0.5 lessons
1 die
1 shaker

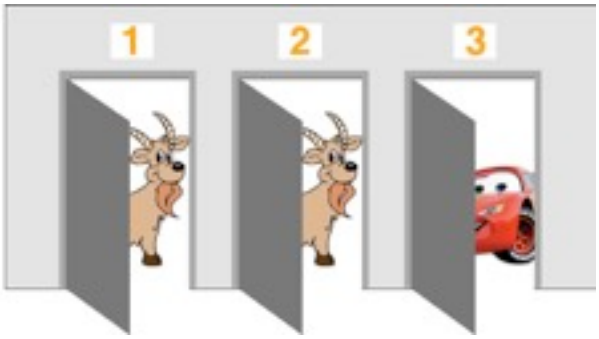
THE MONTY HALL PROBLEM

The Monty Hall problem is a probability puzzle based on the American television game show "Let's Make a Deal". The show was broadcast from 1963 until, with some interruptions and modifications, 2003. The name comes from the show's host, Monty Hall.

In 1990 Marilyn vos Savant, the person tested with the highest IQ ever (228), wrote in the magazine "Parade" in her column about the Monty Hall problem:

> Suppose you're on a game show and you're given the choice of three doors. Behind one door is a car; behind the others, goats. The car and the goats were placed randomly behind the doors before the show. The rules of the game show are as follows: After you have chosen a door, the door remains closed for the time being. The game show host, Monty Hall, who knows what is behind the doors, now has to open one of the two remaining doors, and the door he opens must have a goat behind it. If both remaining doors have goats behind them, he chooses one randomly. After Monty Hall opens a door with a goat, he will ask you to decide whether you want to stay with your first choice or to switch to the last remaining door. Imagine that you chose Door 1 and the host opens Door 3, which has a goat. He then asks you "Do you want to switch to Door Number 2?" Is it to your advantage to change your choice?

1 Let yourself be guided by intuition. What is it telling you? Does swapping the doors raise your chances of winning?



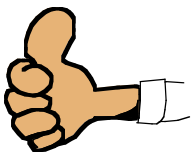
Then vos Savant presented the solution:

> As the player cannot be certain which of the two remaining unopened doors is the winning door, most people assume that each of these doors has an equal probability and conclude that switching does not matter. In fact, in the usual interpretation of the problem the player should switch – doing so doubles the probability of winning the car, from 1/3 to 2/3.

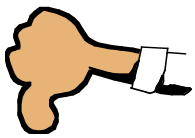
When the above statement of the problem and the solution appeared approximately 10,000 readers, including nearly 1,000 with PhDs, wrote to the magazine claiming the published solution was wrong.

2 Simulate the game in pairs, one takes the role of the host, the other one the one of the player. Do it 40 times, the first 20 times the player does not change the door, the second 20 times the player changes the door. Note how many cars are being won with either strategy.
Is Marilyn dos Savant right or not?

That is how the simulation can take place:
- First the host hides the car. He makes a throw but does not remove the shaker with the die inside. He alone peeps underneath to see the result (1 or 2 pips means that the car is behind door 1, 3 or 4 pips that it is behind door 2 and 5 or 6 pips that it is behind door 3).
- Then the player chooses the door.
- Next the host opens one of the remaining doors with a goat behind. There is always at least one with a goat and the host knows which one.
- The player now sticks to his door (in the first 20 simulations) or changes to the third door (in the second 20 simulations).
- Finally the shaker is removed, the car revealed and the result noted down.



PRO VOS SAVANT
Let's assume that the player takes a friend along. They pick a door together. Their chances to have hit the door with the car is 1/3. Now the player sticks to the chosen door whereas his friend swaps.
One of them must win the car, and because the player's chances are 1/3, his friends chances must be 2/3.



CONTRA VOS SAVANT
When the host has opened the door with the goat there are two closed doors left and the car can hide behind either of them. So the chances are the same for both doors, i.e. 1/2.

3 One of the explanations must be wrong. Which one is it and where is the mistake?

4 Watch the movie about the Monty Hall Problem on the DVD downloaded from youtube.