

IMPACT

Benefits of Golfing

- Golfers live 5 years longer (Faramand et al., Swedish study).
- 40% lower mortality rate than non-golfers.
- Improves cardiovascular health, balance, and mental wellness.
- Reduces risk of heart attack, stroke, and depression.

The Problem

- 3 million people quit golf every year.
- Main reasons: lack of time, lack of improvement and frustration due to poor swing set-up (Dropgolf.com)
- Golf has a learning curve that can be discouraging for beginners or experienced players.

My Project

- Tests how tee height and ball position affect distance and accuracy.
- Helps golfers hit straighter, farther shots.
- Reduces time spent searching for balls → makes golf faster & more fun.

Why It Matters

- Golf = physics in motion (launch angle, spin, energy transfer).
- Small adjustments can lead to big improvements, such as less time looking for balls, more confidence, and seeing improvements quickly.
- Fewer people quitting → longer lives, better health, less healthcare cost

INTRODUCTION

- Tested how tee height and ball position affect distance, carry, and accuracy.
- Built a custom machine (modified clay pigeon thrower with driver head) for consistent swings.
- Used a golf simulator to collect accurate data.
- Tested 4 tee heights: 3 cm, 2.5 cm, 2 cm, 1.5 cm (10 trials each).
- Then adjusted ball positions: 2 cm forward & 2 cm back.
- Measured:
 - Carry distance
 - Total distance
 - Backspin/accuracy
- Physics concepts involved: Lift, Drag, Thrust, Gravity.
- Tee height changes the angle of attack, making drives longer and more forgiving.
- Ball position affects spin, distance, and direction (pull, push, straight).
- Goal: show how small setup adjustments can improve performance and make golf more enjoyable.

HYPOTHESIS

- 1.It is hypothesized that the golf ball on the second-highest tee (2.5 cm) in the forward position will produce the most total distance.
- 2.It is hypothesized that the golf ball on the highest tee (3 cm) in the forward (control) position will produce the longest carry distance
- 3.It is hypothesized that the golf ball on the highest tee (3 cm) in the back position will produce the most backspin accuracy.

MATERIALS

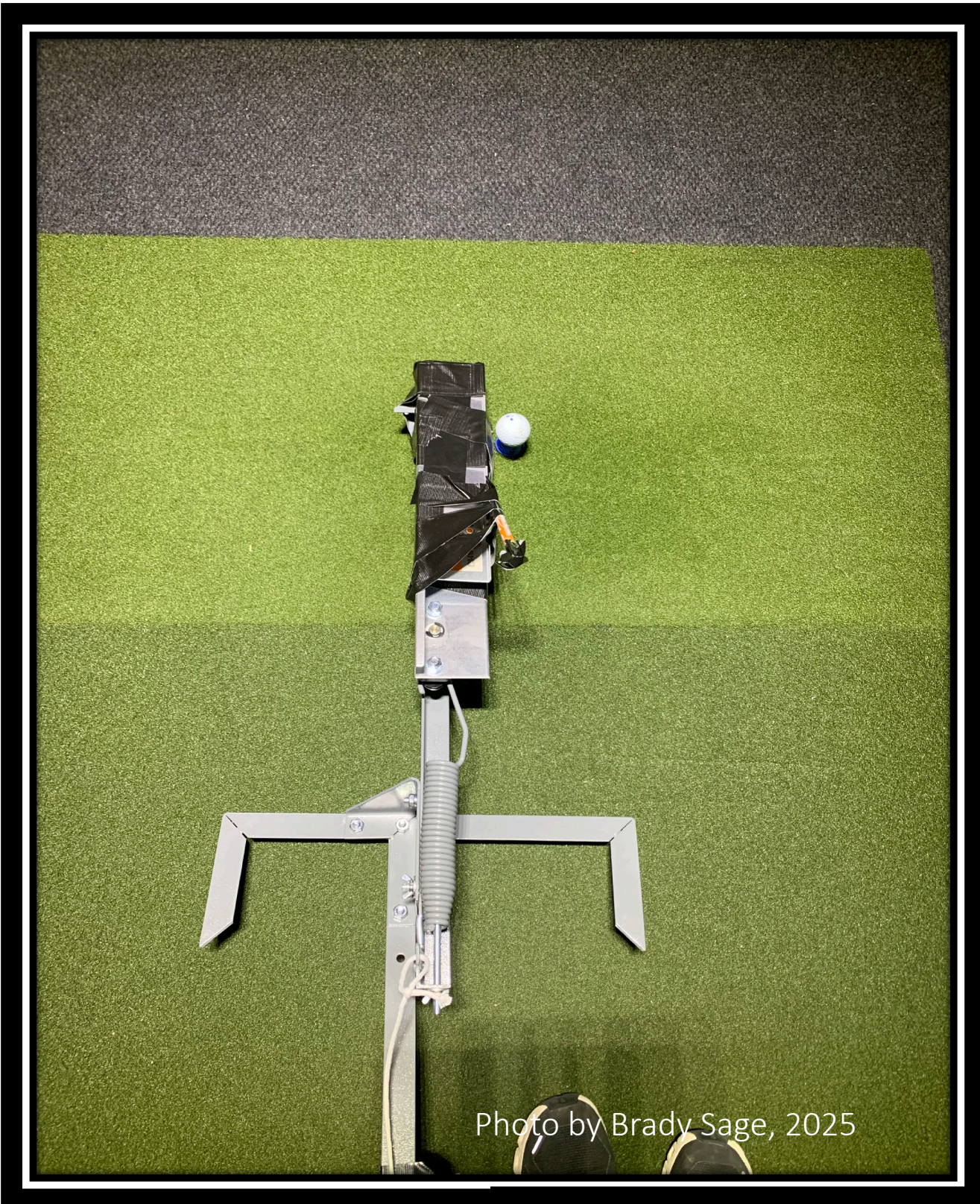
Things needed for the experiment:

- 1 tee 3 cm tall (above the ground)
- 1 tee 2.5 cm tall (above the ground)
- 1 tee 2 cm tall (above the ground)
- 1 tee 1.5 cm tall (above the ground)
- 1 Titleist golf ball
- 1 roll of painters' tape (to mark the three places where the golf ball and each tee will be placed)
- A paper and a pen (to record measurements)
- A ruler (to measure tee heights)
- The modified golf ball hitter (materials and instructions below)

Things needed to build the golf club hitter:

- 1 CHAMPION clay pigeon launcher
- 1 role of T-REX tape
- 1 PRECISE XD-J JUNIOR driver head (when attached, it should have a loft of 15 degrees
- 2 pieces of wood: 18.5 cm * 2.5 cm

Optimizing Driver Flight Distance and Accuracy



Modified clay pigeon shooter with driver head attached



Modified clay pigeon shooter with driver head attached, positioned with simulator



Modified clay pigeon shooter with driver head attached

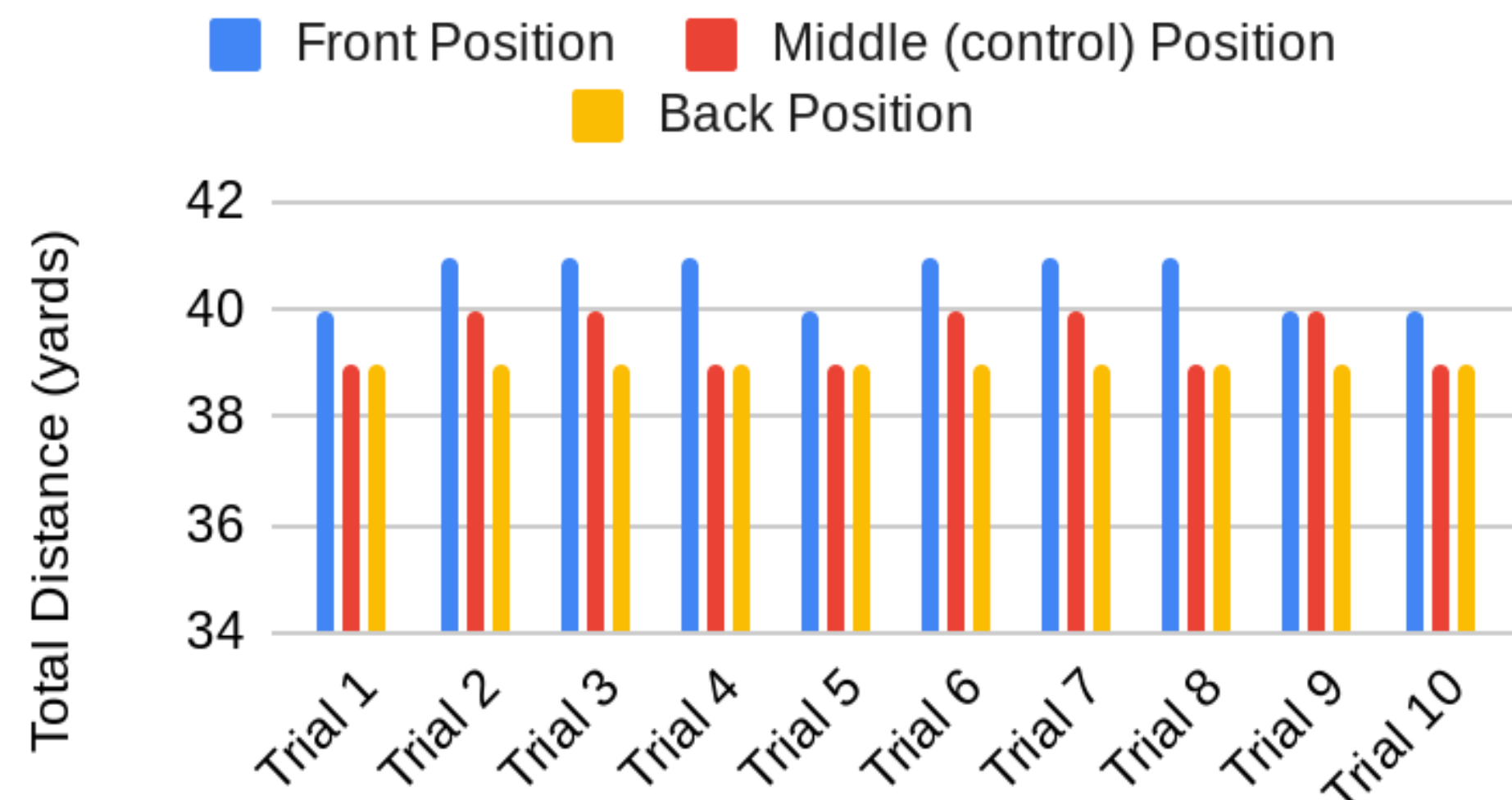


Golf simulator with launch monitor



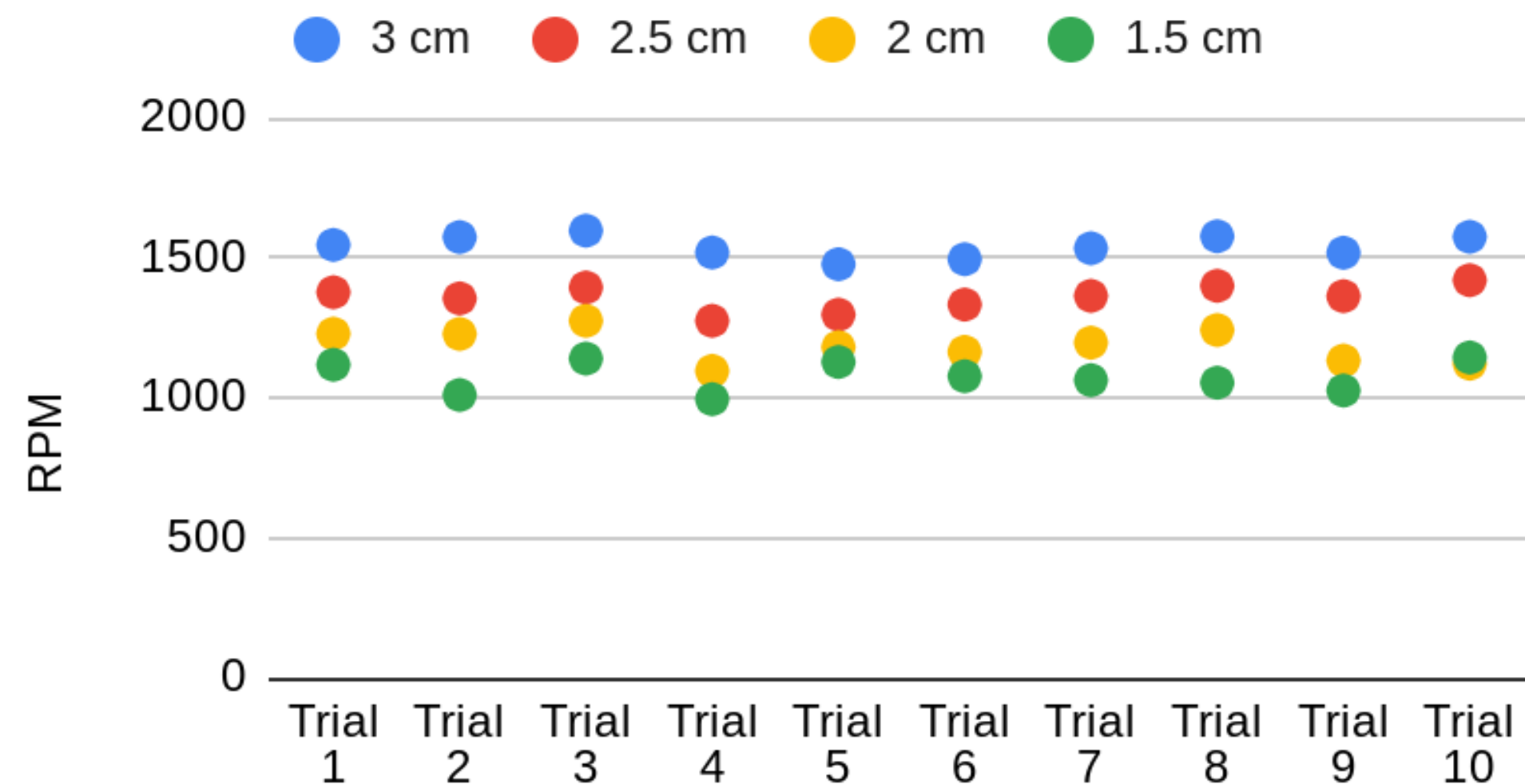
Sample golf tees

2.5 cm Tee In All Positions



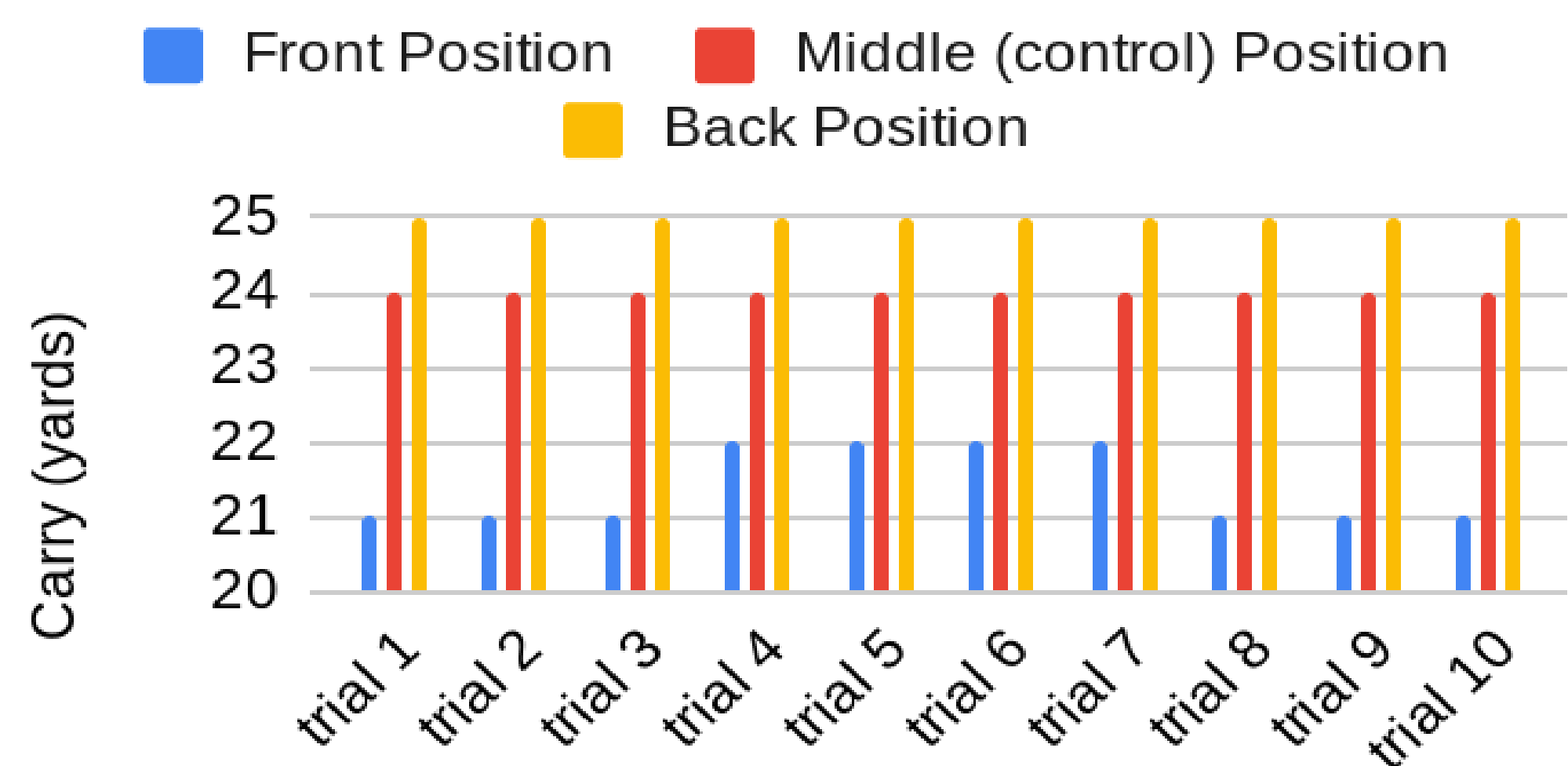
Graph by Brady Sage using Google Sheets, 2025

Backspin



Graph by Brady Sage using Google Sheets, 2025

3 cm Tee In All Positions



Graph by Brady Sage using Google Sheets, 2025

Carry (yards) and Total distance (yards)



Graph by Brady Sage using Google Sheets, 2025

BIBLIOGRAPHY

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- Goodstein, M., *Sports Science Projects: The Physics of Balls in Motion*. 1999.
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- Scott, Alex., *What's inside golf balls, and can chemistry make them fly farther?* C&EN, June 12, 2017.

ACKNOWLEDGEMENTS

I would like to thank my dad for introducing me to the game of golf. Because of him, I chose a golf-related science project because I love the game and I never quite understood the magic or importance of the golf tee or ball position and how it can impact and relate to spin, carry, and total distance. I would also like to thank my mom for being my moral support and encouraging me to keep going even when I got stuck and did not know what to do next. She encouraged me to push my experiment even further.

PROCEDURE

When testing the different tee heights

The independent variable is the different tee heights

The dependent variable is the carry, total distance, and backspin

When testing the different positions and different tee heights

The independent variable is different ball positions and tee heights

The dependent variable is the carry, total distance, and the backspin

How to Build the Golf Club Pendulum

- After you buy everything on the materials list, assemble the CHAMPION clay pigeon thrower and then follow the instructions
- Sandwich the two pieces of wood at the end post of the launcher in between the metal to serve as a stand that tips the front end toward the ground
- Cut off the grip part of the shaft and tape the club underneath the launcher arm so it hovers about 1 cm above the ground and is square to the ground

EXPERIMENT

- Place the launcher square to the impact screen (golf simulator)
- Place a piece of tape directly underneath where the club head rests so you can put the tee in the same place every time. This is the control or middle position.
- Weight down the backend by having someone stand on the back wooden post to keep it in place
- Place the tallest tee (3 cm) with the golf ball on top of the tape
- Pull back the arm all the way until it clicks into place. Then, pull the string
- After the ball was hit, record the carry, total distance, and the backspin rate of the ball from the simulator
- Repeat steps 3-6 10 times with every tee
- Analyze and find the mean of the data for the easiest comparisons
- Once the data has been analyzed, take the tees that produced the most carry, total distance, and backspin
- Mark two places on the floor with the painter's tape: one 2 cm forward and the other 2 cm backward for the tees
- Take only the winning tees and follow steps 3-6 again in their new positions 10 times each to see if the results change
- Analyze and compare to see if the positions improved or worsened and decide which tee in what position has won the three categories

RESULTS & ANALYSIS

Testing Tee Heights (Middle Position)

Backspin: Highest tee (3 cm) had most spin (1,542 rpm). Lowest tee (1.5 cm) had least (1,076 rpm).

Carry Distance: Highest tee (3 cm) carried farthest (24 yds). Lowest tee (1.5 cm) carried shortest (20.2 yds).

Total Distance: Second-highest tee (2.5 cm) went farthest overall (39.5 yds) due to best carry-to-spin ratio.

Testing Ball Positions (Winning Tees)

High Tee (3 cm - Best Carry): Back position gave longest carry (25 yds) and most backspin (1,586 rpm).

Second-High Tee (2.5 cm - Best Total Distance): Forward position gave longest total distance (40.6 yds).

Analysis

Higher tees → more backspin & carry (ball in air longer).

Lower tees → less spin & more rollout.

Best for carry: High tee, back position.

Best for total distance: Second-high tee, forward position.

CONCLUSION

- Total Distance** - Hypothesis correct: 2.5 cm tee (forward position) went farthest.
- Carry Distance** - Hypothesis incorrect: 3 cm tee (back position) carried longest.
- Backspin/Accuracy** - Hypothesis correct: 3 cm tee (back position) had most spin.