Design Project I

For the first project, we created a portable coffee mug with a sheath-like handle that runs from one side of the cup to the other, covering half of the cup's circumference. This handle is wide and deep enough for large hands, but also can be easily used by small-handed individuals as well. It was designed so that any person with one finger, no matter the finger, could use the mug, and distribute the weight of it on the side of their hands. The cup also accommodates both left and right handed people without disabilities, and will help one finger disabled individuals to enjoy their coffee.

In the research step of the design process, we found information on the requests of customers of our prospective invention. These were organized in a Customer Needs Hierarchy by using AHP to rank the different aspects.

Some of our AHP tables:

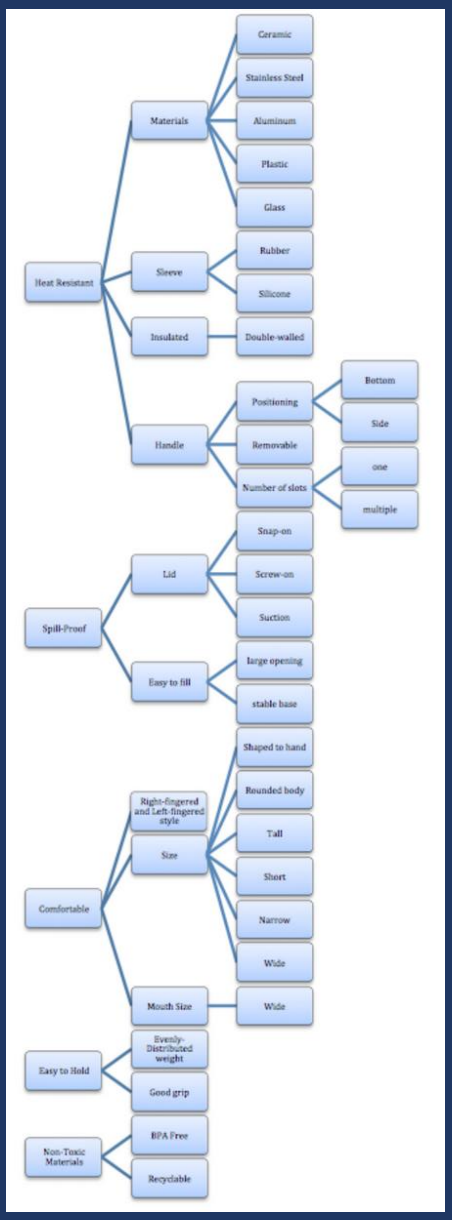
First-Layer	Safe	User Friendly	Portable	Affordable	Appearance	Total:	Weight
Safe	1	3	4	5	6	19	0.430351076
User Friendly	0.3333	1	2	3	5	11 1/3	0.256700642
Portable	0.25	0.5	1	3	3	7 3/4	0.175537939
Affordable	0.2	0.3333	0.3333	1	2	3 7/8	0.0875
Appearance	0.1666	0.2	0.3333	0.5	1	2 1/5	0.049838
					Total:	44 1/7	0.999927656

Safe	Non-Toxic Materials	Insulated /Heat Resistant	Microwave Safe	Dishwasher Safe	Spill-Proof	Total:	Weight
Non-Toxic Materials	1	1	2	3	3	10	0.239426335
Insulated/Heat Resistant	1	1	5	3	3	13	0.311254235
Microwave Safe	0.5	0.2	1	0.2	0.2	2.1	0.05027953
Dishwasher Safe	0.3333	0.3333	5	1	0.3333	6.9999	0.16759604
Spill-Proof	0.3333	0.3333	5	3	1	9.6666	0.231443861
					Total:	41.7665	1

User Friendly	Comfortable	Easy to hold	Fits in cup holders	Rubberized Grip	Holds same amount as regular mug	Total:	Weight
Comfortable	1	0.25	2	5	3	11.25	0.27754957
Easy to hold	4	1	2	2	2	11	0.271381802
Fits in cup holders	0.5	0.5	1	4	0.25	6.25	0.154194206
Rubberized Grip	0.2	0.5	0.25	1	0.25	2.2	0.05427636
Holds same amount as regular mug	0.3333	0.5	4	4	1	9.8333	0.242598061
					Total:	40.5333	1

Once we found the five most important concepts through AHP, we had find ways to materialize these needs. To organize these options, we created a concept classification tree, in which it is much easier to visually understand the many possibilities for our mug's identity.

Our concept classification tree:



After creating the concept classification tree, we continued narrowing down our options in order to create the optimal mug. We selected those concepts from our tree which we thought might apply best to our end goal, and gave them each a letter-number code so as to easier reference their combinations. We then used the technique of concept screening, where we ranked each possible mug against a reference in our five selection criteria (the original customer needs). After giving each a net score, we decided which designs were best, and should continue, and which were no longer an option.

Our initial concept screening:

A: Materials
1. Ceramic
2. Stainless Steel
3. Aluminum
4. Plastic, Double-Walled

B: Sleeve
1. Yes
2. no

C: Handle
1. One, side
2. Two, sides
3. One, bottom

D: Lid
1. Snap-on
2. Screw-on
3. suction

E: Size
1. Tall
2. Short
3. Narrow

F: Mouth Size
1. Wide
2. Regular

Initial Concepts

Selection Criteria	A1B1C1D1E1F1	A2B1C1D1E1F1	A3B1C1D1E1F1	A4B1C1D1E1F1	A1B2C1D1E1F1	A1B1C2D1E1F1	A1B1C3D1E1F1
Non-Toxic Materials	0	0	0	-	0	0	0
Easy to Hold	+	+	+	+	+	+	0
Comfortable	+	+	+	+	+	+	0
Spill-Proof	+	+	+	+	+	+	0
Heat Resistant	0	-	-	0	-	0	0
Sum +	3	3	3	3	3	3	0
Sum 0	2	1	1	1	1	2	5
Sum -	0	1	1	1	1	0	0
Net Score	3	2	2	2	2	3	0
Rank	1	7	7	7	7	1	14
Continue?	Yes	Combine	Combine	Yes	No	**YES**	No

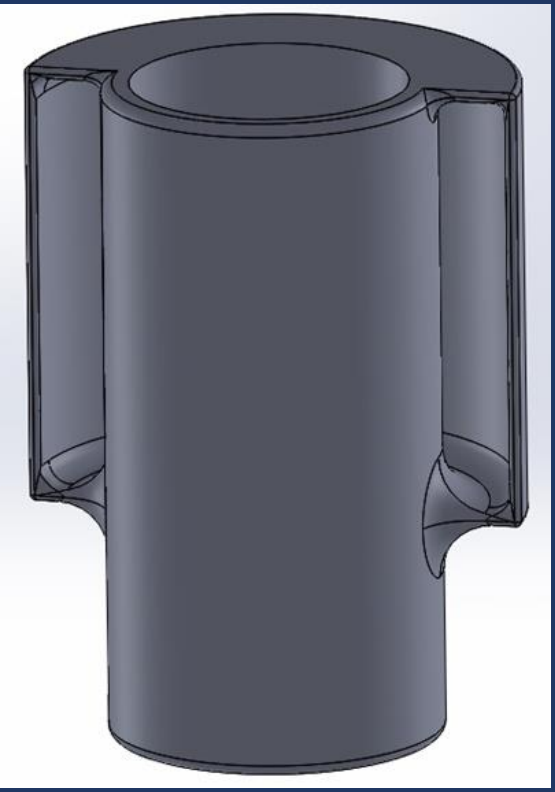
A1B1C1D2E1F1	A1B1C1D3E1F1	A1B1C1D1E2F1	A1B1C1D1E3F1	A1B1C1D1E1F2	A2B2C2D2E2F2	A3B2C3D3E3F2	A4B2C3D2E2F1
0	0	0	0	0	0	0	-
+	+	+	+	+	+	0	0
+	+	+	+	+	+	-	0
+	-	+	+	+	+	-	+
0	0	0	0	0	-	0	0
3	2	3	3	3	3	0	1
2	1	2	2	2	1	3	3
0	0	0	0	0	1	2	1
3	2	3	3	3	2	-2	0
1	7	1	1	1	7	15	14
Combine	Combine	No	No	No	Yes	No	No

After deciding on the continuing designs, we again ranked them against each other, but this time we used the technique of concept selection. We were very satisfied with the first-ranked design, and decided to use this as our prototype in the next step of the design process.

Final Concepts

		A1B1C1D1E1F1		A2B1C1D2E1F1	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score
Non-Toxic Materials	10%	3	0.3	3	0.3
Easy to Hold	40%	3	1.2	3	0.3
Comfortable	10%	3	0.3	1	0.1
Spill-Proof	15%	3	0.45	2	0.3
Heat Resistant	25%	3	0.75	2	0.5
Total Score	100%	3		1.5	
Rank		3		5	
Continue?		No		No	

Selection:
A1B1C2D1E1F1

		A3B1C1D3E1F1		A1B1C2D1E1F1		A2B2C2D2E2F2	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Non-Toxic Materials	10%	3	0.3	3	0.3	3	0.3
Easy to Hold	40%	3	1.2	4	1.6	4	1.6
Comfortable	10%	1	0.1	4	0.4	3	0.3
Spill-Proof	15%	1	0.15	3	0.45	2	0.3
Heat Resistant	25%	2	0.5	3	0.75	3	0.75
Total Score	100%	2.25		3.5		3.25	
Rank		4		1		2	
Continue?		No		Yes		No	

After deliberation, our concept selection ended up being made from ceramic, having a “sleeve” type handle on two sides, having a snap on lid, being tall, and having a wide mouth.