(general notes: for final portfolio skip to page 3)

Initial Thoughts

Expandable table?
Expandable nightstand?
Hidden drawer?
Needs to be light enough, portable
Modern
Power brick?

Nightstand -> Table?
Semicircle nightstand with doubled up 6ths -> full circle table?
Easy way quarters -> halves

Inspiration/Research

#10 and #7: https://www.youtube.com/watch?v=EtRmCwIuGjc
Suggested furniture measurements: https://imgur.com/pyQgSzD
Expanding iris table:
https://www.reddit.com/r/oddlysatisfying/comments/6ihjc9/this_table_that_extends_into_a_bigger_table/
Expanding iris table tutorial: https://imgur.com/a/AIENz
Expanding rectangular table:
https://www.reddit.com/r/EngineeringPorn/comments/6yhqcc/this_wonderfully_designed_retractable_table/
Dorm furniture/general space saving:
https://expandfurniture.com/back-to-school-space-saving-dorm-tricks/
Hidden drawers, mechanisms?:
https://www.youtube.com/watch?v=I3CJioDTa7M
https://i.pinimg.com/originals/e4/fd/d5/e4fdd5d8d4debcd7614ed5c79fccfdc4.jpg
Design inspiration/visuals:
https://www.yliving.com/copeland-furniture-exeter-extension-table.html
https://www.yliving.com/lago-air-table-extendible.html
http://www.ebizbydesign.com/data/img/gorgeous-design-for-oval-nightstand-ideas-60-diy-bedroom-nightstand-ideas-ultimate-home-ideas.jpg
http://sipfon.org/wp-content/uploads/2015/08/attractive-modern-wooden-nightstand-design-introducing-smart-drawer-system-with-hole-handle-teamed-with-black-industrial-table-lamp-ideas-christmas-tree-trimming-ideas-furniture-breathtaking-modern-ni-936x1248.jpg
http://kotonihouse.com/g/2017/04/Danish-Modern-Nightstands_Mid-Century-Modern-Nightstand_Nightstands-Modern_Modern-Metal-Nightstands_.jpg
https://www.wayfair.com/furniture/pdp/iconic-furniture-deco-extendable-dining-table-icnf1109.html
https://www.wayfair.com/furniture/pdp/beachcrest-home-tamiami-rectangular-leg-extendable-dining-table-bchh7091.html

https://www.wayfair.com/furniture/pdp/red-barrel-studio-aucoin-counter-height-extendable-dining-table-rdbs9286.html
https://www.ikea.com/us/en/catalog/categories/departments/dining/21829/
https://www.allmodern.com/furniture/sb1/extendable-dining-kitchen-tables-c366120-a136032~450049.html
https://www.wayfair.com/bed-bath/cat/dorm-furniture-c1862793.html
https://images.britcdn.com/wp-content/uploads/2014/08/06_final-645x429.jpg?w=1000&auto=format
https://www.wayfair.com/keyword.php?keyword=expandable+side+table
https://www.houzz.com/pull-out-nightstands-and-bedside-tables
https://www.allmodern.com/furniture/sb0/dining-kitchen-tables-c366120.html
https://www.yliving.com/category/extendable-dining-tables/_/N-173ms
https://i.redd.it/n1x2mqf0cgsz.jpg

Research Questions (ask college students? people who live/have lived in dorms)
?

Woodworking notes/links:
https://www.thespruce.com/standard-furniture-measurements-1391374
http://s3files.core77.com/blog/images/370296_81_43422_zDq2AVRaw.jpg
https://www.woodworkerssource.com/shop/product/cp-che-s.html
http://extension.missouri.edu/scripts/explore/G05506.asp
25/32 * 32 = 25
3/4 * 32 = 24
https://www.google.com/search?q=best+pillow+fabric&oq=best+pillow+fabric&aqs=chrome..69i57j0l5.3230j0j1&sourceid=chrome&ie=UTF-8

Nightstand / Chair Hybrid

HUNTER HANCOCK

June 2018
Industrial Design

Artist's Statement

This project was a long ride, but I am excited about the end result. In the beginning, I knew that I wanted to create some item of furniture that would be useful next year as I begin life in the space-limited conditions of a college dorm, but that was about all I started with. Over the next few months, I talked to people who had gone through the experience themselves, spent significant time researching, sketching, and experimenting with different approaches to the problem at hand, and learned many new woodworking skills in order to bring my final solution to life. Along the way, I was inspired by many people who had tackled similar problems in the past but came to a final design that I think is uniquely my own. I encountered many roadblocks–design challenges, time limitations, shipping delays, and more–but each time I grappled with a new problem I eventually came up with a creative way to solve it. As these solutions built up, the project became more and more personal. It is the result of long nights of planning and even longer ones of execution, a mosaic of creative solutions that come together to make a cohesive final product. From the beginning, I challenged myself to make a piece that is both multifunctional and elegant; despite some imperfections in implementation, I believe I succeeded in reaching these lofty goals.

Milestone One: **Research**

MECHANISMS

I began by exploring existing mechanisms for optimizing use of space. I quickly fell in love with the idea of an expanding or transforming solution– something that can serve one purpose in one state, then shift forms to solve another need. This got me thinking, what if something I use commonly could turn into something I need less frequently when necessary? I will be heading to college next year, where living space is limited. In the specific case of a college dorm, what if my nightstand could transform to serve as a table? With this inspiration I set off to explore this idea's plausibility and assess my options.

Capstan Table

(in action: https://gfycat.com/JaggedIdleGelding)

I first came upon the Capstan table– an almost magical marvel of engineering. The images above cannot fully do it justice. At first it is not at all apparent what is going on here, but after some digging I found a tutorial that goes through the process in more depth. From there I determined that, though I could at least attempt such a design, it would be unlikely that I would finish in the time I have due to its immense intricacy.
The full tutorial can be found here: https://imgur.com/a/AIENz

Rectangular Extending Table

(in action: https://i.imgur.com/jEO8osw.gifv)

Next I found a much simpler design where the table simply pulls out. This design, though straightforward, is limited to rectangular surfaces, and cannot pull out any further than

its own length. This makes it useful for a table that just needs to extend from time to time, but less useful for something that starts as a nightstand.
Source: https://www.reddit.com/r/EngineeringPorn/comments/6yhqcc/this_wonderfully_designed_retractable_table/

Folding Table

(#10 in https://www.youtube.com/watch?v=EtRmCwIuGjc)

This is the simplest design I came across, but I find it elegant rather than basic or oversimplified. This is as straightforward as it appears– a table with two hinged areas that allow it to fold up. The folded state could store nicely under a desk and even act as a footrest, which would be an interesting alternative to my original idea. That being said, this seems like it might not provide sufficient challenge for the time I have to complete it.

Rising Table

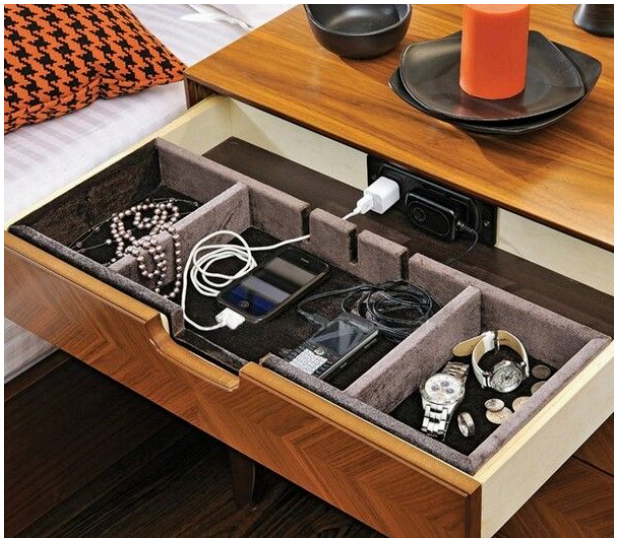
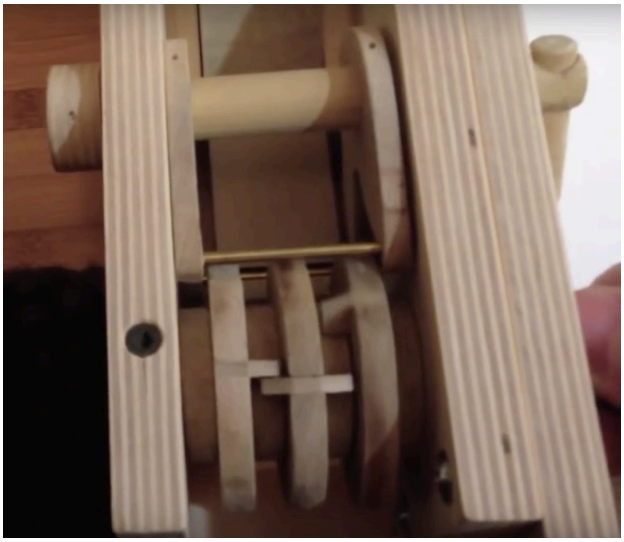
(#7 in https://www.youtube.com/watch?v=EtRmCwIuGjc)

This was my favorite design I came across, because it is closest to what I set out to create. In its compressed state it is a short but functional nightstand (which I can raise, perhaps adding a bottom drawer below) and once expanded it is a fully-functional table. Though I cannot find a specific schematic or explanation of its mechanism, it does not seem overly complex, and creating something similar would be a fun and welcome challenge.

Special Features

I also explored special features that I might want to incorporate into my design– things like drawers (perhaps even hidden or locking ones), chargers for electronics, and cable management for something like an alarm clock. All of these fall into the category of “nice to haves” rather than “need to haves,” so they will not take priority over the main folding/transforming function. I also considered adding a reading light, but because it would likely have to be removed to become a dining table it is probably easier to just leave room for a light on top.

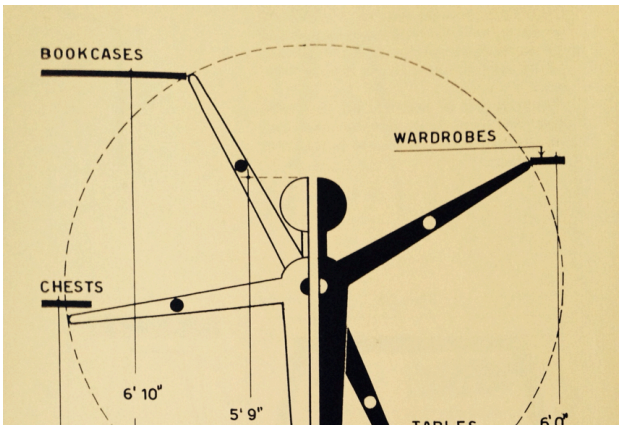


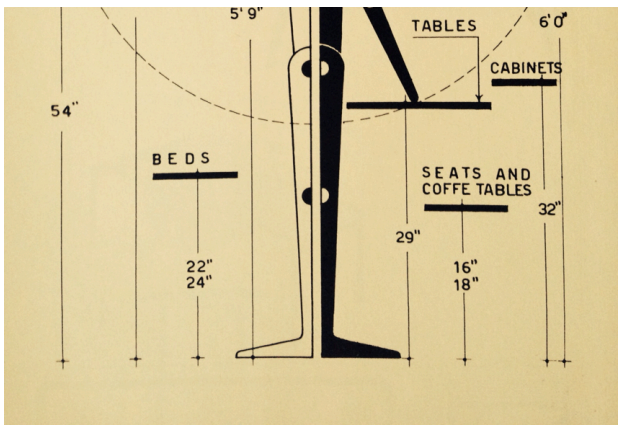



(drawer lock mechanism from https://www.youtube.com/watch?v=I3CJioDTa7M)

MEASUREMENTS

My next research step was to find standard measurements for nightstands and tables. This will be necessary for planning out the transformation mechanism. The first document I came upon is rather retro, but provides a good start to suggested dimensions.





(from https://imgur.com/pyQgSzD)

It is also worth consulting slightly more modern standards (and dimensions other than height). As I found out, many pieces of furniture today are made to fairly strict measurement standards.

> *Dining room tables and chairs are also usually made according to standard measurements.*
>
> *Dining table with one leaf:* ***36 inches wide by 72 inches long***
> *Round dining table for four people:* ***36-inch diameter to 44-inch diameter***
> *Nightstand:* ***18 inches wide by 18 inches deep***

(from https://www.thespruce.com/standard-furniture-measurements-1391374)
With these dimensions in mind I set out to consider the aesthetics of my nightstand.

AESTHETICS

I began by exploring designs for existing tables and nightstands and collecting my favorites. In general I leaned towards a minimalist style, although for the most part each design has some unique characteristic that makes it stand out. I will likely embrace a primarily wooden look, but potentially paired with other secondary materials.














With these ideas in mind I can begin to compare materials. I know I want to learn woodworking skills on this project, but it still have to choose between the many different types of wood available. Furthermore, depending on the design I choose I may use other materials as well as wood. These decisions will not be made until after sketching and prototyping, but this background allows me to do some preliminary materials research.

MATERIALS

There are many resources online for comparing types of wood, but the one I found most useful was targeted specifically towards popular options for DIY furniture. Three main options stood out to me here: pine, maple, and cherry.

> ***Pine***
> *As a softwood, pine is not appropriate for all DIY wood furniture projects. Pine is a lightweight material which makes it easy to work with and move once a piece is completed, but is more susceptible to dings and scratches than*

> *hardwood options. More often than not, pine furniture lumber requires a coat of primer prior to painting or staining because it has a pale hue in its natural state. Pine is one of the least expensive choices for DIY furniture.*

Pine seems promising because it is lightweight, so moving a mechanism made out of it would be easier than other options. I am concerned about its lack of durability though and its need for more coating/treatment. The price is a plus too.

> ***Maple***
> *As a common hardwood used for DIY wood furniture, maple is known for its strength and durability. The most common real wood furniture created from maple includes bedroom furniture or large hutches and china cabinets because of its known sturdiness. Maple wood is resistant to moisture and often has unique swirls in the wood grain that make it stand out from other hardwood choices. It is most commonly found in a light color, but takes stains and paint well.*

Maple has the opposite situation– it would be strong and durable but heavier and more difficult to move. It would also be able to be stained or painted in many ways, and its common use in bedroom furniture is promising.

> ***Cherry***
> *Cherry wood is another popular selection for types of wood for furniture, although it is best used for indoor pieces. As a true hardwood, cherry wood is known to be resistant to decay and rot and is able to stand up to dings, dents and scratches throughout the years. Because of its density and strength, it can be difficult to work with when creating real wood furniture. Cherry wood, as its name suggests, comes in deep red hues with noticeable grain.*

Cherry, like maple, is denser. The benefit here is that I have worked with cherry before, so I would be able to apply some of my previous knowledge in order to minimize the learning curve. This piece would only ever be used inside, so that too is not a drawback.

(quotes from http://renolumber.com/2015/06/the-best-woods-for-diy-furniture/)

Finally I am ready to begin my last phase of research: user research.

USER RESEARCH

For user research I set out to consult people closer to the problem than myself. Though I will be entering college next year, so far I have only ever lived in a dorm for about a month. For this stage I came up with questions to ask current college students and people who have already graduated, as both groups have a lot more dorm experience than I do.

> ***Q: What is/was your dorm room like (particularly freshman year)?***
>
> *A: It had two beds and a little desk area with windows that looked out on*

campus. We actually had a sink in a little alcove so we could brush our teeth in our room. I got pretty used to the size, particularly because I grew up in a pretty small room. In general I didn't spend tons of time in there. I studied in lounges, in the library. I mostly just slept in my room. It's really like a bedroom.

A: Freshman year was rough because it was a triple (but still within a suite). There was ample room in the sense that you had a built-in cabinet, but absolutely it's not great having bunk beds in a triple, especially when it was more than three. But the multiples were freshman only. The suite was always helpful because the kitchen and hangout space provided a lot of flexibility.

“ ***Q: Do/did you feel like you had enough space? What objects and furniture do/did you prioritize?***

A: We had a mini fridge, a sink, a hot pot, and a toaster. If we had more space a couch would have been great. We couldn't really hang out unless we sat on our beds, so we mostly went elsewhere.

A: There was no furniture other than the built-ins because there was no room for it. But the built-ins had drawer space, closet space, and desk space (and sleeping space and windows). But there was literally no extra furniture; it was like living on a ship. I don't remember anyone having a piece of furniture except in the public spaces. Sometimes a recliner or something in the public area.

“ ***Q: How do/did you make the most of limited space?***

A: We had a meal plan but we also had small things to snack on (hence the fridge, hot pot, and toaster). We mostly focused on making our beds comfortable and great for sleeping because that's mostly what we did there.

A: It was well chosen already, so it really did have the fundamental categories covered that you needed. It was fully over-threshold for covering your needs so you could worry about other stuff. Basically, housing, sleep, food, and entertainment were covered.

“ ***Q: What do/did you wish you had space for? Perhaps something you added as an upperclassmen after a change in living arrangements?***

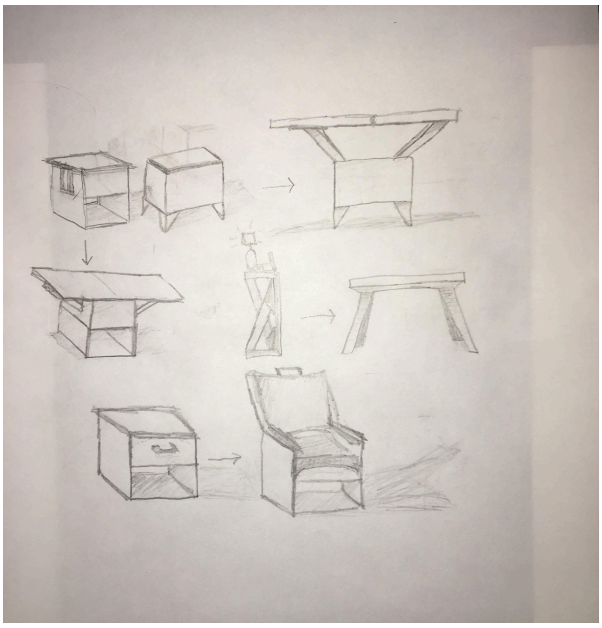
A: I would have loved a living room. We always wanted a couch or some chairs, or even a TV or stereo. Some of that would be less necessary today– the only

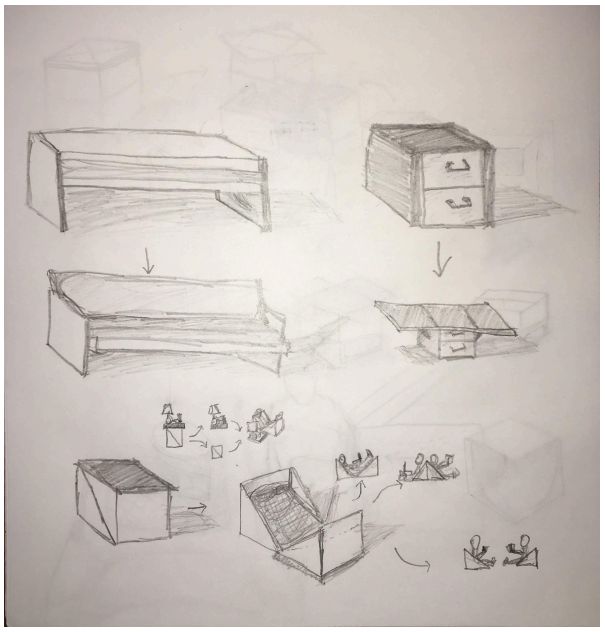
thing you don't have on a phone or laptop is a chair or table, some comfy spot besides the bed. We made do with the couches and piano in the lobby of our dorm. Also realize I lived in an all-girls dorm, so guys couldn't come upstairs which definitely limited the time we spent hanging out there.

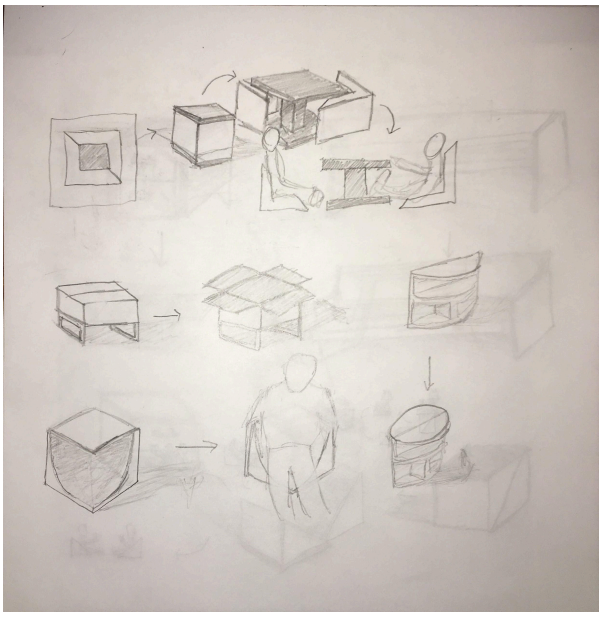
A: Having a single was a huge threshold change because then you were socially in control of your life (not having to coordinate with others). By senior year I had a really spacious room, but I didn't live in it any differently. It had room for a guest to come, but that was about the only change.

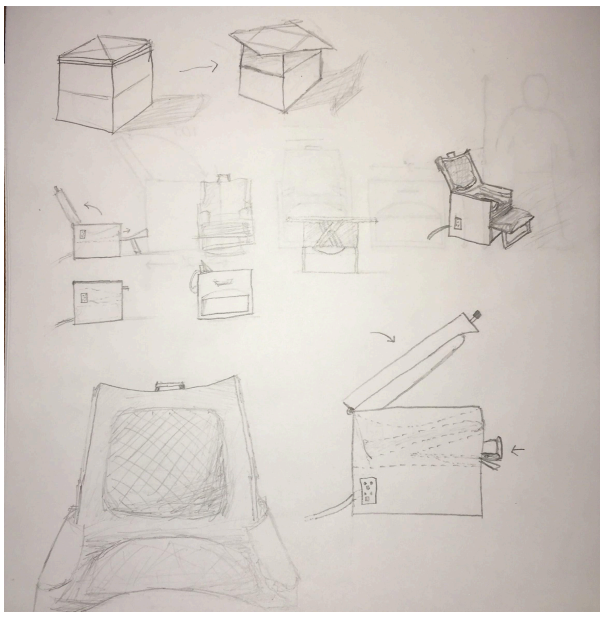
User research left me with a number of takeaways. First off, most people still primarily use their dorm rooms for sleeping, although having social and kitchen space is great when possible. As such, I should be putting the most emphasis on the nightstand functionality of this project, as it will be in this state much of the time. I also learned that there may be more merit to having special features around electrical outlets and cable management than I originally thought, because having something for simple meal preparation like a toaster in my room would be very helpful, and table space will be limited. Because I will not have the option of suite-style living freshman year, a lot of this project will be about making its benefits (hangout space, food-prep) available when necessary. In general, it seems I am on the right track focusing on having a convertible nightstand, but in my sketching and prototyping phase I may want to explore not only the potential of having one that transforms into a table, but also perhaps an extra chair, as everyone highlighted the benefits of having somewhere comfortable to hang out.

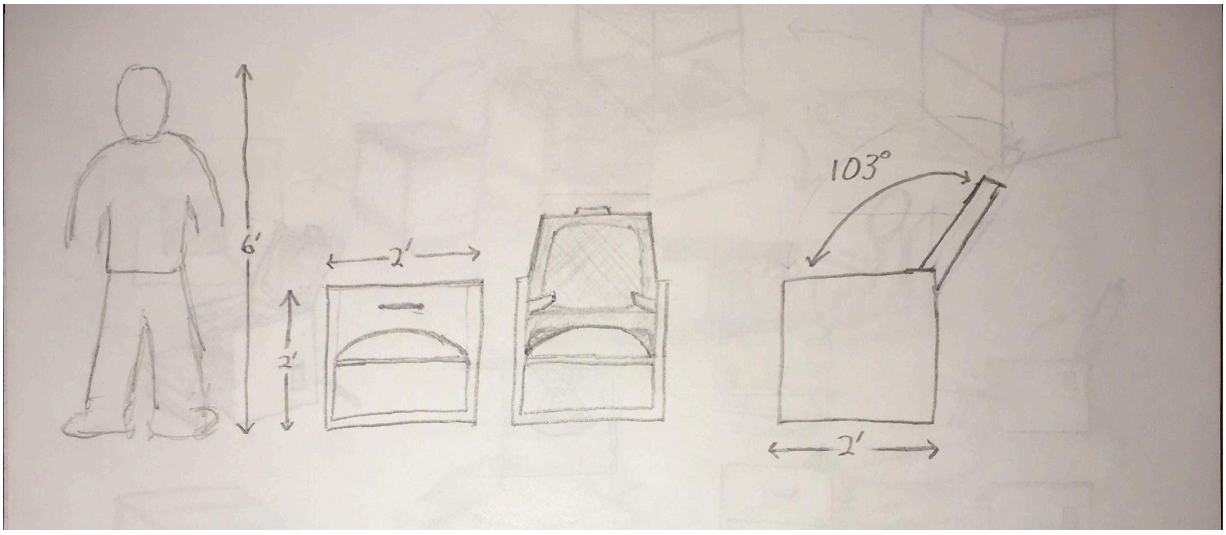
Milestone Three: **Sketching**











Milestone Four: **Design Proposal Sheet**

Milestone Five: **Prototype Plan and Materials List**

Prototype One:

Scale: 1:12 model
Materials Needed: Mat board
Tools Needed: Laser cutter, wood glue
Goal: Test the shape and overall design with a scaled human cutout

Prototype Two:

Scale: Full size
Materials Needed: Plywood, biscuits
Tools Needed: Table saw, jig, wood glue
Goal: Test full scale, determine and familiarize myself with the necessary woodworking tools and techniques before making the final product.

Final Product:

Scale: Full size
Materials Needed: 0.5’ Cherry lumber (20-30 board feet), Pillow fabric and stuffing, drawer slides, hinges
Tools Needed: Table saw, jig, wood glue, sewing machine

Milestone Five (cont.): **Prototype One**

The goal for this scale prototype was to be able to test and iterate on my design’s shape and relative scale. To do this, I not only required a scale model but also an appropriately-sized human cutout. This allowed me to test how an actual human shape would interact and fit with my model. I created this prototype out of mat board, which I laser cut based on my existing 3D model. This was also helpful because by creating flattened versions of my design I was able to get a better estimate for the amount of wood necessary for the final product.

After spending some time with the model, I came to a few takeaways. First, the scale of the chair itself seems appropriate. The nightstand is reasonably sized but folds out into something that holds a full-sized human fairly well (the cutout has a scaled height equivalent to six feet, which translates to six inches). Despite this, three major areas of improvement stood out.

The one detail I immediately changed from my 3D model while making this was the position of the handle. Initially, it was attached to the back of the chair, helping the user to lift it up. In practice, I found this easy to do without a handle but instead the footrest was very difficult to remove. Because of this, I moved the handle to the front of the footrest to make it easier to pull in and out. This has the downside of potentially having a handle in the way of the user's legs when the rest is stowed, but as demonstrated in the model the handle is small enough to mostly stay out of the way (as most people's' legs will go past it anyways).

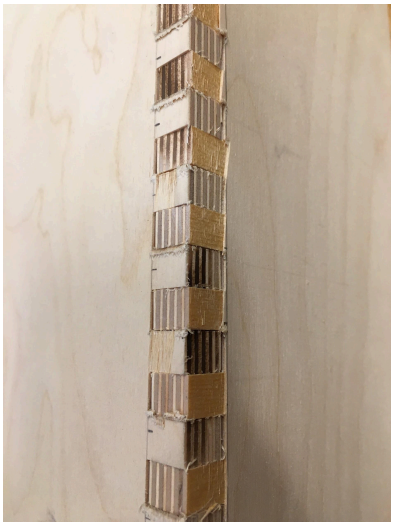
My next concern was also footrest related– with an actual scale model sitting in it, the angle and height of the rest are not particularly comfortable looking. Though this would be improve slightly by pillows (not shown here), it still must be improved. It appears that the rest should be higher and have more of a downward slope to it, but not too much. I will incorporate this in my next iteration.

Finally, this model illustrates a concern I had early on: the cover at the top of the backrest which makes it flush with the front of the nightstand also gets in the way of the user's neck and upper back. I will have to try multiple solutions to this problem, but the most immediate ones that come to mind are to have a cushion that sticks out just as much to lessen the abrupt transition or to mount that panel on hinges so it can fold away.

Milestone Five (cont.): **Prototype Two**

This prototype was all about testing woodworking techniques and hinges, particularly testing out the box and biscuit joints that I will use. I used 0.5” plywood for test cuts and joints, and acquired the exact mechanisms that I will use for hinges.





This box joint will be used at each perpendicular intersection in order to join my pieces as strongly as possible. I decided to use ¾” joints for the actual chair, but in this example I used ¼” which take less time but are very similar.



For parallel joints, such as joining my smaller boards together, I will use biscuit joints. I cut matching holes in each piece of wood with a biscuit joiner, inserted a dry biscuit, filled the hole with glue, and let it expand into a tight joint.

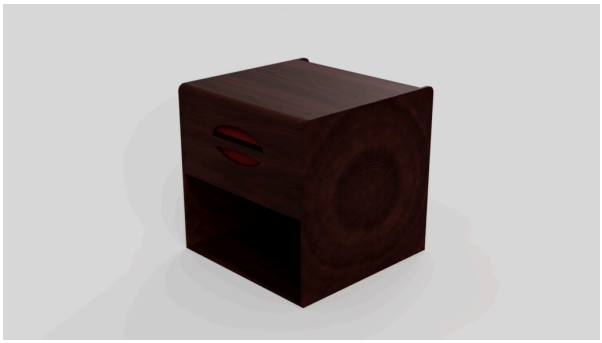


Next, I acquired these drawer slides for my chair's pull out footrest. I decided to buy slides that could support up to one hundred pounds on their own, realizing that strong rails would eliminate the need for a fold-down support for the footrest.

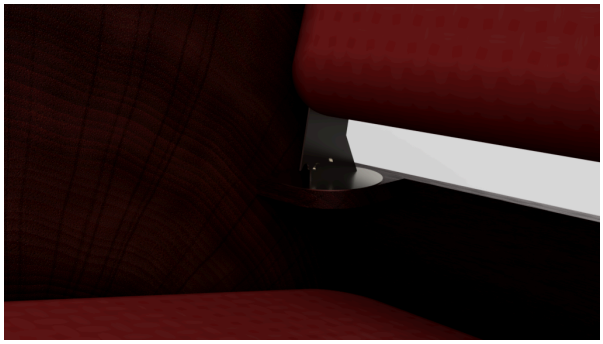


Finally, I bought these laundry valets to use as adjustable hinges for the backrest. Though this required a more significant redesign, they will allow me to rest the chair at a number of different angles depending on what I prefer. I had to modify them slightly, filing down one edge, so they can fold 180°, as seen in the third image.

Taking all of these lessons into account, I came up with a model for my final design:





Milestone Six: **Final Product**

[Once possible, I will insert final design photos]

Though I am really close to finishing, I am not quite there yet. Hopefully, I can finish up the full final product in the next week or so. That being said, I am fairly happy with the progress that I have made in spite of many setbacks. I had to learn a lot over the course of the project, but it has prepared me well for future ventures. Certain details could always be better. With more time I could make my cuts and sanding cleaner. With more materials and more capable tools I could make the chair more beautiful and structurally sound. Had the wood arrived on time, I may have been able to finish by now, but I've done well to get close despite that. This was primarily a design project, and I am really happy with how my design turned out. My only real complaints are on the implementation side which can always be improved. I'm happy with the outcome!