

Designing Fair Tests: Which Bunny Copter Is Faster?

You have made 2 bunny copters for this investigation. Your task is to predict and then test which bunny copter falls to the ground the fastest. You will need to decide how you will make this test fair by controlling certain variables. Then you will conduct the tests and collect data. Once your tests are done, look at your data and draw a conclusion about which bunny copter was faster and why. Be prepared to share your findings.

Planning Sheet

Designing Fair Tests: Which Bunny Copter Is Faster?

Grades 3-5

Time Required for the Task

45 minutes.

Crosscutting Concepts

- Cause and Effect
- Patterns
- Scale, Proportion, and Quantity
- Structure and Function
- Systems and System Models

Science and Engineering Practices

- Analyzing and Interpreting Data
- Asking Questions and Defining Problems
- Constructing Explanations and Designing Solutions
- Developing and Using Models
- Obtaining, Evaluating, and Communicating Information
- Planning and Carrying Out Investigations
- Using Mathematics and Computational Thinking

Context

This task was developed to help a class of third and fourth graders learn and practice the idea of fair testing. The class had been doing a number of guided investigations before this and was struggling with understanding how to control variables. The task was designed as a means for students to select certain variables, then test according to the variables chosen. This task would also allow students to practice predicting, collecting and analyzing data, and drawing conclusions.

Suggested Materials

Students will need to make their bunny copters. They will also need small and large paper clips, measuring tapes and a recording sheet. (Both the bunny copter template and recording sheet are included as a worksheet download.) Students might also want to use a stopwatch or clock with a second hand to get more precise times for each drop.

Teaching Tips and Guiding Questions

The most important part of this task is the discussion that happens beforehand, especially if this is your students' first investigation involving fair testing. Listen to what students are saying that reflects their previous knowledge. Some groups may need more guidance than others. Also, as students investigate, they may discover additional variables, such as how they drop the copters and who is dropping the copters. (It usually makes sense to have one person drop both at the same time.) Let students find this out for themselves or try to guide them to this idea.

Some possible guiding questions to ask students include:

- What is a fair test?
- What words can you use to describe what "fair" means?
- What can you do to make sure an investigation is a fair test?
- Which variables could we control or test in this investigation?
- Which bunny copter do you think is faster? Why do you think so?
- Do you think it's important to drop the copters at the same time? How can you make sure that this happens?
- Do you think it is important to test the copters more than once? Why?

Possible Solutions

If a fair test is conducted, students will discover that the smaller bunny with smaller ears is faster. This has to do with less drag and air resistance affecting its flight. The larger bunny actually has better lift with its larger ears and therefore takes longer to fall to the ground.

Bunny Copters

Which Bunny Copter is faster?

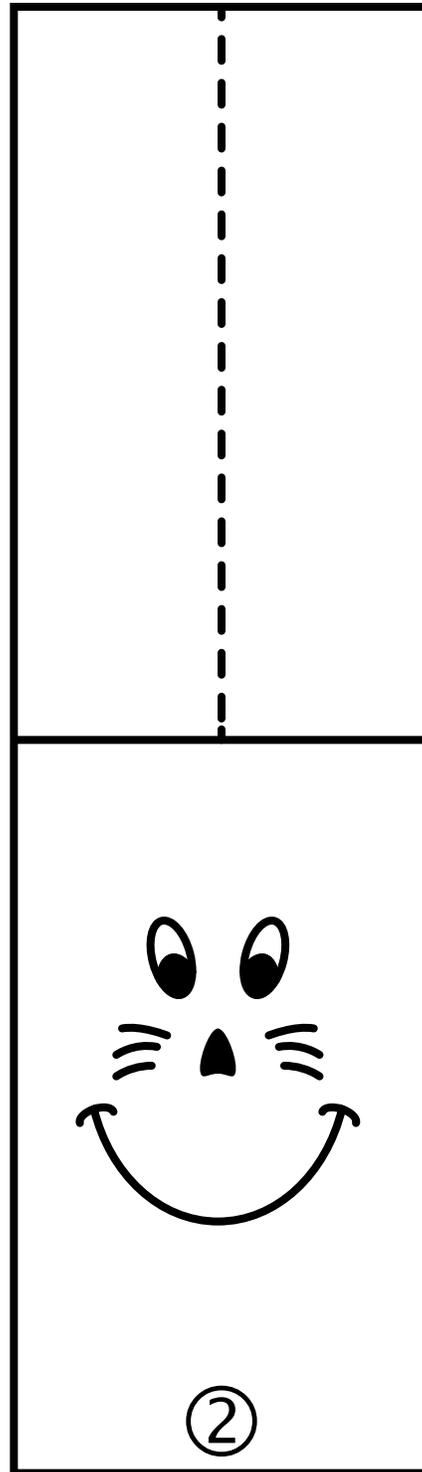
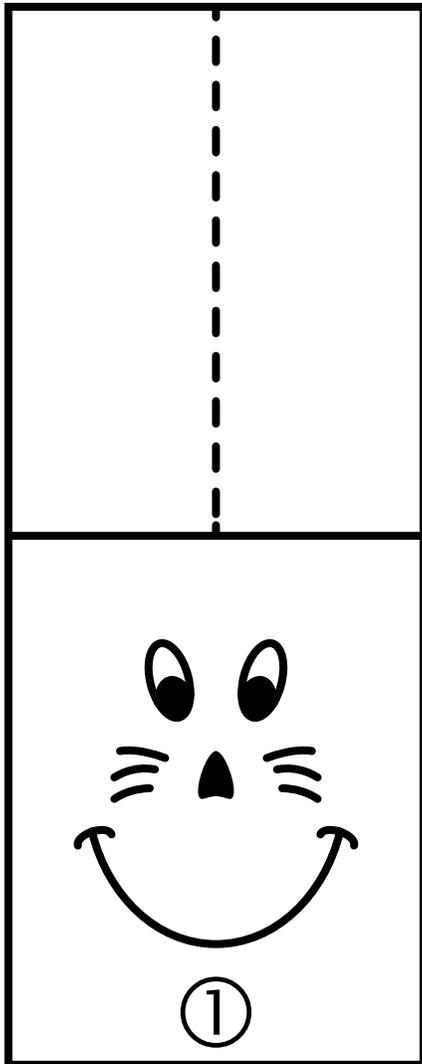
Prediction:

How you will make this a fair:

Results:

# of Paper Clips	Height	Bunny Copter 1	Bunny Copter 2

What you learned:



STUDENT ANCHOR PAPERS & TASK-SPECIFIC ASSESSMENT NOTES:

Novice Scoring Rationale

Each person in this group makes a prediction and gives a supporting reason for his/her choice. They list the variables they would control, but their data indicate they do not control the height from which they drop the copters. Their results reflect that fair testing is not always done in each test; throughout the investigation, students struggle with this idea. Their discussion of what they learned does not effectively reflect their results and mainly reiterates what variables they attempted to control.

Novice

BUNNY COPTERS

Which Bunny Copter is faster? both it was a tie

Prediction: because its Lighter.

A = Small

J = Big because its bigger

How you will make this a fair test:

- * Drop at the same time
- * Same # of Paper clips.
- * Same height

Results:

# of Paper Clips	Height	Bunny Copter 1	Bunny Copter 2
1 B + 15	50 in		X
2 B 35	45 in		X
4 B 15	48 in	X	
4 B	32 inches	X	X
0 B 25	51 in	X	

What you learned:

A Because They where fairley droped.

A = They both obsorbd the same air.

J = They both where the same height.

They listed variables to control, but data shows that height was not held constant.

Each student in this group made a prediction and gave a reason based on some prior knowledge.

Results do not show evidence of conceptual understanding or what actually occurred.

Apprentice Scoring Rationale

This group includes a prediction and gives a supporting reason. They listed the variables they would control and are fairly consistent with regard to height. Their results indicate some confusion with fair testing, as bunny #1 does not always win. This is a result of both students trying to drop the copters at the same time, which is difficult to do. Their conclusions reflect their results and give a beginning understanding of why the smaller bunny might be faster.

Apprentice

BUNNY COPTERS

Which Bunny Copter is faster?

Prediction: The big bunny because

How you will make this a fair test: it is heavier than the little and drop them at the same time. drop faster same

Same amount of paper clips, drop from same height drop lightly the little bunny won

# of Paper Clips	Height	Bunny Copter 1	Bunny Copter 2
1B	1 meter		X
2B 2S	1 meter	X	
2B 1S	1 meter		X
1B 1S	1 meter	X	
1S	1 meter	X	

What you learned: The smaller one

More than the big bunny. The little one won because it is shorter. Smaller ears make it go faster.

This group made a prediction and gave a supporting reason.

They listed variables to control, and data show that height was kept constant.

Results say that the smaller copter "won," however data show that this was not always true.

Practitioner Scoring Rationale

The students in this group include a prediction and begin to give a supporting reason, but it is not clear. One student says that it is a guess. They listed each variable that they would control and are consistent with these. Although they do not mention controlling the number of paper clips in this section, they do include it in their results. This group chooses to test the same number of paper clips more than once and keeps the height consistent each time as well. Their results indicate a good understanding and use of fair testing. Their conclusions include a number of important ideas about what happened with regards to their results and that the smaller bunny gets less (hits) air – evidence of conceptual understanding.

Practitioner

BUNNY COPTERS

Which Bunny Copter is faster? Same

Prediction: J : The small one will win.

C : B because I think it will touch the ground

How you will make this a fair test:

Drop at the same time first
I don't know why I am gettin
Same height

Results:

# of Paper Clips	Height	Bunny Copter 1	Bunny Copter 2
1 B	J- ^{same} Height	✓	
1 B	J- Height	✓	
1 B	J- Height	✓	
1 B	J- Height	✓	
1 B	J- Height	✓	

What you learned:

Gravity was involved.
The small one hitless
air so fell faster.

These students made a prediction, but the supporting reason is not clear.

Variables to be controlled are listed, and data shows that they were.

Data shows that they conducted 5 tests using the same number of clips and height.

Conclusions show evidence of conceptual understanding.

Expert Scoring Rationale

This group includes a prediction and gives a clear supporting reason for their choice. They list the variables they would control and are effective controlling these during testing. Their results reflect understanding of fair testing in that they keep the height the same and the number of paper clips the same on both bunnies during each test. Their conclusions include a number of important ideas about what happened in their results and the concept of flight (air resistance and lift).

Expert

BUNNY COPTERS

Which Bunny Copter is faster?

Prediction: big copter

because it has more wieght than the small one
How you will make this a fair test: drop at same time

same # of paper clips
same hieght

Results:

# of Paper Clips	Height	Bunny Copter 1	Bunny Copter 2
1 small	39 1/2 inches		X
1 small and big	39 1/2 inches	X	
1 small and big	39 1/2 inches	X	
2 small / big	39 1/2 inches	X	
2 ^{and} 25	39 1/2 inches	X	

What you learned: The Bigger one was slow and the smaller one was faster because, the bigger one has longer ears and both of them will spin at the same speed and the

These students make a prediction and include a reason that is plausible.

Variables to be kept constant are listed, and data verifies that they were.

air bigger one will stay at the
because, it has longer ears
that makes the bigger one be
slow and the smaller
one be faster.

Conclusions are based on data and show evidence of conceptual understanding of lift and air resistance.