AMALIA

Industrial Design Capstone Project
Carleton University
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CONTEXT

What is Co-Working?

Co-working establishments are a modern, central space for community, networking, ideation, and business. They are dynamic and adaptable, providing both shared and private workspaces with a variety of resources. Co-working spaces vary from public libraries, and school study-areas, to private work centres and idea hubs with monthly memberships (Salovaara, 2015).

These professional co-working sites often consist of a main, open-concept area for casual work and collaboration, as well as additional spaces for meetings, presentations, or niche work such as podcasting. A variety of businesses and individuals utilize co-working spaces, allowing these sites to have a diverse community of people with varying careers, ages, ethnicities, and skills. This includes students, entrepreneurs, remote or hybrid workers, artists, hobbyists, small businesses, and international businesses ("what Is Coworking," 2022).

Recent trends have shown an increase in co-working after the pandemic. This is because many establishments are moving to hybrid or fully remote work, making traditional offices obsolete. Project-based careers have also become more common, replacing the past trend of long-term, vertical career paths. This has led to people wanting more flexibility of when and where they work, as well as companies downsizing to save on expenses. As a result, businesses and employees are using co-working environments as a third place; a space to work apart from the home or office (Salovaara, 2015).

Figure 1: Co-working space (Hub350, n.d.)

The Open Concept

A key aspect of open-concept work spaces is to provide a variety of work areas to give clients the flexibility to change their work environment within the co-working space. Though these spaces are ideal for collaboration or social atmospheres, they are less ideal for private calls or more focused work.

Figure 2: Co-working seating

The openness of the space results in noise pollution, distractions, and limited privacy. Because of this, co-working sites also provide booths, cubicles, or focus pods for a quieter option. These are ideal for video conferences, one-to-one meetings, and they provide a quieter space to desensitize from the busyness.

PROBLEM

“They all see us as a burden. [They] have separated us from the rest of society. By the end of the day, people are judged by their own activity. Until we are businessmen, politicians, community leaders, people at all levels of society, we will be marginalized and segregated.”

•••

Nothing About Us Without Us:
Disability Oppression and Empowerment
James I. Charlton

A unique and beneficial aspect of co-working spaces is the variety of people they service. Clients often come from many different careers or ways of life, and this variety contributes to the richness of co-working communities. A main people group that is often overlooked, underrepresented, or misrepresented in society is people with disabilities (Charlton, 1998). This group is important to consider in any area of work because their intel contributes to easier usability and variety, and broadens the target audience of any company, product, or service.

Co-working environments lack comfortable, accessible options for semi-private work spaces. This limits the options for people with disabilities, forcing them to work from home and limiting their representation in these regular workspaces. This consequently maintains ableist and normative views in society, creating a hierarchy between able bodied people and people with disabilities, and the exclusion of the latter (Charlton, 1998).

Gaps in Existing Products

Current semi-private workspace options include focus pods, restaurant-style booth seating or alcoves, and high-tech cubicles. Primary research through interviewing able bodied people and people with disabilities revealed many shortcomings in the existing options at many co-working sites.

Figure 3: Telephone-style booth (Teknion, n.d.) • Figure 4: Alcove (ROOM, n.d.) • Figure 5: Accessible cubicle (Teknion, n.d.)

Focus pods and alcove-style seating are the most common options provided. These options are often elevated without a ramp, limiting access for wheelchair users or people with reduced mobility. Also, the furniture in these options is fixed in place and often not adjustable, creating obstacles and not allowing for customizability for different needs. They are also small, leaving no space for mobility aids or wheelchairs.

Figure 6: Co-working focus area (Teknion, n.d.)

Many interviews also highlighted the sense of claustrophobia when working in these focus areas, and that the spaces were not comfortable to work in for longer than thirty minutes. Users also felt isolated and said the focus pod and cubicle options created a ‘fish bowl’ effect wherein the user felt watched by those outside. Many focus area options are also noise proof and fully enclosed, leading to a sense of detachment from the main co-working space.

There are high-tech cubicle options which are more accessible, though they are marketed to corporate-level establishments. These are not affordable to mainstream co-working spaces because of their high-tech features and they need a third party to install the product. These options are not only financially inaccessible, but also limited in physical accessibility. Though bigger, they are built to minimum standards and do not have space for a large variety of wheelchairs. Their minimalist design also does not provide handles or supports for people to transfer from their accessibility aid to the workspace's designated seating.

Figure 7: Co-working cubicle (Teknion, n.d.)

OPPORTUNITY

With the increase in remote and hybrid work post-pandemic, co-working spaces have grown in popularity. These spaces often lack accessibility in their furniture, which dissuades people with disabilities from using co-working spaces. Designing accessible, inclusive furniture will contribute to a more welcoming environment for people with disabilities, leading to more representation and less stigma.

Like many modern-day workspaces, co-working establishments promote inclusivity and diversity. The design of Amalia aims to facilitate this by providing an accessible, comfortable, affordable, and encouraging area for anyone to do focused work. Amalia will create a more welcoming and versatile environment for people with disabilities. More inclusivity and representation in co-working spaces will help reduce negative views towards people with disabilities and will contribute to a more diverse community in these common workspaces.

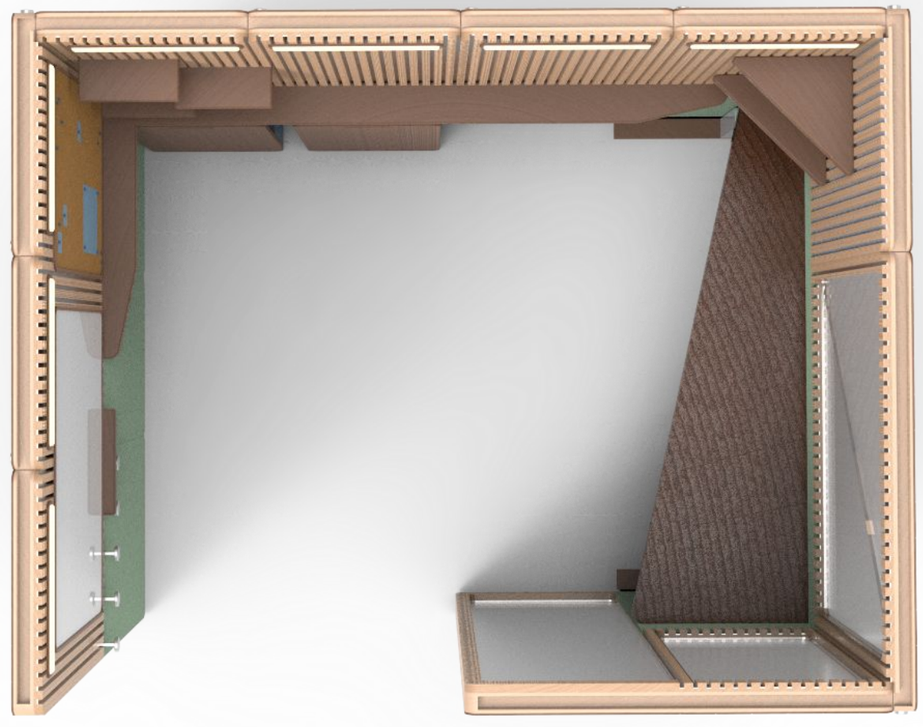


Figure 8: Amalia top view

Criteria

- The workspace should be semi-enclosed, reducing auditory and visual stimuli without isolating the user
- The design should adhere to multiple accessibility standards:
  - The Accessibility Standards Canada (ASC)
  - The Ontario Building Code
  - The Accessibility Design Standards of Ottawa
  - The Americans with Disabilities Act (ADA)
- There should be no obstacles for entering or exiting the workspace
- The design should include furniture that is movable to accommodate for a wheelchair user
- The design should consider aesthetics that invoke a welcoming and comforting environment for users
- Environmental sustainability should be considered when sourcing materials for the design

Having more wheelchair-accessible, semi-private work spaces in co-working areas would create a more welcoming and versatile environment for people with disabilities. This increase in accessibility would encourage more diversity and representation. This would then enhance the flexibility, community, and a sense of welcomeness of the co-working environment. Oftentimes, able bodied people also benefit from increased accessibility in product design because these products are more comfortable for a wider range of body types and varying personal preferences.

Wheelchair Accessibility

It is also important to consider different types of wheelchairs. Most day-to-day wheelchairs are manual or powered. Manual wheelchairs are self-powered by the user to propel themselves forwards, backwards, or when pivoting. Manual wheelchairs can also be moved by someone else pushing the chair from behind. On the other hand, powered wheelchairs are electric and battery driven. They are often bulkier and heavy, though users are able to go longer distances without fatigue (Different Types of Wheelchairs, 2022).

Figure 9: Types of wheelchairs: bariatric wheelchair, manual wheelchair, powered wheelchair (Chair Institute, 2021)

CONCEPT
DEVELOPMENT

From Exploration

Early ideation was primarily exploring form. The main goals were to brainstorm spaces which provide an area for wheelchair-users to work without furniture crowding the space.

These spaces also needed to optimize furniture versatility and customizability for different user needs. Lastly, designs considered overall size, remaining compact for smaller co-working environments.

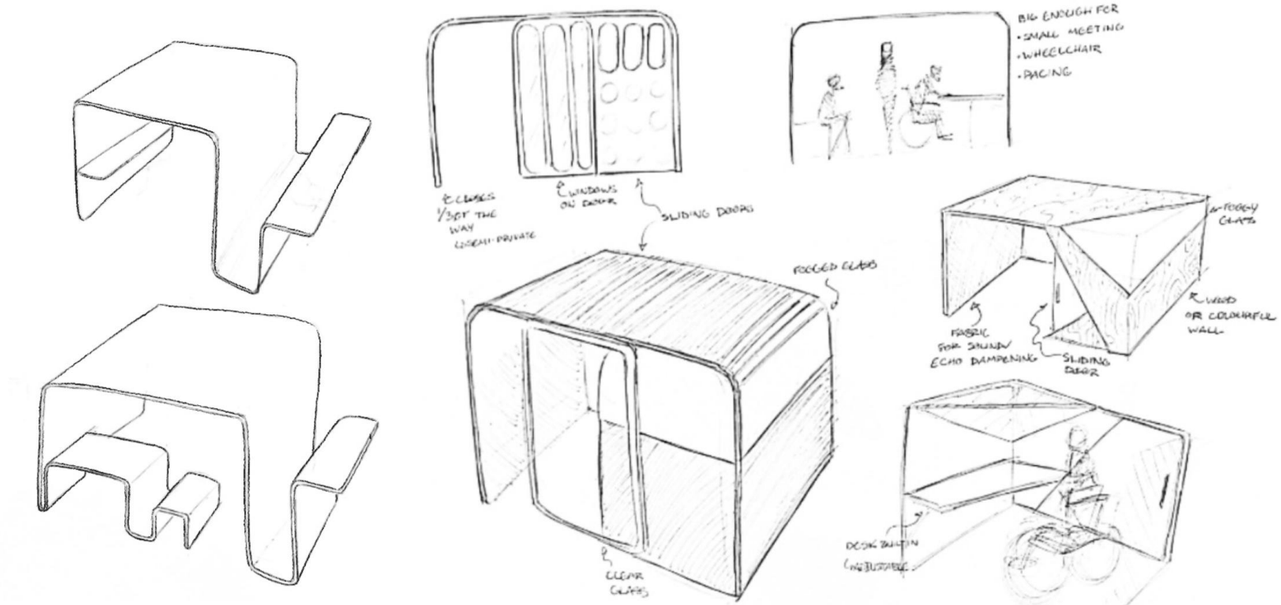
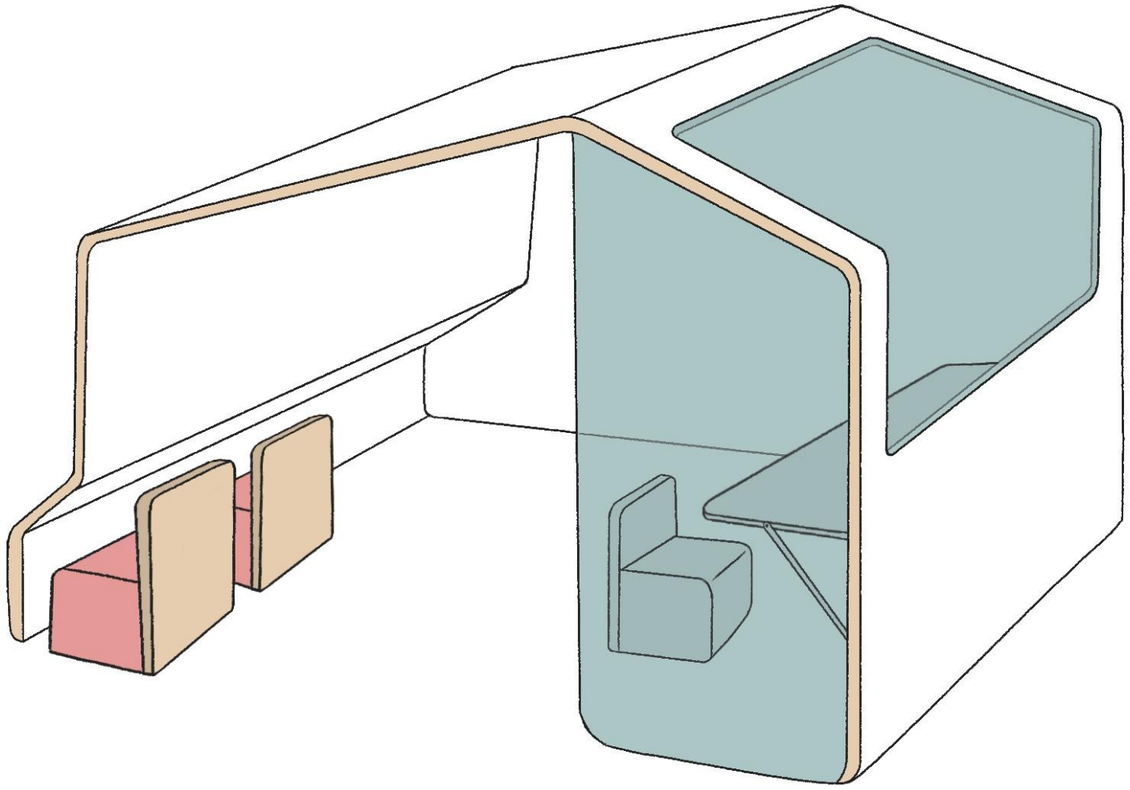


Figure 10: Form exploration sketches

Preliminary Design



The first concept was a house-inspired form with one open doorway and two large windows to create an open, welcoming space. This concept also included a designated space to tuck away furniture, and a hinge-based adjustable desk.

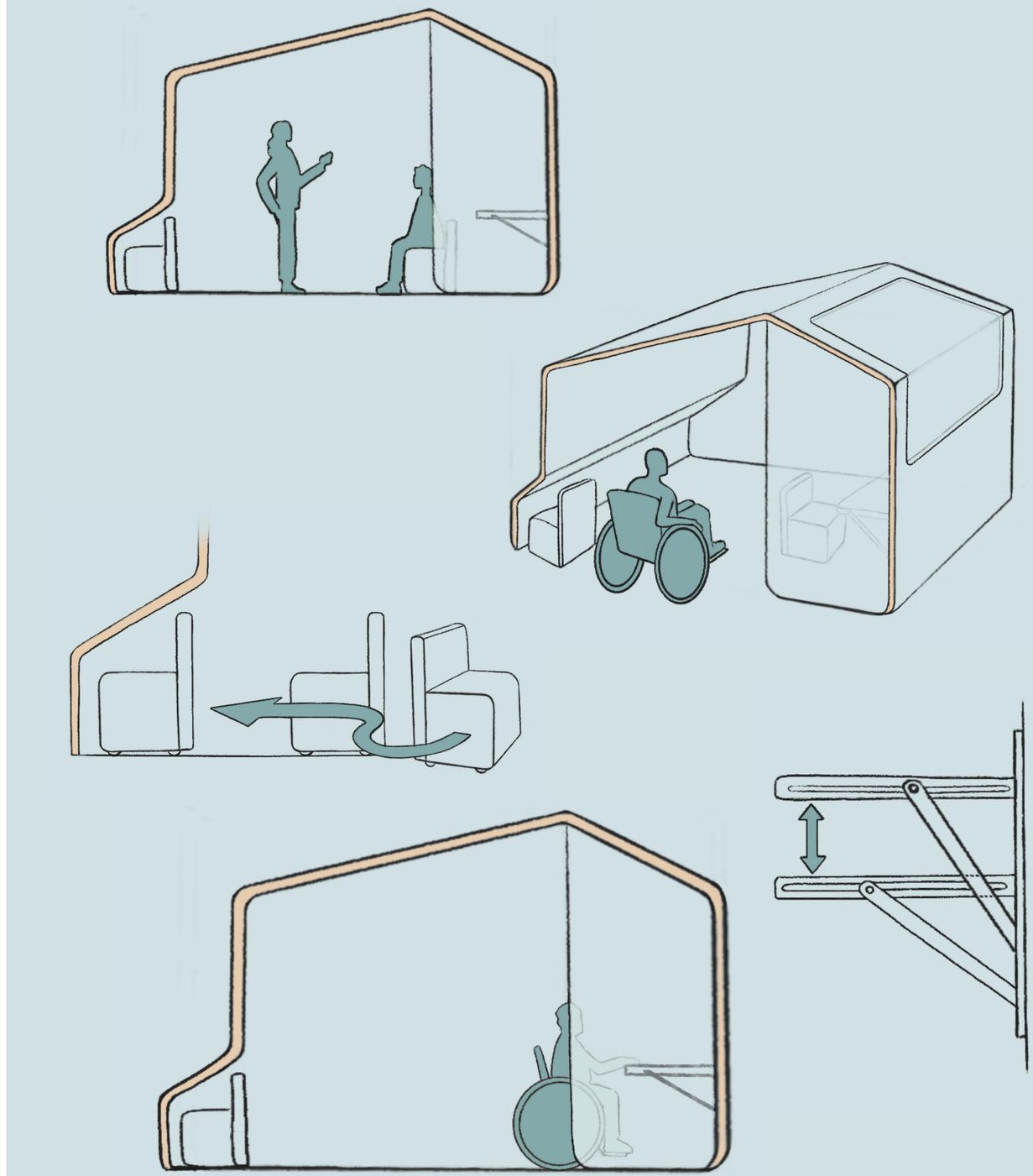


Figure 11: Preliminary design • Figure 12: Preliminary use cycle

USER TESTING

Prototyping the alcove included a tape outline and then a full-scale model. These helped determine the size and space-optimization of the alcove. User testing was implemented with open ended questions and a series of activities or scenarios for testers to play out. User testers included both able bodied people, as well as people with disabilities (see Appendix 1 for the detailed plan).

Testing Phase 1

This phase involved a 1:1 tape outline of possible dimensions for the alcove. The minimal dimensions were determined by referencing accessibility standards. Before creating a physical structure, this skeleton prototype allowed for flexibility with multiple dimensions. Also, users could interact with the space and props. This testing phase was limited since it was hard to imagine the whole physical space.

Figure 13: Alcove prototype with tape outline

Figure 14: Testing table positioning

Figure 15: Testing chair positioning

Preliminary Findings

- Seven feet tall allows access for people of varying heights while staying compact
- A floor space of about 6'7" x 5"6' provides space for a desk and allows for wheelchair maneuverability
- The desk needs to be cantilevered because table legs could be a barrier for wheelchair users
- The hide-away for chairs is placed in an inconvenient spot because users need to reach across themselves to move the chair to or from the desk. Removing this feature would also reduce the overall size of the product
- Suggestions for hooks, a whiteboard,storage, and other features were made to maximize the wall space

Testing Phase 2

This phase involved a 1:1 foamcore mock-up of the focus area, using dimensions from phase 1. Having a three dimensional space for testers to interact with led to a better grasp of the alcove's space and size. Testing with wheelchair-users led to valuable insights and discoveries.

- The alcove felt comfortable and spacious
- With walls, the structure feels more like a focused space
- The ceiling could be concave or a soft material
- Chairs could be foldable or fit under the desk
- An angled desk was considered to orient users more towards the doorway
- Fogged glass and windows will help the space feel larger

Figure 16: Alcove prototype with foam core

Figure 17: Testing phase 2 with 1:1 model

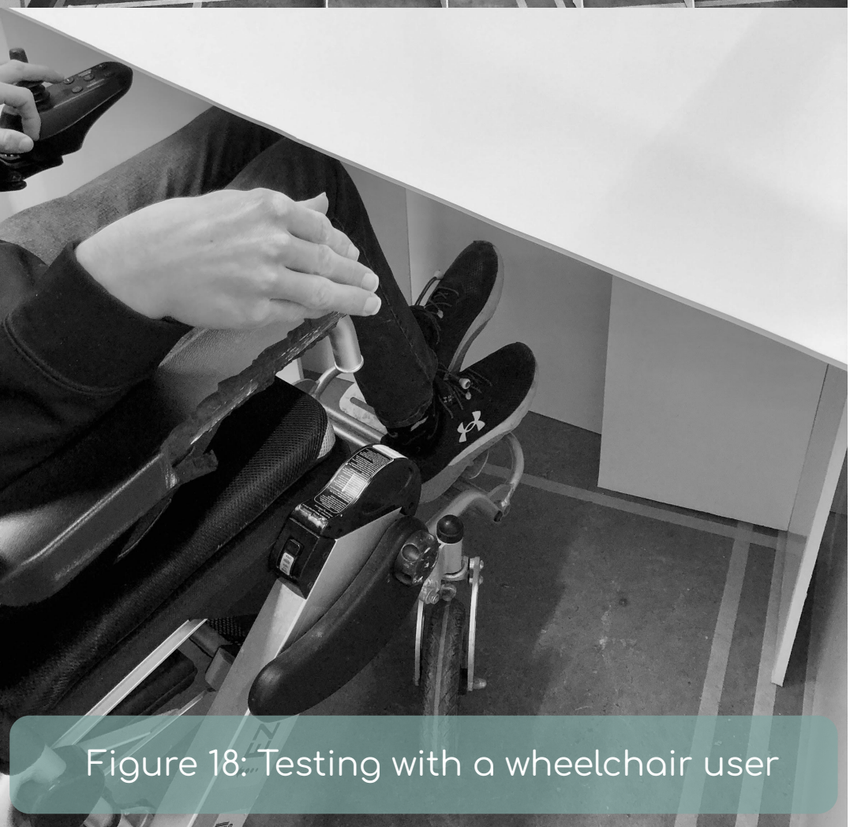


Figure 18: Testing with a wheelchair user

Findings from Wheelchair Users:

- There is enough room inside for the turning radius of the tested powered wheelchair
- It is more comfortable for the user if the fogged glass is not floor-to-ceiling
- A chair under the desk would become an obstacle
- The doorway should be a minimum of 38" for wheelchair clearance
- There should be access to an outlet to charge electric wheelchairs on the left side of the desk
- The angled desk allows for better wheelchair maneuverability when entering and exiting
- More legroom is needed under the desk
- The alcove length should be extended if shelving will be included to make more space inside

Design Refinement

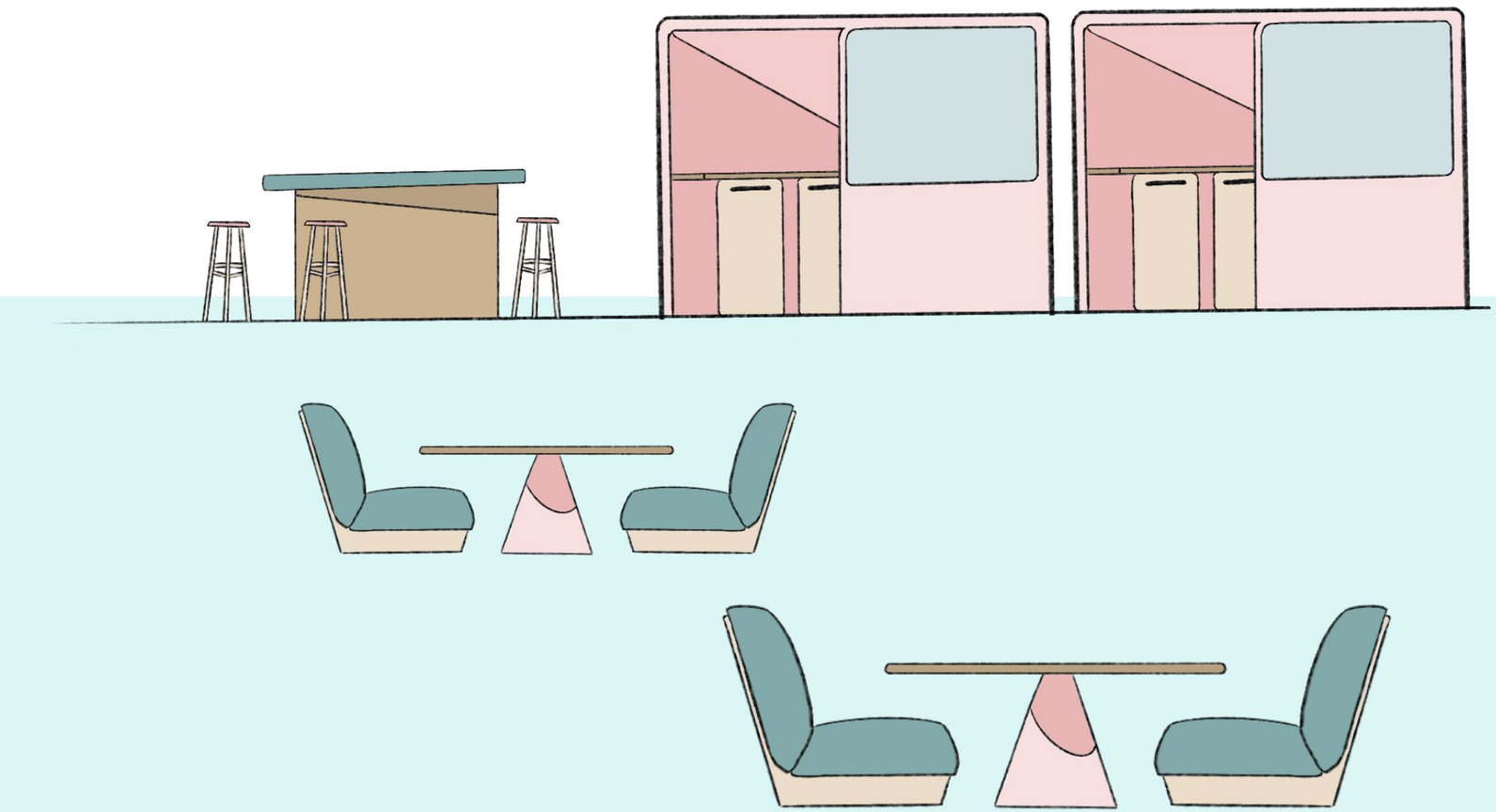
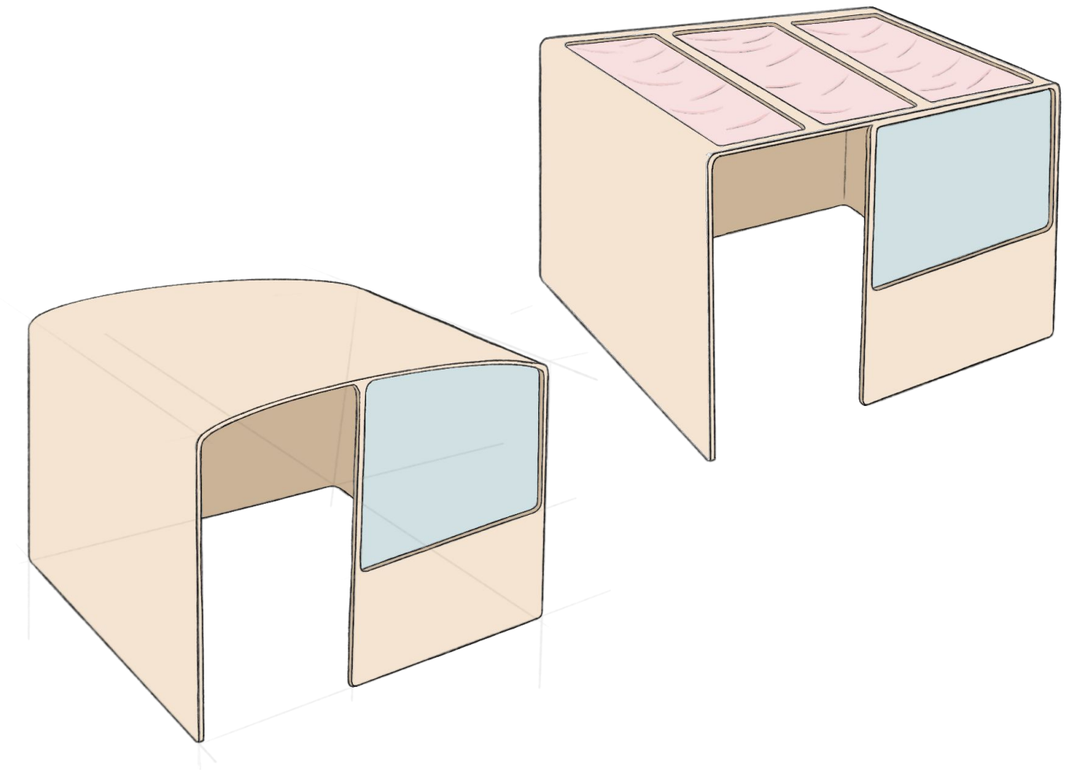
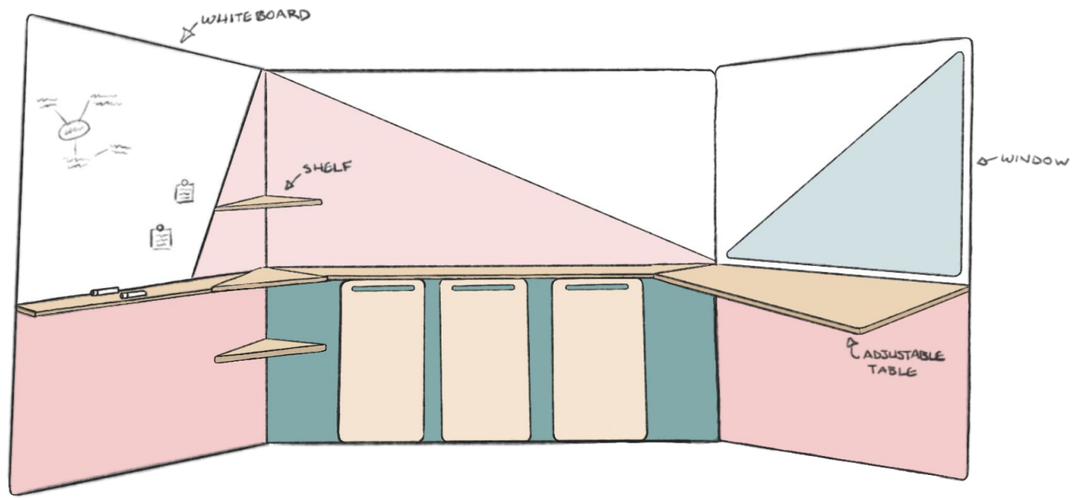


Figure 19: Alcove in context sketch



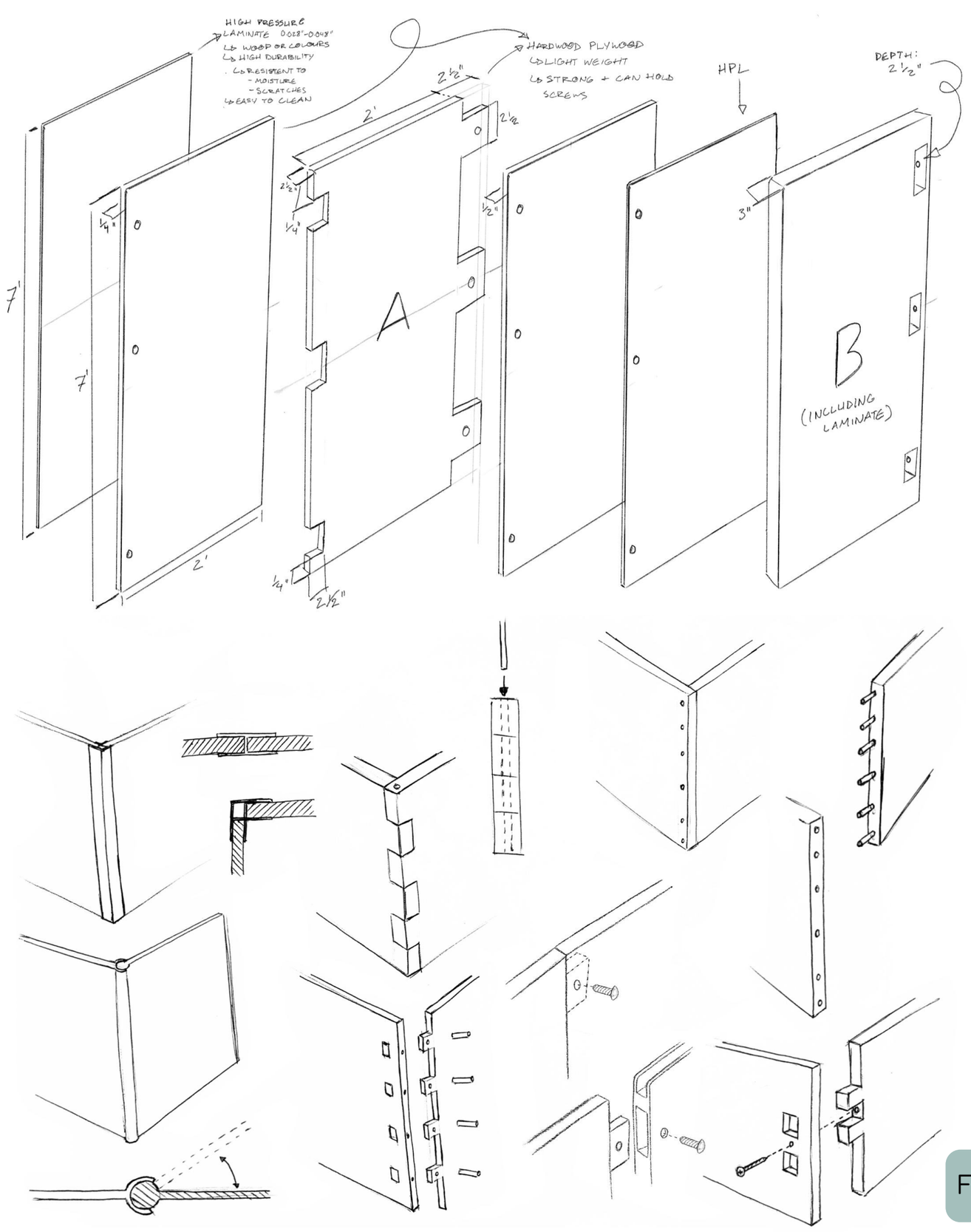


Based on the feedback and findings in the user testing phases, the focus turned more to the physical structure of the alcove instead of possible furniture designs. There are many existing foldable and adjustable chair options for co-working spaces to pair with the alcove design. Main design changes included having an angled desk to allow users to see the alcove entryway, and adding in amenities on the walls to maximize the space. The house-inspired form was changed to an open roof to help with airflow.

Figure 20: Alcove roof variations • Figure 21: Alcove interior sketch

DETAILED DESIGN

After consulting with design and industry professionals, further designs were made on the details of the product. This included designing a panel system to make up the alcove, allowing for a low-cost and simple set-up and deconstruction. Ideation was also continued for alcove details, such as materials, interior layout, and additional features.



Panel Layers & Joinery

The materials, construction, and set-up of the alcove panels are integral to the design. The materials need to be sturdy, durable, and light-weight. Light materials make the alcove easier to assemble, and durability ensures the structure will last. The layers of the panel would be pre-cut, then assembled using lamination with water-based adhesive, heat, and pressure.

Many variations of panel joinery were explored. The goal was to find a method that is simple to assemble with minimal tools and parts.

Figure 22: Panel joinery sketches • Figure 23: Panel layers sketches

Panel Windows

A key feature of this alcove is the windows. Multiple windows of varying sizes creates visual interest and allows more light into the alcove. Having windows of varying opacity offers some privacy to the alcove user, and minimizes visual distractions. Various arrangements and window shapes were explored.

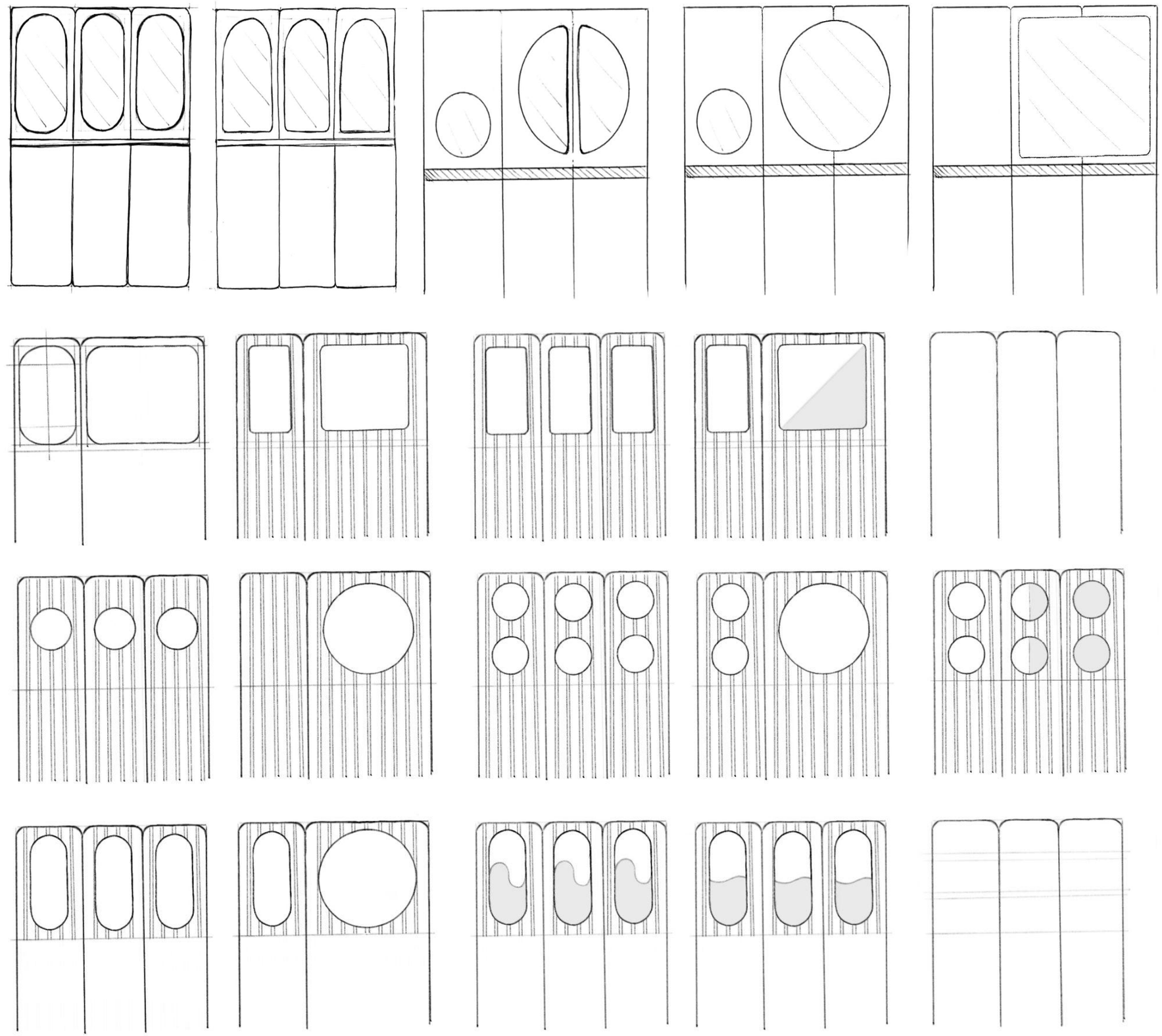


Figure 24: Panel window ideation

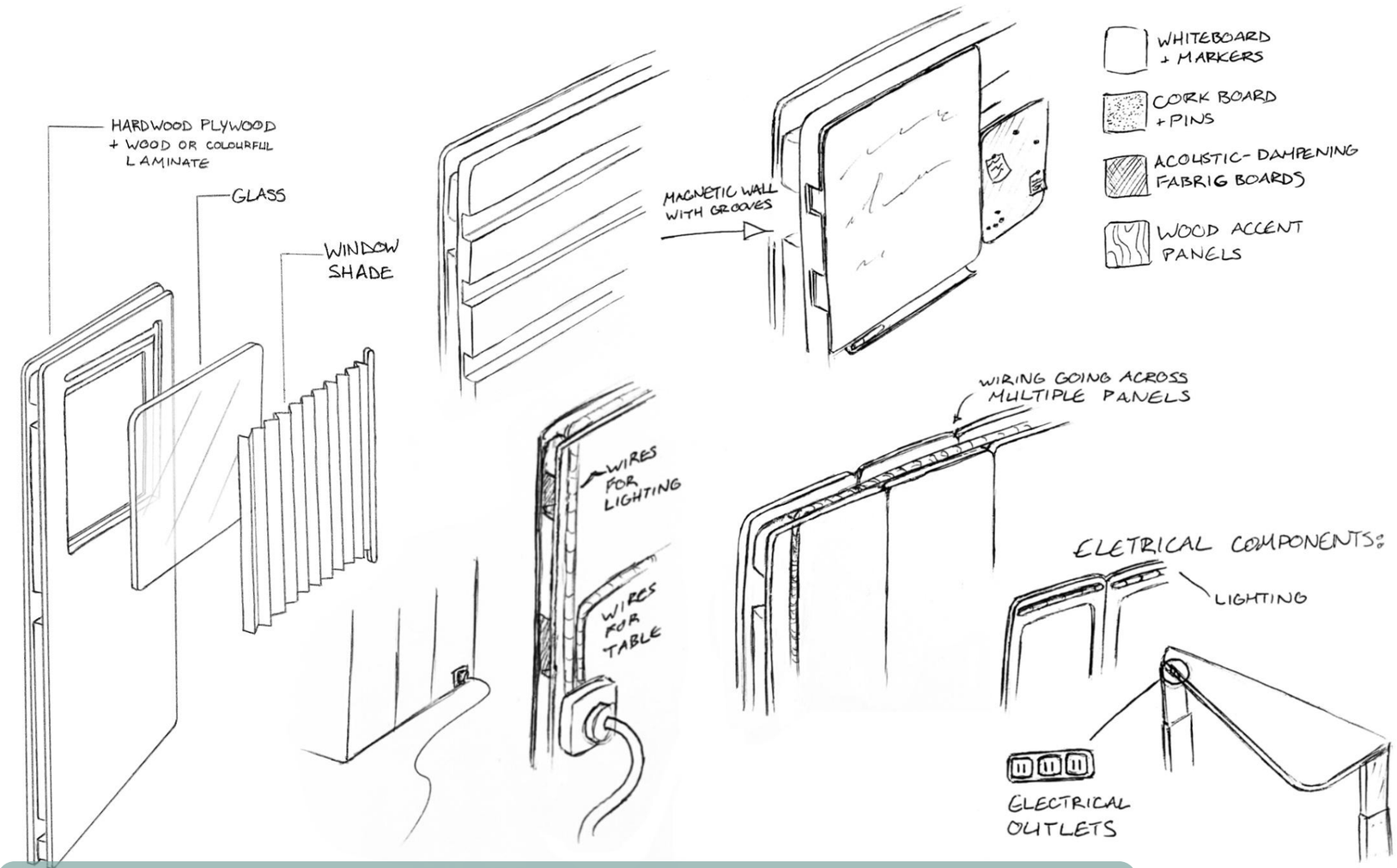


Figure 25: Exploratory sketches for electrical components and modularity

Electrical Components & Modularity

Many sketches were done to explore how the wiring for outlets and lighting would be integrated into the panels so they are not a tripping hazard.

Amenity modularity was also explored, to allow for customizability. Magnets, hooks, peg boards, and slat boards were all considered for how amenities would attach to the panels.

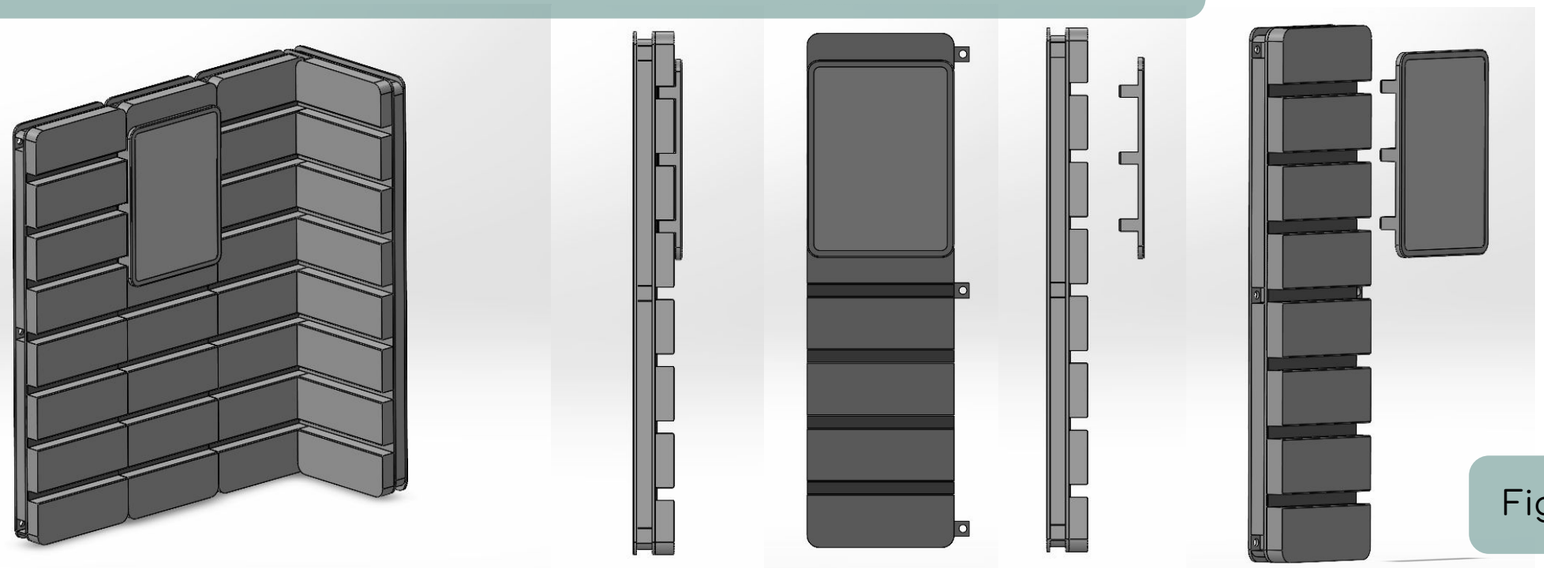


Figure 26: 3D modeling of modularity ideation

Final Concept

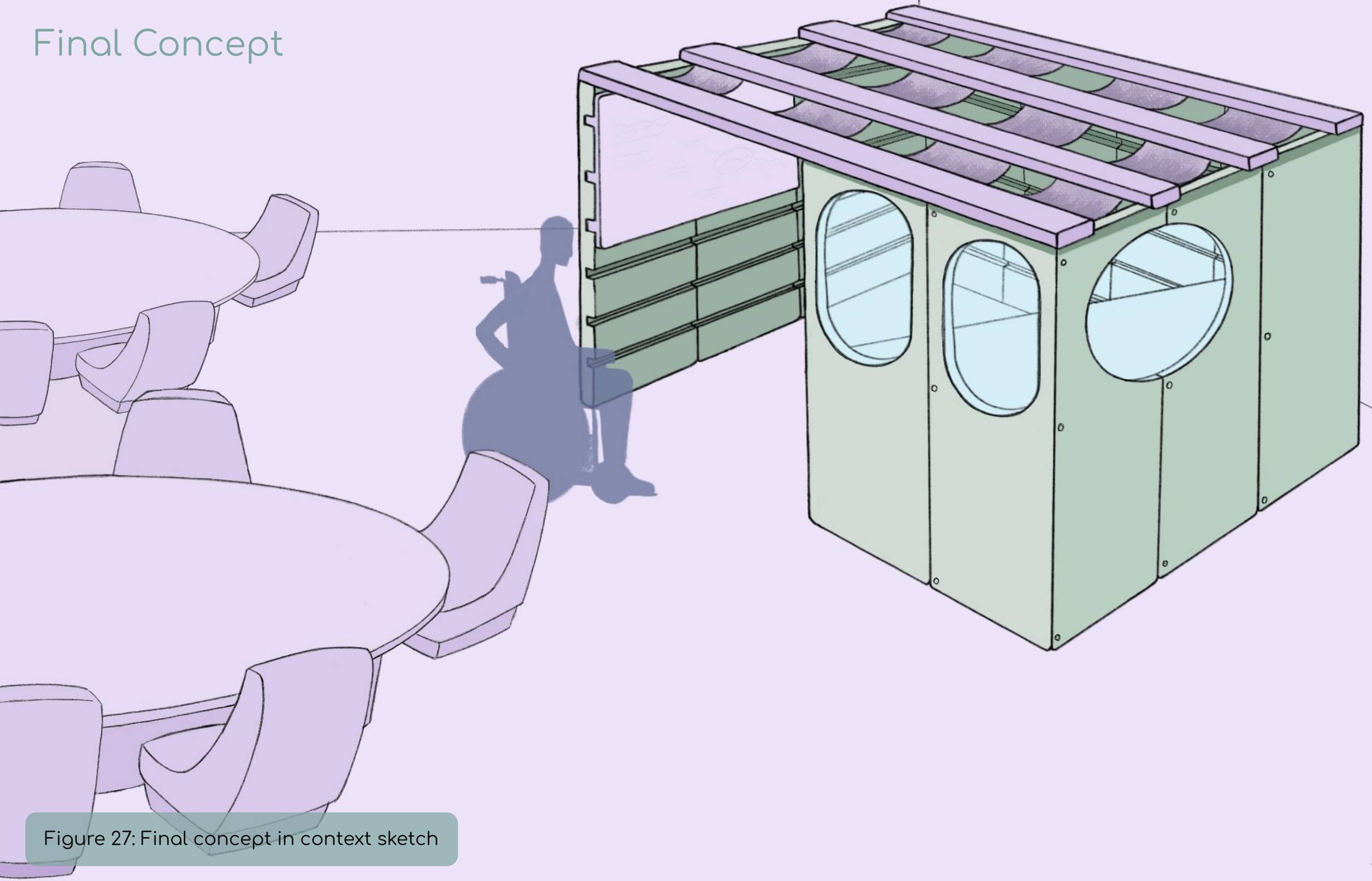
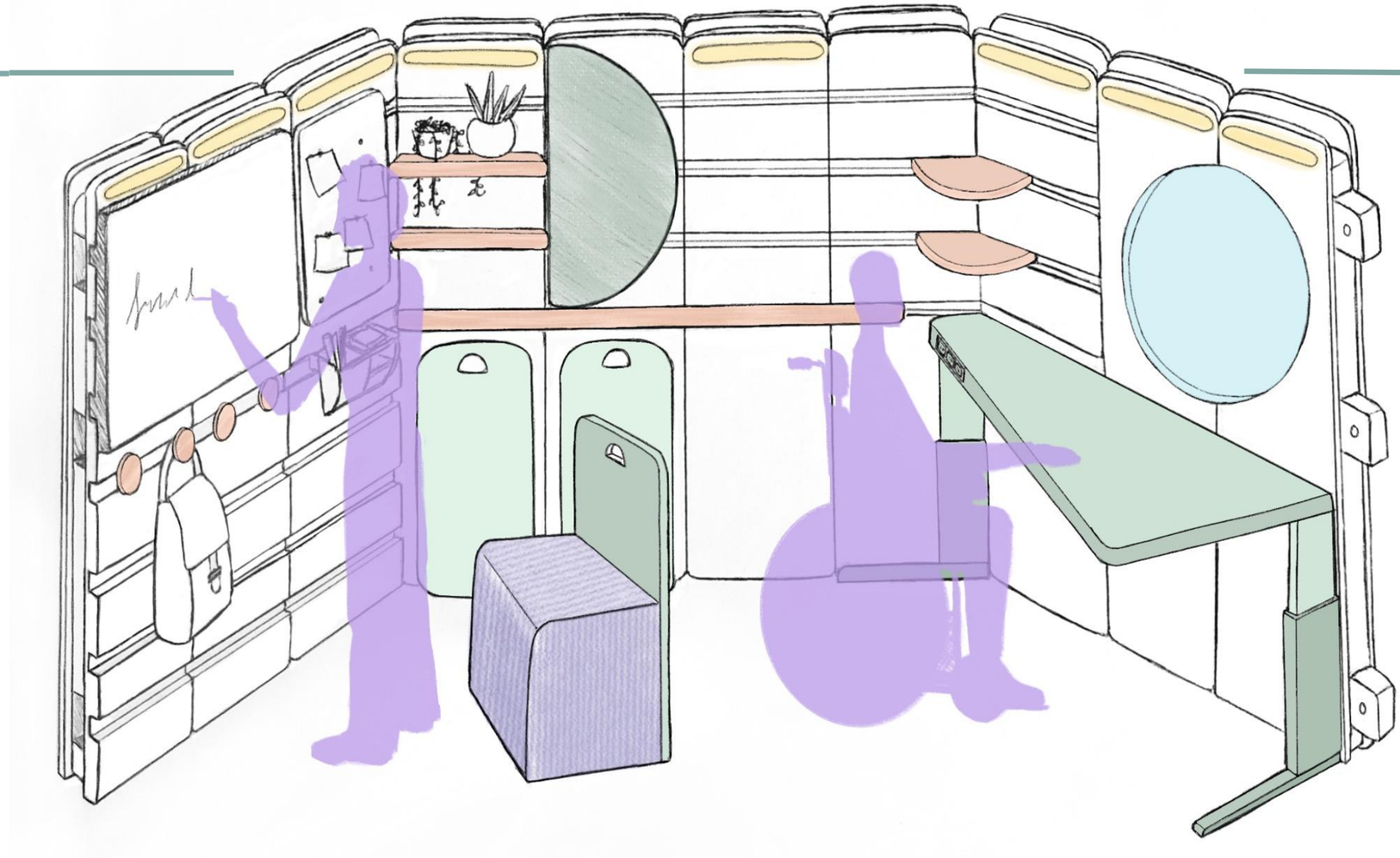


Figure 27: Final concept in context sketch



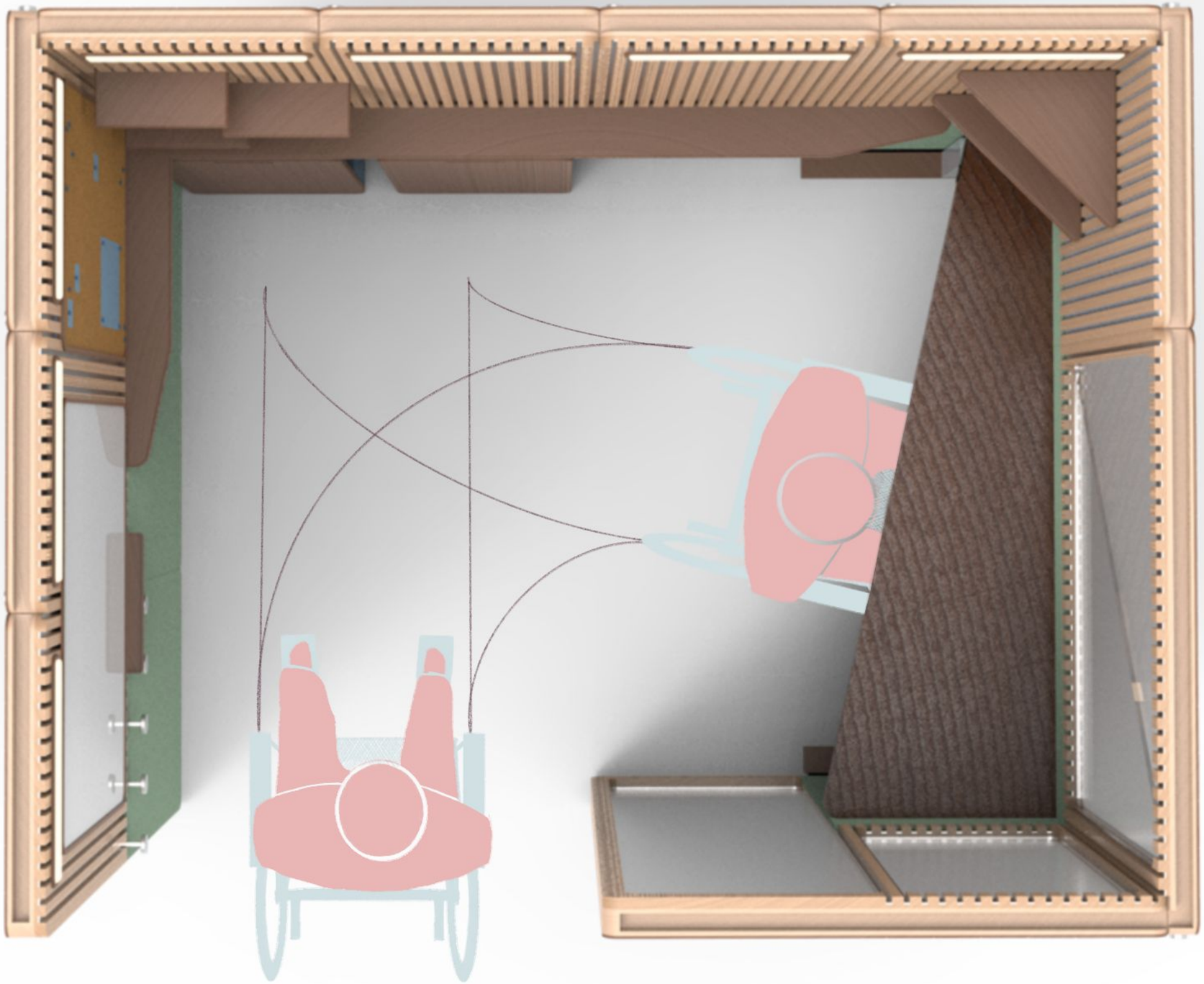
The alcove would sit in the open-concept, co-working area, with the ability to be taken apart and relocated easily to change up the space. The alcove would have a customizable aesthetic with different laminates, and modular accessories which attach with magnets. Electronic components would be powered by hidden wires attached to an external power source.The roof consists of wooden beams with linen draped across to add movement and airflow.

Figure 28: Final concept interior sketch

DEFINITIVE
DESIGN

This semi-private alcove provides a quiet, customizable workspace for co-working environments. Designed to be accessible for people with disabilities, Amalia, meaning work, encourages diversity and provides anyone with an area for focus, regardless of ability (see Appendix 2 for dimensions).

Figure 29: Amalia ¾ view



Amalia provides a space for wheelchair-users to work without furniture crowding the space. This involves compact chairs that are hidden when they are not needed. The alcove also allows space for the turning radius of various wheelchairs.

Figure 30: Amalia top view with wheelchair accessibility

Various amenities such as shelving, a cork board, and a white board are available. The amenities are modular for optimized customizability while using the space efficiently. This gives people with different needs the ability to move amenities to their preferred height or place.

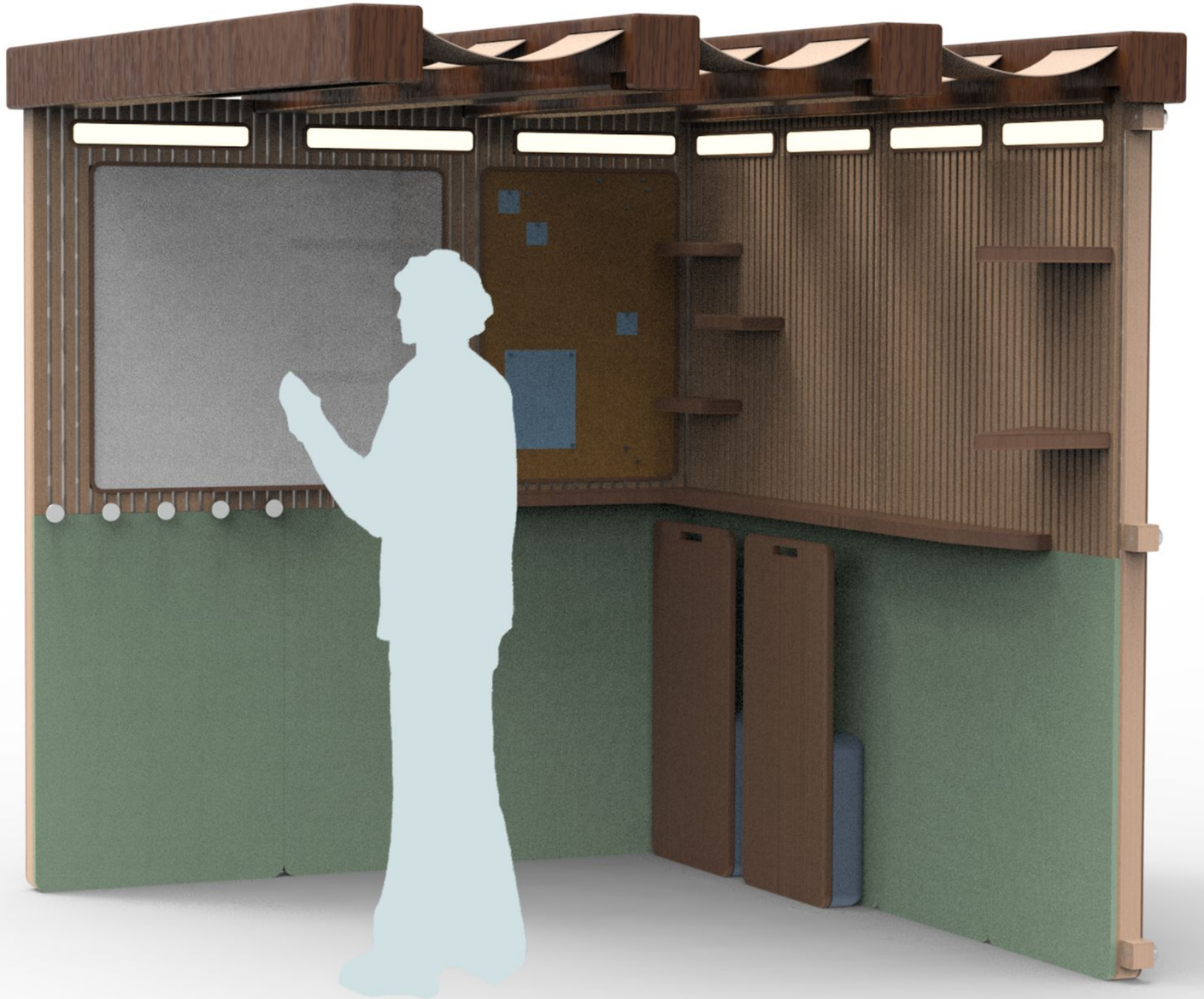


Figure 31: Amalia interior amenities view

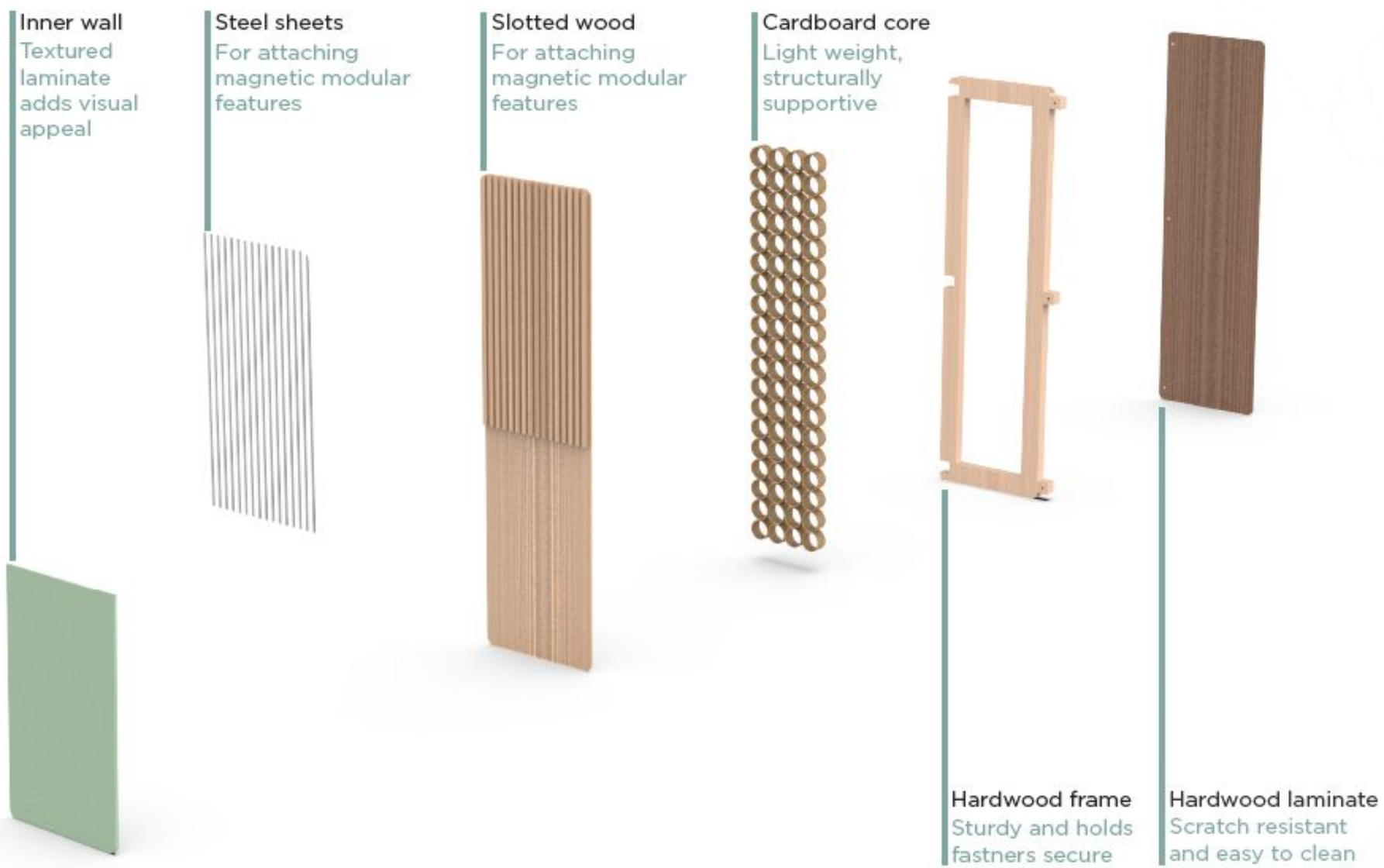
The materials and colours of the alcove provide a nature-like atmosphere. This is calming while also being encouraging, especially for people with sensory difficulties. The colours are all contrasting as well, with either dark accents on light, or vice versa, to help visually impaired users navigate the work space.

Figure 32: Amalia front view

Figure 33: Amalia desk view

By having an open doorway, counterbalance desk, and simple lighting system, Amalia is also low tech to remain financially accessible to co-working establishments.

Panel Details



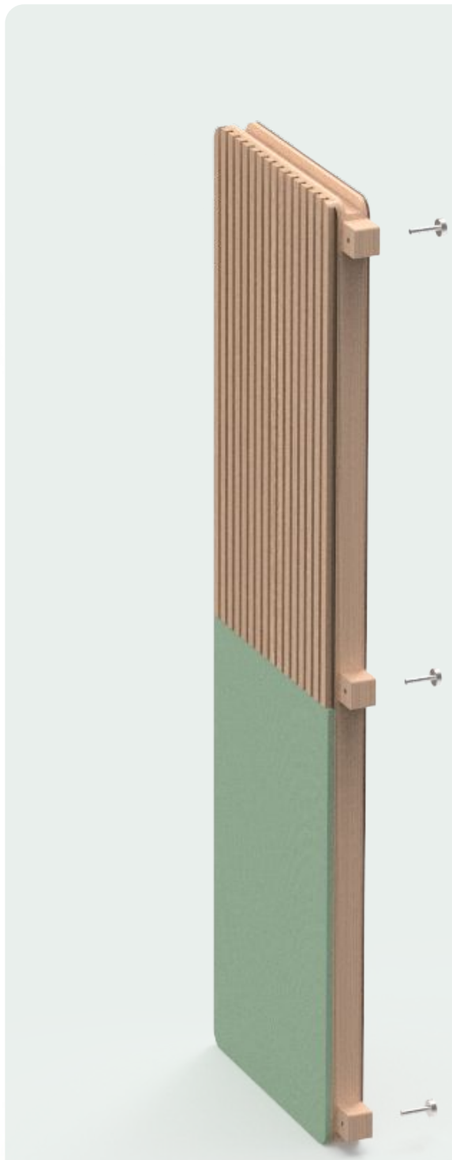
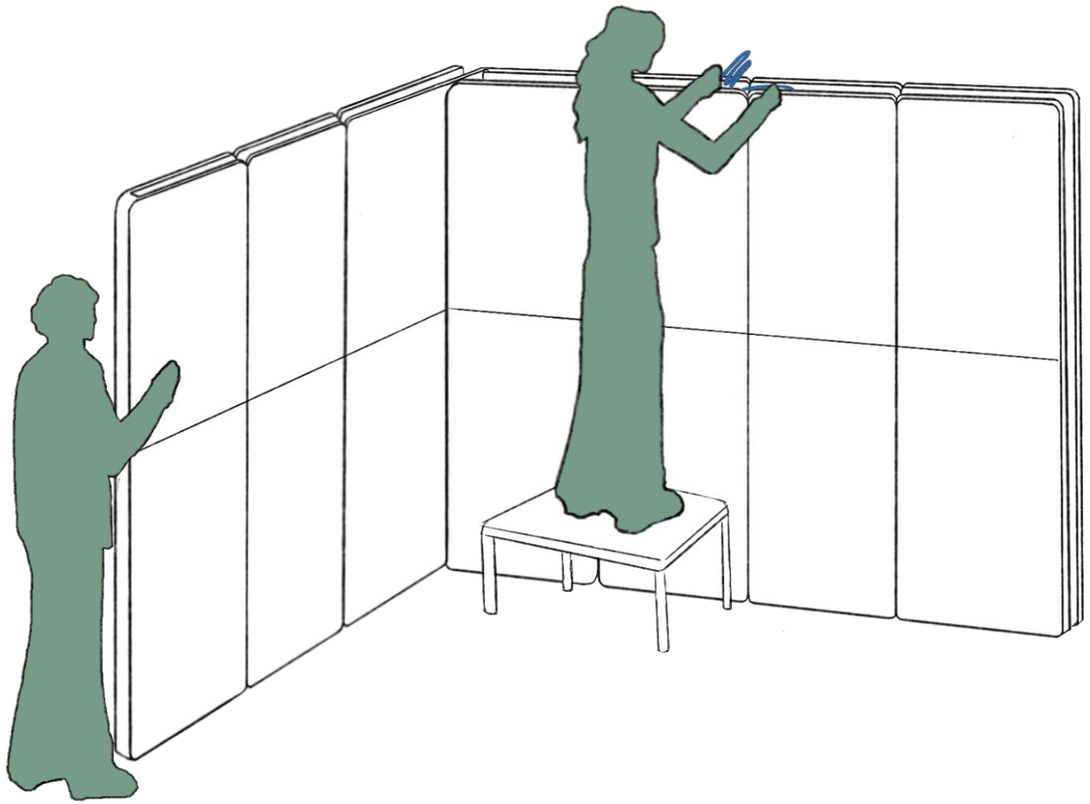


Figure 34: Amalia panel exploded view • Figure 35: Amalia panel joinery details

Amalia is a semi-permanent structure: sturdy and fixed when set up, while also being simple to dismantle and relocate. The alcove is made up of 10 panels which fit together easily with minimal fasteners, making assembly simple and reducing the need for extra tools.



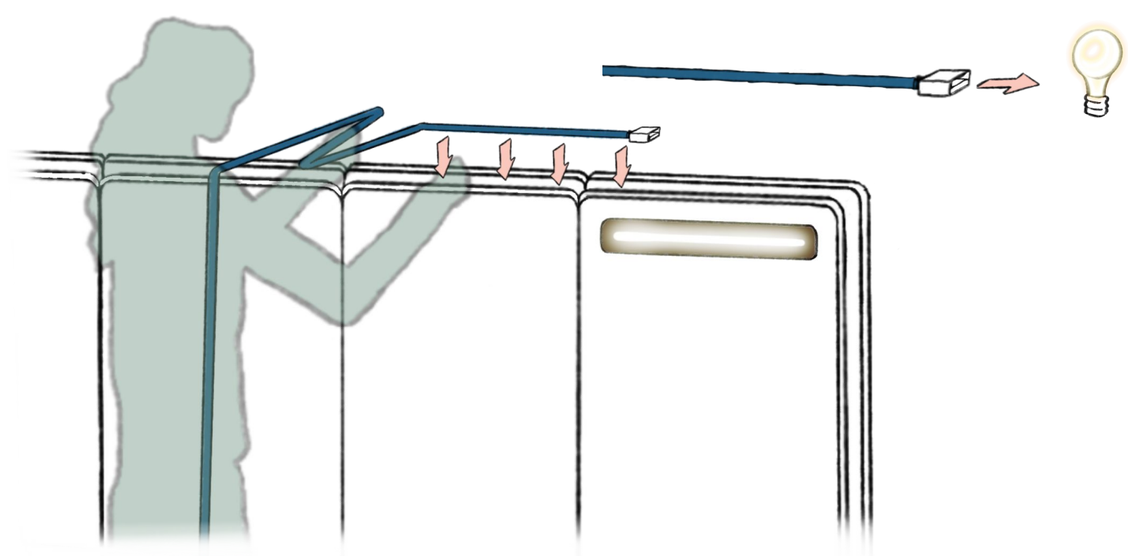
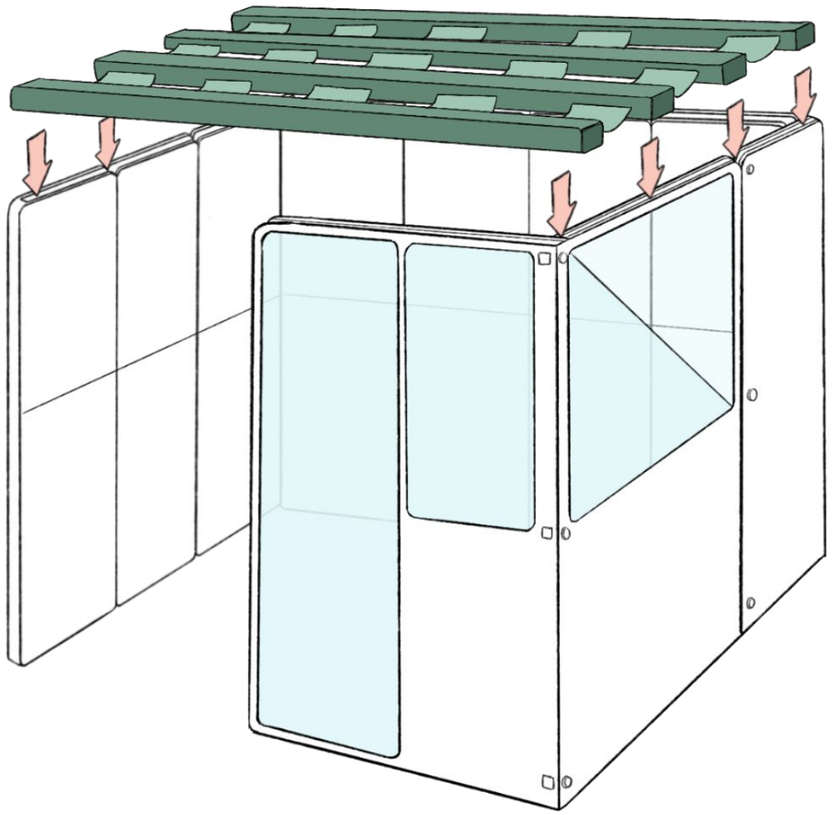
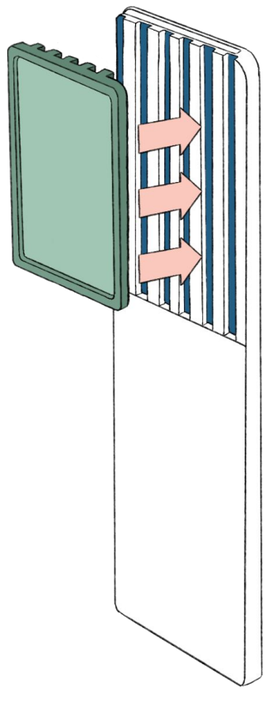


Figure 36: Amalia set-up steps 1 & 2

The first step in assembling Amalia is putting together the 10 panels. This is done by sliding them together and fastening them with the aluminum pegs. The panels are arranged in alphabetical order, as shown in Appendix 3. This mode of assembly is simple, meaning co-working employees are able to set up Amalia without hiring external help.

The second step is to set up the wiring for the light sources and desk outlets. The electrical wiring is pre-integrated into the panels, meaning set up is simply unwrapping the wires and laying them across the joined panels. The wiring fits in a trough at the top of the panels, and then they are plugged into the light sources. At the bottom, there is an outlet to attach Amalia to an external power source.





The fourth step for set-up is to place the roof on top of the panels. The roof has grooves to secure it to the structure. This pagoda style roof allows for airflow while also being light-weight and adhering to building safety codes.

The final step in assembly is to customize the space with the modular amenities. The desk slides in against the left side wall, and the wall amenities attach magnetically to the slats on the panels.

Figure 37: Amalia set-up steps 3 & 4

References

Chair Institute. (2021, April 9). Different Types of Wheelchairs Available. Chair Institute. Retrieved December 10, 2022, from https://chairinstitute.com/types-of-wheelchairs/

Charlton, J. I. (1998). *Nothing about Us Without Us : Disability Oppression and Empowerment*. Chapter 2 – The Dimensions of Disability Oppression: An Overview. University of California Press

Different Types of Wheelchairs. Redman Power Chair. (2022, August 29). Retrieved December 1, 2022, from https://www.redmanpowerchair.com/different-types-of-wheelchairs/

Hub350. Hub350. (2023). https://www.hub350.com/

ROOM: Office Phone Booth and Privacy Pod for the Office. ROOM Canada. (n.d.). https://ca.room.com/pages/office-privacy-booths?utm_source=google&utm_medium=search&utm_campaign=19411753175&gad=1&gclid=CjwKCAjw36GjBhAkEiwAKwIWyei9aZZRhouxz9ZftOHQ_SDxpykrEGYTjnNDwxfV24ZIYTiQy1EIfBoCRoQQAvD_BwE

Salovaara, P. (2015, June 26). Chapter 1: What can the coworking movement tell us about the future of workplaces? Elgar Online: The online content platform for Edward Elgar Publishing. Retrieved October 6, 2022, from https://www.elgaronline.com/view/edcoll/ 9781783477913/9781783477913.00008.xml

Teknion. (n.d.). Retrieved November 3, 2022, from https://www.teknion.com/ca

What Is Coworking? Everything You Need To Know About Coworking Spaces. DropDesk. (2022, April 18). Retrieved October 10, 2022, from https://drop-desk.com/what-is- coworking

Appendix

Test Objective	Test Method	Required Prototype	Test Participants	Documentation	Measure of Success
Determine the best dimensions for the alcove and side window	Observation with think-aloud protocol, environmental exploration, open ended interviews	• Skeleton frame of the alcove made of a tape outline • wheelchair or transport chair	• 2-3 wheelchair users • 2-3 able bodied people • **Need consent forms	• note taking • pictures and videos • measurements of the space	• Users can enter, exit, and maneuver in the alcove comfortably • The alcove fits well in the intended environment • The dimensions allow for an optimization of space • The dimensions create an alcove that is welcoming and not claustrophobic
Test the placement, dimensions, and amount of windows	Observation with think-aloud protocol, environmental exploration, open ended interviews	• Adjustable skeleton frame of the alcove and windows (made of cardboard) • varying window placements and sizes • wheelchair or transport chair	• 2-3 wheelchair users • 2-3 able bodied people • **Need consent forms	• note taking • pictures and videos • measurements of the windows	• The window(s) size and placement create a comfortable alcove that does not feel claustrophobic or create the fishbowl effect • The window(s) size and placement allow light to come in while also providing privacy for users

CARLETON SCHOOL OF INDUSTRIAL DESIGN OTTAWA, CANADA				
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DRAWN:	ERIKA MACGREGOR			
CLIENT:	TIM HAATS		MATERIAL: VARIOUS	
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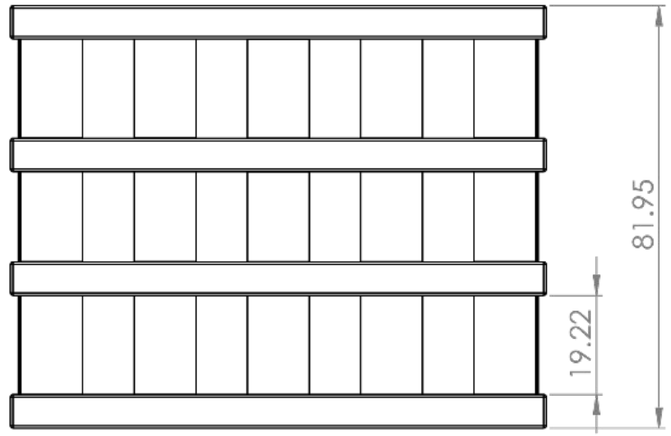
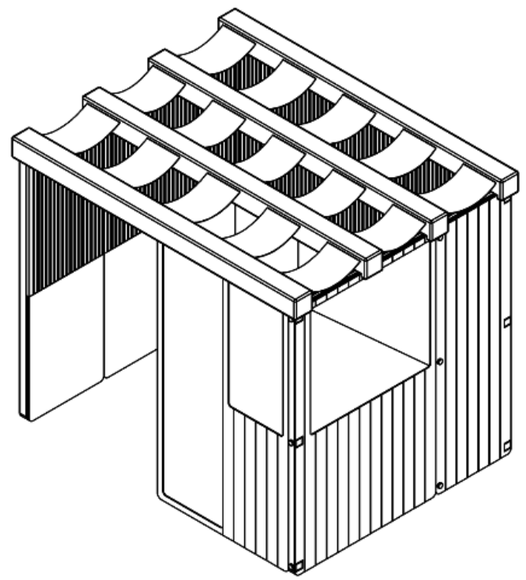
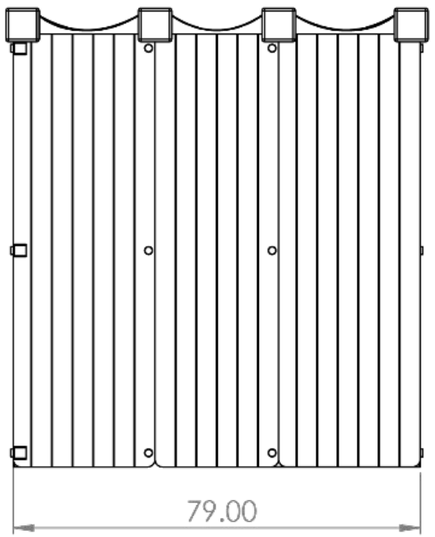


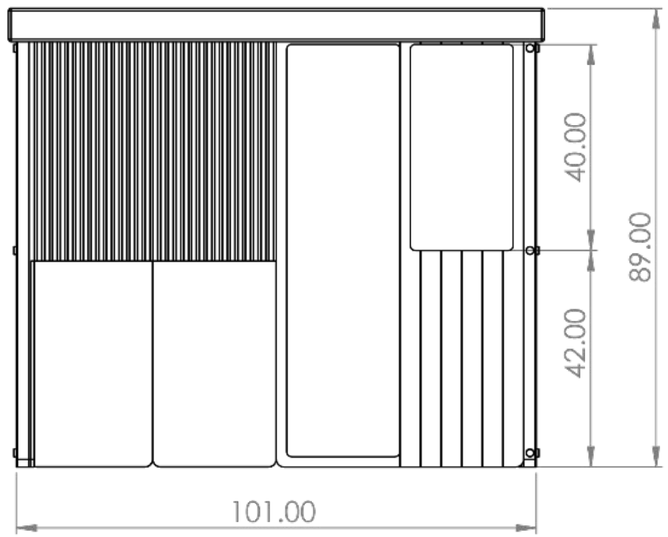
TOP VIEW



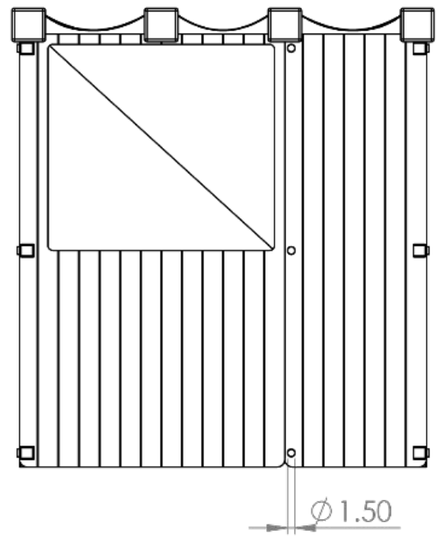
ISOMETRIC VIEW 1:50



RIGHT SIDE VIEW

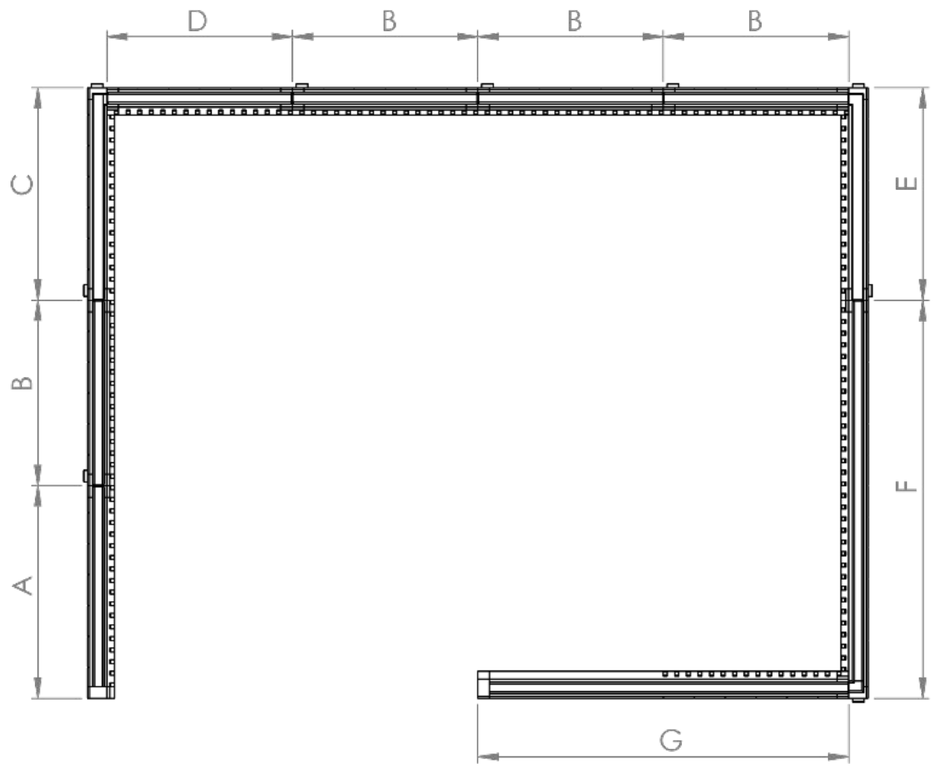


FRONT VIEW

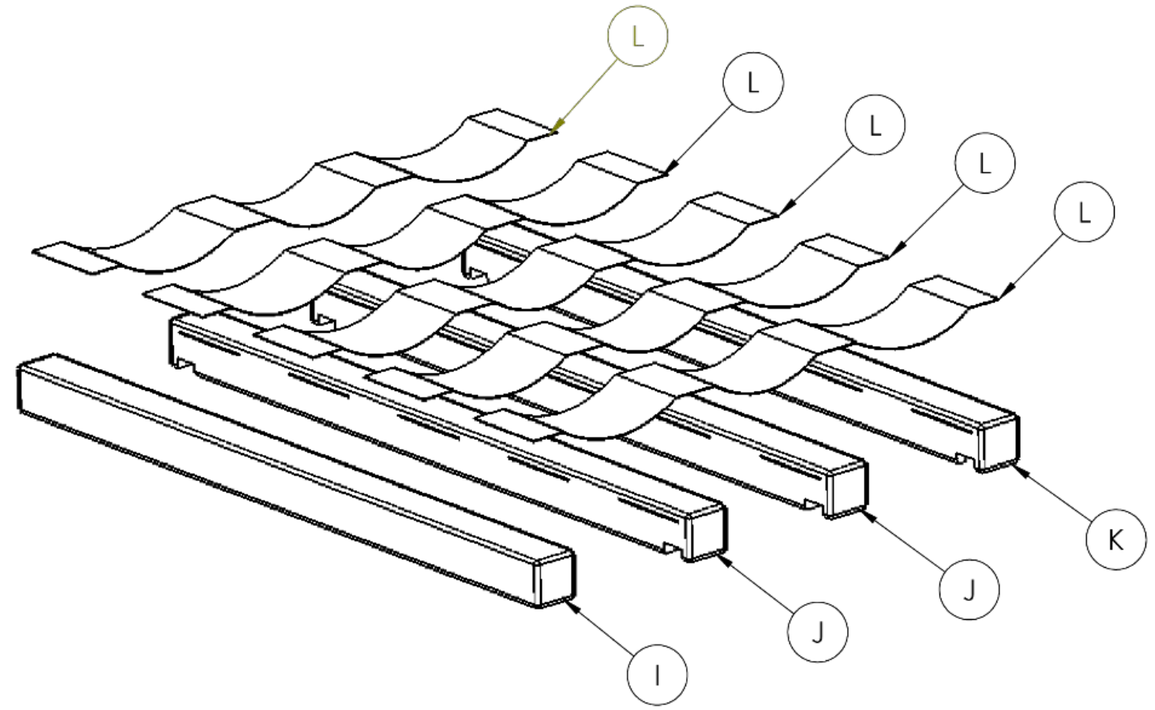


LEFT SIDE VIEW

SI



ALCOVE PANELS
TOP VIEW



ALCOVE ROOF

PART H
FASTNER
X27
1:5

SI

CARLETON SCHOOL OF INDUSTRIAL DESIGN OTTAWA, CANADA				
TITLE: AMALIA			TOLERANCES: DECIMAL ± 0.25 ANGLE ± 0.2°	
DRAWN: ERIKA MACGREGOR				
CLIENT: TIM HAATS			MATERIAL: VARIOUS	
UNITS: IPS	DATE: 04/27/23		SHEET 2 OF 1	2
DWG. #: ASSEMBLY 2	SCALE: 1:20		B 11x17	