

Monty Hall Problem Investigation

Introduction

“Let’s Make a Deal” is a popular TV game show that debuted in the 1960’s that was created, produced and hosted by Monty Hall. The show’s main attraction was a guessing game that Hall invited members of the studio audience to play. The contestant is shown three doors and is told that one door contained a very valuable prize, while the other two contained “zonks”, or nearly worthless prizes (the most famous example of this game had a new car as the prize and live goats as the zonks). The contestant, without knowing which door concealed what, selected one of the doors. Then, Hall revealed one of the two doors that had the zonk behind it.

Hall then posed an important question to the contestant: do they want to stay with the door they chose in the beginning, or do they want to switch to the other door that hadn’t been revealed yet? Once the contestant has made their choice, Hall opened the contestant’s door and revealed whether or not the contestant won the prize or “won” a zonk.

This unique scenario piqued the interest of mathematicians and statisticians who wondered whether there was a strategy to this guessing game, a way to make it so that you have the greatest possible chance of winning the prize instead of the zonk. They named this particular problem the “Monty Hall Problem” in honor of the game show’s host.

This investigation will attempt to solve the Monty Hall Problem and determine the optimal strategy for Let’s Make a Deal.

Hypothesis

When playing “Let’s Make a Deal”, is it a better strategy to always switch doors when prompted, or to always stay with the door you chose initially? Why?

Materials Available

Small opaque paper cups (3 per pair)

Marble

Procedure

- 1) Each pair will be randomly assigned by the teacher to be a “switcher” pair or a “stayer” pair.
- 2) Decide which member of your pair will be the “host” and which will be the “contestant” (these roles will switch later on in the investigation).
- 3) The host will take the three cups and the marble, while the contestant closes their eyes or looks away from the host (no peeking!).
- 4) While the contestant can't see, the host will overturn the three cups and hide the marble underneath one of the overturned cups. Be sure to move the cups around on the table so the contestant can't easily tell which cup has the marble.
- 5) When the host is ready, the contestant will open their eyes or looks back to the host.
- 6) The contestant will pick which one of the cups they believe has the marble underneath it.
- 7) After the contestant selects a cup, the host will reveal only **one of the overturned cups that has no marble underneath** (if the contestant picked the cup with the marble underneath, reveal either of the other two cups; if the contestant picked a cup with no marble underneath, reveal the other cup that has no marble underneath).
- 8) If your pair is a “switcher” pair, then the contestant will automatically switch their choice from the initial cup they chose to the other still-unrevealed cup. If your pair is a “stayer” pair, then contestant will keep their choice as the initial cup they chose.
- 9) The host will reveal the cup that is the contestant's final choice.
- 10) The pair will record whether or not this game was a success (the contestant's final choice had the marble underneath) or a failure (the contestant's final choice did not had the marble underneath) in the “Data” section.
- 11) Repeat steps 3-10 (using the same strategy each game and recording whether each game is a success or a failure) 19 more times, for a total of 20 games played.
- 12) After 20 games have been played, the roles of the pair members will change (the host will become the contestant, and vice versa), **and also** the type of your pair will change (“switchers” will become “stayers” and vice versa).
- 13) Repeat steps 3-10 (being sure to using the other strategy) 20 more times, for a total of 40 games played.

Data

	Number of successes	Number of failures
As “switchers”		
As “stayers”		

Conclusion

Which strategy, switching or staying, had the higher rate of success?

Why do you think this strategy has a high rate of success?