How the Presence of Pedestrians Influences Vehicle Behavior

I. Introduction

The issue of drivers failing to completely stop at stop signs is a widespread one. For example, in my city, there is a neighborhood that is known for its stop signs that very few drivers actually stop at. But this is not an issue that should be ignored. According to the U.S. Department of Transportation's Federal Highway Administration, "Approximately 72 percent of fatal crashes occur at unsignalized intersections. Most often, the cause of the crash can be attributed to a driver failing to yield the right of way." In other words, accidents at intersections without lights, like ones with stop signs, make up a staggering majority of deadly vehicle-related accidents in the U.S.

Failing to stop at stop signs is a dangerous and illegal practice, and this experiment could allow us to understand how frequently this issue occurs. If we find that a shocking portion of drivers fail to follow the laws about stopping for pedestrians, we could use this experiment to spread awareness about the issue and lower the risk for fatal motor accidents in our area.

II. Statistical Question

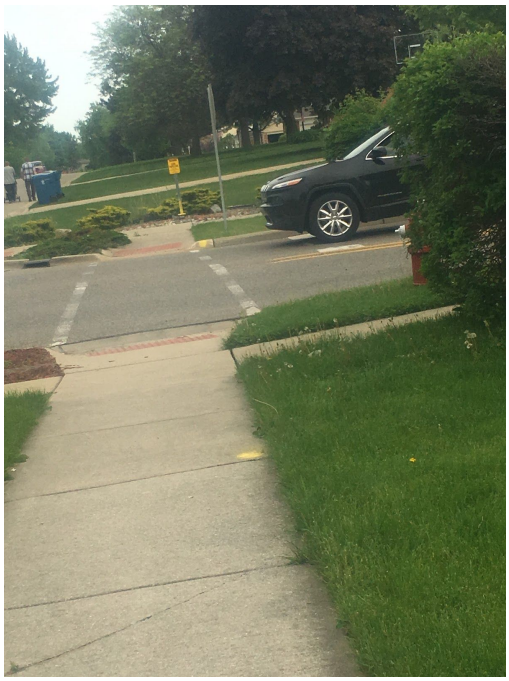
Does the distribution of vehicles at a stop sign who come to a full stop, roll through or don't stop at all when pedestrians are waiting to cross the street differ from the distribution of vehicle behavior when people are not waiting to cross the street?

Ho: There is not a difference between the distributions of vehicle behavior at stop signs when pedestrians are and are not waiting to cross the street.

Ha: There is a difference between the distributions of vehicle behavior at stop signs when pedestrians are and are not waiting to cross the street.

III. Data Collection

We chose to collect our data at a heavily travelled neighborhood intersection. To gather data about how vehicle behavior is distributed when no pedestrians are crossing, we stood about 50 feet away from the intersection so that a hedge along the main road blocked the vehicles from seeing us easily. Because we were out of view of the vehicles, they did not change their behavior simply because we were collecting data on them. We recorded the behavior of 30 cars in the categories that corresponded with their actions, and then we moved on to our second set of data. We collected our second set of data as we waited by the stop sign as if we were waiting to cross the street. We stood on the sidewalk near the pedestrian crossing and made eye contact with any drivers that approached the intersection. If the driver noticed us, we crossed the street when they started to brake, and recorded whether or not they fully stopped before the crosswalk. If they failed to fully stop, we recorded their behavior in the "rolled through" category. If they did so successfully, we recorded it in the "came to a full stop" category, and if they failed to notice us or sped through to avoid stopping to let us cross, we recorded it in the "did not stop at all" category. After each time we crossed the street, we walked about 100 feet in the other direction to prevent any vehicles that witnessed us crossing previously from seeing us cross a second time. We then turned around and repeated the process on the next vehicle that approached the intersection until we had 30 data points.



Our view during data collection while we were not crossing the street

We cross the street as a car stops at the stop sign for us

Raw Data

Timestamp	Crossing (Data #1)	Not Crossing (Data #2)
2019-05-27	Rolled through	Rolled through
2019-05-27	Came to full stop	Did not stop at all
2019-05-27	Came to full stop	Rolled through
2019-05-27	Rolled through	Rolled through
2019-05-27	Did not stop at all	Rolled through
2019-05-27	Rolled through	Rolled through

2019-05-27	Rolled through	Rolled through
2019-05-27	Came to full stop	Rolled through
2019-05-27	Rolled through	Did not stop at all
2019-05-27	Did not stop at all	Rolled through
2019-05-27	Rolled through	Rolled through
2019-05-27	Came to full stop	Rolled through
2019-05-27	Came to full stop	Rolled through
2019-05-27	Rolled through	Rolled through
2019-05-27	Came to full stop	Rolled through
2019-05-27	Came to full stop	Rolled through
2019-05-27	Came to full stop	Did not stop at all
2019-05-27	Rolled through	Came to full stop
2019-05-27	Did not stop at all	Came to full stop
2019-05-27	Came to full stop	Came to full stop
2019-05-27	Came to full stop	Did not stop at all
2019-05-27	Came to full stop	Came to full stop
2019-05-27	Did not stop at all	Rolled through
2019-05-27	Rolled through	Did not stop at all
2019-05-27	Rolled through	Rolled through

2019-05-27	Came to full stop	Did not stop at all
2019-05-27	Did not stop at all	Did not stop at all
2019-05-27	Came to full stop	Rolled through
2019-05-27	Came to full stop	Came to full stop
2019-05-27	Rolled through	Rolled through

IV. Data Display

Two-Way Frequency Table

	Waiting to cross	Not waiting to cross	Total
Complete stop	14	5	19
Rolled through	11	18	29
Did not stop at all	5	7	12
Total	30	30	60

<u>Crossing (Data #1)</u>

KEY

- Came to full stop - **46.7%**
- Did not stop at all - **16.6%**
- Rolled through - **36.7%**

Not Crossing (Data #2)

KEY

Came to full stop - **16.7%**

Did not stop at all **23.3%**

Rolled through - **60.0%**

V. Data Analysis

We used a chi-squared test for homogeneity. Because we had reasonably random samples of vehicles and at least five counts in each category, our data met the assumptions required for chi-squared tests for homogeneity. We calculated a chi-squared value of 6.28614 and a p-value of .04315. We used a significance level of .05. We used the following formula to find our chi-squared value: $\chi^2 = (\text{observed value} - \text{expected value})^2 \div \text{expected value}$

Degrees of freedom = 3 -1 = 2

P-Value = $P(6.28614 < \chi^2)$ = .04315

VI. Conclusion

Given that the distributions of vehicle behavior are the same when pedestrians are and are not waiting to cross the street, there is a .004 probability that data like ours or more extreme would occur purely by chance. This provides strong evidence against the claim that the distributions of vehicle behavior are the same, and is significant at alpha level of .05. Therefore since our p-value of .004 is less than our alpha of .05, we reject the claim that the distributions of

vehicle behavior are the same. There is sufficient evidence to suggest that the distributions of vehicle behavior are different when pedestrians are and are not waiting to cross the street.

VII. Reflection

Our findings suggested that, as we anticipated, there is a significant difference in the distributions of vehicle behavior when pedestrians are and are not waiting to cross the street. Overall, our data collection went well. One thing we could have done to improve our experiment would be to collect data over multiple days and times to ensure that our data is not just an outlier. This would have been a good idea because we collected our data at 4pm on Memorial Day, so the holiday and "rush hour" could have influenced whether or not some drivers decided to be cautious and obey traffic rules during our experiment. We also could have stood further back and waited a bit longer hidden by the shrubbery so our chances of being seen when we weren't waiting to cross the street was lower.

VIII. Citations

"Intersection Safety Issue Briefs." *Safety*, Federal Highway Administration safety.fhwa.dot.gov/intersection/other_topics/fhwasa10005/brief_4.cfm.