BLINK AND YOU'LL MISS IT

by Tara Noon

Introduction

Road safety is a top priority, and a driver's ability to prevent collisions is greatly impacted by their reaction time. Exploring how a driver's vulnerability to crashes is increased when their reaction time is below average as it increases the total stopping distance of their vehicle. This analysis will show how human factors can raise the probability of accidents and emphasise the need for driver awareness and attention.To conduct this investigation, I tested the reaction time from a sample of 14 (7 girls and 7 boys) grade 9 (14-15 years old) individuals, comparing how below average reaction time affects stopping distance.

Aim

To understand how a below-average reaction time impacts a vehicle's stopping distance which could make a vehicle collision more likely.

Hypothesis

If a driver has a below-average reaction time, then their total stopping distance will increase (leading to a higher probability of collision)

equipment

- laptop
- simulating program
- Exisiting statistical studies on reaciton time

Variables

- Independent Variable: Driver reaction time (measured in seconds)
- Dependent Variable: The total stopping distance of the car (measured in metres)

Limatations

Given safety risks, legal restrictions, resource limitations, and difficulty in controlling variables, using a computer simulation is the only feasible method for Year 9 students to safely and accurately investigate how reaction time affects a car's stopping distance.

Analysis of results

As per the graph we see that there is a direct positive relationship between reaction time and stopping distance. We see that the average of reaction times is 0.91sec, and the average stopping distance is 45.2m. Moreover it is observed that the standard deviation of reaction time is 0.25sec, whereas the standard deviation of the stopping distance is 5.2m. Thus there is minimal deviation in reaction times among participants, and this has resulted in minimal stopping distance deviation for most people.

However on the graph it is evident that those with a reaction time significantly above the median reaction time of 0.95sec, the stopping distance is up to 10m more, which is significantly more variation in stopping distance compared to rest of sample.

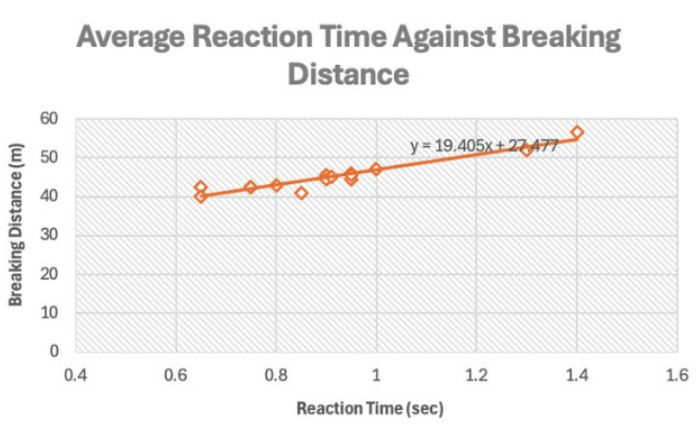
Conclusion

Thus by analysis of results we see that there is a positive linear relationship between stopping distance and reaction time, where for the majority of participants there was minimal deviation in reaction time and this resulted in minimal deviation in stopping distances. However for people who had an abnormally large reaction time we see that this resulted in a significant increase in the stopping distances. Therefore based on these results I can conclude that having a below average reaction time does significantly impact the average stopping distance to an extent where the extra stopping distance could result in an increased probability of collisions. As a young person who is soon to be behind the wheel, this experiment demonstrates the importance of maintaining a high concentration and mental wellbeing when on the road as there are a number of factors which could lead to a slower reaction time such as sleep deprivation, passenger distractions and intoxication,. Thus it's important we all stay vigilant of the impacts these factors can have on our ability to drive safely, preserving the safety of us and other road users in the future.

procedure

1. Prepare simulator: Calibrate program to ensure all participants will complete the simulation on the same laptop, driving the same virtual car at a constant speed of 70 km/h on an identical virtual road surface to ensure validity of results
2. Inform Participants: Students will be briefly informed about the game's objective and given a practice run before the actual data collection begins.
3. Measure Reaction Time & Stopping Distance: The simulation software will precisely measure each participant's reaction time and calculate the corresponding total stopping distance for each trial.
4. Complete Trials and Average Results: Each participant will perform three trials, and the average of their reaction times and stopping distances will be calculated to increase data reliability.
5. Repeat steps with Others: The same procedure will be repeated with multiple participants to gather a larger dataset for a more comprehensive analysis.

graphs & data



AVRG Reaction Time(sec)	AVRGBreaking Distance(m)
0.85	41
1	47
0.65	42.5
0.65	40
0.95	44.5
0.75	42.5
0.75	42.5
0.8	43
0.9	45.5
0.9	44.5
0.95	46
1.4	56.5
1.3	52
0.95	45.5
0.91	45.2
AVRG:0.91	AVRG:45.2

Key findings :

- Only two participants had significantly longer reaction times (above 1.3 s), which caused the largest deviation in braking distance.
- The difference between the slowest and fastest stoppers was more than 15 m, showing how small reaction changes can greatly affect safety.
- Data suggests that even a 0.3 s delay in reaction time can increase stopping distance by roughly 6 m at 70 km/h.
- Around 70% of participants had reaction times between 0.8 and 1.0 seconds, showing consistent driving responses.
- The fastest reaction times (0.65 s) were linked to the shortest stopping distances (42 m).