
# ReflectBack

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# PROJECT STATEMENT

**I will be working to redesign the uniforms worn by sanitation workers in New York City in order to reduce the injury rate.**

The current design of sanitation processes throughout the city are tailored to be easiest for the citizens while disregarding ease and safety for the sanitation workers. Furthermore, the current design is not sustainable, as many garbage men are injured on the job and forced to take days off. I will study the process of how garbage gets from the hands of a citizen into the back of a garbage truck. Ideally, the final design intervention will be low-cost, versatile, and effective.

There are the qualities that the product must have:

- Breathable
- Water proof
- Wearable in both the winter and the summer
- Easy to be seen by others
- Cut resistant from broken glass and needles
- Muscle and bone support
- Accessibility of tools
- Protection from insects and rodents
- Appealing to wear

The main market I have in mind is sanitation departments all around the world. That being said, products of this type can be used in a variety of industries and by a variety of workers from garbage men to arborists to tow truck drivers. Additionally, these products would be utilized all ages. The main difficulty is creating body-tight products for both men and women. The shapes would be slightly different because of different hip dimensions and builds.

There are existing solutions to many of the problems listed above; however, none of them have been combined into a single or few pieces of wearable protection. My goal is to create clothing that can fix a number the problems in just a few items.

In terms of sustainability, these products are bad for the environment. Many slash resistant fabrics are made of polyethylene or high-modulus-polyethylene. This is the same material used in familiar products such as single use plastic bags and water bottles.

# SANITATION WORKER HEALTH RISKS

**needles and broken glass or metal**
present a major danger for sanitation workers' hands and health

**repeated heavy lifting, pulling, and pushing**
can lead to long term back and knee isues

**constant bending over**
along with bad posture can affect long term back health

**hazardous materials**
such as bleach, acids, and feces can cause rashes, infections, and skin damage

**weather**
presents everyday risks from heat, cold, rain or ice

**long days**
on their feet can lead to long term back problems and muscoskeletal disorders for workers

**mice, rats, racoons, cockroaches, and other insects**
can bite workers and spread diseases

In 2006, there were **3,000 work days lost** in the US due to **injuries of workers** for private haulers, according to the Bureau of Labor Statistics.

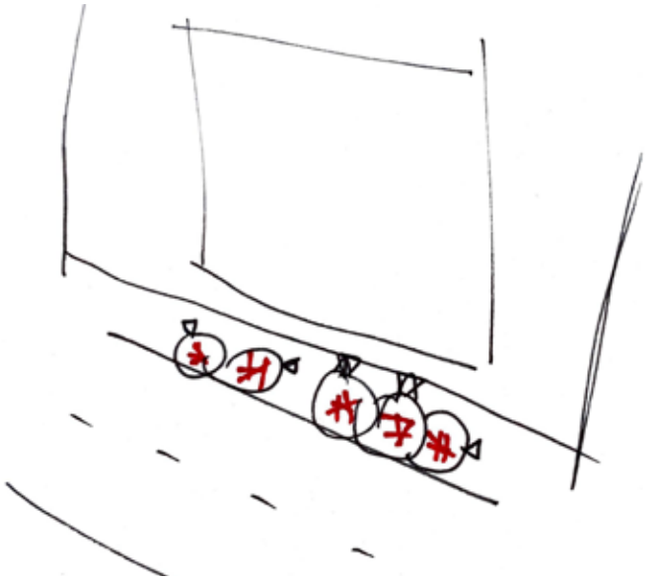
A Florida study states the number of **worker compensation cases** filed by sanitation workers is **7.4 times higher** than that of the general workforce.

# THE JOURNEY OF GARBAGE: HAND TO TRUCK

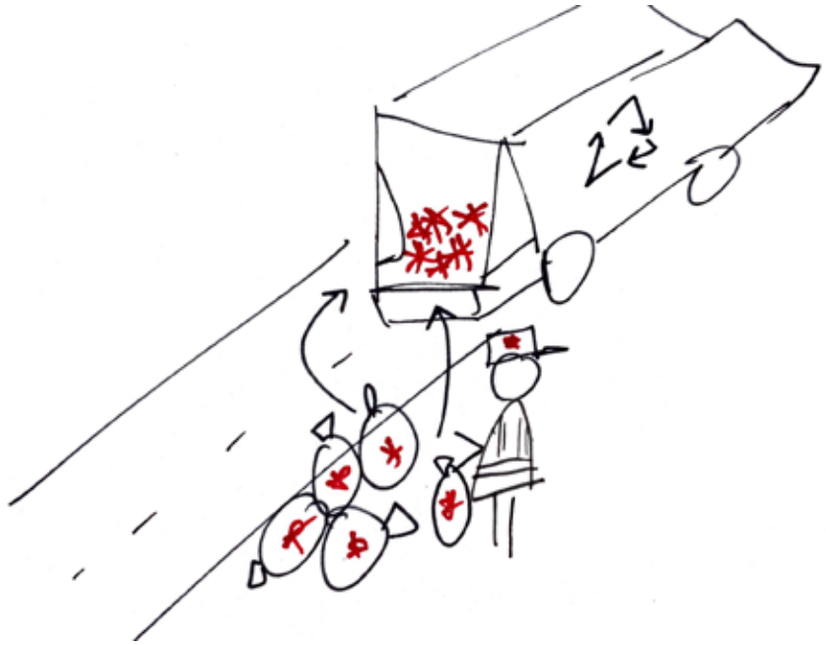
garbage is easily thrown out and slowly fills the bin. this is the time when insects and other pests enter the garbage and feast.

upon arriving at the full garbage can (after either being told it's full or getting to it on the usual schedule), the sanitation worker has to lift the heavy full garbage bag out of the bin. in this process, they are exposed to many dangerous objects and organisms.

the worker must then carry, drag, or wheel the bags to either the side of the street or into a garbage truck.



for hours at a time, piles of garbage sit on the curbside. in the winter, fluids can leak out and freeze. in the summer, fluids become a breeding ground for bacteria and other harmful organisms.



lastly, in the most dangerous stage of the garbage removal process, the workers must load all of the full garbage bags into the truck. they often kick the bags to determine the weight before lifting them. icy grounds, sore muscles, and rodents, along with other factors, all propose possible injuries here.

How can I lessen the lifting done by sanitation workers?

How can I prevent the sanition workers from being pricked by needles or cut by broken glass and metal?

How can I prevent weather-related injuries?

How can I prevent rats from entering garbage bags or bins?

How can I lessen the lifting done by sanitation workers?

How can I inform the sanitation department when a garbage can is full?

How can I reduce the number of garbage bags used?

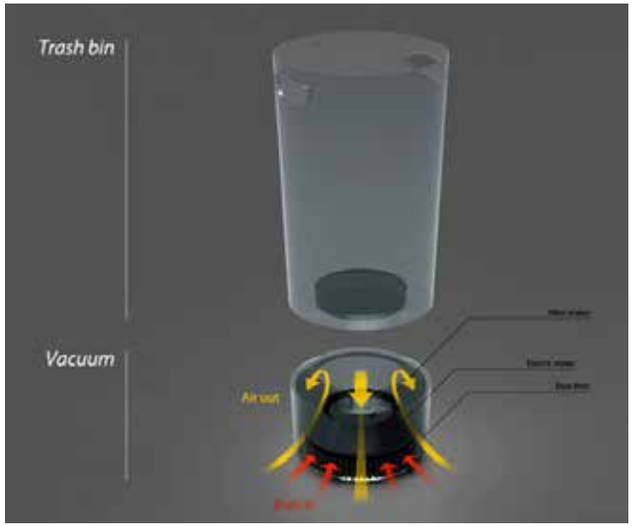
How can I help a worker determine the weight of a dumpster or garbage bag before lifting it?

How can I reduce the number of lost work days due to injury?

How can I reduce the smell of the garbage throughout the city?

# CURRENT GARBAGE DESIGNS

My initial solution was to redesign the garbage cans around the city to make them more **ergonomically friendly** for both the sanitation workers and the users.  These are some examples of what exist.




the **Cuum** is a combination of a vacuum and a garbage can. this solves ergonomic issues as dust is sucked up when swept near the base.

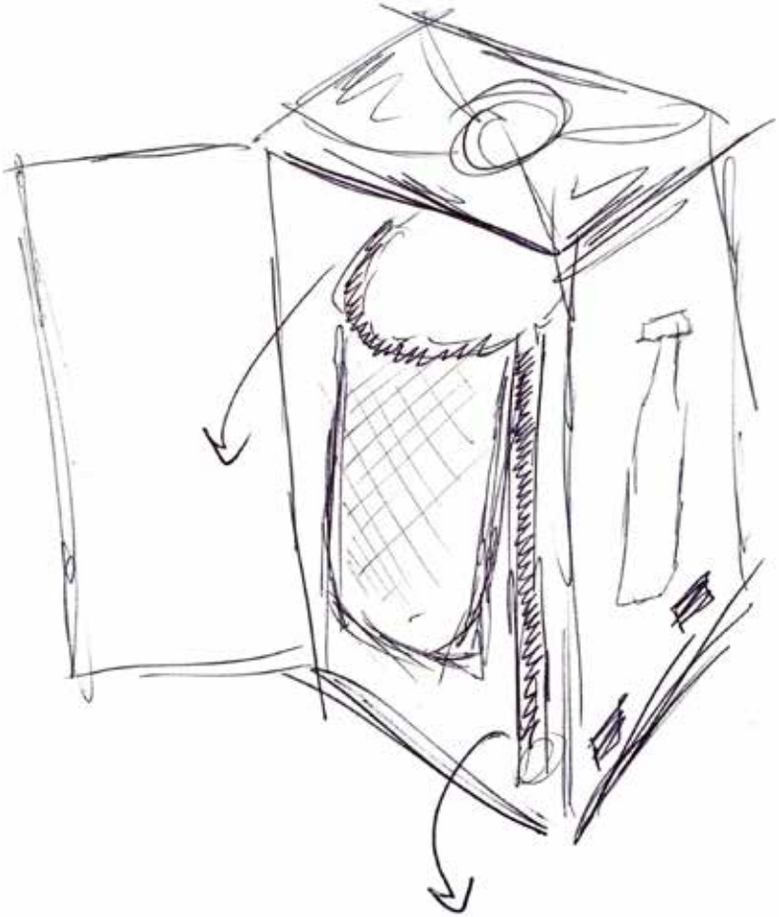
**Envac** uses an underground pipe network and a vacuum system which sucks all garbage to a waste collection site.


Bryant Park in Midtown Manhattan is the new home to many leaf-like garbage cans. The goal is to not only **prevent littering** by grabbing the attention of park patrons but to also **reduce the number of rats** in the area.

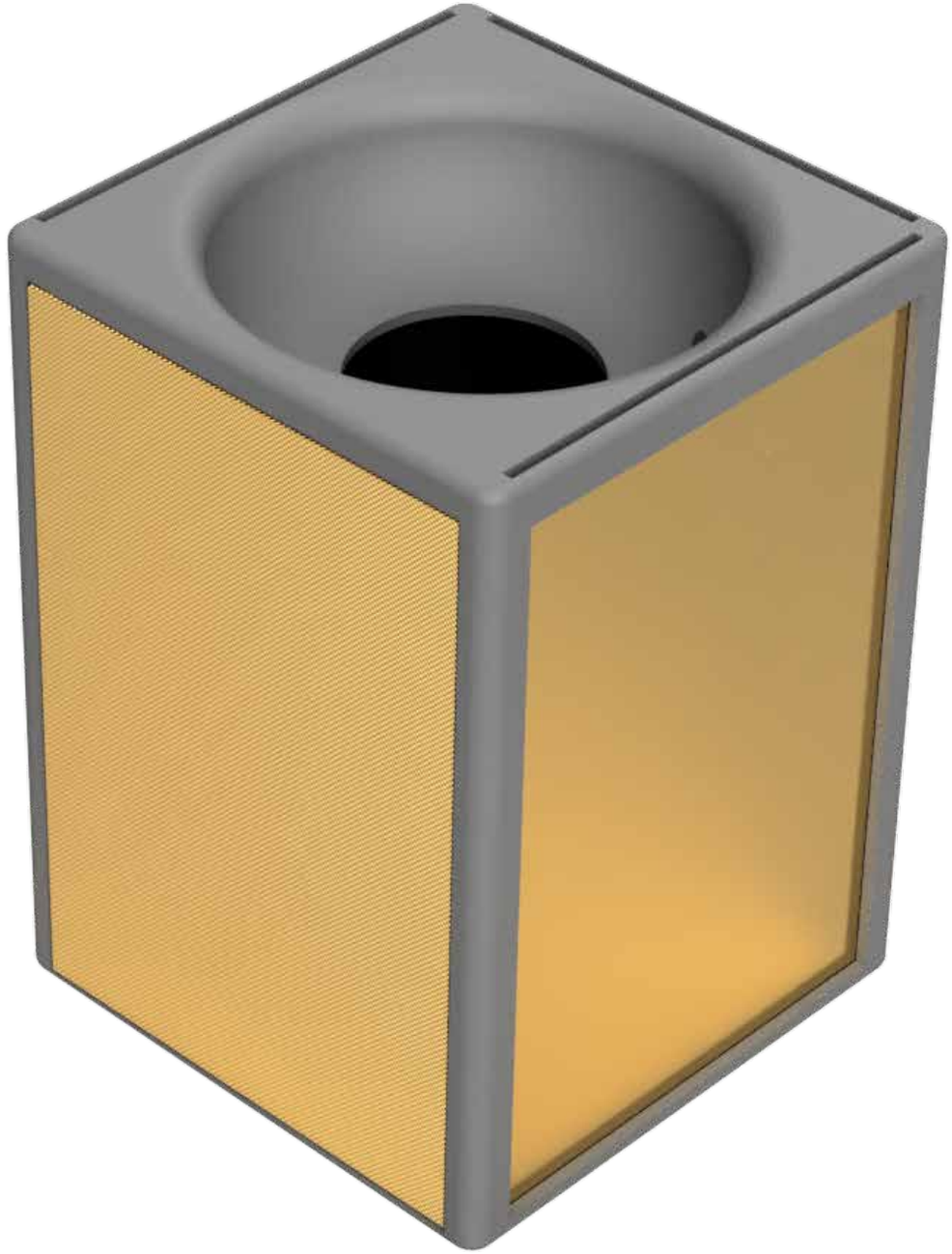
Over 700 twisting garbage cans of various colors can be seen all around Central Park. Another main difference between these and the old garbage cans is the **smarter locations** they can be found in.

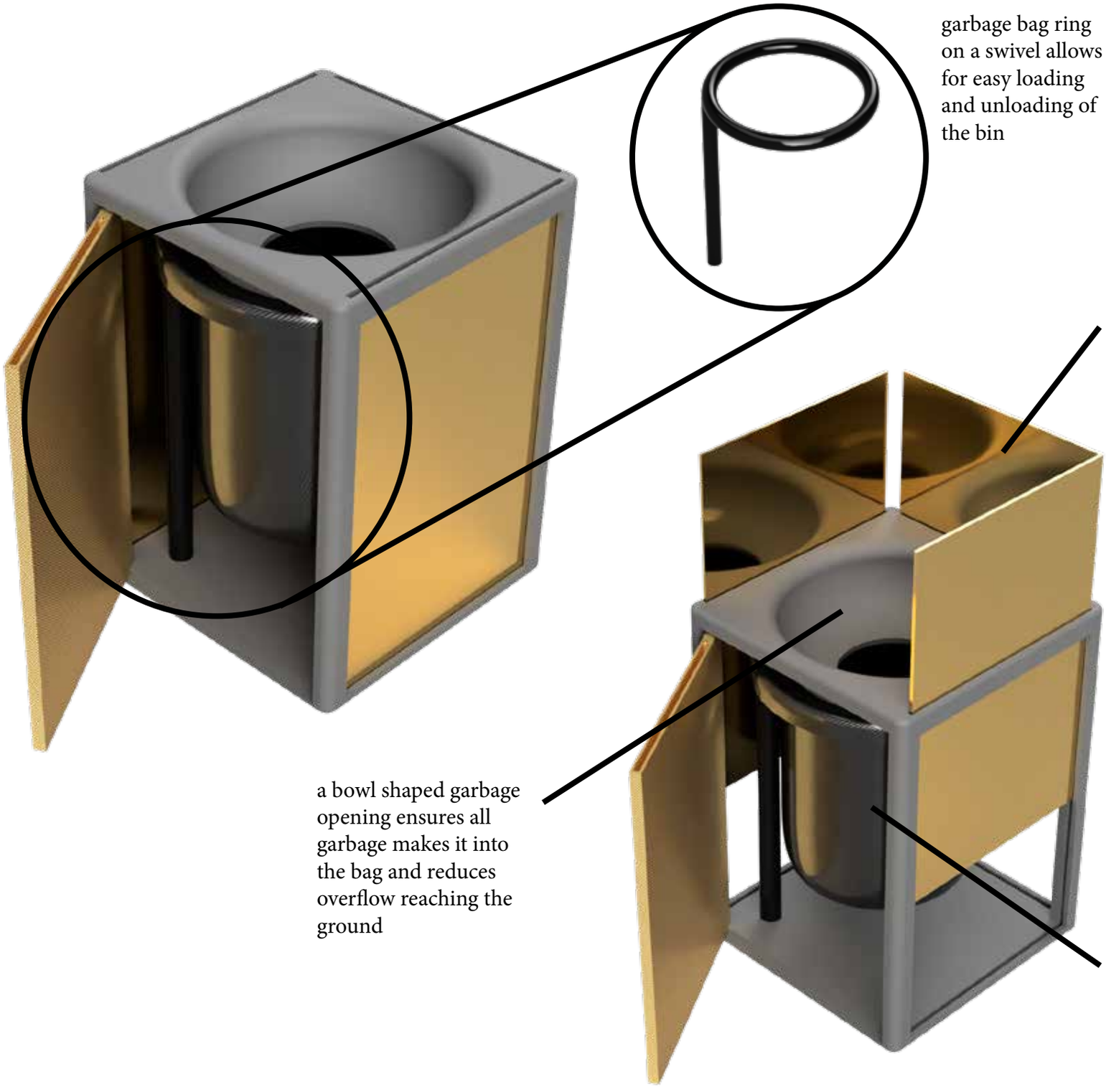
# PRELIMINARY STAGE I DRAWINGS

The initial steps of sketching a redesign for the common NYC garbage can began with determining the overall shape.  I wanted to make sure they could easily be **stacked** and **stored** when they're moved around.



# INITIAL GARBAGE
# REDESIGN RENDERINGS




garbage bag ring on a swivel allows for easy loading and unloading of the bin
easily removable side panels allow for ads, art, and garbage type indicators
a bowl shaped garbage opening ensures all garbage makes it into the bag and reduces overflow reaching the ground
with nothing below the bag, it can easily be removed by the sanitation worker. current garbage cans require the workers to lift each bag, creating back problems

weather

rodents

back issues

long hours

broken glass

moving dumpsters

biohazards


# CHANGE OF PLANS

After some thought and consideration, I soon realized that the main user of a garbage can is not the person throwing something away; it's the sanitation worker who has to service them. Anybody else simply needs to put garbage into a hole.

I took a step back to attempt to find a solution that can act as more of a permanent fix to the high sanitation worker injury rate as opposed to a Band-Aid. Instead of redesigning an existing product which was made without taking the user into account, I decided to create something new to combat injuries stemming from a variety of causes.

Attacking the greater issue would more directly decrease the number of injuries on a larger scale and for the future. Even better, this could be a solution used by workers in a variety of industries.

I landed on the idea of creating clothing with built-in features to maintain the health of the workers. I discovered materials which are slash resistant, water resistant, and temperature regulating, along with certain braces to slow down the arrival of back and knee issues.

# BACK SUPPORT STRUCTURES

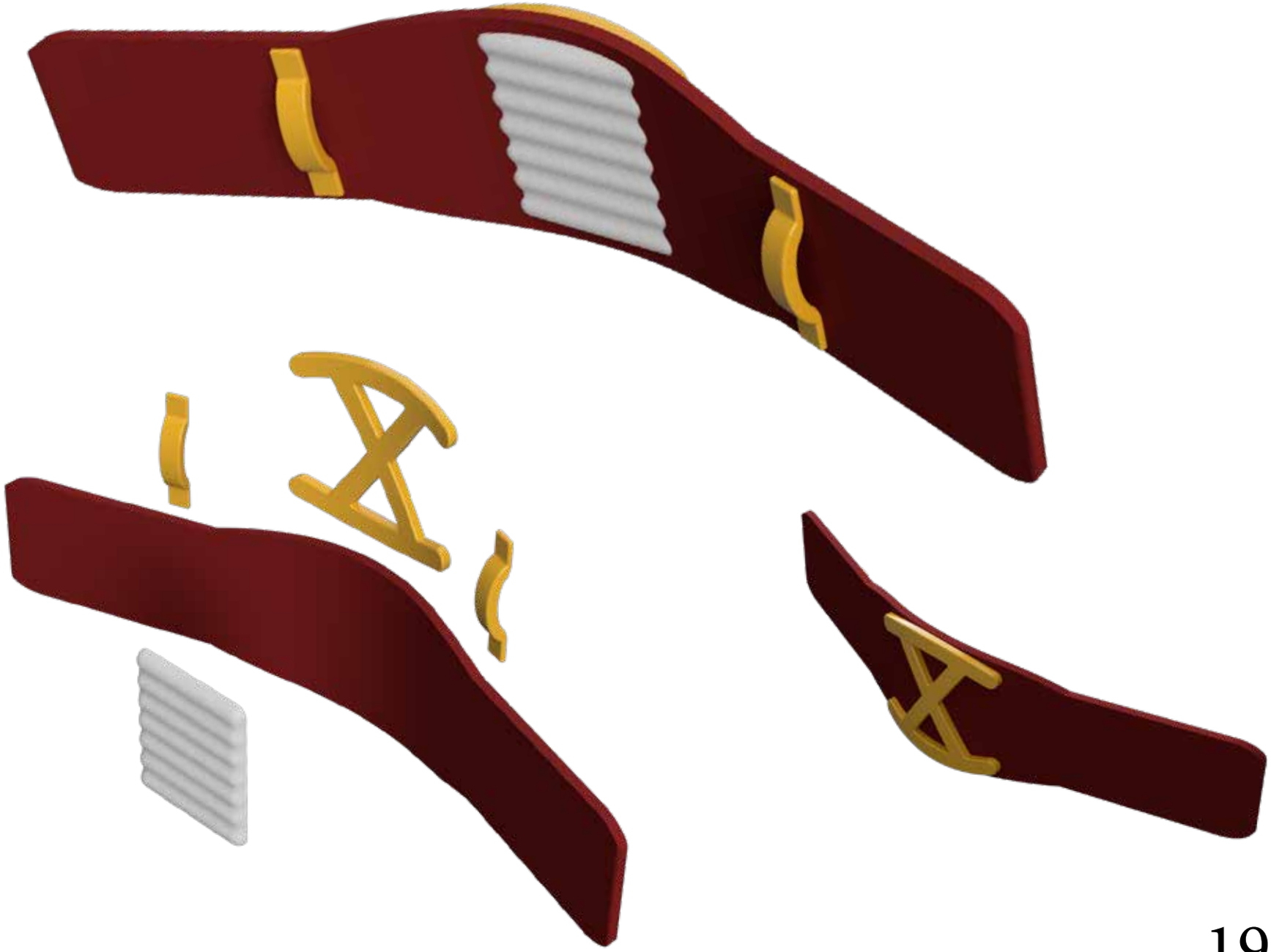
It was necessary to conduct research on the ideal back support structure to have for the support belt. In my case, I did not have much time to test various shapes, sizes, and materials or consult with a trained physical therapist. If I had more time, ideally, I would be able to work alongside someone with more expertise who could offer more guidance as to the right support structure.

corsets allow for limited bending with supports in the front, back, and sides. this mainly adds spinal support and applys pressue to the torso to take some weight off the spine.

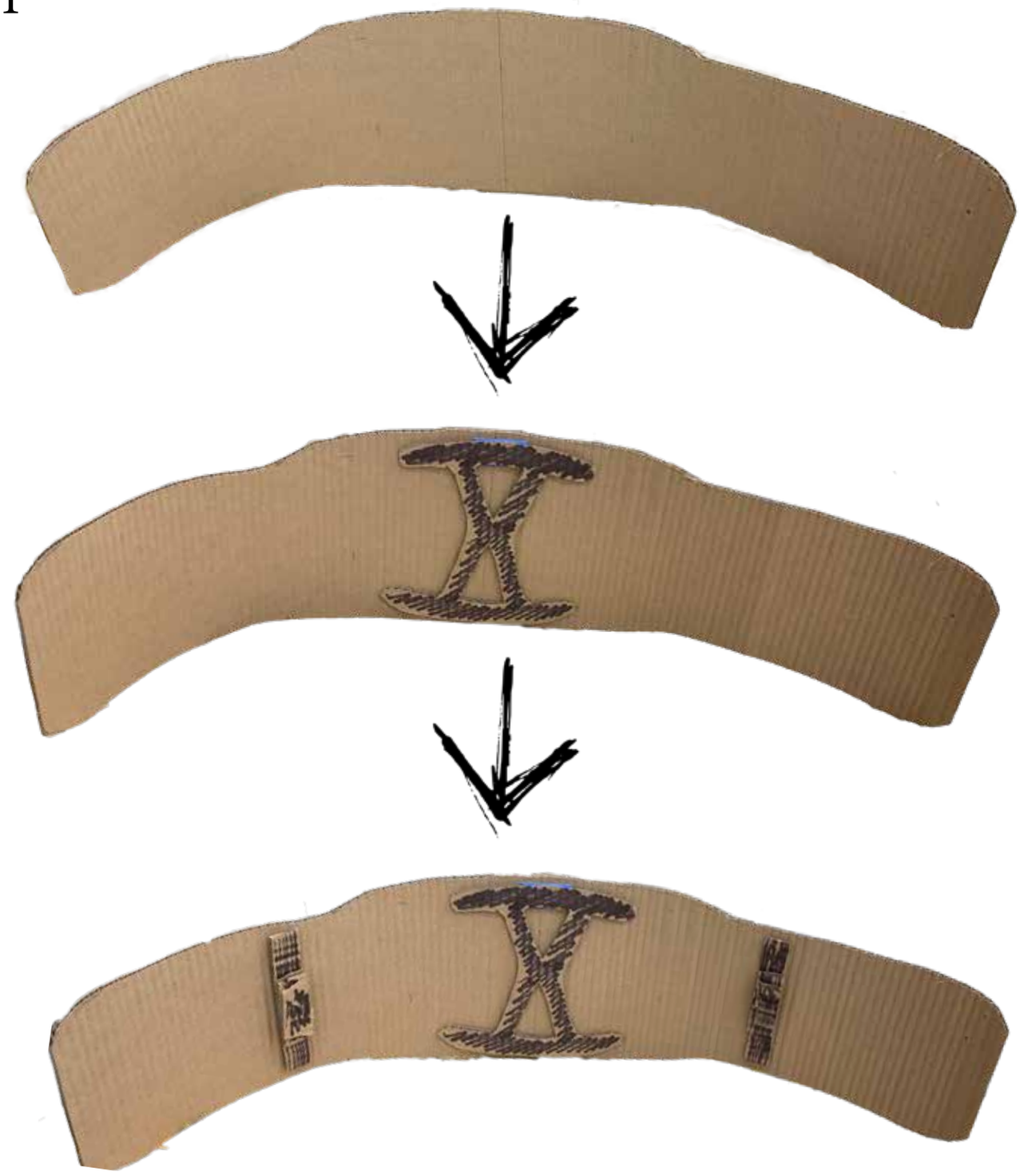
lumbar belts are similar to corsets but allow for more motion. that being said, they maintain the idea of providing spinal support and relieving pressure. at times, these braces are heated to create additional relief.

sacroiliac belts are typically made of a thicker fabric but without sturdier inserts like the other two models. reducing micro-motions at a weakened joint is done by comperssing the torso or pelvis.

I decided to create a lumbar support belt which allows for flexibility, which is necessary for sanitation workers, while also offering the required support for a healthy back. Below is a rendering of my initial idea.



# ROUGH STAGE 1 PROTOTYPE



initial rough prototype attached to a reflective vest

# FINAL STAGE I PROTOTYPE

In the end, I decided to purchase a cheap back support belt online because I did not have much time left for the project and creating my own would be too time-consuming.  I was able to 3D print the main lower back support structure (seen on the right in white).  I did not have time to print the side supports, so I borrowed them from the initial cardboard model I created.

In the following pages, it can be seen how the ReflectBack can be used easily with many layers of clothing.


slash-proof and
waterproof fabric
heavy duty
zipper
heavy duty velcro
with adjustment
straps (not visible)
recycled plastic
core with a high
density foam
shell
durable elastic
elastic band for easy removal of
adjacent support structure

# HOW TO USE

put on the back support belt and
let the reflective vest hang

add on any additional layers

pull up the reflective vest


Walls


Walls
WORK WEAR
Walls
2

# NEXT STEPS

I simply worked on the first stage of the redesign process, and I would argue that this is nowhere near a perfect final solution for this problem.  With more time, I would continue on with the process to strengthen the product.

- experiment with slash resistant fabric
- find a more breathable and comfortable fabric
- have garbage men work their jobs with the product to gain feedback
- consult a medical professional regarding the best shape of back support
- create stage ii prototype and re-test
- design additional protective clothing


GUAC
A BETTER WAY TO
311
911

# CONCLUSIONS

Although the three weeks was not enough time to learn and practice the product design process, I do believe I got a very good understanding of techniques and how it works. Furthermore, watching my fellow students traverse the process with their own designs was a great way for me to learn other design strategies for their various types of projects.

I learned how important it is to understand the problem on both a large and small scale, along with conducting research. It was essential that I knew everything from the processes of sanitation workers throughout their days to the breathability of fabrics. Interviews are also a great way to gain first-hand accounts of people's experiences. If I had more time, I would like to try to speak with more sanitation workers about their experiences and thoughts regarding this topic.

The complete change of design from a garbage can to clothing shows an alternative way of creating solutions for the same problem. This taught me that often it is essential to take a step back to view the problem differently. In this case, a redesigned garbage can would offer a solution to one of the prominent problems, but is it very costly, hard to implement, not very versatile.

I believe this product would be successful in the market simply because it is a combination of many tools already used/worn by workers. It makes getting ready for work much simpler and ensure that the worker does not forget anything. It is a waterproof, slash-resistant, reflective, and supportive. In addition, the ReflectBack can easily be worn with many or no layers, deeming is effective in the winter, summer, and all in between.

# IMAGES

Reflective vest, ebuy7.com

Icons, thenounproject.com

Envac, envacgroup.com

Cuum, dornob.com

Back support structures, spine-health.com

Bryant Park garbage cans, inhabitat.com

# SOURCES

Injury statistics, consumer.healthday.com

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