

MRI Exercise Device

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Overview

- MRI Technology
- Design Requirements
- Previous Prototypes
- Alternative Designs
- Design Matrix
- Testing and Future Work



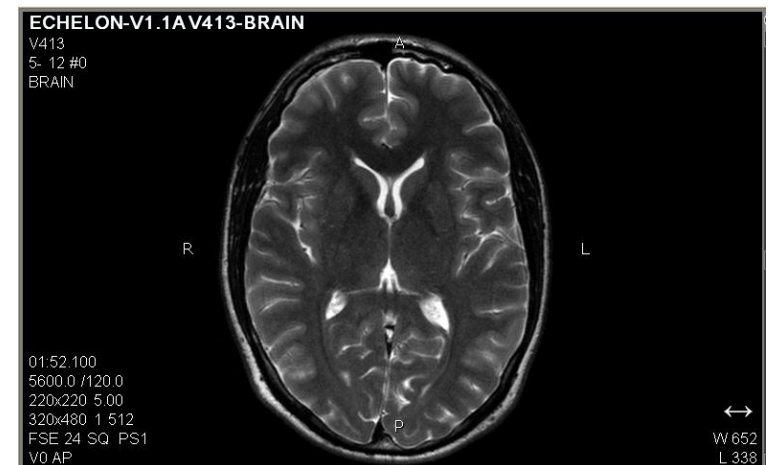
Project Summary

- Design an exercise device
- Compatible with an MRI
- Main objective: assess cerebral blood flow responses to exercise



MRI Exercise

- Want to observe cerebral blood flow during exercise
 - Observe the effects of age and disease states
- MRI is currently the best technology that can make such an assessment



Primary Design Requirements

- MRI Compatible
- Minimize upper body movement
- Adequately raise heart rate
- Adjustable resistance
- Accommodate varying heights
- Withstand frequent use



Secondary Design Requirements

- Comfort
- Aesthetics
- Measure work output
- Accommodate obese subjects
- Easy transport



Previous Prototypes

- Stepper
- Cycle



Farrell, Lenz, Maharaj, Yagow. BME Design, 2009.

Alternate Designs

- Lever
- Cycle
- Ferrous Boots

Lever

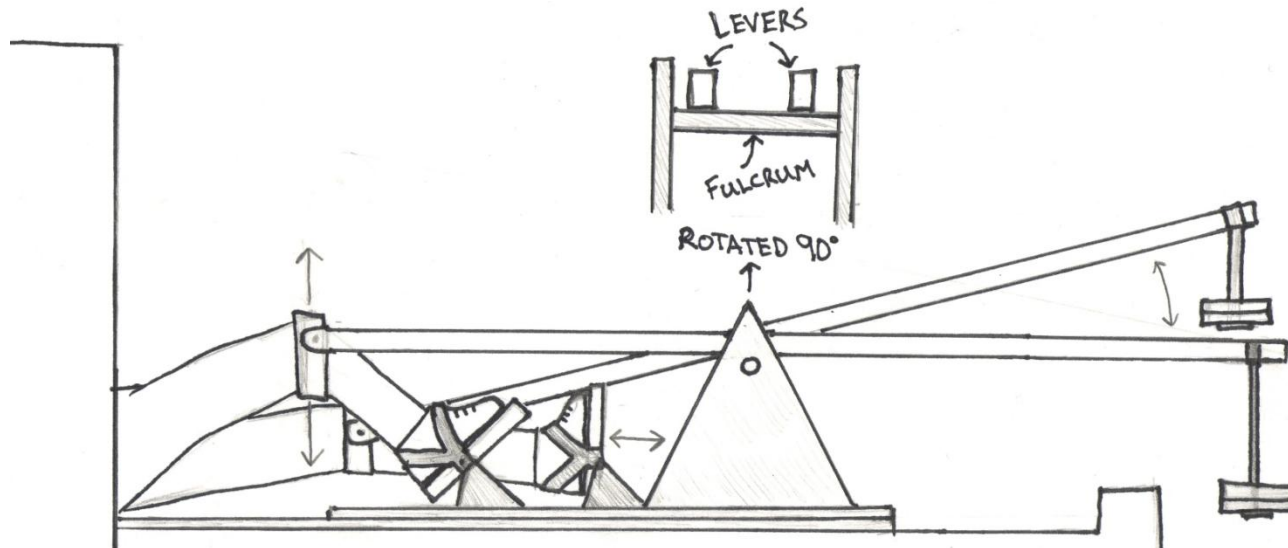
- Uses a stepping motion, with resistance caused by a movable lever

Pros:

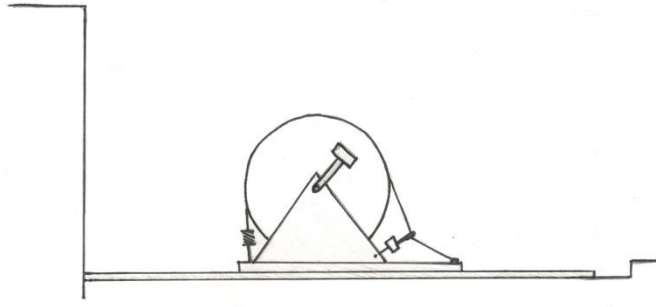
- Minimal upper body movement
- Easy to make non-ferrous
- Simple to adjust resistance

Cons:

- Could be difficult to attach to leg
- Relies on very little friction in track and pulleys



Cycle



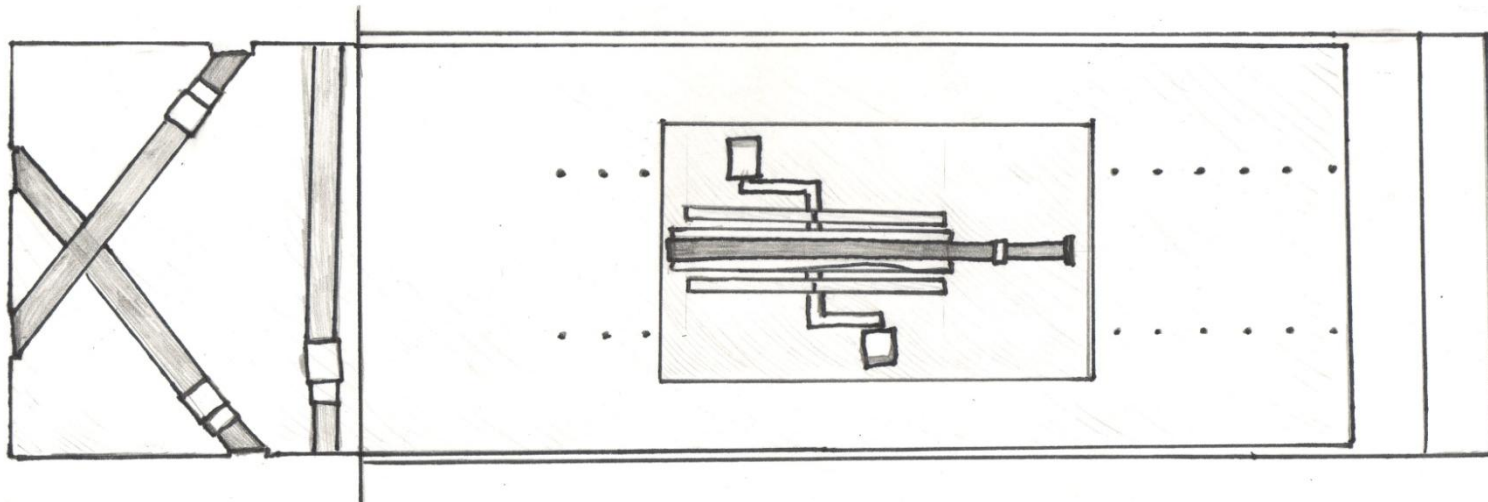
- Uses cyclic motion to apply constant resistance

Pros:

- Steady motion
- Resistance adjustment
- Simple Mechanics

Cons:

- Larger range of motion needed
- Difficult to construct non-ferrous
- Potential upper body movement



Ferrous Boots

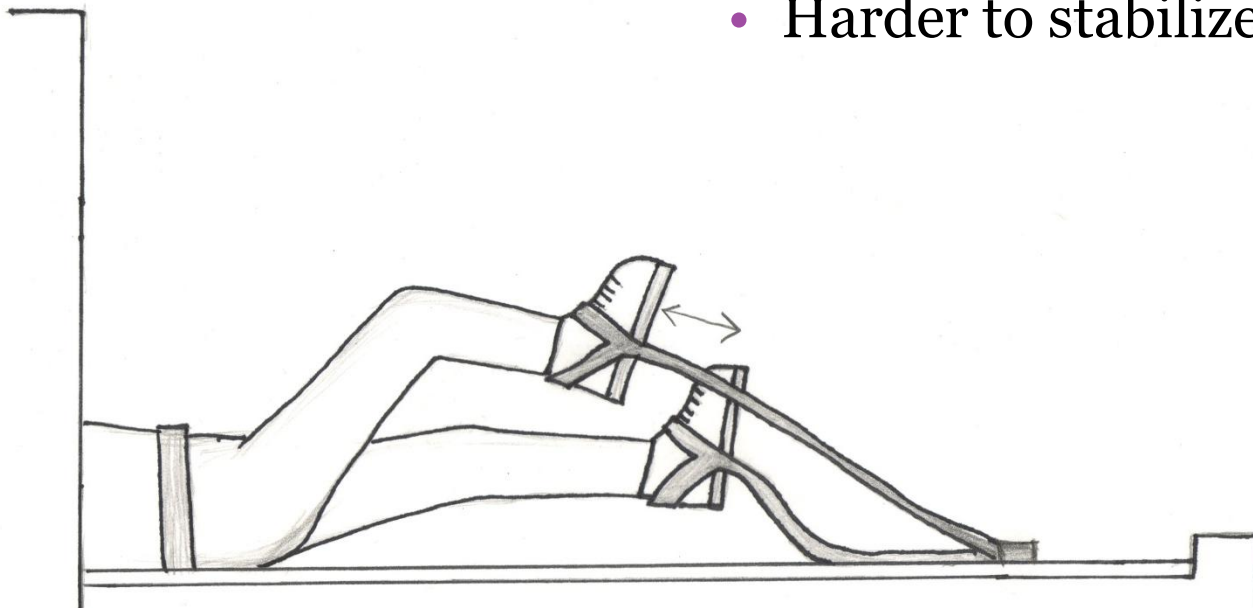
- Uses the magnetic power of MRI to create resistance

Pros:

- Very easy to assemble
- Causes constant resistance

Cons:

- Interferes with magnetic field
- Could be dangerous
- Harder to stabilize upper body



Design Matrix

Criteria		Possible Designs		
Considerations	Weight	Lever	Cycle	Ferrous Boots
Constant resistance	20	18	18	20
Ease of fabrication	10	8	9	10
Adjustability	10	9	6	10
Range of motion	20	16	13	18
MRI Compatibility/Safety	20	17	15	2
Upper-body stabilization	20	17	15	13
Total	100	85	76	73

Testing and Future Work

- Order parts and test for MRI compatibility
- Fabrication
- Test design

Special Thanks

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Questions?

