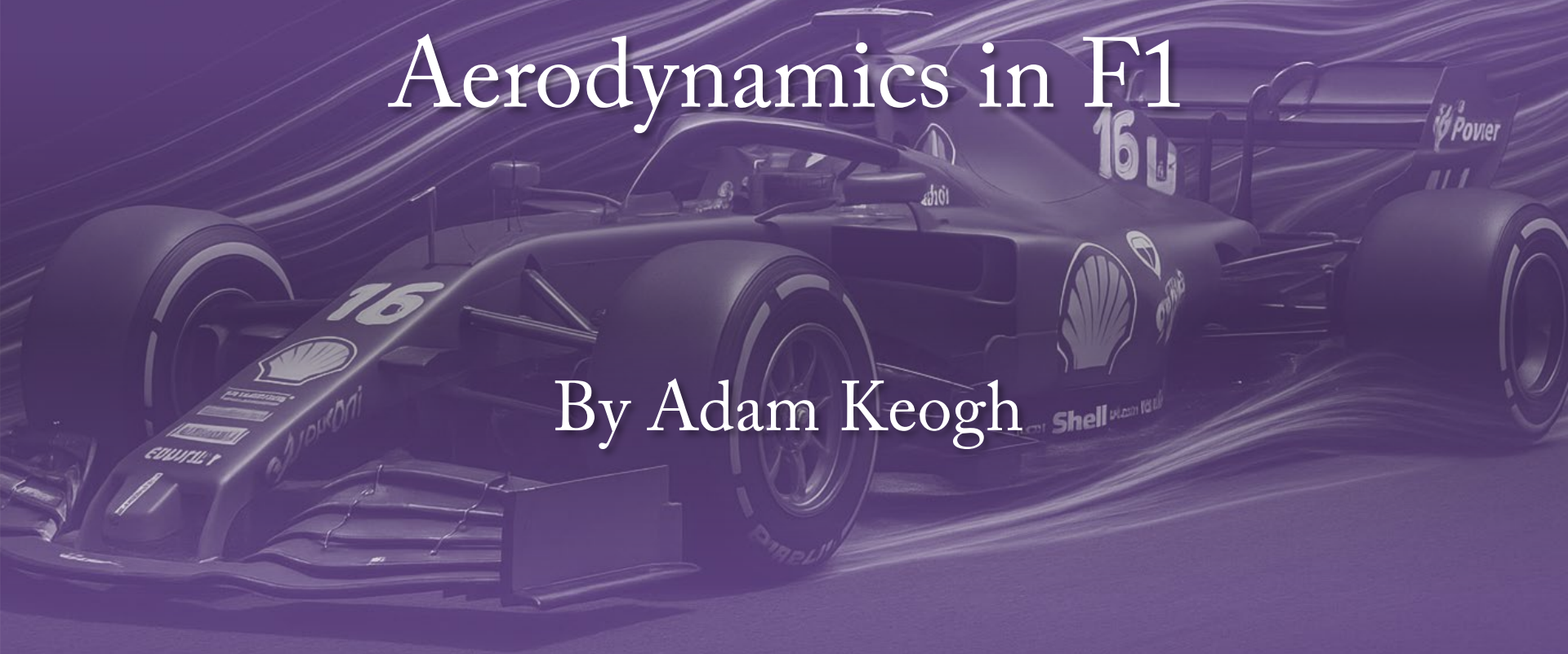


Science CBA Aerodynamics in F1

By Adam Keogh





Contents

3. Introduction
4. Statement of Task
5. Background
6. Hypothesis
7. Considerations
8. Materials/Equipment Used
9. Safety Precautions
10. Method
11. Variables
12. Observations - Airflow over Shapes
13. Results - Airflow over Shapes
14. Analysis - Airflow over Shapes
15. Further Testing with a Cotton Ball
16. Observations - Cotton Ball Movement
17. Results - Cotton Ball Movement
18. Analysis - Cotton Ball Movement
19. Recommendations/Improvements
20. Conclusion

A decorative element on the left side of the slide consisting of four vertical bars of varying heights and widths, colored in a dark purple shade.

Introduction

I have always been interested in Formula 1 and how the cars go so fast while staying stuck to the track. I often hear words like “aerodynamics,” “downforce,” and “drag,” but I didn’t fully understand what they meant. For this project, I decided to test how air moves around different shapes and what happens behind them.

I built a homemade wind tunnel using a model car box and used a hairdryer to blow air across two different shapes, a wedge and a cuboid. I wanted to see how the air would behave behind each one and what that could tell me about how F1 teams control airflow.



Statement of Task

For my experiment, I wanted to find out how different shapes affect airflow. I tested a wedge shape and a cuboid to see how the air behaved behind each one using tissue paper and a cotton ball.

A decorative element on the left side of the slide consisting of four vertical bars of increasing height from left to right, colored in a dark purple shade.

Background

In Formula 1, the design of the car is really important for speed and stability. Teams work hard to make sure the car is shaped in a way that cuts through the air as smoothly as possible. This is called aerodynamics. Cars that aren't aerodynamic will have more air pushing against them (drag), which slows them down.

I wanted to test how the shape of something affects the air behind it. I used simple materials and a homemade wind tunnel to try and see this for myself.

A decorative element on the left side of the slide consisting of four vertical bars of varying heights and widths, colored in a dark purple shade.

Hypothesis

If the shape used in the wind tunnel is a cuboid, then it will cause more airflow disturbance and the tissue paper will move more compared to a wedge, because the cuboid has blocky surfaces that interrupt the air, while the wedge shape helps the air flow more smoothly.



Considerations

I had to think about where to set up the experiment so the air wouldn't get disturbed by anything else. Even my own breath or someone walking past could have affected it.

I used a model car box to make a wind tunnel so the air would go straight from the hairdryer to the shape, and I could see the affects through the clear plastic.

I also had to make sure that both shapes were made from the same material and were roughly the same size so that the results would be fair.

Materials/Equipment Used



- A model car box (used as a wind tunnel)
- A hairdryer (for airflow)
- A wedge shape (made from an easter egg box)
- A cuboid shape (made from an easter egg box)
- Tissue paper strips (taped behind each shape)
- Cotton ball (for extra airflow testing)
- Sticky tape
- Blue tack (to keep everything in position)
- Metal ruler (to measure distances for cotton ball testing)



Safety Precautions

- I used the hairdryer on a cool setting to avoid overheating or risk of burns.
- I kept the area around the experiment clear.
- I didn't put my hands or anything near the back of the hairdryer while it was on.
- I made sure everything was stable so nothing would fall or get knocked over.

Method



1. I set up the hairdryer in front of the wind tunnel and made sure it was blowing straight.
2. I placed the cuboid shape inside first, with a strip of tissue paper taped to the back.
3. I turned on the hairdryer and observed what happened to the tissue paper.
4. I repeated the test using the wedge shape instead.
5. I took note of what happened in each case.

Variables

- **Independent Variable:**
This is what I changed in the experiment.
I changed the shape being tested (wedge or cuboid).
- **Dependent Variable:**
This is what I measured or observed.
I looked at how the tissue paper moved when the air hit it.
- **Controlled Variables:**
These are the things I kept the same to make it a fair test.
I used the same hairdryer and settings, the same tissue paper, the same size and material for the shapes, and the same setup every time.

Observations - Airflow over Shapes

Click the images to play the videos

Wedge shape airflow test



The wedge shape caused the tissue paper to lift and curl backwards, showing disturbed airflow.

Cuboid shape airflow test



The cuboid shape caused no visible movement in the tissue paper.

This result was surprising because I expected the wedge to have smoother airflow, but the paper showed more air movement behind it.

Results - Airflow over Shapes

Shape	Airflow Behaviour	Tissue Paper Movement
Cuboid	Very little airflow	Tissue paper stayed still
Wedge	Noticeable airflow disturbance	Tissue paper lifted and curled

Analysis - Airflow over Shapes

The results were different from what I expected. I thought the wedge would have smoother airflow and the tissue would stay still. But it actually showed more movement.

The tissue paper lifted and curled, which meant the air was curving or spinning in some way behind the wedge. Even though I could see the tissue moving, it was hard to tell exactly how the air was behaving just by looking at it. I needed a better way to show what the air was doing, so I decided to do more testing using a cotton ball.

Further Testing with a Cotton Ball

After seeing how the tissue paper lifted and curled, I wanted a better way to show exactly what the air was doing behind the shapes. I decided to use a cotton ball because it was light and would move more clearly with the airflow, especially if the air was pulling or pushing.

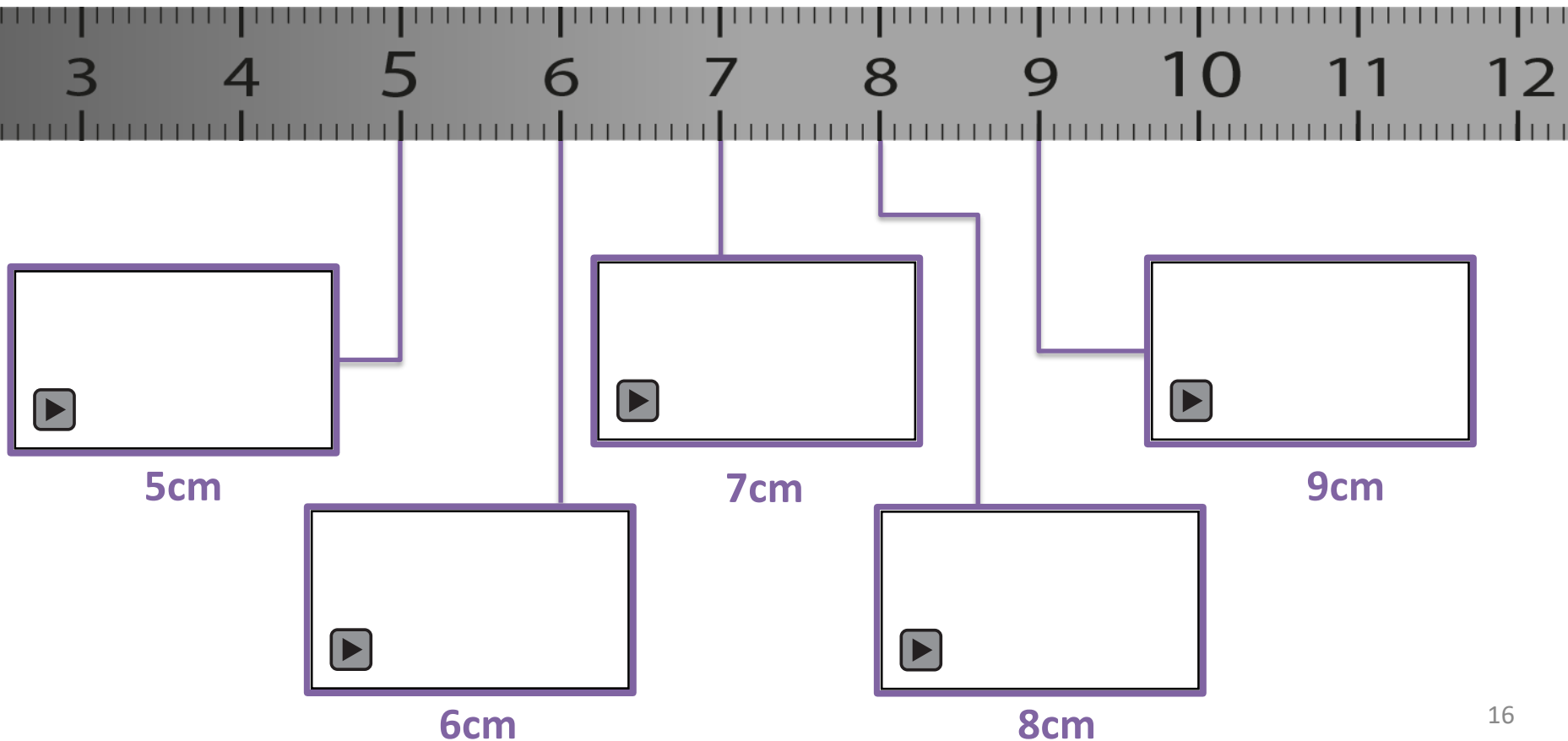


For this test, I placed the cotton ball behind the shape inside the wind tunnel. I used a ruler to measure how far the cotton ball was from the back of the shape each time. I started close to the shape and moved it further away to see if the air would pull it in or push it away. I made sure the hairdryer stayed in the same place and on the same setting so the airflow stayed the same for each test.

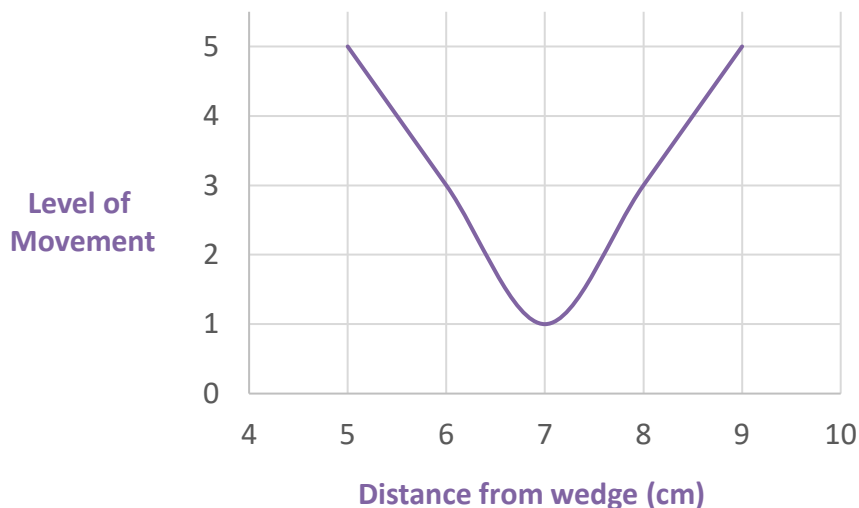
Observations - Cotton Ball Movement

Below are 5 videos showing the cotton ball placed at different distances behind the wedge. The cotton ball was positioned at 5cm, 6cm, 7cm, 8cm, and 9cm from the back of the wedge. Each video shows how the airflow affected the cotton ball's movement at each position.

Click the images to play the videos



Results - Cotton Ball Movement



The graph shows how far the cotton ball was placed behind the wedge and the level of movement when the air hit it.

It helped me see where the airflow had the strongest effect (at 5cm and 9cm), and where the inward and outward airflow cancelled each other out (at 7cm), causing the cotton ball to wobble in place.

Distance (cm)	Behaviour	Direction	Level of Movement (1–5)
5	Pulled in quickly	Inward	5
6	Pulled in slowly	Inward	3
7	Wobbled in place	Neutral	1
8	Pushed away slowly	Outward	3
9	Pushed away quickly	Outward	5

Analysis - Cotton Ball Movement

- With the cuboid, the cotton ball didn't move at all, even with the hairdryer blowing.
- With the wedge, if the cotton ball was placed a bit further away, it was blown away. But when placed closer to the wedge, it was pulled backwards, like the air was sucking it in. This showed that the air was curving or circling in behind the wedge. It made me wonder if F1 teams use this kind of effect to control airflow around the back of the car.

Recommendations/Improvements

- If I was doing this experiment again, I'd try using different shapes like a rounded dome or a wing shape.
- I would also like to use smoke or fog to see the air movement more clearly.
- I think using a slow-motion camera could help show how the air and paper move in more detail.
- I'd also test placing the cotton ball at more distances behind the wedge to see exactly where the pulling effect stops.



Conclusion

- This project helped me learn how air flows around different shapes. Even though the wedge seemed more aerodynamic, it caused more air movement behind it, which surprised me.
- The cotton ball test showed that air can behave in unexpected ways, like getting pulled in behind the wedge. It made me think that maybe this is something F1 teams use to manage air movement and help the car go faster or stay more stable.