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MythBusters "Wheel of Mythfortune" Analysis

This episode of MythBusters, called "Wheel of Mythfortune" included the testing of several myths that involved statistics. One such myth was about the Monty Hall paradox, which is a mathematical paradox that is named after the host from the TV show Let's Make a Deal. On this show, the contestant would choose one of three doors to try to find the one that had a prize behind it. After their initial choice, the host would reveal an empty one of the two remaining doors. The contestant would then have to choose whether to stick with their initial choice, or switch to the other door. The prize would then be revealed. The paradox is in the fact that the majority of the time, switching yields a prize more than sticking with one's initial choice. This is counterintuitive, because it seems that there should be a 50-50 chance between the two doors. After the reveal there are only two options left, one of which must contain the prize. The psychological part of the problem is that the majority of people tend to stick to their initial guess thereby winning the prizes less frequently. The mythbusters' question was whether the Monty Hall paradox is real, both psychologically and mathematically.

The mythbusters tackled the psychological aspect first, by creating a simulation of the TV show. They created a version of the set, with the doors to choose from. They did this instead of using a deck of cards to represent the doors to make the experience more like the game show. This was in order to remove potential lurking variables such as the difference in feeling of a

game show, rather than viewing a deck of cards. They then collected a group of volunteers to participate in the experiment. Each volunteer was kept apart from the stage, so they did not see the process before their turn. This was a control for the experiment. They also used a randomizer to determine the order in which the participants went, in order to randomize the assignment. The mythbusters ran the simulation just like Let's Make a Deal, and counted the number of successes, switches, that took place. They found no successes, because 100% of their volunteers decided to stick with their original guess. The proportion of sticking is far greater than the proportion would be if people's decisions of door choice were independent of their original guesses, which would be approximated as 50% each stick and switch. The mythbusters could have performed a one sample z test for proportions to determine if this proportion was significantly different from 50%. The null hypothesis, Ho, would be the population proportion of people who stick is 0.5, and the alternative hypothesis, Ha, would be $p>0.5$. The mythbusters concluded that there is a psychological preference for sticking, because their sample appeared to show that, but they did not perform the z test.

The next portion of their testing was to perform a simulation of results if people were to switch and stick evenly. They again built a simulator to test this, but this time a mini version of the doors with pre-decided scenarios of wins to run through it. The pre-decided winning doors were randomly assigned in order to remove bias. This simulator allowed them to execute a greater number of tests, because they could run through each scenario much quicker. This increased sample size increases the accuracy of the simulation. Each mythbuster took one scenario, so one of them always stuck with his original choice on the simulator, while the other always switched. They recorded the number of wins in each case, and compared after. It is

unclear how the mythbusters chose their original door choices in the test. Their choices may not have been random, and may have been biased because the same person might be inclined toward a given door number. However, with the randomization of the winning doors, this should not affect the results, as long as the winning doors were unknown by the mythbusters. They found that switching yielded a much larger proportion of wins than sticking. If they had used a statistical test, they could have done a two sample z test for the difference in proportions, where Ho: p_{switch}-p_{stick}=0 and Ha: p_{switch}-p_{stick}>0. In this case p_{stick} represents the true proportion of wins with sticking, and p_{switch} represents the true proportion of wins with switching. The sample size n for each population was 50. The number of successes for switches was 37, so p_{switch}=0.74. The number of successes for sticks was 8, or p_{stick}=0.16. Using the two sample z-test, the pooled proportion is $p_c=\frac{37+8}{50+50}=0.45$. Then, $z=\frac{(0.74-0.16)-0}{\sqrt{(0.45)(1-0.45)(\frac{1}{50}+\frac{1}{50})}}=5.83$. Then the p-value = normalcdf(5.83, ∞, 0, 1) $\approx$ 0. Since the p-value of 0 is far smaller than the α of 0.05, we can reject the null hypothesis that there is no difference in proportions. We conclude that the proportion of wins switching from the original answer is statistically significantly greater than the proportion of wins sticking. The mythbusters also reached this conclusion, due to their observed differences in the data collected.

After all of their analysis, the mythbusters concluded that the Monty Hall paradox is in fact a statistically significant event, both psychologically and mathematically, and so they called it confirmed. After my own statistical analysis, I agree with this assessment. It would have been beneficial if they had shown their work through statistical tests that led them to their conclusions. However, the experimental designs were relatively solid, and their results, if tested using

statistics, would have yielded the same conclusions. Therefore, this portion of the “Wheel of Mythfortune” was true!