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B.Des | Design Project 2

# Exploratory Project on Constructive Toys

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# **Approval Sheet**

This project report entitled 'Exploratory Project on Constructive Toys' by Kathir Eshvar M E, 18U130015 is approved for partial fulfillment of the requirements for Bachelors of Design Degree

Guide

Chairperson

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External Examiner

# Declaration

I declare that this written submission represents my ideas in my own words, and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated, or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will because for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been appropriately cited or from whom proper permission has not been taken when needed.

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# Acknowledgments

I am very grateful to my guide Prof. Ravi Pooviah, whose guidance has been invaluable to me and whose constant support helped me tremendously throughout the project.

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I also want to thank my panel, Prof. Prasad Bokil and Prof. G. V. Sreekumar for their feedback during the stage presentations.

Kathir Eshvar M E  
June 2022

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# Abstract

This report documents the process I followed during the course of my project and the final output I arrived at. It was an exploratory project where I combined different materials and tried to make a set of pieces that can be joined to construct different forms.

It initially began with deciding the materials to explore with and then deciding the different methods of joining and what purpose for the toy to serve and progressed from there. The final output involves joining bamboo pieces using 3D printed joinery to create different forms and shapes

# Introduction

## Motivation

I was really interested in working with toy design and wanted to work on a project that aligned with my interest for my P2 and “Project 3: Design of a constructive toy through the use of interesting building blocks. This would be a creative exploratory project conceiving of new ways of using, constructing, joining, blocks together. It could also be an exercise using sustainable materials.” was a project offered by Prof. Ravi Pooviah which I believed I would love to work with and something that I was interested in. This served as main motivation for the project and also one of the guidelines that I kept coming back to for my explorations

## Approach

I began with deciding the directions I want to explore in and using that as a basic framework, I started ideating on these directions. After grouping the ideas and analysing them I further narrowed down into what I would want my final output to be and began prototyping it. After making the prototype I had users try it out and recorded their feedback for future improvements.

# Secondary Research

## Similar Toys and my takeaways

### Legos

The most common one was legos, in particular the "adults welcome" category which was the most similar to what I had in mind for the explorations.

They are sold as a set with an intended final output and putting it together is the activity and after which it can be used for decorative purposes.

They come with detailed instructions of how to assemble and what the intended outcome is supposed to look like.



[https://www.lego.com/en-in/categories/adults-welcome-products?icmp=HP-SHQL-Standard-NO\\_QL\\_Adults\\_Welcome\\_new\\_HP-OP-NO-QJN5TN3F3T](https://www.lego.com/en-in/categories/adults-welcome-products?icmp=HP-SHQL-Standard-NO_QL_Adults_Welcome_new_HP-OP-NO-QJN5TN3F3T)

# Secondary Research

## Gundam Fighters

Gundam Action Figures are another set of toys that cater to a very niche but enthusiastic fan base

Once again they are sold as a set with an intended final output and putting it together is an activity and after which it can be used for decorative purposes and are of very high value to collectors.

It has many intricate pieces and is considered very relaxing to put together



<https://p-bandai.com/us/search/?character=03-001>

# Secondary Research

## Literature Review

There is a variety of scientific literature that talks about how constructive play activities are positively related to children's spatial ability. This was one such piece of literature that was available freely to read.

This study examines the relation between children's early puzzle play and their spatial skill. It observed 53 children between the ages of 2 and 4 every 6 months and were given spatial transformation tasks to measure their ability.

Not considering the gender differences the main takeaway is that puzzle play had positive relation to the children's spatial ability and discusses about the role of puzzle play in development of spatial skills

### Early puzzle play: A predictor of preschoolers' spatial transformation skill.

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[Levine, Susan C.](#) [Ratliff, Kristin R.](#) [Huttenlocher, Janellen](#) [Cannon, Joanna](#)

#### Citation

Levine, S. C., Ratliff, K. R., Huttenlocher, J., & Cannon, J. (2012). Early puzzle play: A predictor of preschoolers' spatial transformation skill. *Developmental Psychology, 48*(2), 530–542. <https://doi.org/10.1037/a0025913>

# Secondary Research

## Literature Review

This paper from MIT Media Labs talks about how they created digital manipulatives by adding computation to four traditional children's toys-blocks, beads, balls, and badges.

Of particular interest is the Blocks section where they embedded programming into Lego blocks and a group of kids tried to recreate a dinosaur from the movie Jurassic Park - a program that made the dinosaur move towards light like they had seen in the movie.

This sheds some light onto how kids see the toys and the type of scenario building and roleplay that goes on when playing with them.

## Digital Manipulatives: New Toys to Think With

**Mitchel Resnick, Fred Martin, Robert Berg, Rick Borovoy, Vanessa Colella, Kwin Kramer, Brian Silverman**  
MIT Media Laboratory  
20 Ames Street  
Boston, MA 02139 USA  
+1 617 253 0330  
{mres, fredm, rberg, borovoy, vanessa, khkramer, bss}@media.mit.edu  
<http://el.www.media.mit.edu/groups/el/>

# Explorations

I began by coming up with basic working goals that I wanted to have for my explorations

- Be dynamic, have some motion or putting together with it
- Use multiple materials (Maybe sustainable materials?)
- Try coming up with unique joining methods for different pieces

With these 3 goals in mind decided what areas I wanted to explore in and set up a basic framework for the directions so that they can be categorised easily

## **Material - What materials the toy could be made of**

Plastic - It was easy to form due to the 3D Printing process and had quite a lot of flexibility in its shapes

Bamboo/Wood - Sustainable material and similar looking pieces are easy to make

Metal - Heavy material that can come out looking good but harder to work with. Still eco-friendly due to the durability

## **Joints - Different methods of joining the parts together**

Carpentry - I was fascinated by carpentry joints and wanted to try using the joints that didnt require glue or nails but still held the pieces together firmly

Screws - Simplest and most obvious solution to joining pieces that is used in toy sets such as mechanix etc

Friction - In my opinion the best way to join 2 pieces for my use case due to ease of use and lower number of parts require in addition to ease of disassembly

## **Purpose - what purpose did I want the toy to serve**

Decorative/ Static - Serves no other purpose other than being a non moving decorative piece

# Explorations

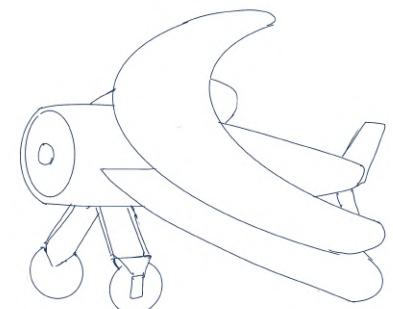
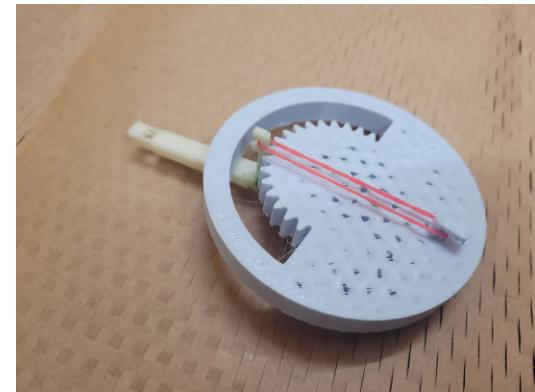
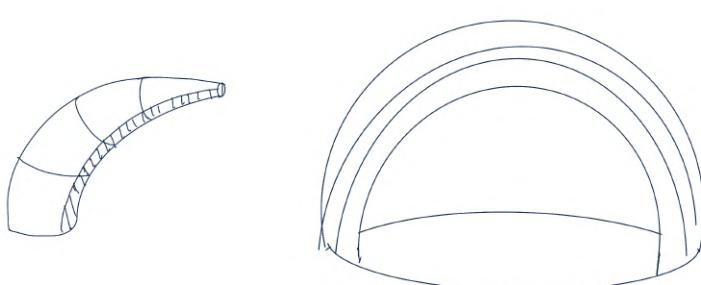
Moving Piece - Where the moving piece is the focus of the toy similar to a perpetual motion machine or an oscillating toy

Putting together - Where the point is to put it together and that activity is its purpose

With these decided on, I began ideating and making small physical prototypes to see which ideas could work. I grouped these ideas according to the different areas I had decided on previously and then narrowed down to one final idea

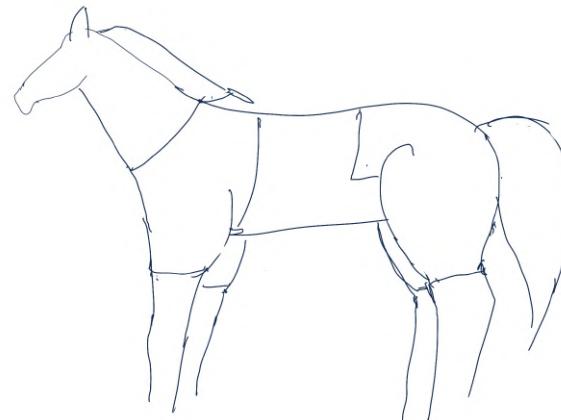
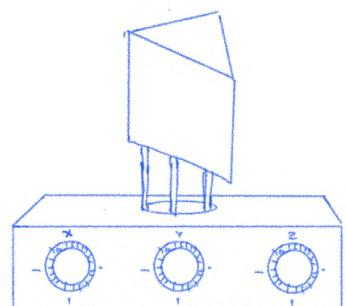
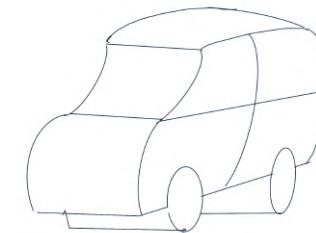
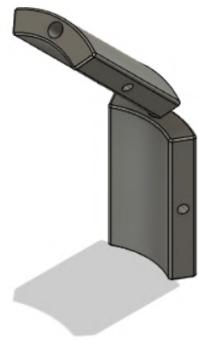
# Explorations

## Plastic



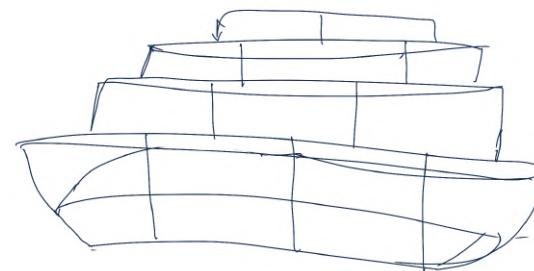
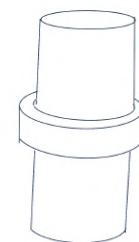
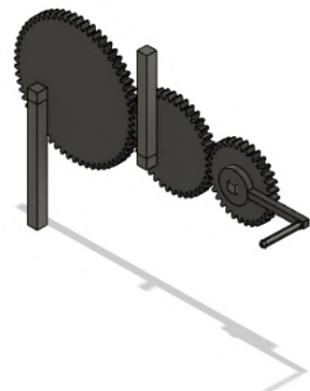
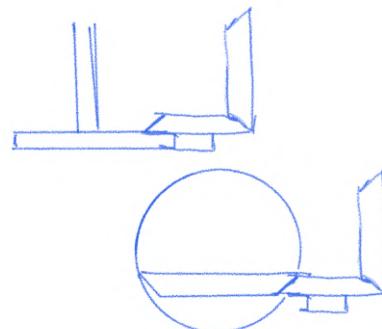
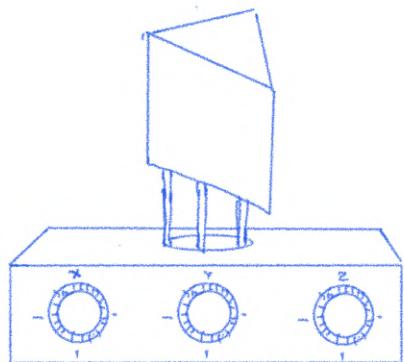
# Explorations

## Bamboo/Wood



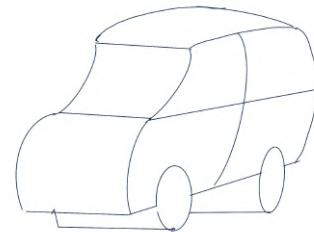
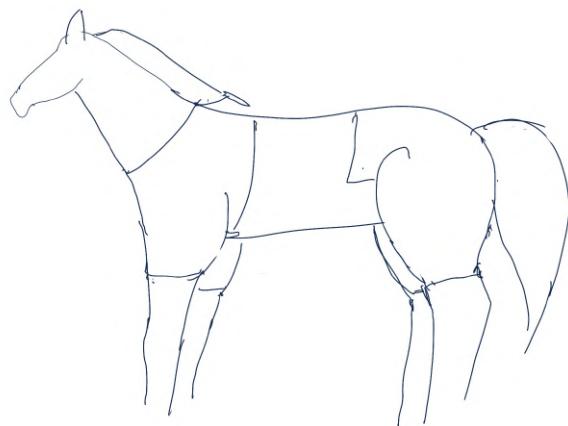
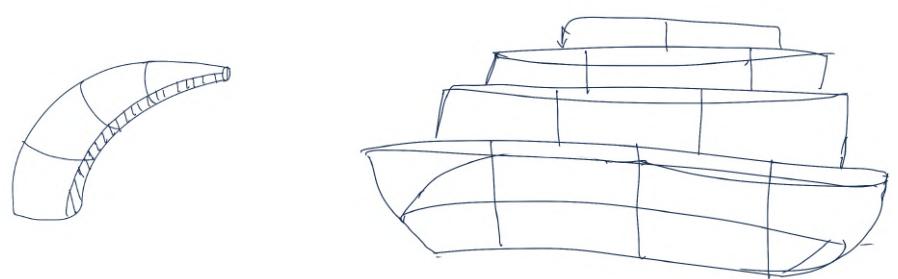
# Explorations

## Metal



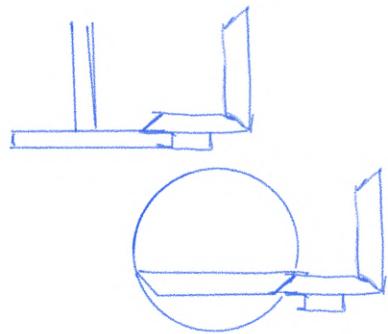
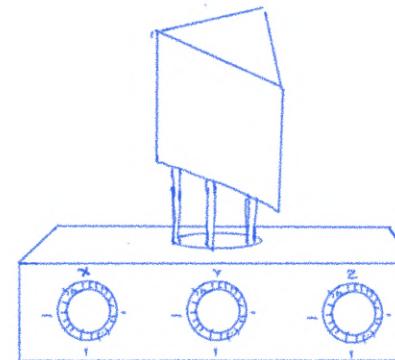
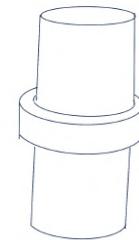
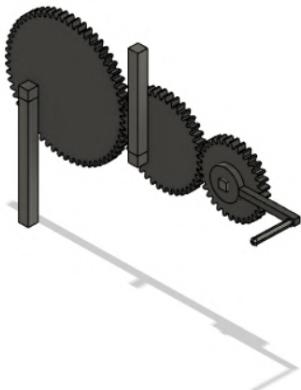
# Explorations

## Carpentry Joints



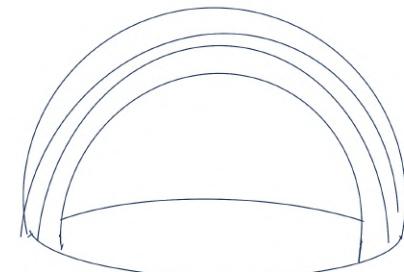
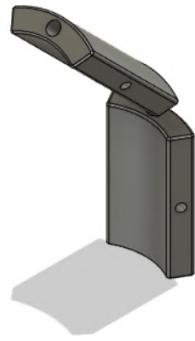
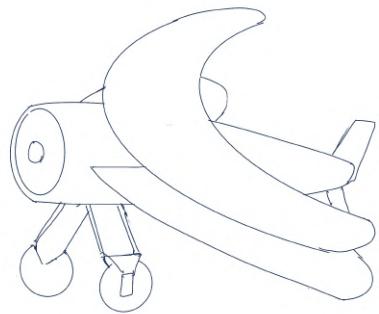
# Explorations

## Screws



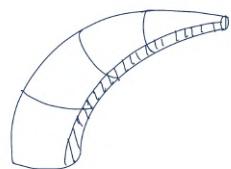
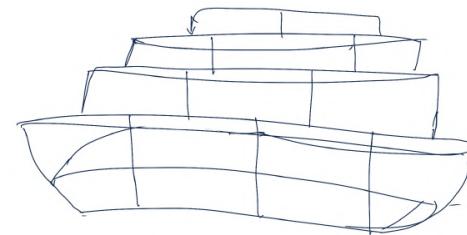
# Explorations

## Friction



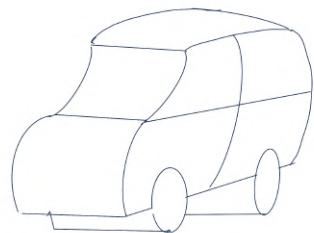
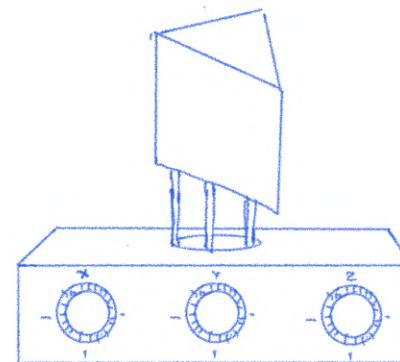
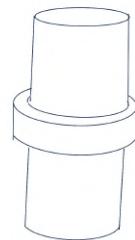
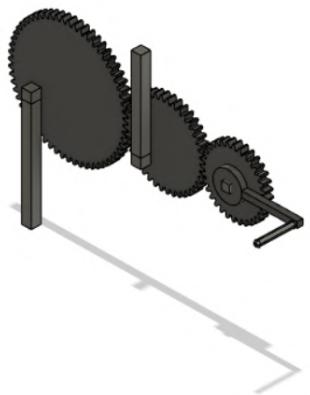
# Explorations

## Static



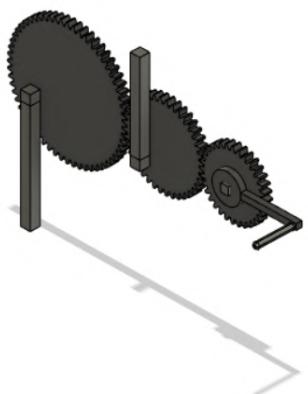
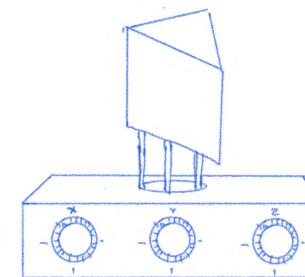
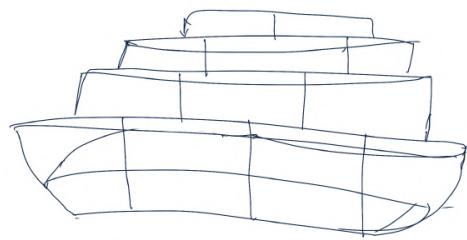
# Explorations

## Moving Piece



# Explorations

## Putting Together



# Final Prototype

After this I narrowed it down to one idea which seemed like it had a lot of potential and still fit the original brief I had started with when I chose this project - “Design of a constructive toy through the use of interesting building blocks. This would be a creative exploratory project conceiving of new ways of using, constructing, joining, blocks together. It could also be an exercise using sustainable materials.”

It was a mixture of resin prints and bamboo pieces with holes on it that was held together by friction and the purpose was to put it together to create different interesting forms as the user liked.

After some experimenting with the 3D prints I decided to make the holes on them larger by 1mm which surprisingly made it noticeably stronger and also changed the shape of the parts of the 3D prints which went into the holes to be cuboidalsince due to the nature of the 3D printing process the cuboids came out better as they were easier to print



# Final Prototype

And then as a final change I added stoppers so that 3D printed form was still visible when using them to join pieces of bamboo. I wanted it to be part of the form and not just tools that join pieces of bamboo.

With all of this done I set about making multiple 3D prints that connect them at different angles and many different bamboo pieces of different sized with holes drilled along the grain.

When finished I had around 30 pieces of bamboo and approximately the same number of 3D printed plastic parts



# Final Prototype

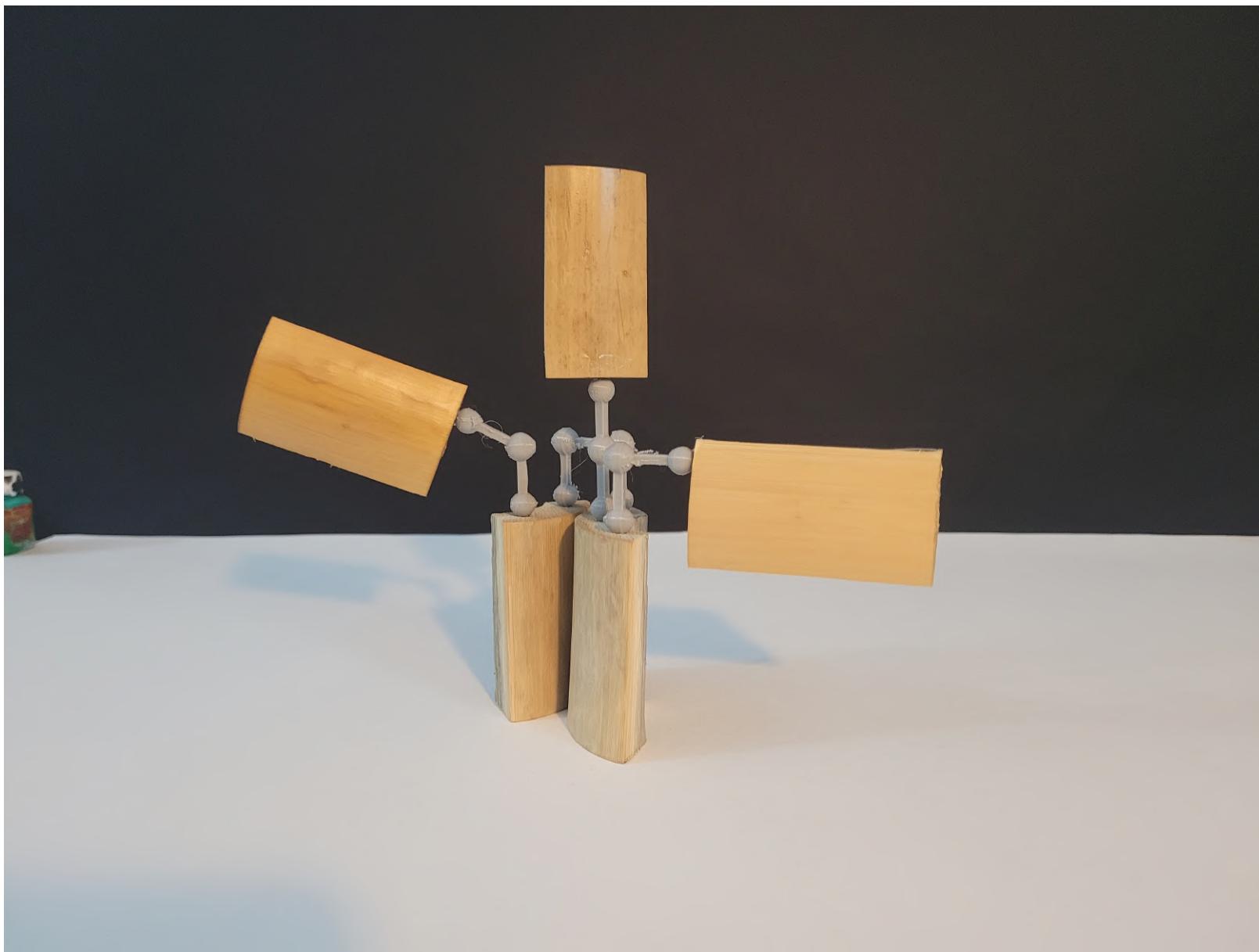


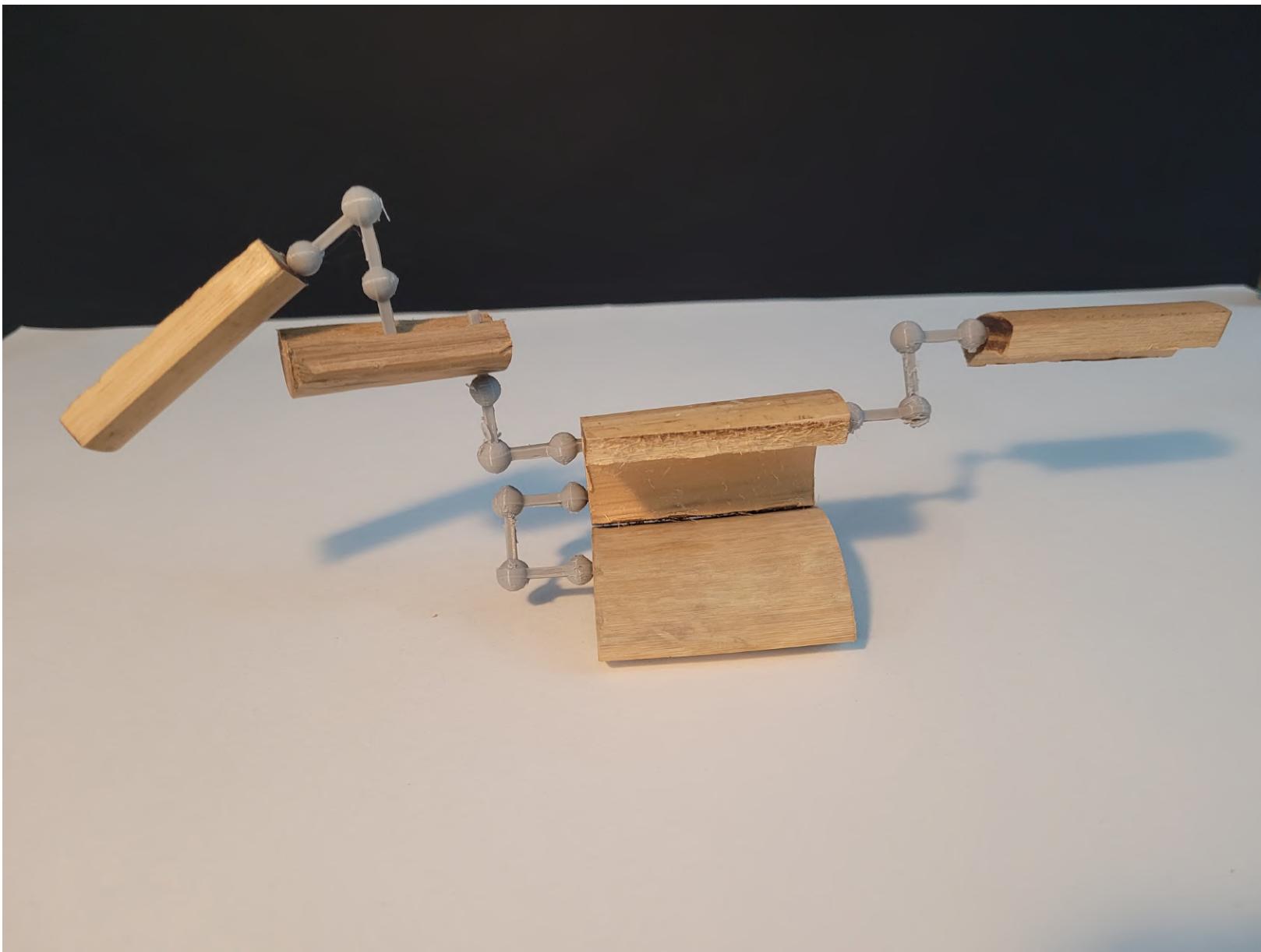
# Final Prototype Explorations

With this complete I set about making some explorations to show the different forms possible using the bamboo pieces and 3D printed joinery.



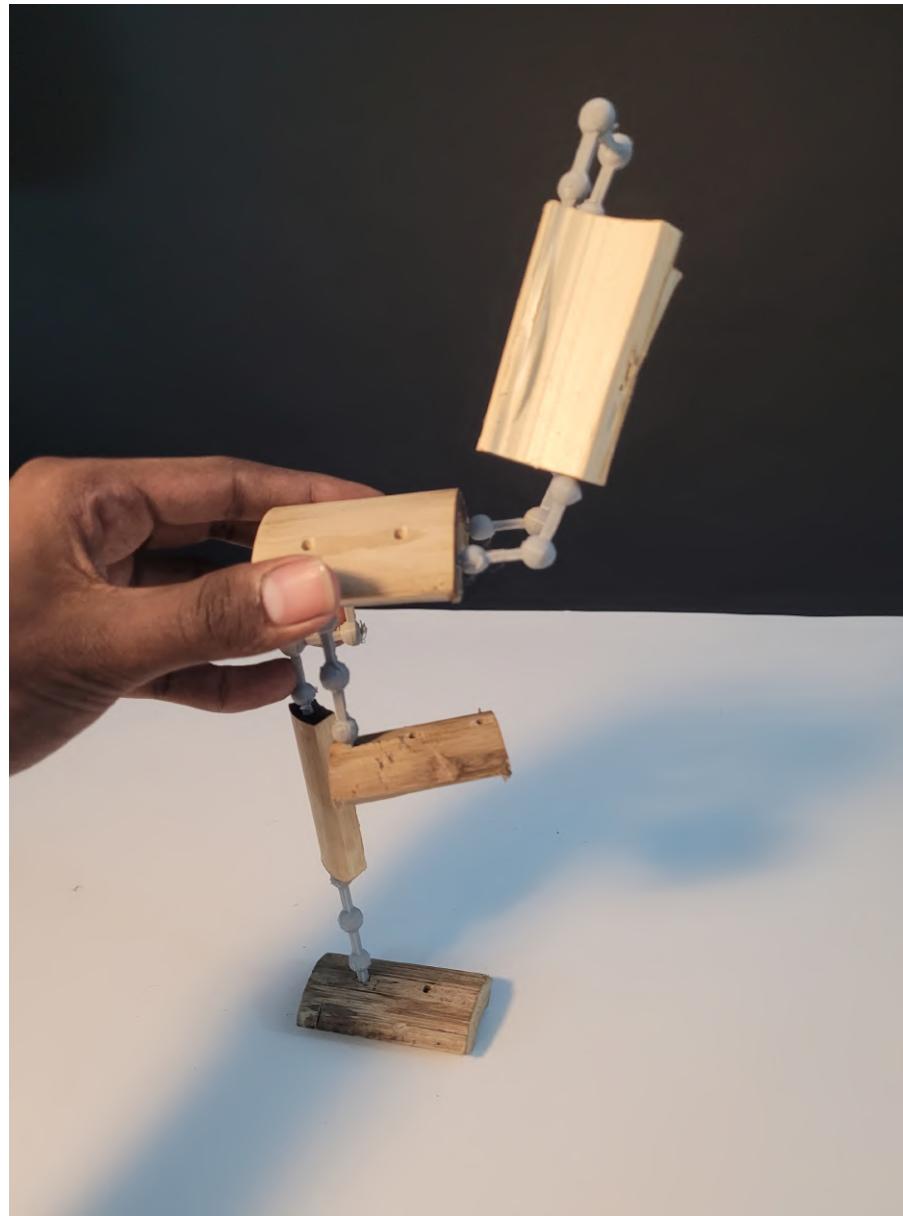












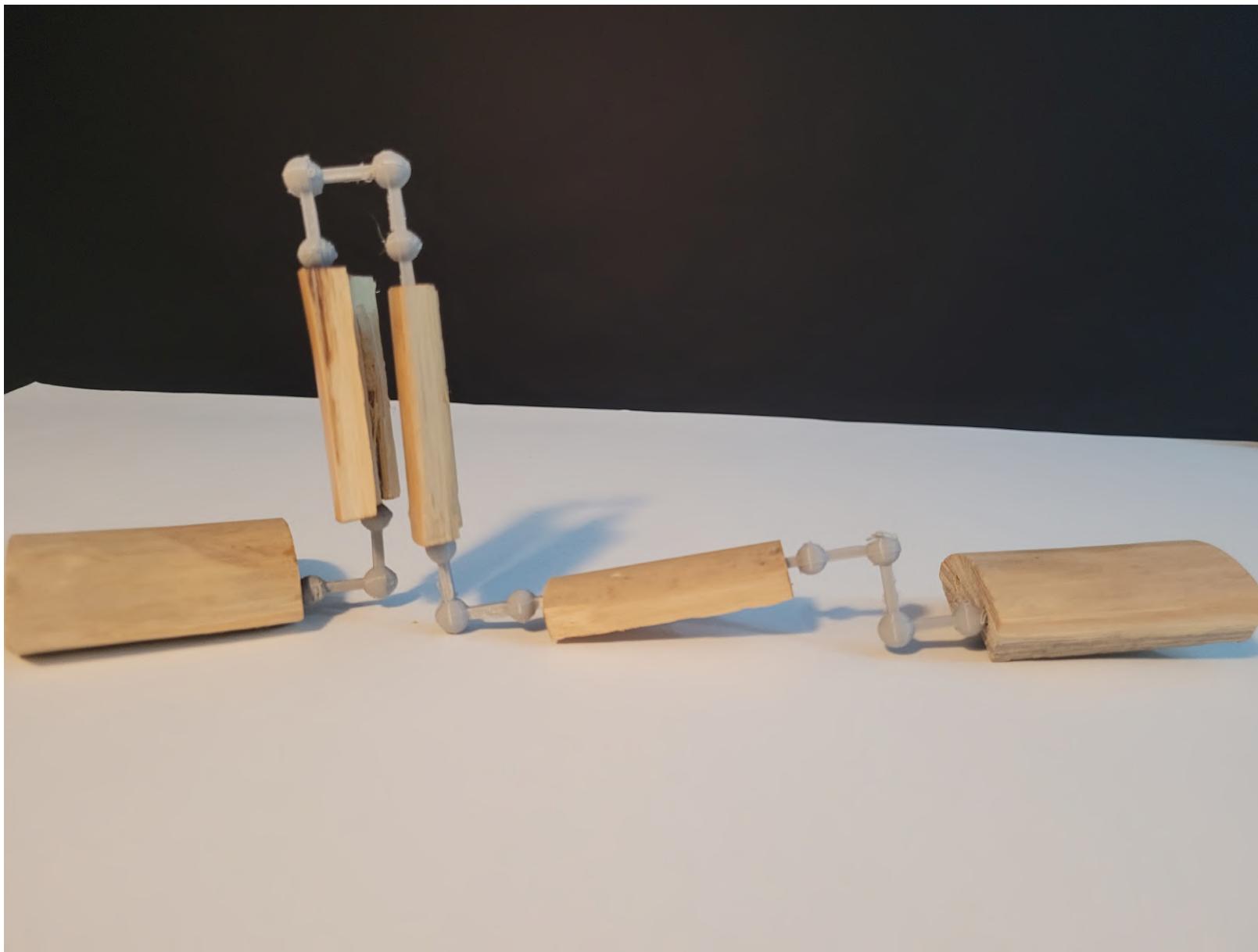






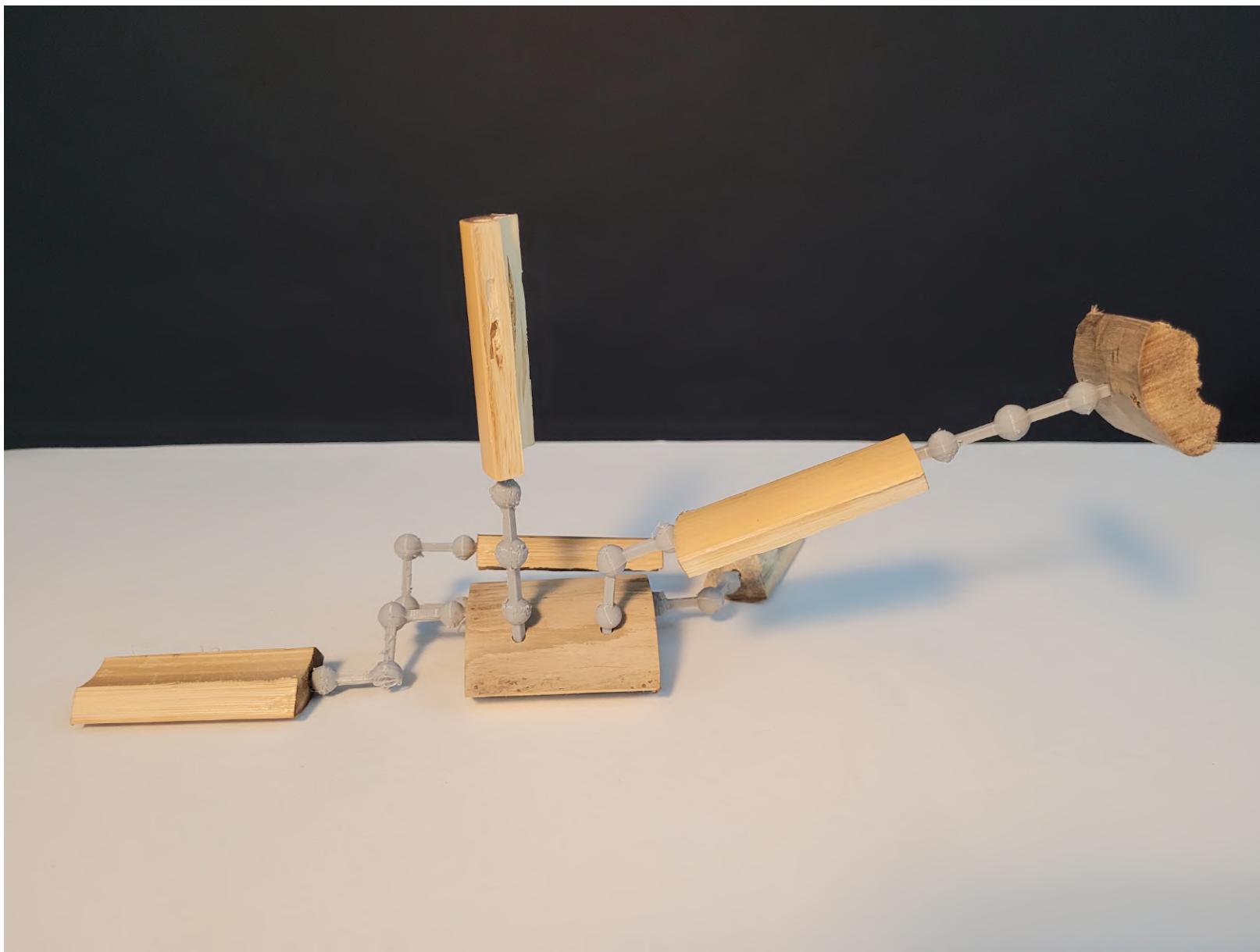






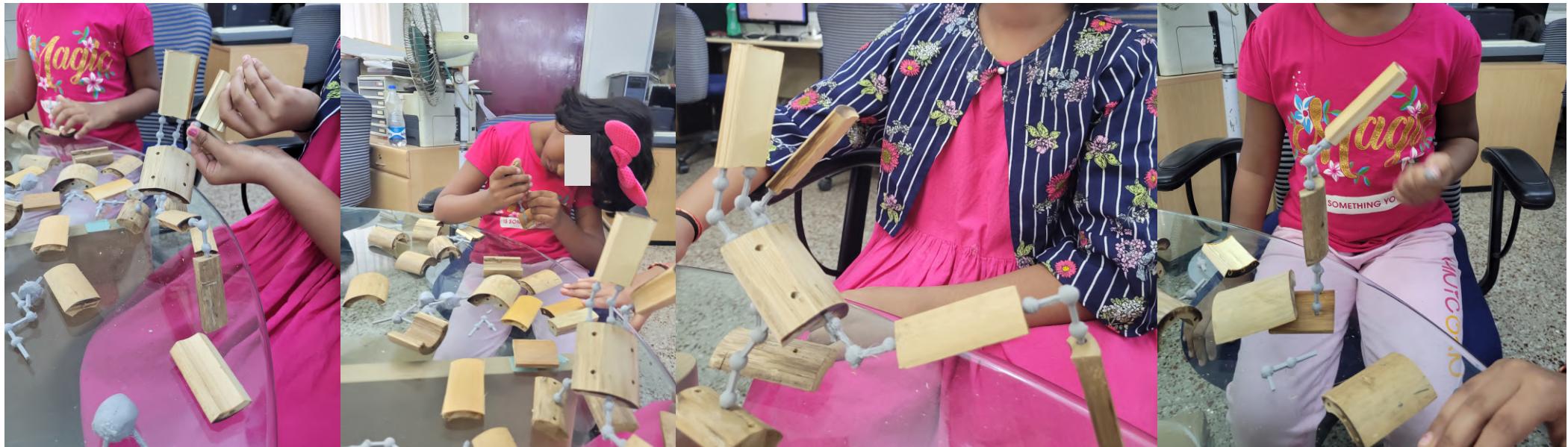






# User Feedback

I did 2 sets of user feedback sessions with 2 adults of college age and 2 kids of 8 and 10 years of age



# User Feedback

Of the 2 kids who tried playing with this, the 8 year old tried to recreate things she could see like a table or a chair. But still did not quite use this the way I imagined unprompted. She tried to use all the holes possible and filled them all with 3D printed parts and then tried to connect it to another piece using all the 3D printed parts.

The 10 year old did it better and was making animals, she began with making a peacock and was using the pieces to make scenarios in ways I did not think of. She found it more fun and used it more akin to the way I did in my explorations

Both of them did not use the physics that older people naturally understand like putting heavier pieces in the bottom for stability and the lighter ones on top so that it does not tip over and similar ideas.

But the 2 college aged users did not have any such difficulties and had similar feedback to each other. They constructed forms more similar to what I had made and

they said the feeling of attaching them together to make something was satisfying.

An interesting point they added was that this was something they would keep on their desks to play with and as a show piece with some touching up to the appearance especially the 3D prints' because not all of them came out perfectly. This was something I had not thought of and this made the toy also a decorative piece they would like to have on display in addition to putting together being the main activity.

# Reflection

While I began with this project because I was interested in toy design I ended up learning a lot about the materials and the processes to give shape to the materials - especially 3D printing.

Although it was a little difficult in the beginning especially with creative block I managed to come up with some possible outcomes and the physical prototyping and experimentation I did was especially fun. Each time I gave a piece for 3D print eagerly waiting for the print to finish to see how it would come out and what it would end up looking like, whether it would look the way I wanted - I enjoyed the whole process including the anticipation and the failures.

And the user feedback in the end was especially insightful and made me look at the output a different light. It gave me some ideas for future improvements and ways in which I could make this overall better and more finished

# References

The relation between children's constructive play activities, spatial ability, and mathematical word problem-solving performance: a mediation analysis in sixth-grade students - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4102248/#B22>

Early Puzzle Play: A predictor of preschoolers' spatial transformation skill - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3289766/>

Digital Manipulatives: New Toys to Think With - [https://www.researchgate.net/publication/2606980\\_Digital\\_Manipulatives\\_New\\_Toys\\_to\\_Think\\_With](https://www.researchgate.net/publication/2606980_Digital_Manipulatives_New_Toys_to_Think_With)

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