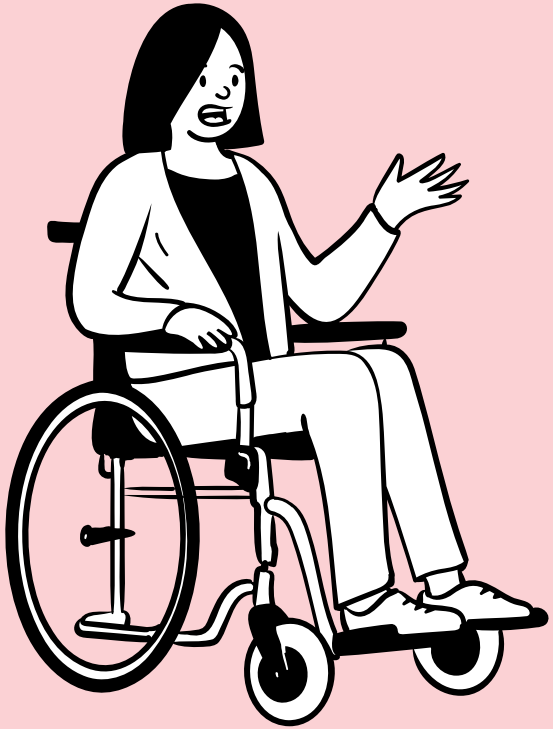
The Cush

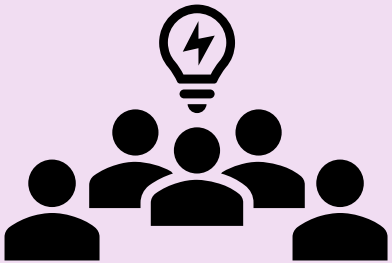
A CUSHY FOR YOUR BACK AND TUSHY

Agenda

- Client Needs and Problem Statement
- Engineering Design Process Model
- Project Management Plan & Risks
- Product Benchmarking & Target Specifications
- Concepts Generated
- Decision Matrix & Concept Selected
- Feedback
- Prototypes
- Functional Decomposition
- Feasibility
- Testing
- Business Model
- Economic Analysis
- Trials and Tribulations
- Lessons Learned
- Future Work



Our client suffers with Ehlers-Danlos Syndrome, which causes symptoms of joint dislocation frequently.
When our client goes over a bump in their wheelchair, their back and shoulder tend to dislocate.



Our job is to create a wheelchair cushion for our client to prevent this from occurring.

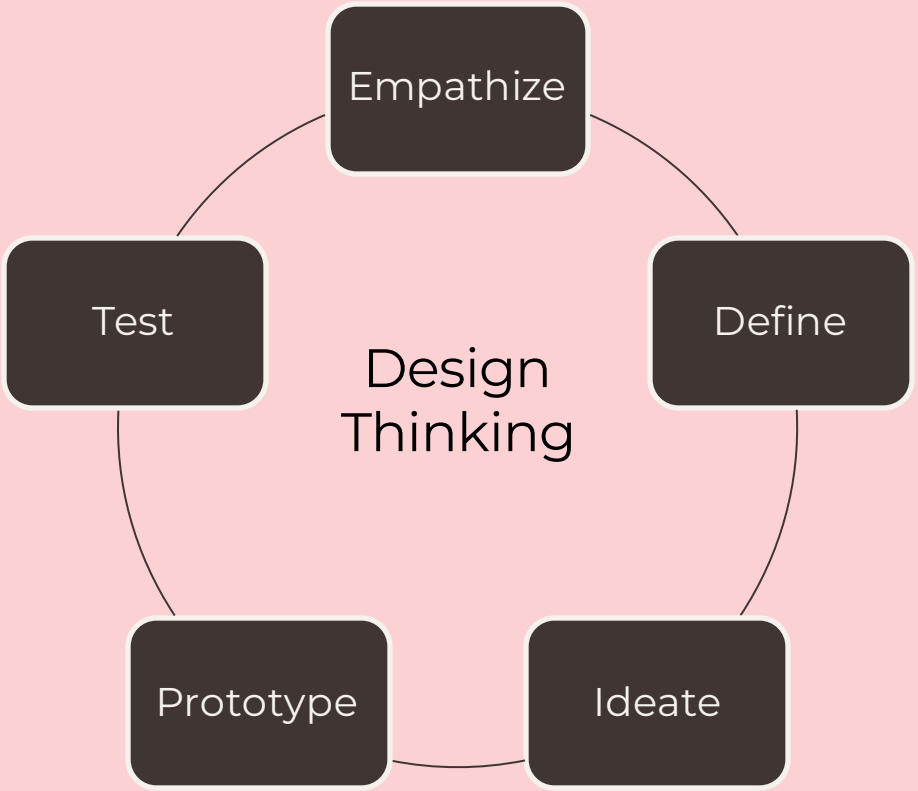
Client Needs

- Mitigate the force on the client's upper back when the wheelchair is reclined
- Comfortable to use for several hours a day
- Maintains the width of padding on the lower back of the chair
- Capable of attaching to the wheelchair
- Easy to put together
- Lightweight

Problem Statement

The client is experiencing discomfort when reclining in their wheelchair due to their EDS diagnosis and insufficient padding. Our product will mitigate force on the client’s back while maintaining the dimensions of the chair’s lower backrest.

Engineering Design Process Model



Project Plan

#	Task	Month																Task Owner
		Sept.				Oct.				Nov.				Dec.				
1	Team Contract	X																All members
2	Client Meeting 1 & Needs		X															Justin
3	Problem Statement		X															All members
4	Target Specs			X														Amy
5	Prototype 1 (Analytical)			X	X	X												Andrew
6	Prototype 2						X	X	X	X								All members
7	Prototype 3										X	X	X					All members
8	Design Day													X				All members
9	User Manual												X	X	X			All members
10	Project Complete														X			All members

Project Plan Risks

- Timeline for receiving materials
- Acquiring foam
- Learning how to sew
- Having access to machines in Makerspace
- Team member availability

User Benchmarking

Computer Chair Cushion

What our client is currently using

Technical Benchmarking

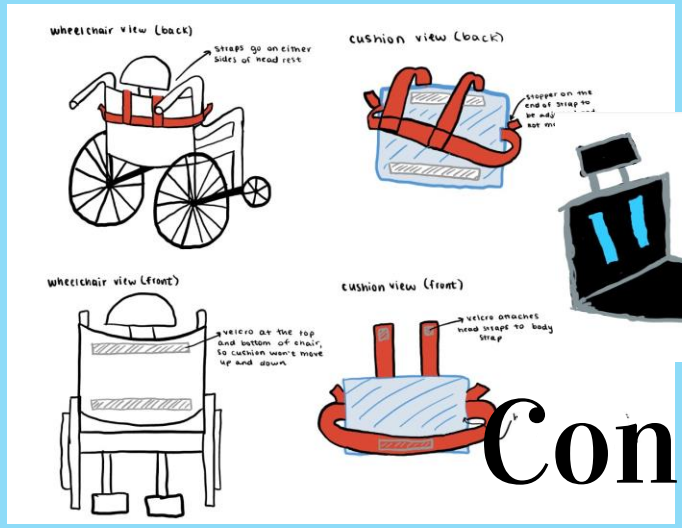
Qutool Memory Foam Cushion

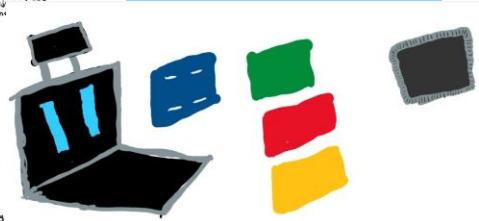
SmartMove Wheelchair Cushion

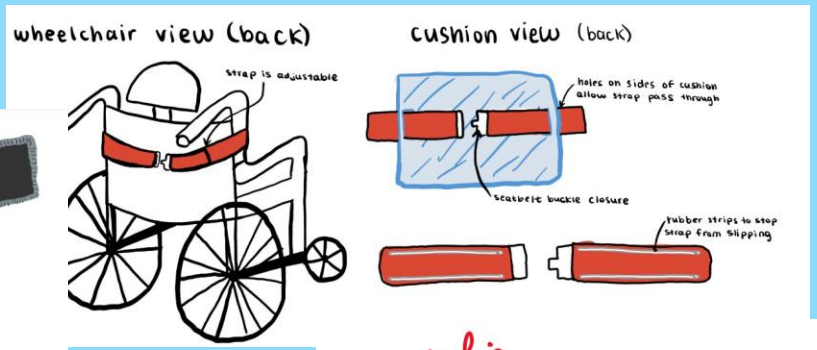
Target Specifications

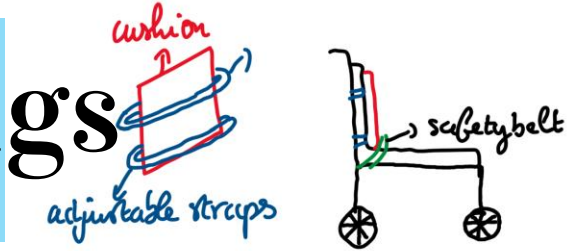
	At Least	At Most	Ideally
Functionality	Improves pain 50% of the time.	Improves pain 100% of the time.	Improves pain 90-95% of the time.
Ease of Use	Cannot be installed by themselves.	Can be installed by themselves.	Can be installed by themselves.
Efficiency	Can be installed in 5 minutes.	Can be installed in 1 minute.	Can be installed in 1-2 minutes
Durability	Lasts 6 months.	Lasts over 2 years.	Lasts 1-2 years.

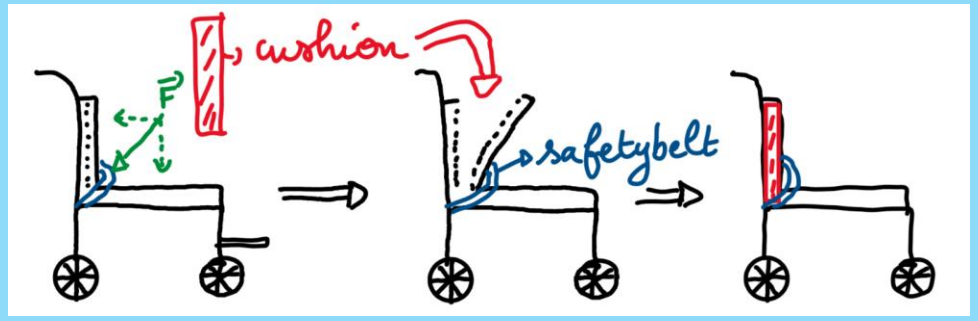
Concept Drawings

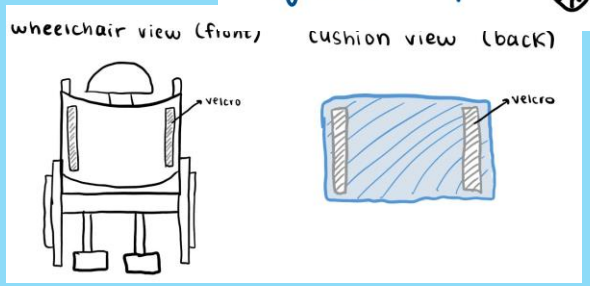












Decision Matrix

Concept	Support	Comfort	Durabilit	Modularit	Fit	Weight	Aesthetic	Cost	Total
1	7	6	7	10	10	5	5	5	55
2	8	8	9	10	10	8	5	4	62
3	6	6	10	10	10	10	4	6	62
4	6	10	6	10	10	8	6	7	63
5	8	9	6	10	10	5	6	2	56
6	8	5	9	7	10	5	7	4	55
7	7	7	8	10	10	8	8	6	64
8	7	7	5	8	10	7	8	5	57
9	7	7	6	9	10	8	8	6	61
10	8	10	6	4	7	7	10	3	55
11	10	7	10	7	10	10	6	4	64
12	8	7	10	5	9	3	10	2	58
13	10	8	10	1	10	6	10	3	58
14	10	8	10	1	10	6	10	3	58
15	8	8	9	10	10	8	5	4	62

Final Concept

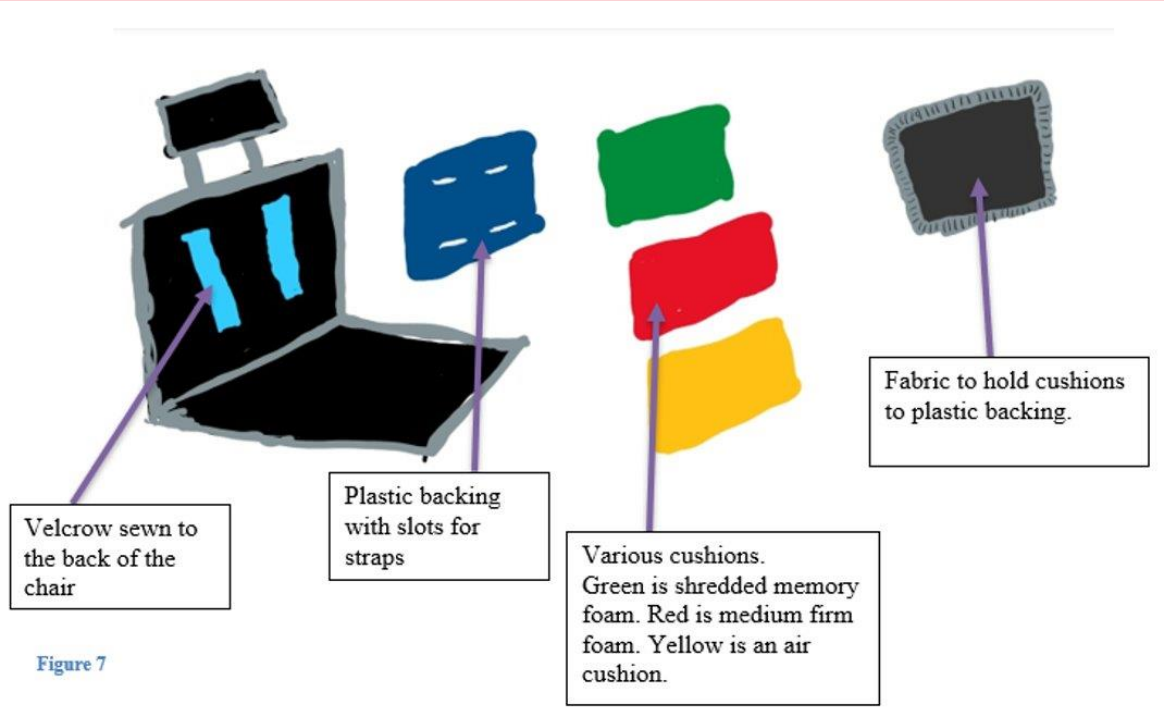
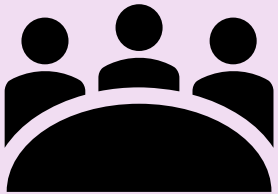


Figure 7

Feedback



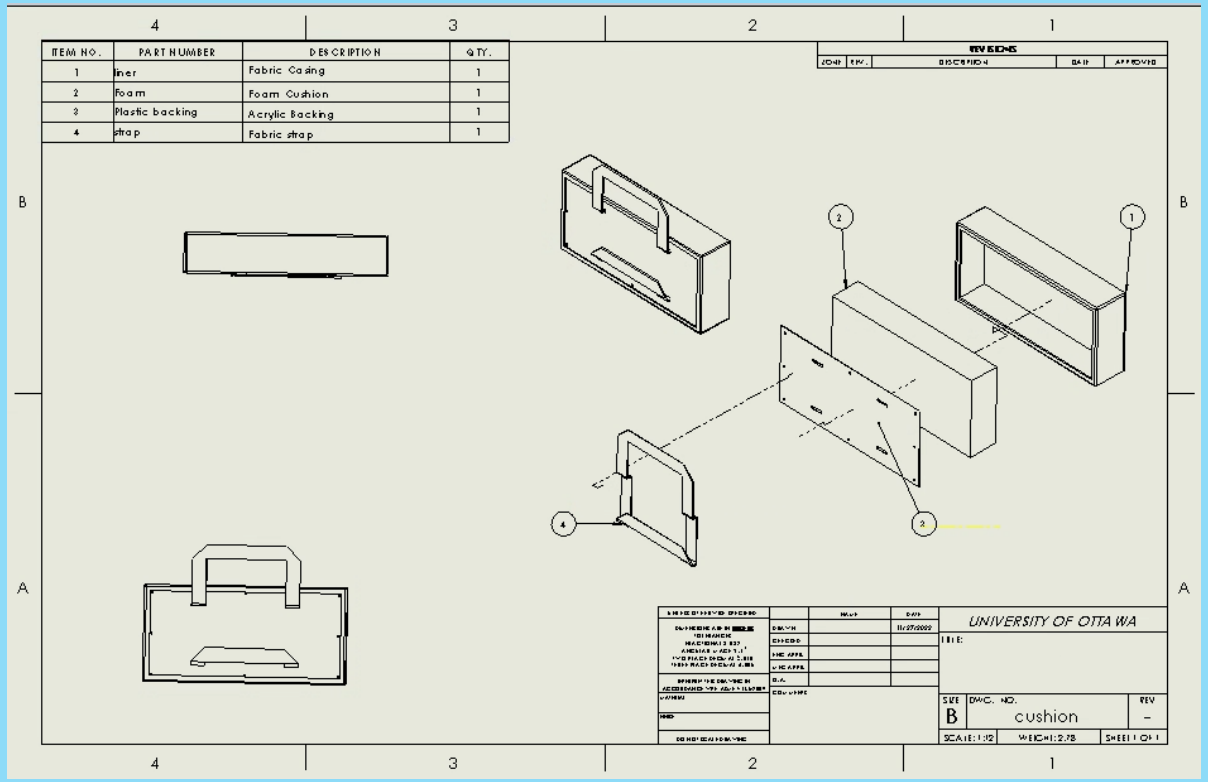
TA

- Modular backing design may not work
- Find a way to make the amount of foam in the cushion customizable
- No velcro
- Consider using acrylic

Client

- Prefers acrylic backing
- No Velcro
- Likes compression cover
- Would like product to be red
- Soft foam

Prototype 1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	liner	Fabric Casing	1
2	Foam	Foam Cushion	1
3	Plastic backing	Acrylic Backing	1
4	strap	Fabric strap	1

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cushion

Prototype 2

Front

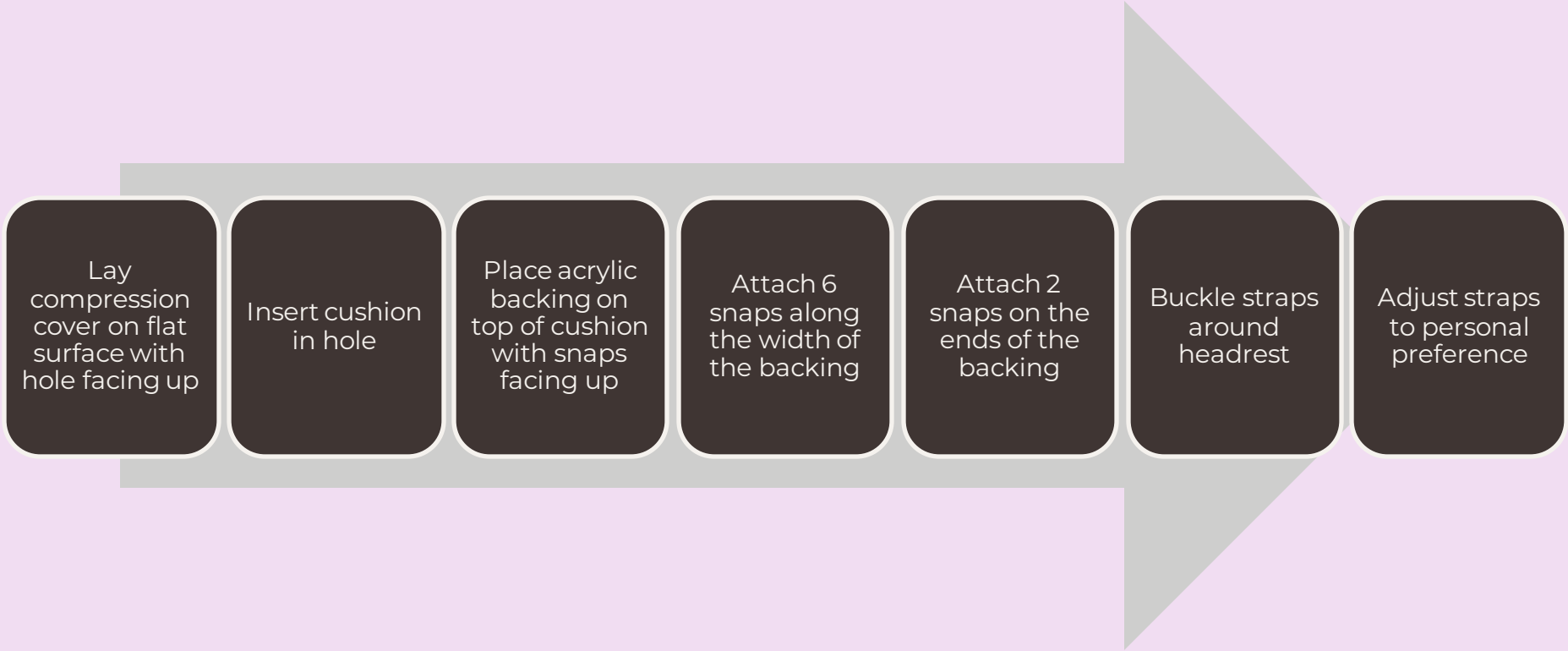
Back

Prototype 3

Front

Back

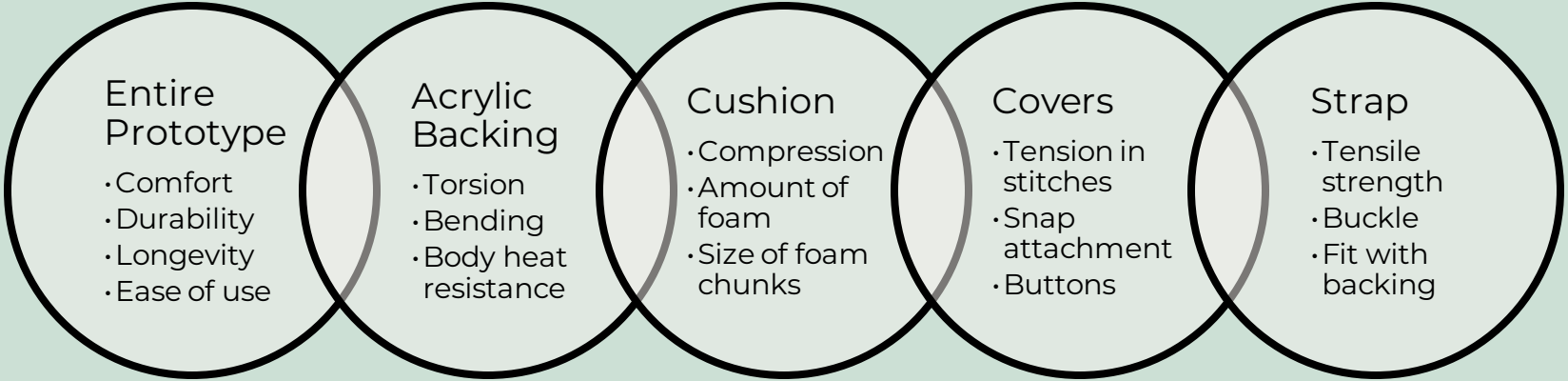
Functional Decomposition

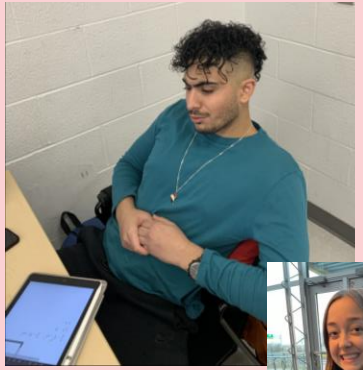


Feasibility

- Do we have access to all the materials and machines we need?
- Can we purchase all these materials while staying under budget?
- Is acrylic durable enough to withstand the client's weight without cracking?
- Do we have enough time to complete this?

Tests

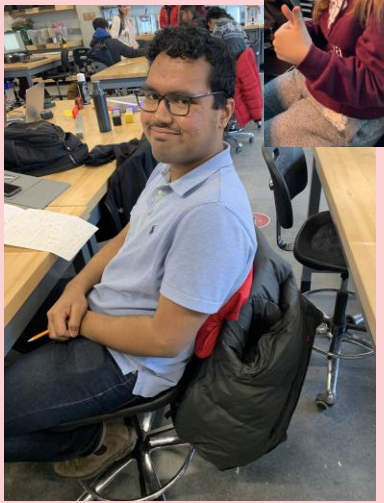

Entire Prototype
• Comfort
• Durability
• Longevity
• Ease of use
Acrylic Backing
• Torsion
• Bending
• Body heat resistance
Cushion
• Compression
• Amount of foam
• Size of foam chunks
Covers
• Tension in stitches
• Snap attachment
• Buttons
Strap
• Tensile strength
• Buckle
• Fit with backing











Triple Bottom Line Business Model

Key partners
What are your key partners to get competitive advantage?

- Fabric companies
- Foam suppliers
- Acrylic sheet suppliers

Key activities
What are the key steps to move ahead to your customers?

- Design
- Product development
- Engineering
- Client care

Key resources
What resources do you need to make your idea work?

- Seed funding
- Empathetic workers
- High demand

Value propositions
How will you make your customers' life happier?

- To create a cushion that prioritizes comfort
- To create a personalized experience for each customer
- To create a great customer experience
- To always be there for the customers when they need

Customer relationships

- Monthly follow ups with customers to ensure satisfaction
- Quick response time to during online communication
- Transparency in the process
- End-to-end solution

Channels
How are you going to reach your customers?

- Website
- Social media
- Endorsements
- Contracts with medical centers

Customer segments
Who are your customers? Describe your target audience in a couple of words.

- Handicapped individuals
- Physiologists
- Rehabilitation staff
- Wheelchair users
- Support workers
- Office workers

Cost Structure

- Marketing
- Product development
- Manufacturing
- Customer support

Revenue Streams

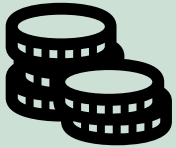
- Product sales

Bill of Materials

Item Number	Part Name	Quantity	Unit Cost	Extended Cost
1	Fabric	1	$10.00 / yard	$14.97
2	Sewing Kit	1	$0	$0
3	Foam Cushion	1	$0	$0
4	Strap	1	$2.00 / yard	$20.00
5	Snaps	10	$1.20 / snap	$12.00
6	Acrylic Backing	1	$13.00	$13.00
				Total $59.97

Economics

6000 units sold in 3 years



A total profit of $106,825.62 in 3 years

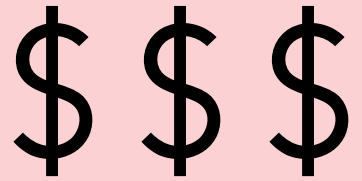
A unit cost of $27.65

Breakeven point hit at 1551 units

A price of $149.99

3-Year Income Statement

Sales Profit	$899,940.00
Loan	$70,000.00
Cost of Goods Sold	$195,000.00
Gross Profit of Sales	$704,940.00
Operating Expenses	$546,458.00
Operating Income	$158,481.94
Interest Expense	$21,000.00
Tax Expense	$11,851.58
Net Income	**$106,825.00**



Trials and Tribulations

- Lack of information about the specifics of the cushion
- Inexperience with manufacturing processes
- No in-person client meetings
- Crack in acrylic backing
- Busy schedules

Lessons Learned

- When the client has a good idea of what they would like, it's easier to create a design concept
- Snap fasteners lock ring can be stretched by putting fabric in it
- Acrylic can be cracked by high force impact
- In-person team meetings are typically more productive than online ones

Future Improvements

- [x] Better snaps
- [x] Sleeker case
- [x] Cleaner sewing
- [x] Higher quality of material
- [x] Thinner acrylic sheet

Thank you for listening!

Any questions?