SASTA OLIPHANT SCIENCE AWARDS

SOUTH AUSTRALIAN SCIENCE TEACHERS ASSOCIATION

Prize Winner

Programming, Apps & Robotics

Year 5-6

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Speed Kills

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Introduction

Many people are driving vehicles every day. According to the Transport Accident Commission, speeding is the main cause of fatal car accidents in Australia and consistently contributes to 41% of road fatalities and 24% of serious injuries each year. Globally, 1.25 million road crash deaths occur every year and road crash is the #1 cause of death for people aged 15-29 years old (World Health Organisation, 2019). ***This proves that a large proportion of road crashes happen primarily from speeding and we lose many lives from it every year.***

Aim of entry

The aim of my entry is ***to educate drivers and make them aware that, although they choose the speed they are driving at, physics chooses the rest***. My program explains the physics behind speed, reaction time and braking distance to the main target audience of students and new drivers in order to hopefully reduce accidents on the road. I have done this using an interactive interface and live explanation. ***The main aim therefore is to encourage people to pay attention to the speed they drive on the roads so that they avoid accidents and save lives.***

Scientific purpose of entry

The scientific purpose of my entry is to teach people the physics of speed, velocity, reaction time and distances. The entry also serves the purpose of demonstrating how physics triggers speed to cause road crashes and the inter-relationships between speed and crashes.

Explanation of the program

Speed is the time rate at which an object moves along a path, while velocity is the rate and direction of an object's movement. Reaction time is the time taken for a distraction or hazard to be noticed. Reaction distance is the distance the vehicle would travel between the time the hazard is noticed and the brakes are applied (Figure 1). When travelling at different speeds, reaction time differs as the distance travelled before brakes are applied changes depending on the speed of a vehicle.

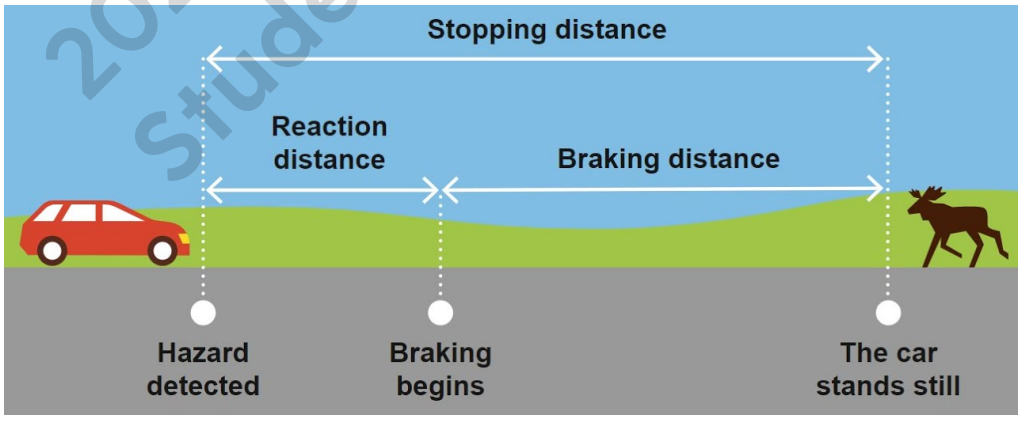


Figure 1: reaction distance + braking distance = stopping distance

When the brakes are applied, the vehicle still travels a distance before it comes to a stop and this is known as the braking distance (Figure 2). This braking distance too is directly influenced by the speed of the vehicle. As the braking distance is proportionate to v^2 (speed * speed) shown below, any small change in speed increases the braking distance significantly. This can result in the driver being not able to stop the vehicle in time when the travelling speed is high.

$$Stopping\ Distance = RD + BD$$

$$RD = v.\ t_r$$

$$BD = \frac{v^2}{2\mu g}$$

v	Velocity (speed) of the vehicle in m/s
t_r	Reaction time in seconds (s)
μ	Friction coefficient
g	Gravity (9.81 m/s^2)

Figure 2: reaction distance + braking distance = stopping distance

Potential applications

Potential applications for my entry are to use as an educational component for drivers and as a demonstration of physics knowledge of vehicle speeds. Also, my program could be used for people learning or who will soon learn how to drive, so they can understand the significant role the speed they are driving at play, and the negative effects which occur when speed limits are not followed.

It can raise awareness amongst these audiences and improve the safety on the roads and thereby, hopefully reduce crashes and save lives.

Computer required

My program can be accessed from any computer, as long as there is access to the internet.

Instructions

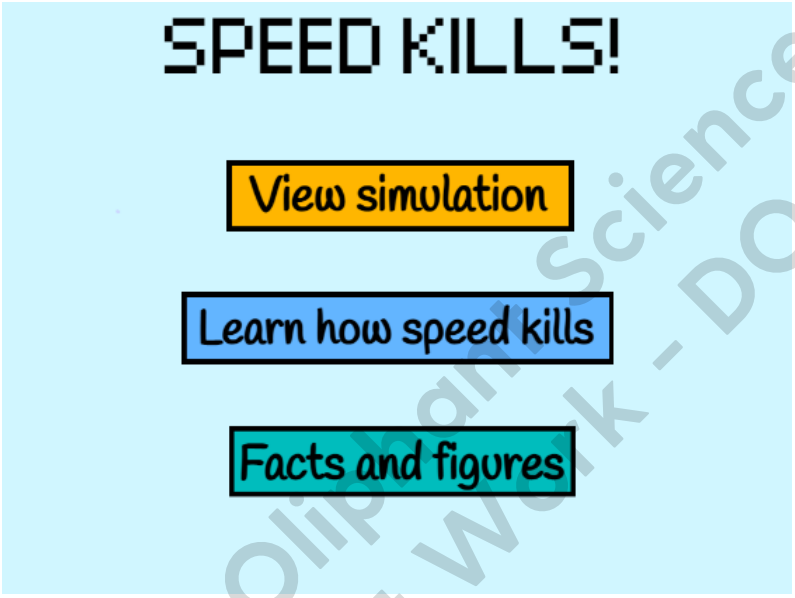
1. Once connected to the internet, go to the following URL using any browser https://scratch.mit.edu/projects/552849656/

2. When you are ready to start, press 

3. Click on the desired section to learn about how speed affects your reaction time and the consequences that come with it

Explanation of program

The program is presented under three areas:



- ***Simulation:*** This section of the program is the interactive simulation of different speeds. The user can select a starting speed of either 60 km/h, 80 km/h or 100km/h to see how fast vehicles move for each speed and the consequences. Once a speed is selected, a simulation is shown of how reaction times work and what would happen if something appears unexpectedly on the road whilst driving. The user is able to experience that faster speeds makes it harder to apply brakes in time and that the object, in this case a bear, will be injured at 80km/h and killed at 100km/h.

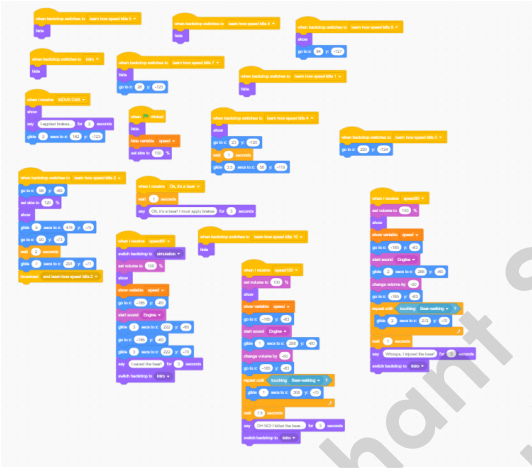
- ***Knowledge Base:*** This section of the program contains the physics knowledge base around *'how speed kills'*. From here, the user can learn about speed, consequences of higher and lower speeds, reaction time and braking time. The physics behind the speed of the vehicle is explained in detail in this section.

- ***Statistics:*** Seeing *facts and figures*. This allows users to get an insight into how speeding looks in the real world and the effects it has on crashes. The facts and figures highlight the intensity of road crashes nationally and globally.

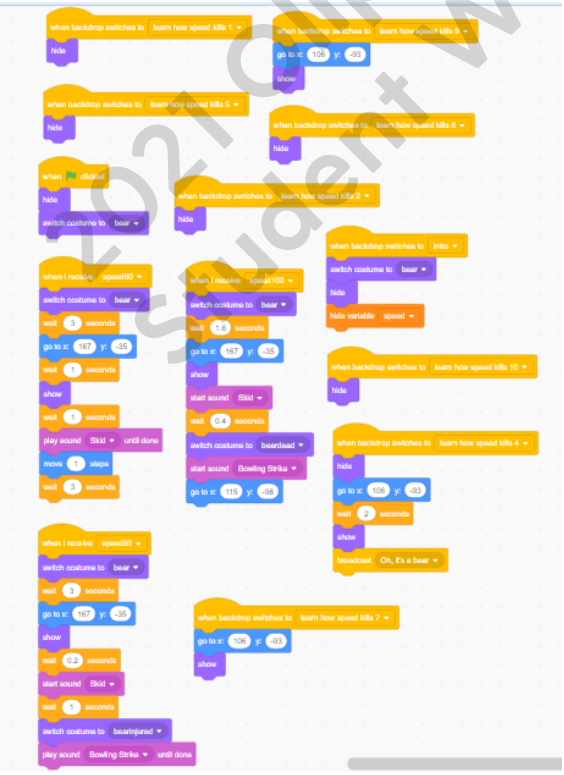
Acknowledgements

My mum helped me understand speed, velocity and reaction time.
My dad helped me when I got stuck with some coding.

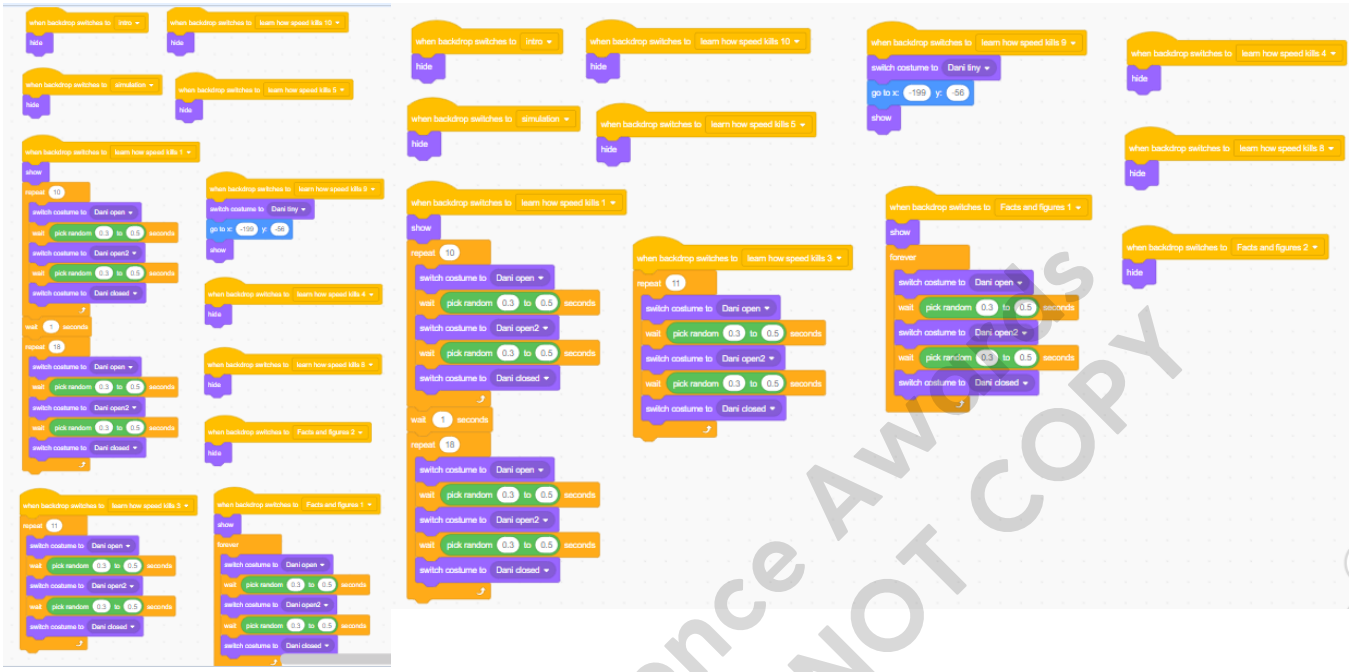
Screenshots and explanation of project



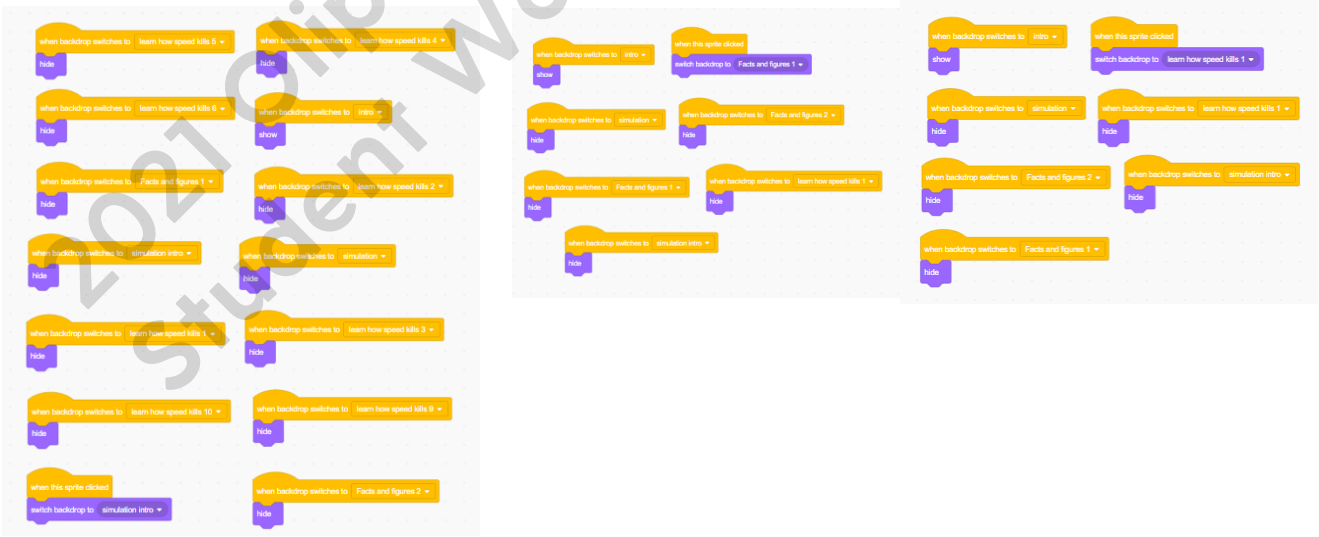
This section of code handles the movement of the car throughout the program. This includes moving the vehicle at different speeds and stopping before or when hitting the obstruction. This code also controls the car in the knowledge base sesion of the computer program. The car moves at different speeds depending on the speed limit selected by the user. This was programmed by gliding the same distance in different amounts of time.



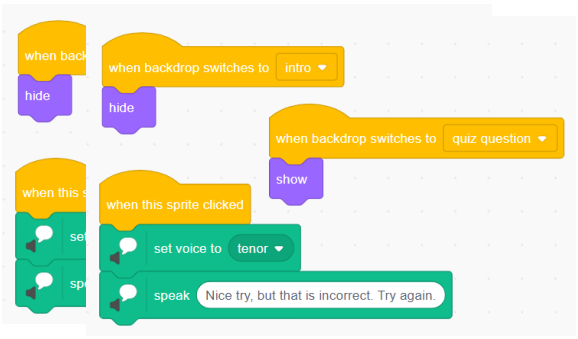
This is the section of code which relates to the obstruction on the road (bear). These blocks of code make the bear appear as an obstruction as well as show the consequences the obstruction faces when it is hit by the vehicle at different speeds.

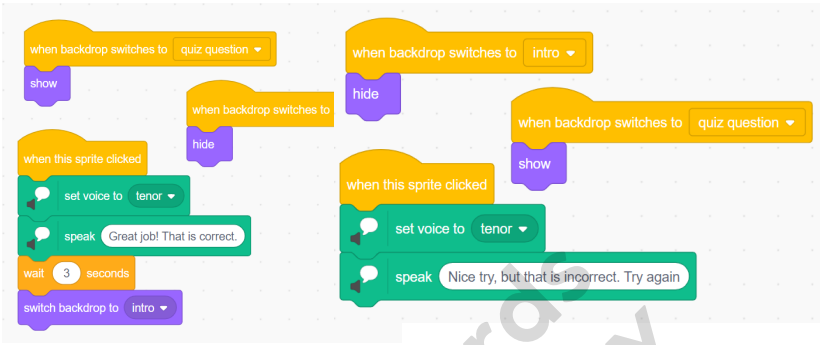


The above section of code manages Dani. He is the 'narrator' of my computer program. He explains all the physics in relation to how speed kills along with facts and figures about speeding and how it looks in the real world. A problem I had with this sprite was the movement of his mouth. I struggled to figure out how to do it in the first place and once I knew how to make it move, I could not exactly synchronise it to the words he said. I tried my best but it is definitely not perfect.

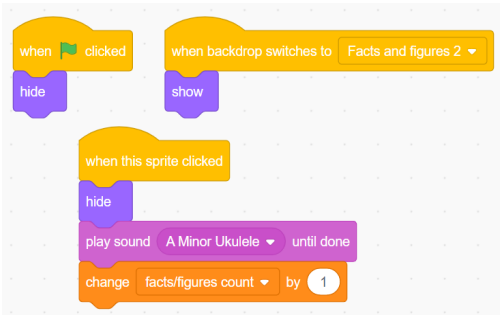


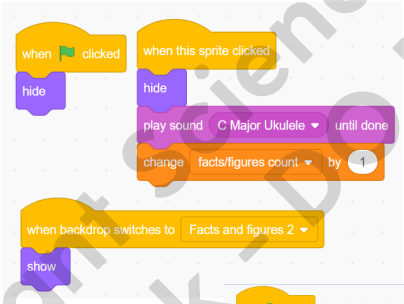
These above blocks of code control the navigation of my program. They ensure that the user is able to seamlessly run each function of the program. After the end of each section, the user is taken back to the introduction screen to continue with any part of the program.

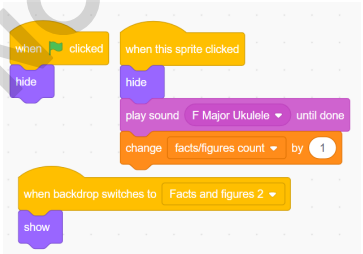


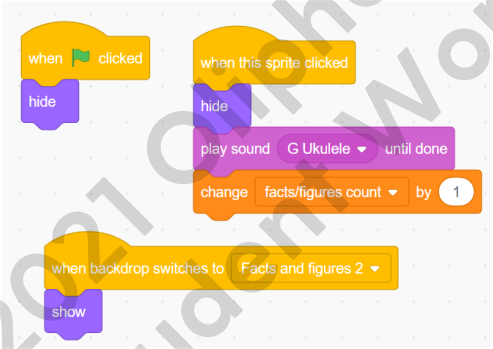


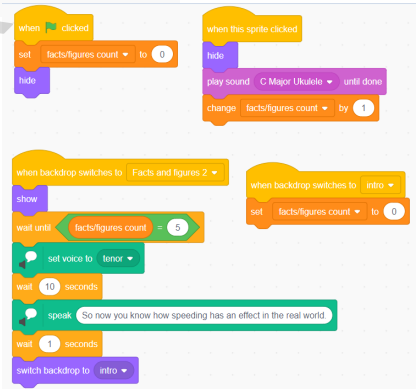
The above blocks of code handle the quiz question of the program. It validates the answer and lets the user know when the correct answer is provided.



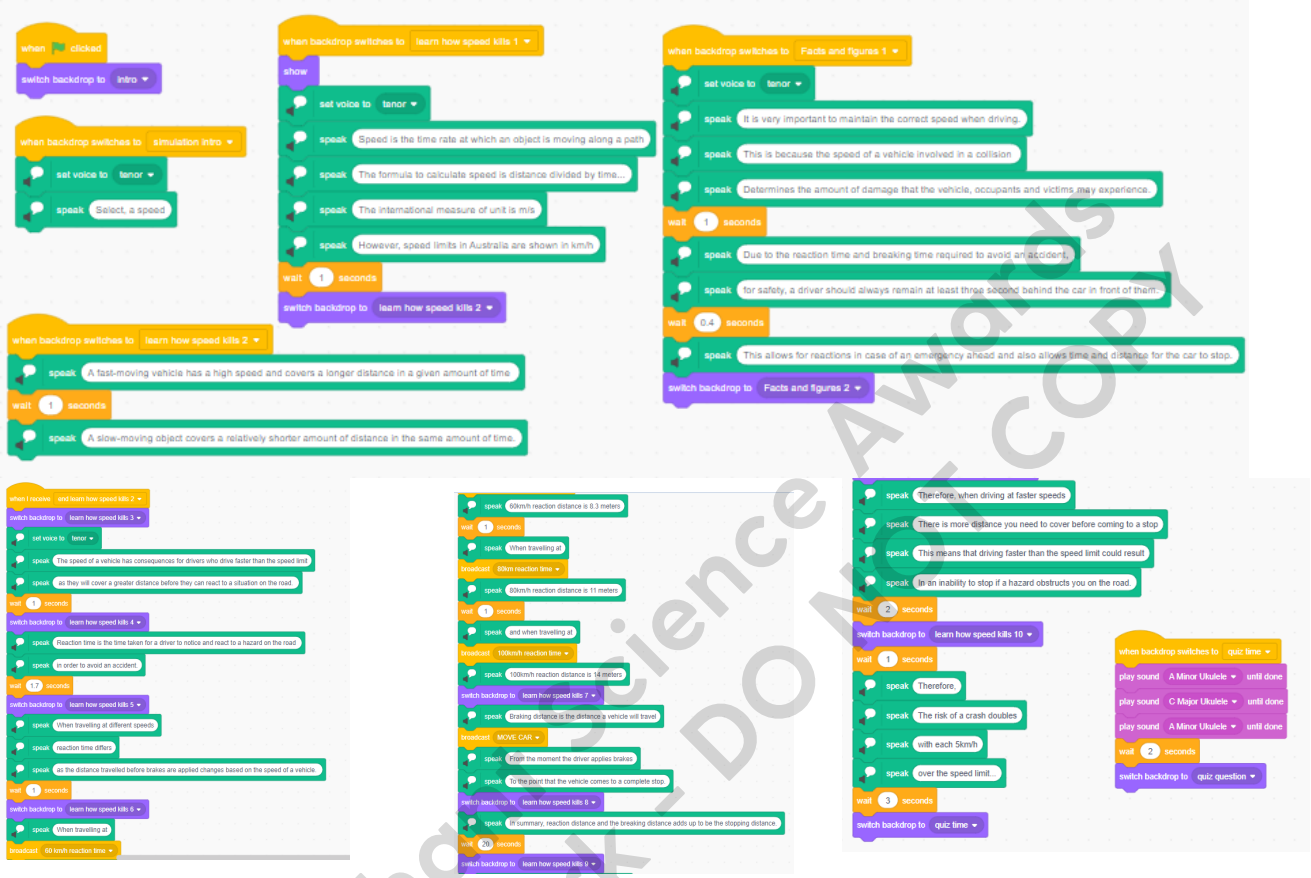








The above blocks of code are used to reveal the facts and figures about road crashes and their impacts pertaining to speed. These key figures are both global and national. I have programmed it in a way where the user can choose the order in which they reveal the facts and figures in. When all the facts/figures have been revealed (in any order), there is time given for the user to read them again as it is important to understand the consequences of speeding.



I overcame the challenge of Scratch not allowing a sprite to do multiple things at once by making Dani, who is the "narrator", move his mouth on his own and have the stage do the speaking for him. I used the extra block text-to-speech to do this. The above code is what I used to make Dani speak.

A demonstration of the project can be accessed at URL:
https://www.youtube.com/watch?v=HM-Df4W5VrI

Bibliography

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