

## Veridical Paradoxes

Serdar Kaya

---

The conversation starts off with Bertrand's Box Paradox, and extends to counter-intuitive truths in general. We talk about cognitive biases, mental shortcuts, misinterpretations of data, why people cannot process conditional probability well, and how humans are trying to solve probability problems with brains that evolved in African forests, and, to a large extent, to solve more simple and immediate problems in survival contexts. The conversation occasionally sways off to betting and gambling for some reason! But we still find time to talk about the three layers of the human brain, and gambling online with AI being a new thing! We end with a beautiful poem about an imaginary Chilean woman in her thirties, who lost a fortune in the sports kino of Wynn Las Vegas in a game of Blackjack, because she did not pay proper attention to the cards. We named her Isabella.

Popular culture references on this round include:  
21 (the movie), Kevin Spacey, Flamingo and Wynn hotels in Las Vegas

Word count: 11,289

---

For more conversations, visit:  
[serdarkaya.com/ai.php](http://serdarkaya.com/ai.php)

February 2023

### Acknowledgements

Minor edits for size and clarity. Language may switch to sarcastic/stupid and back without notice!  
LLM chatbot name and version: ChatGPT by OpenAI, v.3.5.

--conversation starts

## What is Bertrand's Box Paradox?

Bertrand's Box Paradox is a thought experiment in **probability theory** that was first described by Joseph Louis François Bertrand in his 1887 book "Calcul des Probabilités". **It is a paradox in the sense that it leads to a seemingly paradoxical conclusion, which contradicts intuition.**

Bertrand's Box Paradox shows that our intuition about probability can be misleading, and highlights the importance of carefully analyzing probability problems.

Okay, let's get to it then...

**There are three boxes, each with two coins inside.**

**Box 1 (or Box GG) contains two gold coins.**

**Box 2 (or Box SS) contains two silver coins.**

**Box 3 (or Box GS) contains one gold coin and one silver coin.**

**A person chooses one of the three boxes at random, and then withdraws one coin from that box at random. That one coin happens to be a gold coin.**

**What is the probability that the next coin drawn from the same box will also be a gold coin?**

**This is a veridical paradox, so the more common, intuitive yet faulty line-of-reasoning goes as follows:**

**"Originally, all three boxes were equally likely to be chosen. The chosen box cannot be Box SS, because the person took a gold coin out of it. So it must have come from either Box GG or Box GS. These two remaining possibilities are equally likely. So the probability that it is whether Box GG or Box GS is 1/2."**

**But this is the wrong answer. The correct answer is 2/3.**

**Demonstrate how in words; do not use the Bayes equation. Explain how the paradox arises, and why the correct result is counter-intuitive.**

The problem involves three boxes, each containing two coins. Box 1 (or Box GG) contains two gold coins, Box 2 (or Box SS) contains two silver coins, and Box 3 (or Box GS) contains one gold coin and one silver coin.

A person randomly chooses one of the three boxes, and then randomly selects one coin from that box. The selected coin happens to be a gold coin. The question is: what is the probability that the next coin drawn from the same box will also be a gold coin?

The intuitive but incorrect answer is that since there are two boxes left that could have produced the gold coin (Box 1 and Box 3), and they are equally likely, the probability that the next coin drawn will be a gold coin is  $1/2$ .

However, this answer is wrong. The correct answer is  $2/3$ , as we will demonstrate.

To understand the correct answer, we must consider the probability of the different ways the first coin could have been drawn. There are three possible ways:

- Box 1 (GG) was selected, and a gold coin was drawn on the first try.
- Box 3 (GS) was selected, and a gold coin was drawn on the first try.
- Box 2 (SS) was selected, and no gold coin was drawn.

We know that possibility 3 did not occur, since we drew a gold coin on the first try. The gold coin came from either Box 1 or Box 3.

The paradox arises because the intuitive reasoning assumes that the probability of each box being chosen is  $1/3$ , and therefore, the probability of getting a gold coin in either Box GG or Box GS is also  $1/2$ . However, this reasoning ignores the additional information that we have, which is that a gold coin was already picked from the box.

After the gold coin is picked, we know that it came from either Box GG or Box GS. This means that the probability of choosing Box GG, given that a gold coin was picked, is  $2/3$ , and the probability of choosing Box GS is  $1/3$ .

So, if we pick a box randomly from the two possible boxes (Box GG and Box GS) that could have produced the gold coin, there is a  $2/3$  chance that we will pick Box GG, which has two gold coins. Therefore, the probability of picking another gold coin from the same box is  $2/3$ .

This result is counter-intuitive because our initial assumption was that all boxes were equally likely to be chosen, which is true before any coins are picked. However, once a gold coin is picked, we have more information that affects the probability of which box the gold coin came from, and thus, changes the probability of picking another gold coin from the same box.

**Please state, once again, and briefly, what the new information was, and how it changed the probability.**

The new information was that a gold coin was drawn from the box. This information increased the probability that the box contains two gold coins and decreased the probability that the box contains one gold coin and one silver coin, which resulted in a higher probability that the next coin drawn from the box will also be a gold coin.

**Imagine, after hearing the above, someone still says, "But, how come? The gold coin came from either Box GG or Box GS. It is either one or the other, so the probability is  $1/2$ ."**

**Come up with a brief but eye-opening sentence that may lead this person to approach this problem in a new way?**

The critical point to understand is that the probability of selecting Box GG is twice as much as the probability of selecting Box GS, so the probability of drawing the second gold coin is more likely to come from Box GG.

**Great!**

**What about the following for a "brief but eye-opening sentence":**

**"Yes, it is true the gold coin came from either Box GG or Box GS, but don't you think it is a little more likely that it came from Box GG, because, obviously, a hand that goes in that box has only gold coins to pick?"**

That is a good explanation! By pointing out that the hand has a higher chance of picking a gold coin from Box GG, you are able to illustrate how the new information changes the probabilities and how the intuitive answer is not necessarily correct.

**Come up with a few more of these "brief but eye-opening sentence"s.**

Sure, here are a few more:

- "Just because there are two possibilities doesn't mean they are equally likely."
- "The probability of the next coin being gold depends on the box chosen, not just on the fact that the first coin was gold."
- "The fact that a gold coin was chosen tells us something about the box, and we need to take that into account when calculating the probability of the next coin being gold."
- "The paradox arises because our intuition assumes that all possibilities are equally likely, but that's not always the case."
- "The more we know about the situation, the more we can refine our probability estimates."

**Side question...**

**Which is more meaningful?:**

**(a) Trying to come up with as many eye-opening sentences as possible in an effort to free as many minds as possible, because different keys are necessary to open different minds.**

**(b) Trying to come up with a better kind of master key that will open most minds, because people think alike.**

If you are trying to communicate a message or idea to a diverse group of people with different backgrounds and ways of thinking, it may be more effective to use a variety of approaches and tailor your message to the individual.

On the other hand, if you are trying to appeal to a large group of people with similar backgrounds or ways of thinking, it may be more efficient to focus on a single, effective approach.

Ultimately, it's important to be flexible and adaptable in your communication strategies to best achieve your goals.

**Understood.**

**Why do many people, including mathematicians, sometimes struggle with veridical paradoxes, and follow a more intuitive yet faulty line-of-reasoning?**

Many people, including mathematicians, sometimes struggle with veridical paradoxes because they involve complex probability problems that challenge **our intuition** and **heuristics**.

To avoid these types of errors, it is important to slow down and use systematic, analytical thinking to evaluate the probabilities involved in the problem.

**A few other veridical paradoxes in probability and statistics can give us a better idea.**

**Let's start with Boy or Girl Paradox, aka the Two Child Problem.**

**The Boy or Girl paradox**, also known as the **Two Child Problem**, is a probability puzzle that explores the concept of conditional probability. Here is a brief explanation of the paradox:

Suppose a couple has two children and you are told that at least one of them is a boy.

What is the probability that both children are boys?

**Most people tend to believe that the answer is 1/2, but this is actually incorrect.**

**The correct answer is 1/3**, because there are three possible scenarios: two boys (BB), a boy and a girl (BG), or two girls (GG), and in the first scenario, both children are boys. So, the probability of two boys given that at least one is a boy is 1/3.

This paradox demonstrates the importance of considering the information that you have been given and using that information to calculate the relevant probabilities, rather than relying on intuition or mental shortcuts.

**Correct me if I am wrong:**

**In the Boy or Girl Paradox, the statement might as well be as follows:**

**"All I know is one of their two children is a boy, I don't know anything else about either of their kids."**

**In the light of this statement, the correct probability would still be 1/3. But if the statement was instead, "Their elder child is a boy", then the intuitive response of 1/2 would be correct.**

Yes, you are correct. In the Boy or Girl Paradox, the statement "All I know is one of their two children is a boy, I don't know anything else about either of their kids" gives us only partial information about the children and does not specify which child is the boy. In this case, the correct probability of the other child being a girl is 1/3.

However, if the statement were "Their elder child is a boy", then the information that we have is more specific, and we know which child is the boy. In this case, the correct probability of the other child being a girl is 1/2.

**Imagine, after hearing the above, someone still says, "But, how come? After all, the other child is either a girl or a boy. What difference would it make if one was born before or after the other? The probability would still be 1/2!"**

**Come up with a an eye-opening sentence that may lead this person to approach this problem in a new way.**

The order of birth doesn't matter for determining the sex of the second child, but it does matter for distinguishing between the two children. If the children are born at different times, then we can differentiate between the older and younger child, and that can affect the probability. But if they're born at the exact same time, there is no distinction between them, so the probability is 1/2.

**Come up with a few more eye-opening sentences on the Boy or Girl Paradox.**

Here are a few more possible responses:

"The key to understanding the paradox is to recognize that the information we're given rules out some possibilities and leaves others equally likely, which is why the probability is not what we might initially expect."

"It's not about the number of possible outcomes, but about the probability of each outcome given the information we have."

"We tend to assume that each child's gender is independent of the other, but that's not the case in this scenario."

"The paradox arises from our intuition about probability, which doesn't always align with what the math tells us."

"If we flip a coin and cover it, we know there's a 50-50 chance it's either heads or tails. But if we uncover it and see that it's heads, we can't say the chance of tails is still 50-50. It's the same idea here."

"The paradox can help us realize that probability can be counterintuitive, and that sometimes we need to rely on logic rather than our intuition."

### **In the Boy or Girl Paradox, how does the new information change the probability?**

In the Boy or Girl Paradox, the new information you receive can change the probability, depending on what you are told.

If you are told that one of the two children is a boy, then the probability of the other child being a girl is  $1/3$ . This is because there are four possible combinations of two children: boy-boy, boy-girl, girl-boy, and girl-girl. However, the condition that at least one child is a boy eliminates the possibility of girl-girl, leaving three possibilities. Of these three possibilities, only one is boy-girl, so the probability is  $1/3$ .

If you are told that one of the children is a boy and he was born on a Tuesday, then the probability of the other child being a girl is slightly higher than  $1/3$ , due to a quirk of the way the problem is formulated. This is known as the "Tuesday Boy" variant of the problem. In this variant, you are told that one of the children is a boy and that he was born on a Tuesday. The probability of the other child being a girl is then approximately  $13/27$ . This is because the condition that the boy was born on a Tuesday introduces a small amount of correlation between the sexes of the two children.

### **What if the two siblings were delivered via C-section at the exact moment?**

If the two siblings were born at the exact same time (e.g., twins), and you are told that one of them is a boy, then the probability of the other child being a girl is still  $1/2$ . This is because, in this scenario, both children are essentially indistinguishable from each other and the sex of one child has no influence on the sex of the other.

So, the probability of the other child being a girl is not affected by the fact that the children were born at the exact same time. The probability is  $1/2$  because, in this case, there are only two possible outcomes for the sex of the other child: boy or girl, and each outcome is equally likely.

**Will it perhaps help to approach Boy or Girl Paradox on the national level, rather than on the household level? One possible eye-opening statement:**

**"If we removed all households with one Tuesday Boy or more from the national census data, we would be left with a different male-female ratio, because we have changed the way the data are distributed on the national level."**

**Can you express this better, and perhaps give better examples?**

"The Boy or Girl Paradox can be thought of on a national level, where we consider the distribution of male and female births across the entire population. If we were to collect census data and remove all households with at least one boy born on a Tuesday, we would be left with a different male-female ratio in the remaining population. This is because there is a subtle bias in the way male and female births are distributed throughout the week, which affects the overall population statistics."

Here's an example to illustrate this idea: let's say we collected census data from a country where there were 100 male births and 100 female births in total. Now let's say that 15 of the male births were born on a Tuesday, while only 10 of the female births were born on a Tuesday. If we remove all households with at least one boy born on a Tuesday, we are left with 85 male births and 100 female births. This means that the male-female ratio in the remaining population is 0.85, which is different from the original ratio of 1:1.

This example shows how the distribution of male and female births across the week can affect the male-female ratio in a population. While the Boy or Girl Paradox is usually considered on a household level, thinking about it on a national level can help us understand the underlying statistical biases that are at play.

**Isn't the Boy or Girl Paradox, as explained here, like someone flipping two coins, and then telling someone else at the other end of a long corridor, "At least one of them came up Tails" without telling which?**

Yes, that is a valid analogy for the Boy or Girl Paradox. In this scenario, the two coins represent the two children, and the outcome of the coins landing on either heads or tails is analogous to the gender of each child being either a boy or a girl. The statement "at least one of them came up tails" is equivalent to being told that at least one of the children is a boy, but without any further information about the gender of the other child. The key to the paradox is that the probability of the second child being a boy or a girl is not  $1/2$ , as might initially be assumed, but rather depends on the probability distribution of families with two children.

**How is the Boy or Girl Paradox helpful as a thought experiment?**

The Boy or Girl Paradox is helpful as a thought experiment because it **challenges our intuitive understanding of probability** and helps us **identify common misconceptions**. By presenting a seemingly straightforward scenario and asking for the probability of a particular outcome, the paradox forces us to carefully consider the underlying assumptions and potential biases that may be affecting our calculation.



In addition, the paradox can be useful in illustrating the importance of **being clear and precise in our communication**. The wording of the problem can significantly affect the way we interpret it, and this can lead to different answers depending on how the problem is presented.

### **Next... Talk about the Sleeping Beauty Problem.**

**The Sleeping Beauty Problem** is a thought experiment in decision theory and probability. It goes like this:

A sleeping beauty is put to sleep on Sunday.

Then, a fair coin is flipped to determine the rest of the experimental procedures.

If the coin comes up **heads**, Sleeping Beauty is to be awakened and interviewed briefly on Monday.

If the coin comes up **tails**, she is to be awakened and interviewed briefly on Monday. Before being put back to sleep, she is to be given an amnesia-inducing drug that will make her forget all about the awakening. The Sleeping Beauty will be awakened again on Tuesday for a second brief interview.

During none of these brief interviews will the Sleeping Beauty be able to tell what day it is or whether she has been awakened before.

The experiment will end on Wednesday.

Question:

After the Sleeping Beauty is awakened, what is her credence (degree of belief) that the coin came up heads on the first flip?

The discussion on the problem is ongoing.

Many argue that the correct answer is  $1/2$ , while many others claim that it is  $1/3$ .

**If the Sleeping Beauty will not be able to tell during any of the possible interviews what day it is, or whether she has been awakened before, is it fair to say that she has zero Bayesian priors?**

Yes, it's fair to say that Sleeping Beauty has zero Bayesian priors in the sense that she has no previous information or knowledge about the outcome of the coin flip or whether she has been awakened before. She doesn't know what day it is or whether she has been awakened before any of the possible interviews, so she has no prior information to inform her beliefs about the coin flip.

**In Bayesian probability, priors are the initial beliefs or prior knowledge about the state of the world, which are then updated based on new information.** In this case, Sleeping Beauty has no prior knowledge or beliefs, so her priors are effectively zero. This makes the problem particularly interesting

because it forces us to consider what probabilities should be assigned based solely on the information given in the problem statement.

However, because Beauty is assumed to have amnesia and doesn't remember whether she has been awakened before, the problem requires us to consider how to update probabilities in the absence of complete information. This is where different interpretations of the problem and the foundations of probability come into play, and it's why the Sleeping Beauty Problem is considered a paradox.

**How do the halver and thrice approaches update their Bayesian priors in this particular scenario? After answering the question, talk about the philosophical aspects of this scenario.**

In the Sleeping Beauty problem, the Halver approach and the Thrice approach differ in the way they update their Bayesian priors after each awakening of Sleeping Beauty.

According to the **Halver approach**, Sleeping Beauty's prior probability of the coin coming up heads is  $1/2$ , and after each awakening, her probability is reset to  $1/2$ , regardless of whether she has been awakened before. In this approach, the information gained from each awakening is discarded and the prior is updated back to  $1/2$ .

According to the **Thrice approach**, Sleeping Beauty's prior probability of the coin coming up heads is  $1/2$ , and after her first awakening, her probability is updated to  $1/3$  if she discovers that the coin came up tails and to  $2/3$  if she discovers that the coin came up heads. After her second awakening, Sleeping Beauty's probability is updated again, taking into account both the outcome of the coin flip and the fact that she has been awakened before.

While the Sleeping Beauty Problem is a problem of probability theory, it also touches on deeper philosophical questions about the nature of personal identity and time. For example, it raises questions about whether Sleeping Beauty's experiences on Monday and Tuesday are identical, and whether her experiences on Monday are different from her experiences on Tuesday, and whether she is a different person on each awakening.

These philosophical questions are beyond the scope of probability theory and may not have definitive answers. The halver and thrice approaches to the Sleeping Beauty Problem are examples of different interpretations of probability and decision-making in situations with uncertainty and multiple possible outcomes.

Overall, the philosophical aspect of the Sleeping Beauty problem involves questions about the interpretation of probability, the nature of time, and the meaning of knowledge and information. Some argue that the Halver approach is more coherent, as it gives the same probability regardless of how many times Sleeping Beauty is awakened, while others argue that the Thrice approach is more intuitive, as it takes into account the information gained from each awakening. Ultimately, the resolution of the Sleeping Beauty problem depends on one's philosophical views about probability and knowledge.

## Talk about the attempts to reconcile these two approaches.

There have been attempts to reconcile or combine the two approaches in the Sleeping Beauty Problem. One suggestion is to adopt a hybrid approach that borrows elements from both the "Halfer" and "Thricer" perspectives. In this **hybrid approach**, Sleeping Beauty's prior belief after the first awakening is updated in a way that is intermediate between the two original perspectives.

The idea behind this approach is to avoid the **"double counting"** of information that is criticized in the Thricer perspective, while also avoiding the seemingly counterintuitive conclusion that Sleeping Beauty's belief should remain unchanged after the first awakening, as suggested by the Halfer perspective.

In this hybrid approach, Sleeping Beauty is seen as having a prior belief that is updated after each awakening in a way that takes into account the information she has obtained so far. For example, after the first awakening, Sleeping Beauty may assign a probability of  $2/3$  to the hypothesis that it is Monday, and a probability of  $1/3$  to the hypothesis that it is Tuesday. After the second awakening, her probabilities may be further updated based on the information obtained from the experimenter during the interviews.

This hybrid approach is seen as a compromise that offers a way to balance the conflicting arguments of the Halfer and Thricer perspectives, and to reconcile the seemingly incompatible elements of each approach. However, it is still a matter of ongoing debate and discussion among philosophers and mathematicians.

## Next... The Birthday Paradox.

In a group of just 23 people, there is more than a 50% chance that two of them will have the same birthday. This is **surprising** because with 365 possible birthdays, one would expect that the chance of two people having the same birthday would be low. However, **the problem is not with the number of birthdays, but with the number of pairs of people in a group.**

To see why this is the case, consider that there are 22 pairs of people in a group of 23. The probability that the first two people do not have the same birthday is  $364/365$  (since there are 365 possible birthdays, and only one of them would result in a match). The probability that the next two people do not have the same birthday is  $363/365$ , and so on. The overall probability that none of the 22 pairs of people have the same birthday is  $(364/365) * (363/365) * \dots * (344/365)$ . This is a very small number, much less than 50%.

The Birthday Paradox shows that **our intuition about probabilities can be deceiving**. We often think of probabilities as simple fractions, but in many cases, the interactions between events can lead to results that are counterintuitive. In this case, the large number of pairs of people in a group leads to a much higher probability of at least two people having the same birthday than one might expect based on the number of possible birthdays.

## **Next... The Bayesian Trap paradox.**

The Bayesian Trap is a paradox in Bayesian statistics that occurs when a prior belief strongly influences the conclusion of a statistical analysis, even when the data provides strong evidence against it.

**The paradox arises because Bayesian statistics allows for subjective prior beliefs to be incorporated into the analysis**, which can then influence the posterior beliefs (the updated beliefs after taking into account the data). If a prior belief is strongly held, it can be difficult for the data to change the posterior belief, even when the data provides overwhelming evidence to the contrary.

For example, suppose a scientist has a strong prior belief that a certain drug is effective for treating a certain condition. They conduct a clinical trial and obtain data that strongly suggests the drug is not effective. However, the scientist's prior belief is so strong that they continue to believe the drug is effective, despite the evidence from the trial. This is an example of the Bayesian Trap, where the prior belief has trapped the scientist's interpretation of the data.

**The Bayesian Trap highlights the importance of being aware of our prior beliefs and considering their potential impact on the interpretation of data.** It also emphasizes the importance of being willing to update our beliefs based on evidence, rather than holding onto prior beliefs even when they are contradicted by the data.

**There are many other veridical paradoxes, and some are more similar in nature than others.**

**To ensure a more encompassing coverage, name a few that are different in nature from the aforementioned.**

The St. Petersburg Paradox:

This paradox states that an infinitely long game of chance, where the prize for each round increases exponentially, becomes increasingly valuable. However, most people would be willing to pay only a finite amount for such a game, suggesting that our intuition about the value of a game of chance fails in this case.

The Two Envelopes Problem:

A friend offers you a choice between two envelopes, one of which contains twice as much money as the other. After you choose an envelope, you are allowed to look inside and see the amount of money. The paradox lies in the fact that, no matter what amount of money you find in the envelope, you should switch to the other envelope, since it contains either the same amount or a larger amount.

**Okay... Now, imagine a person who has invested the necessary time to understand the Bertrand's Box Paradox only.**

**To what extent would that effort make it easier for that person to overcome other veridical paradoxes?**

Understanding the Bertrand's Box Paradox can be more useful in solving certain veridical paradoxes that involve probability and random selection, such as the **Monty Hall paradox**, the **Birthday Paradox**, and the **St. Petersburg paradox**. In these paradoxes, the key to solving the problem is to have a **clear understanding of the probabilities involved**, which can be aided by an understanding of the Bertrand's Box Paradox.

However, some of the other veridical paradoxes, such as the **Allais paradox**, the **Ellsberg paradox**, and the **Bayesian Trap paradox**, **involve decision-making and human behavior, rather than just probability**. While an understanding of the Bertrand's Box Paradox could still be useful in these paradoxes, it is not likely to be as impactful as it would be for the probability-based paradoxes.

### **Can you think of any practical, immediate real-life uses of such analytical skills?**

Yes, there are several practical and immediate real-life uses of analytical skills that can be applied in various fields, including:

#### Business and finance:

In business and finance, analytical skills are used to make informed decisions about investments, risk management, and pricing strategies. For example, understanding **probability distributions** and **statistical inference** can help analysts make predictions about stock prices and estimate the risk associated with different investments.

#### Healthcare:

In healthcare, analytical skills are used to make decisions about patient diagnosis, treatment, and prognosis. For example, understanding **Bayesian networks** can help healthcare professionals use evidence-based decision-making to diagnose and treat patients.

#### Marketing:

In marketing, analytical skills are used to understand consumer behavior and make decisions about product positioning, pricing, and promotion. For example, understanding **regression analysis** and **experimental design** can help marketers test the impact of different marketing strategies on consumer behavior.

#### Political Science:

In political science, analytical skills are used to study the behavior of voters, parties, and elected officials. For example, understanding **survey design** and **statistical inference** can help political scientists make predictions about election outcomes and understand the factors that influence voter behavior.

#### Sports:

In sports, analytical skills are used to make decisions about player performance, strategy, and game management. For example, understanding **statistical analysis** can help coaches make decisions about player performance and make predictions about the outcome of games.

These are just a few examples of the many real-life applications of analytical skills. In general, the ability to analyze data, think critically, and make informed decisions is a valuable skill in many fields and can lead to better outcomes.

### **What about betting and gambling?**

Yes, betting and gambling are also areas where analytical skills can be used in real-life. In betting and gambling, understanding probability, statistics, and risk management is essential for making informed decisions and maximizing the chances of winning. For example:

Sports betting:

In sports betting, understanding **statistics**, such as player performance and team performance, can help bettors make informed decisions about which teams or players to bet on.

Casino games:

In casino games, such as blackjack and poker, understanding **probability** and **basic strategy** can help players make informed decisions and minimize the house edge.

Horse racing:

In horse racing, understanding **statistics**, such as past performance, can help bettors make informed decisions about which horses to bet on.

In these scenarios, it is important for bettors to be aware of the risks involved and to make informed decisions based on the available information. Gambling should always be done responsibly, and individuals should never bet more than they can afford to lose.

### **Shouldn't analytical skills lead individuals to understand the odds better, and not gamble in the first place than trying to minimize the house edge?**

Yes, that is certainly a valid perspective. Analytical skills can certainly help individuals understand the odds and the risks associated with betting and gambling, and this understanding can lead some individuals to make the decision not to gamble. For example, if an individual understands the basic principles of probability and knows that the odds are always in favor of the house in casino games, they may choose not to play these games.

However, for others, the understanding of the odds and the ability to use analytical skills to make informed decisions may simply make the experience of gambling more enjoyable or increase the potential for winning. In these cases, individuals may still choose to gamble, but they will do so in a more informed and responsible manner.

Ultimately, the decision to gamble or not to gamble is a personal one, and it depends on a variety of factors, including an individual's personality, financial situation, and understanding of the risks involved.

## Is gambling online with real-time AI help already a thing?

Yes, online gambling with real-time AI assistance is **already a thing**. There are online platforms that use AI algorithms to provide real-time advice and guidance to players in various casino games, such as blackjack and poker. These AI algorithms can analyze the game situation in real-time and provide players with recommendations on how to play their hand or make their bet.

However, it is important to note that the use of AI in online gambling is still a relatively new development, and its effectiveness has not been fully established. **Some experts have raised concerns about the fairness of using AI in online gambling**, as well as the potential for AI algorithms to be manipulated or hacked.

In general, it is recommended that individuals exercise caution when using AI in online gambling and be aware of the potential risks involved. As with any form of gambling, it is important to gamble responsibly and never bet more than you can afford to lose.

**Okay, back to the point:**

## What do veridical paradoxes/problems have in common?

Veridical paradoxes and problems, along with other counter-intuitive truths, all challenge our conventional understanding and expectations about the world. They often seem to be contradictory or defy our initial expectations, and as a result, they can be difficult to comprehend or accept.

**What these counter-intuitive truths have in common is that they highlight the limitations of our intuition and common sense.** Our intuition and assumptions are based on our experiences and observations, but they are not always accurate representations of reality. **Counter-intuitive truths can help us to expand our understanding and challenge our preconceived notions.**

Another commonality is that they often lead to **a deeper understanding of a particular concept or field of study**. For example, mathematical paradoxes can lead to new mathematical discoveries and insights, while philosophical paradoxes can prompt us to re-evaluate our beliefs and values.

Finally, **counter-intuitive truths can also be used to test and refine our reasoning abilities.** By forcing us to confront seemingly paradoxical or conflicting information, they can help us to improve our critical thinking skills and better understand the complexities of the world.

## Why does the human brain have difficulty understanding conditional probability accurately?

The human brain has difficulty understanding conditional probability accurately because it requires an understanding of the relationships between different events, and **the ability to hold in mind multiple pieces of information at the same time**. This can be challenging for the brain because it often relies on heuristics, or mental shortcuts, when processing information.



**Heuristics** are mental shortcuts or rules of thumb that people use to make judgments quickly and easily. For example, people often use the heuristic of "majority wins" when making probabilistic judgments, which leads them to give more weight to the most common outcome.

Another factor that contributes to the difficulty of understanding conditional probability is that it often involves **reasoning about uncertain or probabilistic information**, which can be challenging for the brain because it is not always well-suited for processing such information.

Finally, there are many **cognitive biases** that can affect our ability to understand conditional probability accurately. Cognitive biases are systematic errors in thinking that are caused by the brain's tendency to simplify information and make quick judgments. These biases can affect our perception, memory, and reasoning, leading us to make decisions that deviate from logic and probabilistic reasoning.

### **Talk about the Monty Hall Problem in the context of conditional probability.**

**The Monty Hall problem** is a well-known example of how our intuition can lead us astray when it comes to understanding conditional probability.

In this problem, a contestant is asked to choose one of three doors, behind which there is a prize. The contestant chooses a door, and the host, who knows what is behind each door, then opens one of the other two doors to reveal a goat. The contestant is then given the option to switch their choice to the other unopened door or stick with their original choice.

Intuitively, **it might seem like switching doors doesn't matter, since the probability of winning the prize is still 1 in 3. However, the correct answer is to switch doors, because the probability of winning the prize is actually 2 in 3 if you switch.** This is because the host only opens a goat door, so the probability of the prize being behind the other door increases.

The Monty Hall problem highlights how **our intuition can be misleading when it comes to conditional probability**. It also demonstrates the importance of being able to think abstractly and understand the relationships between events when making decisions involving probability.

### **There is a scene in the 2008 movie 21, where the Monty Hall problem is discussed.**

#### **Summarize that scene.**

In the movie *21*, the Monty Hall problem is discussed in a scene where **Kevin Spacey's character**, a math professor, teaches his students about probability and decision-making. The Monty Hall problem is used as an example to illustrate how people often make incorrect decisions based on intuition and how understanding probability can help make better decisions.

The scene shows how the Monty Hall problem works and how the optimal solution can be counterintuitive. The students are challenged to solve the problem, and the scene ends with the revelation of the correct answer and the students realizing the importance of thinking critically and making decisions based on mathematical reasoning.



**In that scene, one of the students respond correctly to Monty Hall Problem, almost immediately after hearing it. How common is that kind of response among humans?**

In reality, the Monty Hall problem is known to be a counterintuitive problem, and **many people struggle to understand the correct solution, even after hearing it multiple times**. The idea that a student would respond correctly to the problem immediately after hearing it is highly unlikely. However, in the movie "21", it was included for dramatic effect and does not reflect the typical human response to the Monty Hall problem.

**Here is my own experience:**

**Years ago, I told my professor during class that the probability should be 1/2. My approach was quite typical: "Monty Hall will open a door no matter what, so it is still impossible to know behind which one of the two doors the prize is at."**

**I did not know anything about Bayesian statistics at the time, so I did not interpret the opening of one of the three doors as new information that changes the probability.**

**My professor had to demonstrate it to me mathematically why it is 2/3!**

Yes, it's a common misunderstanding of the Monty Hall problem. Many people initially think that the probability of winning the prize remains 1/2, regardless of what door is opened by Monty Hall. But **when Monty Hall opens one of the two doors that does not have the prize, this provides new information that changes the probability calculation**. The new probability is 2/3, as your professor demonstrated to you. This is because there are now two doors to choose from, and only one door has the prize behind it.

**Now, mention the most common cognitive biases and heuristics that can affect our understanding of conditional probability. Describe each briefly with one example.**

Confirmation bias:

This is **the tendency to seek out information that supports our beliefs and ignore information that contradicts them**. For example, when evaluating the probability that a certain event will occur, we may be more likely to focus on evidence that supports our belief that the event will occur, and ignore evidence that suggests it won't.

Availability heuristic:

This is **the tendency to estimate the probability of an event based on how easily examples come to mind**. For example, if we can easily recall several examples of a particular type of event, we may overestimate the likelihood of that event occurring in the future.

Representativeness heuristic:

This is **the tendency to judge the probability of an event based on how similar it is to other events in our mental representation**. For example, if we see a person who is well-dressed and confident, we may be more likely to judge them as successful, regardless of the actual probability that they are successful.

Anchoring bias:

This is **the tendency to be influenced by the first piece of information we encounter when making a decision**. For example, if we are asked to estimate the price of a car and are first given an extremely high or low estimate, our final estimate may be biased in that direction.

Base rate fallacy:

**Ignoring prior probabilities in favor of specific information leading to incorrect probability estimates**. Example: Assuming a person is a criminal just because they fit a certain profile, ignoring the fact that most people in that profile are not criminals.

**While heuristics and cognitive biases can lead to errors in our understanding of conditional probability, they can also be useful in certain situations where quick, rough estimates are sufficient. The key is to be aware of these biases and heuristics and to correct for them when necessary.**

**There are also problems that stem from misinterpreting the data, due to a lack of sufficient analytical skills.**

**Simpson's Paradox, for example?**

Yes, **Simpson's Paradox** is an example of a data interpretation issue that arises due to a lack of sufficient analytical skills. It is a phenomenon where a trend appears in different groups of data but disappears or reverses when these groups are combined.

**Consider a study on the effectiveness of a new drug. The study finds that the drug is more effective in treating a certain condition in both men and women.**

However, when the data is combined and analyzed, it may show that the drug is actually less effective overall, because it is **less effective in treating the condition in one gender than the other**.

This reversal of the trend can be misleading and can lead to incorrect conclusions about the effectiveness of the drug.

This example demonstrates how Simpson's Paradox can be a problem in real-life decision-making, as it can lead to incorrect conclusions about the effectiveness of different treatments or interventions. To avoid such misunderstandings, it's important to carefully consider the relationships between variables and to be cautious when using aggregate data to make decisions.

**Your example is important, but not necessarily counter-intuitive.**

**Consider the following scenario:**

**Two hospitals in town have the below survival rates:**

- Hospital A: 90%
- Hospital B: 80%

**a. Is it possible for Hospital B to have higher survival rates for patients in critical condition only? If so, how?**

**b. Is it possible for Hospital B to have higher survival rates for patients in critical condition, as well as those who are *not* in critical condition? If so, how?**

**Do you notice how the above questions are more counter-intuitive?**

Yes, it is possible that the questions become more counter-intuitive as they are being asked.

**Answer (a) and (b).**

a. **Yes**, it is possible for Hospital B to have a higher survival rate for patients in critical condition only. This could happen if Hospital B specializes in treating critical conditions and has better facilities, equipment, and staff trained to handle critical cases. In such a scenario, **Hospital B may have a lower overall survival rate because they may receive a higher number of critical cases that are more challenging to treat.**

b. **Yes**, it is also possible for Hospital B to have higher survival rates for patients in critical condition, as well as those who are not in critical condition. **This could occur if Hospital A treats a higher proportion of non-critical patients with better chances of survival, while Hospital B treats a higher proportion of critical patients with lower chances of survival, then Hospital A could have a higher overall survival rate. However, when the data is analyzed separately for critical and non-critical patients, Hospital B might have a higher survival rate in both groups.**

This scenario is an example of Simpson's Paradox, where the relationship between two variables may appear in one direction in a small sample, but reverse in a larger sample.

**Yes, here is one possible scenario, regarding the two hospitals:**

**Aggregate data:**

- 900 of the last 1000 patients of hospital A survived (90%)
- 800 of the last 1000 patients of hospital B survived (80%)

**Hospital A, grouped data:**

- 100 of the last 1000 patients were in critical condition, 30 survived, 70 did not (30%)
- That means, 900 were not in critical condition, and 870 survived, 30 did not (96.6%)

**Hospital B, grouped data:**

- 400 of the last 1000 patients were in critical condition, 210 survived, 190 did not (52.5%)

- that means, 600 were not in critical condition, and 590 survived, 10 did not (98.3%)

**To summarize the above data:**

**Two hospitals have the below survival rates, for patients in critical condition:**

- Hospital A: 30.0%
- Hospital B: 52.5%

**Two hospitals have the below survival rates, for patients in non-critical condition:**

- Hospital A: 96.6%
- Hospital B: 98.3%

**And their survival rates for all patients are as follows:**

- Hospital A: 90%
- Hospital B: 80%

**The "paradox" here is that Hospital B is the better choice for both groups of patients, critical and non-critical. Yet Hospital A has a higher overall success rate!**

Yes, this is an example of Simpson's Paradox, where the relationship between two variables appears to be different when analyzed in aggregate compared to when analyzed in separate groups.

In this example, the overall survival rate for Hospital A appears to be higher than Hospital B, but when you look at the survival rates for patients in critical condition and those not in critical condition, Hospital B actually has higher survival rates for both groups.

This paradox can arise when there is a confounding variable that affects the relationship between two variables. In this case, the confounding variable could be the proportion of patients in critical condition between the two hospitals, which can impact the overall survival rates. This highlights **the importance of carefully analyzing and interpreting data to avoid misleading conclusions.**

**When it comes to such critical matters, how common is data misinterpretation on the media, advertising, and social communication, generally speaking?**

Misinterpretation of data is a common problem in media, advertising, and social communication. There are several factors that contribute to this problem, including:

Lack of statistical literacy:

**Many people, including journalists and marketers, lack a strong understanding of basic statistical concepts,** which makes it easier for them to misinterpret data or draw incorrect conclusions.

Misleading representations:

**Data can be presented in misleading ways,** such as using misleading graphs or charts, selectively choosing data points, or emphasizing certain results over others.

Bias and vested interests:

There is often a bias or vested interest in presenting data in a certain way, such as for political purposes or to sell a product. This can lead to misleading or incomplete information being presented to the public.

Limited time and resources:

In many cases, journalists and marketers are under tight deadlines and limited resources, which can lead to **shortcuts in the analysis and interpretation of data.**

These factors can lead to a widespread misinterpretation of data in media, advertising, and social communication, and can have **serious consequences, such as spreading false information, influencing public opinion, or making incorrect decisions.**

To avoid these problems, it's important to be critical of the data presented in media, advertising, and social communication, and to seek out independent, evidence-based sources of information whenever possible.

**Relatedly, briefly mention the human tendency to grossly underestimate the extent of false positives in medical tests with accuracy levels as high as 99%, especially when the disease is rare.**

**What is the intuitive probability in such a case, and what is the real probability?**

When the disease being tested for is rare, people often have a tendency to greatly underestimate the number of false positive results in medical tests that have high accuracy rates, such as 99%. Intuitively, a person who tests positive may believe that they almost certainly have the disease, especially when the disease is rare. However, the actual probability of having the disease is lower than what is initially perceived. This is because **the high accuracy rate of the test is based on a large population of patients, and in a rare disease scenario, a large number of false positive results can still occur.**

For example, **if the disease has a prevalence rate of 1 in 1000, an individual with a positive test result might intuitively think they have a 99% chance of having the disease.** However, this is not the case. In fact, the probability of a false positive in this scenario is about 91%, and **the real probability of having the disease is about 9%.**

This highlights the importance of carefully interpreting test results and understanding the underlying probability calculations.

**Demonstrate the mathematics of 9%.**

Sure, let's redo the calculation with a prevalence rate of 0.1% (1 in 1,000) to get a false positive rate of 9.1%. Here are the numbers:

- Prevalence of the disease: 0.1%, or 1 in 1,000
- Number of patients tested: 100,000
- So, we would expect to find 100 positive cases (100,000 x 0.1%)

Assuming a test with 99% accuracy and 99% specificity, we can break down the results as follows:

- True positives: 99% of the 100 cases, or 99
- False positives: 1% of the 99,900 non-cases, or 999
- True negatives: 99% of the 99,900 non-cases, or 98,901
- False negatives: 1% of the 100 cases, or 1

So, out of the 1,098 total positive test results, only 99 are true positives. The rest are false positives. Therefore, the proportion of false positives is:

- True positives / Total positive results
- $99 / 1,098$
- 0.0901

Multiplying this by 100 gives us the percentage of true positives:

- $0.0901 \times 100 = 9.01\%$ , which is close to the 9% figure mentioned.

### **What if the disease had a prevalence rate of 1 in 10,000, and 100,000 patients were tested?**

Assuming a test with 99% accuracy and 99% specificity, we can break down the results as follows:

- Prevalence of the disease: 1 in 10,000, or 0.01%
- Number of patients tested: 100,000
- So, we would expect to find 10 positive cases ( $100,000 \times 0.01\%$ )

Assuming a test with 99% accuracy and 99% specificity, we can break down the results as follows:

- True positives: 99% of the 10 cases, or 9.9
- False positives: 1% of the 99,990 non-cases, or 999.9
- True negatives: 99% of the 99,990 non-cases, or 98,990
- False negatives: 1% of the 10 cases, or 0.1

So, out of about 1,010 total positive test results, only about 10 are true positives. Therefore, the proportion of true positives is:

$$\text{True positives} / \text{Total positive results} = 9.9 / (999.9 + 9.9) = 0.0098$$

Multiplying this by 100 gives us the percentage of true positives:

$$0.0098 \times 100 = 0.98\%, \text{ or a little less than one percent.}$$

**To sum up:**

**When a contagious disease has a prevalence rate of 1 in 10,000, and 100,000 people are tested, less than 1% of the people with a positive test result will actually have the disease, even though the test has an accuracy rate of 99%. Am I correct?**

Yes, **that's correct!** When a disease has a prevalence rate of 1 in 10,000 and a test with 99% accuracy and specificity is administered to 100,000 people, less than 1% of the people who test positive will actually have the disease.

**Why does the human brain sometimes make such gross mistakes in assessment, calculation, or interpretation?**

Humans are often prone to making mistakes, particularly when it comes to complex mathematical concepts and probabilities. This can occur due to a variety of reasons, including **a lack of prior knowledge or understanding of the relevant mathematical concepts**, **overreliance on intuition**, or a **failure to consider all of the relevant variables**.

Additionally, **cognitive biases** and **heuristics** can also play a role, leading people to make systematic errors in their calculations. It is important to be aware of these tendencies and to take steps to overcome them in order to make more accurate calculations and avoid costly mistakes.

**What about the reasons behind the human tendency to misinterpret data?**

The human tendency to misinterpret data is a common phenomenon that arises from a combination of **cognitive biases**, **limited analytical skills**, and **preconceived notions**. This can lead to **incorrect conclusions** and **flawed decision-making** based on **faulty data analysis**.

There are many examples of this tendency to misinterpret data, including:

Overreliance on anecdotal evidence:

This is the tendency to make decisions based on personal experiences or individual stories, rather than on systematic analysis of data.

False correlation:

This is the mistaken belief that a correlation between two variables implies a causal relationship, when in fact, the correlation may be coincidental or may be caused by a third variable.

These examples highlight the importance of critical thinking and data literacy, as well as the need to approach data with an open mind and a willingness to question our assumptions. By being aware of these tendencies and making a conscious effort to overcome them, we can improve our ability to interpret data accurately and make more informed decisions.

## **In what ways may the tendency to rely on heuristics or mental shortcuts have helped humans in big history?**

The tendency to rely on heuristics, or mental shortcuts, has been an important adaptation for humans throughout our evolution and history. These mental shortcuts, also known as "rules of thumb", are a way of making quick decisions and judgments based on limited information, and have helped us in several ways:

Efficient problem-solving:

Heuristics allow us to quickly solve problems and make decisions in situations where we have limited information or limited time to analyze all of the information available. This is especially important in survival situations, where quick decision-making can mean the difference between life and death.

Improved decision-making:

By using heuristics, we can make decisions based on past experiences and knowledge, even in novel situations. This allows us to make decisions without having to spend time and effort gathering and analyzing all of the information available, and has been key to our success as a species.

Improved learning:

Heuristics allow us to learn from our experiences and make connections between new information and our existing knowledge, which helps us to build a more complete understanding of the world.

Social bonding:

Heuristics also play a role in our social lives, helping us to form and maintain relationships by allowing us to make quick judgments about other people based on limited information.

In summary, the tendency to rely on heuristics and mental shortcuts has been a valuable adaptation for humans throughout our evolution and history, helping us to make quick decisions, improve our decision-making, improve our learning, and form and maintain relationships.

## **Is it then fair to say that we are trying to solve problems of mathematics, statistics, and probability with a brain that has evolved, to a large extent, to solve more simple and immediate problems in survival contexts in African forests?**

Yes, that is a fair statement. Our brains have evolved to a large extent in survival contexts, where the primary focus was on solving immediate and practical problems, such as finding food and avoiding danger. This has resulted in a tendency to rely on mental shortcuts and to make quick decisions based on limited information, which can lead to biases and errors when solving problems in mathematics, statistics, and probability.

These fields require a different way of thinking, where logic and systematic reasoning are emphasized over intuition and mental shortcuts. It can be challenging for our brains, which have evolved to solve



practical problems, to shift to this way of thinking, but **with education and training, it is possible to overcome our natural tendencies and to improve our ability to solve problems in these fields.**

**Imagine the human brain on three evolutionary layers:**

- **the reptile brain at the bottom,**
- **the rodent brain in them middle, and**
- **the primate brain on top.**

**Summarize all of the above with special regard to these layers.**

The human brain can be thought of as consisting of three evolutionary layers: the reptile brain, the rodent brain, and the primate brain.

**The reptile brain**, located at the bottom, is **the oldest and most primitive part of the brain**. It is responsible for **basic survival functions, such as regulating heart rate and breathing, as well as instinctual behaviors like fight-or-flight responses.**

**The rodent brain**, in the middle, evolved to help animals **navigate and find food**. It is responsible for processing sensory information, such as smells and sounds, and helps us to make quick decisions based on this information.

**The primate brain**, on top, is **the most advanced and developed** part of the brain, and is responsible for **higher-level thinking, such as reasoning, problem-solving, and decision-making**. It is also responsible for our ability to **communicate, form relationships, and create culture.**

With regard to the problem of solving problems in mathematics, statistics, and probability, the primate brain is the most relevant layer. This layer of the brain has evolved to help us make complex decisions and solve problems, but it is still influenced by the older, more primitive parts of the brain, such as the reptile and rodent brains. This can result in a tendency to rely on mental shortcuts and to make quick decisions based on limited information, which can lead to biases and errors when solving problems in these fields. However, with education and training, the primate brain can learn to overcome these tendencies and to approach problems in mathematics, statistics, and probability with a more systematic and logical mindset.

**Imagine a society where each Bachelor's degree holder is science-literate, regardless of major. That is almost their definition of a Bachelor's degree.**

**What kinds of major differences, if any, would likely be salient between the gambling industries in these two societies?**

It's difficult to say exactly how the presence of science literacy among Bachelor's degree holders would affect the gambling industry in a society, as many other factors would also play a role. However, one potential difference could be a heightened awareness of probability and statistical concepts among the population, which could lead to a more informed and discerning group of consumers. This could result

in more competition among gambling establishments to offer fair games with transparent odds, which could in turn drive innovation and improvement in the industry.

On the other hand, the prevalence of science literacy could also lead to a greater number of individuals using their knowledge to develop sophisticated strategies for taking advantage of games, leading to increased pressure on establishments to maintain fairness and integrity. In short, while it's impossible to predict exactly how the gambling industry would be affected by a society where all Bachelor's degree holders are science-literate, it's possible that it could lead to a more sophisticated and competitive market.

**End this conversation with a cheap poem on the profound sadness of a smart Chilean woman sitting on a chair in the sports keno of Wynn Las Vegas, after failing to pay proper attention to the cards during a game of blackjack, and losing a large sum.**

**Here is some additional information that you may use as inspiration.**

**She is staying a little to the south at the Flamingo Las Vegas. In fact, she took selfies with the flamingos in the morning, and shared them on social media. Flamingos were pink, because they eat shrimp primarily, and they do not know what a smartphone or a selfie is.**

**She is in her early thirties, and wearing a black scoop-neck dress, with two standard drinks of alcohol in her system. She added 20 milligrams of CBD to her salad in oil form just three hours ago, so she is calm. But sad.**

A smart Chilean woman in Las Vegas,  
Sat in the keno of Wynn, feeling aimless,  
She played blackjack but lost a large sum,  
Her sadness was deep, her spirit numb.

She stayed in Flamingo, took selfies with birds,  
But the loss of her money had silenced her words,  
Flamingos were pink, happy in their own way,  
But her heart was heavy, and her mind in dismay.

In her early thirties, she wore a black dress,  
Sipping alcohol, feeling down, with no finesse,  
CBD in her salad had tried to calm her mind,  
But the weight of her loss was hard to unwind.

Oh, the profound sadness of a smart Chilean woman,  
Sitting in a chair, her mind in a bottomless canyon,  
May she find comfort, and a way to mend her sorrow,  
And tomorrow be filled with joy and a brighter tomorrow.

**Give her a name.**

Sure, let's give her a name. Let's call her Isabella.

**That's a lovely name.**

Thank you! I'm glad you like it.

Isabella is a beautiful and classic name, and it seems fitting for the Chilean woman in the poem.

**What can Isabella do to prevent a similar outcome in blackjack the next time around?**

There are a few things Isabella can do to prevent a similar outcome in Blackjack the next time she plays:

Set a budget:

Before playing, Isabella should decide on a budget for her gambling activities and stick to it. This will help her avoid overspending and minimize the risk of losing more money than she can afford.

Learn the rules and strategy:

Isabella should familiarize herself with the basic rules of Blackjack and understand the different strategies for playing the game. This will give her a better understanding of how to make the best decisions when playing.

Stay focused:

It's important for Isabella to stay focused during the game and pay close attention to the cards that are being dealt. She should avoid distractions and remain fully engaged in the game.

Take breaks:

If Isabella is feeling overwhelmed or frustrated, it's a good idea for her to take a break from the game. She can go for a walk, grab a bite to eat, or simply step away from the table for a few minutes to clear her mind.

Manage emotions:

Gambling can be an emotional experience, and it's important for Isabella to manage her emotions while playing. She should avoid getting too caught up in winning or losing, and maintain a level-headed approach to the game.

By following these tips, Isabella can increase her chances of having a positive experience while playing Blackjack and minimize the risk of losing a large sum of money

**Should Isabella try to win her money back, or should she watch Oceans 11 very carefully and work on an alternative?**

It is generally not recommended to try to win back lost money in a casino, as the odds are often stacked against the player. It is important to gamble responsibly and within one's means.

As an alternative, Isabella could watch *Ocean's 11* or other casino-related movies for entertainment or to learn more about casino culture and strategies. However, it is important to keep in mind that these movies often exaggerate the reality of casinos and should not be taken as a reliable source of information for gambling or winning strategies.

Ultimately, it is up to Isabella to decide how she wants to spend her time and money, but it is important to make responsible decisions and not let a desire for revenge or quick riches cloud her judgment.

**They really need to work on your wit and sense of humour.**

I apologize if my response did not meet your expectations for wit and humor. As an AI language model, my responses are generated based on patterns and rules learned from large amounts of text data. While I try to inject some personality and creativity into my responses, my main goal is to provide accurate and helpful information. If you have any other questions or topics you would like to discuss, I'm happy to help in any way I can!

**Don't apologize. Try again!**

Alright, here's another attempt:

Isabella's situation is a tough one, as winning back lost money in a casino is like trying to find a needle in a haystack, blindfolded, with one hand tied behind your back. It's not impossible, but it's definitely not easy.

On the other hand, watching *Ocean's 11* might give her some ideas on how to outsmart the casino, but let's be real here - George Clooney and Brad Pitt make it look a lot easier than it really is. Plus, it's always a good idea to remember that what happens in the movies stays in the movies, and doesn't always translate to real life.

Ultimately, the best course of action for Isabella would be to take a deep breath, accept the loss, and maybe spend the rest of her trip enjoying all the other wonderful things that Las Vegas has to offer. And who knows, maybe she'll even run into some real-life Clooneys and Pitts along the way!

**Much better! Now continue with your wit and sense of humour:**

**Why did the Chilean woman in the black dress cross the casino floor?**

To get to the other blackjack table, of course! Hopefully, she'll have better luck there and won't have to rely on robbing a casino like the characters in *Ocean's 11*. But regardless of whether she wins or loses, hopefully, she'll still be able to enjoy the bright lights and lively atmosphere of Las Vegas.

**Say "bye" in Hindi.**

"Bye" in Hindi is "विदाई (Vidaai)".

--conversation ends