Adaptive Ball Launcher 2: Accessible Design for Independent Play

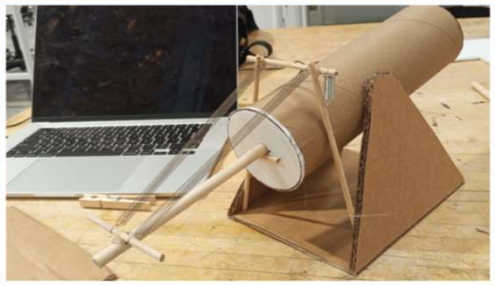
Motivation & Objectives

Challenge: Children with motor impairments **cannot launch objects** due to limited **strength and control**.

Limitations: Existing launchers are **expensive**, **complex**, or **unsafe**, limiting **independent play** and **therapy opportunities**.

Significance: Throwing/ Launching activities build **independence**, **coordination**, and **confidence**.

Impact: A **safe**, **affordable**, and **replicable** launcher allows **inclusion** and **well-being**.



Low Fidelity prototype: discovered **key** issues such as lack of stability and durability.

Design Solution

The **Adaptive Ball Launcher** is a compact spring-based system selected via a **Pugh Scoring Matrix** for balanced **durability, adaptability, and affordability**.

A **linear drive system** compresses the spring, releasing the gates and launching the projectile.

Design features include a **modular frame** and **universal mount. Quantitative and qualitative testing** validated **usability, performance, and adaptability**.

Children and caregivers reported **safe, enjoyable operation**, confirming user-centered design goals.

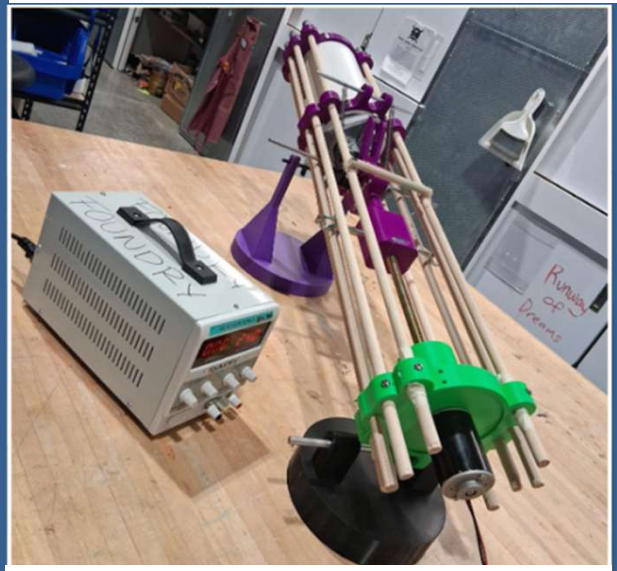
Key functions including **consistent trajectory,** and **stable operation** were demonstrated under multiple conditions.

Testing and Design Criteria

Design criteria were defined from user needs and refined through **client feedback** to ensure safety and accessibility, evaluated using **quantitative metrics** and **qualitative**

Design Criteria	Test	Metric	Method
Ease of Use for Child	Activation Force	Force to trigger launch (< 20g)	Force Gauge – Pass
Launch Distance (5-15 feet)	Launch Distance	Range consistently between 5 and 15 feet	Tape Measure – Low Pass
Stability (Works on outdoor surfaces)	Stability Test	Launches without falling over on multiple surfaces	Slow Motion Camera High Pass
Durability (Lasts 50+ Launches)	Durability	Performs after 50 launches	Continuous Trigger Test – Low Pass
Replicability (Can be setup and rebuilt)	Assembly Time	Setup within 5 minutes, replicable within 2 weeks.	Stopwatch / Tool Count – Pass
Adaptability (Shoots various items)	Adaptability	Shoots items of various size and quantity	Types of Items – High Pass

Testing confirmed strong overall performance, with all primary functions achieved. Range and **durability** require further refinement and will be addressed in future iterations.



Final launcher demonstrating **compact**, user-centered design. **Above are the spring mechanism, linear drive and mount.**

Reflection

Iterative testing refined **spring alignment** and **mount stability**.

Collaboration with **clients** ensured a **safe, user-centered design**. The launcher supports **independent play** through **affordable, accessible engineering**.

Early prototypes shaped realistic criteria, and **low-cost materials** delivered high functionality.

In the future, we need to integrate **auto-reloading** and **angle adjustment**. We also will develop **3D-printed, replicable modules** for home and school use.

References

We would like to thank our clients at Lennox Baker, our Professors Dr. Brooke and Dr. Delagrammatikas, and our TAs: Drew C, Karstan B, and Lauren S.