. People construct mental scenarios—a kind of representation like concepts or scripts—of how something is likely to turn out and forecast outcomes based on these scenarios. Experimental research has shown that when individuals are provided with reasons or scenarios for why an outcome will be achieved, their expectation of the occurrence of that outcome increases. Plans devised by entrepreneurs are a type of scenario representation. Such plans are usually created formally based on some data through management activities. When individuals can give explanations of their choices and beliefs, they become more confident and optimistic [3].

Also, since entrepreneurs have more inside knowledge, like their own talents and capabilities, they may neglect the importance of outside information like their competitors' capabilities which can contribute to overoptimism and overconfidence. Hence, entrepreneurs with an absolute interest in these planned behaviours are more likely to have increased tendencies to formulate overoptimistic expectations [3].





## 2. Overconfidence bias

*Overconfidence is an overestimation of one's own abilities. It occurs due to biases in information processing and effects of unbiased judgemental errors. Overconfidence bias, when combined with other biases like distrust and optimism bias, is an important factor in failure of entrepreneurial activities and new businesses.*

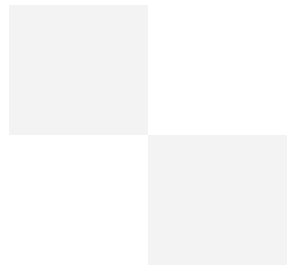
*But overconfidence also helps entrepreneurs to exude strong belief in their views. As such, it may help in gaining necessary financial and human resources.*

The association of entrepreneurship with overconfidence is a well-researched topic.

Overconfidence bias is quite self-explanatory. But a more technical definition of overconfidence would be something like this—"the difference between confidence and accuracy" [4]. Overconfidence may also be defined as the "overestimation of one's own abilities relative to others" [7]. It is one of the most common biases to which human judgement is vulnerable.

Changes in confidence are one of the most important milestones in a person's life. As we develop into adulthood, our confidence supposedly becomes firmer and good-natured as compared to the apprehension and recklessness of our childhood and adolescent days [5].

Overconfidence is researched on the basis of many factors such as age. While young people are considered more overconfident as compared to senior citizens who are reckoned to be more cautious, this assumption may not always be true. Young people may be more risk-tolerant and take calculated risks while knowing their odds [5]. Overconfidence can occur in two forms—personal (dispositional) and predictive (situational). The former is something that is firm and does not change while the latter varies according to the context [4].




In another study, overconfidence is classified into three types—overestimation, overplacement and overprecision. Overestimation is the belief that you are better than you really are. Overplacement refers to your strong belief that you are better than the others. Overprecision is the exaggerated faith that you know the truth. These three forms of overconfidence are different and their relation to each other is complex and correlated with many factors [5], which would be too long to cover in the present report.

So the question arises, why are people generally overconfident? Two important explanations have been suggested [6]. Biases in information processing occur due to a person's overestimation of himself and errors in estimations of external factors. The person in question (judge) searches his/her memory for relevant information and reaches a conclusion based on the information. Then he/she searches for more evidence to support this conclusion and accidentally ignores other possibilities.

This is because the mechanism of associative memory works such that only those information that is relevant to the initial conclusion, thus making the decision biased while the judge believes their process to be unbiased. Thus, they take action based on their conclusion with more assurance than is right that their judgment is correct. Also, people like to believe that they are intelligent and knowledgeable, which leads them to conclude that their judgement is true. This common aspect of human nature contributes to overconfidence bias [6].

Another cause of overconfidence bias are unbiased judgemental errors which are possibly caused by false interpretations of the predictive validity of different information sources, imperfections in evaluation available information, and mapping one's subjective feeling of confidence to a response scale. These errors are not due to biased judgements, but due to imperfections in the information or its perception [6]. While these factors come to play mostly, measuring overconfidence is a hard task and the possibility of experimental error is also wide [6].



While overconfidence is a cognitive bias in and of itself, it can be closely associated with other biases like the optimism bias. Unrealistic optimism leads to an overrating of the likelihood of good events and having positive outcome expectations on events that the judge has no control over, thus increasing overconfidence. Another bias, the distrust bias, is also positively associated with overconfidence. Here, positively associated implies that the said bias promotes or encourages overconfidence [4]. Thus overconfidence does not exist in a vacuum: it is significantly influenced by other biases.

### **The impact of the overconfidence bias on entrepreneurs**

Overconfidence widely impacts entrepreneurial behaviour. Overconfidence bias is common among individuals in general and among entrepreneurs in particular [7]. It is a central theme in entrepreneurial ventures' failures and its effects are magnified when combined with other biases like optimism bias and distrust.

Overconfident entrepreneurs tend to under evaluate their competitors. They also tend to introduce riskier products with lower success rates, to under-resource the business, to engage less in legitimacy gaining activities, and to rely less on external networks for the survival of the firm—all of which are factors that are critical for a firm's survival and success [4].

Research shows that distrust-overconfidence and optimism bias-overconfidence are two distinctive cognitive types in that entrepreneurs are generally overconfident and opportunity oriented, but either optimistic or distrusting and not both. It was also shown that since both types are distinct, they have markedly different links with the survival of the firm when considered separately [4].

While overconfidence is a seemingly negative bias, it may also be associated positively with entrepreneurship. What is really interesting is that most of the research on overconfidence points to the fact that it is closely associated with altruism or optimism bias [4, 5].

Overconfident behaviour of an individual entrepreneur shows his strong belief in his/her private information. This information may not be available to the public and the public as a whole only has access to little information. Instead, the public or group can study the individual and use this information to make judgements. Hence, overconfidence can persist because overconfident behaviour broadcasts information to the group which can be beneficial in the long run [6].

A study [6] showed that a group with too many entrepreneurs has too many individuals relying on their own information and making too many mistakes, while a group with too few entrepreneurs falls too easily to an incorrect choice. Another interesting point of view is that the benefits of overconfidence rest on an individual's inability or another individual willingness to let themselves be deceived. Also, another point of view in consideration is that entrepreneurs are tempted by high payoffs associated with not conforming to the herd [6].

Whatever the point of view may be, entrepreneurs are strongly influenced by this particular bias. This is probably because entrepreneurs have a strong tendency to consider their situation as unique. As a result, they tend to neglect past data and statistics and future situations that could help them to form better judgements [7].

What are the benefits of overconfidence for the individual and society? The pros of being overconfident clearly outweigh the costs. For example, people may step into entrepreneurship believing that they have what it takes to be successful. And this initial step may require so much effort that the individuals learn what they need to in order to be successful entrepreneurs. In addition, overconfidence may be beneficial in persuading others to believe in the entrepreneur's decisions.

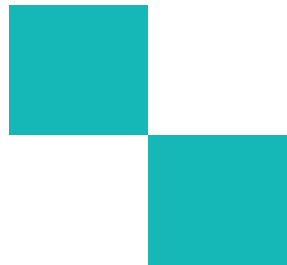
Overconfidence leads to more entrepreneurs. More entrepreneurs, even though unsuccessful, may spur competition and push existing business towards efficiency [7]. The apt conclusion here would be: while overconfidence bias does come with its own benefits and detriments, too much of it in entrepreneurs is usually associated with non-survivals, but it all depends on the individual's "inside view", that is, the unique situation or the private information the entrepreneur possesses.

# 3. Planning fallacy

*Since entrepreneurs focus more on the future than non-entrepreneurs, they are more susceptible to planning fallacy. It refers to the phenomenon wherein people underestimate the time required to complete a specific future task, ignoring the negative historical evidence, causing a delay in decision making and delivering promises. However, it may cause entrepreneurs to think that the impossible is possible.*

Planning Fallacy is a bias which all of us often fall prey to at least once in our life. This bias refers to a phenomenon wherein people underestimate the time they require to complete a particular future task even with the knowledge that previous similar tasks have taken longer to complete [8]. A good example of this situation will be students underestimating the time they require to prepare for an exam, even though they know from exams held before that it will take longer than what they estimated. Studying planning fallacy helps us answer some questions relevant in everyday life like “Why does major construction work take longer to complete than expected?” [8].

Formally, planning fallacy may be defined as “the conviction that a current project will go as planned even though most projects from a relevant comparison set have failed to fulfil their planned outcomes” [9]. A key feature of this bias is that those involved, also called the planners, maintain their optimism about the current task ignoring the negative historical evidence. The phenomenon that occurs from a combination of realistic knowledge about the past and still being able to maintain optimism about the time taken to complete a similar future task is called planning fallacy [8]. Sometimes people may also underestimate the time required without access to any negative historical evidence, but such cases are not included under planning fallacy.



A key aspect of planning fallacy is that planners tend to take into account or give importance to inside facts and ignore or do not give enough importance to outside facts[8]. For instance, a student estimating the time they will require to complete an assignment takes into account the things like their speed of writing/typing, understanding of the subject, comprehensive power etc., but does not take into account the fact that most of their classmates, including some who were better than them on the features that they evaluated, failed to complete the assignment in the time they estimated. Here, the student only considered the inside view and ignored the outside view [8].

So, why do people neglect useful insights from past experiences? This is probably because each individual interprets their past differently. In addition, people generally give more importance to future tasks than tasks that happened in the past.

The planner often does not know with certainty what happened in the past, unless it's their own past, and hence is doubtful about the generalizability of those experiences. Hence, a combination of optimism, focus on future scenarios, lack of certainty of past events, and attributional processes that diminish the relevance of the past to the present are few of the factors that contribute to planning fallacy [8].

### **The impact of the planning fallacy on entrepreneurship**

Research shows that most people are susceptible to the planning fallacy, but entrepreneurs are more so than others [10]. This is because entrepreneurs focus on the future more than non-entrepreneurs. As mentioned above, the planning fallacy is considered to be caused by one's disregard for past experiences in estimating the time it will take someone to complete a future task. Entrepreneurs regard past experiences as less important and give a lot of importance to the future.

Besides, they are more prone to taking risks. Entrepreneurs take risks despite being aware of the chance of negative outcomes. All of this points to the idea that entrepreneurs are very susceptible to planning fallacy. Another reason for this might be that entrepreneurs attribute positive results to their own capabilities and negative results to external causes (called the self-serving bias) [10][11].

Planning fallacy was observed to have an effect on entrepreneurial activities like marketing strategies. It can cause delays in decision making which is a key component in marketing [11]. While planning fallacy may seem like a trap set for us by ourselves, it can have a positive impact. It makes entrepreneurs think that the impossible (well, not impossible, but very unlikely) is possible because of their belief in their own capabilities.

Hence, it drives entrepreneurs to make decisions and take actions that people otherwise wouldn't, especially when there is very little room for error. For instance, funding is a very important aspect of new venture formation. The skewed beliefs of entrepreneurs in their own skills may lead them to expect more returns, which in turn affects other financial decisions like pursuing investors they otherwise wouldn't. The entrepreneur may believe in their decision and skills so strongly that they can be very persuasive which can influence the investors to fund the venture [12]. Hence, in some aspects, planning fallacy also has a positive impact on entrepreneurship.





## 4. Illusion of control

*Illusion of control makes people feel like they are more in control over a situation than they really are. People tend to treat chance events like winning a lottery or rolling dice with an illusion of control, similar to the way they treat a skill situation—a situation they are familiar with and hence do have some control over, for instance, a pro tennis player will have more control over the game than a beginner. In the case of entrepreneurs, a higher sense of illusion of control is negatively associated with the quality of decision making. This bias makes entrepreneurs consider a limited number of alternatives in the decision-making process and hence they make less comprehensive decisions that lead to poor quality decisions.*

One might find it interesting that the most cited paper on “illusion of control” was written way back in 1975 and still contains a lot of insight on the topic.

The technical definition of this bias is something like this—“an expectancy of a personal success probability inappropriately higher than the objective probability would warrant” [13]. To put it simply, illusion of control is a bias which makes one feel like he/she has control over a situation and can change it to produce a positive outcome.

An illusion of control may arise as due to different factors like choices, stimulus or response, familiarity, nature of involvement in the situation (active or passive), or competition [13]. When a person is allowed choices, it may give them an illusion of control over the outcome. Similarly, someone who has a lot of practice in certain tasks will exhibit more confidence than someone who doesn't have much practice. More confidence results in a feeling of control, which is justified in this case. Familiarity is another factor which gives people confidence. Practice gives familiarity with certain tasks, and familiarity with a situation leads to confidence. Hence, familiarity is also a contributing factor to the illusion of control [13].

While it makes sense that people feel a feeling of control in situations where they can use certain factors like practice, or familiarity to their benefit, it is worth examining the illusion of control one exhibits in chance events like rolling dice or winning a lottery. It was found that people treat such chance events the same way they treat a skill situation—"skill" here being choice, practice, etc). For instance, people tend to choose numbers which are meaningful to them when buying lottery tickets (most of us can relate, right?). We believe that it increases our chances to win. This sentiment gives people a reason to confidently choose something in a chance situation, which in turn gives them confidence that the event will give them a positive outcome—thus causing an illusion of control [13].

So, in short, people treat chance situations as skill situations due to an illusion of control which gives them confidence that a positive outcome will occur. The more the chance situation is similar to a skill situation, the greater the illusion of control.

This phenomenon gives rise to the question: why do people treat chance situations as skill situations? People are motivated by control. Many possible reasons have been researched. It can be due to an instinct to master something or to feel superior. We feel a sense of satisfaction when we solve a problem that many others have failed to solve. This satisfaction to demonstrate one's competence may be a reason people seek to control their situation. Another possible reason is that an illusion of control allows one to focus on the positive outcomes and to divert one's mind from all the negative stuff that can happen when the situation gets out of control. Most of us are familiar with the anxiety we feel when we feel like things are not under our control and are not working out according to our plan.

As mentioned above, the illusion of control is studied in relation to depression most likely because a chronic feeling of lack of control is characterised by passivity and giving up in the face of failure—a phenomenon called "learned helplessness."

Learned helplessness is believed to be an important contributing factor of reactive depression. It was found that depressed subjects give relatively accurate judgements of degree of contingency between their responses and outcomes while non-depressed subjects show an illusion of control and overestimate their impact on chance situations. It can be reversed by teaching response-outcome contingencies to the patients. Hence, in this case, an illusion of control is beneficial and has a positive impact [13][14].

A negative effect of the illusion of control is reactions associated with mania. Mania is characterized by goal-directed overactivity and very high self-esteem. A person with mania believes that he/she will not fail in any activity they undertake. Even when given an impossible task, a manic patient will be confident that he can find a solution. Hence, this is the other extreme of the illusion of control which you will agree is not a good thing [13]. That's why the illusion of control is another bias that we may need, but in moderation. Too much and too little may be dysfunctional to the individual.

## **The impact of illusion of control on entrepreneurs**

The illusion of control is again one of the moderating factors which influence the decision of entrepreneurial pursuit. In fact, entrepreneurs may be especially prone to this bias since they face situations of high risk and uncertainty more than non-entrepreneurs. Studies show a positive relationship of the illusion of control with entrepreneurial outcome variables—venture formation and opportunity evaluation, respectively.

But the overall effect of this bias on venture formation may or may not be positive. In fact, it was found that a higher sense of illusion of control is negatively associated with the quality of decision making. This bias makes entrepreneurs consider a limited number of alternatives in the decision-making process, and hence they make less comprehensive decisions that lead to poor quality decisions.

Besides, entrepreneurs are already under the stress of building a venture which magnifies the negative effect of the illusion of control on decision-making quality.

Contrary to what you may expect, it was also shown that past experience also contributes to this negative effect. Decision making is an important variable in entrepreneurship and poor decisions lead to failure. Hence, an illusion of control has a negative effect on entrepreneurship. Even experienced small business owners tend to fall prey to their biases when they have high levels of the illusion of control, thus making poorer decisions [15][16].

The illusion of control also affects the risk-perception of entrepreneurs making them think they can control the future. This perception of control is an illusion which may cause them to misjudge a situation and take more risk, thus affecting their venture negatively. This may also be a reason for poor decision quality [15][16][17]. So, the conclusion one can draw is that, while a certain level of illusion of control is necessary for everyone to function normally, high levels of this bias in entrepreneurs can lead to poor decision making and risk perception, which may affect their business poorly. However, it's important to note here that the research on the relationship between the illusion of control and entrepreneurship is rather rare and requires further prodding.

# 5. Belief in the law of small numbers

*Belief in the law of small numbers refers to the tendency of people to view a sample (even if it is small) randomly drawn from a population as highly representative, that is, similar to the population as a whole in important characteristics. It affects many entrepreneurs who tend to use small samples because they may not have access to large data. The belief in the law of small numbers may also be the reason that entrepreneurs overestimate demands or end up testing their services with a small number of people, and using that data as representative of larger markets trends. Hence, the impact of this bias on entrepreneurs is negative.*

The law of **large** numbers states that a large random sample from a population will have a distribution that closely resembles that of the overall population, which makes sense.

On the other hand, the law of **small** numbers states that people have a tendency to view a sample (even if it is small) randomly drawn from a population as highly representative, that is, similar to the population as a whole in important characteristics [18][19]. Another phenomenon closely associated with this bias is when some deviation occurs in the population from the expected characteristics (observed from the small sample), people usually expect the results to self-correct in further observations [18][19].

In a coin-tossing experiment, it was observed that people expected the probability of occurrence of heads and tails to remain closer to 0.05, that is, they expected the coin to be “fair”. If more heads occurred than tails in tosses, the subjects expected a corrective bias in the other direction, that is, more tails in subsequent tosses, so as to maintain fairness. This tendency is called the gambler’s fallacy [18].

Both of these biases are commonly observed in people. People tend to believe in sequences, patterns and general fairness. And that is one of the basis for their belief in the law of small numbers.

While this bias may or may not be important to every one of us, it can affect scientists or people who are meant to employ logic and calculations for solving problems. Hence, even though this belief is natural and cannot be unlearned, it is important to be aware of it and take necessary precautions, especially if you are someone who does scientific work.

The believer in the law of small numbers has incorrect intuitions about significance level, power, and confidence intervals. Significance levels are usually computed with probabilities, but the other two are usually not [18]. Significance levels truly depend on sample size, and a true believer in the law of small numbers will go way off of statistical inference. It's important to note their intuitions are guided by consistent misperceptions of the world rather than by opportunistic wishful thinking which is the case in optimism bias [18].

Being aware of this bias may help people to disregard their misconceptions and rely more on the actual logic of statistical inference and computation.

### **What's the impact of this bias on entrepreneurs?**

Research shows that belief in the law of small numbers has a relationship on entrepreneurial aspects like opportunity evaluation. Some research shows that there is a direct link, while some others say that the effect of this bias on entrepreneurship is moderated by risk perception.

Belief in the law of small numbers implies using a small sample of data to make a decision. Small samples are usually skewed and contain more positives than negatives. For instance, newspapers and magazines tend to publish success stories more than failures: entrepreneurial failures are indeed much less publicized than successes and the publicized ones only stay for a short time and are forgotten soon. So using this small sample as a representative skews the subject's risk perception when deciding to start a new venture, or while making other critical entrepreneurial decisions [20][21].

Entrepreneurs tend to use small samples or a small amount of data because they may not have access to large data or have enough resources to access enough data since they are just starting out and hence will have to generalize based on the small sample they have which makes it easier for the bias to manifest.

The belief in the law of small numbers may be the reason why entrepreneurs overestimate demands or end up testing their services or asking for advice from a small number of people like friends or potential customers and using that data as a representative of larger markets and scenarios [20][2][21].

The belief in small numbers arises from misconceptions and makes us reach the wrong conclusion or make wrong decisions. Unlike the other biases discussed above, the impact of this bias is negative and one should be wary of it – especially entrepreneurs and scientists.




## 6. Confirmation bias

*People find it easier to believe in hypotheses they would like to be true. Confirmation bias is the tendency of people to hold on to their preferred theory with unjustified persistence. It can be especially visible in entrepreneurs when they have some piece of information that they prefer, they tend to be biased towards it, and try to find evidence to support this information in order to prove it right.*

Confirmation bias has received a lot of attention since the late 20th century, when researchers and psychologists started getting interested in cognition and biases. Loosely put, confirmation bias is the tendency of people to hang on to their favoured hypothesis with unwarranted tenacity and confidence [22][23]. Often, the subject builds up evidence to justify the conclusion they have drawn instead of collecting and inspecting evidence impartially to reach an unbiased conclusion.

Obviously, building up evidence may be conscious and done as a part of a job—for instance, lawyers do that. But, sometimes this happens less consciously or unconsciously, and that phenomenon is called confirmation bias. The subject in this case already has reached a hypothesis and seeks confirmation for the hypothesis in the form of supporting evidence [22][23].

Confirmation bias can be classified into two categories—motivated and unmotivated. In motivated confirmation bias, the subject tries to find evidence to defend his/her own beliefs. Note that this seeking of evidence is not a conscious action where the subject treats evidence unfairly. In the case of unmotivated confirmation bias, the subject defends or seeks evidence to support the hypothesis in which they have no interest or material stake. As expected, motivated confirmation bias is easier to understand [23].



Why does confirmation bias occur? Many explanations have been given for this, but the most prominent one is that people find it easier to believe in hypotheses they would like to be correct. Research suggests that people like to choose the hypothesis that is relevant to prior experiences and beliefs. Another explanation suggests that people like to gather information about one hypothesis at a time [23].

Confirmation bias can contribute to delusions and can be taken advantage of. For instance, fortune tellers can use this bias to exploit you. This bias may also be a reason for continuous standoffs between people with conflicting ideas. So, while this bias exists in us, it may be particularly dangerous compared to other biases, and it will serve one well to be aware of it to steer clear of its manifestation.

### **Impact of the confirmation bias on entrepreneurs**

While confirmation bias is problematic in general, it can be especially problematic for entrepreneurs.

It may cause problems like overestimating many aspects of running a venture, such as the extent to which they will be successful, whether or not they will be successful, how much other people believe in their beliefs, and may lead them to refuse to challenge core assumptions, and to neglect to look for alternative hypotheses or unintended consequences [24].

Entrepreneurs are more driven and goal-oriented than non-entrepreneurs which makes them especially vulnerable to confirmation bias. As a result, they may end up ignoring evidence that goes against their goals and ideas. In addition to the previous risks we mentioned, entrepreneurs may end up underestimating their competitors, overestimating the demand for their product in the market, neglecting customer needs and estimating the time and resources needed for achieving business goals.

A lot of other biases have a positive (albeit secondary) impact. Even when suffering from confirmation bias, an entrepreneur may end up proving that their hypothesis is correct. But this can be achieved through objectively inferring evidence as well, and this logical process has fewer chances of error and is hence a much better way.

A few methods have been tested to avoid the perils of this bias on entrepreneurs. Entrepreneurs are encouraged to consider the opposite of their hypothesis or consider an alternative to their hypothesis. These strategies may be effective in combating confirmation bias and related biases [24]. Basically, being aware of the bias will prompt us to ask these questions.

In the references at the end of this report, you will find a checklist for entrepreneurial decision-making [24] which may be useful for entrepreneurs to ensure that they won't fall prey to this bias or any related bias while making important business decisions.

# 7. Anchoring and adjustment

*Anchoring and adjustment occur when uninformative starting points are influential or when informative starting points are overly influential. Entrepreneurs may anchor their decisions on personal judgements because of their overconfidence or greater sense of certainty in their estimates, especially if these judgements have served well in the past, which may cause them to wrongly evaluate complex situations.*

Research shows that starting points influence people's decisions and hypotheses, that is, people tend to reach conclusions based on the starting point. For instance, when we are given an estimate of the value of a certain property at a certain time, we predict its value in the future based on the estimate given initially. While this seems like the sensible thing to do, sometimes we anchor too much on our starting points and adjust the final conclusions to align with the starting point.

When we anchor on an unclear and uninformative starting point, the phenomenon is called anchoring and adjustment bias [25][26].

As the name of this bias indicates, anchoring and adjustment has two components—generation of anchor (preliminary judgement) and adjustment of the anchor. When no starting point is given, people are more likely to generate anchors that are quite close to the correct value/right conclusion. In addition, people who are knowledgeable about the topic on which to make an estimate are usually immune to this bias whereas less knowledgeable people are more prone to this bias [26].

Anchoring is also considered a “resource rational” phenomenon. People make a judgement (anchor) prone to errors which are later adjusted based on computational resources available to them, thus causing this bias to act as a reasonable compromise between the cost of computation and error in judgement.

Obviously, the computational resources also influence the adjustment. If the person is pressed for time, inebriated or stressed, his/her adjustments will also suffer accordingly. But usually, adjustments are made by making use of good computational resources and hence gives relevant conclusions while staying close to the anchor. In this sense, anchoring and adjustment bias may be considered as a window on resource-rational computation rather than a sign of human irrationality [26].

### **Anchoring and adjustment in entrepreneurship**

Anchoring may help you harness some starting points which you can get from relevant information, and make an initial judgement which you can alter at a later point to minimize error. But anchoring may also lead to over-optimism about a venture, especially in the cases where expectations are anchored on forecasts that are far too optimistic [2].

Entrepreneurial overconfidence is attributed to anchoring bias, and anchoring is attributed to availability bias, where certainty is placed on personal beliefs because of the ease to which the entrepreneur can draw on their personal experiences in predicting uncertain events. Entrepreneurs may anchor their decisions on personal judgements because of their overconfidence or greater sense of certainty in their estimates, especially if these judgements have served well in the past [27][28].

Overconfidence occurs due to entrepreneurs' tendency to overestimate the correctness of their initial beliefs (starting point) while making future decisions. Also, it was observed that people tend to under-adjust until they reach a plausible solution which is related to the anchor. This under adjustments makes the solution erroneous and in this case, anchoring and adjustment bias does not work as a resource rational phenomenon and has a negative effect in general and especially on entrepreneurs who have to work in complex situations [28].



## 8. Sunk-cost fallacy

*The tendency to make investments in vain to prevent wasting sunk investments made earlier is known as the sunk cost fallacy. Eating a dessert that you hate just because you paid for it is an example of manifestation of this bias. Sunk-cost fallacy comes into play often in entrepreneurship, and in particular in tech entrepreneurs. For instance, the more money and time entrepreneurs have spent beforehand, the more time and money they spend after receiving external advice to cease effort.*

Cost is considered **sunk** when it cannot be recovered. It is lost forever and has no impact on future outcomes. So, it is in the past and must be considered irrelevant, except maybe as a lesson learned. For example, you invested a few thousand dollars in stock but you lost the money. But you still keep on investing thousands of dollars in the same stock, just because you invested initially and want to get some returns.

This phenomenon is called **sunk-cost fallacy**. Many people make investments in vain to prevent wasting earlier investments.

The sunk-cost fallacy comes into play in different scenarios. For instance, you paid some money for a concert or a dessert. You ended up hating it. But you still stayed at the concert until it ended/you finished the dessert because your thought process goes like this—'I paid for it already, might as well get the money's worth'. But regardless of if you stayed/finished eating the dessert or not, that money was already spent and cannot be recovered. In this case, you have fallen prey to sunk-cost fallacy, which is the tendency to honour prior cost by holding on to failing projects [29][30].

The cost may be money, effort or time, and the sunk-cost fallacy can extend to non-economic situations.

For example, one of the important reasons to continue the war in Iraq was to prevent acknowledging the fact that the soldiers died in vain [30]. Hence, people in any sector are likely to become victims of this bias. But are all people equally likely to become a victim of this bias? A study [30] showed that people who are generally more prone to dwell on the past (state-oriented) are more prone to this bias. But action-oriented people (get over past events quickly) are more likely to quit or change the course of action once they realize that the cost has sunk. Besides these factors, individual differences also influence how people treat sunk costs. In addition, the stronger the association between the sunk cost and the current investment decision, the more people are prone to fall prey to this bias [30].

### **The impact of the sunk-cost fallacy on entrepreneurship**

Entrepreneurs are expected to make financial decisions all the time. Where finances are concerned, abandonment of a course of action which led to sunk costs is a difficult decision.

Hence, sunk-cost fallacy comes into play often in entrepreneurship. Quitting investments that lead to sunk cost means an immediate loss which is difficult to swallow. The sunk-cost fallacy can cause the decision-maker to consider past outlays in order to avoid facing this situation. Unless he/she is sure that abandoning the current investment will be beneficial, the correct decision on future investments which can lead to incremental benefits may not be made. Thus, the sunk-cost fallacy can lead to poor quality decision-making [31].

Another observation was that entrepreneurs who fall prey to sunk-cost fallacy in combination with endowment effect—a bias which causes people to value an object that they own more than when the same object is owned by another person—are less likely to sell family businesses on succession.



They are also less likely to take more risks when it comes to investments [31]. In the case of failing businesses, a study showed that the more money and time entrepreneurs spent beforehand, the more time and money they spent after receiving external advice to cease their efforts [16].

Finally, entrepreneurs were observed to have continued unsuccessful development effort for longer periods than established firms. The sunk-cost fallacy was found to be especially strong in entrepreneurs who received negative financial feedback in the first year after starting a business. It's interesting to note that another study showed that technology entrepreneurs are more prone to this bias than non-technological entrepreneurs, and this relationship grows stronger when they are intrinsically motivated and have set no budget for their business venture [16].

# 9. Counterfactual thinking

*Have you ever found yourself saying: “If this hadn’t happened then...”? Counterfactual thinking is a psychological phenomenon in which people tend to create possible alternatives to events that have already occurred—something contrary to what has actually happened. Studies show that entrepreneurs can be prone to counterfactual thinking since they face many setbacks during venture formation, which can give rise to dissatisfaction and regret. On the other hand, entrepreneurs who tend to indulge in counterfactual thinking often gain valuable insights as to why whatever occurred, occurred, which can help in better future decision making, in developing better strategies, and in increasing their feeling of personal control.*

Counterfactual means “contrary to the facts.” Technically, counterfactuals are mental representations of alternatives to the past that produce consequences that are both beneficial and aversive to the individual [35].

Counterfactual thinking is usually activated by occurrences of negative events. A common example of counterfactual thinking is “if this hadn’t happened then...” As you can see, counterfactual thoughts usually have an antecedent and a consequent, for instance: “If she hadn’t met him, she wouldn’t have been in jail” [35][36].

Counterfactual thoughts may be upward (those that describe better alternatives to what has occurred) or downward (those that describe alternatives worse than reality). Studies have shown that upward counterfactuals act as preparative functions, that is, imagining better alternatives serve as a function that opens the subjects’ need for new information and will help them achieve better outcomes in the future. For example, an experiment showed that the losers of a card game generate more upward counterfactuals since they need to win in the future games, and are open to information that can help them with that.

In contrast, the winners generate fewer upward counterfactuals since they need less preparatory information as they already won [35][36].

Counterfactual thinking also helps people make themselves or others feel better. For instance, people injured from road accidents may take comfort in the fact that they could have been killed but escaped with minimal injury. This thought makes them feel better about an unfortunate event. Upward counterfactuals have also been associated with feelings of dissatisfaction. The loser of the card game mentioned above may generate a lot of upward counterfactuals, as he/she assumes that he could have won if things turned out differently. This assumption generates feelings of dissatisfaction.

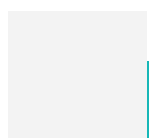
Some counterfactuals can actually be beneficial for individuals. High self-esteem individuals were observed to draw positive effects from both upward and downward counterfactuals than low self-esteem individuals, especially in the case of upward counterfactuals [36].

But another study showed that the role of self-esteem was not that significant in drawing effects from counterfactuals. Thus, counterfactual thinking brings you both negative as well as positive effects. Which effect you draw depends on your mindset [36].

### **The counterfactual thinking of entrepreneurs**

Various studies have shown that the tendency to engage in counterfactual thinking may have negative implications on new venture formation. This is because, counterfactual thinking gives rise to negative emotions like dissatisfaction, envy and regret. The more individuals tend to generate such negative emotions, the less likely they are to initiate new ventures.

But this bias also has positive effects. Individuals who tend to indulge in counterfactual thinking usually gain insights as to why something happened the way it did. These insights will be valuable in the case of entrepreneurship as it will contribute to improved performance in many ways.



It will help in better decision making, in increased optimism, in developing better strategies, and in giving the entrepreneur a better feeling of personal control which will all help in the process of venture formation.

An interesting study [37] showed that entrepreneurs are less likely to indulge in counterfactual thinking than non-entrepreneurs. It also showed that entrepreneurs find it easier than non-entrepreneurs to admit past mistakes. Usually, people who indulge in counterfactual thinking often think that they should have been better at avoiding mistakes and this belief makes it difficult for them to admit their mistakes.

Various studies showed that counterfactual thinking, especially upwards counterfactual thinking, has many negative effects, causing people to perceive opportunities as more uncertain and costlier than they really are, which will prevent them from taking initiatives. In that light, entrepreneurs tend to indulge in less counterfactual thinking, which in turn may allow them to perceive higher odds of success and to maintain their self-efficacy.

Hence, a reduced tendency in counterfactual thinking may be one of the important factors that contribute to entrepreneurs' decision to start a new venture [37].

But some studies also show that entrepreneurs are more likely to engage in counterfactual thinking. People try to imagine what would have happened if they had acted differently, because this helps to reduce the negative feelings they are experiencing. Entrepreneurs often meet with many setbacks in the early days of their new ventures. Moreover, their commitment to their ideas, businesses, and products are frequently intense, thus magnifying the negative emotions generated by these disappointments. For these reasons, entrepreneurs may be more likely than other persons to engage in counterfactual thinking and their greater tendency to have regret over missed opportunities is the reason that they identify and act upon perceived opportunities [10].

# 10. Negative bias

*In most situations, negative events are more potent, salient, and dominant than positive events. In other words, we have a greater sensitivity to negative information, which is called negativity bias. Negativity bias has an influence on the entrepreneurial decision-making process. Entrepreneurs perceive approaching positive effects as less important than avoiding negative outcomes when it comes to entrepreneurial decision making, orienting their decisions such that they can avoid failures much less than they orient their decision towards their goals.*

The best way to explain the negativity bias is through an old Russian adage—"A spoonful of tar can spoil a barrel of honey, but a spoonful of honey does nothing for a barrel of tar." This adage shows the dominance of negative over positive contamination.

Another interesting comparison will be the Christian concept of redemption from original sin which follows the general principle that for forgiveness to be achieved, the degree of acceptable expiation must exceed that of the initial fault. These examples of dominance of negative over positive occur because of a very general principle called the negativity bias [32][33].

Negativity bias was further differentiated into negative potency, negativity dominance and negative differentiation. The principle of negative potency states that negative events are more potent as compared to a positive event of equal objective magnitude. For instance, when we have a negative experience like a rejection from a job, we stay sad for a longer period of time than when we experience positive things like getting a job offer which can be considered as a positive event of equal magnitude [32].

According to the principle of negativity dominance, the holistic perception or value of integrated negative and positive events is more negative than the algebraic sum of individual entities [32]. For instance, if we feel that losing \$100 is as bad as winning \$150 is good, and that losing \$100 and winning \$150 is negative, then we have negativity dominance. Another example would be, when we are having a delicious dessert but it has a slightly off taste, we tend to focus more on the off taste and consider the dessert bad. This is also negativity dominance [32].

Negative differentiation means that we tend to embellish negative events much more than positive events. That is, negative events are construed more elaborated and differentiated than the corresponding positive stimuli. A good example would be when people tend to explain what went wrong in a negative situation much more than they tend to elaborate what went right in a positive situation.

In addition, negative events are expected to occur much less than positive events and hence positive is considered the norm.

That may also be a reason why we put an emphasis on negative events [32][33]. As you can see, more than one phenomenon is involved in negativity bias.

### **What's the impact on entrepreneurs?**

Like many other biases discussed in this report, negativity bias has an influence on the entrepreneurial decision-making process. Research showed that entrepreneurs perceive approaching positive effects as less important than avoiding negative outcomes when it comes to entrepreneurial decision making.

This means that coaching and training given to entrepreneurs should focus on the reduction of negative emotions and coping with failure than on enhancement of positive emotions like how to achieve your goals [34]. Please note that studies on the effect of negativity bias on entrepreneurship is rather less and more research has to be done on the field to know the effect of one of the most prominent biases that can be observed in the majority of the people.

# Conclusion

After reading through a lot of content related to cognitive biases, I believe that the best way to deal with these biases is actually by being aware of them, whether entrepreneur or non-entrepreneur. No bias stands alone. Every bias is influenced by other biases. Awareness gives you the ability to recognize if you are being biased, even if it originally happens unconsciously.

While writing this report, I have certainly been a victim of planning fallacy a number of times. But now that I know of this bias, I am able to recognize whenever I engage in it which helps me avoid falling prey to it.

Besides, as discussed in this report, most of the biases are desirable in moderate amounts. For instance, a lack of illusion of control and optimism was found in people diagnosed with depression.

Finally, despite our cognitive biases, humans still outperform intelligent systems built on the laws of logic and probability on many real-world problems. This poses a paradox: how can we be so smart, if we appear so irrational? Cognitive biases offer a window into this human paradox.

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