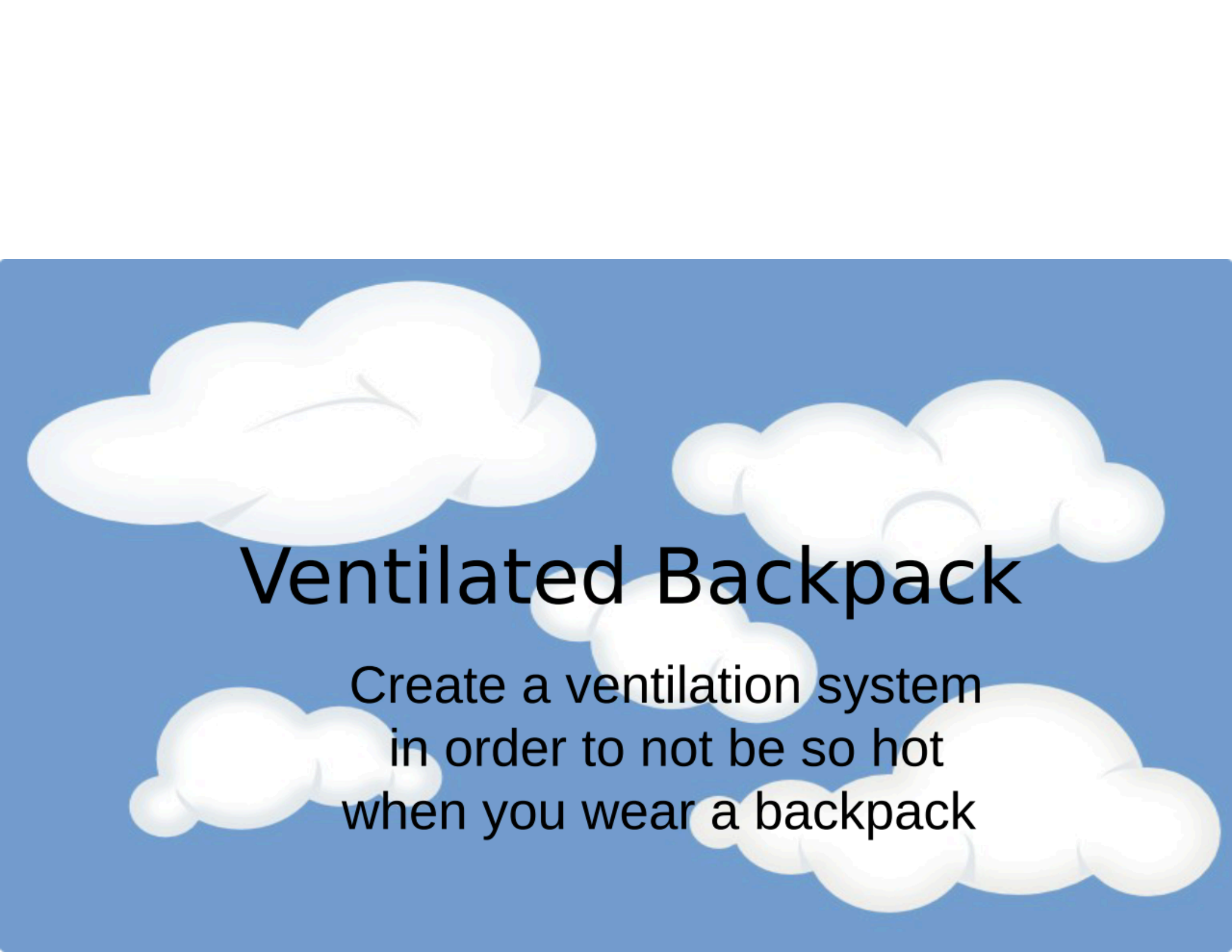




Ventilated Backpack

Create a ventilation system
in order to not be so hot
when you wear a backpack

Criteria & Constraints

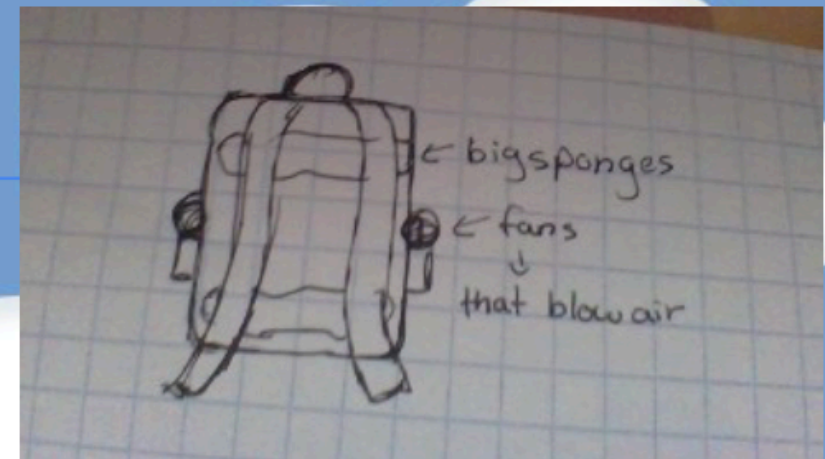
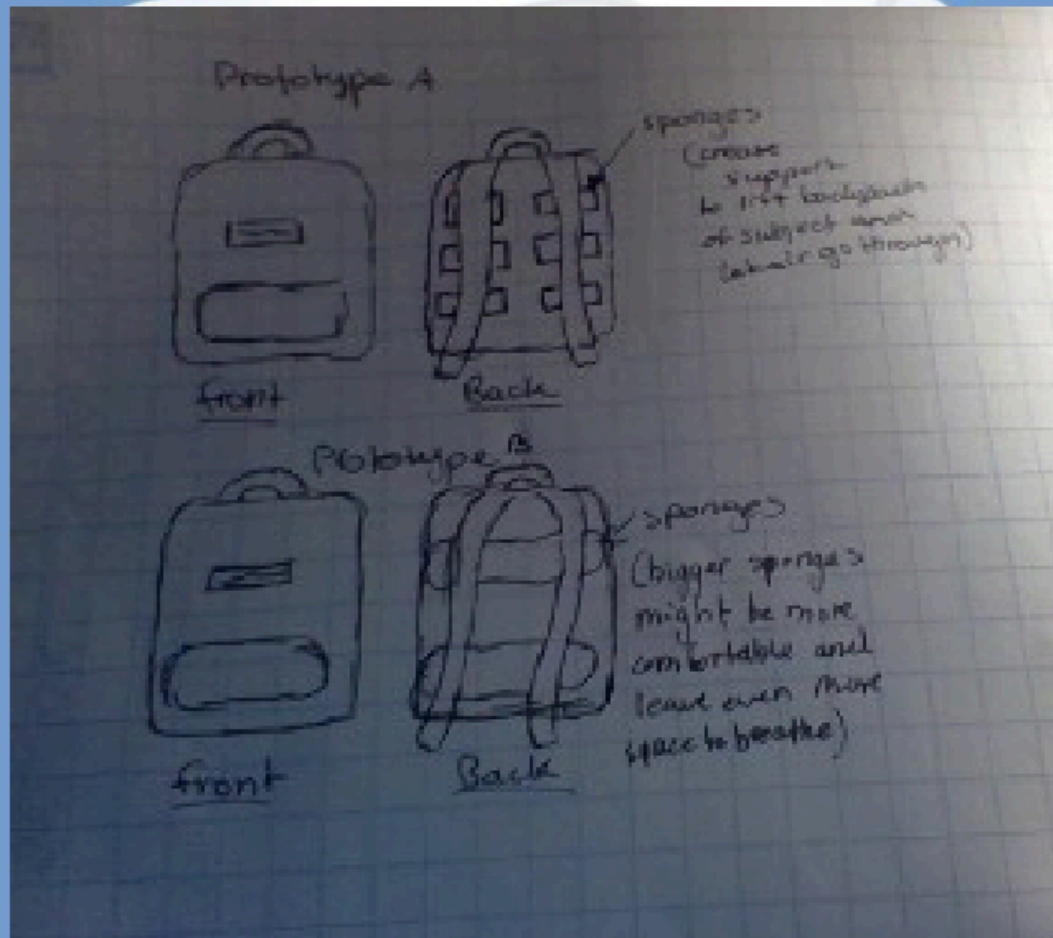
Constraints (Limitations and Conditions)

- 1. Time**
- 2. Materials**
- 3. Conditions**

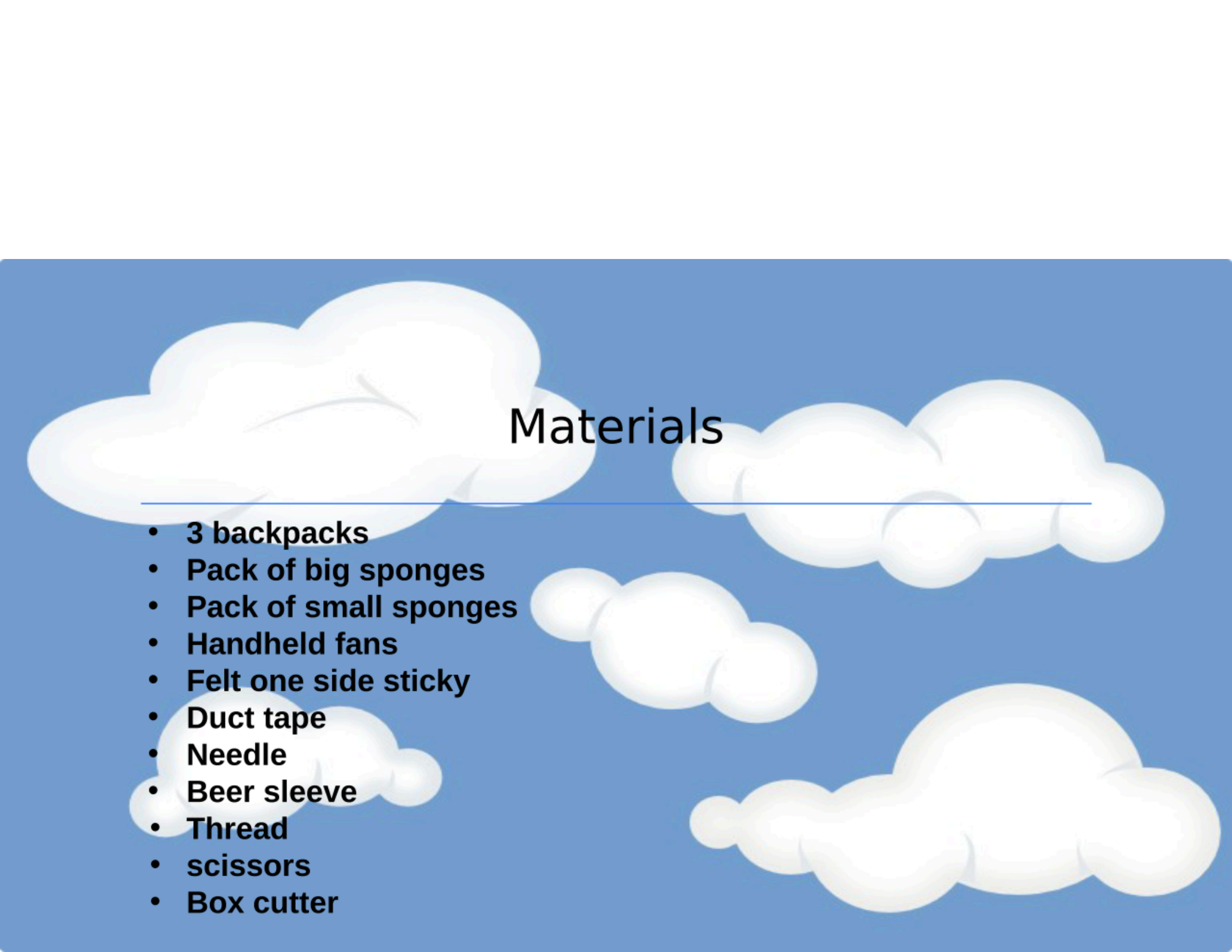
Criteria (standards or features to be measured, I know I have a successful prototype because it does....)

- 4. The subject would not be sweating from the backpack.**
- 5. Pads lift the backpacks off the person preventing sweat**

Sketches and Concept Rubric



I chose these designs because I wanted to see if there would be a difference in using bigger and small sponges and to arrange them differently. The third prototype with the fan was an advancement because I used the best sponge and arrangement and added another ventilation aspect.



Materials

- **3 backpacks**
- **Pack of big sponges**
- **Pack of small sponges**
- **Handheld fans**
- **Felt one side sticky**
- **Duct tape**
- **Needle**
- **Beer sleeve**
- **Thread**
- **scissors**
- **Box cutter**

Procedure

1. Get all the supplies needed for all three prototypes.
2. First take the small sponges and wrap them in duck tape.
3. Then wrap them in felt that is sticky on one side and felt on the other.
4. Repeat this step for all the sponges you need in the first prototype.
5. For the long sponge in the first prototype you just need to tape two of the small sponges together.
6. Then you sew the long sponge at the top and the two small ones at the bottom.
7. Next you start on the second prototype and cut 1 ½ inch off the big sponge.
8. Then take that 1 ½ inch and wrap it in duck tape.
9. Add the felt to it.
10. then you have to take another sponge of the same size and cut 1 ½ inch off.
11. wrap it in tape and felt again.
12. Then again you need to sew the sponges on the backpacks. One on the top and one on the bottom.
13. Starting on the third prototype you need to cut 1 ½ inch off one of the big sponges then take another big sponge and cut off 1 ½.
14. then take both of those 1 ½ inch sponges and wrap them in tape and felt.
15. Next sew the pads onto the backpack in the same order like the second prototype.
16. Then take a beer sleeve and put the fan in it and hold the fan tight in the sleeve and sew the beer sleeve so it fits the fan.
17. Then sew the beer sleeve with the fan in it on the backpack.
18. Then the third prototype is done and you can easily slide the fan in and out of the sleeve to charge it even without the fan falling out.

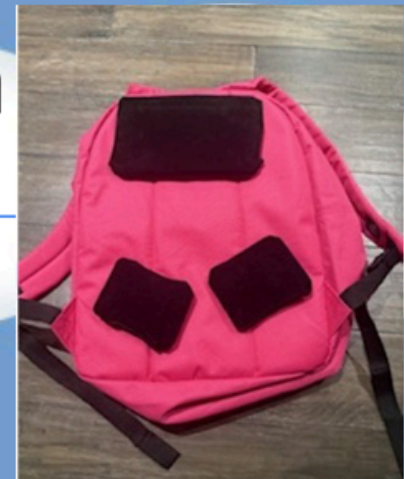
Data Collection Table

Prototype	Hours	Cost	How long did the subject go outside minutes	weather outside	How many inches off the back
Prototype A	4 hours	\$8.04	30	25 C	½ inch
Prototype B	4 hours	\$10.24	30	23 C	1 ½ inch
Prototype C	4.5 hours	\$19.24	30	23 C	1 ½ inch

Critique and Redesign

Prototype A

- Strength: Airflow comes through the middle of the back and in the middle of the bottom of the backpack.
- Weaknesses: Not super comfortable.
- Improvement: Use a softer sponge with a higher width.



Critique and Redesign

Prototype B

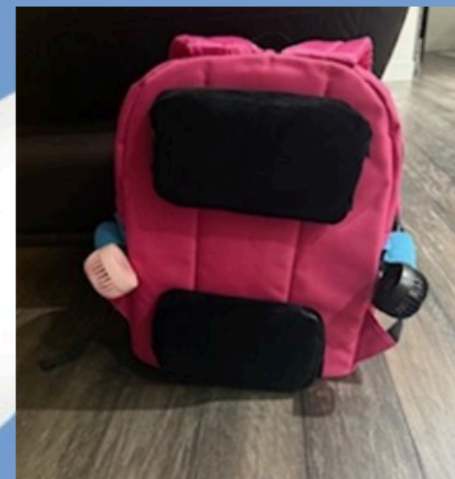
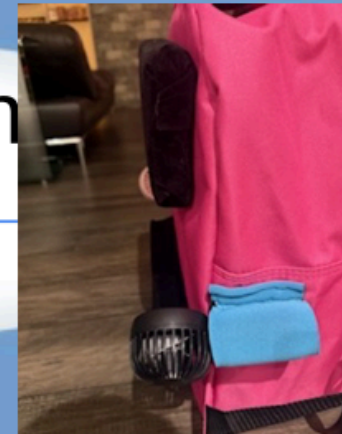
- Strength: Airflow through the middle of the back and subjects said it was a lot more comfortable than Prototype A.
- Weakness: only had airflow through the middle.
- Improvement: Add fans to move air through the back.



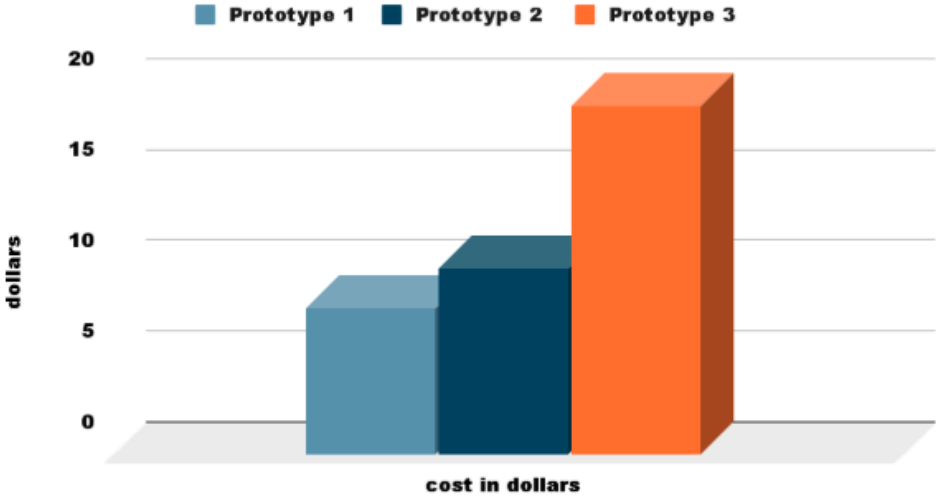
Critique and Redesign

Prototype C

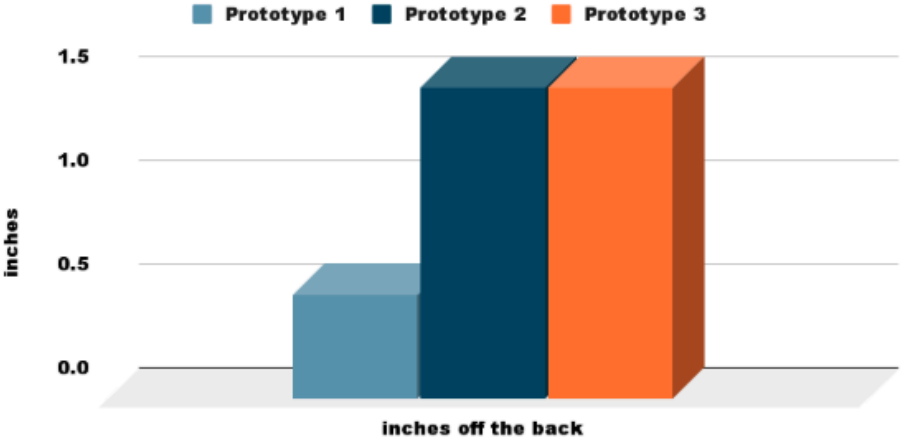
- Strength: Backpack is lifted off the back of the subject and cold air from the fan comes through.
- Weakness: The battery of the fan could die while you use it.
- Improvement: Somehow make the fans solar powered so they never run out of battery.



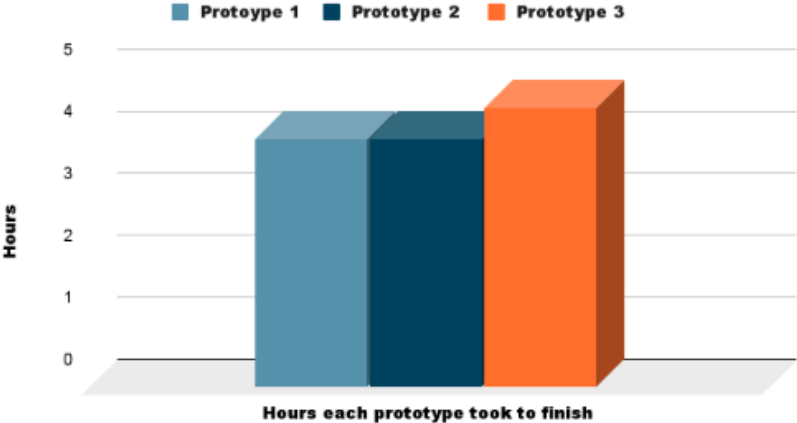
Cost in Dollars to Make Each Prototype



Height in inches that backpack is off subject's back

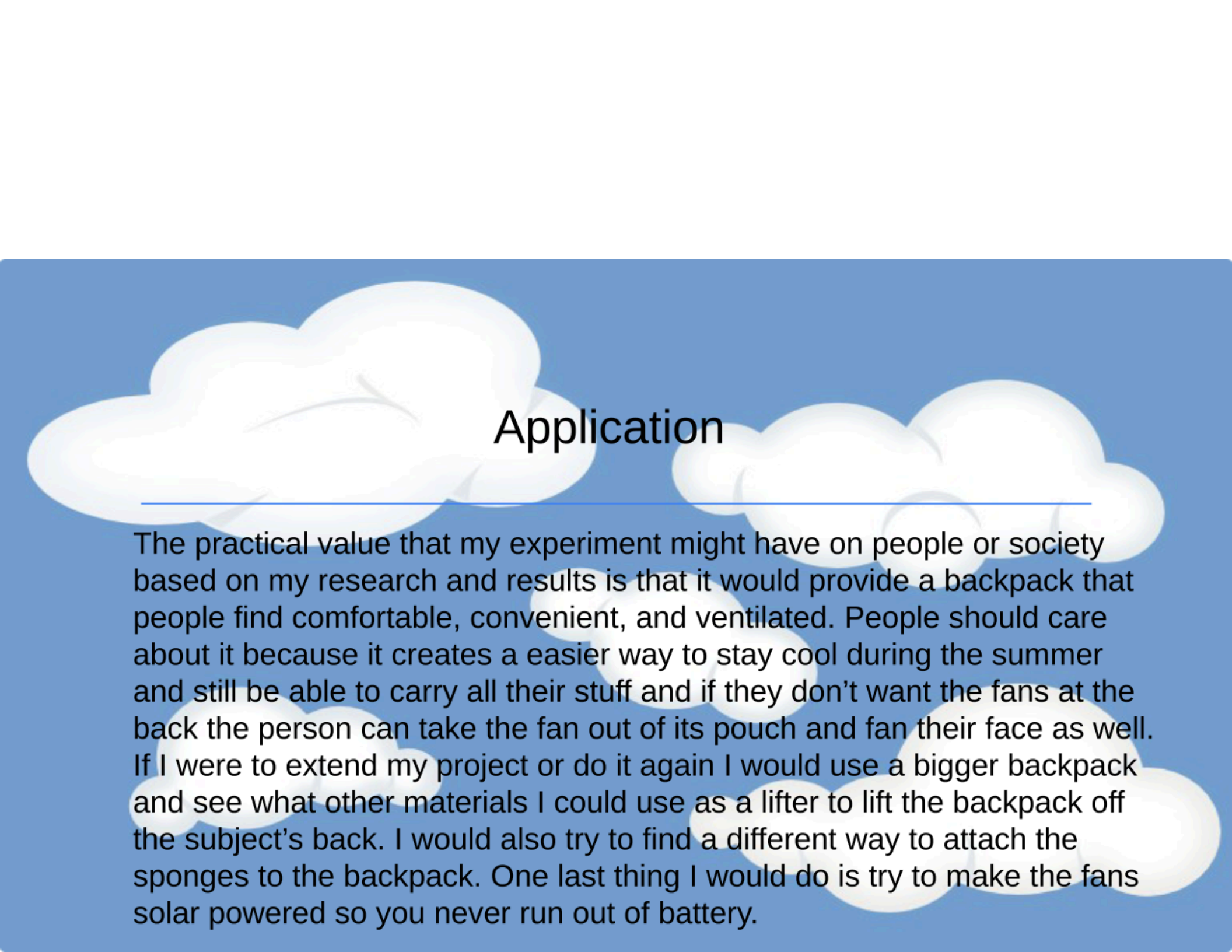


Time in Hours Taken to Complete Project



Evaluate Solutions

Prototype A was successful because when the subject went outside for 30 minutes at 78 degree weather the airflow went through well but the wind was also helpful. We used dish sponges which were harder and skinny and it wasn't as comfortable and cushiony. For Prototype B we took this information and used a car sponge for a bigger more cushiony area. The subject went outside for a 30 minute walk at 75 degree weather and said that the Prototype B was a lot more comfortable and the sponges lifted the backpack off the subject's back 1 inch more. For prototype C I used the sponges from Prototype B because they lifted the backpack higher off the back of the subject's back and added fans to give more airflow. Prototype C performed the best because it was lifted off the subject's back enough and fans were present to push cold air through the back of the subject. My design solved my problem because it provided ventilation and cooling. Future improvements would be to try different materials other than sponges and make the fans solar powered.



Application

The practical value that my experiment might have on people or society based on my research and results is that it would provide a backpack that people find comfortable, convenient, and ventilated. People should care about it because it creates a easier way to stay cool during the summer and still be able to carry all their stuff and if they don't want the fans at the back the person can take the fan out of its pouch and fan their face as well. If I were to extend my project or do it again I would use a bigger backpack and see what other materials I could use as a lifter to lift the backpack off the subject's back. I would also try to find a different way to attach the sponges to the backpack. One last thing I would do is try to make the fans solar powered so you never run out of battery.



Acknowledgements

- I would like to thank my dad who helped me gather all my materials for the assignment
- I would like to also thank my mom and my sister who helped me practice my presentation.