

# Universal Exercise Unit (Spider Cage)



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# Overview

- Introduction
  - Client
  - Background
    - Cerebral Palsy
    - Spider Cage Therapy
  - Problem Statement
- Designs
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- Acknowledgements
- References

# Client Description

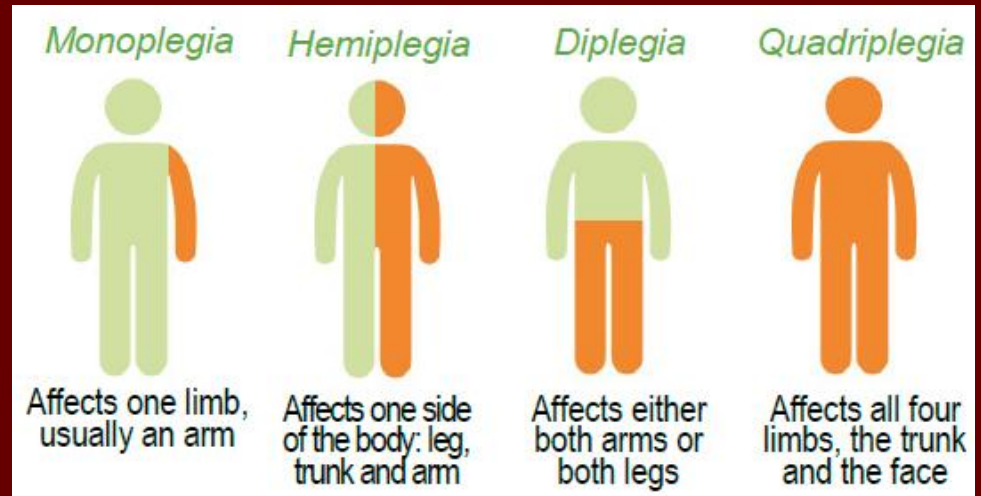
Matt Jahnke



- Adult program director for United Cerebral Palsy (UCP) of Greater Dane County
- Supportive services for children and adults with disabilities

# Cerebral Palsy

- Cerebral Palsy: non-progressive, non-contagious motor conditions that cause physical disability in development
  - Due to abnormal brain development
- Can be treated but no cure
  - Surgery
  - Medication
  - Therapy



# Therapy

- Goal: maximize functional control of the body/increase gross motor function
  - Develop coordination
  - Build strength
  - Improve balance
  - Maximize independence

- Common equipment

- Exercise balls
- Resistant bands
- Orthotics
- **Spider cage**



<http://ursdayton.org/spidercage/spider-cage-5/>



<http://www.abclawcenter.com/>

# Spider Cage Therapy



## Goals:

- Strength training
- Head, neck, and trunk control
- Balance and function

# Problem Statement

- Provides a form of physical therapy for persons with CP
- Supports varying amounts of weight and must be structurally sound
- Current designs are expensive (~\$4,000) and difficult to transport

# Design Specifications

## Client Requirements:

- Low Cost
  - Lower than commercially available cost
- Functionality
  - Replicate that of the commercially available product
- Easy Assembly
  - Assembled by our client and a few others

## Design Requirements:

- Transportable
  - By non-commercial transportation
- Fit through tight doorways
  - Smallest door sized 82" x 42.5", or 6' 10" x 3' 5.5"

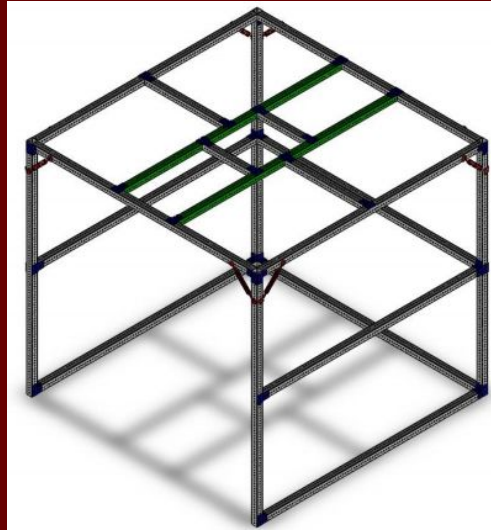


# Past BME Design Work

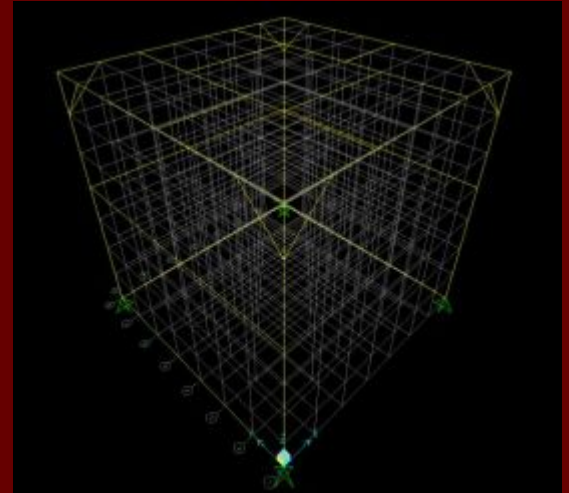
Wooden prototype



Solidworks CAD model



FEA simulation in SAP2000



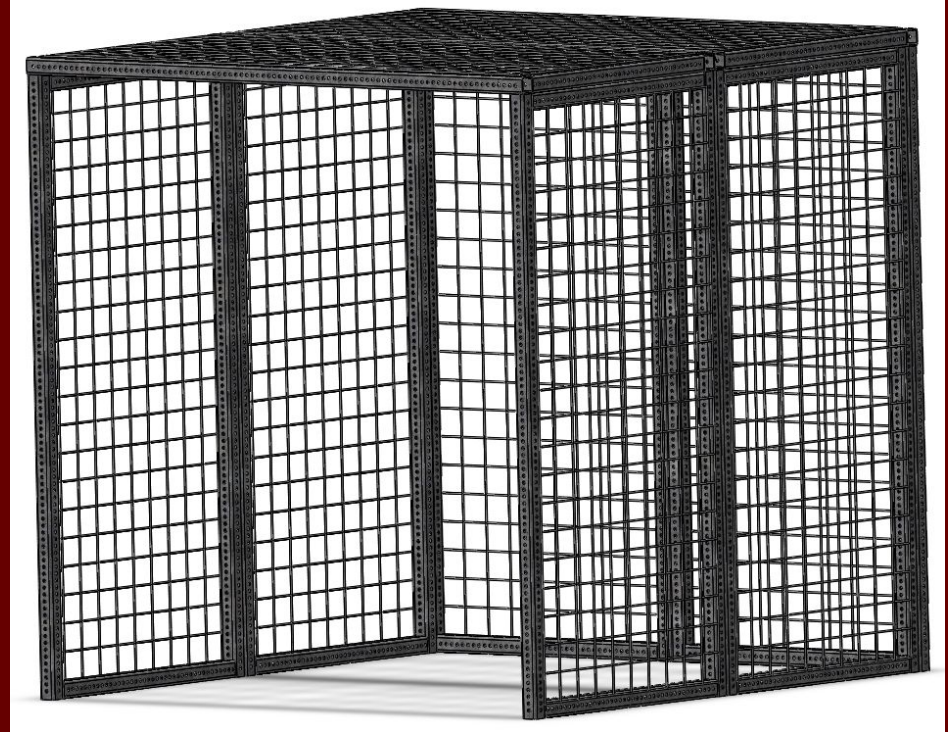
# Design 1 - Panels

## Pros:

- Easy to manufacture
- Few pinch points
- Repairability
- Low section weight

## Cons:

- Potentially cumbersome to assemble sides and top
- Many sections



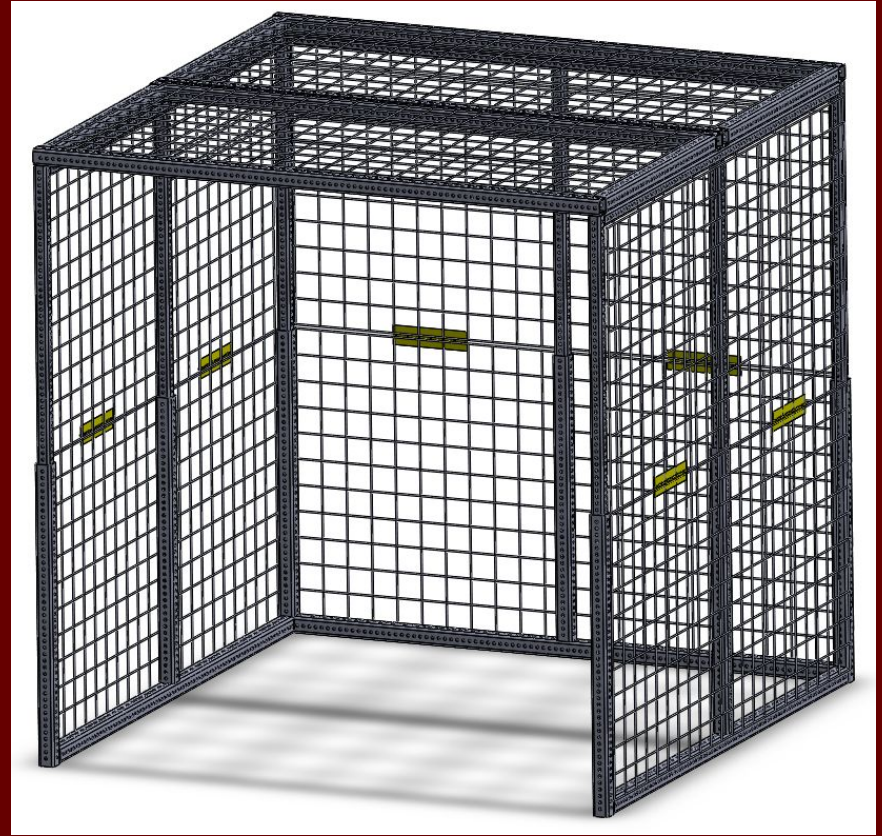
# Design 2 - Telescoping

## Pros:

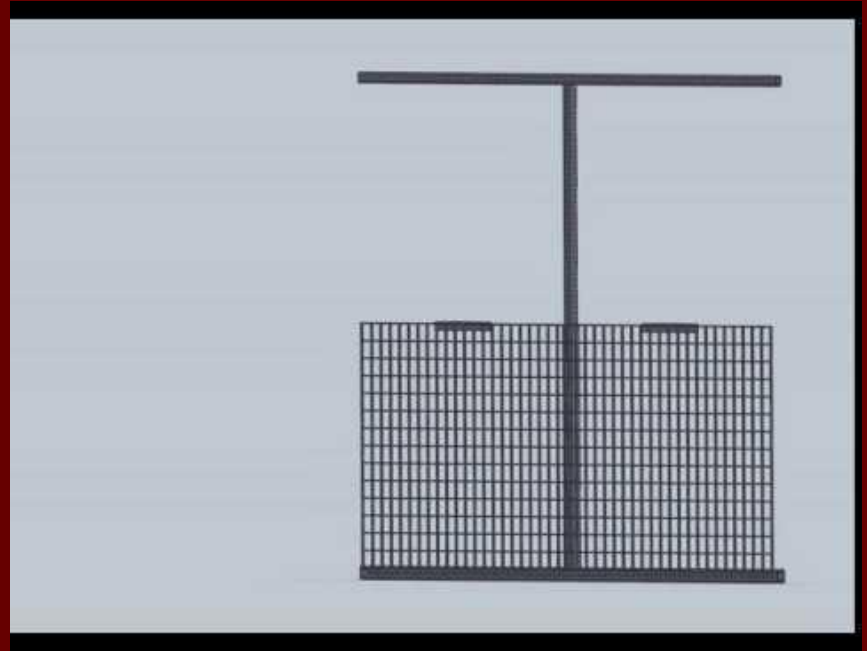
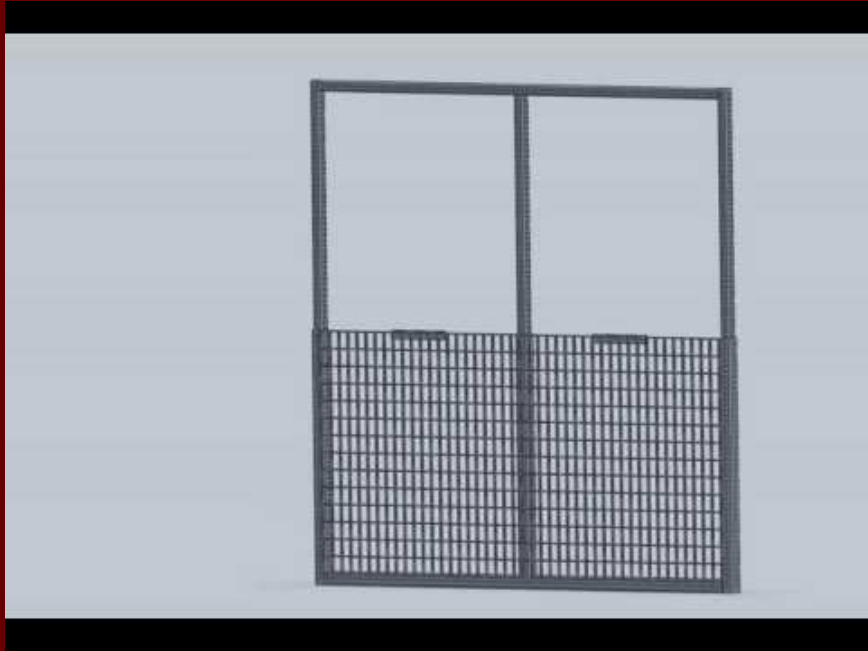
- Fewer sections
- Easy to assemble sides and top

## Cons:

- High section weight
- Pinch points
- More difficult to manufacture
- Repairability



# Design 2 - Telescoping



# Design 3 - Foldable

## Pros:

- Easy to manufacture
- Fewer sections

## Cons:

- Pinch Points
- High section weight
- Potentially cumbersome to assemble top



# Design Matrix

Design Considerations	Weight	Panels		Telescoping		Foldable	
		Score	Weighted	Score	Weighted	Score	Weighted
Cost	10	3	6	4	8	3	6
Safety of Assembly	25	2	10	4	20	2	10
Ease of Assembly	25	2	10	4	20	3	15
Portability (Weight & Size)	15	4	12	3	9	2	6
Ease of Fabrication	15	5	15	1	3	5	15
Repairability	10	4	8	2	4	3	6
SUM	100		61		64		58

# Future Work

- Material selection
  - Lighter weight
- Fabrication
- Testing
  - Possible human subject testing
    - IRB
  - Testing on group members

# Acknowledgements



Client:  
Mr. Matt  
Jahnke



Advisor:  
Dr. Joseph  
Towles



Dr. John  
Puccinelli



Dr. Michael  
Cheadle



Travis  
Dick



Jon Elicson and past BME  
Design Team



# References

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**Questions?**