

Biomimicry as an Authentic Anchor - T-shirt Launcher Design Challenge (Resource Exchange)

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Dr. Ethan Danahy is a Research Associate Professor at the Center for Engineering Education and Outreach (CEEEO) with secondary appointment in the Department of Computer Science within the School of Engineering at Tufts University. Having received his graduate degrees in Computer Science and Electrical Engineering from Tufts University, he continues research in the design, implementation, and evaluation of different educational technologies. With particular attention to engaging students in the STEAM content areas, he focuses his investigations on enhancing creativity and innovation, supporting better documentation, and encouraging collaborative learning.

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Biomimicry as an Authentic Anchor (Resource Exchange)



Suggested Grade Levels

Middle School (6th-8th grade)



Estimated Time

2-3 hours; limited time of 1 hour for building phase

Design Challenge

Use biomimicry to design a mechanism capable of safely distributing t-shirts from a ground location over a safety barrier in a concert or sporting event



Natural Organisms

Seed Pods, Click Beetle, Spring Tail



Learning Goals



- Use the **NGSS** crosscutting concept of **Structure and Function** to analyze how organisms **fling**.
- Implement a **biomimetic design** process.
- Use TinkerCad to construct a **digital 3D prototype** and physical prototype with moving parts.
- Investigate the **strengths and weaknesses** of different **nature-inspired** design ideas.

What is Biomimicry?



"A practice that learns from and mimics the strategies used by living organisms to solve challenges." (Biomimicry Institute, n.d.)

Procedure

- **Study natural organisms** that can fling
- **Analyze their structure and function** for bio-inspiration.
- Use the provided tools and materials to **build** the device.
- **Test and iterate** the design.
- **Reflect and share** the final design.

Flinging



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Design Challenge: T-Shirt Launcher

Structure Function Analysis Worksheet (sample answers)

Organisms	Parts that support Flinging	Properties or characteristics of those parts	Action(s) enabled by parts and their properties
Click beetle	2 pegs and 2 grooves, head, muscle	Pegs and grooves: interlocking Head: rotates around the abdomen. Muscle: like an internal spring	Pegs: slide into grooves Head: pushes off the ground Muscle: holds/releases the pegs
Seed pods	Walls, seeds	Seeds: smooth, spherical Walls: long and thin, can hold water or dry out	Violets: walls shrink and move closer together, put pressure on seeds. Impatiens: walls shrink on one side, bending. The bending wall pushes on seeds.
Spring tail	Upper muscle, lower muscle, tail	The upper muscle: long Lower muscle: short Tail: fork shaped	Upper muscle: contracts at launch, lower muscle: extends, and tail: unfolds, pushes against the surface.

Tools and Materials

Craft Materials

Paper and pencil for sketching ideas; Rulers for measuring real world objects; Classroom available materials to create structure and/mechanism

Technology Tools

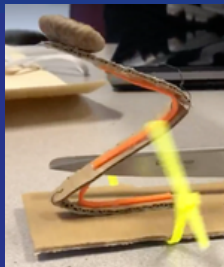
TinkerCAD

Craft Tools

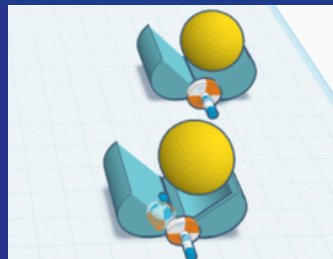
Hole punchers, scissors, hot glue guns, glue sticks, ruler, tape measure

...

Student Flinging Designs



Inspired by the Spring Tail



Inspired by the Seed Pod

Padlet Resources



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