ANCHORING BIAS:

The anchoring bias is a cognitive bias that causes us to rely heavily on the first piece of information we are given about a topic. When we are setting plans or making estimates about something, we interpret newer information from the reference point of our anchor instead of seeing it objectively. This can skew our judgment and prevent us from updating our plans or predictions as much as we should.

MITIGATE→

Avoiding the anchoring bias entirely likely isn't possible, given its pervasiveness and how powerful it is. Like all cognitive biases, the anchoring bias is subconscious, meaning it's difficult to interrupt. Even more frustrating, strategies that intuitively sound like good ways to avoid bias might not work with anchoring. For example, it's usually a good idea to take one's time with making a decision, and think it through carefully—but, as discussed above, thinking more about an anchor might actually make this effect stronger, resulting in more anchor-consistent information being activated.

One evidence-based and straightforward strategy to combat the anchoring bias is to come up with reasons why that anchor is inappropriate for the situation. In one study, experts were asked to judge whether the resale price of a certain car (the anchor) was too high or too low, after which they were asked to provide a better estimate. However, before giving their own price, half of the experts were also asked to come up with arguments against the anchor price. These participants showed a weaker anchoring effect, compared to those who hadn't come up with counterarguments.[10]

Considering multiple options is always a good idea to aid in decision-making. This strategy is similar to that of red teaming, which involves assigning people to oppose and challenge the ideas of a group.[11] By building a step into the decision-making process that is specifically dedicated to exposing the weaknesses of a plan, and considering its alternatives, it may be possible to reduce the influence of an anchor.

HALO EFFECT:

The halo effect often occurs when we consider appearances. A classic example is when one assumes that a physically attractive individual is likely to also be kind, intelligent, and sociable. We are inclined to attribute positive characteristics to this attractive person even if we have never interacted with them. The halo effect is an error in our judgment and reflects individual preferences, prejudices, and social perception.

MITIGATE→

While the halo effect may seem like an abstract concept that is hard to actively notice, there are many ways we can attempt to avoid the bias.

Cognitive Debiasing

To minimize the influence of the halo effect, one can look to various cognitive debiasing techniques such as slowing down one's reasoning process. For example, if you are aware of the halo effect, you can mitigate the bias by trying to discourage character judgments when first meeting someone. Remind yourself that once we gain more information about the person, we can get a more accurate image of

who they are. Another tip would be to reduce comparison. When meeting someone, we should try to let them show us who they are, rather than pushing them in a box just because they bear some resemblance to an existing schema.

The halo effect is not solely limited to the way we look at other people. It can also play a role in how we judge things such as products and brands. For example, if you have a positive impression of a certain brand, you will be more likely to buy products from that brand, even if your impression has no relation to the product's quality. You should always consider the bias when purchasing products because the highest quality brand, or the best brand for you, may not be the most popular or heavily advertised.

The Horns Effect

Although we should maintain an awareness of the halo effect, we should also look out for when the bias works in reverse—a psychological process called the horns effect. This cognitive bias causes our negative impression of someone or something in one area to change our impression of them in other areas. For example, if someone does not like the way a product looks, they will not buy the product despite the potential benefit that it could bring them.

AVAILABILITY HEURISTIC BIAS:

The *availability heuristic* describes our tendency to use information that comes to mind quickly and easily when making decisions about the future.

Where this bias occurs

Imagine you are a manager considering either John or Jane, two employees at your company, for a promotion. Both have a steady employment record, though Jane has been the highest performer in her department during her tenure. However, in Jane's first year, she accidentally deleted a company project when her computer crashed. With this incident in mind, you decide to promote John instead.

In this hypothetical scenario, the vivid memory of Jane losing that file likely weighed more heavily on your decision than it should have. This unequal evaluation is due to the availability heuristic, which suggests that singular memorable moments have an outsized influence on decisions when compared to less memorable ones.

WHY IT HAPPENS:

Your brain uses shortcuts

Certain memories are recalled easier than others

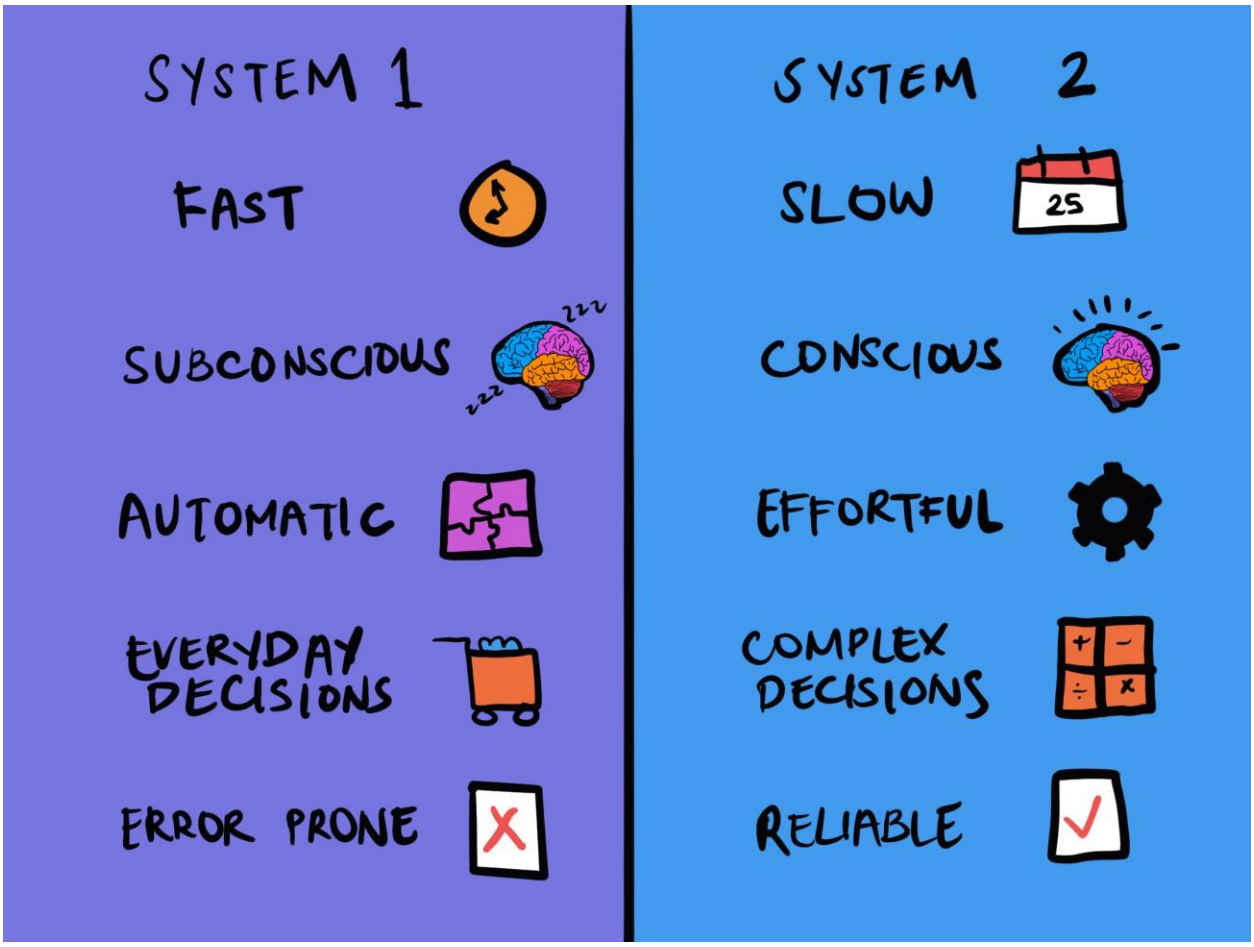
Some memories appear to happen more often than they do

Events that leave a lasting impression seem more common

MITIGATE→The availability heuristic is a core cognitive function for saving mental effort, resulting from numerous shortcuts our brain makes to help process as much information as possible. Unlike a sleight-of-hand trick, simply knowing how it works is not sufficient for overcoming its illusion completely.[4] This bias is too deeply rooted in our neural networks to completely rewire our brains to avoid it.

Although awareness of the availability heuristic alone cannot change our personal thought processes, it can help ensure systematic changes in regard to supporting or implementing policies. For instance, taking measures to identify and remove biased information in our legal system is crucial for ensuring fair treatment for everyone—especially minority groups that are disproportionately affected by the availability heuristic such as trans individuals. Just as important, we must hold media sources and newspapers accountable for their unequal reporting of events because it bears real consequences on how the general public shapes their view of the world and of each other.

System 1 and System 2 thinking



Although guaranteeing thoughtful and rigorous mental analysis sounds great in theory, it is challenging in practice. This is because our default setting is what Kahneman refers to as “System 1 Thinking,” which is fast and automatic. The availability heuristic takes advantage of System 1 because, without thorough deliberation, we rely on quick approximations that are often skewed by our memories.

Overcoming the availability heuristic requires us to instead activate “System 2 thinking,” which Kahneman defines as deliberative, careful, and reflective decision-making.[5] This is often easier to do in collective decision-making because others can catch instances when an individual is captivated by superficially convincing (but ultimately false) information.

REPRESENTATIVENESS HEURISTIC BIAS:

The *representativeness heuristic* is a mental shortcut that we use when estimating probabilities. When we're trying to assess how likely a certain event is, we often make our decision by assessing how similar it is to an existing mental prototype.

Where this bias occurs

Let's say you're going to a concert with your friend Sarah. She also invited her two friends, John and Adam, whom you've never met before. You know that one is a mathematician, while the other is a musician.

When you finally meet Sarah's friends, you notice that John wears glasses and is a bit shy, while Adam is more outgoing and dressed in a band T-shirt and ripped jeans. Without asking, you assume that John must be the mathematician and Adam must be the musician. You later discover that you were mistaken: Adam does math, and John plays music.

Thanks to the representativeness heuristic, you guessed Adam and John's jobs based on stereotypes surrounding how these careers typically dress. This reliance caused you to ignore better indicators of their professions, such as simply asking them what they do for a living.

WHY IT HAPPENS:

Conserving energy with categories

We draw on prototypes to make decisions

We overestimate the importance of similarity

MITIGATE→ Since categorization is so fundamental to our perception of the world, it is impossible to avoid the representativeness heuristic altogether. However, awareness is a good start. Countless research demonstrates that when people become aware that they are using a heuristic, they often correct their initial judgment.[10] Pointing out others' reliance on representativeness, and asking them to do the same for you, provides useful feedback that might help to avoid this bias.

Other researchers have tried to reduce the effects of the representativeness heuristic by encouraging people to "think like statisticians." These nudges do seem to help, but the problem is that without an obvious cue, people forget to use their statistical knowledge—not even those in academia.[10]

Another strategy with potentially more durability is formal training in logical thinking. In one study, children trained to think more logically were more likely to avoid the conjunction fallacy.[10] With this in mind, learning more about statistics and critical thinking might help us avoid the representativeness heuristic.

CONFIRMATION BIAS:

The *confirmation bias* describes our underlying tendency to notice, focus on, and give greater credence to evidence that fits with our existing beliefs.

Where this bias occurs

Consider the following hypothetical situation: Jane is the manager of a local coffee shop. She is a firm believer in the motto, "hard work equals success." The coffee shop, however, has seen a slump in sales over the past few months. Since Jane strongly believes that "hard work" is a means to success, she concludes that the dip in the coffee shop's sales is because her staff is not working hard enough. To account for this, Jane puts several measures in place to ensure that her staff is working consistently. Consequently, she ends up spending more money by having a greater number of employees staffed on a shift, exceeding the shop's budget and thus contributing to overall losses.

Consulting with other business owners in her area, Jane is able to identify her store's new, less visible location as the primary cause of her sales slump. Her belief in hard work as the most important metric of success led her to mistakenly identify employees' lack of effort as the reason for the store's falling revenue while ignoring evidence that pointed to the true cause: the shop's poor location. Jane has fallen victim to confirmation bias, which caused her to notice and give greater credence to evidence that fits with her pre-existing beliefs.

As this example illustrates, our personal beliefs can weigh us down when conflicting information is present. Not only does it stop us from finding a solution, but we also may not even be able to identify the problem to begin with.

Why it happens

Confirmation bias is a cognitive shortcut we use when gathering and interpreting information. Evaluating evidence takes time and energy, and so our brain looks for shortcuts to make the process more efficient.

Confirmation bias is aided by several processes that all act on different stages to protect the individual from cognitive dissonance or the discomfort associated with the violation of one's beliefs. These processes include:

- **Selective exposure,** which refers to the filtering of information. Meaning that the individual avoids all challenging or contradictory information.
- Selective perception occurs when the individual observes or is exposed to information that conflicts with their standing beliefs, yet somehow tries to manipulate the information to affirm their existing views.
- Selective retention is a major principle in marketing and attests that individuals are more likely to remember information that has been presented to them if it is consistent with what they already know to be true.[3]

Our brains use shortcuts

Heuristics are the mental shortcuts that we use for efficient, though sometimes inaccurate, decision-making. Though it is debated whether or not confirmation bias can be categorized as a heuristic, it is certainly a cognitive strategy. Specifically, it helps us to avoid cognitive dissonance by searching and attending to information that we already believe.

It makes sense that we do this. Oftentimes, humans need to make sense of information quickly however, forming new explanations or beliefs takes time and effort. We have adapted to take the path of least resistance, sometimes out of necessity.

Imagine our ancestors hunting. An intimidating animal is charging toward them, and they only have a few seconds to decide whether to hold their ground or run. There is no time to consider all the different variables involved in a fully informed decision. Past experience and instinct might cause them to look at the size of the animal and run. However, the presence of other hunters now tilts the chances of successful conflict in their favor. Evolutionary psychologists believe that the modern use of mental shortcuts for in-the-moment decision-making is based on past survival instincts.[1]

It makes us feel good about ourselves

No one likes to be proven wrong, and when information is presented that violates our beliefs, it is only natural to push back. Deeply held views often form our identities, so disproving them can be uncomfortable. We might even believe that being wrong suggests that we lack intelligence. As a result, we often look for information that supports rather than refutes our existing beliefs.

We can also see the effects of confirmation bias in group settings. Clinical psychologist Jennifer Lerner in collaboration with political psychologist Phillip Tetlock proposed that through our interactions with others, we update our beliefs to conform to the group norm. The psychologists distinguished between confirmatory thought, which seeks to rationalize a certain belief, and exploratory thought, which takes into consideration many viewpoints before deciding where you stand.

Confirmatory thought in interpersonal settings can produce **groupthink**, in which the desire for conformity results in dysfunctional decision-making. So, while confirmation bias is often an individual phenomenon, it can also take place in groups of people.

How to avoid it

Confirmation bias is likely to occur when we are gathering information for decision-making. It occurs subconsciously, meaning that we are unaware of its influence on our decision-making.

As such, the first step to avoiding confirmation bias is being aware that it is a problem. By understanding its effect and how it works, we are more likely to identify it in our decision-making. Psychology professor and author Robert Cialdini suggests two approaches to recognizing when these biases are influencing our decision-making:

First, listen to your gut feeling. We often have a physical reaction to uncomfortable stimuli , like when a salesperson is pushing us too far. Even if we have complied with similar requests in the past, we should not use that precedent as a reference point. Recall past actions and ask yourself: “Knowing what I know now, if I could go back in time, would I make the same commitment?”

Second, because the bias is most likely to occur early in the decision-making process, we should focus on starting with a neutral fact base. This can be achieved by diversifying where we get our information from, and having multiple sources. Though it is difficult to find objective reporting, reaching for reputable, neutral outlets can allow us to have more agency in our beliefs.

Third, when hypotheses are being drawn from assembled data, decision-makers should also consider having interpersonal discussions that explicitly aim at identifying individual cognitive bias in the hypothesis selection and evaluation. Engaging in debate is a productive way to challenge our views and expose ourselves to information we may have otherwise avoided.

While it is likely impossible to eliminate confirmation bias completely, these measures may help manage cognitive bias and make better decisions in light of it.

An echo chamber circulates existing views without encountering opposing views, potentially resulting in confirmation bias. Echo chambers may increase social and political polarization and extremism.

Backfire Effect is the tendency of some people to resist accepting evidence that conflicts with their beliefs. The effect is demonstrated when people presented with that conflicting information become even more convinced of their original beliefs rather than questioning them.

Common sense tells us that if we are presented with new information that clearly suggests we've been wrong about something, we will consider that information and adjust our thinking on the matter. That may happen most of the time. However, some people in some cases will react illogically.

The backfire effect is one manifestation of confirmation bias, the tendency of people to give more credence to evidence that supports their preexisting beliefs. In this case, the bias is so strong that people refuse to consider the possibility that they were mistaken. Data that does not support their beliefs is dismissed and, perhaps because they know on some level that they were wrong, they profess even greater confidence that they have been correct all along. They may dismiss data as statistical noise and take even more extreme positions on issues than was initially the case.

Cognitive errors such as the backfire effect can be problematic for data analysis. Despite all the technology, the human factor is inevitably involved in selection of inputs and criteria as well as interpretation of results. Cognitive bias is unavoidable, however. The best protection from it is awareness of its presence and applying critical thinking skills to overcome it.

OVERCONFIDENCE EFFECT

Overconfidence bias is a type of cognitive bias that causes us to think we are better in some areas than we really are. Most people believe that they are more intelligent, more honest, or that they have a brighter future than the average person. For example, 93% of American drivers claim to be better than average, which is statistically impossible.

Because human judgment is highly susceptible to overconfidence bias, it is one of the most common types of bias. It is also a very serious one, as it reinforces other decision-making biases, such as hindsight bias, optimism bias, and action bias. Excessive faith in ourselves and our abilities makes it harder for us to see how prone we are to errors and biases.

Why does overconfidence bias matter?

Overconfidence bias causes us to lose objective perspective about our abilities or knowledge. This can create unrealistic expectations and make us more vulnerable to disappointment.

For example, overconfidence often leads students to poor study decisions, such as causing them to choose subjects they don't really have an aptitude for. Overconfidence bias can also impede our learning if we don't accurately assess the gap between what we currently know and what we need to know.

However, overconfidence bias does not only lead to poor decisions. Depending on the context, it can sometimes be the source of the right decision. For example, overconfident managers tend to push for innovation more frequently, and they are better at persuading investors to invest in higher-risk projects, which can enable further growth.

Overall, overconfidence bias is a double-edged sword: successful people show overconfidence, but overconfidence is not the determinant of success.

What are different types of overconfidence bias?

There are three distinct types of overconfidence. Each one has different psychological origins, occurs under different conditions, and has different consequences.

- Overestimation refers to the overestimation of one's true ability, performance, level of control, or chance of success. For example, doctors may overestimate the accuracy of their diagnoses, employees may overestimate the speed with which they can finish a task, and people tend to overestimate the level of control they have over situations.
- Overplacement (or "better-than-average") occurs when a majority of people rate themselves better than average, even though it is statistically impossible for most people to have better-than-average abilities. For example, in one study, 37% of a firm's engineers ranked themselves among the top 5% of performers at the firm.
- Overprecision is the false belief that the individual knows more than they know. It manifests as excessive certainty regarding the accuracy of one's beliefs. This certainty is expressed using numbers, usually with unrealistic percentages or confidence intervals. For instance, gamblers exhibit overprecision when they assume that they can accurately predict what will appear next on the roulette.

Overconfidence bias example

Overconfidence bias is a common decision trap, or a thought process that can lead to suboptimal decisions. Anyone can fall for it, even experts.

Example: Overconfidence bias in business decisionsOverconfidence bias and optimism bias often cause company managers to underestimate the risk of entering a new market or introducing a new product. Because they are convinced that their product is innovative, managers overlook the intensity of the competition which endangers successful entry and the sales of the product in a new market.

Thanks to this, managers might succeed in entering the market, but studies show that this entry has a lower chance of survival and may cause the company to remain in an unprofitable market for too long.

One would expect that seasoned executives don't make this type of mistake—however, experience, level of knowledge, and past achievements actually all strengthen the overconfidence bias.

How to reduce overconfidence bias

Because overconfidence bias operates at an unconscious level, it is difficult to eliminate completely. However, there are steps you can take to keep it in check.

- Perform a "premortem" on your decisions. Imagine that your decision led to a negative outcome and work backwards, thinking of all the possible reasons this might have occurred. This allows you to anticipate risks and be better prepared for negative outcomes.
- Ask for feedback. Hearing other people's perspectives, whether family members or colleagues, can help you identify areas where you may need improvement, and become less likely to fall for the overconfidence bias.
- Instead of being afraid of mistakes, try to learn from them. When a decision doesn't pan out the way you hoped, think about what you could have avoided, or in what areas you can do better. This will lead you to better-informed decisions and shield you from being overly optimistic in the future.

FRAMING EFFECT

The *framing effect* is when our decisions are influenced by the way information is presented. Equivalent information can be more or less attractive depending on what features are highlighted.

Where this bias occurs

Consider the following hypothetical: John is shopping for disinfectant wipes at his local pharmacy. He sees several options, but two containers of wipes are on sale. One is called "Bleachox" and the other is called "Bleach-it."

Both of the disinfectant wipes Jon is considering are the same price and contain the same number of wipes. The only difference Jon notices, is that the Bleachox wipes claim to "kill 95% of all germs," whereas the "Bleach-it" wipes say: "only 5% of germs survive." After comparing the two, John chooses the Bleachox wipes. He doesn't like the sound of germs 'surviving' on his kitchen counter.

John's decision to buy the Bleachox over Bleach-it wipes was informed by the framing effect. Although both products were equally effective at fighting germs, and essentially claimed the same thing, their claims were framed differently. Bleachox highlighted the percentage of germs it *did* kill (a positive attribute), whereas Bleach-it highlighted how many germs it *did not* kill (a negative attribute).

Why it happens

Our choices are influenced by the way options are framed through different wordings, reference points, and emphasis. The most common framing draws attention to either the positive gain or negative loss associated with an option. We are susceptible to this sort of framing because we tend to avoid loss.

We avoid loss

The foundational work of psychologists Daniel Kahneman and Amos Tversky explains framing using what they called "prospect theory." According to this theory, a loss is perceived as more significant, and therefore more worthy of avoiding, than an equivalent gain.[3] A sure gain is preferred to a probable one, and a probable loss is preferred to a sure loss. Because we want to avoid sure losses, we look for options and information with certain gain. The way something is framed can influence our certainty that it will bring either gain or loss. This is why we find it attractive when the positive features of an option are highlighted instead of the negative ones.

Our brain uses shortcuts

Processing and evaluating information takes time and energy. To make this process more efficient, our mind often uses shortcuts or "heuristics." The availability and affect heuristic may contribute to the framing effect. The **availability heuristic** is our tendency to use information that comes to mind quickly and easily when making decisions about the future. Studies have shown that the framing effect is more prevalent in older adults who have more limited cognitive resources, and who therefore favour information that is presented in a way that is easily accessible to them.[4] Because we favour information is easily understood and recalled, options that are framed in this way are favoured over those that aren't.

The **affect heuristic** is a shortcut whereby we rely heavily upon our emotional state during decision-making, rather than taking the time to consider the long-term consequences of a decision. This may be why we favor information and options that are framed to elicit an immediate emotional response. Research has shown that framing relies on emotional appeals and can be designed to have specific emotional reactions.[5] Picture this: most of us would be more willing to listen and vote for a political candidate that presents their platform in an emotional speech framed at inspiring change, over a candidate with the same platform that is presented it in a dreary report.

How to avoid it

There are a few strategies for reducing the framing effect. Research has shown that people who are more "involved" on an issue are less likely to suffer from framing effects surrounding it. Involvement can be thought of as how invested you are in an issue. A 2010 study found that "people who are involved with an issue are more motivated to systematically process persuasive messages and are more interested in acquiring information about the product than people who are less involved with the issue." More involved individuals were found to be less susceptible to the framing effect, whereas those who were less involved were more susceptible.

What we can take from these findings, is that we should think through our choices concerning an issue and try to become more informed on it. Indeed, the authors posit that previous literature has found that "framing bias would be mitigated or eliminated if individuals thought more carefully about their choices" and that "when older adults examined more information relevant to the decision, they made more effective decisions".[7]

A more specific strategy that falls in line with this more general approach is to provide rationales for our choices. A 1997 study found this reduced framing effects in participants as it forced them to engage in more detailed mental processing.[8] This makes sense: If we really think through why we selected an

option or relied on certain information, we might realize that the way in which it was presented influenced our decision too much.

LOSS AVERSI

Loss aversion is a cognitive bias that describes why, for individuals, the pain of losing is psychologically twice as powerful as the pleasure of gaining. The loss felt from money, or any other valuable object, can feel worse than gaining that same thing.[1] Loss aversion refers to an individual's tendency to prefer avoiding losses to acquiring equivalent gains. Simply put, it's better not to lose $20, than to find $20.

Where this bias occurs

Loss aversion is a relevant concept in cognitive psychology, decision theory, and behavioral economics.

Loss aversion is especially common when we make financial decisions. An individual is less likely to buy a stock if there is a potential risk of losing money, even though the reward potential is high. Notably, loss aversion grows stronger as the stakes of a choice grow higher.[2]

Additionally, marketing campaigns such as trial periods and rebates exploit our tendency to opt into a presumed free service. Once a buyer incorporates a specific software or product into their lives, they are more likely to purchase it to avoid the loss they will feel once they give it up. This tends to happen because scaling back—whether on software trials, expensive cars, or bigger houses—is an emotionally challenging decision.

Why it happens

Loss aversion results from three coinciding components: our neurological makeup, socioeconomic factors, and cultural background.

Our brains

Three specific brain regions become activated in situations involving loss aversion.

The *amygdala* is the part of our brain that primarily processes fear, creating an automated, pre-conscious sense of anxiety when we detect danger. Loss aversion also activates the amygdala, which explains why our visceral reaction to danger, such as seeing a spider or snake, is so similar to our visceral reaction to loss, such as losing money or possessions. Both situations stimulate the release of hormones like adrenaline and cortisol, energizing us to protect ourselves and avoid getting hurt. This overlap explains why loss aversion is so hard to resist: our brains and bodies are automatically programmed to be scared of loss![5]

The second brain region engaged by loss aversion is the *striatum*, which is responsible for calculating prediction errors and anticipating events. Although the striatum shows increased activity when we experience both losses and their equivalent gains, it lights up even more for losses.[6] This unbalanced reaction suggests that the striatum helps us avoid losses rather than motivating us to seek gains.

Finally, our brain's *insula* area reacts to disgust, working with the amygdala to encourage us to avoid certain types of behavior. Neuroscientists have noted that the insula region also lights up when responding to a loss. The higher the prospect of loss, the more activated the insula becomes compared to an equivalent gain, potentially explaining why we are so repulsed by losing out.[7]

Though there are many other parts of the brain that contribute, these three regions are vital to understanding how we process and respond to loss. The strength of these regions in each person may determine how loss averse they are.[5]

Socio-economic factors

Socio-economic factors also play an essential role in one's individual disposition to loss aversion, such as their placement within the social hierarchy. Ena Inesi, an Associate Professor of Organizational Behavior at the London School of Economics, found that powerful people are less loss averse because their status and network places them in a privileged position to handle a loss if it should incur.[8] As a result, these individuals give less weight to losing out than the average person since it is a less risky endeavor for them. To no surprise, Inesi's research also suggests that powerful individuals value gains more than others, further explaining why they are success driven rather than failure deterred.[8]

Wealth also plays an important role in our inclination toward loss aversion. Like powerful people, wealthy people typically have an easier time accepting losses they incur due to additional financial resources. But interestingly enough, their level of loss aversion may be modified by how wealthy their social environment is as well.

One study in Vietnam revealed that wealthier villages were overall less loss averse than poor villages. Those with higher mean incomes situated in affluent areas were more willing to take risks in particular.[8] However, wealthy individuals who lived in poor environments were more likely to fear losing out than poor individuals who lived in wealthy environments.[9] These findings suggest that our level of loss aversion may be just as determined by the financial well-being of the people surrounding us as our own. In short, a complex combination of personal and environmental socioeconomic traits determines our willingness to take risks when making decisions.

Culture

Cultural background has been linked to how loss averse an individual may be. A study conducted by Mei Wang surveyed groups from 53 different countries to understand how different cultural values affect one's perception of losses compared to gains. The group discovered that people from Eastern European countries tended to be the most loss averse, with people from African countries being the least.[10]

One explanation for this variation among cultures lies in the difference between collectivist and individualist cultures. Those from collectivist cultures who value closer social connections may be less loss averse because they can rely on their friends, family, and community if they make a poor decision.[11] This support system helps individuals take risks without feeling losses as intensely. On the other hand, those from individualistic cultures that do not value close relationships lack the same social safety net as their collectivist counterparts.

How to avoid it

Loss aversion is a natural human tendency that exists to keep us from incurring losses. That being said, it is essential to know how to avoid loss aversion to prevent it from influencing our decisions, especially when there are potential gains to be made. There are two main strategies we can use to fight back against this bias: framing and putting loss into perspective.

Framing

The way that a transaction is framed can significantly influence an individual's perception of loss aversion. Phrasing a question as a loss may increase loss aversion, while phrasing that same question as a gain may reduce loss aversion, leading to a more calculated response.[12] When proposing a transaction, try framing the options in a way that highlights the potential benefits that can be achieved, rather than emphasizing the risks.

Putting Loss into Perspective

A simple way to tackle loss aversion is to ask ourselves what the worst outcome would be if the course of action was taken. Usually, this helps us put loss and the strong associated feelings with it into perspective. This way, we can get over our fears and better rationalize if it is worth making a decision or not.

STATUS QUO BIAS

The *status quo bias* describes our preference for the current state of affairs, resulting in resistance to change

Where this bias occurs

Sam is a college student, gearing up to start a new semester. Her school automatically enrolls students in medical and dental insurance. Of course, there is the option of opting out, which would decrease the total sum of her school fees. Sam isn't even sure whether or not she needs health insurance, since she might be already covered by one of her parent's plans. However, she doesn't give it much thought and pays her tuition anyway.

This is an example of status quo bias because Sam decides to leave things as they are rather than investigate further and opt out of health insurance. If things were reversed, and the school did not automatically include insurance in the total fees, far fewer students would probably choose to be covered. However, the school uses the status quo bias to their advantage, knowing that students are more inclined to stick to the original plan instead of going out of their way to pay less.

Why it happens

Social psychology has identified two reasons why the status quo bias happens when making decisions. First, we prefer the norm because of two other cognitive biases: loss aversion and regret avoidance. Second, we prefer the norm to avoid feeling overwhelmed by our choices, each plagued with uncertain outcomes.

Loss aversion and regret avoidance

Loss aversion is a behavioral economics theory denoting that the psychological pain we experience from a loss is significantly greater than the pleasure we experience from an equal gain. This imbalance prevents us from selecting the best option out of fear of failure.

When choosing between the default option and its alternatives, we treat the status quo as a reference point because we know exactly what to expect from it. On the other hand, choosing an alternative would be taking a risk, since its outcome is uncertain. This is where loss aversion comes into play: when considering the other options, we assign greater weight to potential losses rather than potential gains. In this way, we are biased in favor of the status quo, and inclined to stick with it no matter what.[3]

Another concept related to the status quo bias is **regret avoidance**, which posits that we take action to avoid feeling regret about not doing it later.[4] This tendency reinforces our misconception that adhering to the norm is the "safe thing" to do, as it is less likely to leave us feeling like we missed out.

For example, after graduating high school, we may choose to go to college simply because everyone else does. Plus, we may regret not learning valuable knowledge or making lifelong friends if we don't go. But for some people, entering the workforce might make more sense to save money and learn a different subset of skills. However, their inclination to follow the status quo—combined with their fear of missing out—leads them to not even consider this as an option.

Decision-making can be overwhelming

There is a reason why we resort to the status quo bias, even if it sometimes leads to bad decisions. When given a choice, it is not always obvious what the correct option is. If we feel stressed and overwhelmed, sometimes it is easiest to go with what we know.

Early research illustrates that the strength of the status quo bias is positively correlated with the number of options in a choice set.[5] Put simply, the more we have to choose from, the more likely we are to fall back on the norm.

We can explain this pattern using **choice overload**, which asserts we make worse decisions when given too many options.[6] In fact, the status quo bias may not be a form of decision-making at all, but rather a form of *decision avoidance*.[7] After all, we are not even considering our other options, and only choosing the default to escape the stress of actually making a decision.

Although this strategy is dangerous for important choices, it may be useful during everyday tasks. While grocery shopping, it's far easier to choose the same loaf of bread you always get rather than evaluating every other variety and brand. Not only does this save you time, but frees up mental resources. In this case, the status quo bias allows you to minimize deliberation costs and dedicate your energy to greater tasks.[8]

How to avoid it

As with any cognitive error, the first step to avoiding the status quo bias is increasing awareness. Part of this involves simply taking the time to weigh all of your options carefully and giving them each equal consideration. Doing so will prevent you from automatically opting for the default option.

Sometimes we engage in status quo bias because choosing the norm is easier. Deliberately deciding on an alternative may require us to go slightly out of our way, even if it's something as simple as signing the form to opt out of an insurance plan. In cases like these where the outcomes of our decisions really matter, it's a good idea to make a plan. Write it on the calendar, schedule it into your planner, set a reminder on your phone, whatever works for you. When we're motivated to do something, having action steps already drafted increases the chances of us actually getting around to it.[9]

-ENDOWMENT EFFECT

The endowment effect describes how people tend to value items that they own more highly than they would if they did not belong to them. This means that sellers often try to charge more for an item than it would cost elsewhere.

Where this bias occurs

Let's say a few months ago, you bought a concert ticket for $100. You just found out that you won't be able to make it to the concert after all, so you decide to resell your ticket. You price the ticket at $150, because just selling it at market value would feel like you were losing out.

Why it happens

The endowment effect is usually explained as a byproduct of **loss aversion**—the fact that we dislike losing things more than we enjoy gaining them.

Because of loss aversion, when we're faced with making a decision, we tend to focus more on what we lose than on what we gain. As a result, in general, we are biased to maintain the status quo, rather than shake things up and risk sustaining losses. In one experiment by Daniel Kahneman and Amos Tversky, two of the founding fathers of behavioral economics, participants were asked to imagine that they were in one of two jobs—let's call them Job A and Job B. They were told they've been offered the option of moving to the other job, A or B. The new job was better than their current one in one aspect, but was worse in another. Kahneman and Tversky found that regardless of which job they started out in, most people did not want to move to the other one.[2]

Another aspect of loss aversion is the fact that, when we make decisions, we usually under-value opportunity costs. Opportunity costs are benefits that we miss out on when we choose one alternative over another, as opposed to out-of-pocket costs, which is the direct payment you make in a transaction. In the endowment effect, when we try to overcharge a buyer for something we own, it is partially because we are more focused on the out-of-pocket cost (losing that item) than we are on the money we miss out on if the buyer doesn't agree to our price.[1]

Buyers and sellers value things differently

Although the endowment effect was originally attributed entirely to loss aversion, other researchers have suggested a few other explanations that are better supported by evidence. **One of these** comes from a 2012 paper by Ray Weaver and Shane Frederick, who argue that the endowment effect actually happens because people are trying to avoid getting suckered into a bad deal. This view is known as reference price theory.

According to this view, when buyers and sellers approach a transaction, they often have different reference prices, or ideas about how much something is worth. Buyers don't want to pay more than they think an item is worth, but sellers don't want to sell for less than that item's market price.[3] So, for example, if you were trying to sell something that normally retails at $5, you probably wouldn't want to settle for anything less than that, because then you would feel like you're losing out. However, for a buyer who's just casually interested in getting your item, $2.50 might be the most they are willing to pay.

In other words, the endowment effect happens when there's a gap between a buyer's willingness to pay and a seller's willing to accept a certain price. Sometimes this gap appears because, when trying to decide what a reasonable price for something is, buyers will look to the lowest available price as a reference point, while sellers look at the highest ones. For example, if you were reselling a $250 ticket for a basketball game, and you saw that some people were reselling similar seats for $400, you might feel like a sucker if you sold for less than that. Meanwhile, people who are looking to buy tickets like yours

see that others have gone for closer to the original price, and so they're not willing to pay your higher price.[4]

Our positive self-concepts spill over to our possessions

Another possible driver of the endowment effect stems from the fact that we tend to like things more when we associate them with ourselves. Whether it's justified or not (and it's **very often not**), we are biased to see ourselves in a positive light, and we often believe that we are exceptional in various ways. Research has shown that this view of ourselves even extends to items that we own. This is known as the mere ownership effect.[5]

In one study looking at the mere ownership effect, university students who participated in the study were told they were taking part in a consumer preference study, and their job was simply to rate the attractiveness of a bunch of different products, including items like chocolate, a key ring, and soap. One of the items was a plastic drink insulator—a tube you can put around cans to keep them cold. To investigate whether people felt more strongly about items they owned, some of the participants were told they would be given a drink insulator as a "thank you" gift for participating.

If a plastic tube sounds like it would be a boring present to receive, you're right: researchers chose it because they had found, in a separate study, that people's feelings about the drink insulator were pretty much neutral. As unexciting as this item ordinarily is, the researchers found that participants who received it as a gift rated it as more appealing, compared to participants who were not offered a gift.[5]

One interesting aspect of this theory is that people have an even stronger need to enhance their mental image of themselves if they feel like their self-concept is being threatened. Indeed, one study found that after getting a bad rating for their performance on a task, people who had been given a drink insulator as a gift rated it as more appealing, compared to people who had not received negative feedback.[5]

Psychological ownership is different from actual ownership

Even if something doesn't technically belong to us, we might still feel like it's somehow ours. A lot of research has explored how much it takes for us to develop a sense of ownership over something, and the answer turns out to be not very much. This means that there is also a pretty low threshold for the endowment effect to kick in.

In one experiment, researchers gave each participant a chocolate bar, placing it on their desk—but also telling them they weren't allowed to eat it. For thirty minutes, the participants worked on a project, with the chocolate bar staring them down all the while. Finally, when the project was done, the researchers told the participants that the chocolate bar was theirs. But before they left, people were given a choice: to keep the chocolate, or to sell it back at a price they determined.

On average, participants who sold the chocolate bar back sold it for $1.72. However, in another group, where the chocolate bar was merely handed to people as a reward at the end of the project instead of sitting on their desks for half an hour, people only valued the chocolate at $1.35.7 That's the endowment effect at work.

As this study shows, psychological ownership can spring up really easily. Other research has found many other ways that people can be made to feel a sense of ownership, including being allowed to touch a product before buying it.[6]

How to avoid it

Beware of psychological ownership

When buying a new car, it's common for salespeople to encourage customers to imagine themselves driving around in a particular model, and of course to let people take cars for test drives. Granted, being able to test drive a car before you buy it is important to get a feel for it—but these tactics are also in place to encourage psychological ownership. The more time you spend using and interacting with a product, the more it starts to feel like yours, and the harder it is to part with it.

Be aware of sales tactics and salespeople who try to make you "bond" with products in this way.[6] And when you do run into them, try to keep in mind that this very brief interaction with a product does not make it superior to your other options, and doesn't necessarily mean this item is worth forking out a bunch of extra money for.

Try to consider opportunity costs

When trying to sell something, you may be inclined to price it higher than the average market value—maybe because it has sentimental value, or maybe because you don't want to miss out on money you could potentially make by charging so much. But keep in mind that pricing your item higher than market value, or at the higher end of what people typically sell it for, is going to make it more difficult to attract a buyer—especially if they can get the same thing somewhere else, for cheaper. It's better to sell something for close to what it's worth than to not sell something at all.

Base your prices on market value

As a seller, one of the most straightforward ways to avoid falling prey to the endowment effect is to keep closer to market value. In their paper, Weaver and Frederick show that when both parties value the item at its market price, the endowment effect no longer happens.[3] If there's a range of prices that that this item is usually sold for, try to stay close to the middle of that range: when buyers and sellers both have moderate reference prices in mind, there tends to be a smaller gap between the buyer's willingness to pay and the seller's willingness to accept.

HINDSIGHT BIAS

The *hindsight bias* describes our tendency to look back at an unpredictable event and think it was easily predictable. It is also called the "knew-it-all-along" effect.

Where this bias occurs

Consider this hypothetical: John and Jane have a fantastic relationship. They are madly in love and even have plans to move in together in a few months—at least that's what John thinks.

One day after work, John receives a message from Jane: "We need to talk." Suddenly, he gets worried. Is everything alright? Does Jane still love him? After all, he *did* pick up on some tension between them over the last few weeks. When they talk later that day, John learns that Jane is not so happy with the relationship. She needs a break from John.

He knew it! John tells himself and his friends. Now that he looks back at his relationship with Jane, he saw many signs that pointed to trouble: canceled plans, awkwardness, being ignored by her friends, and so forth. He had known it all along, and so this bad news from Jane was actually no surprise to him.

This is the hindsight bias at work. An unforeseen break-up becomes foreseeable to John only *after* it takes place. He overestimates his ability to have predicted the end of his relationship with Jane once the relationship is suddenly over.

Why it happens

The hindsight bias happens when new information surrounding a past experience changes our recollection of that experience from an original thought into something different.[2] According to psychologists Neal Roese and Kathleen Vohs, there are three stacking levels of which this can occur.

The first level is "memory distortion." This involves misremembering a past judgment or opinion. We often do this when claiming we said something when we didn't. The second level is centered around our belief that a past event was inevitable. Roese and Vohs call this degree of the hindsight bias "inevitability." The last level, "foreseeability," entails believing that we could have foreseen the event.[3] So, the bias occurs when we misremember our past thoughts, think a past event was inevitable, and subsequently, believe the event was foreseeable.

From their review of the existing literature, Roese and Vohs conclude that there are three main variables that affect the three levels of the hindsight bias to create our tendency to overestimate our predictive abilities:

1. **Cognitive:** We often distort our memory of past events by selectively remembering information that confirms what we already now know to be true. We do this to create a story that makes sense with the information we already have in what's known as "sensemaking." This is related to the **confirmation bias**.

2. **Metacognitive:** Metacognition is when we think about our thoughts themselves. When we find it easy to think and understand a past judgment or event, we might confuse ease with certainty. It is often easy to understand how or why an event happened in retrospect, due, at least in part, to the **availability heuristic**. This makes us certain that we had this understanding *before*.

3. **Motivational:** It brings us comfort to think that the world has order. This can motivate us to see unpredictable events as predictable. It also feels nice to think that your predictions were right or that you knew it all along even if you might not have. Research shows that our actions are often subconsciously motivated to promote a positive view of ourselves.[4,5]

How to avoid it

One way that Roese and Vohs suggest counteracting the hindsight bias is to consider and explain how the outcomes that did not unfold could have unfolded. By mentally reviewing all the potential outcomes, an event will seem less inevitable and foreseeable. However, Roese and Vohs note that we should not look to consider an overwhelming number of alternative outcomes, as the decision-maker could misinterpret this difficulty as an indication of their implausibility rather than their sheer number.[6]

Another way of addressing dangerous overconfidence is to keep track of your past decisions and their associated predictions. This can be done in what's known as a "decision journal," which is similar to a diary but with details your decisions and what you were thinking when you made them.[7] Having an unalterable track record of the predictions associated with your decisions (which will surely show some false predictions) might prevent the mistake of thinking you always knew it all along.

MORAL LICENSING

Moral licensing is a cognitive bias where individuals justify less ethical behavior by citing their previous good behavior. Essentially, when someone does something that they perceive as morally positive, they feel licensed to act in a less ethical or less responsible way afterward. This phenomenon can undermine efforts to maintain consistent ethical standards and can be counterproductive to long-term goals.

Examples of Moral Licensing

1. **Health and Fitness**: A person might eat an unhealthy meal because they exercised earlier in the day.

2. **Environmental Behavior**: Someone might justify using disposable plastics because they usually recycle.

3. **Charitable Actions**: An individual might feel entitled to act selfishly after making a charitable donation.

How to Avoid Moral Licensing

1. **Awareness and Mindfulness**: Simply being aware of moral licensing can help reduce its impact. Mindfulness practices can help individuals recognize when they are using past good behavior to justify current or future poor behavior.

2. **Consistent Standards**: Establish clear and consistent standards for behavior. Rather than viewing actions as one-off instances, consider them part of a larger commitment to ethical behavior.

3. **Long-term Goals and Identity**: Focus on long-term goals and the kind of person you want to be. When ethical behavior is tied to identity (e.g., "I am an environmentally conscious person"), it's harder to justify actions that contradict that identity.

4. **Separate Actions**: Treat each action as independent. Past good deeds should not be seen as credits that allow for future lapses. Each decision should be based on its own merits and the current context.

5. **Reflective Practices**: Regularly reflecting on one's actions and their alignment with personal values can help. Journaling or discussions with a mentor or peer can provide perspective and accountability.

6. **Setting Smaller, Specific Goals**: Instead of broad, general goals, set smaller, specific goals that are easier to achieve consistently. This helps maintain focus and reduces the likelihood of using previous successes as a justification for lapses.

7. **Accountability Mechanisms**: Use external accountability mechanisms, such as reporting progress to a friend or using apps that track behavior. This external oversight can reduce the likelihood of moral licensing.

8. **Reward Systems**: Be cautious with reward systems. Instead of rewarding oneself for good behavior in a way that might lead to lapses, choose rewards that further reinforce positive behavior (e.g., treating oneself to a new book on environmentalism after a month of consistent recycling).

Conclusion

Moral licensing is a subtle yet powerful phenomenon that can undermine efforts to maintain consistent ethical behavior. By being aware of this bias and implementing strategies to counteract it, individuals can better align their actions with their long-term values and goals.

OUTGROUP HOMOGENEITY BIAS

Outgroup homogeneity bias is a cognitive bias where people perceive members of an outgroup (a group to which they do not belong) as more similar to each other than they perceive members of their own group (ingroup) to be. This means they tend to see outgroup members as more alike in terms of characteristics, behaviors, and attitudes, while viewing their own group as more diverse.

Examples of Outgroup Homogeneity Bias

1. **Ethnic and Racial Groups**: People might believe that individuals from other ethnic or racial groups all look alike or have the same behaviors and attitudes, while recognizing a wide diversity within their own ethnic or racial group.

2. **Social and Political Groups**: A person might think that all members of an opposing political party hold the same views and have similar personalities, while perceiving a wide range of opinions and characteristics within their own party.
3. **Cultural Groups**: Someone might assume that people from a different culture all follow the same traditions and customs, while seeing a variety of practices within their own culture.

How to Avoid Outgroup Homogeneity Bias

1. **Increase Contact and Interaction**: Spend more time interacting with members of the outgroup. Personal experiences and relationships can highlight individual differences and reduce stereotypes.
2. **Education and Awareness**: Educate yourself about the outgroup. Learning about the history, culture, and individual stories of outgroup members can help dispel myths and highlight diversity.
3. **Perspective-Taking**: Actively try to see things from the perspective of outgroup members. Empathy and understanding can reduce biases by humanizing individuals from the outgroup.
4. **Challenge Stereotypes**: When you catch yourself generalizing about an outgroup, challenge these thoughts. Remind yourself of examples that contradict the stereotype.
5. **Media Consumption**: Consume media that portrays outgroup members in a nuanced and varied manner. Books, movies, and news from diverse perspectives can broaden your understanding.
6. **Critical Thinking**: Engage in critical thinking about the sources of your beliefs and attitudes. Question why you hold certain views about the outgroup and whether they are based on evidence or stereotypes.
7. **Promote Inclusivity**: Encourage inclusive environments where diversity is celebrated and outgroup members are integrated. Schools, workplaces, and community organizations can play a significant role in reducing biases.
8. **Reflect on Personal Biases**: Regularly reflect on your own biases and work to recognize and mitigate them. Biases are often unconscious, so self-awareness is key to addressing them.
9. **Diverse Friendships**: Cultivate friendships and relationships with people from different groups. These relationships can provide firsthand experience of the diversity within any group.

Conclusion

Outgroup homogeneity bias is a common cognitive bias that can lead to misunderstandings and perpetuate stereotypes. By taking steps to increase interaction, challenge stereotypes, and broaden our perspectives, we can reduce this bias and foster more accurate and inclusive views of others.

ALGORITHM AVERSION

Algorithm aversion refers to the tendency of people to distrust and avoid using algorithms or automated systems, especially after seeing them make mistakes, even if these algorithms generally outperform

human judgment. This aversion can lead to underutilization of potentially beneficial technologies in areas such as medicine, finance, and decision-making.

Examples of Algorithm Aversion

1. **Medical Diagnosis**: Patients or doctors might distrust diagnostic tools powered by AI, preferring human doctors even when algorithms have a better track record of accuracy.
2. **Financial Advice**: Investors might ignore algorithm-based financial advice after witnessing an algorithm's failure, even if the algorithm generally performs better than human advisors.
3. **Hiring Decisions**: HR professionals might avoid using automated resume screening tools after encountering a few incorrect rejections, despite the tool's overall efficiency and accuracy.

How to Avoid Algorithm Aversion

1. **Transparency and Explainability**: Ensure that algorithms are transparent and their decision-making processes are explainable. When users understand how an algorithm works and why it makes certain decisions, they are more likely to trust it.
2. **Human-AI Collaboration**: Combine human judgment with algorithmic recommendations. Allowing humans to oversee and refine algorithmic outputs can increase trust and acceptance.
3. **Education and Training**: Educate users about the strengths and limitations of algorithms. Training can help users understand when and how to rely on algorithmic assistance.
4. **Incremental Implementation**: Introduce algorithms gradually, allowing users to see their benefits and limitations in controlled scenarios before full deployment. This phased approach can build trust over time.
5. **Performance Monitoring**: Continuously monitor and improve algorithm performance. Regular updates and improvements can address issues and increase user confidence.
6. **Feedback Mechanisms**: Implement feedback mechanisms where users can report errors or provide input on algorithmic decisions. This involvement can make users feel more in control and increase their trust.
7. **Highlighting Success Stories**: Share success stories and case studies where algorithms have significantly outperformed human judgment. Positive examples can help counteract the impact of occasional failures.
8. **Risk Management**: Clearly communicate the risk management strategies in place for algorithmic decision-making. Users are more likely to trust algorithms if they know there are safeguards to handle mistakes.
9. **User Involvement in Development**: Involve end-users in the development and testing phases of algorithms. Their input can help shape more user-friendly and trustworthy systems.
10. **Balanced Comparison**: When presenting algorithm performance, compare it fairly with human performance, including the frequency and impact of human errors. This balanced view can help users appreciate the relative benefits of algorithms.

Conclusion

Algorithm aversion is a significant challenge in the adoption of automated systems, but it can be mitigated through strategies that build trust, ensure transparency, and foster collaboration between humans and algorithms. By addressing the root causes of aversion and demonstrating the reliability and benefits of algorithms, we can enhance their acceptance and utilization in various fields.

DIGITAL AMNESIA

Digital amnesia, also known as the "Google effect," refers to the tendency to forget information that is easily accessible through digital devices and the internet. People rely heavily on technology to store and retrieve information, which can lead to a decline in their ability to remember facts and details independently.

Examples of Digital Amnesia

1. **Phone Numbers**: Many people no longer memorize phone numbers because they rely on their smartphones to store this information.
2. **Directions**: With the widespread use of GPS, individuals often do not remember routes or directions as they rely on navigation apps.
3. **Appointments and Birthdays**: People frequently use digital calendars and reminders, which can result in a reduced ability to remember important dates and events without these aids.

How to Avoid Digital Amnesia

1. **Active Engagement**: Engage actively with the information you want to remember. Instead of just storing it digitally, take notes by hand, discuss it with others, or teach it to someone else. These activities enhance memory retention.
2. **Mnemonic Devices**: Use mnemonic techniques such as acronyms, visualization, and chunking to help retain information. Associating new information with familiar concepts can improve recall.
3. **Memory Exercises**: Regularly practice memory exercises and games that challenge your brain, such as puzzles, memory games, and activities that require recall and critical thinking.
4. **Limit Digital Dependency**: Make a conscious effort to memorize important information instead of immediately resorting to digital storage. Try to recall facts before looking them up.
5. **Healthy Lifestyle**: Maintain a healthy lifestyle with regular exercise, a balanced diet, and sufficient sleep. Physical health has a significant impact on cognitive functions, including memory.
6. **Mindfulness and Meditation**: Practices like mindfulness and meditation can improve concentration and memory by reducing stress and enhancing cognitive functions.
7. **Frequent Review**: Periodically review important information to reinforce memory. Repetition strengthens neural connections and helps in retaining information.

8. **Use Digital Tools Wisely**: While it's important to limit over-reliance on digital tools, they can still be beneficial if used wisely. Use them to complement, not replace, your memory. For instance, set reminders for critical tasks but make an effort to recall the details without immediately checking your device.
9. **Practice Retrieval**: Regularly test yourself on the information you want to remember. Practice retrieval enhances memory consolidation and makes it easier to recall information later.
10. **Balanced Digital Consumption**: Limit screen time and ensure a balanced consumption of digital content. Excessive use of digital devices can overload your cognitive functions, making it harder to remember information.

Conclusion

Digital amnesia is a growing concern in the age of information technology. By adopting strategies that actively engage memory, practicing cognitive exercises, and maintaining a healthy lifestyle, individuals can mitigate the effects of digital amnesia and improve their ability to remember important information independently. Balancing the use of digital tools with active mental engagement is key to maintaining strong memory functions.