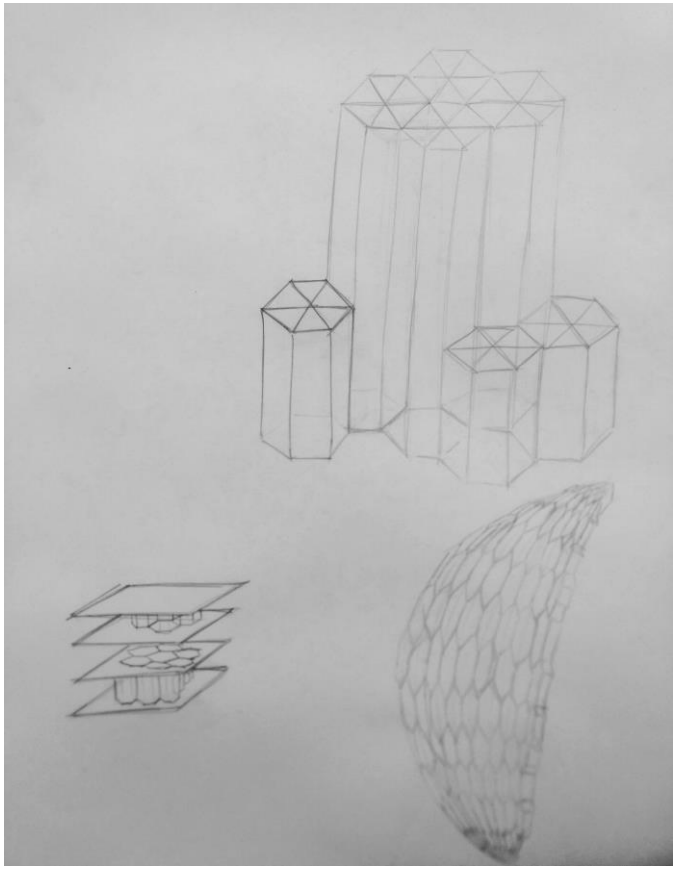
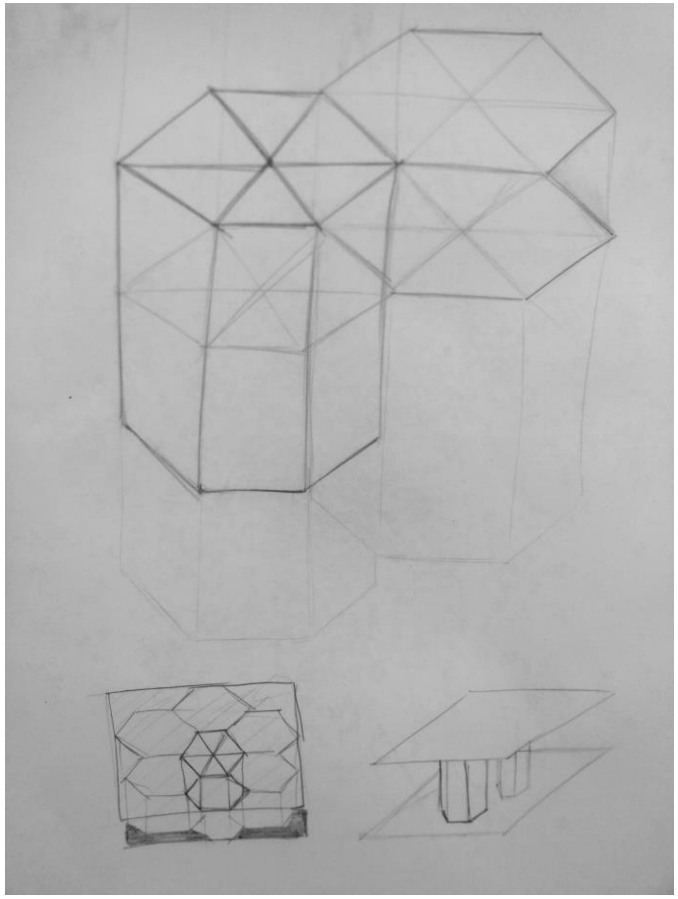
Days 1, 2 and 3

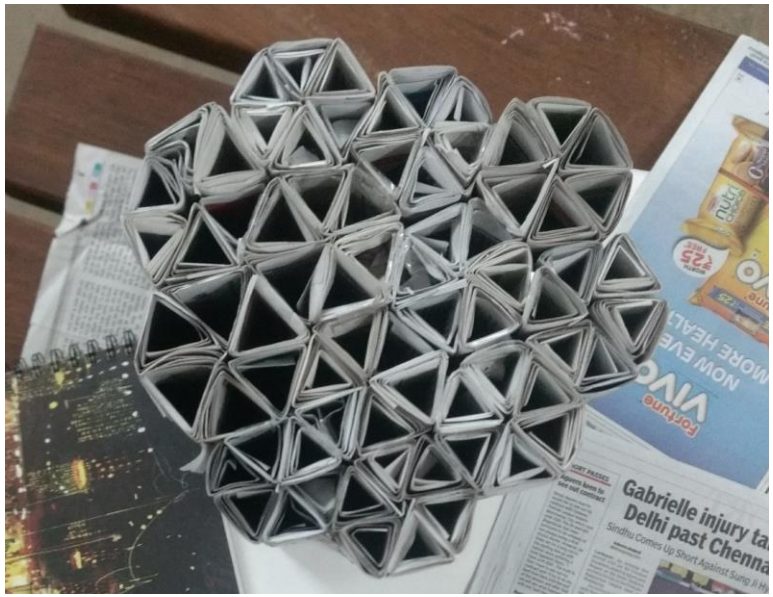


When we were given the assignment, the first thing that struck me was a similar assignment we had in our first year, where we had to use newspaper to hold weight. All of us of course made rolls and used their structural support, but this one person in class folded the newspaper into square rolls, stuck them together and made a rather sturdy structure.



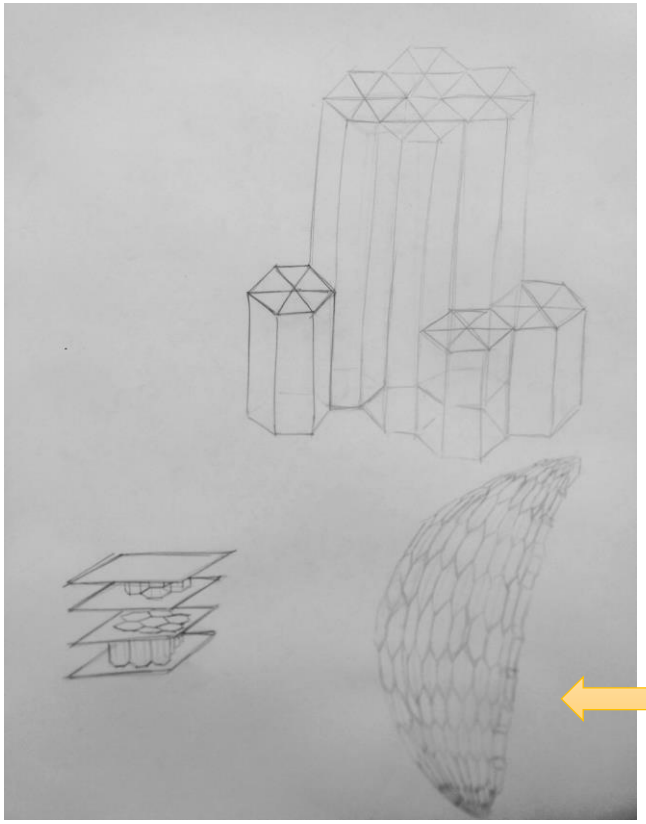
I decided to make 4 layers of newspaper triangle columns, and then stagger them for equal weight distribution. This was going to be very time consuming and I was advised to just go ahead and make 35cm columns instead. I did, and stuck them with cello tape, and later glued the columns together for extra support. The side columns were still buckling, so I added smaller columns to create a triangular (kind of) structure to distribute the weight better.

The final stool – holds weight but is wobbly



What could be done better

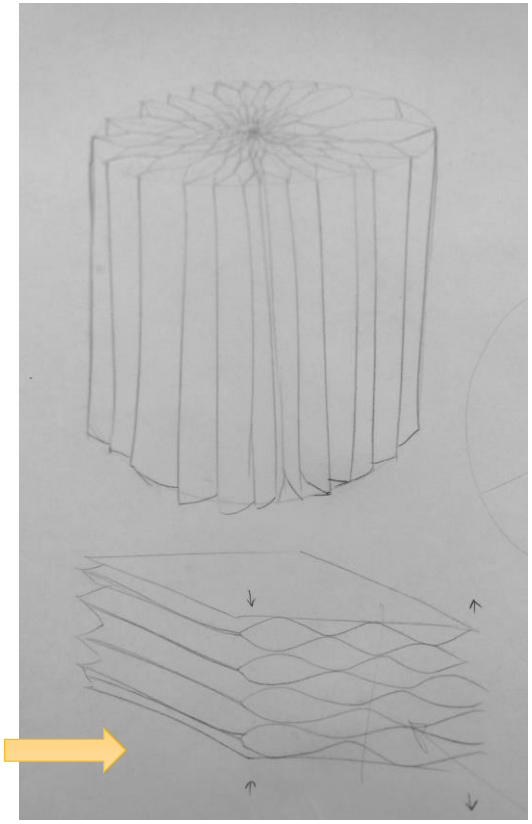
- Glue between the sheets as they were folded, as opposed to just between the triangles to gold them together would have made the whole thing stronger.
- I could actually have poured a mixture of glue and water on the whole thing to make it stronger.
- Level the newspapers, some of the sheets were a few mm more in length and that threw off the balance

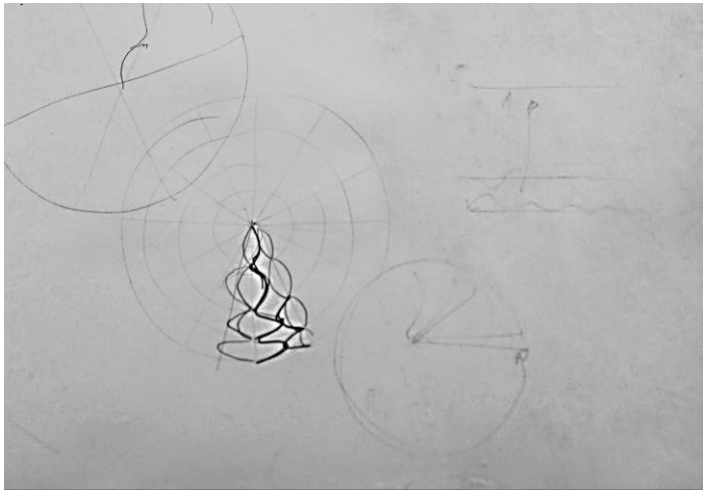


The hexagonal structure reminded me of a video I had once watched, of Chinese helmets made of paper in a way that resembled a honeycomb sheet, and I wanted to try something similar with news paper.

The helmet structure

Making process

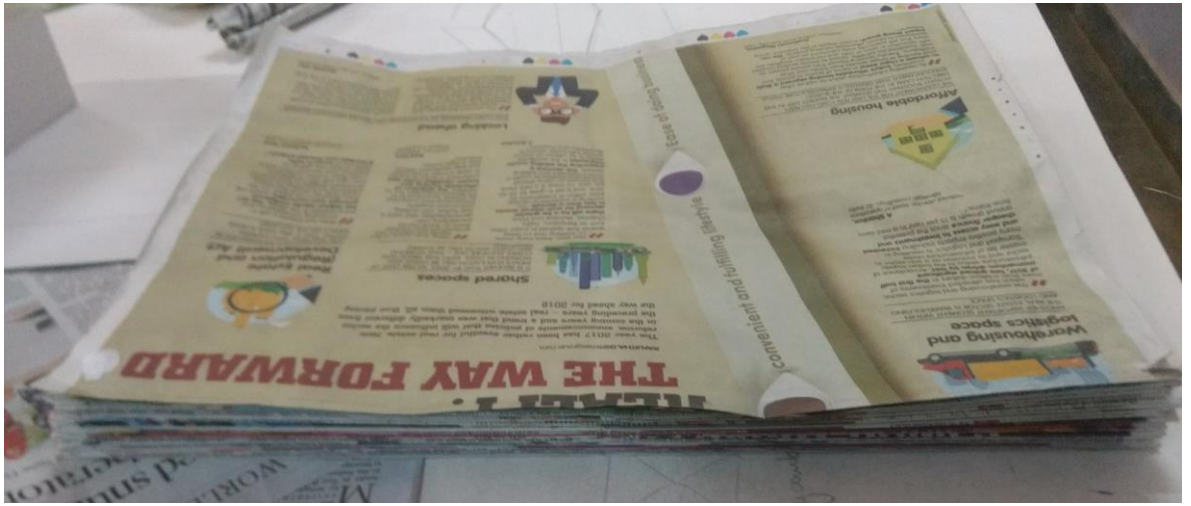




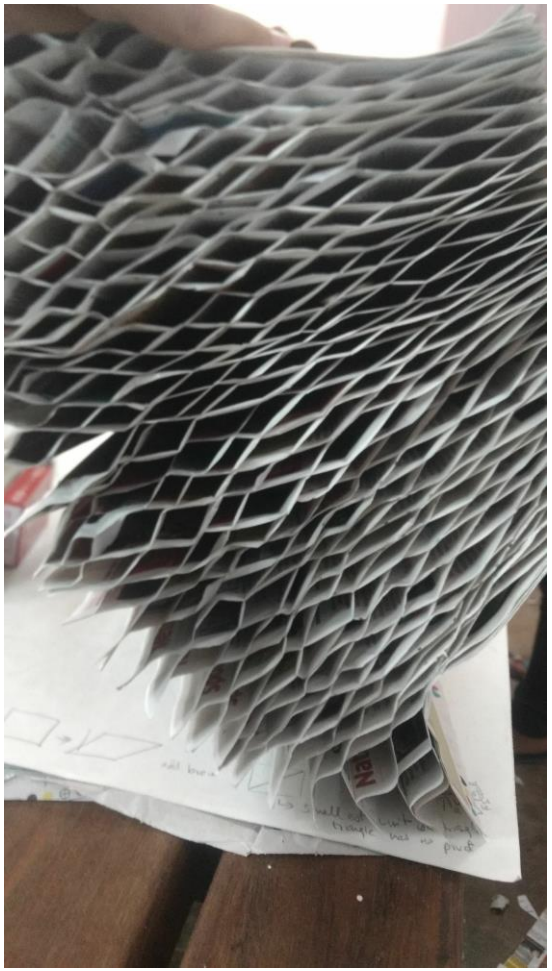
The idea was to glue together enough sheets that I could pull open one end and take it around to meet the other, creating a circle that is dense on the inside and sparse on the outside. After some discussion with my guiding facilitator I realized something like this would require a bit more calculation with the spacing of the glue lines, but I could just open the stack linearly instead.

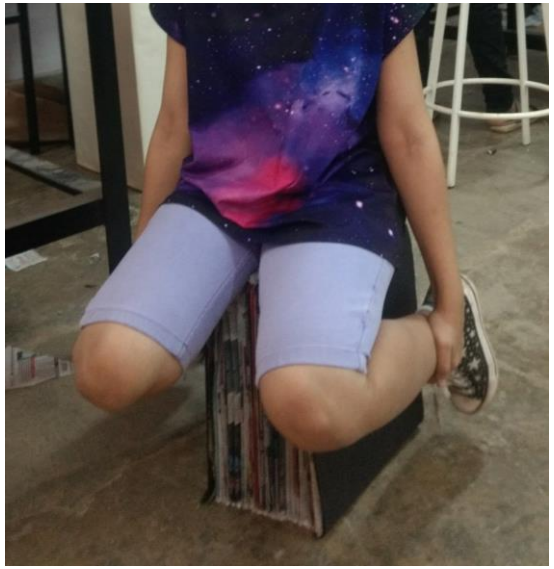
The making process was simply collecting half sheets of newspapers, stacking them folded into quarters, making alternate guideline marks on either side of the sheets and putting alternate lines of glue in alternate sheets (like in the picture, even markings have glue lines, next sheet odd markings will have glue lines.

This was the initial volume of material used, when the sheets are flattened, on opening it is around 7 times the volume



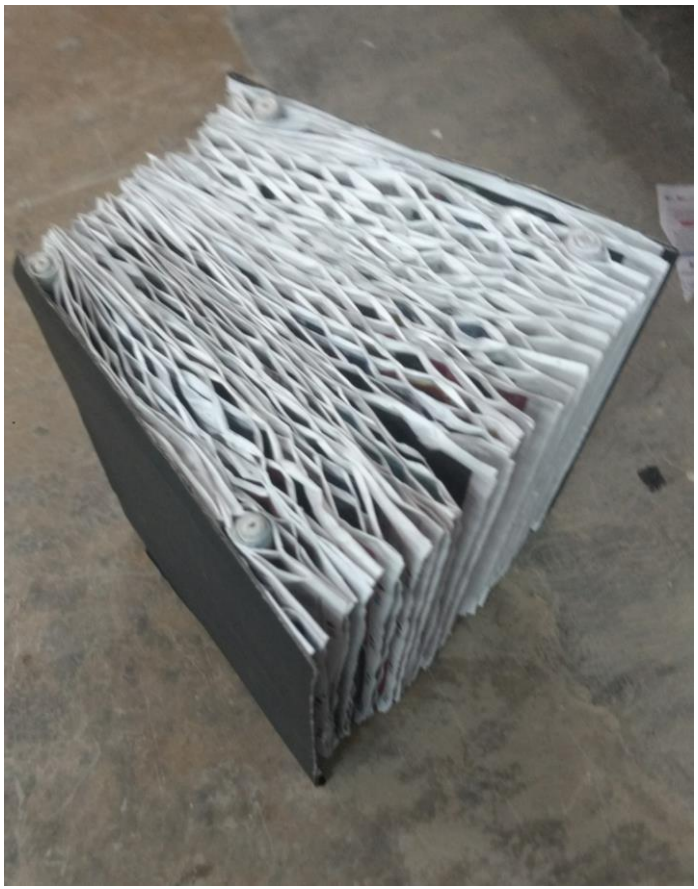
The stool - holds weight

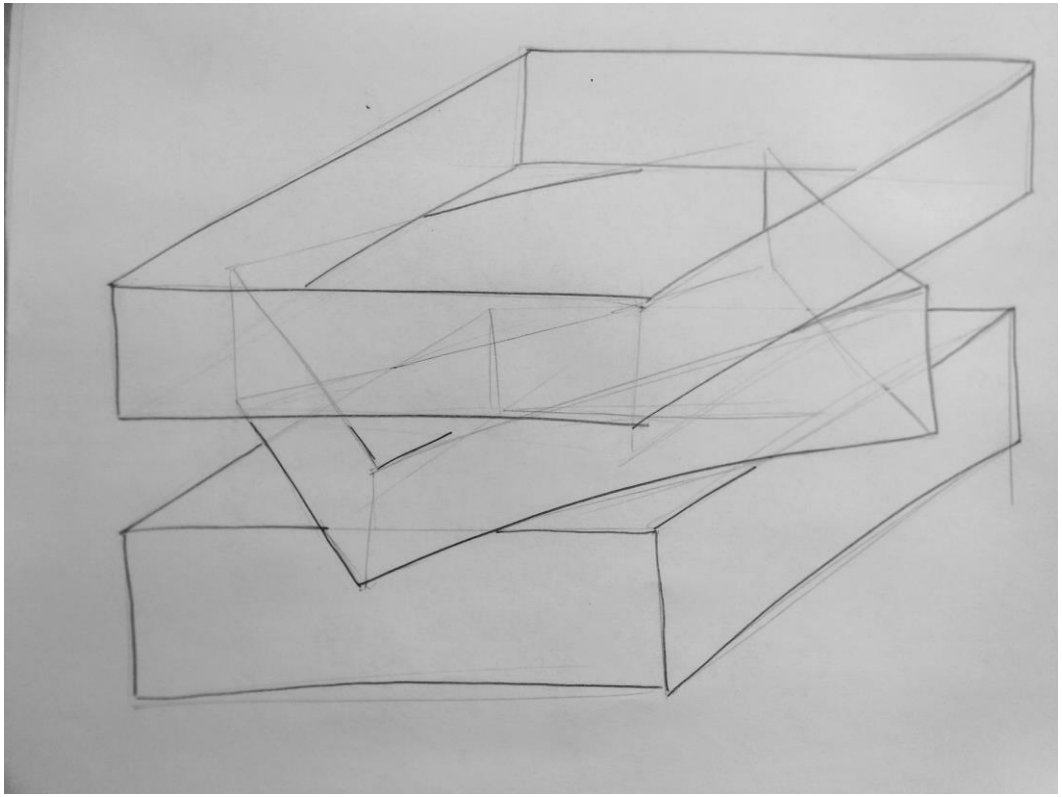


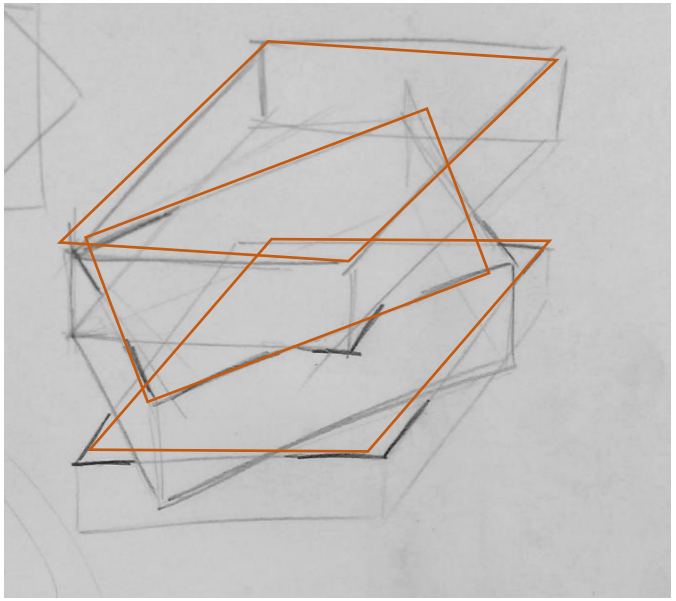


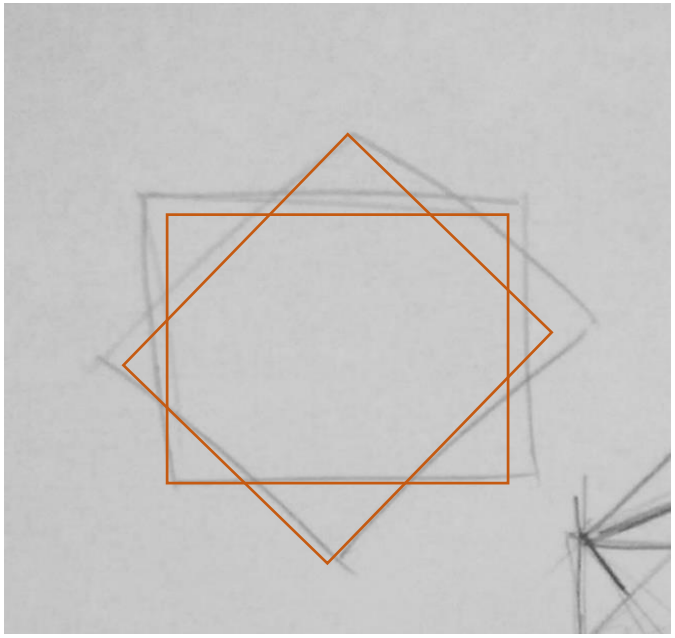
The diamond structure is quite sturdy, although it lacks balance. The collapsible stool refused to stay open, and the sides kept buckling inwards, to tackle this problem, I added boards as braces on both sides.

Although this worked, to give it a bit of extra support, I added tightly wound newspaper rolls to the four corners.



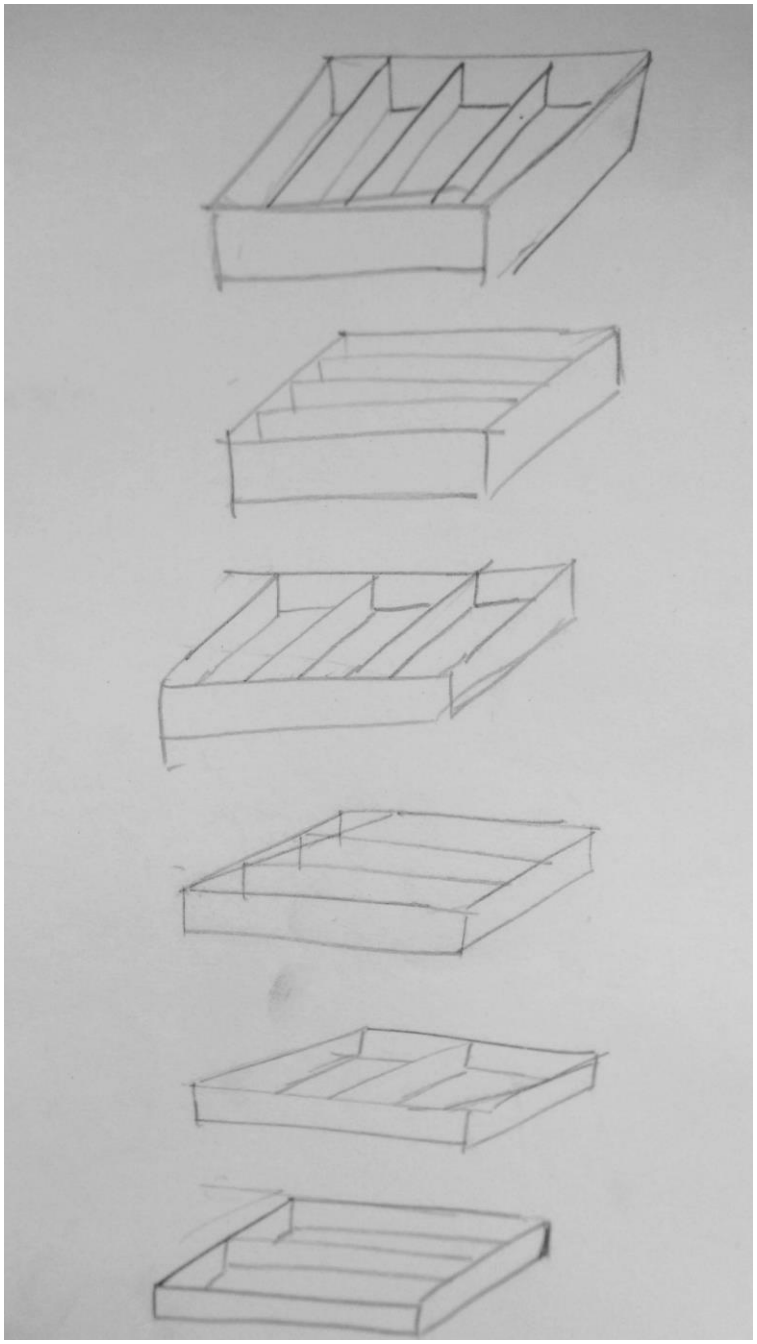




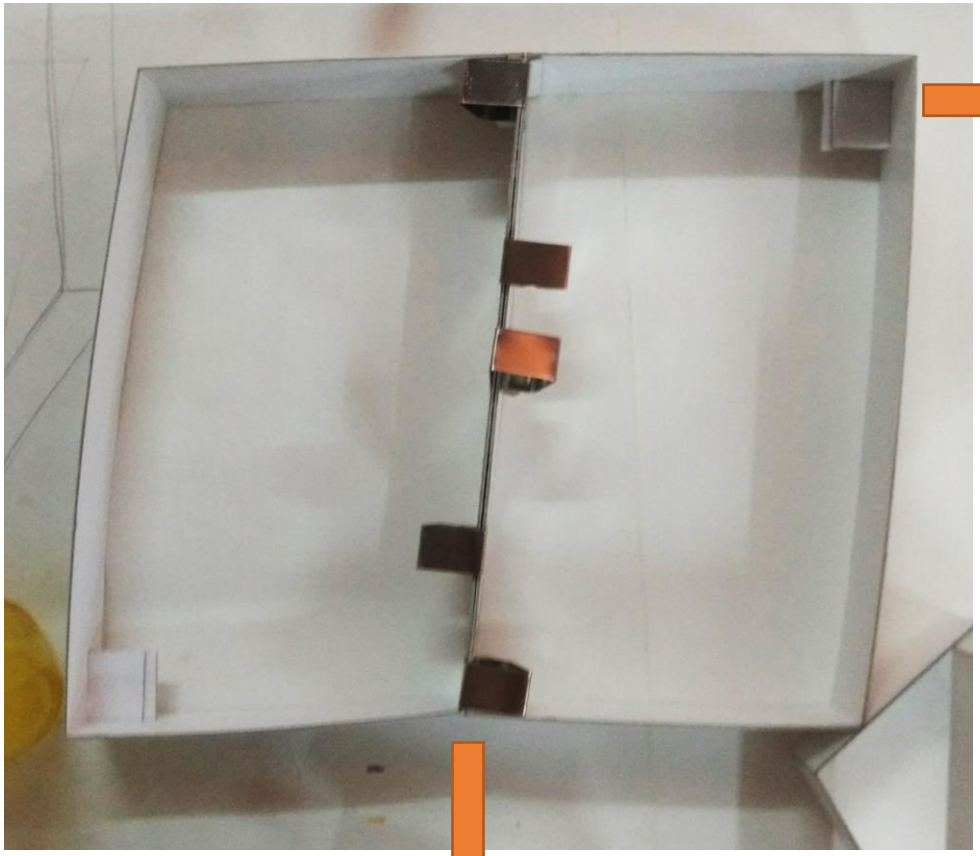


As I watched other people work, I realized that if newspaper at angles can hold weight then mount board probably does it better, so I decided to try it

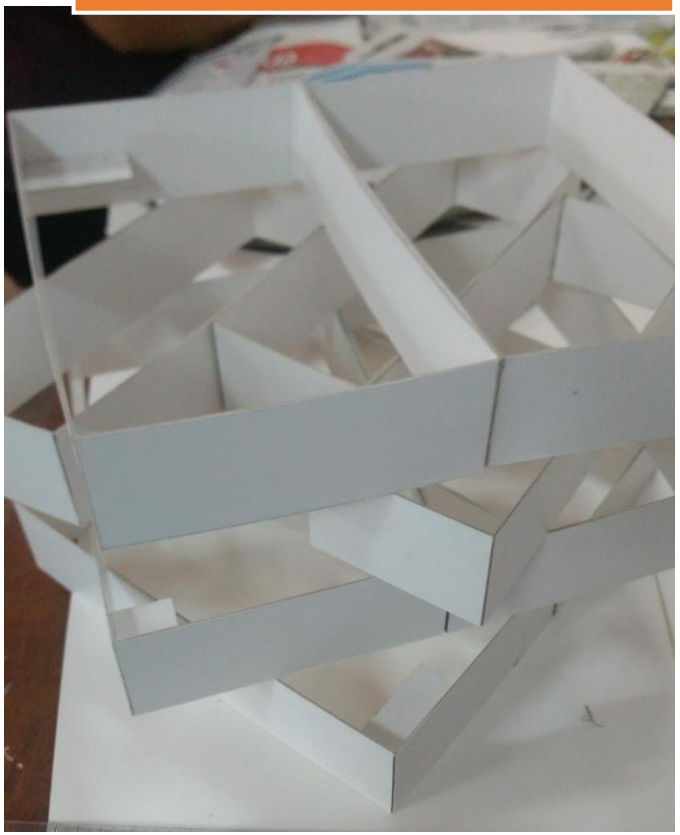
I planned to make mount board squares, each 5cm high and stagger them.



I worked out how an even distribution of 7 5cm layers, gradually increasing the slats in each so the stool could support a seat. In order to keep minimal aterial and minimal points of failure I avoided too many slats on the slower layers, that, in hindsight, might have helped.



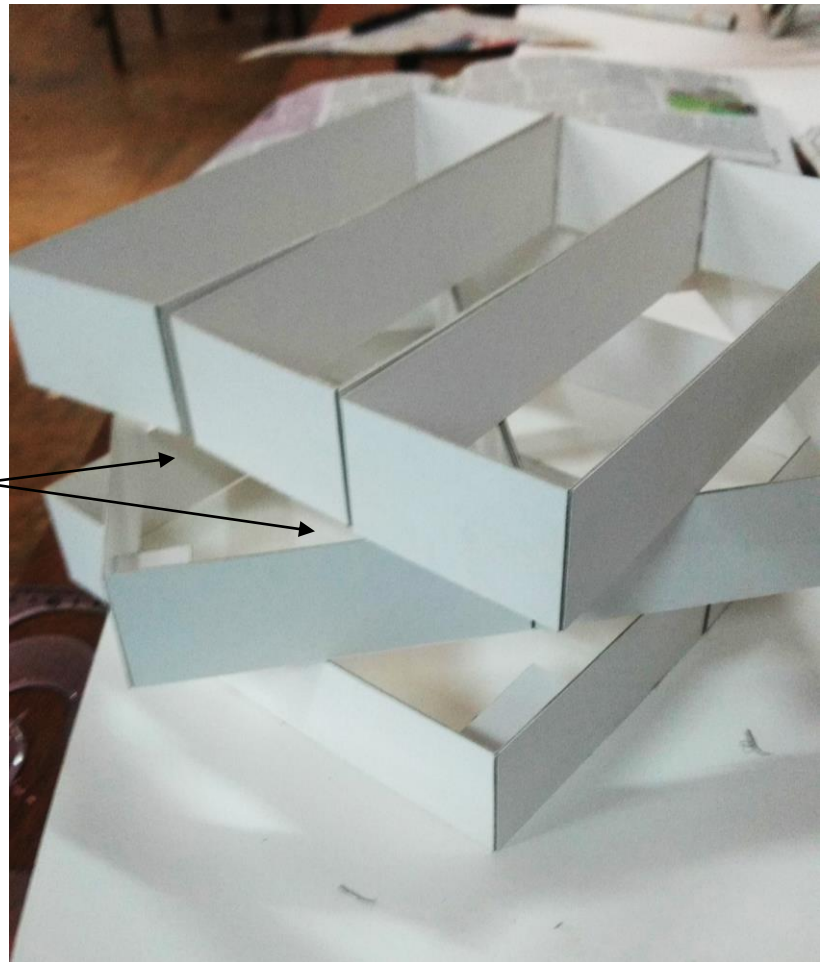
Adding small right angle braces is not enough to keep the structure at 90° , because mount board is flexible, it needs a brace throughout.



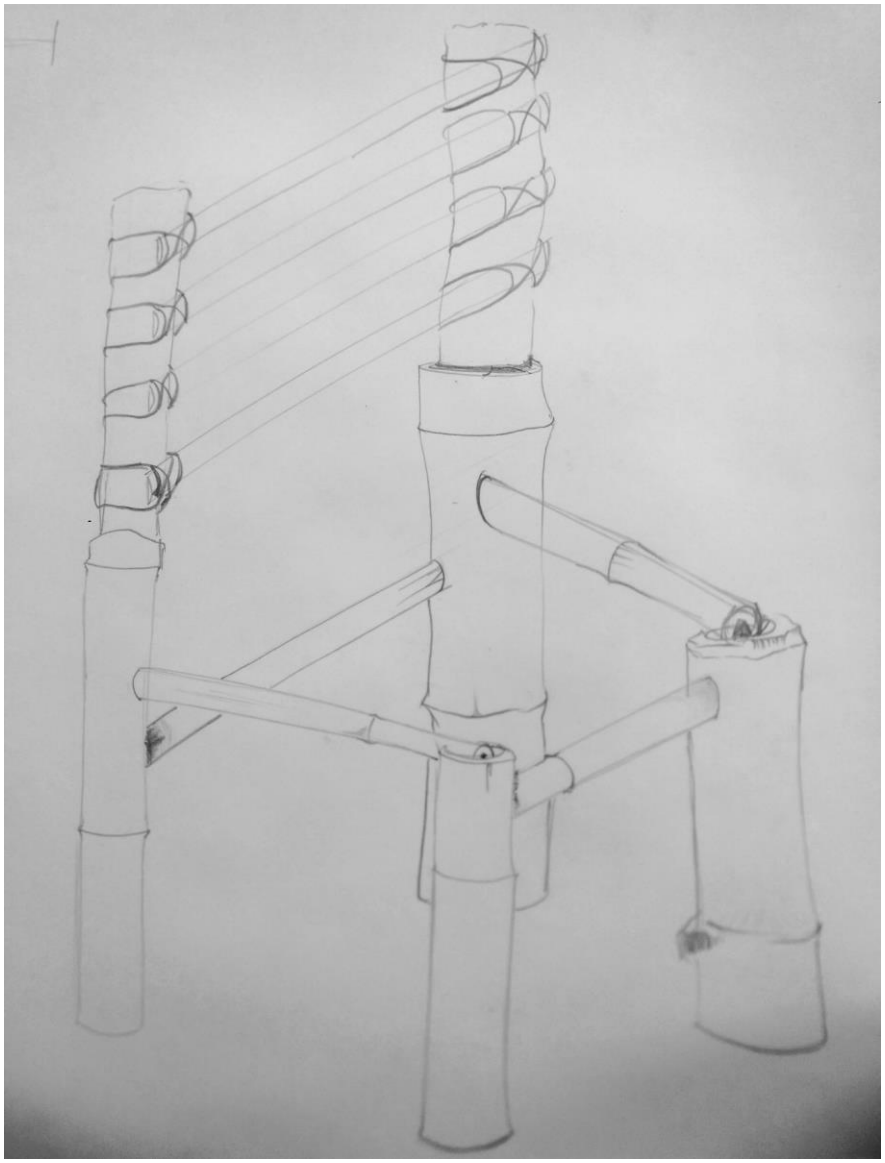
It is very difficult to stick mount board using paper fevicol, it needs to be clamped and held for several minutes (around 15) before it has any structure. Even then it sometimes fails.

Not enough points of contact : the compressional strain at the few points of contact was damaging the material and causing bends and dents, and in some cases tears. To tackle this I staggered the 3 part square, but that did not help as much either

Points of failure

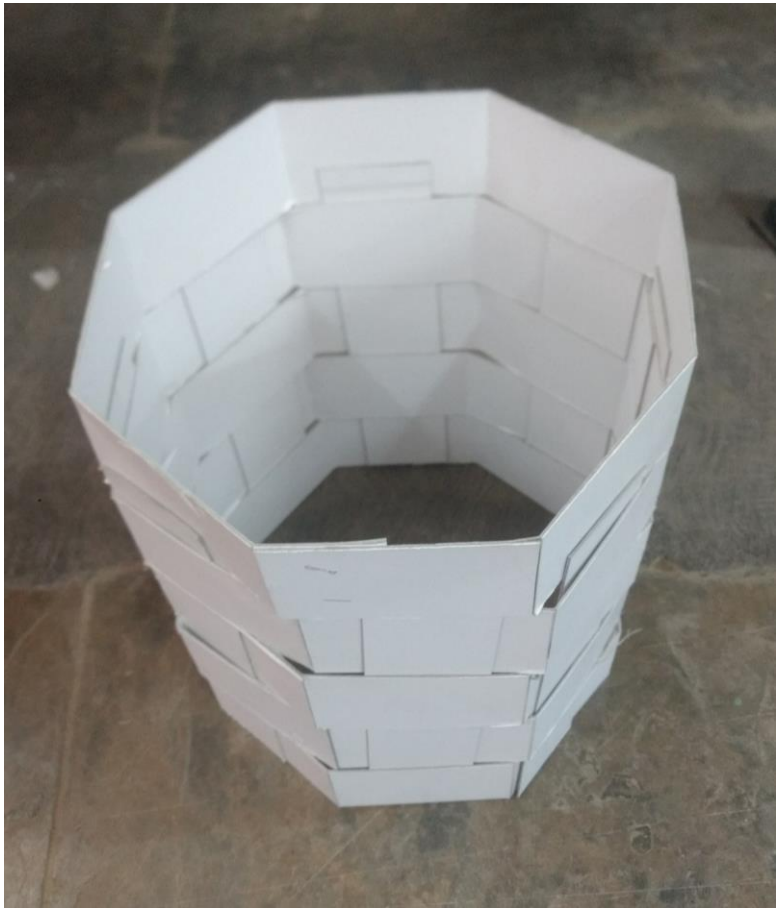


After this, Anushka Gokhale gave me the idea to try using a hexagon or an octagon the same way, to increase the points of contact, and so I did.



Side sketch- of an adjustable chair I made in foundation with bamboo. The only thing that didn’t fail was the structure, its pretty uncomfortable and looks hideous.

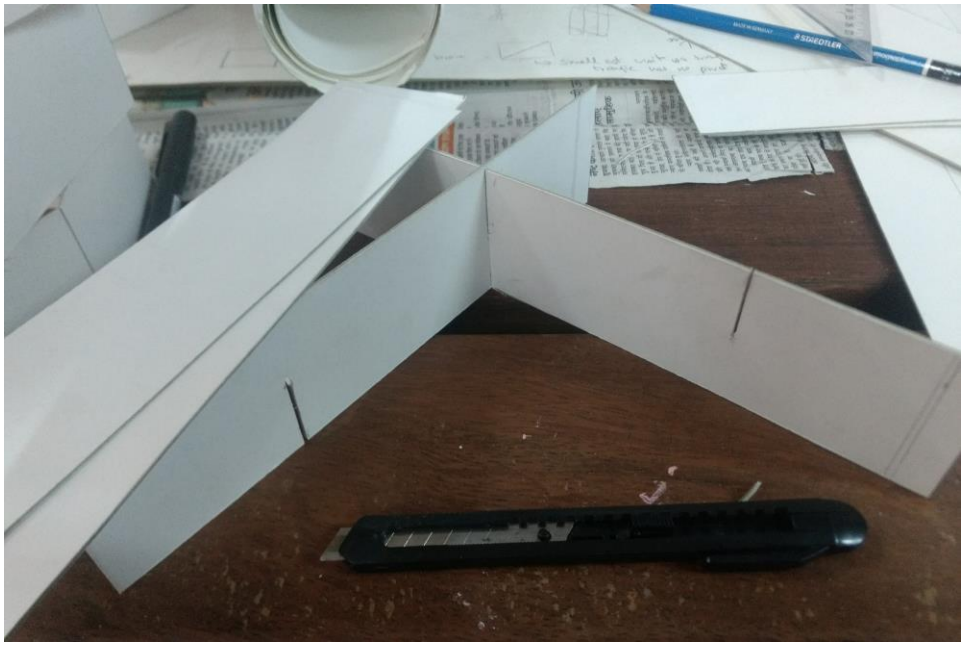
Days 4, 5, 6



As suggested by Anushka, I started to make mount board octagons and stacking them

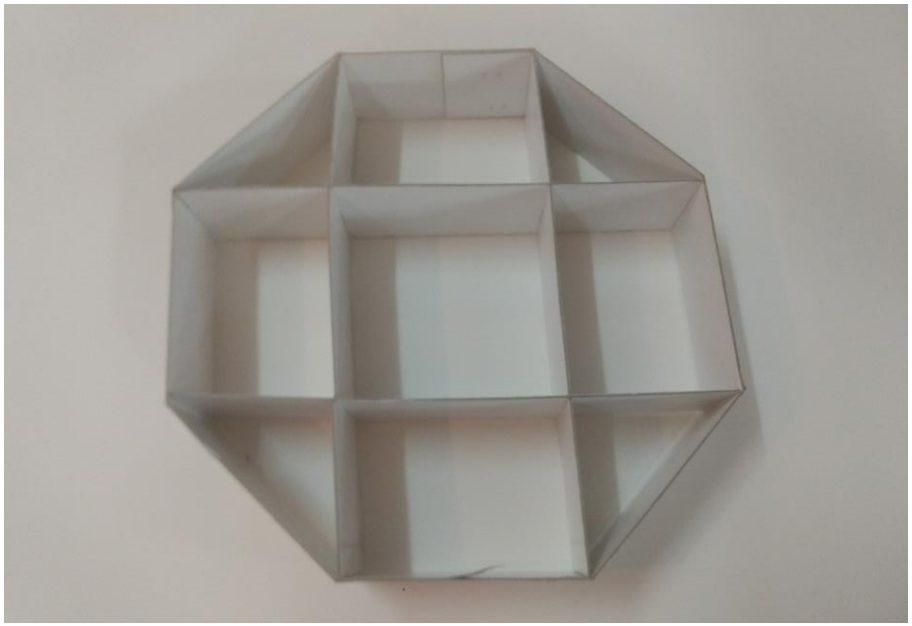
Point Of denting

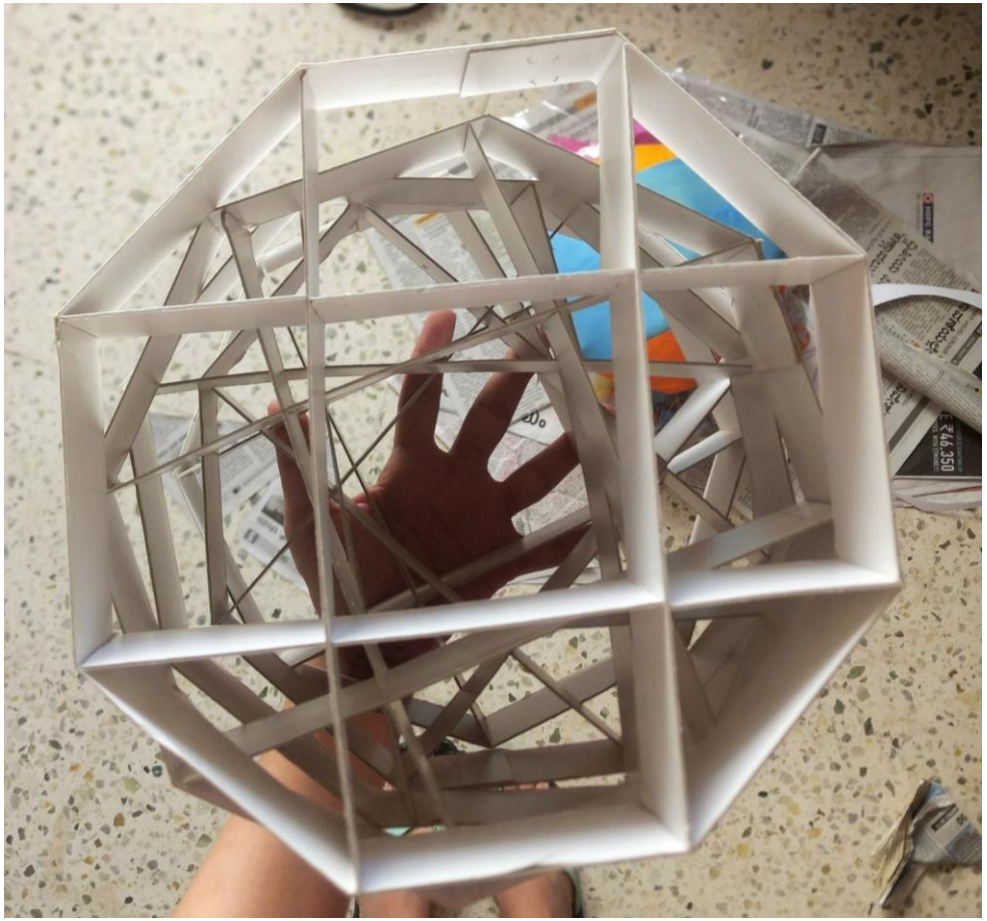
I first tried weaving them, just to see if it worked. Turns out there weren't enough points of contact to distribute the weight, and as strong as the structure was, it didn't take vertical compression very well and started to dent.
To tackle the previous problem of fevicol not working well with mount board, I coupled it with staple pins.



To increase points of contact, I added slats between the octagons, in hopes that it would further help distribute the weight and further support a seat.
I calculated the lengths with very slow and bad math, cut slits of 1mm width in each of them and slotted them in.

I fit the hash structures into the octagons and stacked them, staggered them, and to my surprise, they worked very well, better than I had expected. It was still a little wobbly because I had not glued any of the pieces together, which I continued to do.

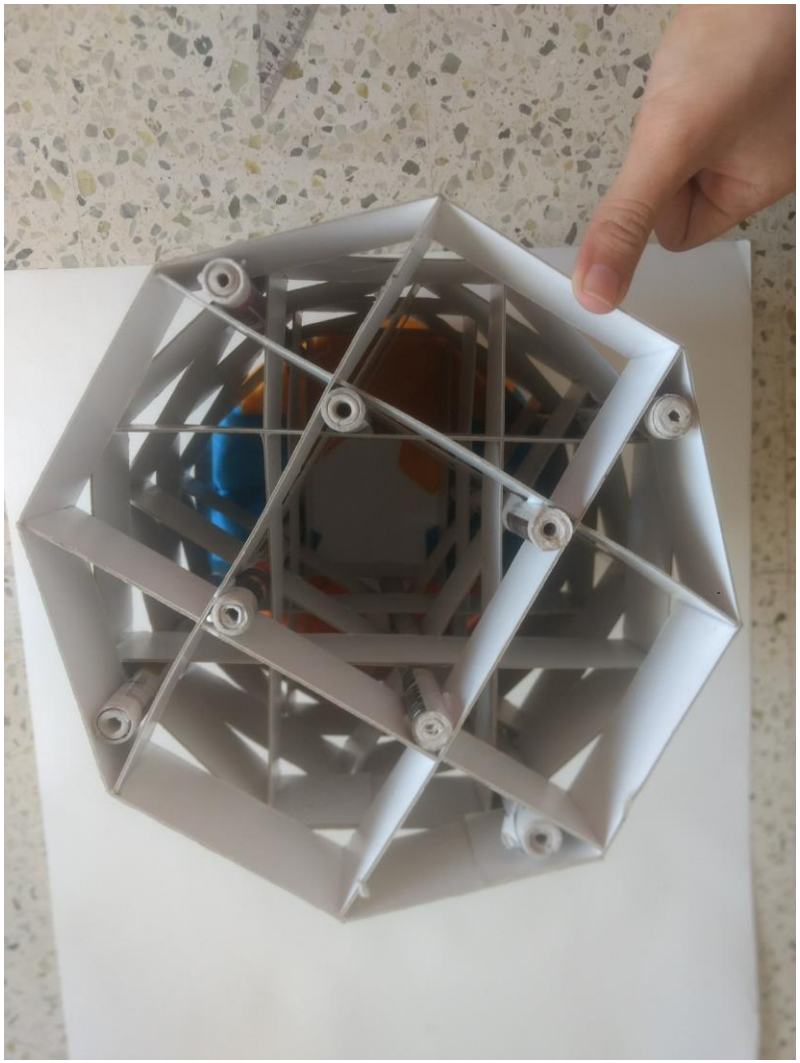




In order to keep the pieces stacked together, I added eight newspaper rolls vertically in the spaces between the slats

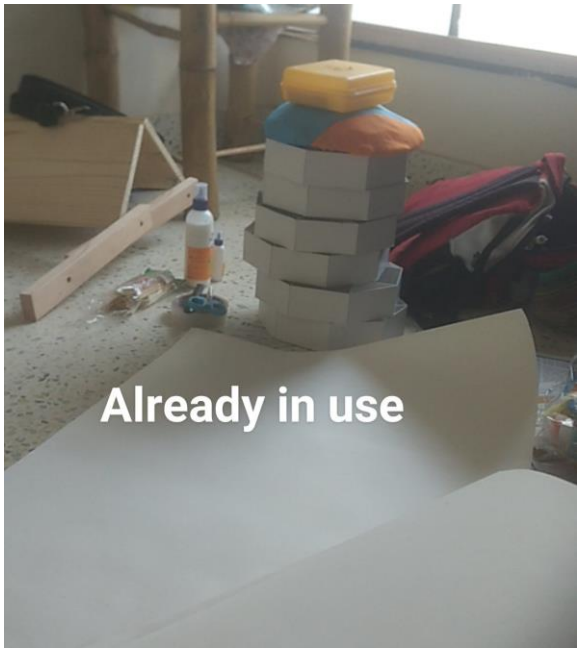
It took a few rotations of trial and error, whether the slats should coincide alternately or not, and what angle to keep them at so the newspaper rolls would perfectly fit.

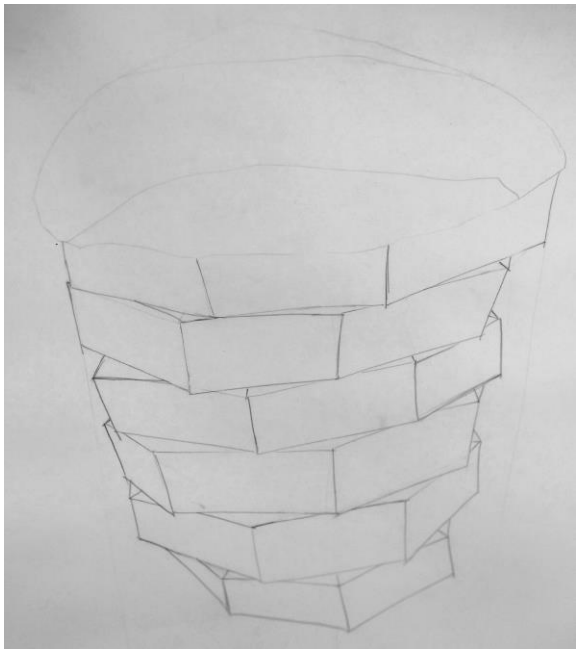
Clearly, I went a bit overboard with this stool, I found scrap fabric, got some sponge, a needle and thread and stitched together a cushion. I stapled a piece of ivory sheet at the bottom to give it a bit of structure. I made the vertical columns around 2cm higher than the stool, made holes in the cushion base and fit it on.



The placement of the slats and the newspaper rolls.

The stool – isn't wobbly, holds weight, reasonably comfortable

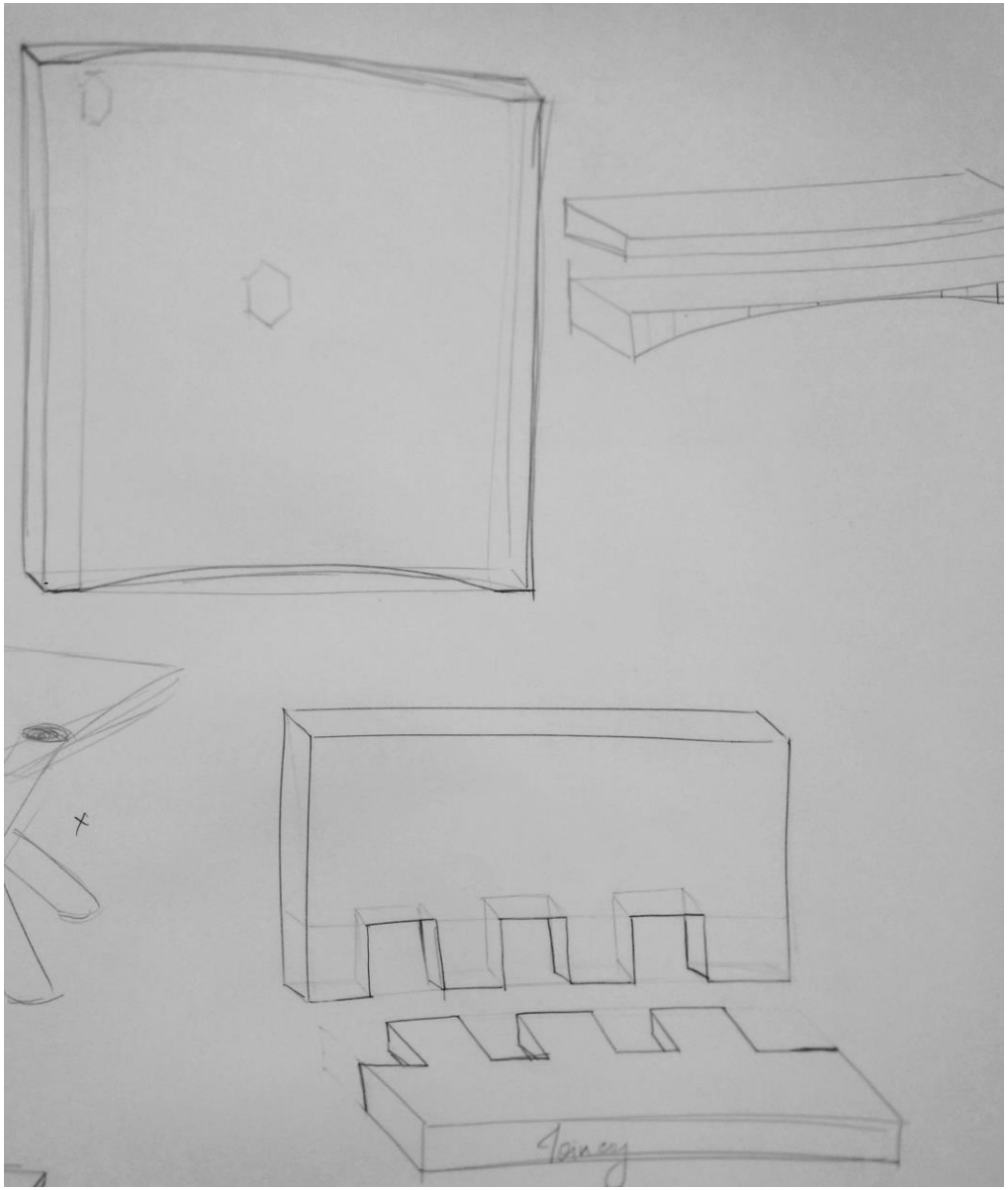


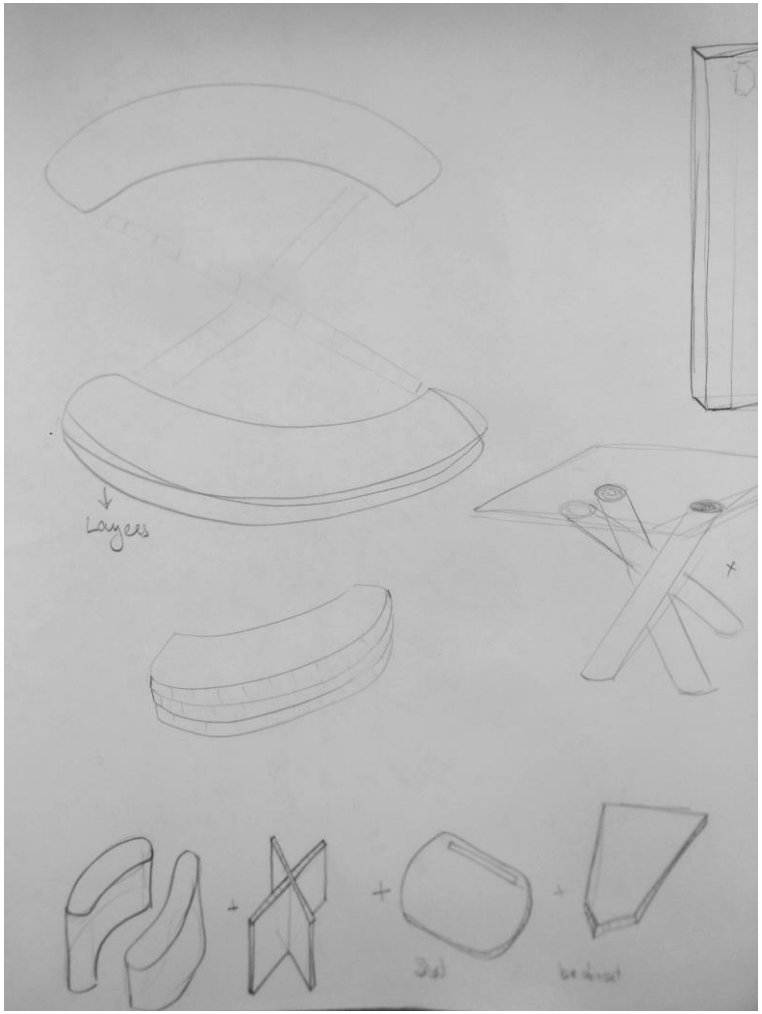


A bad sketch of the stool

A good picture of the stool

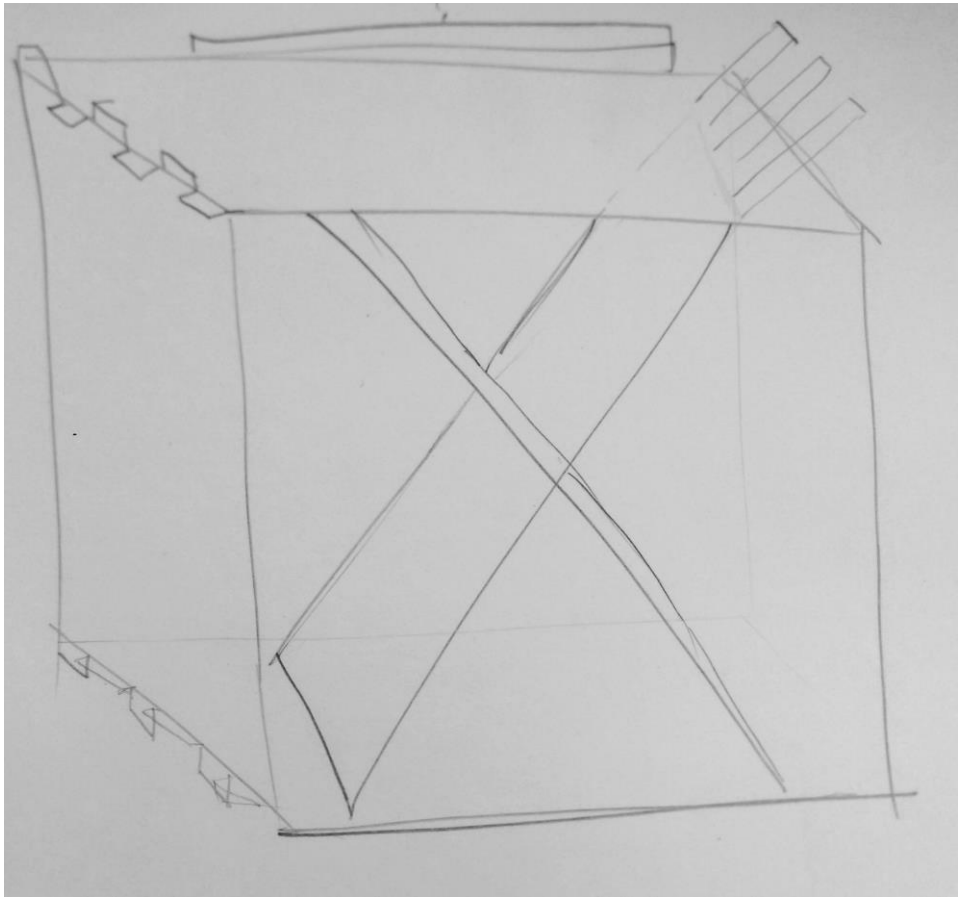
Brainstorming the new material, possibilities of making curves and joineries

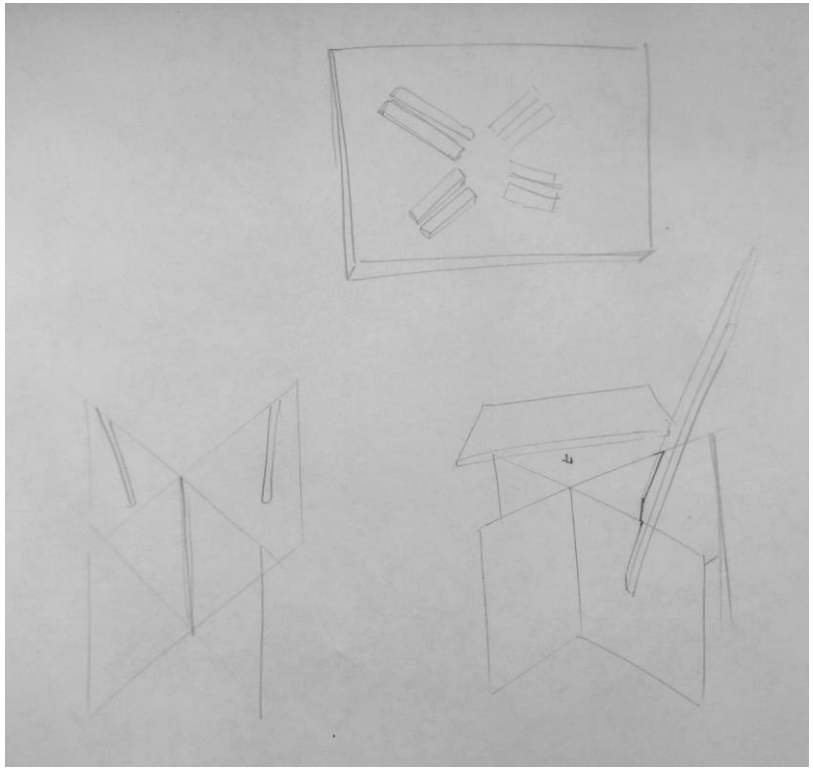




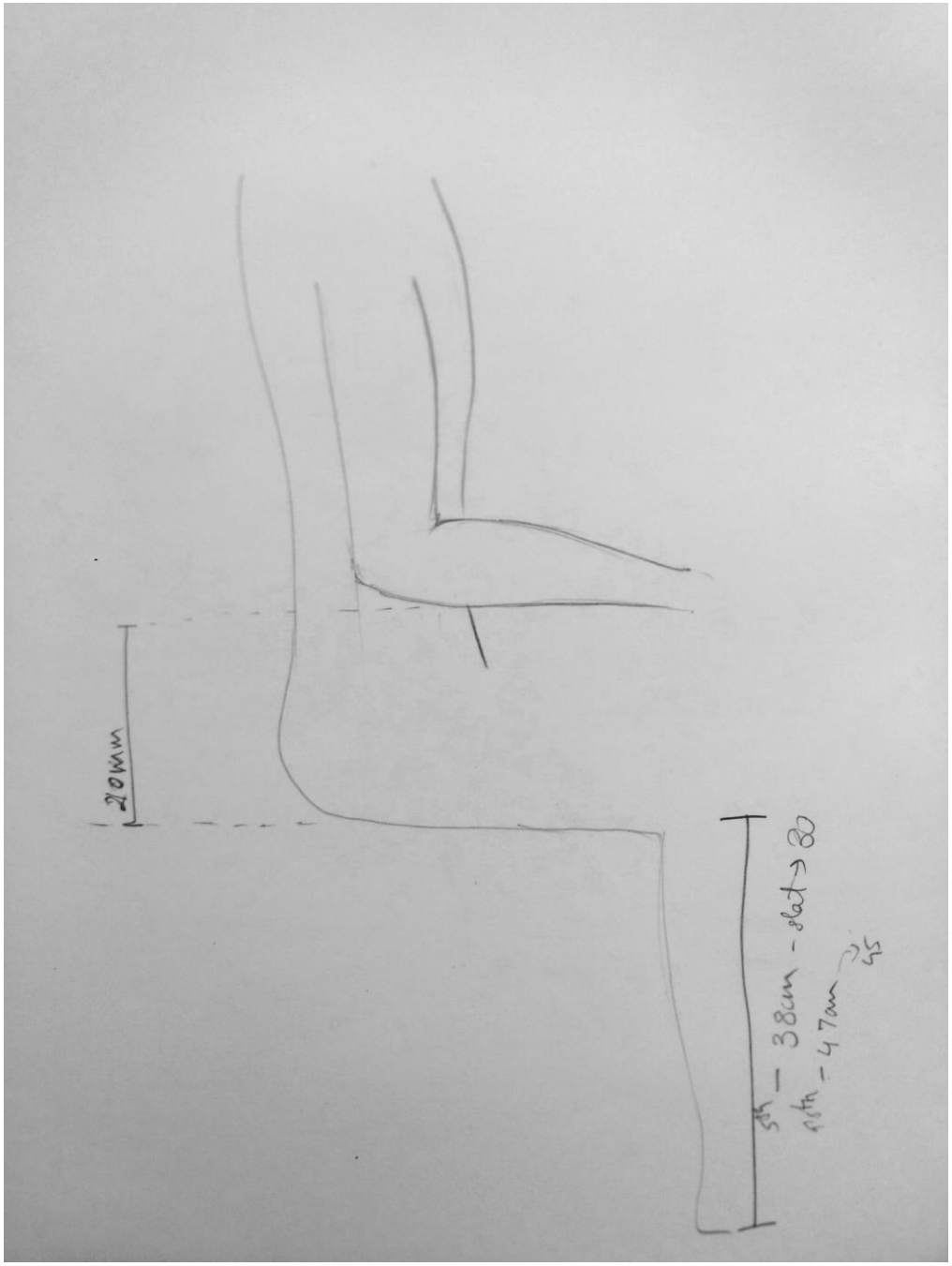
I spent a lot of my time debating ideas for stools instead of actually making them, because I was very scared of messing up and wasting the material, as it was limited.

A cross made with honeycomb sheets and a backrest slotted into it. I did not know the strength of the honeycomb sheet then.
I was not sure if it took compression in any direction besides on its surface.
On the right is a vertical cross slotted into a box, held together by tenon and mortise joints.



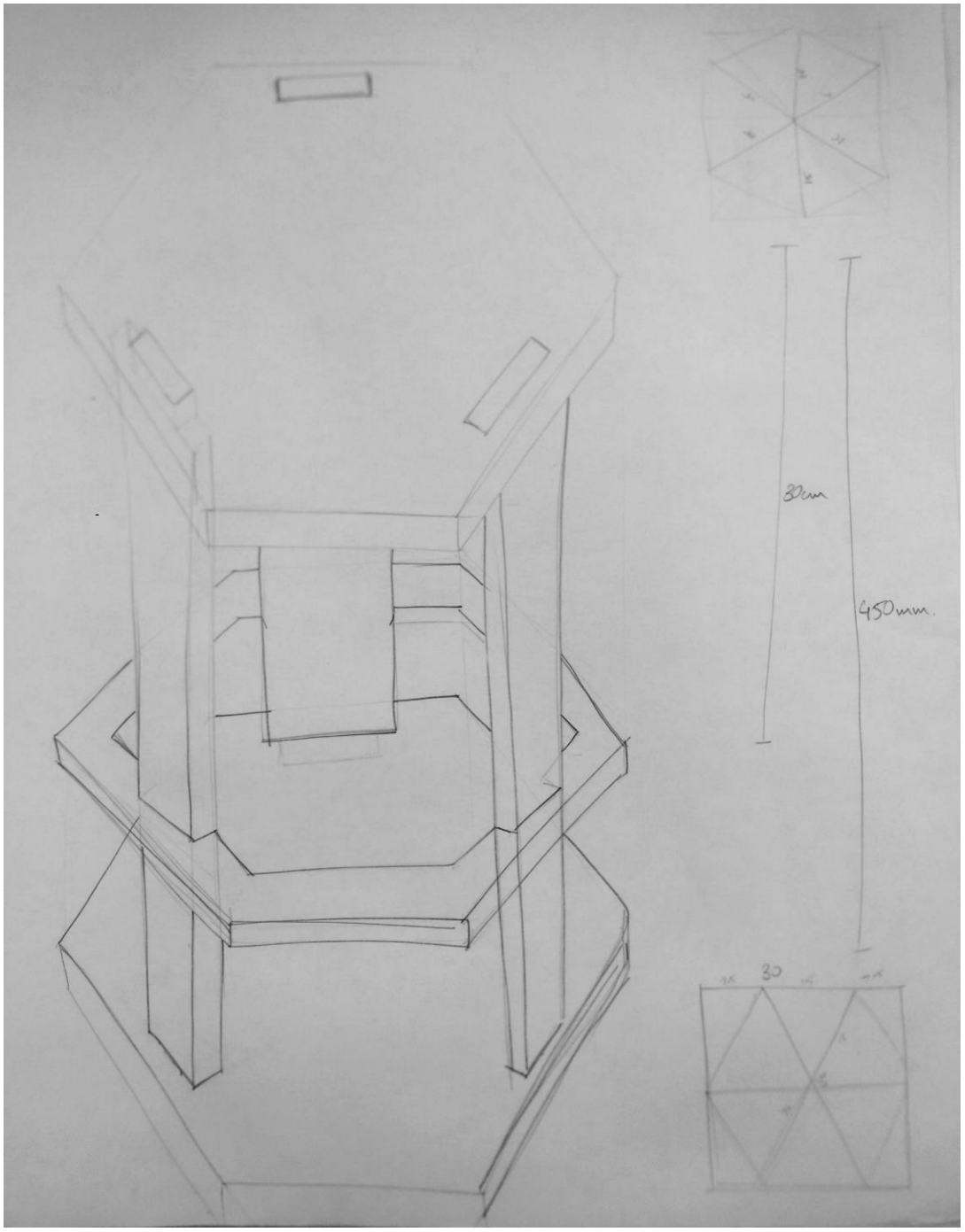


All these ideas I wanted to try but I was too scared of wasting the sheet to start. So I decided to start with yet another simple stool in hopes of first understanding the material.

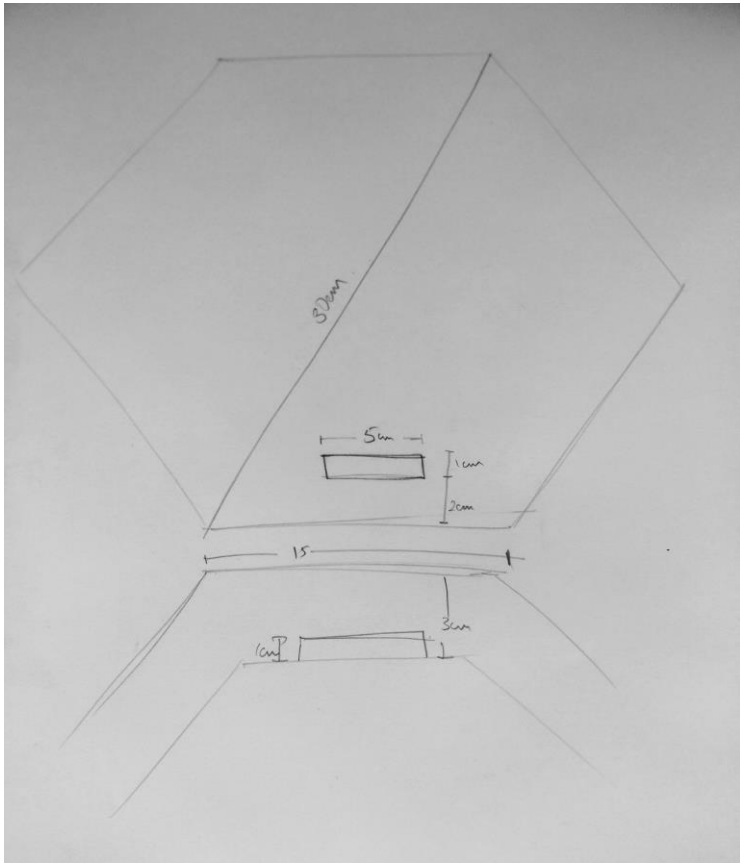


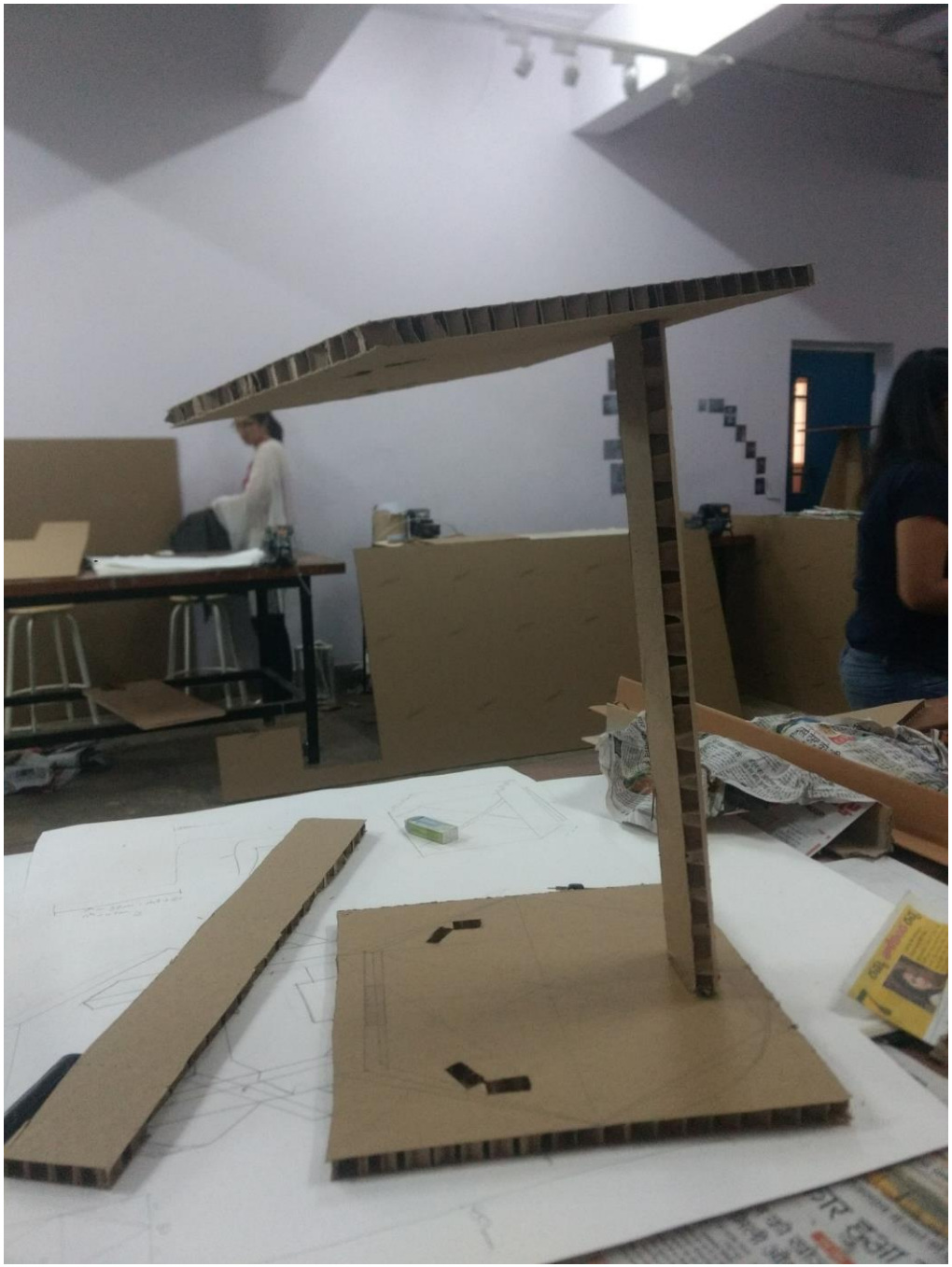
The process for this stool was quite unusual. My primary concern was to not do what everyone else was doing, and secondary was to use minimal material, almost to a failing point, so I wasn't wasting any material but I was understanding it as much as I could.

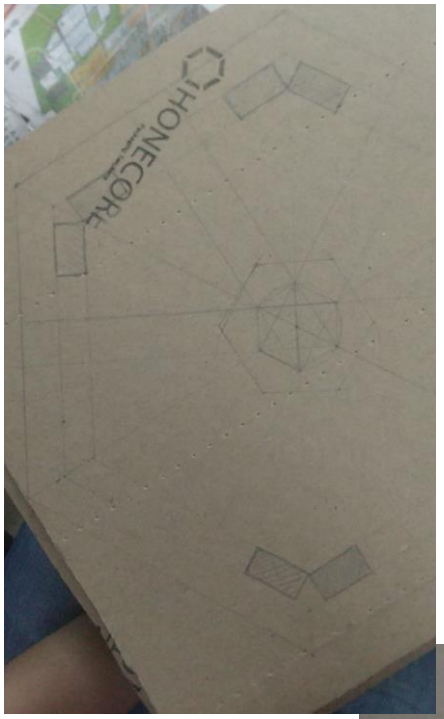
I started with the dimensions, decided I would test the strength of the board by making 6cm wide stool legs with it. I added a brace to prevent buckling, but like the stools in the bench studio, I kept it at 30cm from the seat (5th percentile for footrest) and the height of the stool 45 cm (95th percentile). I kept the seat to a minimum 30cm radius.



After a discussion with Sachi I realized that the stool was likely to sway unless it had diagonal braces. After a bit of brainstorming we decided I should fold the legs at an angle and try. Thus began the measurements and drawings.



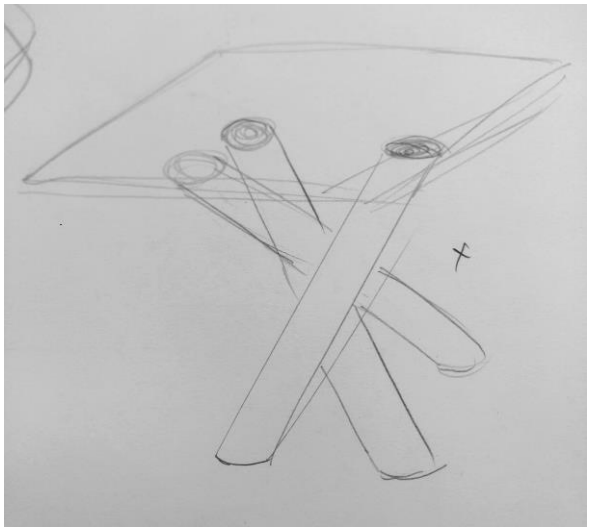


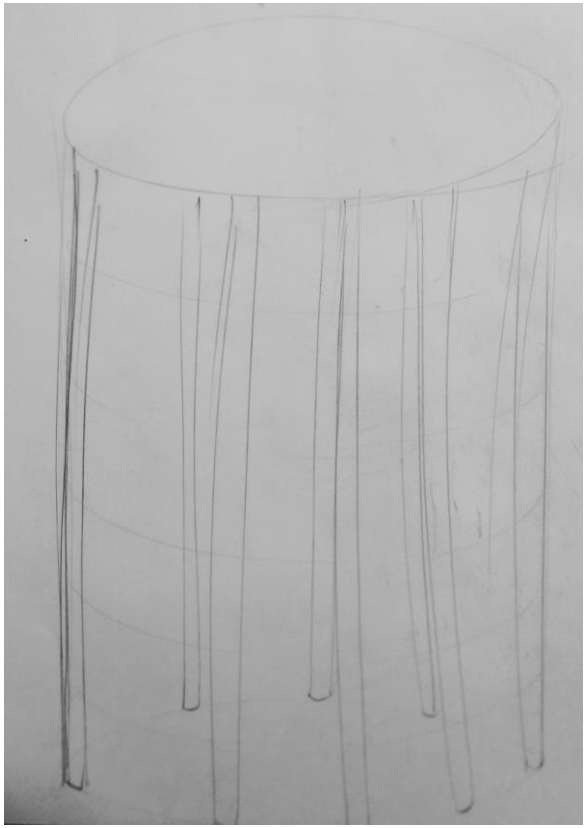


Work in progress
I spent a lot of time calculating and drawing and making mistakes and redrawing arcs and hexagons

I completed this the next day, after cutting my thumb with a paper cutter in a moment of carelessness

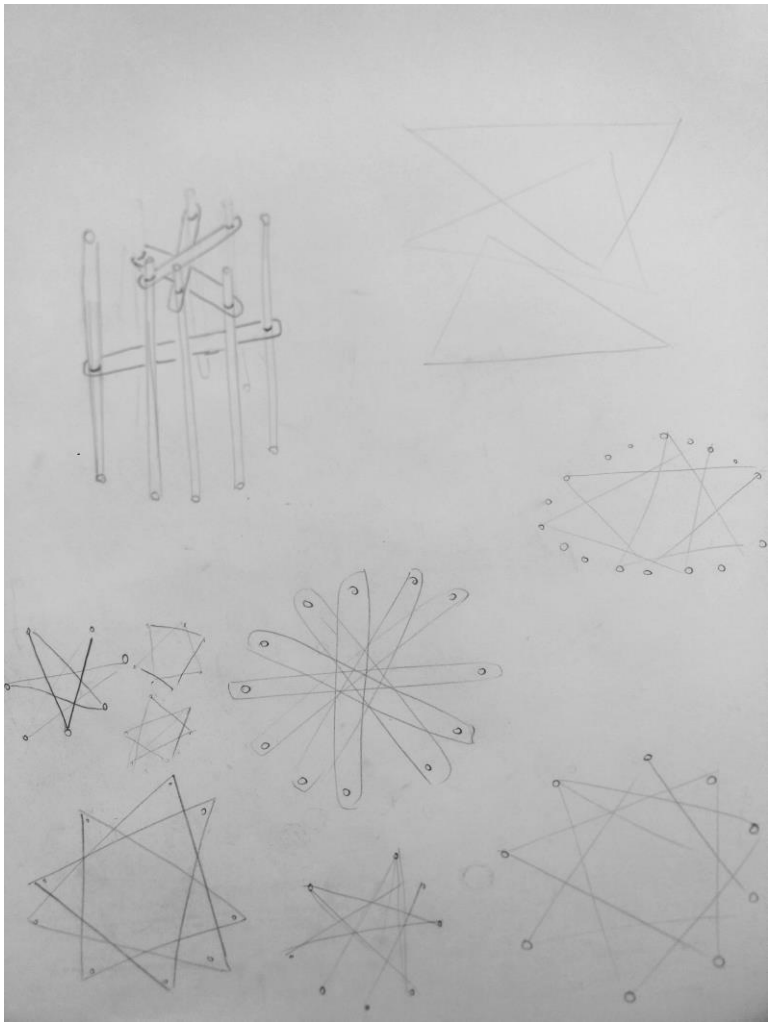
It was exciting to find out that the stool was stable, even without the brace,, but I went ahead and added it anyway.
I learned after sitting on it with full confidence and full weight that 2.5cm was not enough width of honeycomb sheet to hold weight. I also learned that these sheets are weakest at the perforated lines



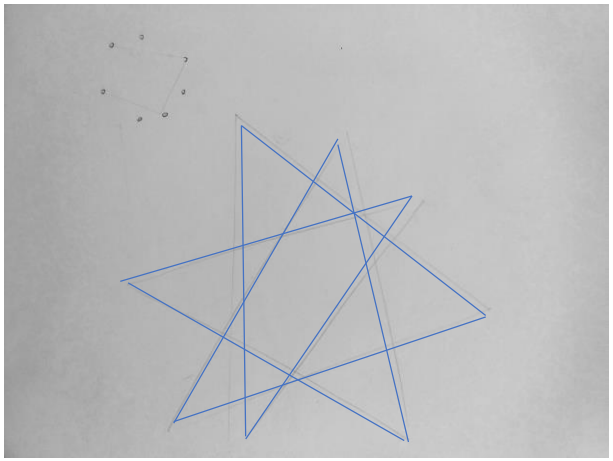


I finally came to the conclusion that I had to start combining material (honeycomb and newspaper and everything in between)

I wanted to have newspaper roll legs and a honeycomb seat. I tried twisting them and realized it might not be sturdy because I don't have structural support, so I decided to keep the legs at 90° and add multiple braces.

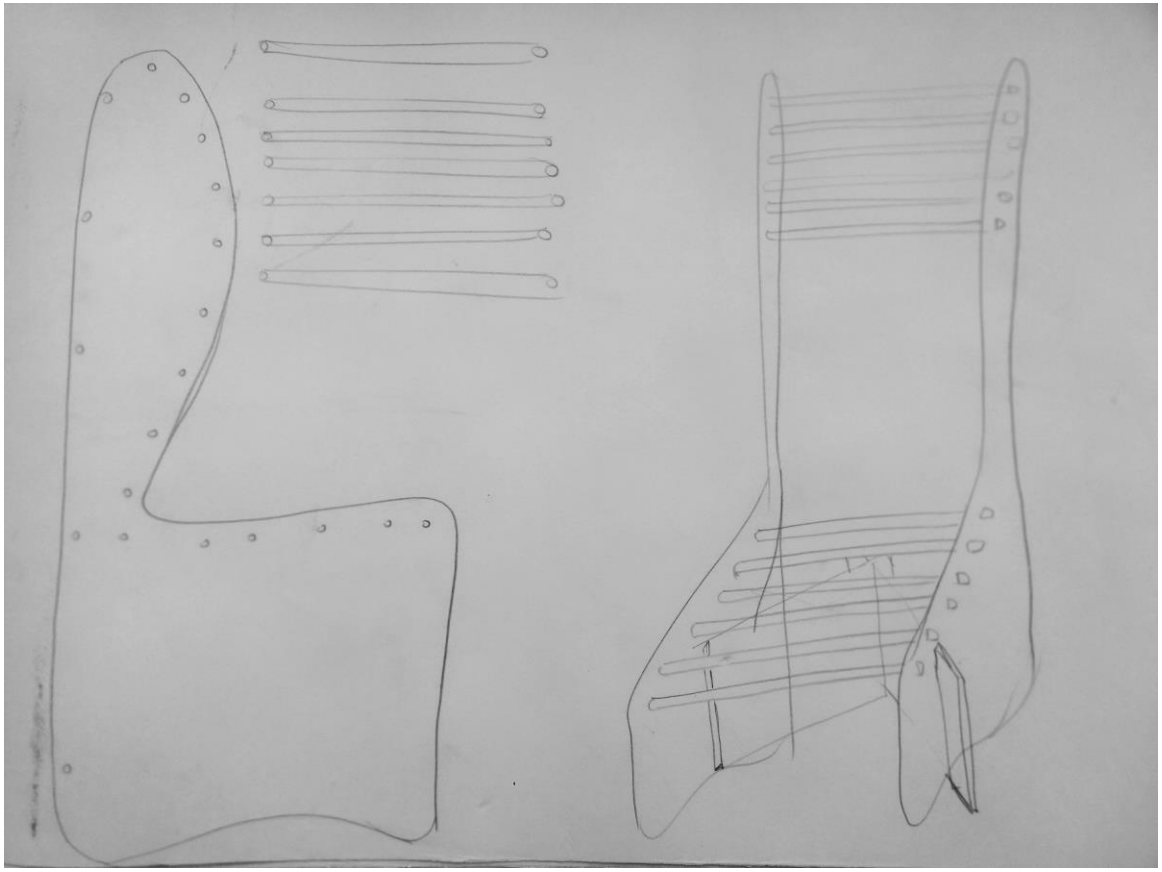


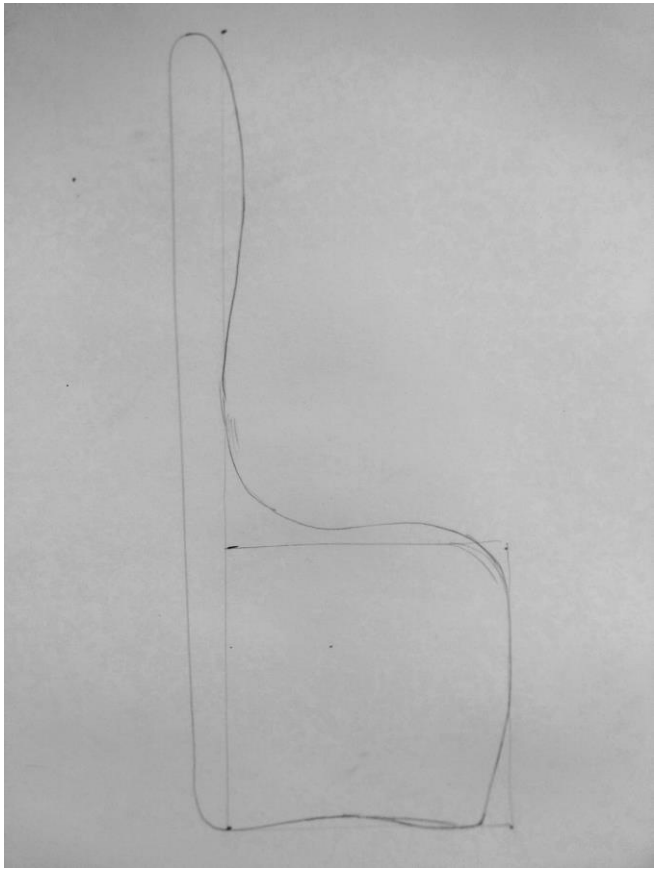
I spent time figuring out how the braces would be, I started with braces between opposite sides causing a pinwheel, then moved over to star designs



Final star shape for braces

I made the whole structure only to realize it was not table at all. It was very wobbly and it would require a lot of material and three layers of braces to make it work, so I decided there was no point going ahead with this idea.

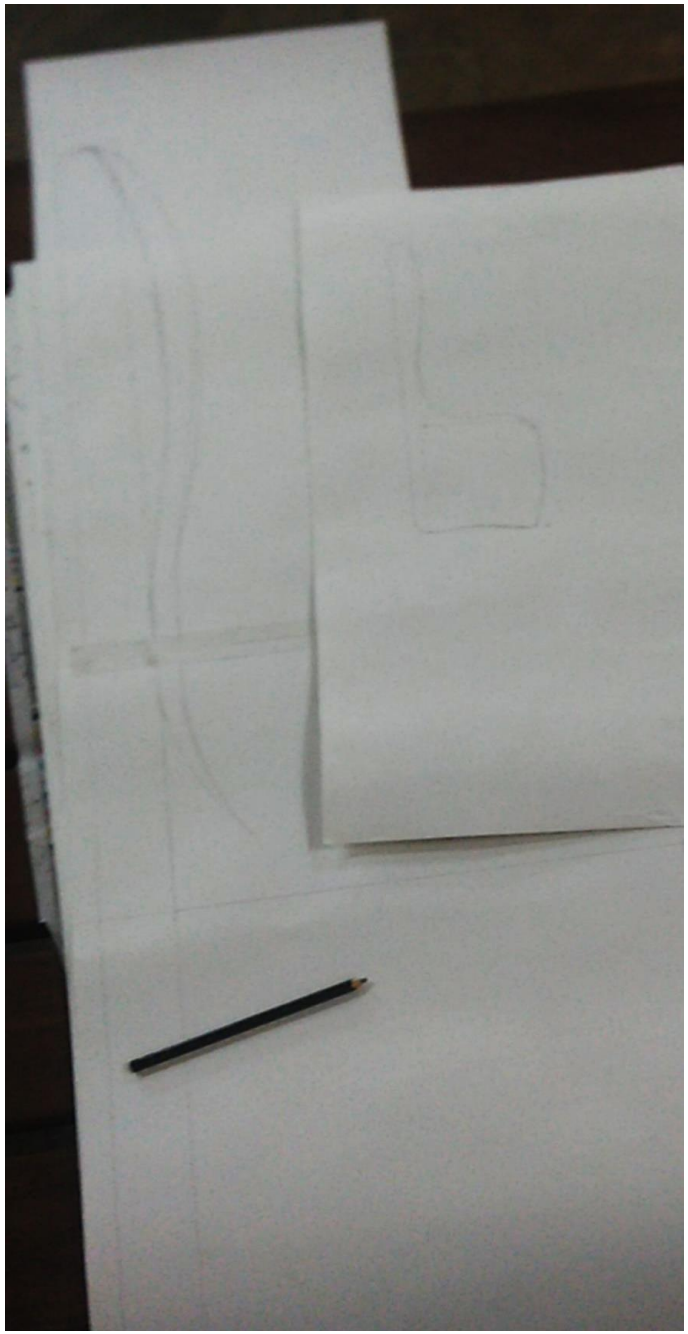




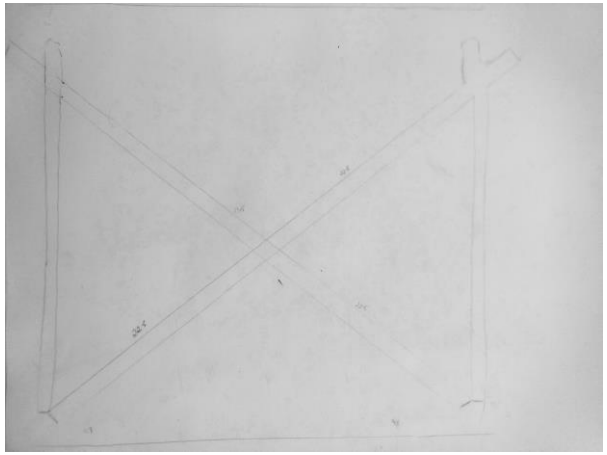
One thing I learned from the previous experiment was that newspaper rolls when passed through honeycomb sheet gives a very strong join. So I wanted to use this to my advantage. I came up with the above idea of using two honeycomb frames held together by newspaper rolls.

These newspaper rolls would form the seat and the backrest of my chair.
To give the chair support against wobbling, and to keep it from splicing, I added a cross made of honeycomb sheet, passing through the side frames of the chair.
decided and drew out the proportions (to the right), scaled it up to actual dimensions (next slide) and used it as a stencil

Using the stencil I made from making a skeleton of the right dimensions, then adding flesh to it, keeping in mind what height supports what part of the back, except I read the book wrong, and took heights from the seat instead of from the ground.



Making the cross in between took a lot of work, and I finally had to trace a template for its measurements, keeping the chair on a sheet and marking where it should be.



That wasn't enough, I also had to mark the height of the diagonal at each point, by crumpling and folding paper and making it fit diagonally under the newspaper rolls.
The cross couldn't be a safe distance below the rolls either,

it had to snugly fit right below the rolls to give them support and hold bodyweight.
The cross had further been slotted into the frames, both to five the frames support against splicing and to keep it from moving around, which was unlikely anyway since it was snugly fit.

Although the seat was fairly comfortable (without the cushion I was going to make) possibly because of the wide seat and the stable structure, the backrest needed fixing.

The dimensions I had used were right for the seating (45cm by 30cm, 95th percentile and 50th percentile respectively, the heights of the different points of the backrest were 30cm higher than planned (mistaken while reading from the book of Indian anthropometric dimensions). Also, the seat was at 90 degrees to the backrest which was rather uncomfortable. So, I cut off the backrest, and after making a couple of people try it and marking suitable backrest positions, I remade a lower and more angled backrest. Further I had to increase the width of some newspaper rolls and change some positions after trial and error, and it works comfortably now.

The stack-ability of the stools may not be particularly great, but hey, I've still got a lot to learn.

I recycled one of the failed stools and turned it into shelves on my cotton-webbed wall. It seems to be working just fine.