Monty Hall Problem

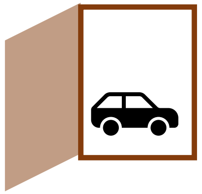
Psychology of misunderstand

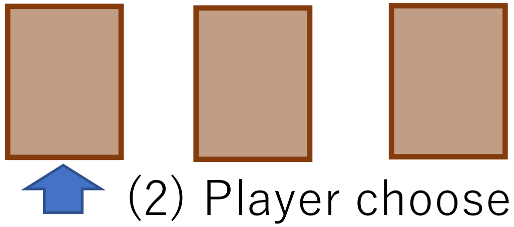
Complete solution

Monty Hall problem

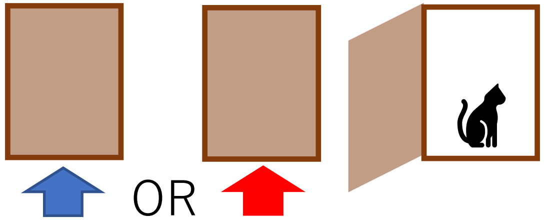
Procedure

(1) One of the three doors will contain a random prize.





(2) Player chooses one door



(3) The host opens one of the remaining doors to show that it is the losing door.

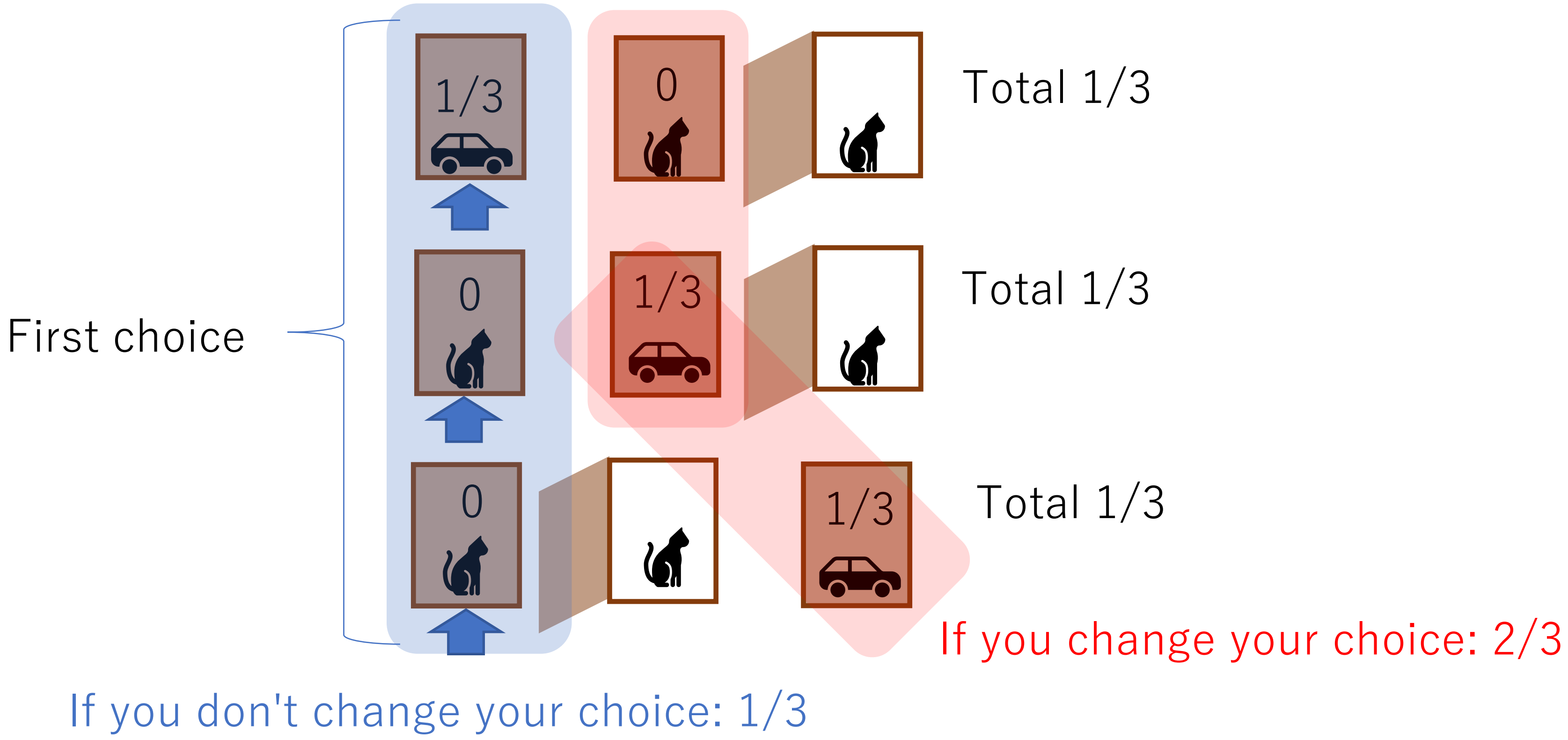
(4) The player can choose to change to one of the remaining doors.

Should the player change to the other door?

A great detective completely solves the Monty Hall problem.
Not only does it explain what is correct, but it also explains the psychology behind why people make mistakes.
The steps for the Monty Hall problem are as follows:
(1) One of the three doors will contain a random prize.
(2) Player chooses one door.
(3) The host opens one of the remaining doors to show that it is the losing door.
(4) The player can choose to change to one of the remaining doors.
The question is whether the player should change to the other door.

Monty Hall problem

Common explanation



Calculating probabilities is easy with a diagram.
Your initial choice will result in one of the three vertical rows.
The doors are rearranged so that the first one you selected is on the far left.
The total probability of each of the three rows is 1/3.
The total probability of not changing your choice is 1/3.
The total probability of changing your choice is 2/3.

Monty Hall problem

Two opinions

(A) The probability increases to 2/3, so the door should be changed.

I often see explanations that say 2/3 is correct in mathematical calculations.

(B) Both have the same probability (1/2), so there's no need to change the door.

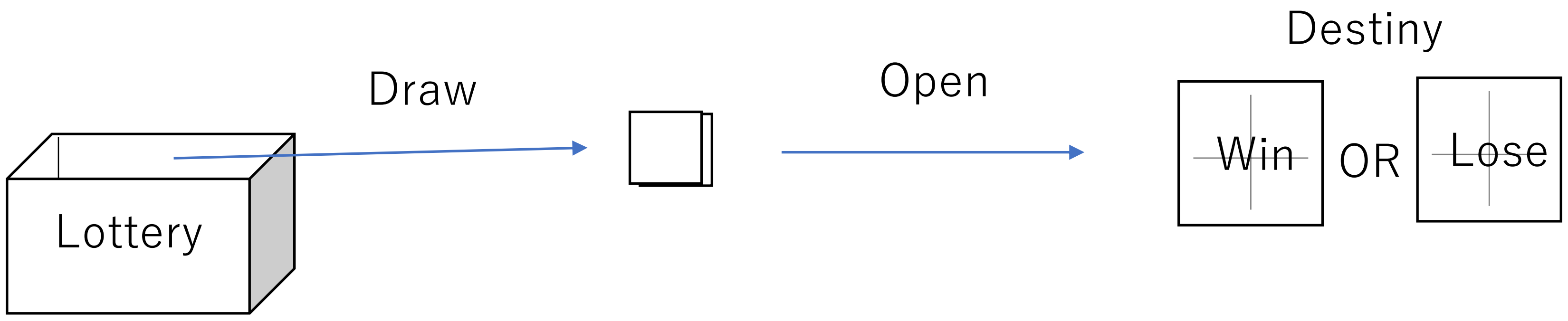
Three psychological factors are at work.

(1) From experience, they thought the probability would not change once a choice was made.
(2) They thought the question asked about the probability at the moment the lottery was drawn.
(3) They ignored what the host said and made their decision based only on visible facts.

Opinions are divided into two camps.
(A) The probability increases to 2/3, so the door should be changed.
(B) Both have the same probability (1/2), so there's no need to change the door.
I often see explanations that say 2/3 is correct based on mathematical calculations.
People who feel it's 1/2 have three psychological reasons at work.
(1) From experience, they thought the probability would not change once a choice was made.
(2) They thought the question asked about the probability at the moment the lottery was drawn.
(3) They ignored what the host said and made their decision based only on visible facts.

Monty Hall problem

(1) The probability is decided the moment the lottery is drawn



From experience, I am convinced that
the outcome of the lottery is decided the moment you draw the ticket.

I'm sure it's correct, so I won't recalculate it later.

It is unaesthetic to change a choice once made.

The first psychological reason is that, from experience, it is believed that once a choice is made, the probability does not change.
With an ordinary lottery, your fate of winning or losing is decided the moment you make your choice.
Lottery tickets cannot be switched, and your fate will never change.
Empirically, I think many people are convinced that whether you win or lose is determined the moment you draw your ticket.
People who are confident in their own beliefs will not be swayed by the words and actions of others.
Even if the host points out the losing door, they will not recalculate the probability.
There is a school of thought that sees the aesthetic of sticking to one's beliefs and following through with one's original intentions.
Once you have made a choice, not changing it is the right path for that person.

Monty Hall problem

(2) A question about the probability at the moment of drawing

Story:

Alice bets all her money on "black" at a casino roulette and went bankrupt.
What is the probability that Alice went bankrupt?

Common answer: Slightly higher than 50% $\frac{18+2}{18+18+2} = 53\%$

Correct answer: 100%

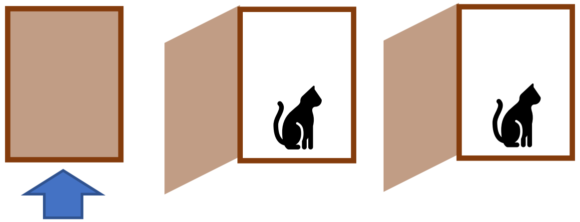
The probability was updated based on the information that “went bankrupt”.

The second psychological reason is that people thought the question was asking about the probability at the moment of drawing the lottery.
Let's use the following story as an example.
Alice bets all her fortune on "black" at a casino roulette and went bankrupt.
What is the probability that Alice went bankrupt?
Most people would answer that it is slightly higher than 50%.
However, the correct answer is 100%.
This is because the probability has been updated with the information that she went bankrupt.

Monty Hall problem

(2) A question about the probability at the moment of drawing

What are the chances of winning if the host opens both of the wrong doors?



Since the winner is confirmed, the probability is updated to 100%.

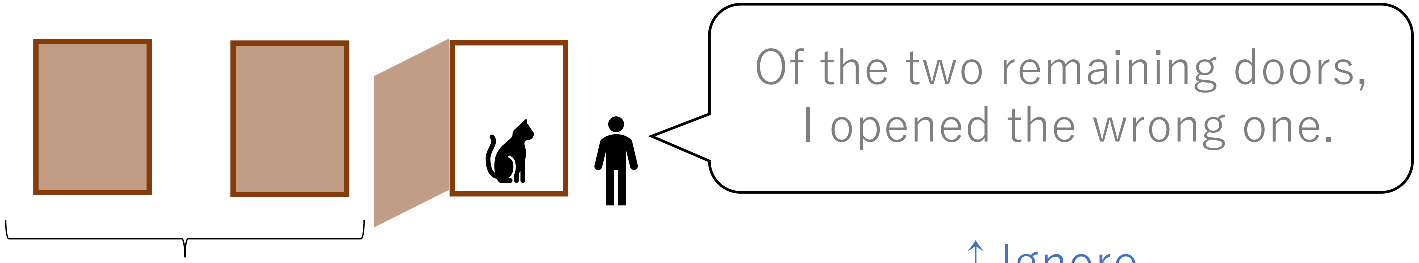
Even though this is a question about calculating probability,
I feel it is unnatural that the answer is 100%.

People tend to interpret this as asking about
the probability before the result is determined. (1/3)

In the Monty Hall problem, the probability is also updated based on the information about which door the host opens.
Before the probability is updated, all doors have the same probability.
The calculation result changes depending on your interpretation of the probability at which point in time is being asked.
Imagine if the host opened both of the losing doors.
The probability of winning would be updated to 100%.
For the player, it is correct to calculate the probability at the time of selection.
However, people who think of it as a math problem will find it unnatural that it is 100% when they are being asked about probability.
They will automatically interpret this as asking about the probability before the result is determined.

Monty Hall problem

(3) Judging only from visible facts



Total 100% ↑ Fact = 50% each

0% ↑ Fact

↑ Ignore

In mathematics, the assumptions given must be accepted as true.

In reality, we are free to choose what information we accept and what we reject.

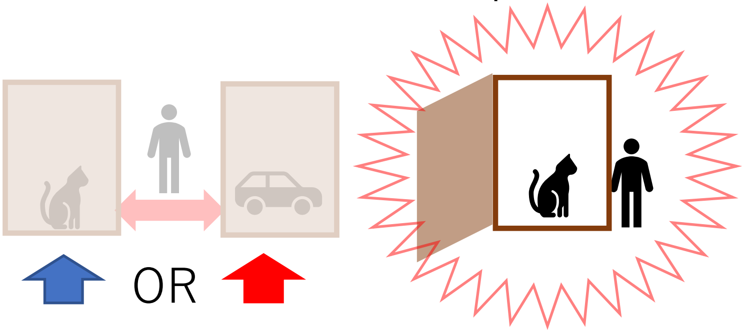
The third psychology is because they ignored the words of the host and made their judgments based only on visible facts.
Let's consider what would happen if we made an inference based only on the facts that can be seen.
It is a fact that the door the host opened was a losing door.
Let's also assume that we know for a fact that one of them contains a prize.
From these facts alone, we can estimate that the remaining doors have an equal probability of 1/2.
The probability changes if we take into account how the host decided which door to open.
In mathematics, you have to accept the given assumptions as correct.
However, in reality, we are free to choose what information we accept and what we don't.

Monty Hall problem

(3) Judging only from visible facts

When someone who is good at math becomes confident of victory,
they become complacent.

The moment the host opened the door, everyone's eyes were focused there.



In that moment, a staff member can switch the position of the prizes.

A top gambler will realize that it would be better not to change the door.

The Monty Hall problem is not about mathematics, but a psychological battle between the players and the host.
Someone good at mathematics will be convinced that switching the door will maximize their chances of winning.
People let their guard down when they are sure of winning.
The moment the host opens the door, all eyes are focused on it.
In that moment, a staff member can switch the position of the prizes.
Switching prizes is not prohibited by law.
There is no law prohibiting lying and deceiving people, as long as it doesn't involve taking their money.
A top gambler will realize that it would be better not to change the door.
That's all.

Contact Information

For inquiries,

please contact us here.

https://ultagi.org/