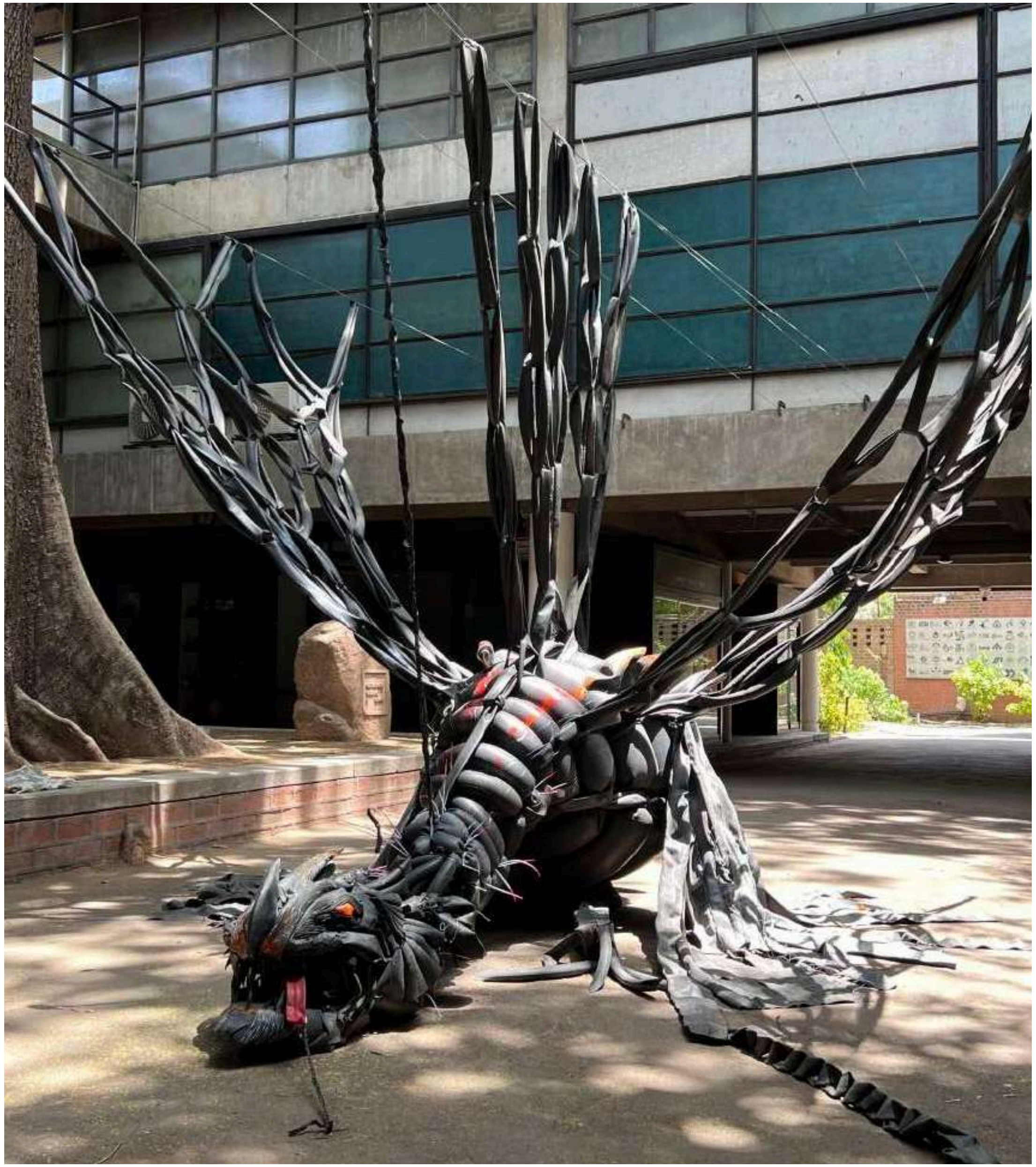

Public installation built entirely from **waste tyre-tubes.**

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Kapil Bhai and team for cable installation
Ajay Bhai for media coverage

Also to the numerous first-years that helped us in various parts of the construction:

Materials and making with tyre-tubes

Introduction

Background
Tyre-tubes are a form of non-biodegradable waste that are found to be difficult to recycle. Globally, over 26 million tonnes of 'vulcanised' rubber from tyres is discarded as waste. Tyre tubes represent about 5-7% of this total mass. India is one of the top tyre waste generators in the world due to a lack of regulation and infrastructure for recycling - most of it coming from trucks and bicycles. (cseindia.org)

Waste tyre tubes

Why can't rubber tires simply be remoulded?
Tyre tubes are treated through a process known as vulcanization which improves its' strength, flexibility and durability, but it also makes it thermosetting. This prevents it from easily being recycled. When inner tubes reach a point beyond repair, they are usually either used for crafts or road asphalt - else they are discarded, or with the right facilities burnt through 'pyrolysis'. Regardless, without the right infrastructure, this is difficult, and reduction of tyre waste is still a valuable pursuit.

Design Brief

The goal was to use an allocated budget of 10,000 INR, with institution facilities - makerspaces, hand-tools, maintenance help etc. to explore the feasibility of rubber tyre-tubes as a material for 'making'. We tended towards larger scale creations since the tubes allowed us to do so. At the end we were expected to produce something of finality for public view.

Timeline

	Week 1							Week 2						
Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sourcing and Transportation														
Experimentation using workshop facilities														
Material Exploration Showcase														
Planning final installation design and location														
Sourcing materials														
Construction														
Final presentation (public)														

Setting up (Week 1)

Sourcing materials

Finding waste tyres in Ahmedabad

Most of the tyre-tubes were sourced from local vendors - particularly bicycle, tyre-repair shops. These people got us in touch with the people that collected the tyre tubes that were deemed beyond repair. Eventually these were dumped in a scrapyard where they were either sold - or ultimately sent to the landfills. We managed to purchase a large number of tubes from them and allocated space within our studio to store them.

Types of tyre tubes

Our collection consisted mostly of bicycle tubes, with a few scooter tubes as well, this was ideal for us because their thin form would allow us to perform a wide range of knotting explorations. Some time was spent separating the tubes that had repair potential, about which was about 5% of all the tubes. Later, for exploring inflation techniques, we purchased a few large tractor tubes - these were not exactly waste, and they were costly in relation to our budget but we bought them specifically for the final installation.

Central workspace and tools

We deliberately chose, after emphasis by our preceptor, an open dedicated space for all our explorations - a central destination for all our tools, organised with labels and allocated areas. This saved us from the troubles of fragmented work, all our tools were borrowed and kept in a central area instead of us taking our crafting to other workshops. Spontaneous interactions and public visibility was also encouraged and helped us gain the insights and interest of passerbys.

This perhaps was more encouraging than working in isolation. Our productivity was high during this week. We produced a wide range of explorations within a span of 2 days, and sourced around 400 tyre tubes in total - most spent in the explorations.

Design and Exploration

Generating ideas

Our strategy for generating a wide range of experimentation options was to mind-map all our available options in the following categories - by-hand, hand-tools, power-tools, chemical processes, and ‘other’, which mostly involved combining additional elements - like stitching and zip-locks. This was an effective brute-force method of quickly generating lots of explorations owing to the lack of ambiguity and clear tasks. Work was divided between the four members.

Key Explorations

Inflation and balloon animals

We tried using a similar concept to balloon animals Tying the tyres around specific joints would enable us to make it more flexible. This experiment was quite successful and we did end up using it for the final installation.

Using zip ties was the quickest method we found to create knots

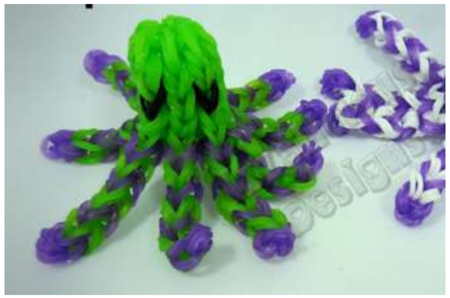
We tried the experiment with both thin and large tyres successfully.

Loom band explorations
Leveraging the tubular nature of the tyres, we explored ways of knotting and working with their pre-existing form. This is also because adhesives were found to be not as effective compared to plain knotting techniques. A helpful reference were the wide variety of 'loom band' patterns found on the internet; some of them involved dense knots, but the simpler ones could be replicated without requiring too many tubes or making the band too heavy.

- **Inspiration**



https://www.reddit.com/r/Rainbowloom/comments/1dpo0ce/hello_dose_anyone_have_any_ideas_for_beginner/
https://www.dailymotion.com/video/x2e6nza
https://www.youtube.com/watch?v=pMzT1WY6g_g

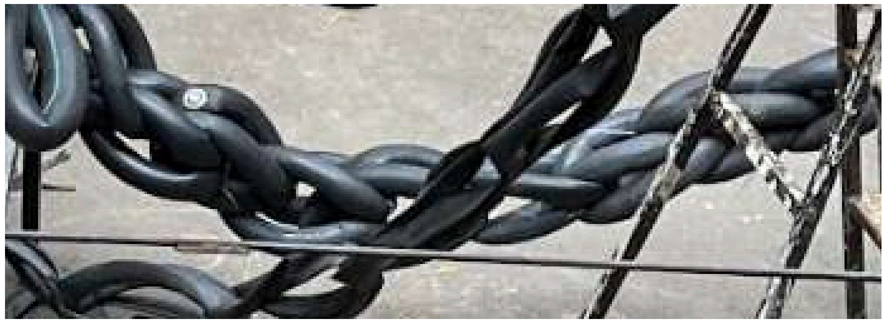



https://pin.it/6NihYuzMW
https://www.youtube.com/watch?v=GATUGLGSFKw

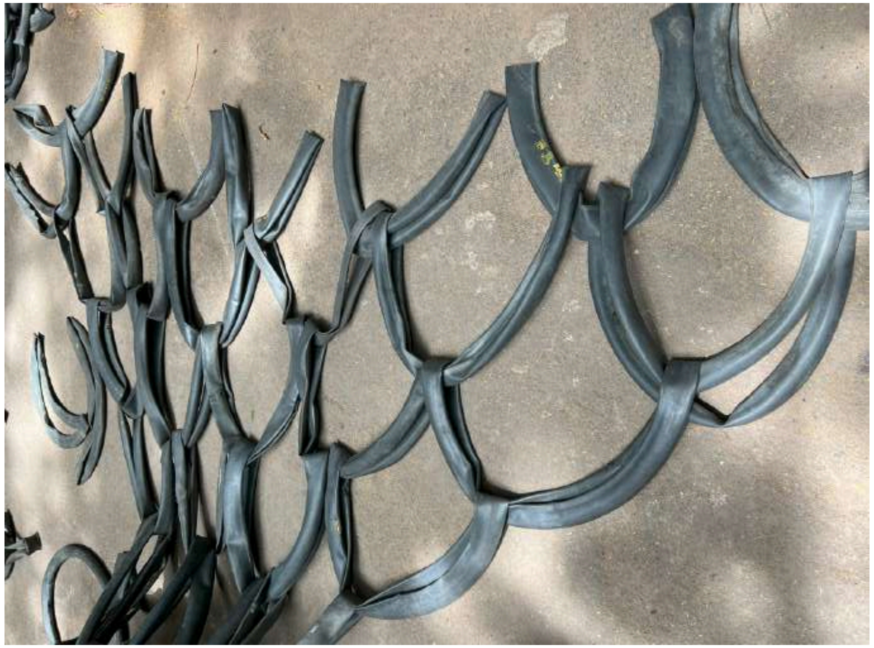
Technically any form is possible using loom-bands using the right technique, but it requires a good understanding of how to build it step by step.

The main techniques we tried replicating were known as the **fish-tail loom, dragon-scale** and other simple braid like patterns

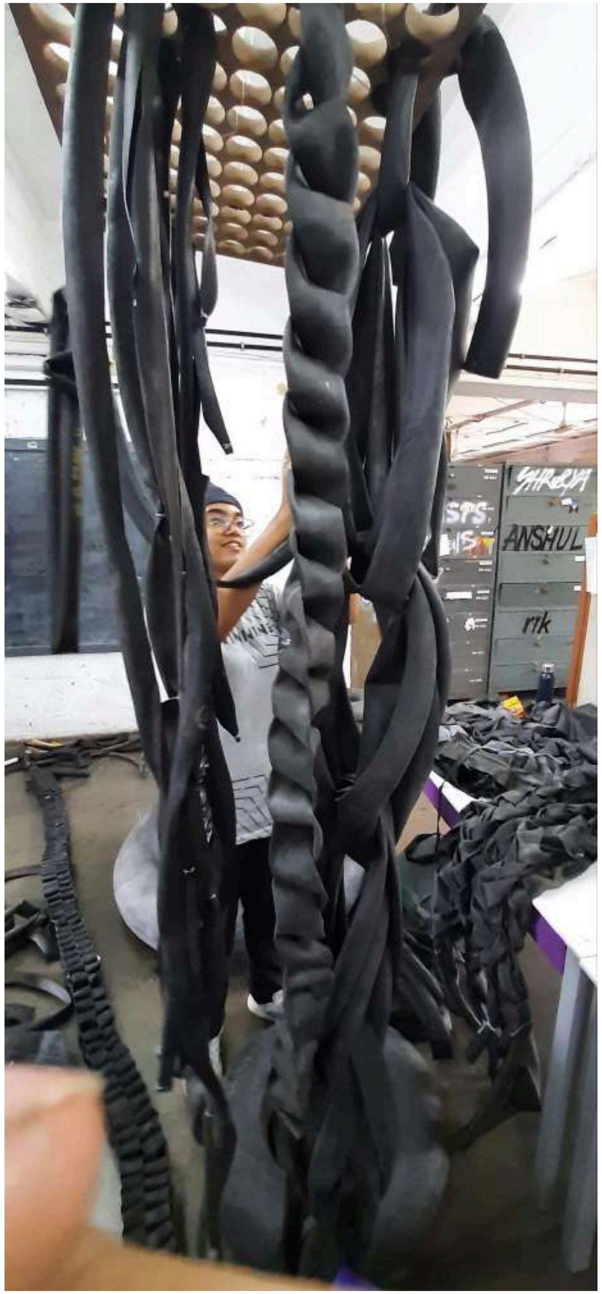

Braid-like patterns



Fish-tail loom (used in the final installation)



Dragon scale pattern



Other explorations

Repairing tubes

A cobbler taught us about how to fix the tyre punctures, find leaks and also inflate them. When inner tubes are punctured, they are placed in water and checked for bubbles to locate leaks. Larger tears of over-used tubes may be beyond repair. A patch of rubber is used to cover and seal the leakage by gluing it with a special adhesive that chemically bonds vulcanized rubber. Some of them require heat application to be cured.

https://www.parktool.com/en-us/blog/repair-help/inner-tube-repair

A cobbler's workplace in Ahmedabad

Inflation check

Punching holes

From the cobbler we picked up a few techniques and learnt about tyre repairing, we purchased some glue and patches so we could fix some of the punctured tubes in our collection by ourselves.

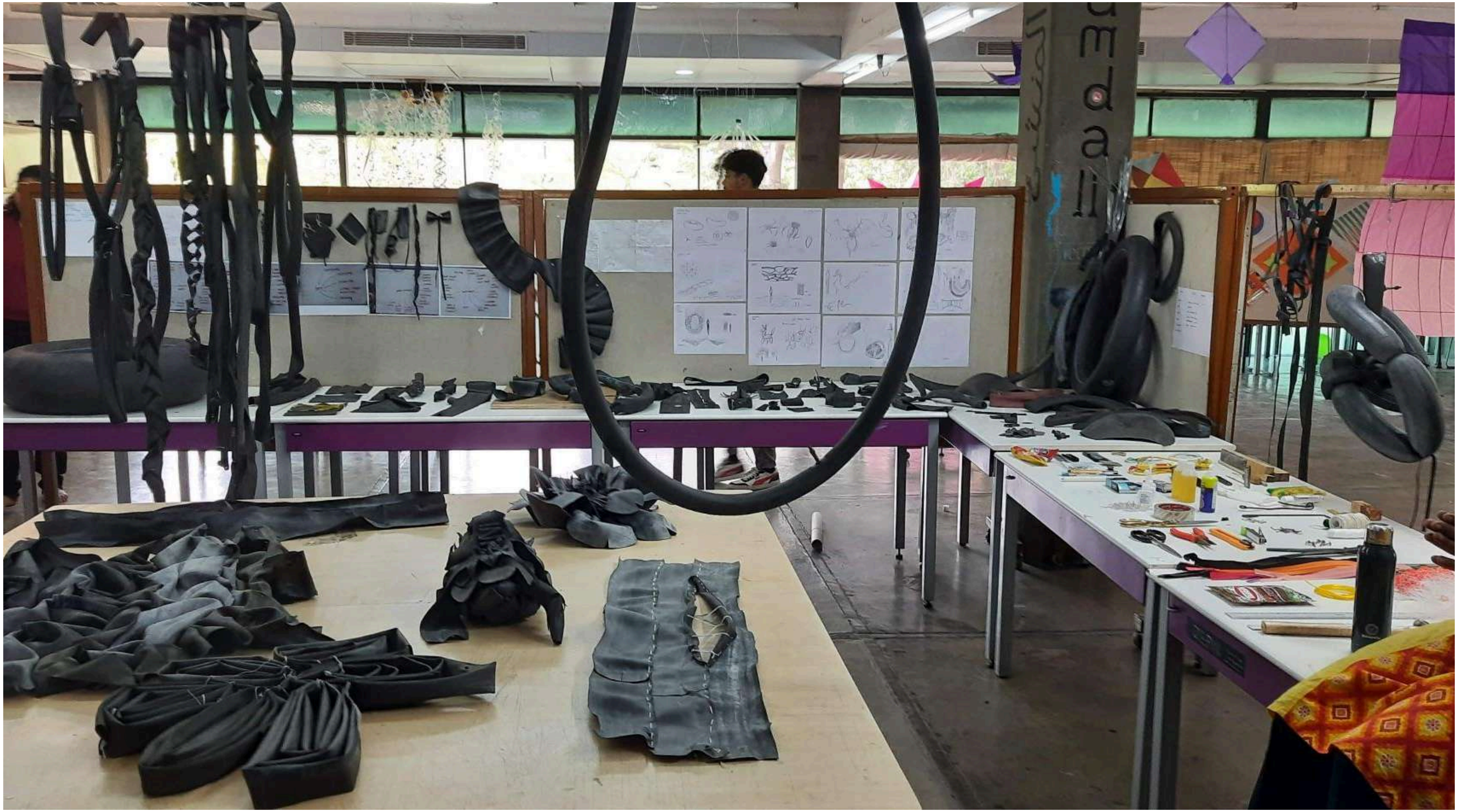
Perforating holes in the rubber to pass rope and strengthen it with an ‘eyelet’.

Stitching, Zipping etc.

Apart from these, we tried a plethora of experiments including stitching, cutting, hammering, nailing etc. Some of these are shown below. In a table showcase we presented all of them at the end of 2 days.

Explorations with stitching and stapling

Stitching a zip OR inserting metal strips inside to make it firm



Final showcase of all our explorations with tyre tubes by the end of 4 days

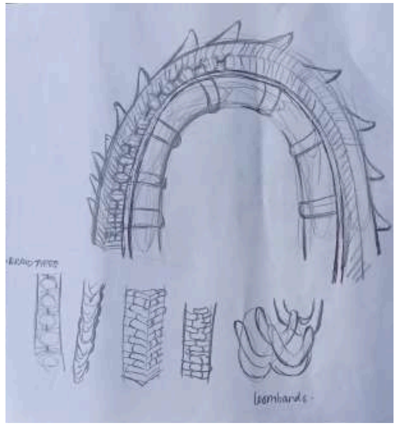
Final Installation (Week 2)

Designing

Justification for design choices
Specific properties of the tyre tubes were selectively chosen for the final installation - the most interesting, and inherent to the form and function of the tyre tubes were their ability to be interlocked, inflated and knotted together; alongside their tensile strength, which made them strong but also stretchable.

Tubes can also be weaved together to create a canopy that stretches over a large area. We had the option of building an experience where people may be able to bounce, lay-on, and have a more tactile experience with the rubber- and/or in combination with water. We chose not to go that way.

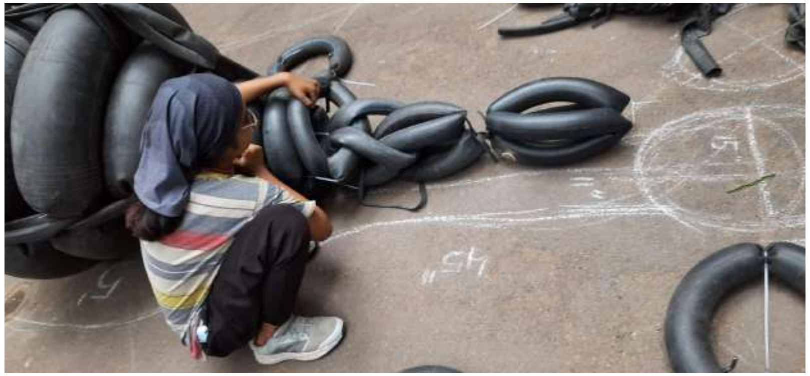
Sketching and Ideation
Out of all our options we selected the challenge of building a ‘Dragon’. It was imagined we could select an appropriate location to ‘enmesh’ a dragon within a canopy of interweaved tyres hung on hooks spaced radially in the ceiling. We couldn’t find such a place, so we settled on a simpler design. Where the dragon was hung on two cables in the open space known as GG square at the institution.



Construction

Building separate modules

The dragon was divided into 3 parts - the head, the wings and the body (which included the torso, neck and tail).



Torso

As imagined in our sketches, we procured tyres of various sizes, mostly from different tractor models, as we go down in size they go into cars, then scooters etc. Voluminous tubes were required so we could fill a large amount of space with air and create the illusion of a bulky body, which is the perk that inflation offers us.

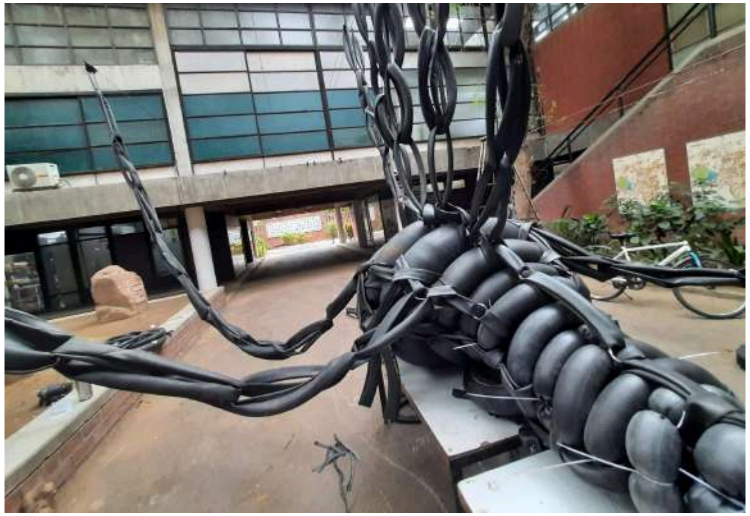
Inflated tubes of various sizes

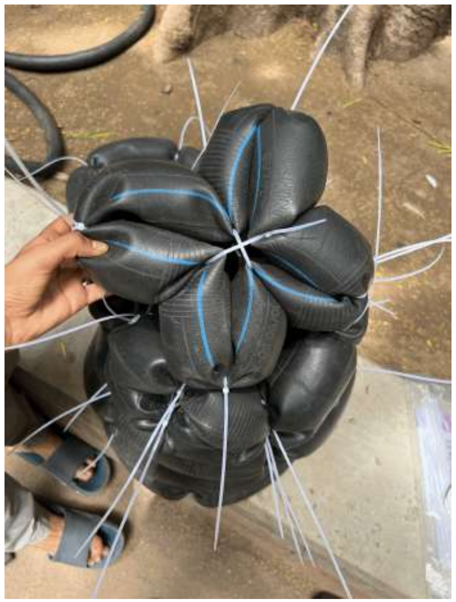
We also added zip ties to the ends to create some abstraction of scales - a smooth body would be too plain, but these gaps also allowed us to pass tubes through them, allowing us to bind all the tyres purely using tubes itself.

We discovered how passing the tubes through the tyres enabled us to bind them securely together - better than any other medium could, including the hassle of ropes. This also created a kind of spine through which we could hang the body on the cables and add the wings. One in the center and one on each side. These three loop de loop tyre joineries bound the torso together.

Neck

We utilised a similar strategy for the neck, making it an extension of the torso itself, joining it with the tubes, as the thickness became really small, we then used zipties.





The neck was composed of small scooter tyres scrunched up (This helped us make them gradually smaller with more scrunches). The zipties helped us do this quickly and gave the neck a spiky appearance, which we abstained from cutting off. It gave it a wild appearance.

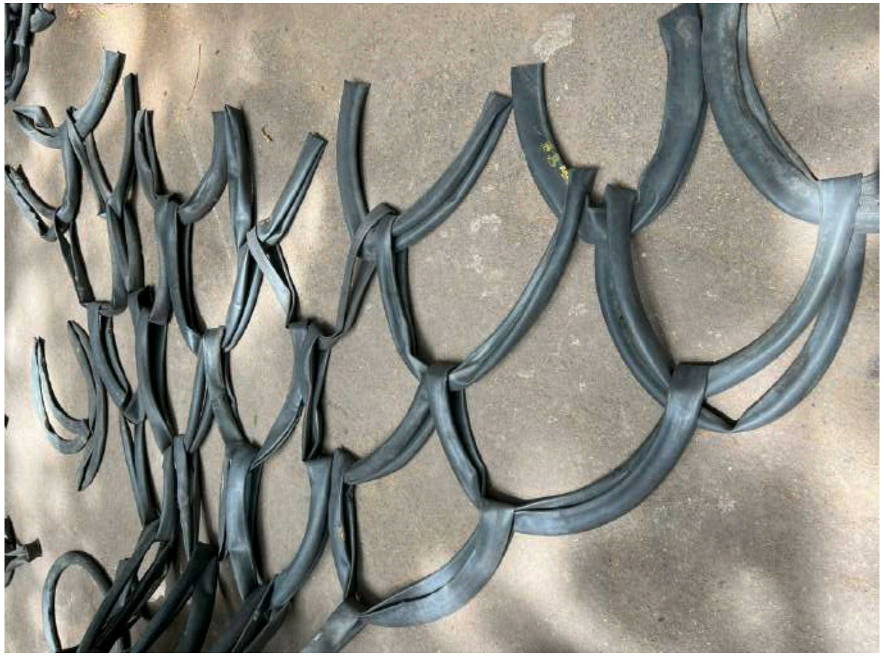
Head

The basic skeleton for the head was sculpted with the balloon animal technique, and ornamented with various tyre tube material explorations conducted in Week 1. The ornamentation was the talent of one of our team members with an adept hand at crafting and art.

Various techniques were employed in the final head. Including stitching, painting, utilising vulcanising glue, glass paints, etc.

Wings

Our strategy for building the wings was simple. There were a total of 4 cable channels running through the top, two in the center (to support more weight) and one on the sides.(for the wings). We intended to start building a mesh of tyres from the main body and then hook it up to the top cable on the sides. Only that we realised that we had to start constructing them from the top and then hook it to the body in the end, because all the loops could not be cleanly attached to the cables and the top since we can’t remove the cable and then insert it through the tyres



Composed entirely using bicycle tubes, which were ideal and to our good fortune considering bicycle tubes represented most of the waste tubes we had collected.

The loom band joinery that inspired the wings is called the dragon scales, it was an effective method to create large spanning wings using the stretching tyres.

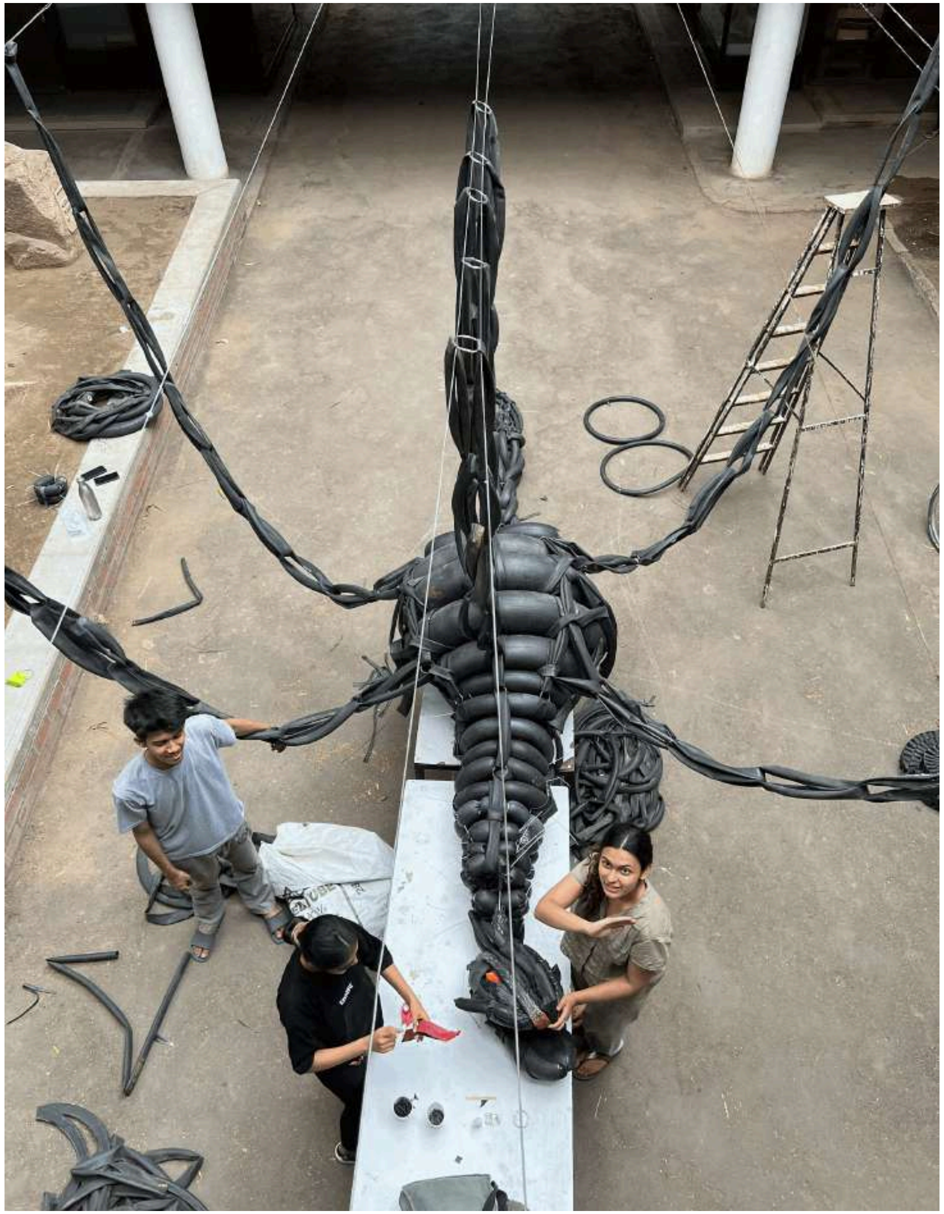
Tail

The tail was made using semi-inflated bicycle tyres - we utilised the fish-tail loom - one of the most basic loom knots we explored in Week 1, but effective since it was lengthy but also light. Inflating the tubes gave it volume and girth.

Assembly process

To make the dragon float and assemble everything together, we started with the torso, which would be the main portion holding all the other parts. It was important that the torso would be up in the air. So we did a weight test which held up sure enough, but the tubes were elastic so the torso was just a few inches off the ground.

After testing we placed the torso on a table and started to append the other parts to it - the neck, tail and the wings.



Attaching the neck, wings and tail. There are 4 cables going through the top

The wings were attached to the body using metal hooks. These were 10 rupees a piece, and helped connect the open joints that remained after using tubes as a joinery system. As they come down to the body, the connections are lesser since the looms in the wing increase exponentially, so they require fewer hooks. The hooks were also helpful in connecting the "spine".

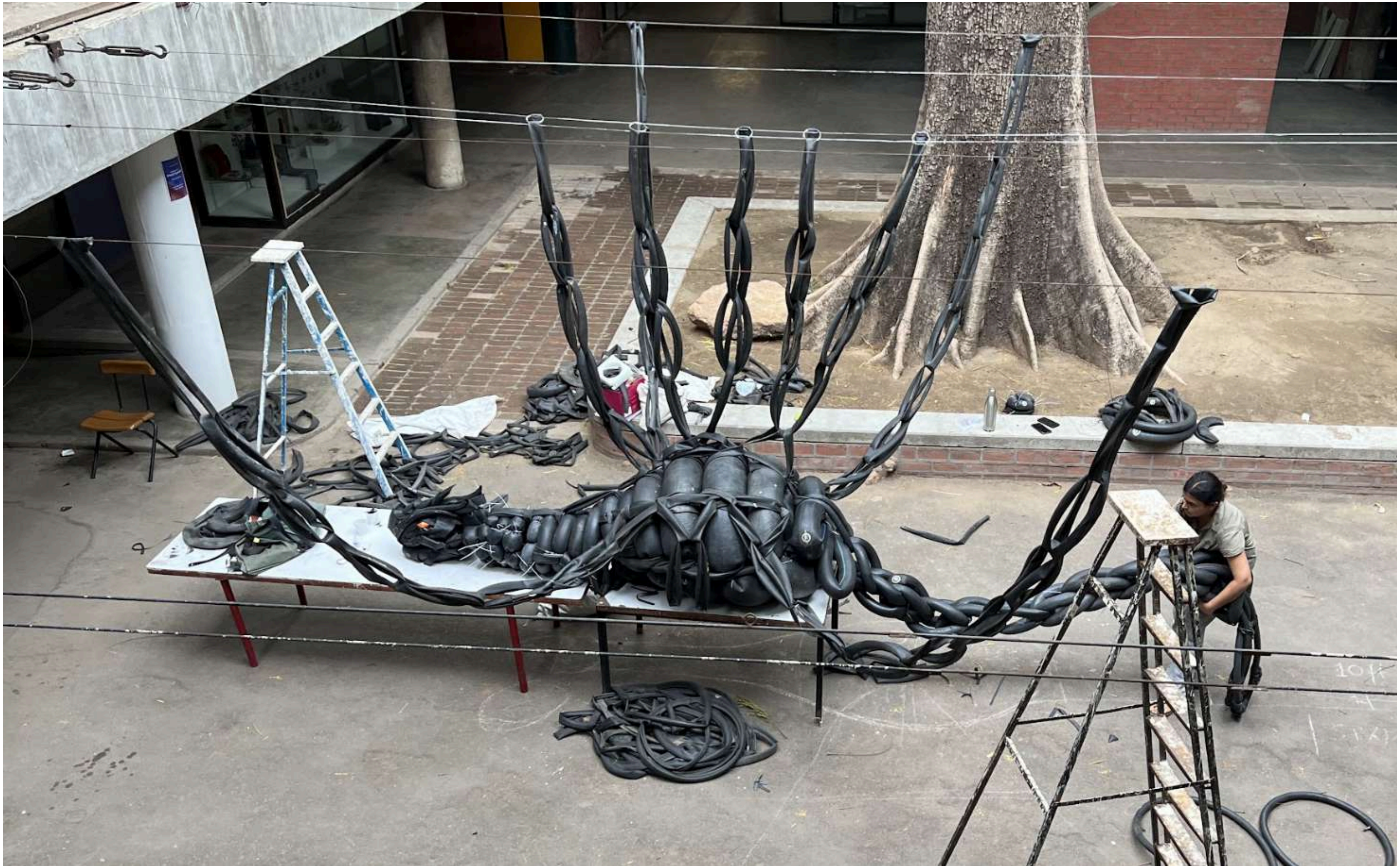
We adjusted the arrangement to use lesser tubes - because exponentially increasing the pattern would require far too many of them

Though it appears in the images that the wings are also holding some of the weight of the body, this is not true. The entire weight is being held by the central column, which we called the ‘spine’. As we added more elements onto the torso the weight increased until the total weight was such that the torso ended up touching the ground in the final piece. This could have been accounted for by creating a shorter spine section, but it was not possible because we found that the cables were getting too tense from the weight, and they would eventually lead to snapping off the edge of the building from which they were clamped. Therefore, the final model was let to rest on the ground.

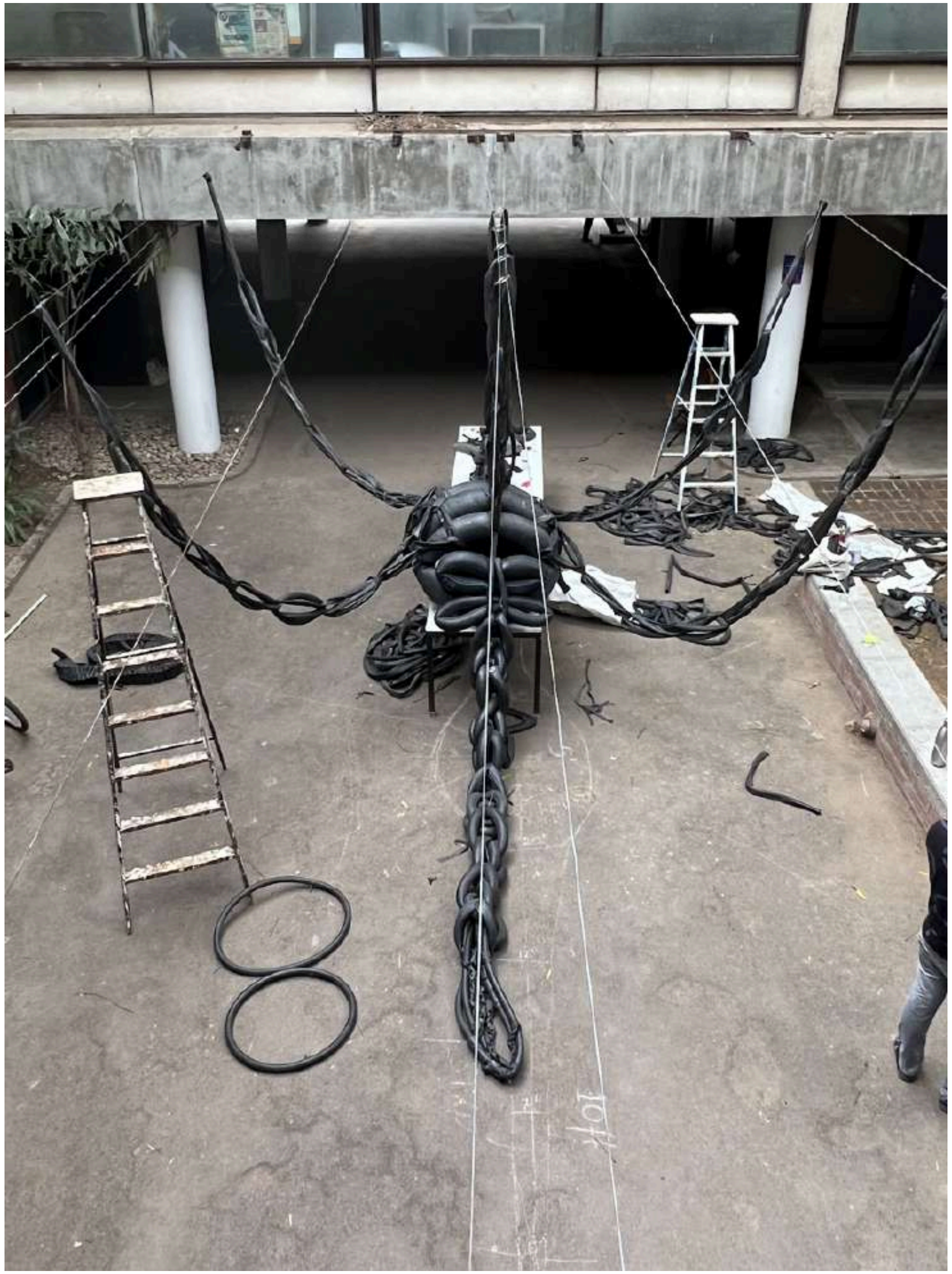
Attaching the tail using tubes

The entire body was assembled on the table. The neck, tail, wings and other parts were slowly appended, and the table was removed in the end, letting the cables hold the weight of the body. Though large and voluminous, the dragon itself was not remarkably heavy. With 2-3 people, it was easy to lift. More looped tubes were used to prevent the neck from sagging and staying firm, creating the appearance of a strong stable and girthy torso.

Appending various body parts onto the main torso

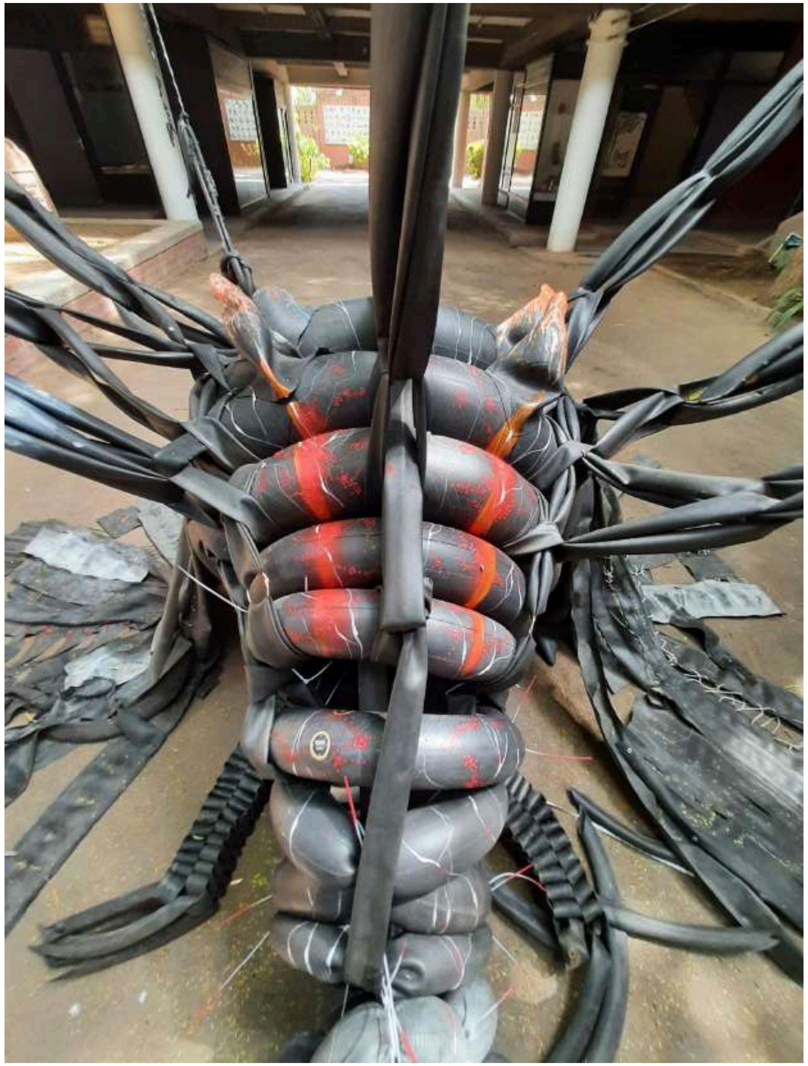


Assembly of the main body



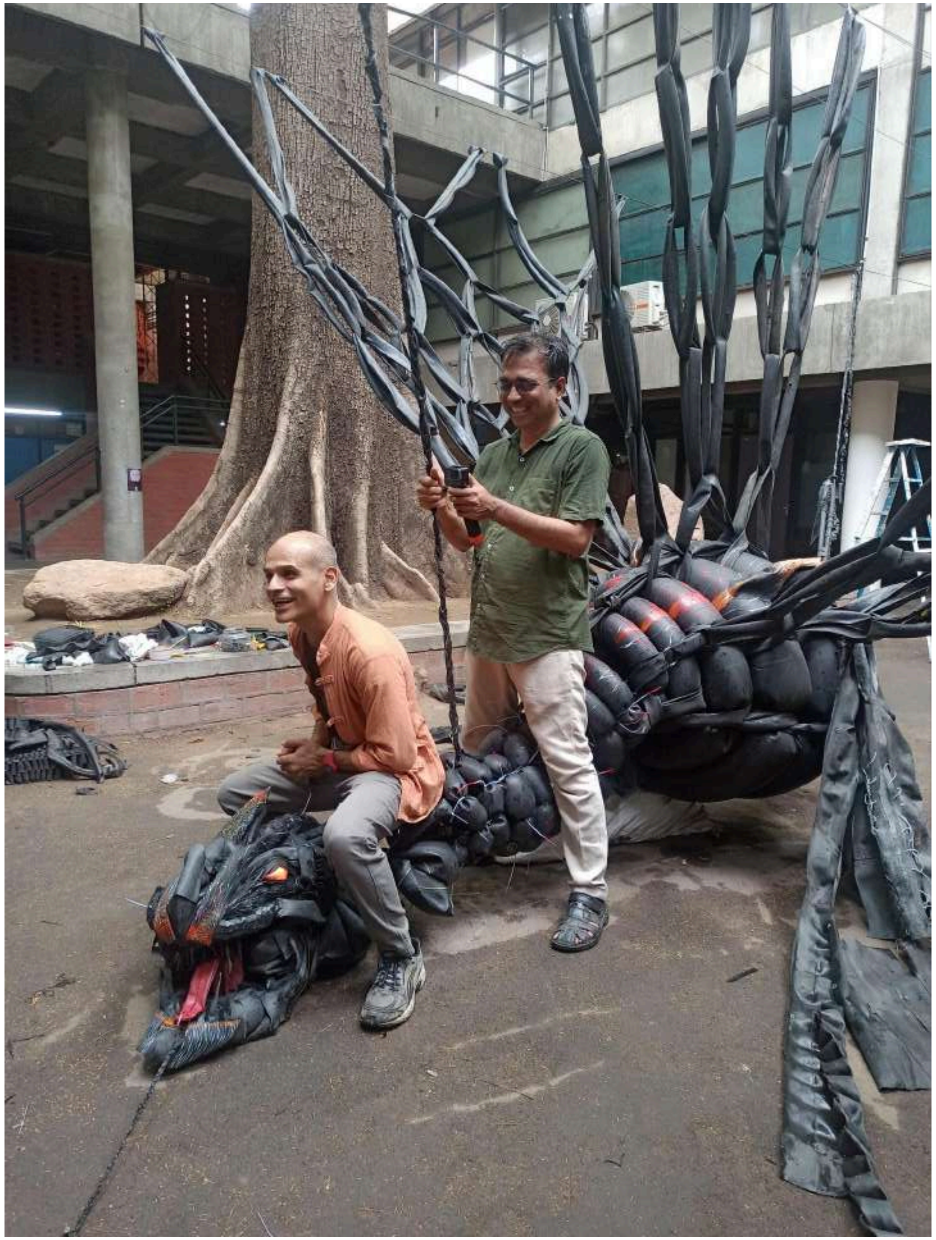
Ornamentation

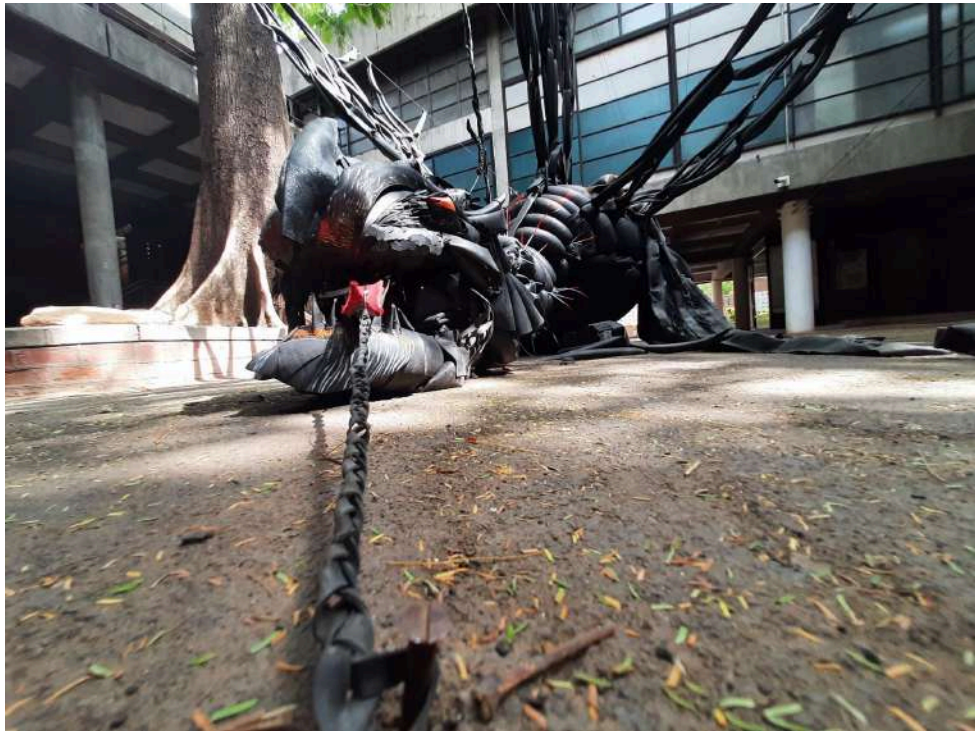
Though the main body looked great, it was clean, large and composed almost entirely of looped tyre tubes - which were knotted together or inflated and never cut or disfigured in any way, It was decided that in order to showcase the wide variety of explorations that were conducted in Week 1, we should ornament the dragon with all those explorations-



Our painting, stitching, weaving, draping explorations were all added onto the main body. Though this had the effect of making the dragon look incongruous aesthetically, the idea was simply to showcase all the explorations that were possible with tyre tubes. The main body had the most structurally effective techniques - involving knotting, inflation, weaving and joineries, while the outside was covered with more aesthetic explorations.

Final view





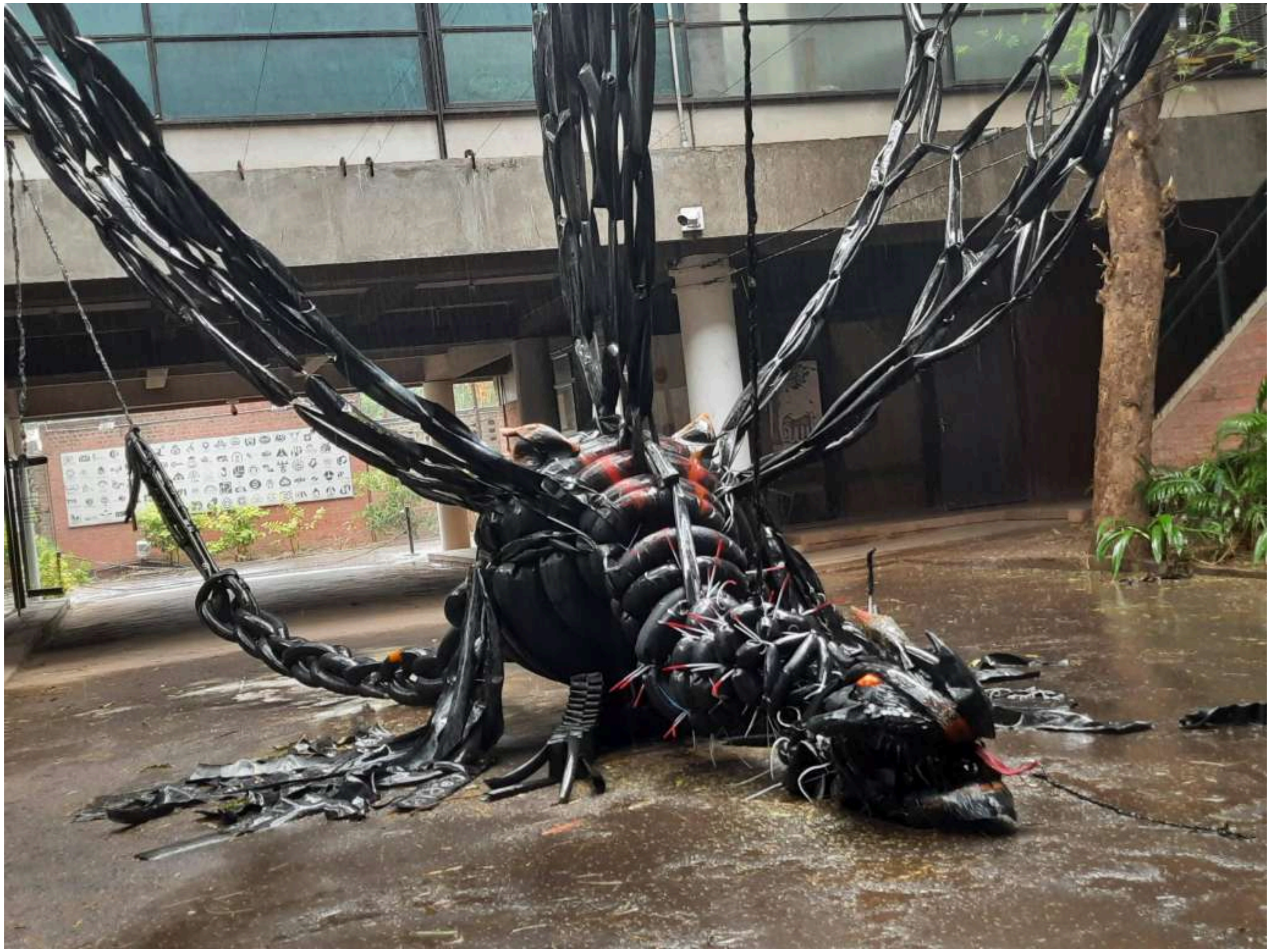
Final installation view

300 ટાયર ટ્યુબમાંથી 7 ફૂટ ઊંચો ડ્રેગન તૈયાર કર્યો

એનઆઇડીના એક્ઝિબિશન ડિઝાઇનના બીજા વર્ષમાં અભ્યાસ કરતા સ્ટુડન્ટ્સને 'મટીરિયલ્સ એન્ડ મેકિંગ' સ્ટડીના ભાગરૂપે મટીરિયલ્સને એક્સપ્લોર કરી શકે તે માટે ટાસ્ક આપવામાં આવ્યા હતા, જેમાં ચાર સ્ટુડન્ટના ગ્રૂપ દ્વારા એક સપ્તાહની મહેનત પછી વિવિધ આકારના ૩૦૦ ટાયર ટ્યૂબની મદદથી ડ્રેગન બનાવ્યો છે. આ વિશે સ્ટુડન્ટ્સ અમૂલ્ય દેશમુખેએ કહ્યું કે, અમારા ગ્રૂપનેં એક મટીરિયલ્સને કેટલા પ્રકારે ઉપયોગ કરી શકાય સાથે મોટી જગ્યામાં ડિસપ્લે કરી શકાય તેવું સ્પેશિયલ વસ્તુ તૈયાર કરવાનું કામ આપવામાં આવ્યું હતું. અમારા ગ્રૂપે રબર ટ્યુબના મટીરિયલ્સ સાથે કામ ન કર્યું હતું ત્યારે આઉટ સોર્સથી વધુ સારી રીતે કામ કરી શકાય તે માટે અમે ડ્રેગન બનાવવાનું નક્કી કર્યું હતું.

GUJARAT SAMACHAR - AHMEDABAD- 05/07/2022

The installation was covered and featured in the Gujarat Samachar. The title reads - "300 tyre-tubes in 7 days to build a public sculpture". Though the real number of the total tubes we used was closer to 500-600.



The installation stayed in the institution square for about a week, after which it was disassembled and the tubes were resold.