



Highly Commended

Programming, Apps & Robotics Year 3 - 4

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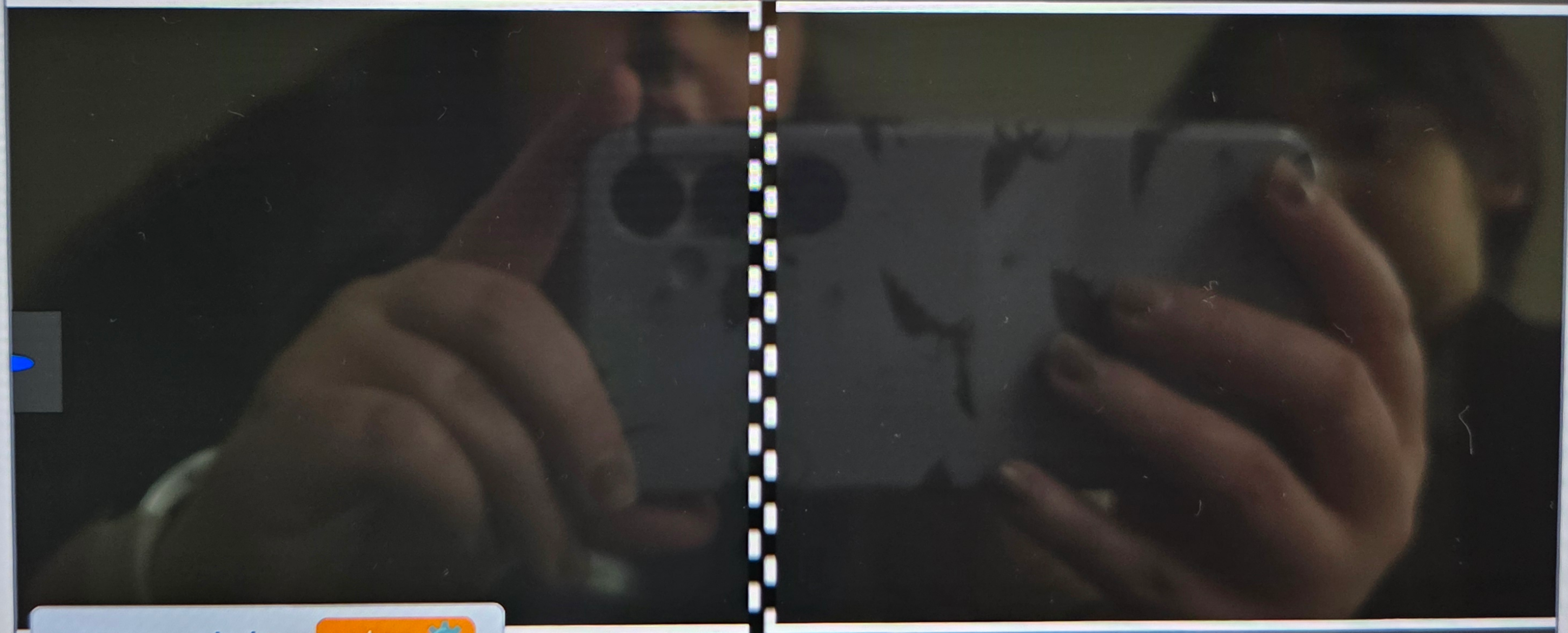
Rose Park Primary School



car_speed 0

downforce_level 0

lap_time 0



game_state setup

High
Downforce

Low
Downforce



Costumes Sounds

Motion

- move 10 steps
- turn 15 degrees
- turn 15 degrees
- go to random position
- go to x: -178 y: -150
- glide 1 secs to random position
- glide 1 secs to x: -178 y: -150
- point in direction 90
- point towards mouse-pointer
- change x by 10
- set x to -178
- change y by 10
- set y to -150
- if on edge, bounce
- set rotation style left-right
- x position
- y position
- direction

Looks

- say Hello! for 2 seconds

```

when clicked
  hide
  wait 3 seconds
  go to x: -178 y: -150
  show

when this sprite clicked
  set downforce_level to 1
  set car_speed to 5
  set wobble_amount to 2
  set game_state to racing
  broadcast start_race
  stop this script
    
```

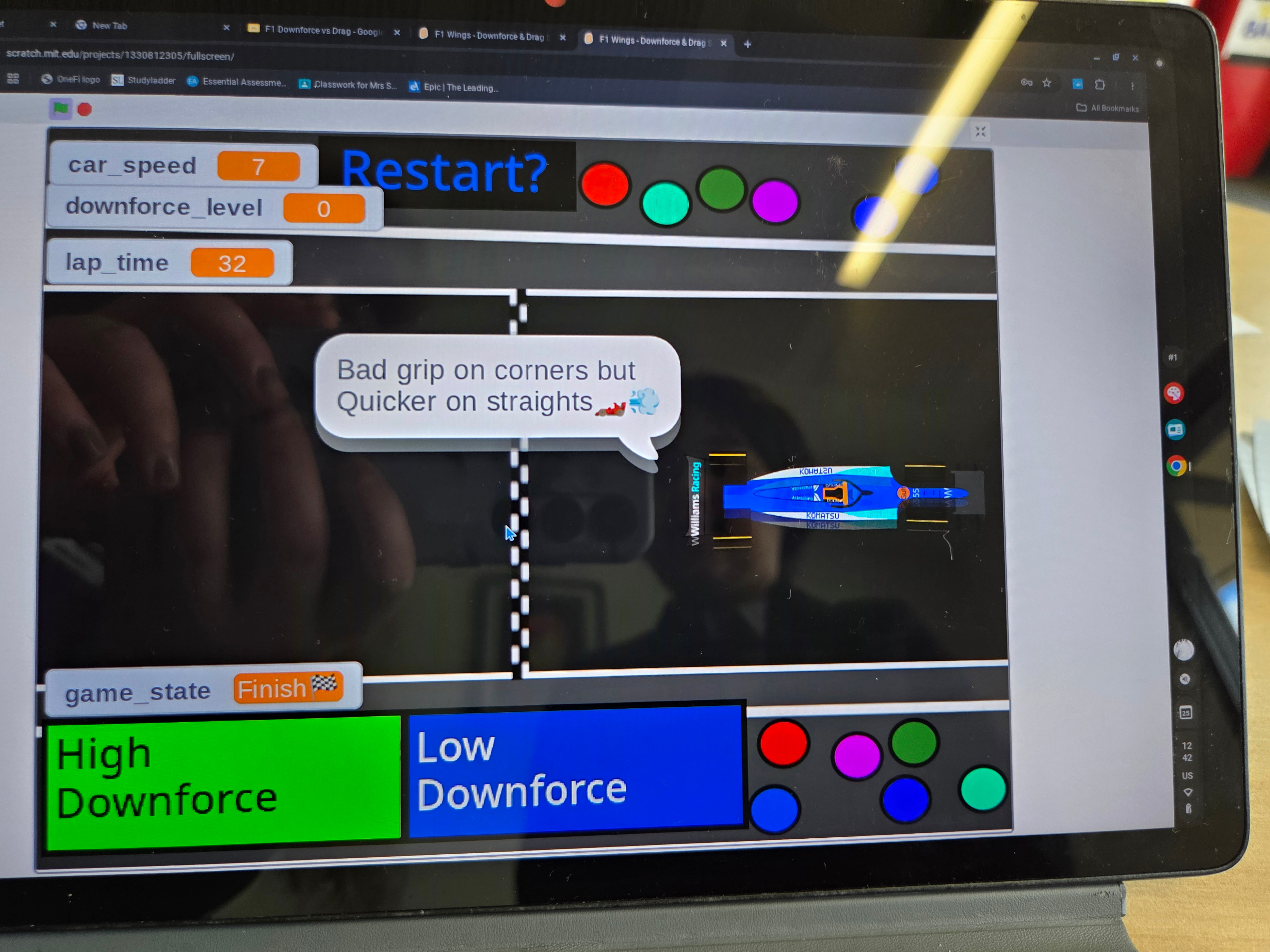
car_speed 7
downforce_level 0
lap_time 10.5

game_state racing

High Downforce Low Downforce

Sprite Sprite2 x -178 y -150
Show Size 100 Direction 90

Sprite2 Sprite1 Sprite4 Sprite3 Sprite5



car_speed

7

Restart?

downforce_level

0

lap_time

32

Bad grip on corners but
Quicker on straights

game_state

Finish

High
Downforce

Low
Downforce

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Aim & Scientific Purpose

My aim is to make a racing game in Scratch that teaches people about downforce and drag in Formula 1 cars. I want to show that you can't have both maximum grip and maximum speed at the same time. As an engineer, you have to choose!

Scientific Purpose

In real Formula 1 racing, engineers have to make hard choices about car design. My game teaches this idea by letting players to try two different car setups and see what happens.

When player click HIGH DOWNFORCE, the car moves slower but stays very stable. This is like what F1 cars do on twisty tracks with lots of corners like in Monaco Track. The cars need the grip for the corners.

When player click LOW DOWNFORCE, the car zooms faster but shakes more. This is like F1 cars racing on Monza, Italy track where it can go very fast and straight track. The cars do not need much grip and can go faster.

In short, cars with big wings (High Downforce) grip really well on corners but go slower. Cars with small wings (Low Downforce) go faster but don't grip as well.

What we'll learn:

- Downforce = better grip on corners
- Drag = air pushing back, making you slower
- Big wing = more downforce but MORE drag
- Small wing = less drag but LESS grip
- Engineers must pick what matters most for their track

Potential Applications

My game could be useful for lots of people in real world.

Science Teachers

Teachers could use this game to teach students about downforce and drag without needing expensive equipment like wind tunnels. Students can learn by playing.

Young Engineers

People learning to design race cars could use a simulator like this to understand the trade-off between speed and grip. They can test different ideas before building real cars.

Racing Teams

Real F1 teams use computer simulations to test wing setups before going to the track. My game shows the same idea in a simple way that anyone can understand.

Other Sports and Vehicles

The same idea could be used for other things:

- **Aircraft design** — planes also need to balance lift and drag
- **Bicycles** — aerodynamics helps cyclists go faster
- **Skateboards** — different shapes affect speed and control

My game proves that simulations are a great way to learn about physics and engineering.

Device Requirements

Item	Details
Device	Any computer, laptop, or tablet with a modern web browser
Internet	Required — the game is hosted on scratch.mit.edu
Browser	Google Chrome, Firefox, Safari, or Edge (latest version)
Scratch Account	Not required to play — the game can be run by anyone with the link
Screen Size	Works best on a laptop or desktop screen (minimum 10 inches)

Instructions for Use

Step 1: Open a web browser (Chrome, Firefox, Edge or Safari).

Step 2: Go to this link: <https://scratch.mit.edu/projects/1330812305>

Step 3: Click the green flag to start the game.

Step 4: You will see two buttons — one GREEN and one BLUE.

- GREEN button = **HIGH DOWNFORCE** (car grips well but goes slower)
- BLUE button = **LOW DOWNFORCE** (car goes faster but slides more)

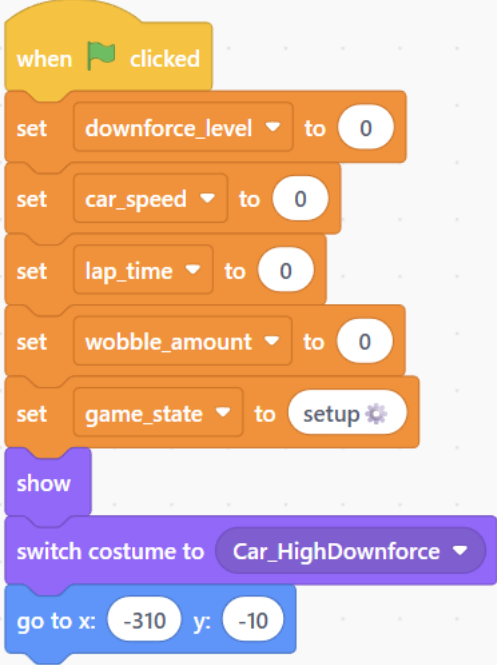
Step 5: Click one button to choose your setup.

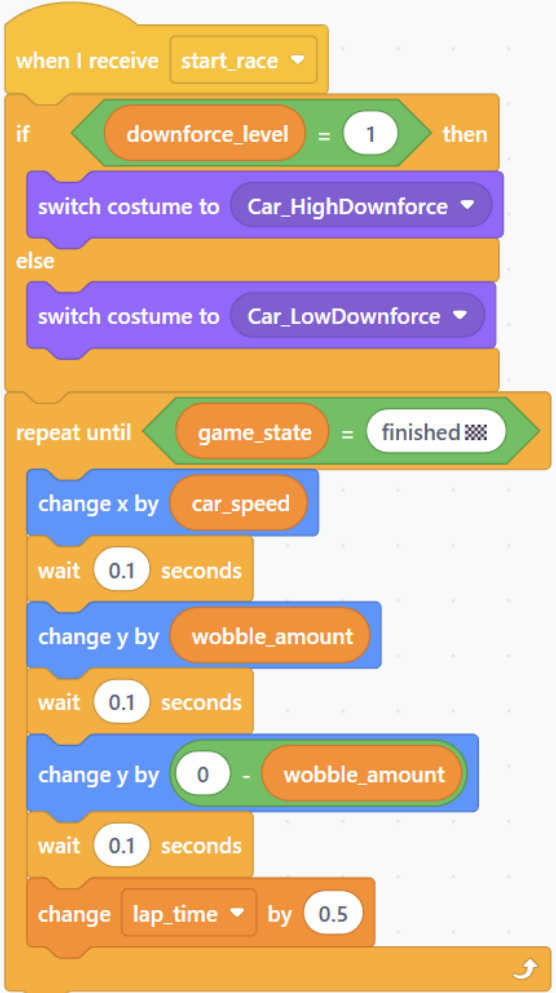
Step 6: Watch your car race.

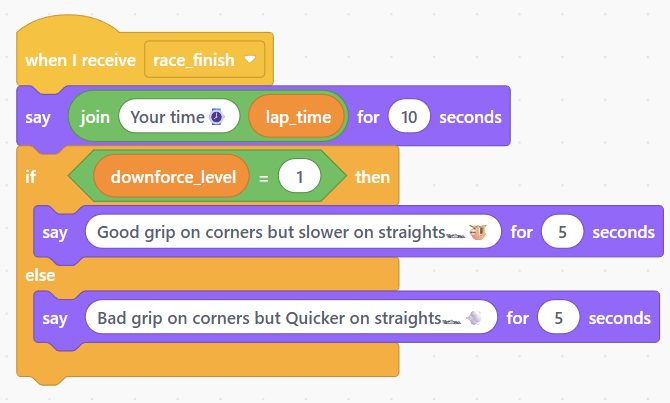
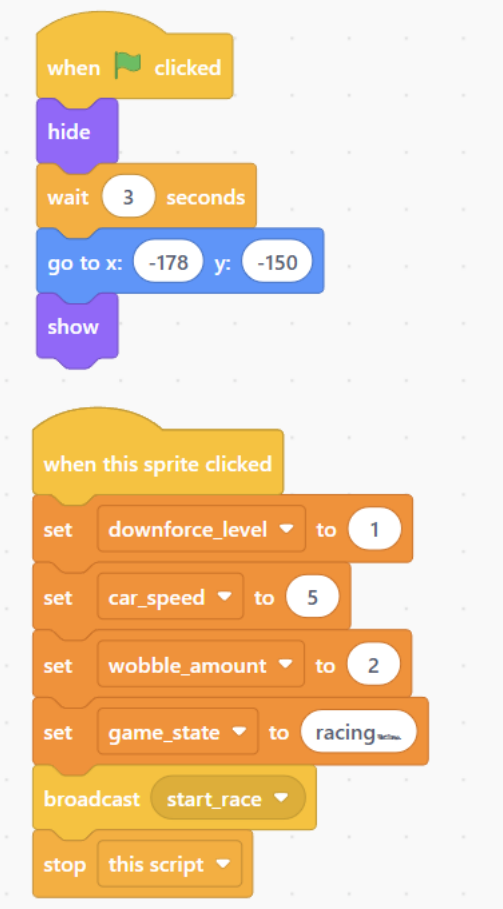
Step 7: When your car reaches the finish line, you see your time.

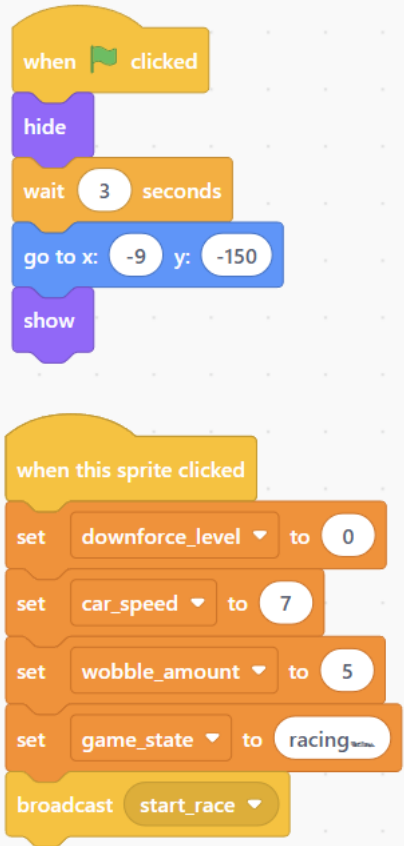
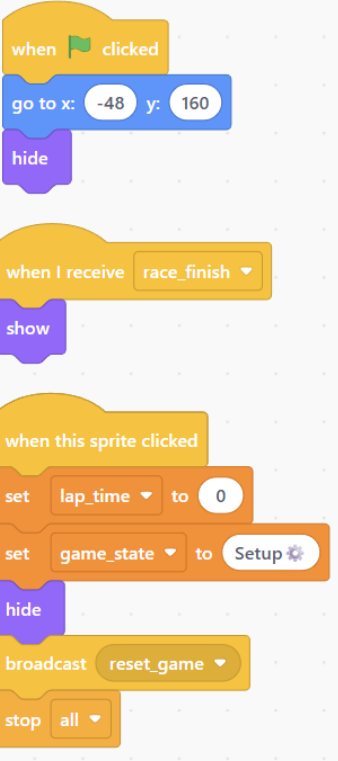
Step 8: Click the RESTART button to race again and try the other setup.

Hard Copy of the Program

Scratch Code Block	Screenshot	Explanation
Setup Script (When Flag Clicked)		When the green flag is clicked, this code sets up the whole game. It resets all variables (downforce_level, car_speed, lap_time, and wobble_amount) back to zero and moves the car to the starting line so it's ready to race.

Race Movement Script (When I Receive start_race)	 <pre> when I receive start_race if downforce_level = 1 then switch costume to Car_HighDownforce else switch costume to Car_LowDownforce repeat until game_state = finished change x by car_speed wait 0.1 seconds change y by wobble_amount wait 0.1 seconds change y by 0 - wobble_amount wait 0.1 seconds change lap_time by 0.5 </pre>	This code makes the car actually race. First, it checks if you picked HIGH or LOW downforce and switches to the right car costume. Then it moves the car across the screen by changing its x position, makes it wobble up and down by changing the y position, and adds to the lap_time counter so we can measure how fast the race is.
Finish Line Detection Script (When I Receive start_race)	 <pre> when I receive start_race forever if x position > -93 then set game_state to Finish broadcast race_finish stop this script </pre>	This code is always watching to see when the car reaches the finish line. When the car's x position gets bigger than -93, it means the car has reached the end of the track, so it changes the game_state to "finished" and sends a message to show the results.

Results Display Script (When I Receive race_finish)	 <pre> when I receive race_finish say join Your time lap_time for 10 seconds if downforce_level = 1 then say Good grip on corners but slower on straights for 5 seconds else say Bad grip on corners but Quicker on straights for 5 seconds </pre>	This code shows the player their lap time and gives them feedback about their choice. If they picked HIGH downforce, it tells them "Good grip on corners but slower on straights." If they picked LOW downforce, it says "Bad grip on corners but quicker on straights." This teaches them about the trade-off.
HIGH DOWNFORCE Button Script	 <pre> when flag clicked hide wait 3 seconds go to x: -178 y: -150 show when this sprite clicked set downforce_level to 1 set car_speed to 5 set wobble_amount to 2 set game_state to racing broadcast start_race stop this script </pre>	When the player clicks the HIGH DOWNFORCE button, the second script sets car_speed to 5 (slower), wobble_amount to 2 (more stable), and sends the start_race message to begin the race.

LOW DOWNFORCE Button Script	 <pre> when green flag clicked hide wait 3 seconds go to x: -9 y: -150 show when this sprite clicked set downforce_level to 0 set car_speed to 7 set wobble_amount to 5 set game_state to racing broadcast start_race </pre>	When the player clicks the LOW DOWNFORCE button, the second script sets car_speed to 7 (faster), wobble_amount to 5 (more shaky), and sends the start_race message to start the race with less downforce.
RESTART? Button Script	 <pre> when green flag clicked go to x: -48 y: 160 hide when I receive race_finish show when this sprite clicked set lap_time to 0 set game_state to Setup hide broadcast reset_game stop all </pre>	When the race finishes, the second script shows the button so the player can click it. When the player clicks RESTART, it resets the lap_time back to 0, changes the game_state to "Setup," and sends a message to reset everything so they can race again.

Acknowledgements

I want to thank my mom and dad for helping me with this project. They helped me use Google Search and Gemini to find information about downforce and drag in Formula 1 cars. They also helped me plan how to write my report and organize all my ideas. My parents reviewed my spelling and grammar to make sure everything was correct. We brainstormed ideas together about how the game should work and what would make it fun to play.

I also want to thank my brother, Armaan for being a user tester. He played my game and told me what he liked and what could be better. His feedback helped me make the game more fun and easier to understand. Without all their help and support, I wouldn't have been able to finish this project.

AI Tools Use Acknowledgement

I used an AI tool called Gemini to help me research information about downforce and drag in Formula 1 racing. The AI helped understand the concepts and answered my questions about how the physics works.

However, I did all the coding myself on Scratch. I wrote every block of code, created all the sprites, and designed the game. The AI helped guide me through the steps, but I was the one who actually built everything. I also designed and drew all the car and button graphics myself.

References

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