Improving the Nail Salon Work Environment

Industrial Design Thesis Report

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Improving the Nail Salon Work Environment

by

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Submitted in partial fulfillment of the requirements to the degree of

Bachelor of Industrial Design

Faculty of Applied Sciences & Technology Humber Institute of Technology and Advanced Learning

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April 18, 2023

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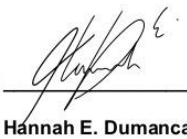
Student Signature : 

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ABSTRACT

Nail technicians are at risk of developing serious health conditions in the workplace. Poor workstation design has subjected technicians to hazards that range from prolonged chemical inhalation to work-related musculoskeletal disorders (WMSDs) that affect work performance and client satisfaction. Poor maintenance of nail salon furniture increases the chances of technicians' exposure to hazards, influences the quality of service provided by technicians, and decreases client loyalty while damaging the reputation of the nail technicians working in the salon. The following thesis provides an in-depth study on the technician's work environment by conducting user research and ergonomic studies to identify and address the factors associated with challenges technicians may face when working in a nail salon. The final design solution hopes to encompass a full-bodied human interaction and ergonomic design that reduces the risk of health hazards in nail salons while promoting a productive and safe working environment for nail technicians.

Keywords: Nail technicians, nail salon furniture, clients, nail salon work environment, work hazards

ACKNOWLEDGEMENTS

I would like to thank my professors, advisors, family, and friends for supporting me endlessly throughout the duration of this thesis. The level of quality, time, and effort I have placed into this thesis would have not have happened without them.

I would like to thank Catherine Chong and Fredric Matovu as my thesis supervisors. I appreciate all the guidance and feedback they have provided me for this project, pushing me to surpass my limits and to consider all possibilities. I would also like to thank my advisors Mariah Martin, Pamela, other survey and interview participants for sharing their experiences with the current nail salon environment that have contributed greatly to this thesis project.

I would like to thank and congratulate my peers of the 2023 class. Their companionship, feedback, and inspiring effort were key motivators for finishing this thesis project strong.

Shoutout to the cousins (you know who you are) for accompanying me in my work, keeping me awake, laughing, and motivated. Finally, I would like to thank my parents and cousin, Liberty, Roderic, and Nikki, for dealing with my messy workplaces, early morning work ethic, and supporting me from the sidelines.

Thank you!

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CHAPTER 1: INTRODUCTION

1.1 Problem Definition

Current workstations in nail salons do not accommodate working conditions for nail technicians. Often designed to accommodate the client rather than the nail technician, lack of ventilation and ergonomics in current workstation design causes work-related injuries to occur in technicians and worsen overtime. The use of multiple personal care products puts technicians at a risk of inhaling toxic chemicals leading to breathing problems, irritated eyes, and dry skin (CCOHS, n.d.). Work-related musculoskeletal disorders (WMSD) in the upper limbs and lower back are also prevalent due to awkward working positions and repetitive movement when filing and cleaning nails (CCOHS, n.d.). Such health hazards in the workplace have been constantly addressed in studies, reports, articles, and workers and have yet to be resolved. With this in mind, the goal of this thesis is to improve the current work environment for technicians to reduce risks of work-related injuries, improve technicians' health, allow them to work efficiently with minimal strain to their bodies, and work the hours they need to support themselves and their families while keeping clients satisfied.

1.2 Rationals & Significance

Given the various hazards associated with working in nail salons, this thesis topic allows an in-depth study into multiple areas of the nail industry associated with these pain points. To determine how the work environment could be improved in the nail industry, studying the technician's workflow, equipment use, and safety procedures may provide insight on the current state of nail salons, areas of improvement, and the discovery of other issues that could be addressed in the final design solution.

Key Questions to be Answered

With these considerations in mind, the following table below summarizes notable areas for research to be identified and answered:

Topic	Research Elements - Notable Areas for Research

Technician experience	- **Typical workflow (tasks)**
	  - Preparation
	  - Disinfecting process
	  - Manicure
	  - Pedicures
	  - Other services (nail art/nail enhancement)
	- **How long does it take to complete certain tasks?**
	- **Responsibilities**
	- **Workstation maintenance**
	- **Tool/implement use**
	  - What tools do they frequently use?
	  - Do they use the same tools for different types of services?
	- **How do they interact with other workers and clients?**

Client experience	- **What services do they book?**
	- **What are their expectations for a high quality salon?**
	- **Waiting times**
	  - How/where do they wait?
	- **Interaction with equipment/tools**
	  - How often do they get injuries from using equipment/tools?
	- **How do they interact with technicians and other clients?**
	  - Do they prefer engaging conversation with the technician or other clients?

Work environment	- **Location**
	  - Where do they place their items?
	  - Workspace surroundings
	  - Hazards
	  - Privacy
	- **Organization**
	  - Location and accessibility to frequently used tools
	  - Mobility around workstation
	  - How do they maintain their workstation?
	- **Product benchmarking:**
	  - Equipment/Furniture (pricing, usage, alternative solutions)
	  - Manicure table, Pedicure Chair/Station, Sanitization

1.3 Background / History / Social Context

The primary service nail technicians provide are manicures and pedicures. Technicians are also trained to massage clients' hands and feet as well as perform other skin treatment services such as facials. Their job is to also be effective communicators where they keep clients comfortable and give advice on nail hygiene and self-care. Success

in the nail industry depends on their client base and the quality of their service, technicians are often recommended through word of mouth.

Demographic Trends

According to Nails Magazine (2018-2019), the majority of technicians are female and middle aged (36-55: 63% of demographic). 74% are licensed technicians with 44% having a college degree (Nails Magazine, 2018-2019). Their typical income is at least $750. Mani-pedis, gel polish, nail art, and traditional acrylics are usual services offered by technicians. Technicians are required to be creative, flexible, accurate, patient, efficient, practice hygiene, knowledgeable in esthetics and self-care, and natural conversationalists in order to provide a top quality service clients expect (Betterteam, n.d).

Lifestyle Trends

Technicians typically work 36-40 hours with Saturday being the busiest day for their salon (Nails Magazine, 2017-2018). Technicians are required to participate in training where 78% train privately or independently online. Almost half (49%) of technicians are married with children and represent 91-100% of their household's income (23%) (Nails Magazine, 2017-2019).

Product Trends

Workstations in nail salons typically consist of a manicure table and pedicure chair where nail technicians provide manicure and pedicure services to clients. Majority of technicians provide their own supplies, tools, and equipment, usually renting a booth in a salon or work at an at-home studio (Nails Magazine, 2017-2018). Salon furniture and equipment is a costly investment, leading managers to purchase cheaper alternatives in the market that pose ergonomic, chemical, physical, and biological challenges for technicians and clients when in use.

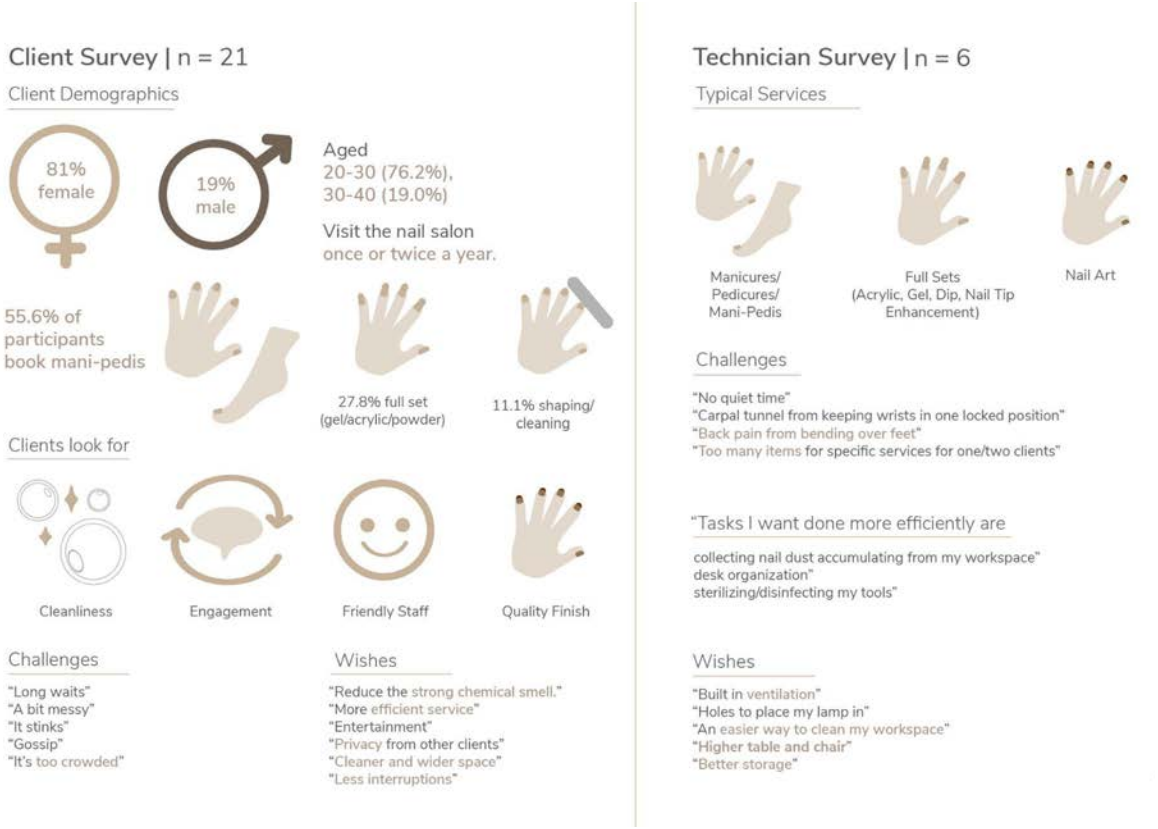
CH 2: RESEARCH

2.1 User Research

The following section provides context of the study for this thesis. This section will first provide a brief summary of the target demographic based on takeaways from user surveys, interviews, and video observation analyses. Chapter two also delves into findings related to product benchmarking, materials and manufacturing methods of existing products, and sustainable alternatives for materials found in those existing products.

2.1.1 User Profile - Persona

A user profile of the target demographic was produced from online articles and discussion forums, surveys, and interviews**.** Surveys with nail salon clients and 1:1 interviews with technicians and salon owners were also conducted to gain several opinions about the current work environment in nail salons **(figure 1).**



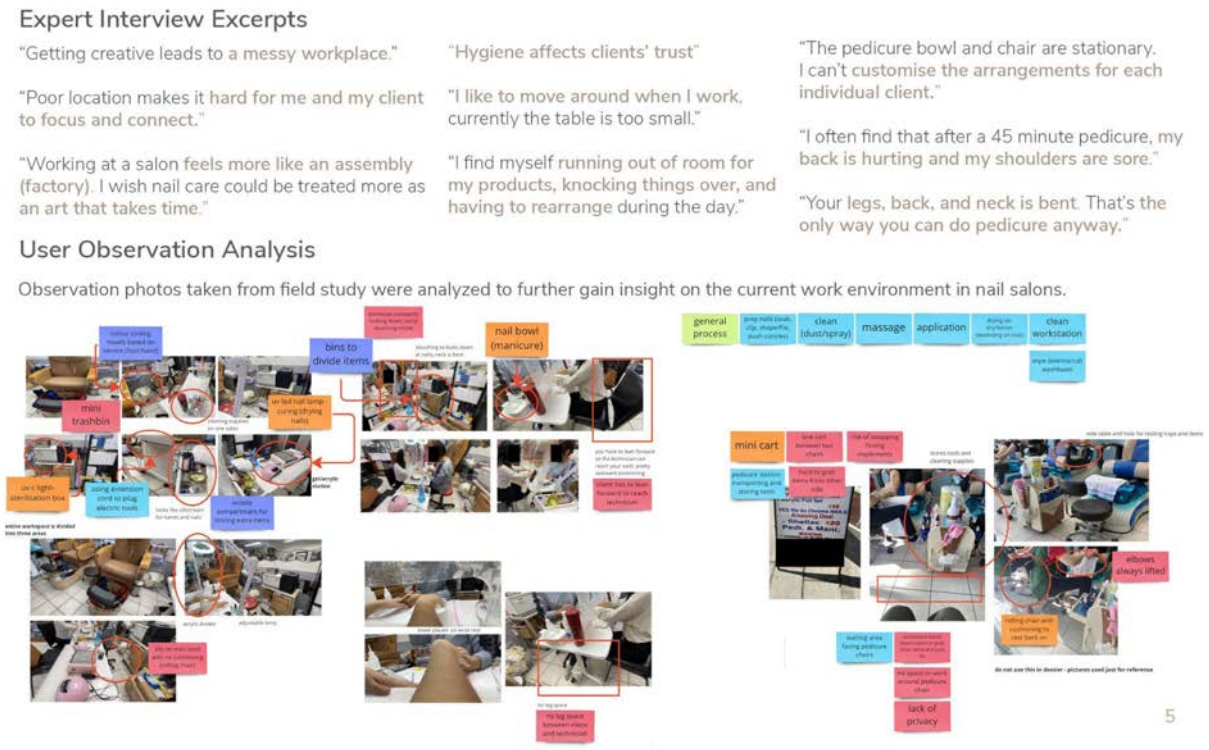


Figure 1 - Client survey and interview findings

Primary User: Nail Technician

Majority of technicians are women between the ages of 40 and 50 (Nails Magazine, 2018-2019). Common services technicians provide are manicures, pedicures, nail enhancements, and nail art **(figure 1)**. They are also responsible for sanitising their nail implements and workstation before and after use. Patience, diligence, and communication are key skills technicians are required to have to ensure clients enjoy a comfortable relaxing session. Technicians often work back-to-back appointments and are often expected to produce high quality nail finishes within a time frame (Betterteam, n.d). Notable challenges technicians face include back pain from constant bending and a crowded workspace leading to knocking items over and rearranging their workspace frequently **(figure 1)**.

Secondary User: Client

Clients visiting nail salons are typically female (81%) aged between 20 - 40 (95.2%). Most clients visit once or twice a year and book mani-pedis (55.6%), gel/acrylic/powder (27.8%), shaping/cleaning (11.1%). Depending on which service they pay for, clients also

have direct contact with the nail technician's workstation. Clients choose a salon through word of mouth; they expect a clean, fast, and engaging nail appointment with friendly and skilled staff performing a quality finish. Clients are usually at risk of injuries and cross-contamination if implements are not thoroughly cleaned or handled **(figure 1)**. Clients may also experience ergonomic and physical hazards if the technician's workstation is not properly equipped and messy.

Tertiary User: Salon owner

The salon owner manages and maintains the salon (Career Insights, 2022). Responsible for maintaining a safe and comfortable environment in the salon for both their clientele and staff, owners purchase nail salon furniture as well as supply products and tools while establishing safety procedures to reduce work hazards in the salon (Career Insights, 2022). When purchasing salon furniture, owners are more likely to purchase refurbished pedicure and manicure sets to accommodate multiple clients (Queueme, n.d.).

2.1.2 Current User Practice

Workstations in nail salons typically consist of a manicure table and pedicure unit(s) where nail technicians provide manicure and pedicure services to clients (Betterteam, n.d). How technicians set up and prepare their workstation influences the overall working and lounging experience for both technicians and clients.

Typical Procedure and Tasks when Performing a Manicure/Pedicure

Preparation and Placement

Since practising good hygiene is an important requirement for all nail salons, technicians are required to disinfect their workstation and nail implements before and after an appointment with a client (CCOHS, n.d.). When preparing their workspace for an upcoming appointment, the technician usually wipes their work surface and lays out implements and products required for the appointment **(figure 4)**. There are some implements that are constantly used by the technician such as nail cutters and cuticle trimmers, however additional implements (ie., skin remover, footbaths) are exclusively used

for pedicures. Frequently used products are usually placed near the technician for immediate access. Referring to **(figure 2)**, implements, polishes, and tools are placed on the left of technicians while cleaning products are placed on the right. Towels are also placed and changed every appointment to catch nail dust and cushion the clients' hand propped on the wrist rest **(figure 2)**.

Manicure and Pedicure Procedure

Referring to **figure 3**, the general process for both manicure and pedicure is as follows:

- Nail preparation and cleaning (sanitising/soaking the hands and feet, removing existing polish, trimming and shaping the nails and cuticles);
- Massaging the hands and feet (application of oil and lotion to exfoliate the hands and feet);
- Application (of polish, depending on clients' request, technicians can apply regular, gel, or acrylic polishes, powders, or monomers);
    - If the client requests a full set (mainly performed on acrylic and gel manicures), technicians glue plastic nail tips then apply the polish.
    - For acrylic full set nails, technicians will often shape the nail after application using an e-file or nail drill.
- Finish (technician buffs and applies a top coat then is left dry, depending on the kind of coat clients' nails are dried naturally or need to use a UV nail lamp to effectively cure the polish)

One notable habit technicians have during an appointment is that they separate used implements from clean ones using a working tray. Throughout both procedures, technicians tend to bend over the clients' nails to accurately shape and appl polish to the nails **(figure 4)**

Cleaning

After every appointment, technicians are expected to clean their workstation and nail implements before their next appointment with a client. Referring to appendix_ workflow, the technician's typical cleaning procedure is as follows:

- Throwing away used disposable files;
- Remove and replace towels (these towels may be exclusive for manicure and pedicures to avoid cross-contamination);
- Wipe and sanitise the workstation to remove excess nail dust, nail trimmings, and polish stains;
- Disinfecting nail implements (typical procedure involves washing the implements with soap and water → dry implements → soak implements in a barbicide jar or sterilisation box for about 20 minutes → take out the implements and wash the solution away thoroughly → leave to dry; **see section 2.1.4**).

2.1.3. User Observation - Activity Mapping

The following section illustrates the technicians' workflow through diagrams illustrating their workspace and procedures summarised in the previous section.

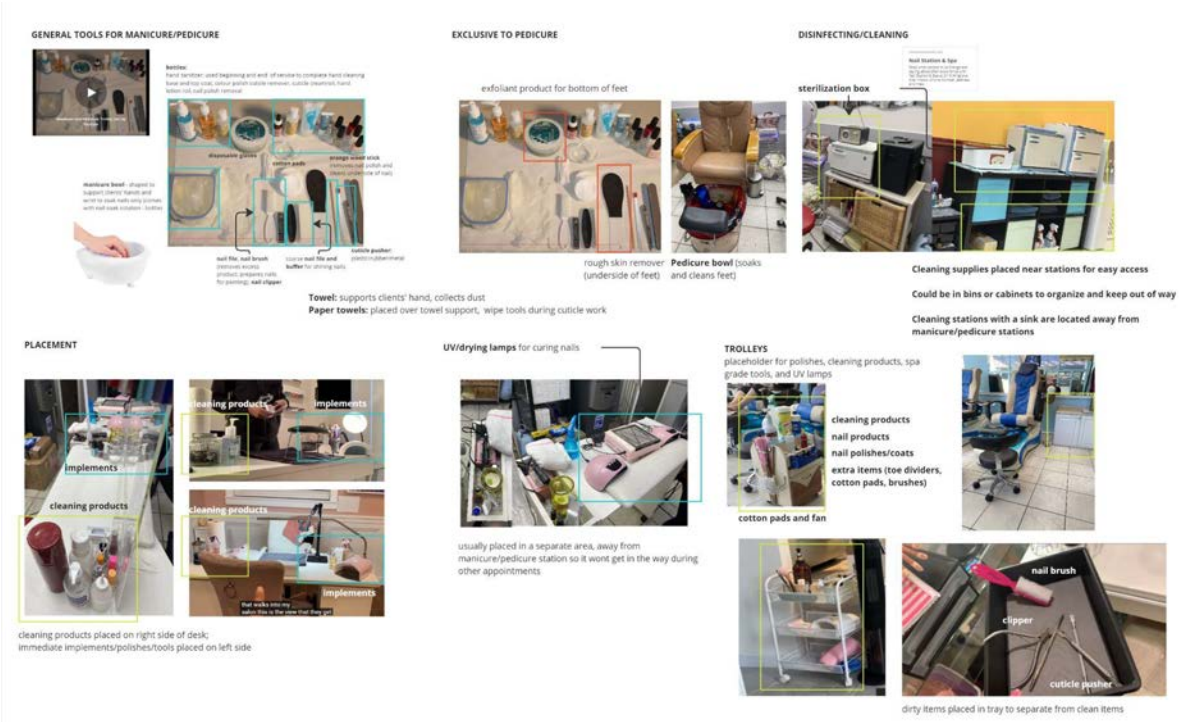


Figure 2 - Technician's Workspace, showing the general tools used for manicures and pedicures, and their placement around the workspace

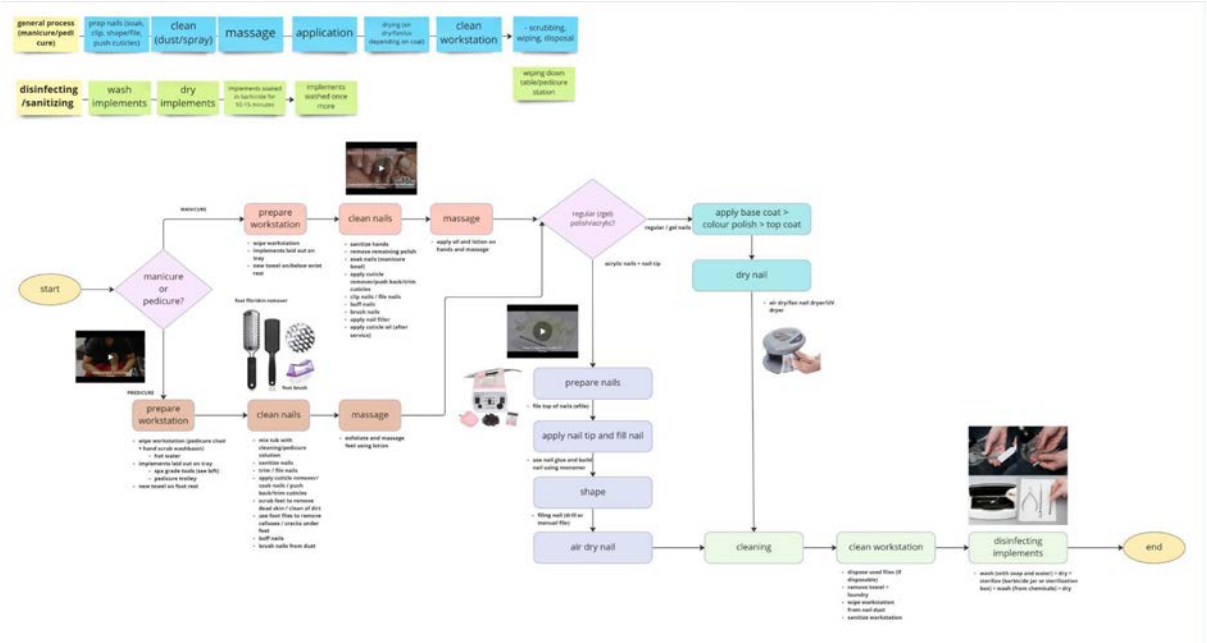


Figure 3 - Technician's Workflow, showing the general process of manicures and pedicures

Conclusion

The purpose of these diagrams was to understand the technician's workstation and experience in a daily setting. Producing a workspace and activity map helped identify notable habits and behaviours from technicians when performing a manicure and pedicure. Mentioned in the previous section, the placement of nail implements and nail products is based on the technicians' accessibility to certain items around their workspace. For instance, cleaning products and implements are the closest to the technician because they are frequently used **(figure 2)**. While bigger items such as cleaning supplies and drying lamps that are used less are typically placed in separate areas to prevent disrupting the technicians' workflow during appointments **(figure 2)**.

2.1.4 User Observation - Human Factors of Existing Products

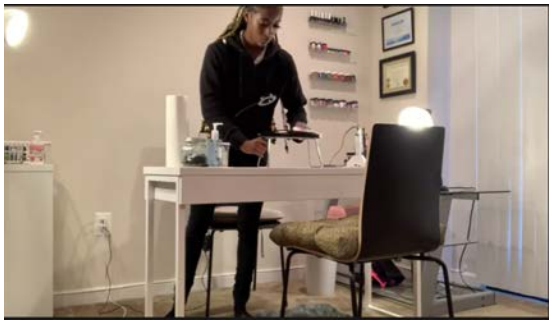
The following section will be highlighting the human factors of existing products in a typical nail salon setting. Using videos as the main study of observation, images and captions will be presented below to point out the ergonomics of current manicure desks and pedicure chairs and how technicians interact with existing products.

Manicure Tables

Video One - Acrylic Full Set Appointment on a Manicure Desk (Home Studio)

- Addresses instance of repetitive muscle movement and hygiene practice

https://www.youtube.com/watch?v=qLJfHdoQPv0 -**28:42**




Preparing workspace: technician wipes work surface (left); Upclose image on top right shows **towel placed under client wrist arm to collect dust** (seen on next series of images below)



Workspace During and After Session: technician using filing and buffing tools to shape nails. Middle image shows the amount of dust that can accumulate from shaping nails; the technician is also seen **wearing safety glasses to keep her eyes protected from the dust.** Last image **shows the amount of space her tools and cleaning items take up on her work surface**.



Cleaning used implements: technicians cleaning process: brushing implements with nail brush soaked in water and soap → wiped with towel → placed in a barbicide jar for 10 minutes. She separates dirty from clean implements by placing dirty implements on a mini tray and storing clean implements in a jar, labelled. **Washing procedure involves a lot of scrubbing and wiping. Direct contact with chemical solution may irritate skin if not careful with handling.**

Video Two - Manicures (Salon Setting)

- Addresses Posture and cleaning procedure

https://www.youtube.com/watch?v=6pp_7iEvKTk - **26:49**


Manicure: Shows technician's working posture. Frequently seen **slouching and bending** to trim and paint nails.

Cleaning at the end of day: Small plastic bag hanging on the side of the desk. Easy to pick up, replace, and throw away. No signs of a vent for collecting dust.

In-person Photo Observation

- **Addresses posture, spacing, accessibility and reach**

Desktop: shows frequently used items used in every session **(ie., tools, cleaning products, lights/electronics) for immediate access.**

Drawers: images above show all the charms, add-ons, and extra tools used for different purposes. Technicians use **different containers and racks to store and divide these items for easy location and access.** Last image are the different pigments she uses for clients' chosen nail colour; these containers holding pigments **take up almost most of her drawers** on the right of her workstation.


Behind technician's workstation: Extra items not frequently used are stored in the back drawer for later use. Right image shows her colour display and license facing clients to prove her legitimacy as a technician and allowing clients to choose colours **without having to turn away or move from facing the client (natural resting position)**

Figure 4 - User Observation Findings, Manicure Table

Pedicure Unit

Video Two - Manicures (Salon Setting)

- Addresses Posture

https://www.youtube.com/watch?v=6pp_7iEvKTk - **26:49**

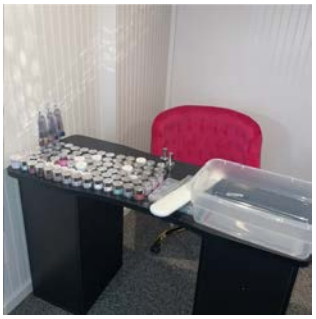

Manicure: Shows technician's working posture. Frequently seen **slouching and bending** to trim and paint nails. Both images show technician **using footrest to lean against when working on the clients' nails.**

In-person Photo Observation

- **Call outs address posture, spacing, and location of items (accessibility and reach)**

Figure 5 - User Observation Findings, Pedicure Unit

2.1.5 User Observation - Safety & Health of Existing Products

Manicure Tables	Pedicure Station
 Stationary desk (office desk)  Portable desk (folding)	  Pedicure chair, washbasin/footbath, technician stool
Pros: **Built-in vacuum** for collecting nail dust and chemicals. Open area allows **mobility for technicians around the workspace**.	Pros: **Modular and adjustable parts**. Takes up minimal space around the nail salon. **Easy to assemble.**
Cons: **Heavy/fragile to move**; technicians have to bend over because they are too short; limited working space for storing tools/products.	Cons: **Leaking wash basin. Jet/electric washbasins can be a potential biological/electrical hazard**. No back support/proper cushioning on the tech stool.

2.2 Product Research

Product research was conducted to gain general insight on nail salon furniture existing in the nail industry. Taken and based on promotional media advertising and reviews on each product, the following section will highlight the benefits and features, functionality and aesthetics of different types of current manicure tables and pedicure chairs in the market.

2.2.1 Benchmarking – Benefits and Features of Existing Products

The benefits and features of manicure tables and pedicure units were compared and illustrated using a product comparison table **(figure 6 and 7)**. To further understand how technicians interact with each product, a product table and graph was created to demonstrate the main touch points common in each product category **(figure 8 and 9)**.

Figure 6 - Benchmarked Product Benefits and Features

1	2	3	4	5	6
Manicure Table	**Manicure Table**	**Manicure Table**	**Pedicure Chair**	**Pedicure Chair**	**Pedicure Chair**
					
LEIBOU Folding Manicure Table	**Taylor Foldable Manicure Table**	**MCombo Craft Table**	**Lorvain Pedicure Stool**	**LCL Adjustable Pedicure Unit**	**La Rêve Pedicure Spa**
$119.99	**$315.00**	**$409.99**	**$139.00**	**$549.88**	**$2495.00 - $2995.00**
Benefits					
- Provides storage - Easy to move - Scratch resistant - Vent collects nail dust	- Provides storage - Portable - Convenient - Foldable - Durable - Customizable	- Easy to wipe - SleekPadded client wrist rest provides comfort - Provides storage range from light	- Adjustable foot rest and stool - Multifunctional	- Adjustable - Easy to clean - Customizable - Comfortable - Fillable and removable washbasin	- Ergonomic - Adjustable - Acetone resistant - Includes ventilation system

- Easy to store and carry		to heavy appliances - Quiet and smooth when moving			
Features					
- Carry bag - Nylon lockable wheels - Vented surface with fan - Plastic protective film - Foldable metal legs	- Side handles, chrome - Several drawers - Foldable table	- Melamine faced board - Wrist rest - 4 removable drawers - Acetone resistant - PVC edging coat - Lockable wheels - Drawer rail and damper hinge	- Steel frame - Leather footrest and seating	- Steel frame - Foam padded seat and footrest - Hydraulic pump - Removable plastic wash basin with massage, bubble, and heat function - Internal heating element - Large massage ball	- Electric chair - PU leather - Pedicure bowl: pipeless magnetic jet system - Adjustable footrest and chair - Narrow tapered front - Flip-up side trays - Ventilation system

Figure 7 - Benchmarked Product Benefits and Features Takeaways

Top Benefits of Benchmarked Products	
1	Provides storage
2	Adjustable
3	Customizable
4	Ventilation System
5	Easy to move/portable
Top Features of Benchmarked Products	
1	Metal frame (steel)
2	Rolling/lockable wheels
3	Removable drawers
4	Padded seat and footrest (leather)
5	Foldable

Figure 8 - Benchmarked Product Main Touch Points (Features)

1	2	3	4	5	6
Manicure Table	**Manicure Table**	**Manicure Table**	**Pedicure Chair**	**Pedicure Chair**	**Pedicure Chair**
					
Wrist rest Dust bag	Wrist rest Handles (side and drawer)	Wrist rest Handle (drawers)	Knobs (foot rest and technician stool)	Foot pump (pedicure chair) Knobs (foot rest and technician stool)	Foot rest Shower handle Temperature dials

Figure 9 - Product graph of major touch points found in existing competitor products

Results - Comparative Analysis

The top benefits of both product categories are that they provide storage, are adjustable, allow option for customizability, and include a ventilation system (vent or fan). Some of these manicure tables and pedicure units are portable as well **(see 2.2.2; figure 10)**. Majority of these products consist of metal and plastic to stay durable and resistant to wearing overtime. Two of the manicure tables **(figure 6 - product 1 and 3)** include a protective film or acetone coating on the surface to resist polish spills. Majority of manicure tables also have wheels for portability, with some being foldable **(product 1 and 2)**. Furthermore, storage systems are built in some manicure tables **(product 2 and 3)** to fit multiple nail implements and products. Both product categories include padding in the wrist rest, seat, and footrest designed to keep clients comfortable throughout the session.

Referring to **figure 6**, notable touch points found in manicure tables are wrist rests and handles located on the drawers and sides of the table for ease when opening drawers and moving the tables around the salon. Foot pumps are found located around some pedicure units for adjustability. Knobs and dials are also located in front of the footbath for the technician to access and adjust the water settings to their convenience. Other criteria that can be evaluated/addressed for future study include:

- Material differences to indicate touch points
- Material differences to indicate function (support, comfort, resistance to heat/impact/etc)
- Ease of interaction (dial location and size)
- Portability (weight, lift points)
- Cleaning (is it easy to clean?)
- Interface for controlling fan/vent

2.2.2 Benchmarking - Functionality of Existing Products

The functionality of each product was identified then compared using a product graph. The variables used were height (inches) and portability (appearance/materials).

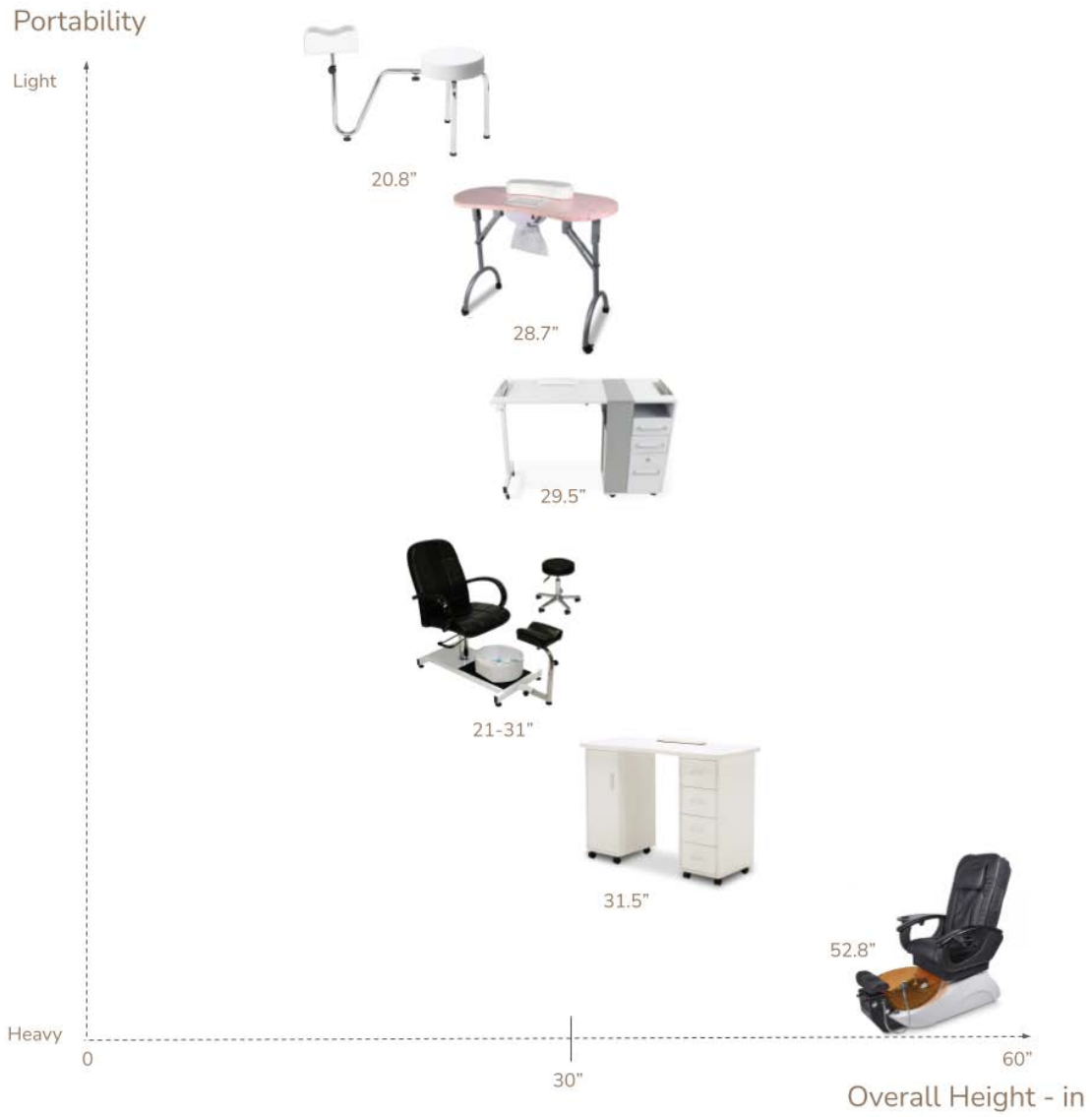


Figure 10 - Product graph of functionality between existing competitor products

Results - Comparative Analysis

A notable takeaway from this comparison is that the lighter and shorter the product, the less features or compartments they include to keep it portable. Majority of portable products include wheels to manoeuvre around salons. Meanwhile heavier and stationery products include more features (massage, water, drawers). Mentioned in 2.2.1, majority of products contain metal, plastic, and padding that also influence the weight and visual

appearance of each product. Lighter manicure tables use steel tubes for easy handling while folding. Heavier products tend to be larger and incorporate a variety of plastics and metals to house different heating and electric components.

2.2.3 Benchmarking - Aesthetics and Semantic Profiles of Existing Products

An aesthetic assessment was conducted below to determine design trends in existing manicure tables and pedicure chairs. Notable features were identified in the table below using the Elements of Design then compared using a product graph.

Figure 11 - Benchmarked Product Aesthetics

1	2	3	4	5	6
Manicure Table	**Manicure Table**	**Manicure Table**	**Pedicure Chair**	**Pedicure Chair**	**Pedicure Chair**
					
Overall Form (categories below reflect type of product selected)					
Shape	Rectilinear Rounded ends	Rectilinear	Rectilinear	Organic Cylindrical	Rectilinear, cylindrical	Organic
Repetition (holes, lines)	Vent Detail 	Drawer handles 	Drawer handles 			
Pattern		Colour Scheme (white - grey - white - grey) 		Colour Scheme (white - grey - black - grey - white) 	Colour Scheme (black - grey) 	
Balance (symmetry)	L & R ends	Asymmetrical L & R	Asymmetrical L & R	Asymmetrical (seat shape, frame, legs, knobs)	Symmetric (seat shape, armrest, frame, legs, knobs)	Symmetric (seat shape, armrest, frame, legs, knobs)

Figure 12 - Product graph of aesthetics between existing competitor products

Results - Comparative Analysis

Aesthetic differences between the benchmarked products were compared based on their shape and form, patterns, and visual balance. In terms of shape, each product was identified to have a rectilinear, rounded, or organic shape. Some products shared similar visual cues in forms (ie., soft or geometrical edges). Majority of products featured in the product comparison graph tend to use three to four colours to indicate the different use and function for each component. Patterns in vent detail and drawer handles are found in manicure tables. All competitor products are symmetric or asymmetric based on their overall shape, frame, legs, as well as knob and arm rest placement. Geometric manicure tables appear to be heavier due to the amount of material being used to create its box-like structure. Meanwhile, more cylindrical and rounded manicure tables appear lighter from using less material allowing more negative space between the seating and metal frame.

2.2.4 Benchmarking – Materials and Manufacturers of Existing Products

Materials of Existing Products

Salon managers choose nail salon equipment based on their appearance, longevity, and comfort. Salon managers tend to purchase light and durable nail salon equipment that lasts a long time **(see 2.2 - Product Research)**. Nail furniture varies in material but are typically made of steel, plastic, wood with protective coating, fibreglass, and leather upholstery. Nail furniture containing these types of materials tend to last longer, are relatively lightweight, corrosion resistant, and easier to clean.

2.2.5 Benchmarking – Sustainability of Existing Products

Majority of salon furniture use fibreglass for bigger components. Fibreglass is non conductive, cost effective to produce, has high strength, and is lightweight (USPedicurespa, 2019). However, fibreglass fabrication can produce toxic air pollutants and is difficult to recycle (United States Environmental Protection Agency, n.d.). Current alternatives that share similar qualities to fibreglass with a longer recycle lifetime are aluminum alloys (6061) and PP

To ensure the final design solution meets the sustainability and social responsibility criteria of this thesis, green alternatives were researched with the intention of maintaining these qualities. Since the majority of nail salon furniture reflect comfort, style, and safety, the materials used in sustainable office seating that also address these qualities were used as a reference.

Alternative Sustainable Solutions to Existing Materials

Current alternatives that share similar qualities to fibreglass with a longer recycle lifetime are aluminum alloys (6061). Aluminum alloys are high strength and resistant to moisture absorption, thus often used for outdoor and indoor applications (Jon, 2021). Aluminum can also be recycled infinitely without reducing its quality and value **(see figure 13)** (The Aluminum Association, n.d.).

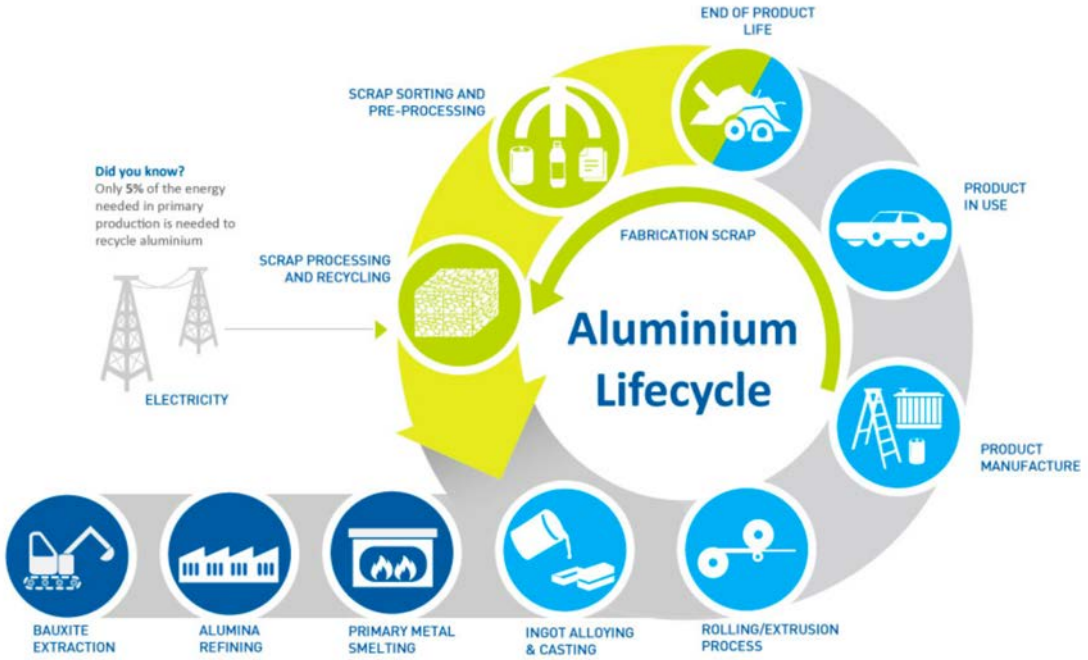


Figure 13 - Aluminum lifecycle. Source:https://www.hulamin.com/about/aluminiums-lifecycle

Meanwhile, PP is a commodity thermoplastic resistant to water, mold, and bacteria, making it easy to clean. PP is also durable, lightweight, and the most efficient material to manufacture due to being a thermoplastic (Adreco Plastics. n.d.). PP is not the easiest plastic to recycle but a current practice does exist. PP scraps are shredded, separated, then melted to create pellets reused for smaller applications such as storage bins and synthetic fibres (Palmetto Industries, 2021). There is also evidence of recycled PP being used to mold seating for office chairs, as demonstrated by Ahrend office furniture brand.

Figure 14 - Ahrend brand's WELL Circulair Black seating. (Source: https://www.ahrend.com/en/collection/materialisatie/kunststof/)

Newer solutions to PP are engineered plastics from Covestro such as Makrolon and Texin that are engineered to reduce CO2 emissions during manufacturing (Covestro, n.d.). Makrolon is just as lightweight and strong as PP while Texin TPU resins come in different grades that can produce both soft and hard plastics suited for a variety of applications (Covestro, n.d.). Makrolon and Texin are currently used for smaller applications but have the potential to be used for areas of a nail salon workstation that require durability.

Figure 15 - car exterior made of high performance Makrolon® polycarbonate

(source:https://solutions.covestro.com/en/highlights/articles/theme/applications/automotive-exterior)

Figure 16- Texin ® thermoplastic polyurethane (TPU) used in optical testing application

(source:https://solutions.covestro.com/en/highlights/articles/theme/product-technology/optical-properties)

In terms of upholstery, an alternative that is more beneficial to use for the environment rather than synthetic leather padding is AppleSkin leather. AppleSkin leather, made with leftover pomace from apple juice manufacturing, imitates the appearance of natural leather, is durable, hypoallergenic, and easy to clean due to moisture resistance (Gusmodern, n.d.). It is a breathable material that takes longer to crack and wear compared to synthetic leather (Vegatex, n.d.). Currently being used for fashion products, appleskin leather is an alternative that promotes upcycling food waste into a durable product that could replace leather cushioning found in existing nail salon furniture.

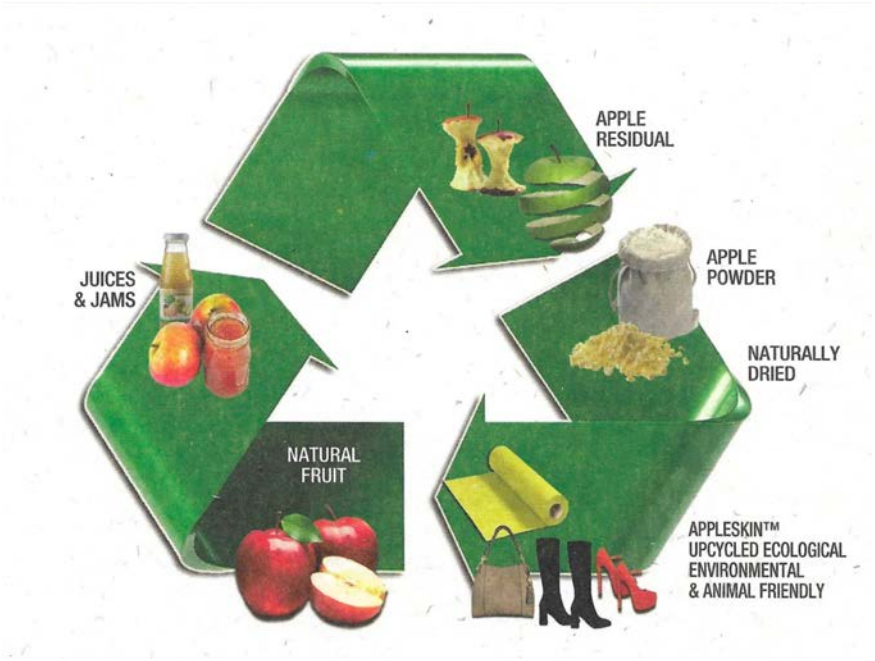


Figure 17 - AppleSkin Leather Product Cycle

(source:https://barefashion.co.uk/blogs/blog/an-apple-a-day-what-is-apple-leather)

Manufacturing

6061 aluminum is the most cost-effective and efficient alloy to machine (Jon, 2021). Die casting aluminum alloys, in particular, is a sustainable metal forming process that involves reusing and recycling molds without wasting material (A&B Die Casting, n.d.). Injection molding PP is another efficient process when having to form complex shapes in larger volumes with minimal waste production (Makenica, 2022). Solvent-free powder

coating parts helps enhance the durability and longevity of aluminum and PP and also requires less energy to perform by using less air pollution control equipment to contain toxic vapours (Ronquillo, n.d.).

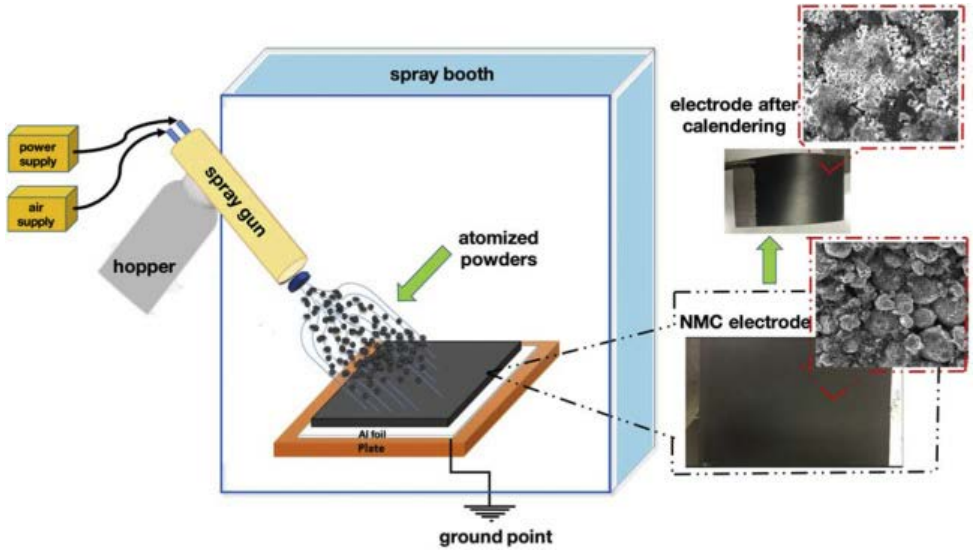


Figure 18 - Solvent-free powder coating. (Source: https://www.sciencedirect.com/science/article/abs/pii/S0378775317304457)

2.3 - Summary of Chapter Two

Research findings from chapter two are summarized as follows:

- Manicures, pedicures, nail enhancements and nail art are common services performed by technicians; clients expect a clean, fast, and engaging nail appointment with friendly and skilled staff.
- Technicians work in manicure tables and pedicure units. Salon furniture is expensive, causing owners to purchase refurbished pedicure and manicure sets that are not comfortable to work in.
- Technicians typical workflow: preparation and placement of implements → manicure/pedicure procedure (nail preparation, massage, application, finish) → cleaning workstation
- **Problem areas from user observation**: dust accumulation from filing nails, bent posture due to lack of support, client forced to lean in to reach technician, technicians have too many items to work with (organizing and locating implements becomes difficult), lack of privacy when salon is busy, disorganized workspace leads to risk of swapping and losing items.
- **Findings from product benchmarking:** Heavier products allow housing of more electronic components, making them more functionable. But they also take up a lot of space. Lighter products consist of fewer components but make them susceptible to breaking easier. Areas that were not addressed in research is time it takes to clean a workstation, how products are assembled, and the specific materials used, manufacturing and packaging.

These takeaways are useful for establishing the problem areas associated with the current nail salon work environment.

CHAPTER 3: ANALYSIS

3.1 Analysis - Needs

The following section provides an analysis on the research findings presented in chapter two. Firstly, findings from **sections 2.1.3 and 2.1.4** will be used to establish the benefits not met by current products. User needs will be determined by categorizing fundings using STEEPV analysis which will help in developing a needs statement that correlates with the problem definition of this thesis. From there, key takeaways gathered from this chapter will be combined to establish opportunities that innovate current nail salon workstation design in the form of a design brief.

3.1.1 - Needs and Benefits Not Met by Current Products

Based on findings from **sections 2.1.3 and 2.1.4** and comparisons conducted from product graphs **(see 2.2 product benchmarking),** benefits not met by current products are

- More working space
- Comfortability for technician rather than client
- A more ergonomically design workspace (seating and padding)
- More efficient way to clean their workspace

3.1.2 - Latent Needs

Method

To gain more insight on the needs of the primary user of study, technicians, a STEEPV analysis was conducted to identify the trends impacting the technicians' working experience in existing salons. All findings mentioned in chapter 2.2 were categorised using a mind map according to social, technological, environmental, and value trends then organized in a design matrix to determine what key problem areas or user needs should be addressed.

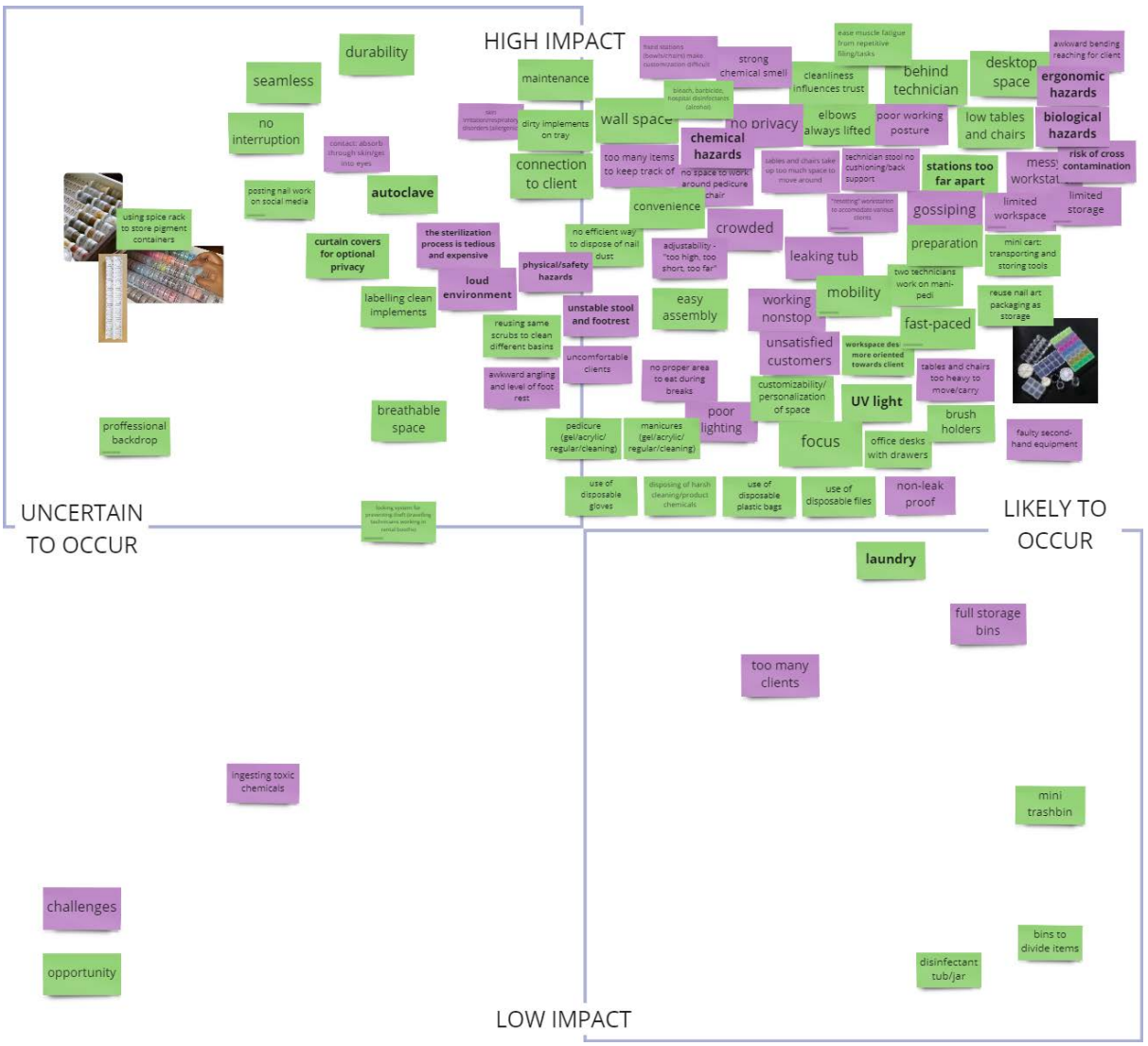


Figure 19 - Product graph of aesthetics between existing competitor products

Finally, a table highlighting key trends that are likely and unlikely to occur was generated to organize the information further into what problem areas should be prioritised **(figure 20)**.

Figure 20 - Key Trends from High Impact - Likely and Unlikely to Occur

KEY TRENDS FROM HIGH IMPACT - LIKELY TO OCCUR QUADRANT

- use of faulty second-hand equipment:
  - low tables and chairs results in poor working posture from bending to reach client
  - bending neck to see clients' nails
  - developing/worsening muscle fatigue from repetitive filing/scrubbing
  - technicians' elbows are always lifted
  - want: easy assembly
  - unstable stool and footrest
  - workspace designed for client than technician
  - poor lighting

- messy workstation:
  - limited storage and workspace
  - no space to work around pedicure chair
  - too many items to keep track of
  - knocking items over
  - risk of spills
  - "resetting" workstation to accommodate various clients

- job is fast-paced and requires a lot of mobility
  - pedicure, manicure, and cleaning stations are far apart and divided
  - swapping items/injuries from sharp implements - risk of cross contamination
  - leads to interruptions during service
  - want: convenience

- use of bleach, barbicide, hospital disinfectants (alcohol)
- non-leak proof jars/tubs
- strong chemical smell
- no privacy
- loud working environment
- no proper area to eat during breaks

- want: customization/personalization

- fixed stations limits mobility and customization around workplace
  - crowded working space
  - using mini trolley carts for transporting and sorting tools

- use of available space
  - desktop, walls, behind technician

- current solutions:
  - reusing nail art packaging
  - use of disposable files
  - use of disposable plastic bags
  - disposing of harsh cleaning/product chemicals
  - UV light/fans for curing/drying nails

KEY TRENDS FROM HIGH IMPACT - UNCERTAIN TO OCCUR QUADRANT

- durability - long lasting and strong equipment
- seamless workstation - no interruptions
- breathable space
- use of autoclaves - expensive
- contact with harsh chemicals - skin irritant/allergy
- loud working environment (depending on how busy the day is/implements being used)

- current solutions:
  - curtain covers for optional privacy
  - spice rack organizer
  - want: professional backdrops for posting nail work on social media

Results

According to **figure 20**, possible areas that correlate with technicians' and clients' latent needs involve the following:

Latent Needs related to Ergonomics (Comfort)

- Higher tables and chairs that reduce instances of neck bending while working
- Improved lighting
- Easy assembly of overall workspace
- Support for technician's arms while working
- Improve working posture, reduce muscle fatigue and neck/back pains to increase productivity

Latent Needs related to Accessibility and Reach

- Improved access to storage and multiple items in workspace
- Reduce chances of knocking items over and spillage
- Breathable space to move and work within workspace
- Seamless workstation that prevents interruptions
- Keeping track of items, even when workstation is "reset" to accommodate various clients throughout the day

Latent Needs related to Efficiency

- Reducing the strong chemical smell emanating from constant use of cleaning products, nail products, and/or hospital disinfectants
- Improve privacy for clients when needed
- Reduce loud working environment to encourage focus and concentration

Technicians' jobs and appointments are fast-paced and require a lot of mobility around the salon. Customizing the space around them, technicians look for a convenient and durable workplace that reduces risk of biological, ergonomic, and chemical hazards and will improve their productivity, efficiency, and wellbeing.

3.1.3 Categorization of Needs

All findings from product benchmarking and STEEPV analyses were summarised into the immediate needs, latent needs, and wishes from users belonging to different demographics of study. The purpose of this chart is to categorise the possible needs associated with each user in relation to the problem definition.

Figure 21 - Categorization of Needs

From there, a needs statement has been developed overtime to consider all possible user needs while having the technician as the main focus:

Needs Statement 1 - Before Research

Technicians need to make improvements to their work area to work efficiently.

Needs Statement 2 - After Benchmarking

An adjustable and modular manicure and pedicure station including all major components (manicure unit - ventilation, wrist rest, lighting; pedicure unit- pedicure chair, footbath, foot rest, and technician stool) will help improve the technicians' work efficiency. An ideal workstation provides space and storage for easy access to improve

workflow. Ventilation in both stations and temperature change to footbath in pedicure units are additional needs to protect clients and technicians from chemical inhalation and bacterial contamination.

Needs Statement 3 - After Benchmarking and Linking with Fundamental Human Needs

Pedicure chairs with added controls and other functions (ie.,temperature, massage, cup holders) will further enhance client experience and technician efficiency. Both client chair and technician stools should consider human factors and padding to prevent any strains from uncomfortable sitting or working positions. The style of a manicure and pedicure station determines the mood of the salon. Promoting cleanliness and aesthetics will encourage clients to return or influence clients' opinion on the salon.

3.2 Analysis - Usability

The technician's workflow and working experience was analysed using a journey map and user experience map to identify the possible pain points and points of delight technicians may experience on a daily basis. Both the journey map and user experience map illustrate the scenario of a technician performing an acrylic nail manicure. Summary of findings is provided in the conclusion section below.

3.2.1 Journey Mapping

Journey Map | Scenario: Acrylic Nail Manicure

Images from: https://www.youtube.com/watch?v=gLJfHdoQPv0

	Planning	Preparation	Cleaning/Shaping Nails	Applying Acrylic Monomer	Shaping Nails	Goal	Cleaning after Appointment	Finishing Up
User Goals	**Tracking appointments and services** booked for the day	**Preparing tools and nail products** before appointment	Preparing nails before applying products	Developing nail design. **Ensure clients are relaxed and comfortable** throughout process.	**Filing and buffing nails** for a more polished look	**Seamless process with minimal disruptions or hazards**. Client is happy with final result.	Follow **cleaning procedures for disinfecting workstation and implements** before next client.	**Preparing workstation according to next service.** Ensure all required tools and products are ready for next appointment.
User Actions	Scheduling appointments. **Noting what services clients are booking for.**	Wiping down workstation. **Laying out tools and nail products**. Lay out **clean towel** under client's wrist rest.	Filing clients nails. Soaking clients' nails. Helping clients choose a look or colour.	Applying acrylic monomer. Making small talk with client. Paying attention to nail job.	Using **files (disposable/electric)** to shape clients nails. Wearing **safety glasses** to protect themselves from dust.	Applying finishing touches. If job is well done, **taking photos for posting on social media.**	Wipe down station. **Dispose used files and replace dirty towels.** Washing implements. Put implements inside **barbicide jar.**	Wiping down workstation. Laying out tools and nail products. Lay out clean towel under client's wrist rest.
User Thoughts	"What will I need to prepare for this appointment?" "How long will this service take before I can take the next client?"	**"Do I have everything I need?"** "Is this a clean towel?" **"Are these tools clean?" "Where did I put ___?"**	"What do I have to do after this?" "Is there anything wrong with the clients' nails?"	**"The smell is too strong"** "This monomer is drying to quick, I can't shape it nail properly" "What areas need more filling" **"My arm and fingers are getting tired"**	"My arm and fingers are getting tired" **"Too much dust"** "What areas need more sanding/shaping?" "This is looking better/worse" **"My back is getting sore/wrist hurts"**	"I'm glad you like it!" "Can I take a photo to post on social media?" **"Let me clean my area before taking a picture."**	"When should I start cleaning before the next appointment? **"There's too many things to clean."** "Where should I put this towel?" **"What do I need to throw away?"**	**"Do I have the tools I need for the next appointment?"** "When is the next client" **"When should I take a break?"**
User Feelings	Thoughtful, contemplative	Thoughtful, contemplative, aware	Thoughtful, aware, focused	Focused, concentrated, troubled, tired	Focused, concentrated, troubled, tired, pleased/annoyed	Satisfied, accomplished	Thoughtful, contemplative, aware	Thoughtful, contemplative, tired
Storyboard								

3.2.2 User Experience

User Experience Map | Scenario: Acrylic Nail Manicure

	Planning	Preparation	Cleaning/Shaping Nails	Applying Acrylic Monomer	Shaping Nails	Goal	Cleaning after Appointment	Finishing Up
User Goals/ Actions	**Tracking appointments and services** booked for the day	Wiping down workstation. **Laying out tools and nail products.** Lay out **clean towel** under client's wrist rest.	Filing clients nails. Soaking clients' nails. Helping clients choose a look or colour	Applying acrylic monomer. Making small talk with client. Paying attention to nail job	**Filing and buffing nails** for a more polished look	**Seamless process with minimal disruptions or hazards.** Client is happy with final result. If job is well done, **taking photos for posting on social media.**	Wipe down station. **Dispose used files and replace dirty towels.** Washing implements. Put implements inside **barbicide jar.**	**Preparing workstation according to next service.** Ensure all required tools and products are ready for next appointment.
Problems/ Challenges	**Scheduling conflicts** with clients. Clients cancelling last minute or coming in late. **Back-to-back appointments limits breaks** and **reduces time frame for each client.**	**Knocking items over** due to **small working space. Unable to locate certain products or implements** required for appointment.	Technician and client are both at risk of **cross contamination if tools are not cleaned properly** or if client has **injuries/nail fungus. Interrupting service to grab misplaced items around workstation.**	**Repetitive movements and poor working posture overtime will cause soreness around the body.** Client and technician may feel **uncomfortable after sitting for a long period of time.** Interrupting service to grab misplaced items around workstation.	Client and technician are both at risk of **chemical inhalation from accumulation of dust if workstation is not ventilated properly.**	**No professional backdrop** for taking pictures of nails when desk space is **messy.** Taking **aesthetic pictures of nails** without **item/tools in the way.**	**Cleaning can be tedious.** Chemicals used for cleaning may be **harsh on hands and nails.** Items may be **misplaced during appointment, difficult to track** what needs to be cleaned **if multiple technicians are using it.**	
Ideas/ Takeaways	More **efficient and accessible** way to schedule appointments. Making the day more flexible for technicians.	Using **space available around technician to store cleaning supplies and items for easier access.** Must **not disrupt workflow.**	Solution should **separate and identify clean from used implements for more efficient location and rotation** between different implements	Adding **cushioning or armrests on technicians' side of workstation.** Design a more **mobile and comfortable** working space.	Implementing proper **ventilation** around workspace. Provide a more **efficient way to collect dust** during and after appointments.	Applying a **professional backdrop/area** for taking pictures of finished nails. May be **integrated with workstation as a separate area.**	Provide an **easier way to transport items to and from sanitization area.** Must separate and identify clean from used implements.	Using space available around technician to store cleaning supplies and items for easier location and access.

Conclusion

Referring to **sections 3.3.1 and 3.3.2**, one possible area where the technician faces the most challenges are during the appointment where cleaning, application of polish, and shaping of nails occur. Repetitive movement and poor working posture throughout these stages may reduce the energy and quality performance the technician had at the start of the appointment. Another possible pain point identified from the journey and user experience map is cleaning after the appointment in which locating and cleaning used implements frequently becomes tedious .

Areas of delight are located when preparing and finishing the appointment. According to technician survey and interview findings **(figure 1)**, technicians are happy to see their clients satisfied and view their occupation as expressing their passion for doing nail art.

With this in mind, major takeaways from the journey and user map that can be addressed in this thesis include the following:

- Using space available around technicians to store cleaning supplies and items for easier access. Must not disrupt workflow;

- Solution should separate and identify clean from used implements for more efficient location and rotation between different implements;
- Design a more mobile and comfortable working space;
- Provide an easier way to transport items to and from the sanitization area.
- Separate and identify clean from used implements.

3.3 Analysis - Human Factors

3.3.1 Product Schematic - Configuration Diagram

While the final design solution must address the needs of the technician, it is also required to ensure that the design is intuitive and user friendly. Below shows a product schematic containing the different components that make up a typical manicure table and pedicure unit. These components were then used as a reference to produce configuration ergonomic diagrams illustrating how the chosen design direction works. The purpose of the product schematic and configuration diagram was to visualise the design working in a 1:1 scale setting. Identifying the major touch points starting from the product schematic will help provide an idea of what areas the technician or client will be interacting with the most. Applying human factors and ergonomics as illustrated in **figures 23 - 25** will further improve the product usability and interaction in order to justify the main purpose the final design is attempting to communicate.

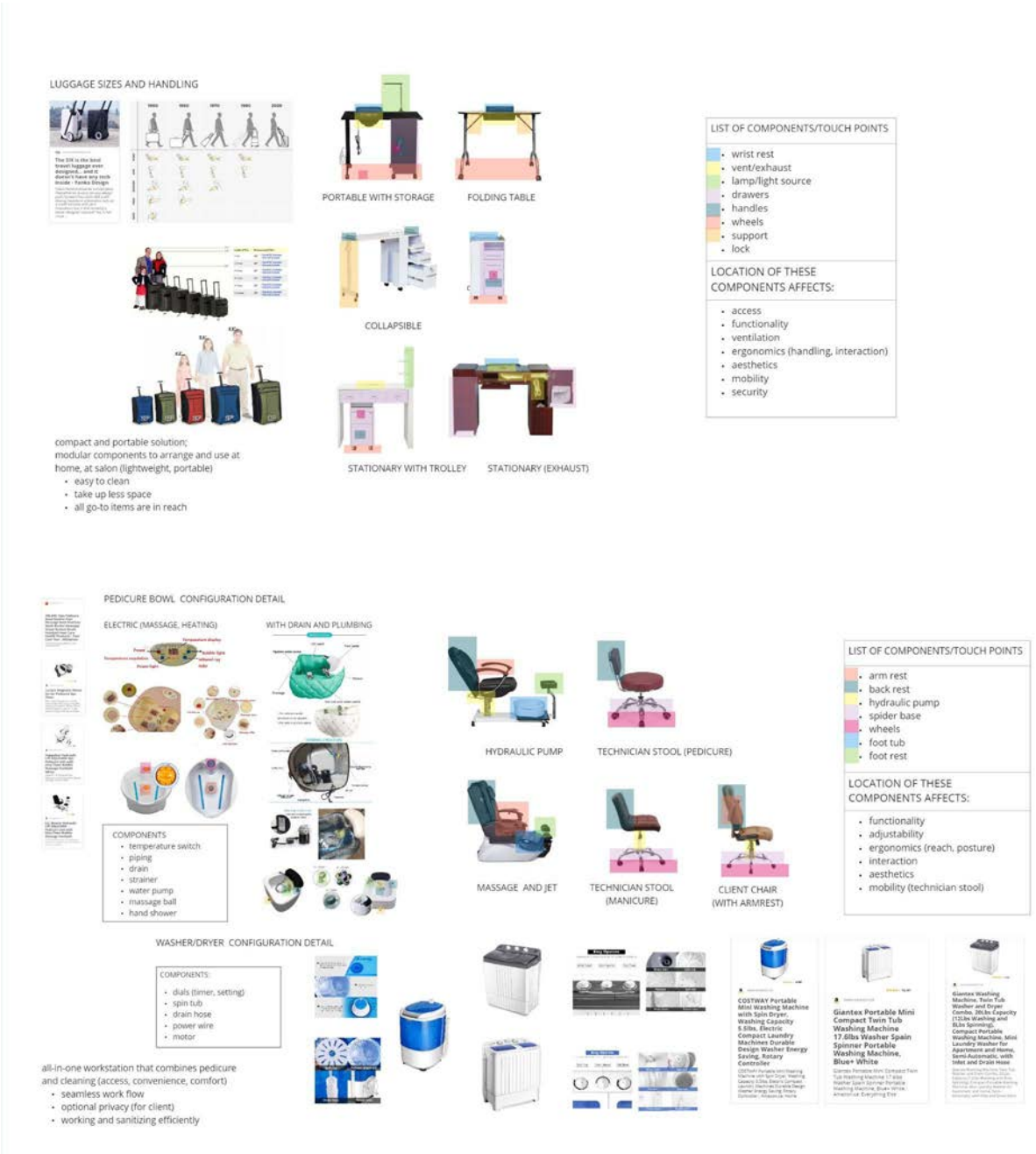


Figure 22 - Product Schematic of Existing Products

Configuration Diagrams

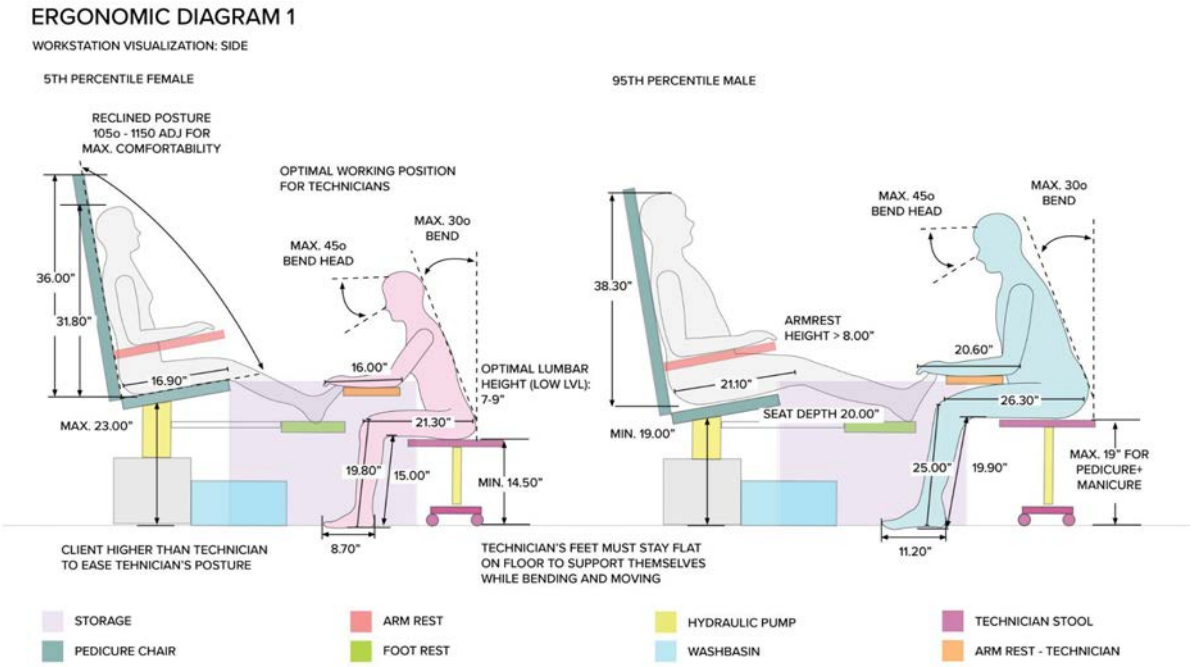


Figure 23 - Configuration Diagram 1: Workstation Visualisation from Side

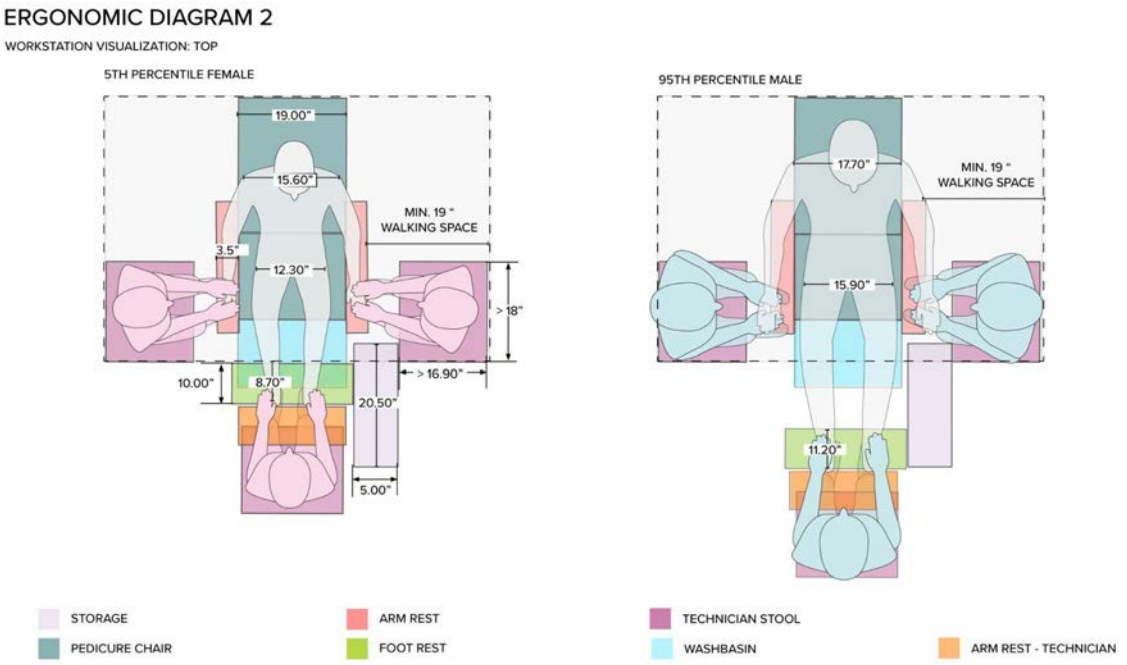


Figure 24 - Configuration Diagram 2: Workstation Visualisation from Top

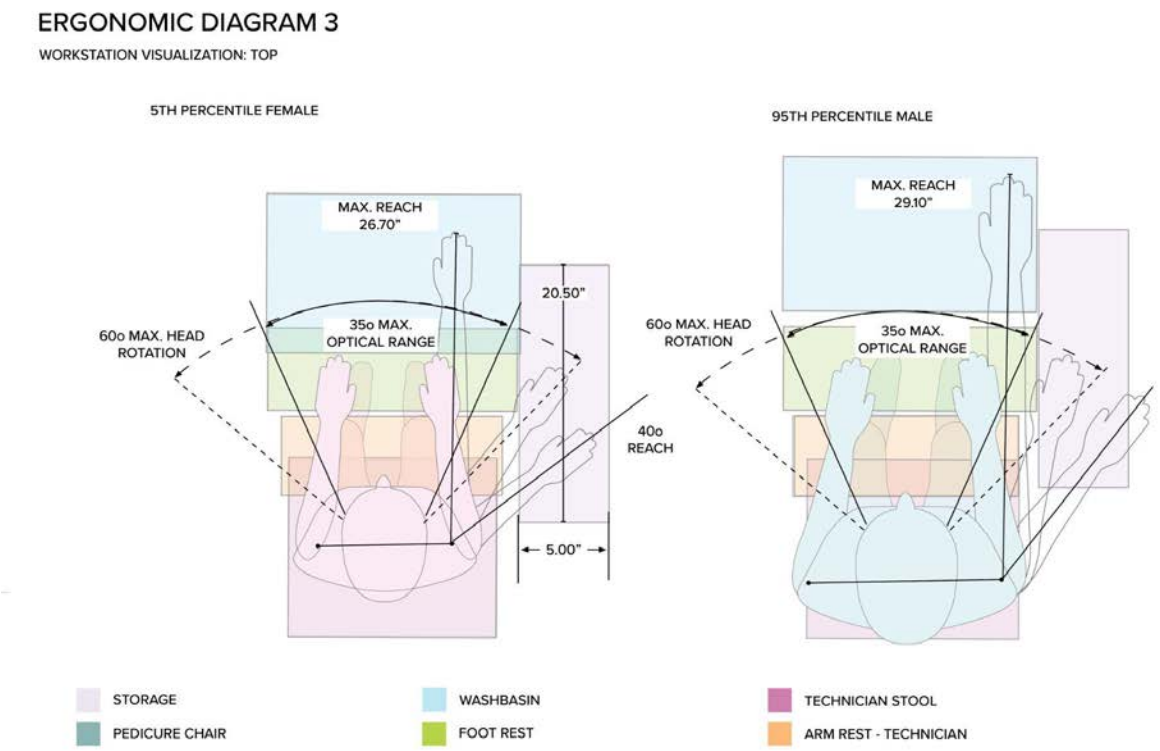


Figure 25 - Configuration Diagram 3: Workstation Visualisation from Top Reach Detail

3.3.2 Ergonomic - 1:1 Human Scale Study

In reference to the configuration diagram in **section 3.3.1**, a 1:1 ergonomic buck was created to demonstrate the useability and interaction between the user and the product. An observation and analysis of the ergonomic study was also conducted to identify the major touch points, justify the current design, and discover any ergonomic challenges found in the current design that needs refining.

Ergonomic Buck Photos

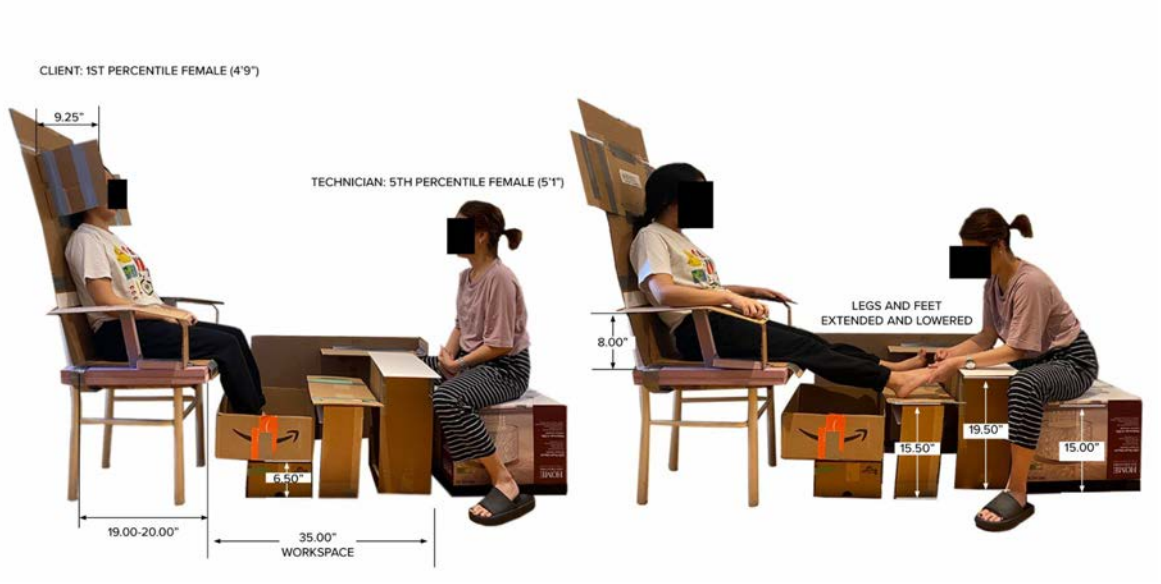


Figure 26 - Pedicure Side View. Client and Technician

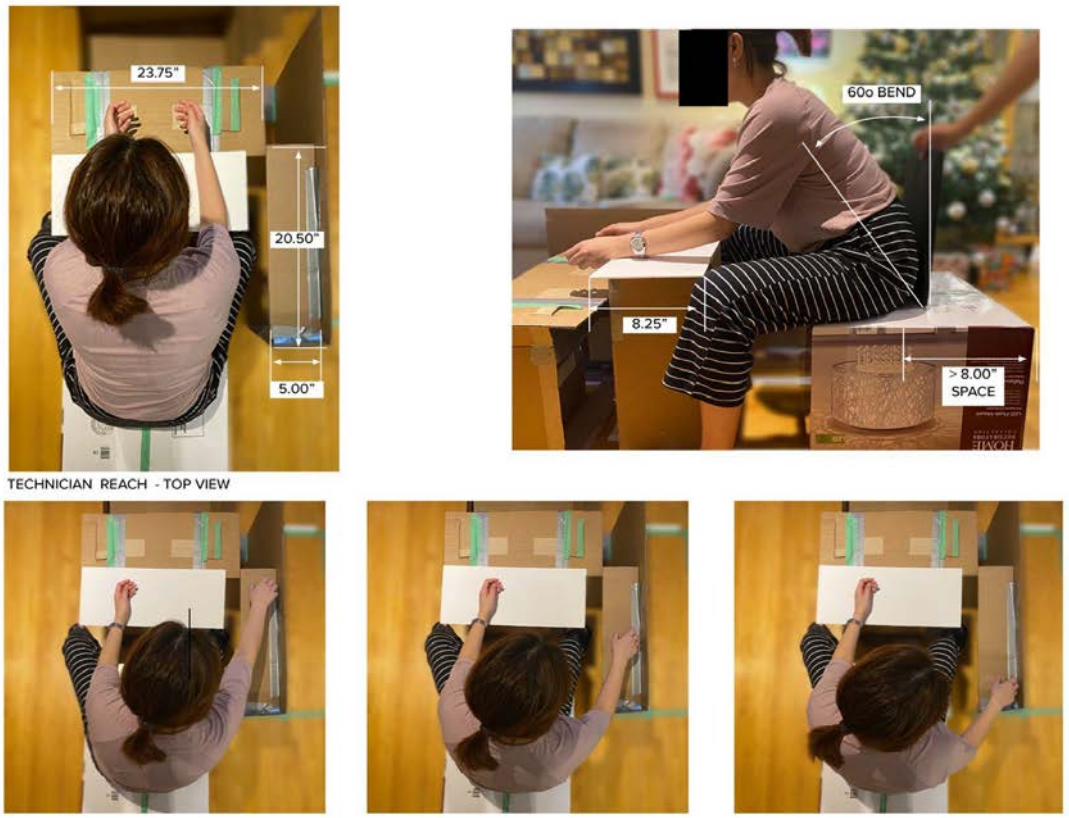


Figure 27 - Pedicure Top View. Technician Reach

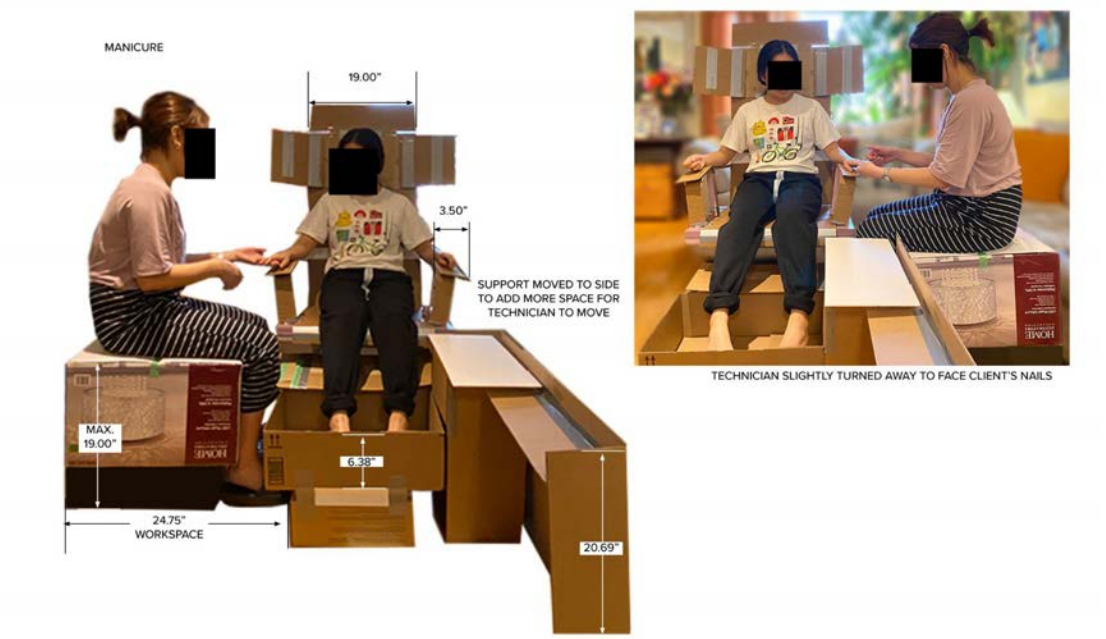


Figure 28 - Manicure Front View. Technician and Client

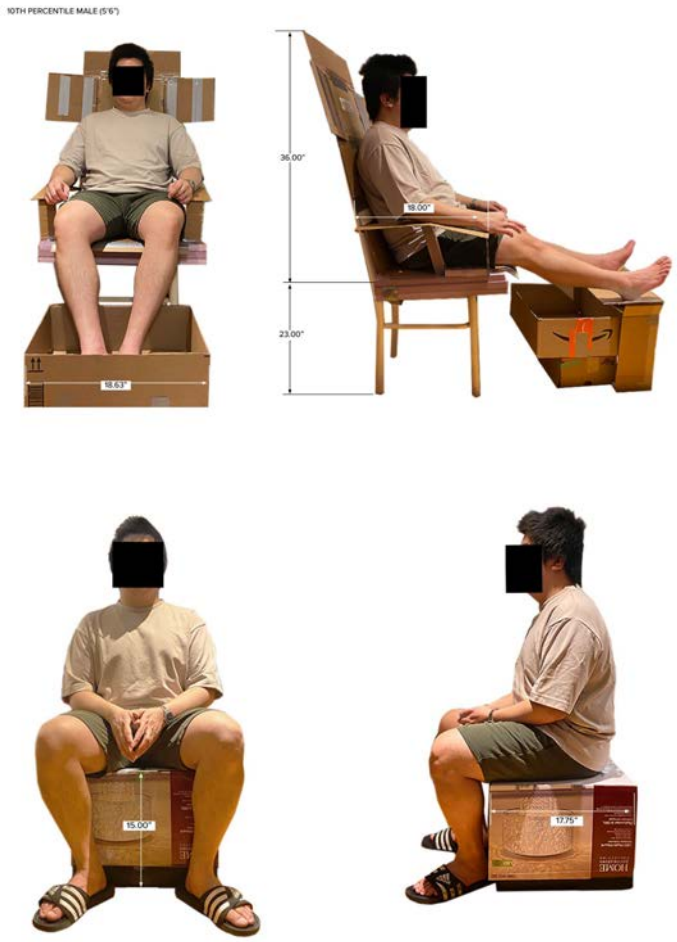


Figure 29 - 10th Percentile Man Testing Buck

Results

The following areas that were studied from this observation were the following:

Hands and Arms

The first major touch point focusing on hands and arms were observed and evaluated based on the following:

- The reach between the client and the technician (hands and feet);
- The reach between the technician and their surroundings (implements and storage);
- Client and technician's resting position (Client: hands resting on armrest; Technician: forearms resting on armrest support).

Legs and Feet

The users' legs and feet were observed and evaluated based on the following:

- Placement of feet (fixed and adjusted)
- Space between feet and other components

Back and Lumbar Region

Observations on the back and lumbar region include the following:

- How the seating holds the client and technicians' posture when reclined or upright.
- Pedicure and technician stool adjustability to accommodate manicure and pedicure.

Conclusion - Ergonomic Challenges that Need Refining

Ergonomic challenges that need refining include elevating the foot rest level for the technician to reach comfortably and better integration of the armrest support. Storage and space are problem areas that should also be addressed when refining the overall workspace design. Given the simplicity of the buck, it was difficult to determine whether the side storage was able to fit larger items (ie., cleaning products, uv lamps, multiple bottles). Furthermore, the placement of the storage space should also be further refined to be less obtrusive for technicians when working around the space.

Design Considerations

Design considerations that should be carried forward with direction development include:

- Extending the armrests and making them adjustable to accommodate higher percentiles while opening the possibility of adding a control interface or storage options that enhance user experience for client or technician.
- Integrate the arm support with the foot rest to allow more breathable working space for the technician while effectively supporting their arms.
- Placing nail tools and equipment on side storage to determine appropriate storage space
- Implementation of lumbar support for both client and technician to reduce back pain

3.4 Analysis - Aesthetics & Semantic Profile

Mentioned previously, a product schematic of both manicure and pedicure stations were created to highlight common components typically found in variations of manicure tables and pedicure stations **(figure 22)**. To ensure the final design is understood as a working manicure table and pedicure station it must include the following components and touch points:

- **Manicure table:** ventilation, a proper light source, storage, wrist rest
- **Pedicure unit:** footbath, footrest, pedicure chair (arm rest, back rest, hydraulic pump, foot tub), technician stool

The location of each component affects the functionality, accessibility, ergonomics, mobility, and aesthetics of a working manicure or pedicure station. Without integrating or addressing these components, the final design would not be user friendly towards the technician or the client. Adding the option to implement water control, massage, or cup holders found in existing competitor products may further enhance the experience for both technicians and clients in terms of comfortability and efficiency.

Existing manicure and pedicure stations contain minimal visual design to fit any salon aesthetic. However a lot of current products are bulky to accommodate storage and other

electronics built inside **(section 2.2)**. Therefore, while creating a design solution that considers the technicians' need and integrating the major components that make a functional manicure and pedicure station, organic forms will also be integrated into the final design to create a lightweight and breathable working space for the technician. Having the station lightweight will also allow the opportunity for components to be modular and fit into any appointment involving a manicure and pedicure.

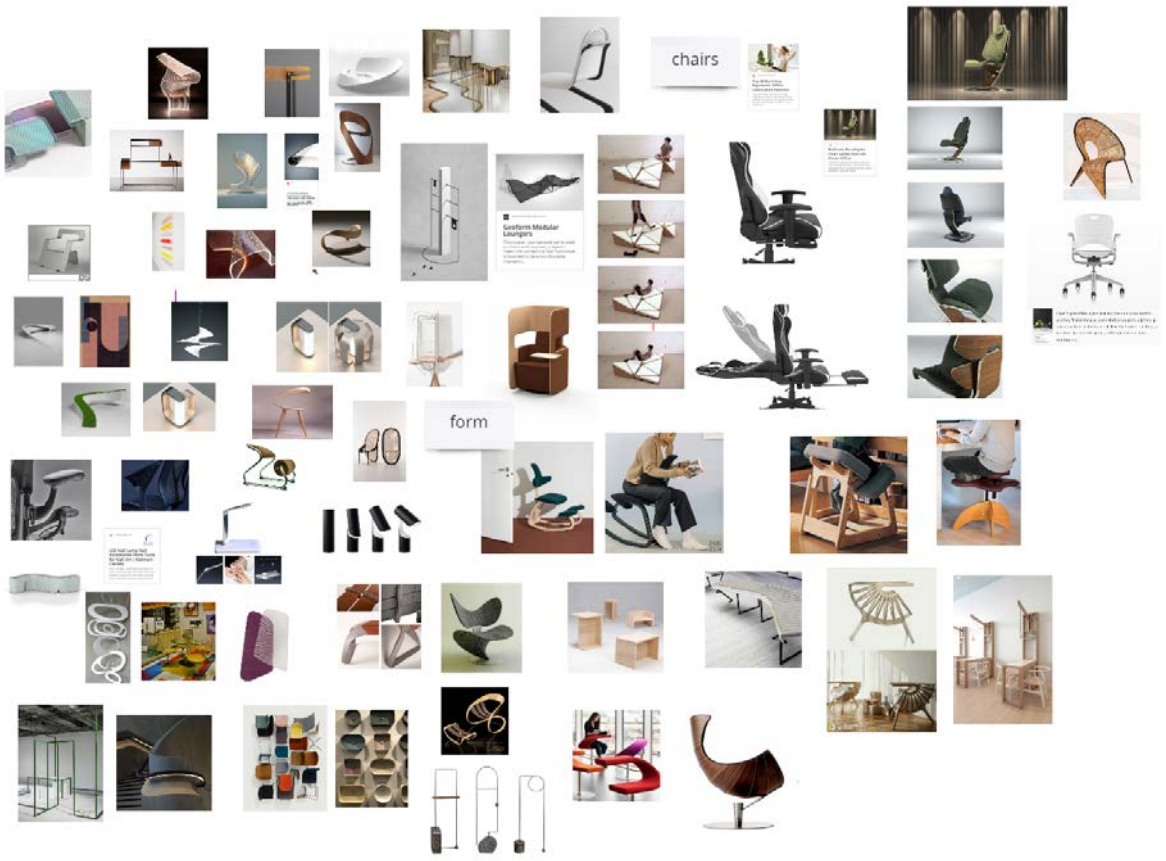


Figure 30 - Moodboard

3.5 Analysis - Sustainability: Safety, Health and Environment

Sustainable Initiatives

Many furniture brands value the use of sustainable materials and methods for their products **(section 2.2.5)**. Below are notable sustainable initiatives proposed by these companies that may be integrated into the sustainable design framework of the final solution.

Majority of furniture manufacturers look to promote longevity and reduce production waste. For instance, Steelcase, a furniture manufacturer, aims to extend the life cycle of their product by utilizing tools such as the Life Cycle Assessment (LCA) to evaluate the material health and impact of their products. Meanwhile other workspace brands such as AllSteel and Ahrend source materials that can be recycled and repurposed after use when manufacturing another product (ie., steel, aluminum, particleboard, PP, solvent-free powder coating). Vegatex, an AppleSkin leather manufacturing company, demonstrates this initiative by using biofuels to upcycle apple waste into a valuable product suited for a variety of applications.

Overall, all companies reduce waste by using materials with properties that enable a long product life. Utilizing newer alternatives such as Covestro plastics and appleskin leather that are durable and long-lasting are also valuable for extending product appearance and usage and are therefore justified to use in nail salon furniture that requires to be strong, long lasting, and aesthetically pleasing.

Health and Safety

Technicians and clients can face ergonomic, chemical, physical, and biological challenges within a nail salon setting (CCOHS, n.d.). Using materials that are corrosion resistant with low moisture absorption makes parts easier to clean and reduces chances of clients or technicians experiencing chemical and biological hazards. In terms of material choice and manufacturing, furniture brands take different approaches in repurposing material to reduce energy consumption throughout the manufacturing process. For instance, Ahrend chairs are individual components that can be replaced and reused. Allsteel looks to identify more efficient processing methods for raw materials that can be repurposed then try to recycle what cannot be reused. Such methods reduce energy consumption and emissions when manufacturing the same parts, reducing chances of harming the environment. Material and product safety can be determined by testing out existing protocols and assessments (Steelcase, n.d.). Allsteel ensures that users feel psychologically safe and supported when interacting with their furniture and refers to ergonomics and anthropometric studies to help users maintain a comfortable working posture while seated for long periods of time.

Using sustainable office furniture brands as a reference, alternatives to materials found in existing nail salon furniture was researched to enhance the longevity and safety of the final design. The following materials represented in this report were chosen and justified based on their product lifecycle and afterlife, manufacturing efficiency, as well as their resistance and durability properties that promote a safe working and leisure environment.

3.6 Analysis - Innovation Opportunity

3.6.1 Needs Analysis Diagram

In reference to the STEEPV analysis conducted in the early stages of user and observation study **(figure 31)**, key insights gathered from user research includes the following:

- **Challenges -** Technicians find challenges in maintaining a clean workspace, maintaining proper work posture when using faulty refurbished nail salon furniture, poor lighting, disposing of nail dust efficiently, limited workspace and storage causing them to lose implements during their session, preparing their workspace constantly to accommodate multiple clients.
- **Pain points -** Technicians and clients may find the nail salon to be crowded, making it difficult for technicians to move around their workstation and making clients feel uncomfortable from a lack of privacy. Technicians experience ergonomic problems from low manicure tables and pedicure chairs, causing them to work in awkward working positions where their elbows are always lifted and upper body constantly bent over. Salon furniture is often fixed in one place, making them hard to move around and limiting the working space for technicians. Technicians' workspace is also very small, causing instances of knocking items over and causing spills. Strong chemical smells are another frequent issue that irritates the client and technicians' skin, eyes, and nose.

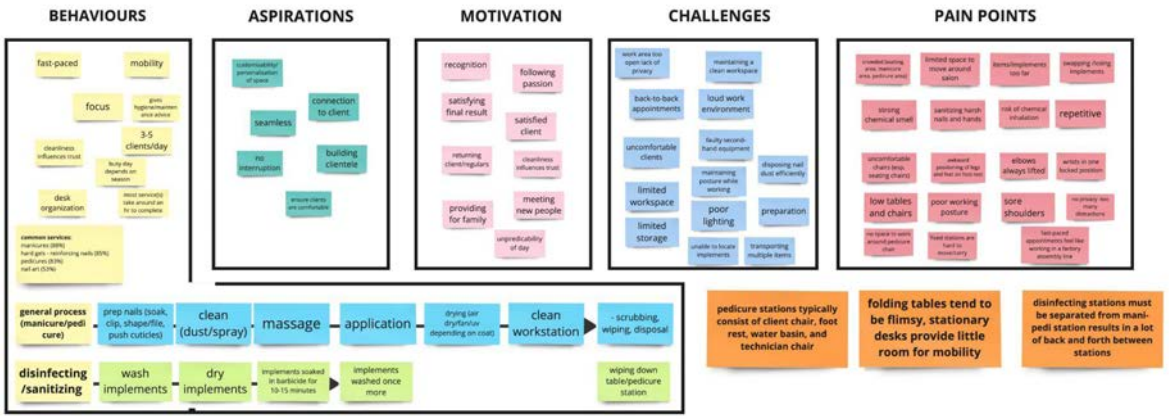


Figure 31 - STEEPV Analysis - Action Strategies

3.6.2 - Desirability, Feasibility and Viability

Taking these key insights into consideration, opportunities of innovation can be found in three ways to create a positive change on this issues associated with the current working environment in nail salons, considering the desirability (user experience), viability (current competitors), and feasibility (materials and manufacturing) aspects of design:

Seamless Workstation

- Redesigning surrounding space (to resolve storage, spatial, and privacy concerns)
- Implementation of features of existing technician furniture to create a solution more oriented towards technicians' benefit (cupholders, temperature/water controls, massage functions)
- Make manicures, pedicures, and disinfecting more efficient for technicians (in the process itself or providing the accessibility to various implements needed for specific tasks ad services)

Integration of Human Factors

- Improve working posture, reduce muscle fatigue and back/neck pains to increase productivity (providing support, rethinking the current manicure table and pedicure chair design to implement ergonomics, materials)
- Pay attention to areas of the body that exert the most movement where support is lacking (elbow movement, lower back, the head)

Including a Ventilation System/Improve Disposing Method

- Reduce chemical smell and risk of toxic inhalation
- More sustainable way of disposing harsh chemicals, disposable files, and plastic bags
- More efficient way of cleaning/preparing the workspace for the next client

Considering these design possibilities will progress the final design into a solution that alleviates existing issues and enhances the technicians' overall working experience.

3.7 - Summary Of Chapter 3

Based on analysis findings, the following brief was produced to establish what the final design should address in this thesis:

1. Design must consider the following hazards: ergonomic, chemical, and physical hazards to stay relevant to the problem definition
2. Redesign the surrounding space (inclusion of storage, bigger workspace, allow mobility)
3. Solution should improve or accommodate the technicians' working posture. The technician should feel comfortable working in their area to increase productivity in the workplace.
4. Technician should be able to perform both manicure and pedicures in one setting
5. Make the workspace lightweight (provide the option for modularity)
6. Workspace should be easy to assemble
7. Workspace must include ventilation and lighting (this is required to avoid physical and chemical hazards within the workplace)
8. Design should also consider the client (comfortability, enhancing the customer experience by adding "quality of life" features that are justifiable and enhance product use).
9. Solution must allow technician and client to properly interact with another (promote engagement and focus)
10. Workspace should be easy to clean (ie., disposing files, wiping surfaces)

CHAPTER 4: DESIGN DEVELOPMENT

4.1 Initial Idea Generation

Early stages of design development towards a final design solution involved initial idea generation using findings taken from user research **(see chapters 2 and 3)**. To aid with idea generation, research findings were organised using the STEEPV analysis framework to build a semantic profile of technicians and clients that identifies the possible challenges both users may have with current workstations in nail salons. To ensure the final design solution is recognized as functionable nail salon equipment, product schematics and mood boards were created to use as a reference throughout design development.

4.1.1 Aesthetics Approach & Semantic Profile

Semantic Profile

Semantic profiling was used to further narrow down research findings into key trends occurring in current pedicure and manicure stations that may impact the target users in a significant way. **Figure 31** provides a semantic profile of nail technicians highlighting their behaviours, aspirations, motivations, challenges, and pain points with their current work station using the STEEPV analysis**.**

Aesthetics Approach

The atmosphere of a nail salon depends on the look and feel of their furniture. Salon owners are very likely to invest in nail furniture that mirrors their brand. Typically, nail salon furniture is modern and sleek, using a minimum of 2-3 colours that contrast one another.

Throughout concept development, product schematics of benchmarked pedicure and manicure units were developed to identify the key components that exist in current pedicure chairs and manicure tables **(figure 22)**. Additionally, a mood board was created to provide inspiration throughout design development. The objective is to design a solution that is lightweight and modular that promotes a seamless workflow within the workstation. Therefore, the moodboard contains visually lightweight and organic forms, shapes, and

materials that may be implemented in the final design that help enhance the appearance and workability of the product **(figure 32).**

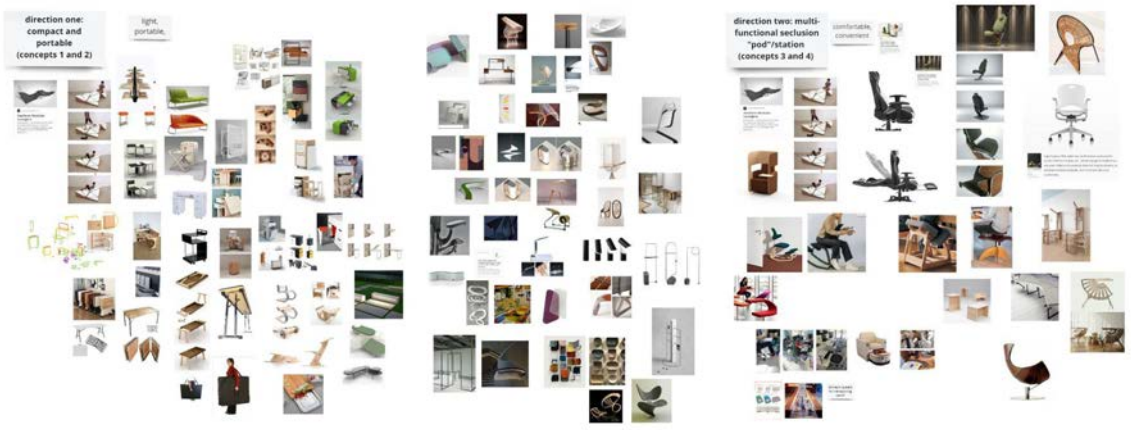


Figure 32 - Aesthetic Profile and Moodboard

With this in mind, earlier iterations of concepts took inspiration from the current look of salon furniture **(figure 22)** while considering more organic forms that make the design appear lightweight and breathable **(figure 32).** Later versions of design development began also taking inspiration from plants, specifically the golden pothos plant, for its convex shape and the idea of its stem being a form of structural support that holds the leaf upright **(figures 33 and 34).**

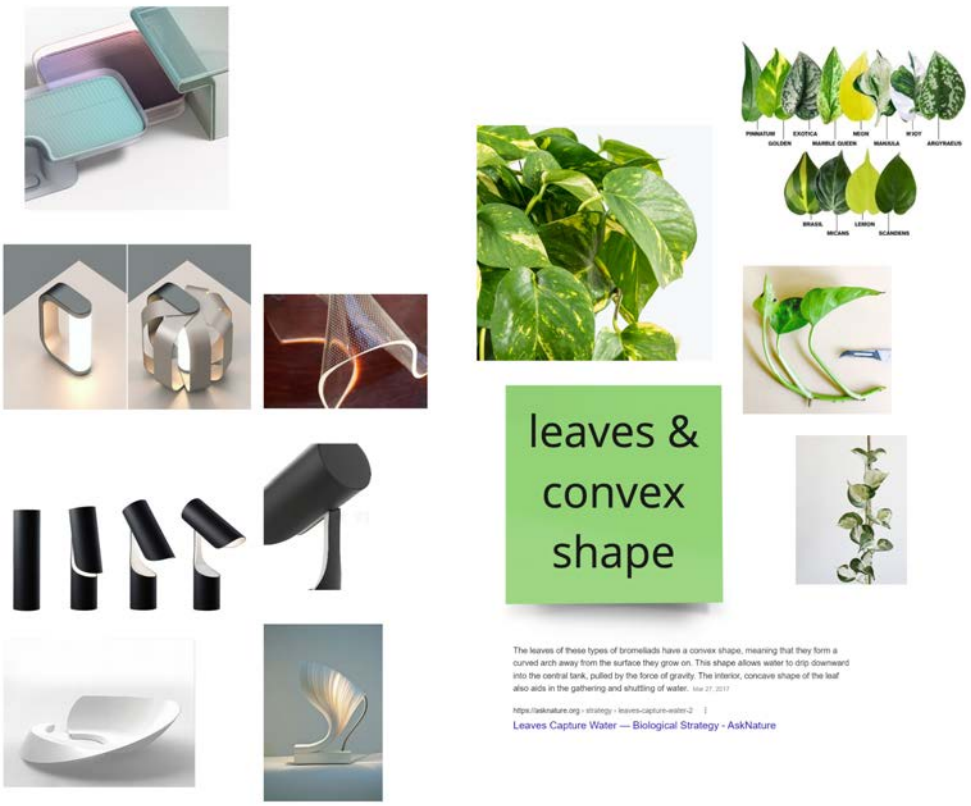


Figure 33 - Leaves and convex shapes

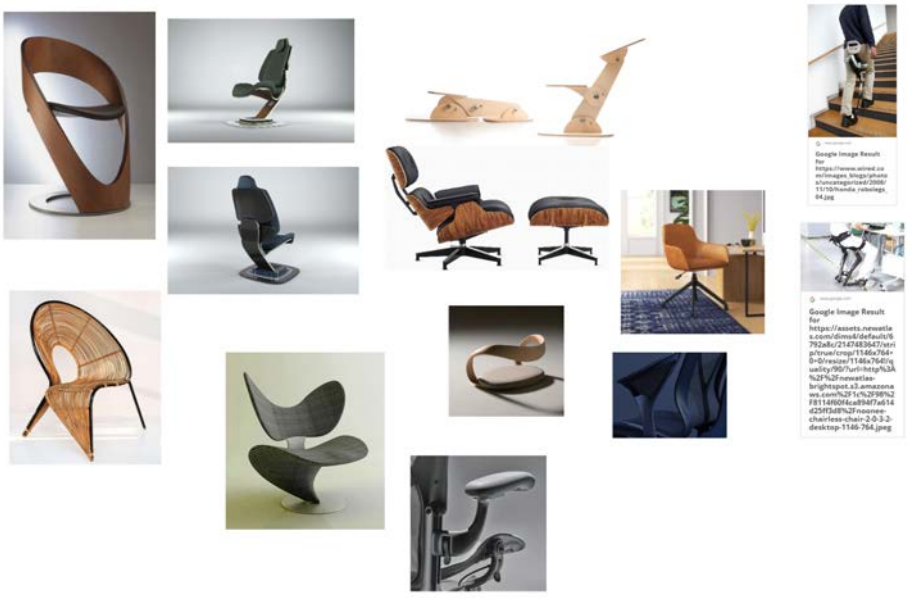


Figure 34 - Future inspiration for form development

4.1.2 Mind Mapping

Key words taken from research findings were mapped out according to the user, their tasks, existing tools and use, technical solutions, the user's emotional feelings and thoughts, and pain points **(figure 35)**. Using the STEEPV analysis framework, these key terms were first categorised under social, technological, environmental and value trends. These findings were then divided based on priorities and impact to the user, leading to the final takeaways recorded in **figure 36**.

Figure 35 - Initial Mapping of Research Findings

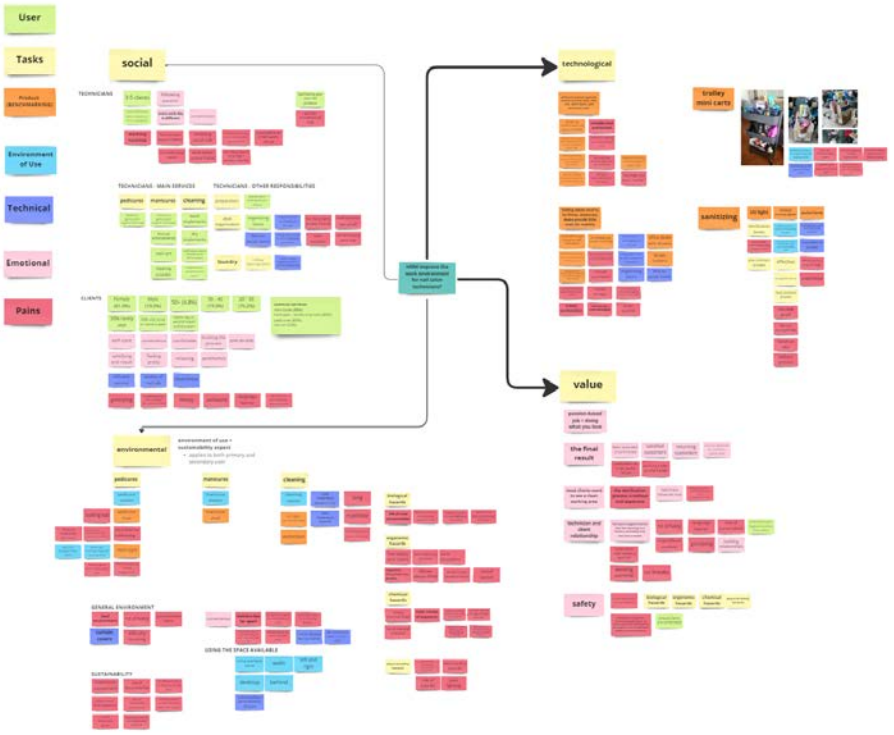


Figure 36 - STEEPV mindmap

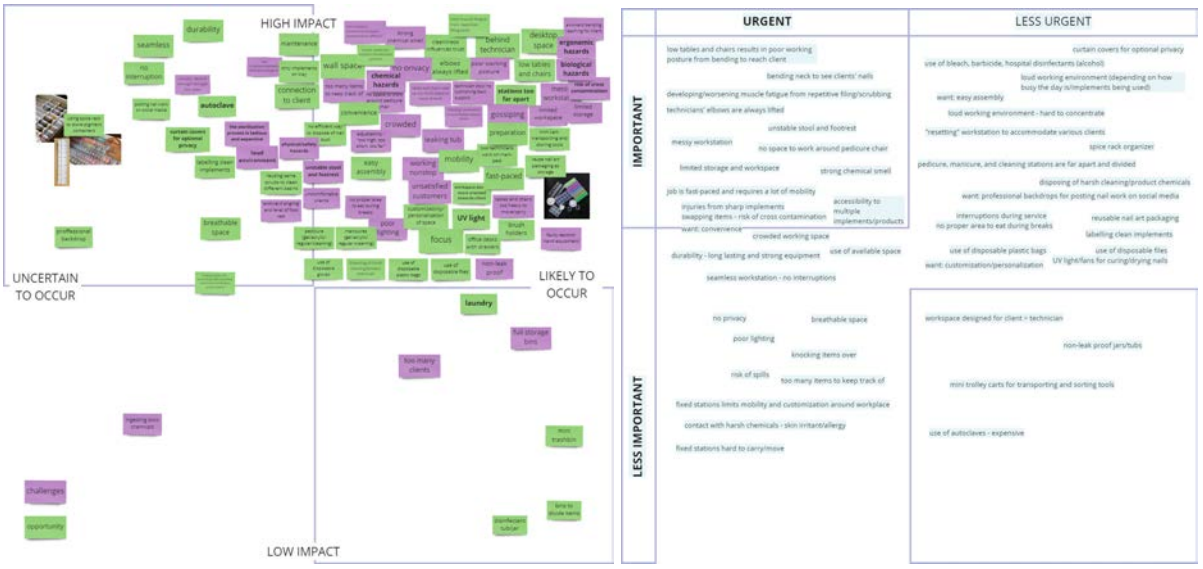


Figure 37 - STEEPV design matrix and strategic priorities

4.1.3 Ideation Sketches

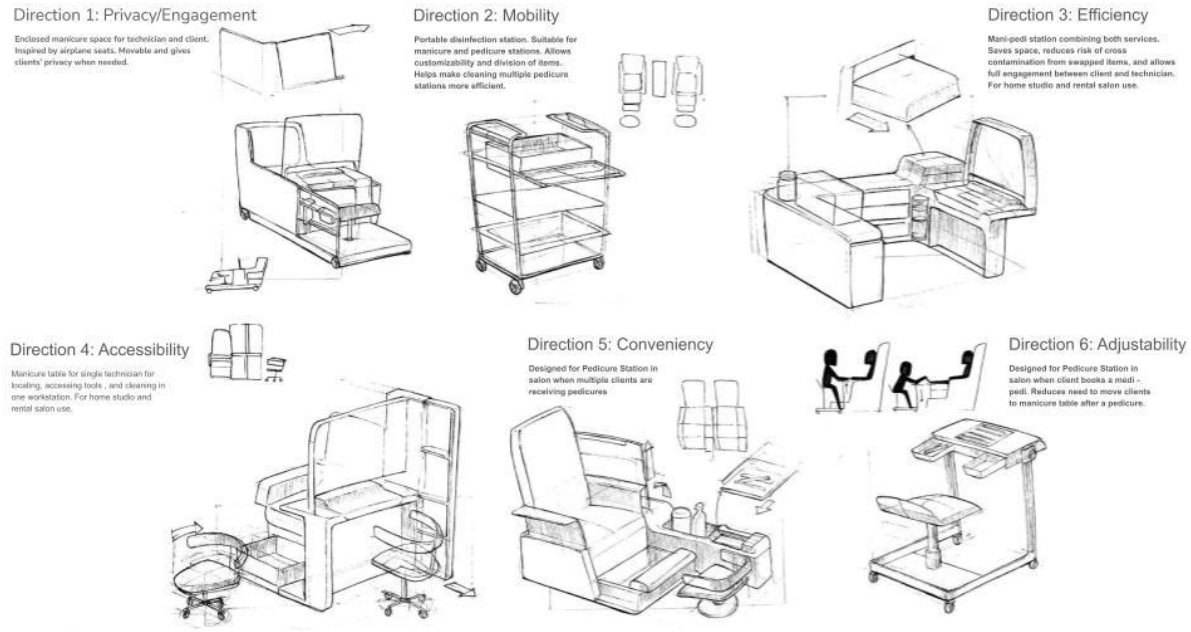


Figure 38 - Ideation Sketches

Each concept addresses challenges and areas nail technicians and clients experience with the current work environment in nail salons.

Direction 1 - Privacy and Engagement

Direction one responds to the lack of optional privacy and engagement technicians and clients experience in current nail salons. Inspired by airline seating, direction one is an enclosed space that can only be used by two people at a time. The purpose of direction one's enclosed design was to encourage engagement and focus between the technician and client while keeping all nail implements in one setting, improving workflow and productivity. Direction one solely focuses on manicures.

Direction 2 - Mobility

Direction two addresses mobility and sanitary challenges around the nail salon. Busy hours in nail salons tend to result in overcrowded spaces, making it difficult for technicians to travel between stations to retrieve implements and items. Cleaning stations are also far away from nail stations to accommodate health regulations. With this in mind, direction two is a portable disinfection station where technicians can transport and access used and

sanitised items between stations. Stored between manicure and pedicure stations, direction two reduces the need for technicians to constantly travel between stations and interrupts the clients' session.

Direction 3 - Efficiency

Direction three is a two-in-one space where manicures and pedicures can be performed. This solution allows more space within a nail salon, reduces risk of cross-contamination from swapped implements, and allows full engagement between the client and nail technician. A two-in-one station also helps technicians clean and prepare their workspace more efficiently between clients.

Direction 4 - Accessibility

Interview and survey findings have revealed that technicians have challenges organising their workspace while clients have mentioned that they dislike it when technicians suddenly leave their workspace to retrieve an item. To improve workflow and accessibility, direction four is a manicure table that combines cleaning, drying, and nail application stations within one setting. Direction four allows technicians to access and perform various tasks without having to leave their workstation during appointments with a client.

Direction 5 - Conveniency

Direction five offers more storage and accessibility to cleaning and nail implements within a pedicure station. Direction five is also designed to improve workflow and accessibility for the technician when working with multiple clients who book for pedicures.

Direction 6 - Adjustability

Direction six is designed for when clients book for both a manicure and pedicure in one session. The design takes on a technician stool with an adjustable arm rest support that contains compartments and an exhaust fan technicians can access when performing a manicure or pedicure. Designed for pedicure stations, direction six reduces the need for clients to move to a manicure table after a pedicure for a more efficient work session.

4.2 Concepts Exploration

Ideation sketches were combined to produce four more distinct and developed concept directions that address the areas of engagement, mobility, efficiency, and accessibility in the form of modularity, portability, comfort, and convenience.

4.2.1 Concept One - Lightweight

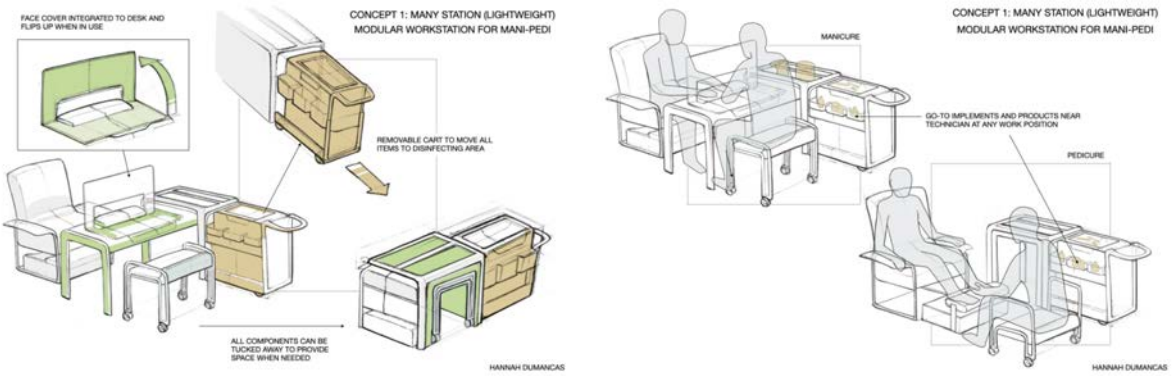


Figure 39 - Many Station Concept

Concept one is a modular workstation suited for manicures and pedicures. This direction consists of lightweight components that can be arranged according to their next appointment. The station also includes a removable cart that transports all items to the sanitation area. Having lightweight components make the station easier to clean and arrange, making the sanitising and preparation stages more efficient for technicians.

4.2.2 Concept Two - Portable

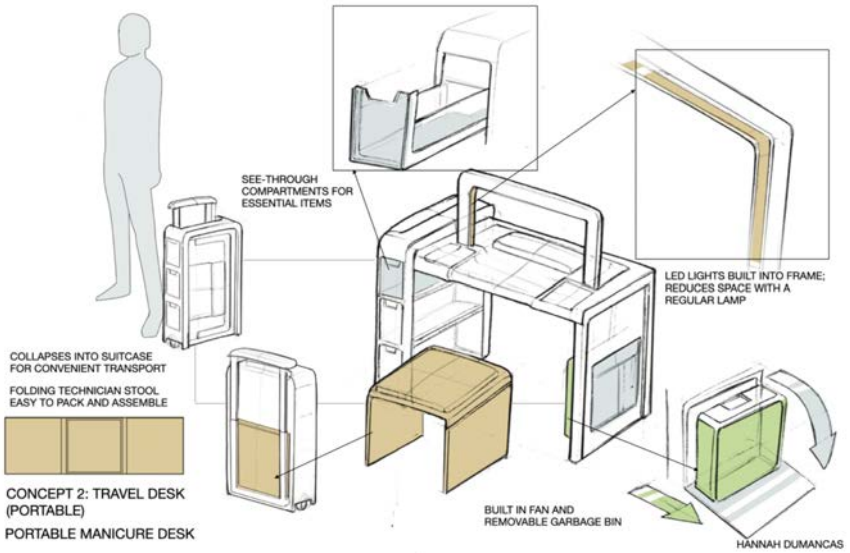


Figure 40 - Travel Desk Concept

Inspired by luggage and carry-ons, concept two is a portable manicure table designed for travelling nail technicians. Similar to concept one, the purpose of the travel desk is to use lightweight materials to create a collapsible and compact workspace consisting of various components and features that enhance the technician's overall working experience (ie., lighting and ventilation).

4.2.3 Concept Three - Comfort

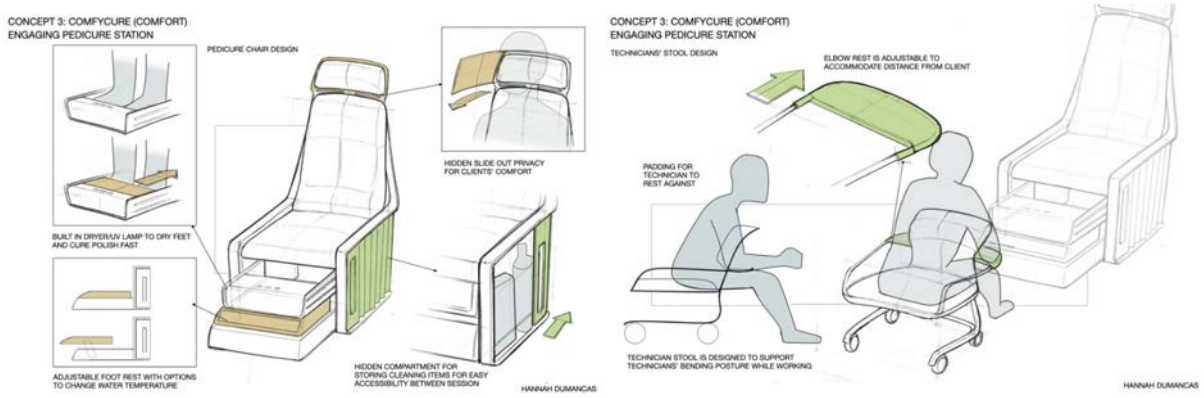


Figure 41 - Comfycure Concept

Concept three is an engaging pedicure station that promotes comfort for both the technician and the client. With the main purpose of enhancing comfort, the following concept prioritises human factors and optional privacy through adjustable components and technology. Features such as a built-in dryer and an elbow rest reduces chances of ergonomic hazards while improving productivity and efficiency by limiting tasks technicians have found repetitive and labour intensive (ie., bending and filing, cleaning station).

4.2.4 Concept Four - Convenience

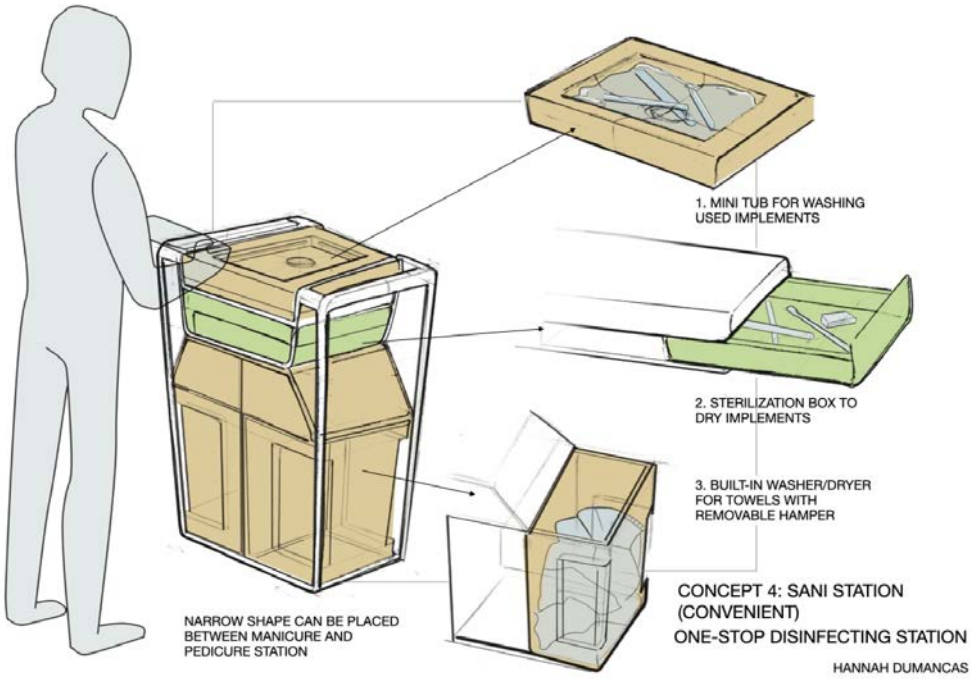


Figure 42 - Sani Station

Concept four focuses on sanitising implements between stations. The purpose of this concept is for technicians to sanitise used implements and towels in one setting. Albeit not as fleshed out as the other three concepts, this design direction was produced to consider the challenges technicians have mentioned experiencing with having to clean multiple items between sessions. Including this concept in earlier stages may be useful for later stages of design development.

4.3 Concept Strategy

Concepts related to lightweight, modular, and portable components were further developed into two separate design directions as presented below.

4.3.1 Concept Direction & Product Schematic One

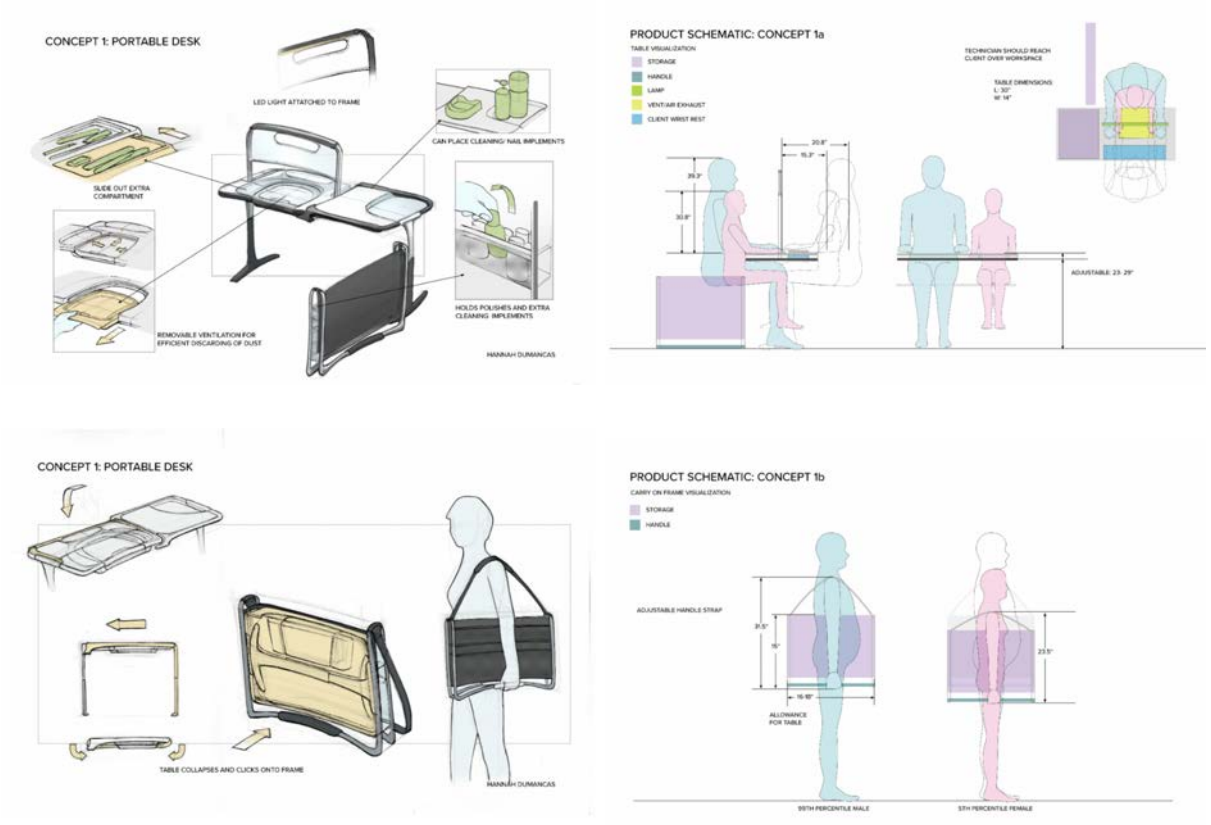


Figure 43 - Portable Desk Sketches and Product Schematic

Due to the potential the travel desk concept had as a product that can be carried and assembled anywhere, the objective for the first concept direction was to consider a more nestled and compact approach. This design of a portable manicure desk is a more lightweight and compact version that includes the same storage, ventilation, and lighting features. A different way to collapse and carry the table was considered while keeping the product light. Configuration diagrams were created to provide a visualisation on how the product can be handled as a physical object. These diagrams also help inform how the product will fit a range of users within the 1st and 99th percentile man and woman. This range was later narrowed to fit the 5th and 95th percentile range in order to accommodate the majority of the user demographic within this range.

4.3.2 Concept Direction & Product Schematic Two

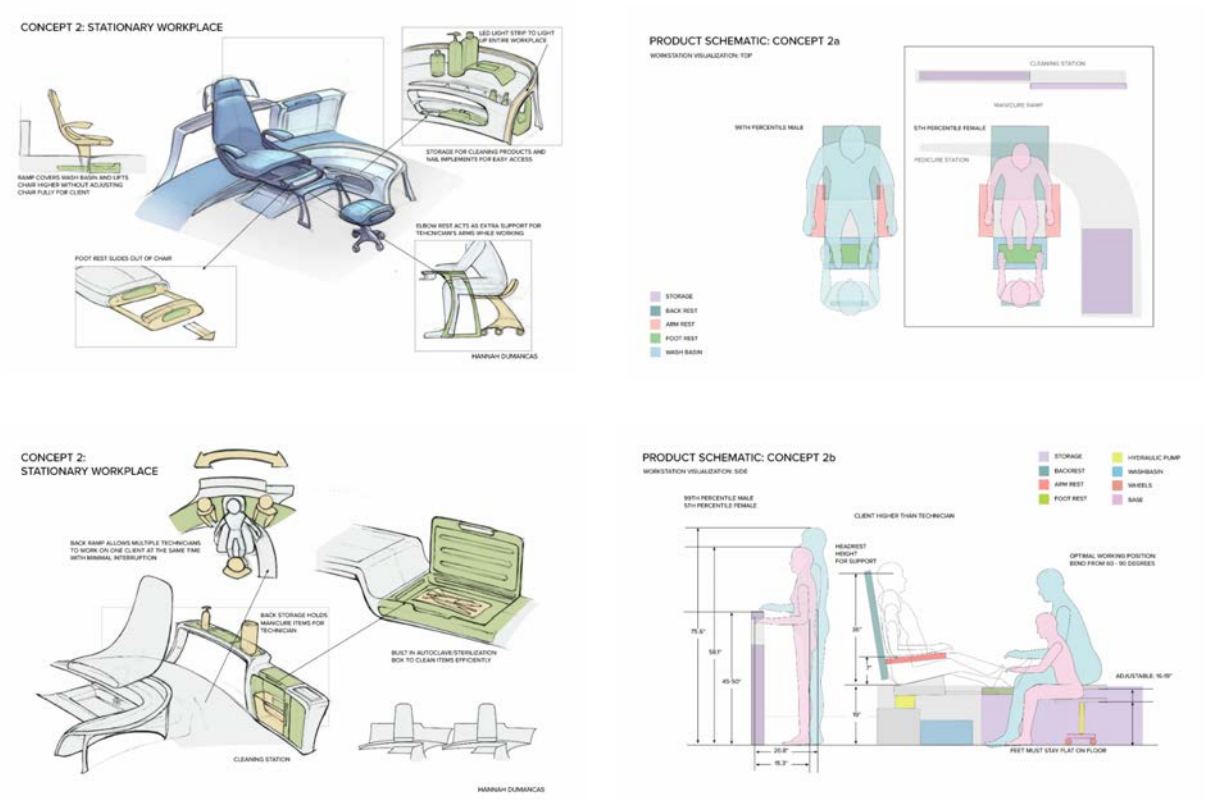


Figure 44 - Stationary Workplace

Direction two takes on a more stationary approach of a manicure and pedicure unit. This concept applies all the sanitation, storage, and ergonomic challenges technicians and clients experience with the current nail salon environment. Because this direction addresses the problem definition of this thesis topic more and offers more potential as a modular workstation, this concept has been chosen for continued development. The configuration diagrams on the right also provide a more useful and in-depth visualisation on how user(s) may interact with the workspace.

4.4 Concept Refinement & Validation

Moving forward with design direction two, the objective was to rethink the whole concept as modular and lightweight that allows technicians to perform both pedicures and manicures in one setting.

4.4.1 Design Refinement

Using direction one's design as a reference and takeaways from the 1:1 human scale study, the stationary unit was refined with the intention of making it visually light and modular with consideration to how its components assemble to form a manicure/pedicure unit demonstrated in.

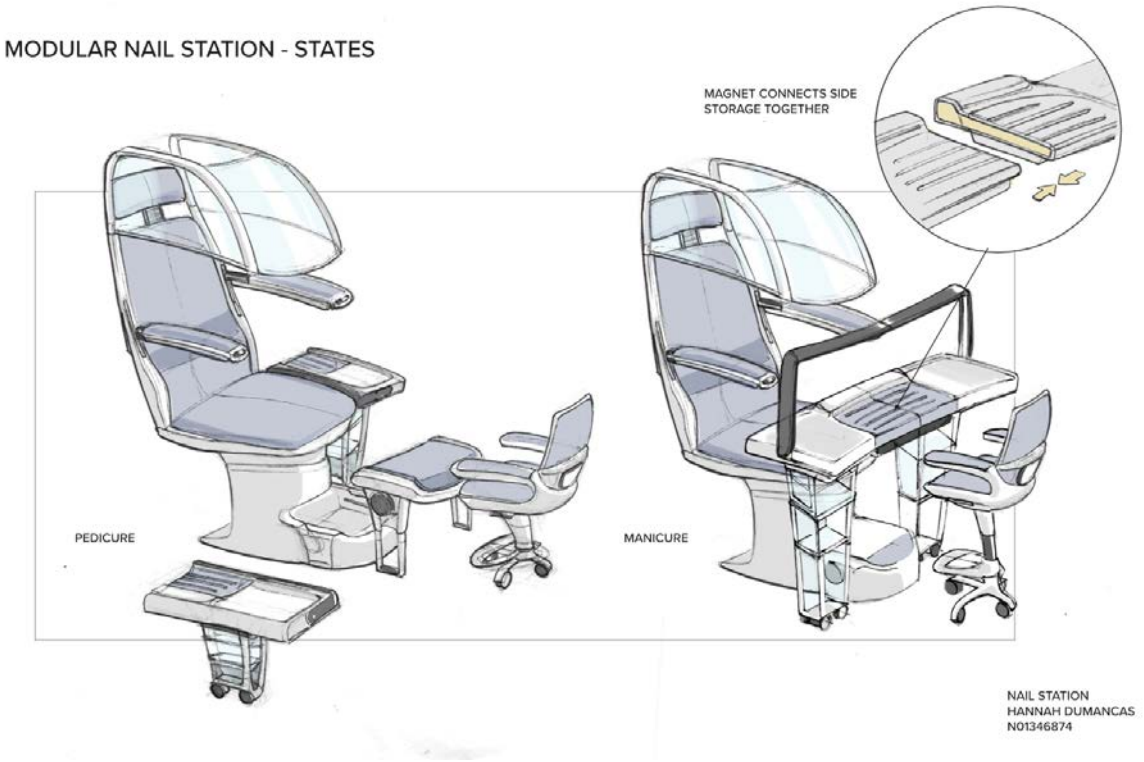


Figure 45 - Different States

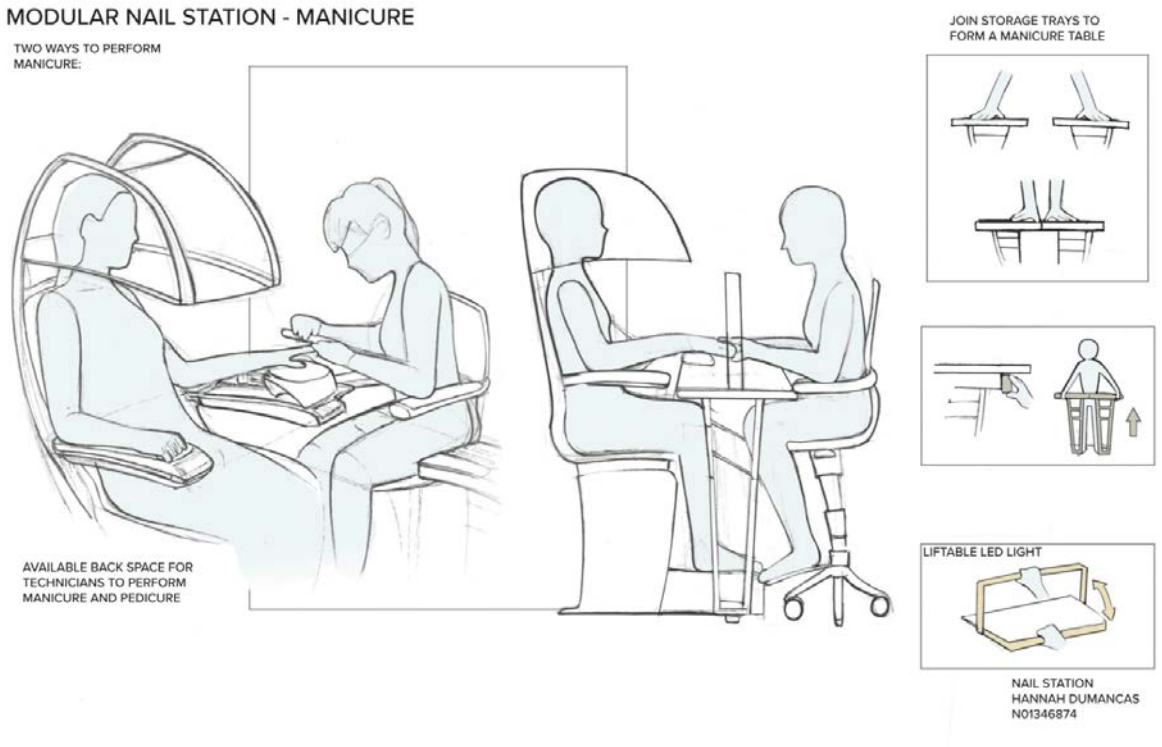


Figure 46 - Manicure

4.4.2 Detail Development

The following concept continues to address the storage and ergonomic challenges this thesis plans to address with additional features that further enhance the client's comfort and safety. For instance, a drop down protective face shield was designed to protect clients from chemical fumes that also functions as a privacy screen users can toggle for optimised privacy. Other design considerations such as tilt lock and UI footbath controls on the footrest have also been integrated to enhance the working efficiency for technicians working from various distances. In order to keep the workspace visually lightweight while utilising the working space around the technician, the side storage has been redesigned as two trays that store and transport nail implements and care products.

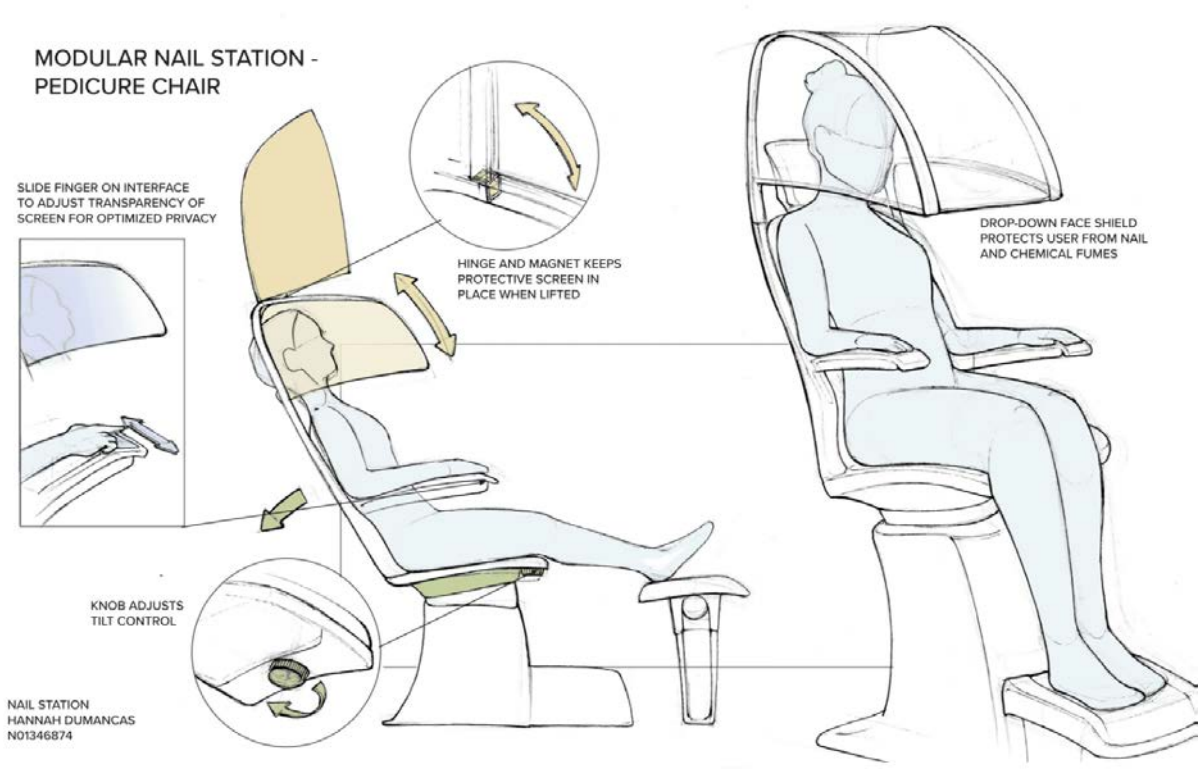


Figure 47 - Pedicure Chair Detail Development

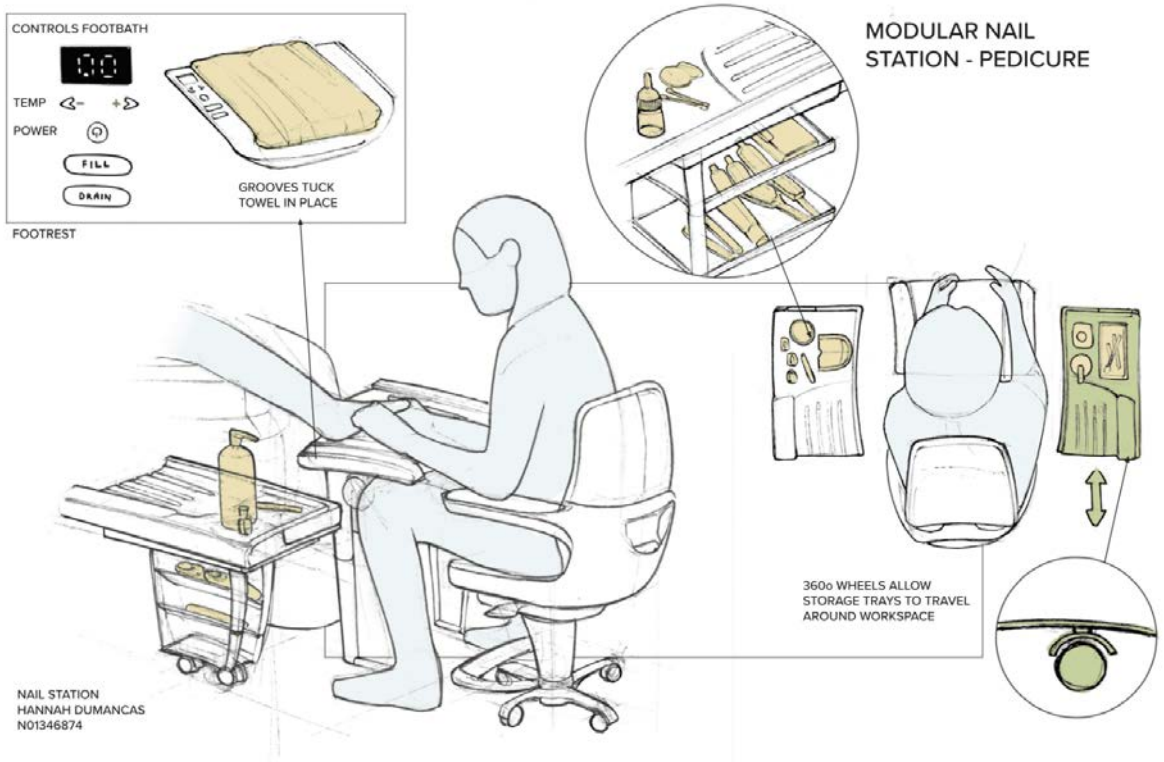


Figure 48 - Technician Workflow Detail Development

4.4.3 Refined Product Schematic & Key Ergonomic

The refined design uses **figures 49 and 50** as a reference during development to determine the available working space around the station for the 5th percentile female and 95th percentile male. **Figure 51** is an updated configuration schematic that reflects the refined design in both pedicure and manicure states. Continuing to update the configuration schematic helps proportion the refined design. Constantly referring to the dimensioning and diagrams offer insight on what parts of the design should be resolved in the final design in order to work within a real life setting.

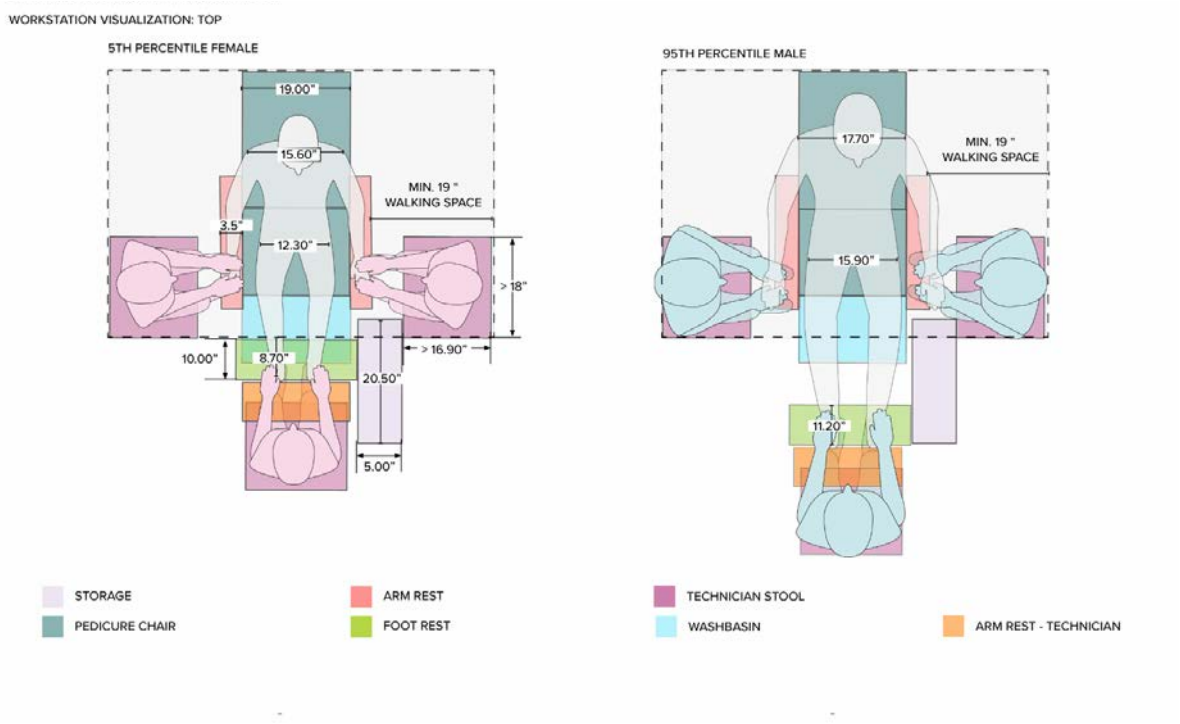


Figure 49 - Workstation visualisation: top

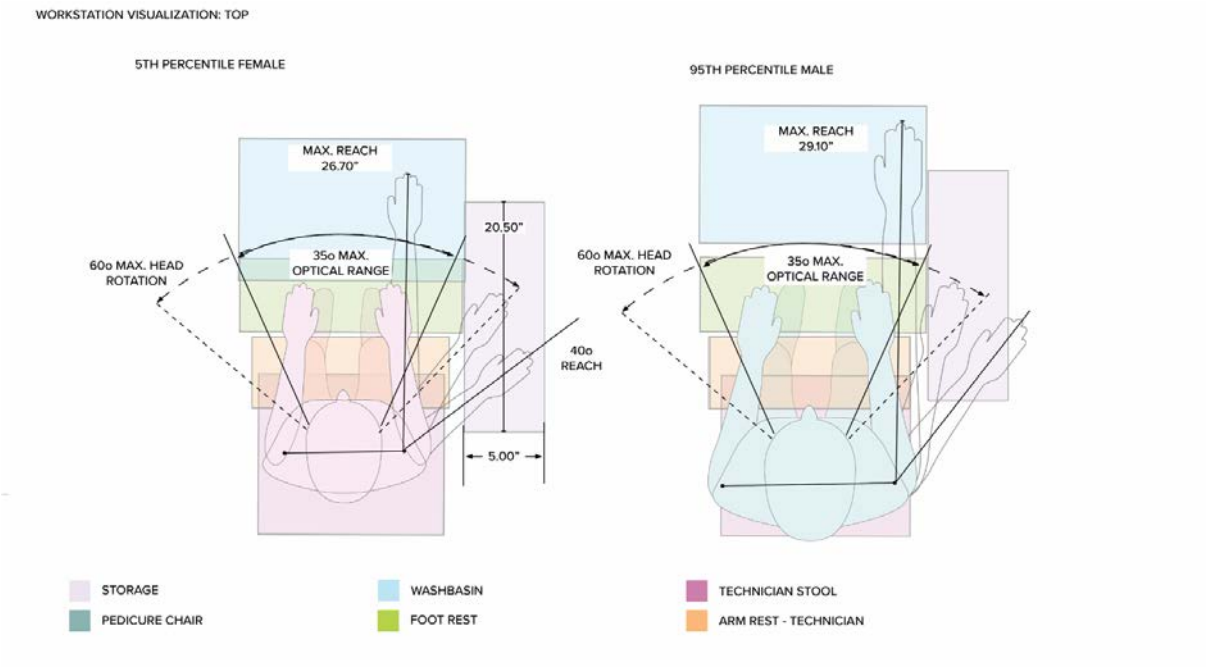


Figure 50 - Workstation visualisation: top detail

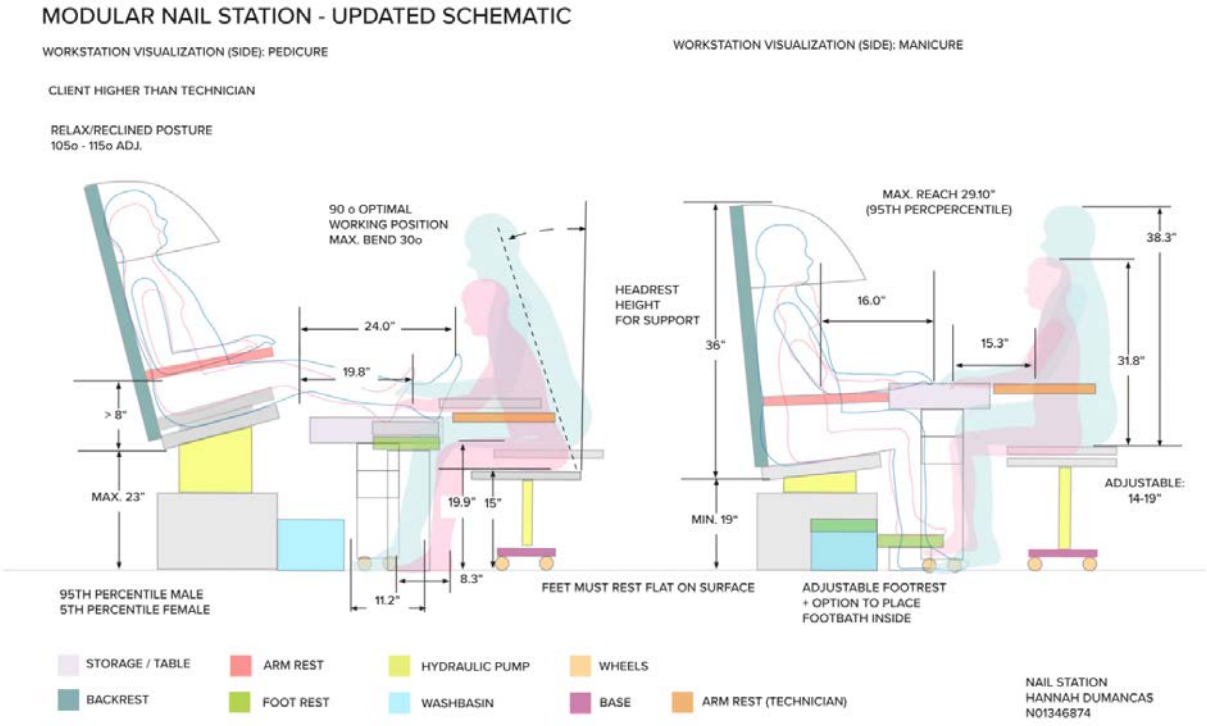


Figure 51 - Updated schematic

4.5 Concept Realization

Based on feedback from the previous concept, the final design was designed to be more visually lightweight while taking up as little space as possible. The following design continues to implement features presented in the previous concept however includes new considerations, such as the armrests for both the technician and pedicure chair being adjustable as well as adding a rotating side manicure table and two side storages the technician can access when performing both manicures and pedicures.

4.5.1 Design Finalization

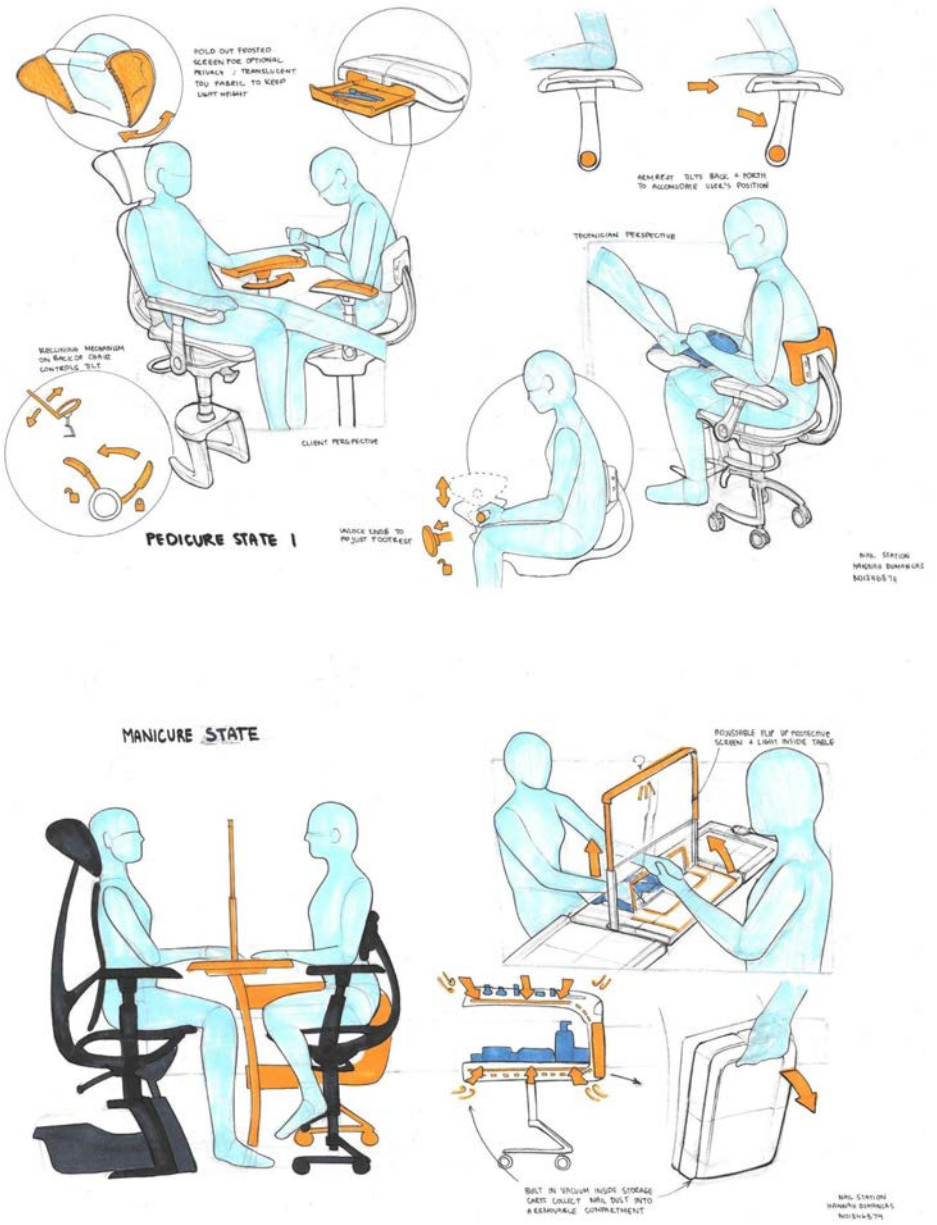


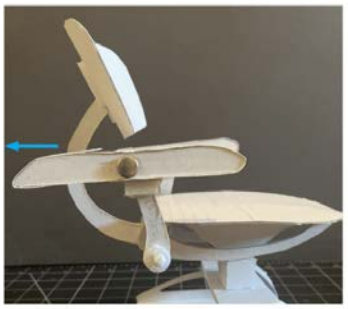
Figure 52 - Final design, pedicure and manicure state

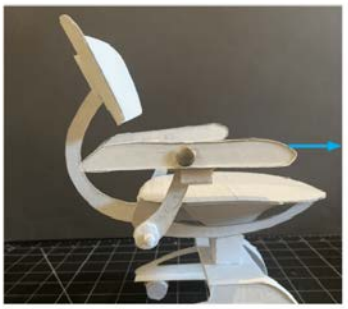
4.5.2 Physical Study Models

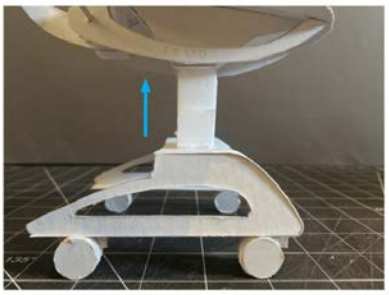
Physical study models were produced to gain a better understanding of the products' form before developing the design further on to CAD. The following sections show a model of each component of the final design and how they interact with one another.

TECHNICIAN STOOL
MODEL 1:4

ARM REST PUSHES BACK AND FORWARD TO ACCOMODATE WORKING POSITION



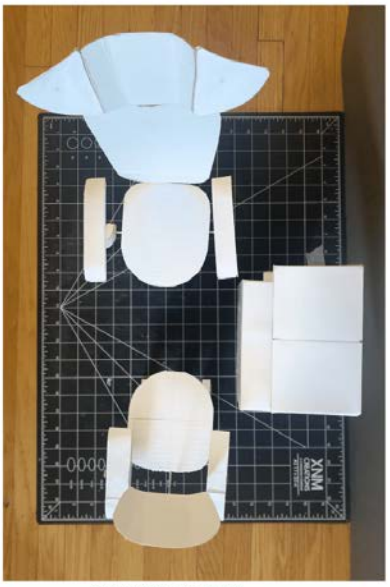




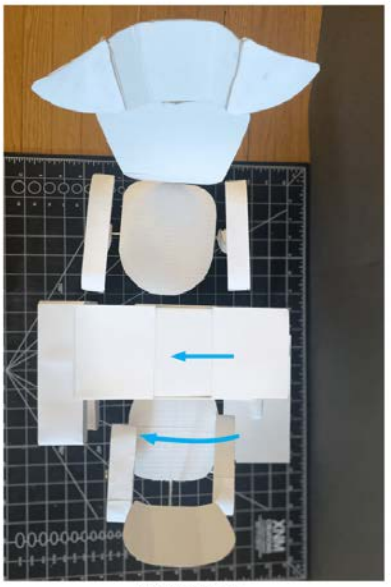
STOOL ADJUSTS FROM MIN. 15.000" (3.750") - MAX 19.000" (4.75")

MODULAR NAIL STATION
HANNAH DUMANCAS

ASSEMBLY



PEDICURE/RESTING STATE



MANICURE STATE

MODULAR NAIL STATION
HANNAH DUMANCAS

Figure 53 - Physical model study (1:4) scale

Producing these models have helped visualize the overall form of the product as well as determining the appropriate spacing between them. Assembling each model of the system together also revealed which area of the design should be changed to ensure the proportions between the chairs, storage, and table appear correct.

4.6 Design Resolution

Creating sketch mock-ups after the design finalization stage of design development have provided a more realistic view of the concept and how the system functions. As the details and features of the product stay relatively the same. The form has been adjusted to correct its proportions.

Figure 54 - Final design, manufacturing details and functionality

Figure 55 - Second mock-up of the pedicure chair, refining form and assembly detailing

4.7 CAD development

Initial CAD models were built to develop a general idea of the final products' form and how all parts could be assembled. Finalized forms were then modelled using existing office chairs as a reference to determine the general proportion for seating and manufacturing details of certain components.

Figure 56 - Initial CAD build

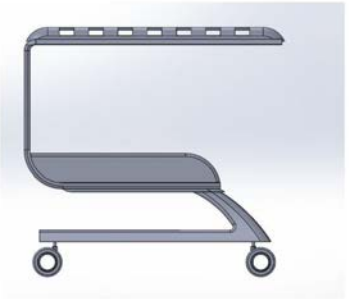
Figure 57 - Form refinement

pedicure chair

section cut

tech stool

side storage



section cut

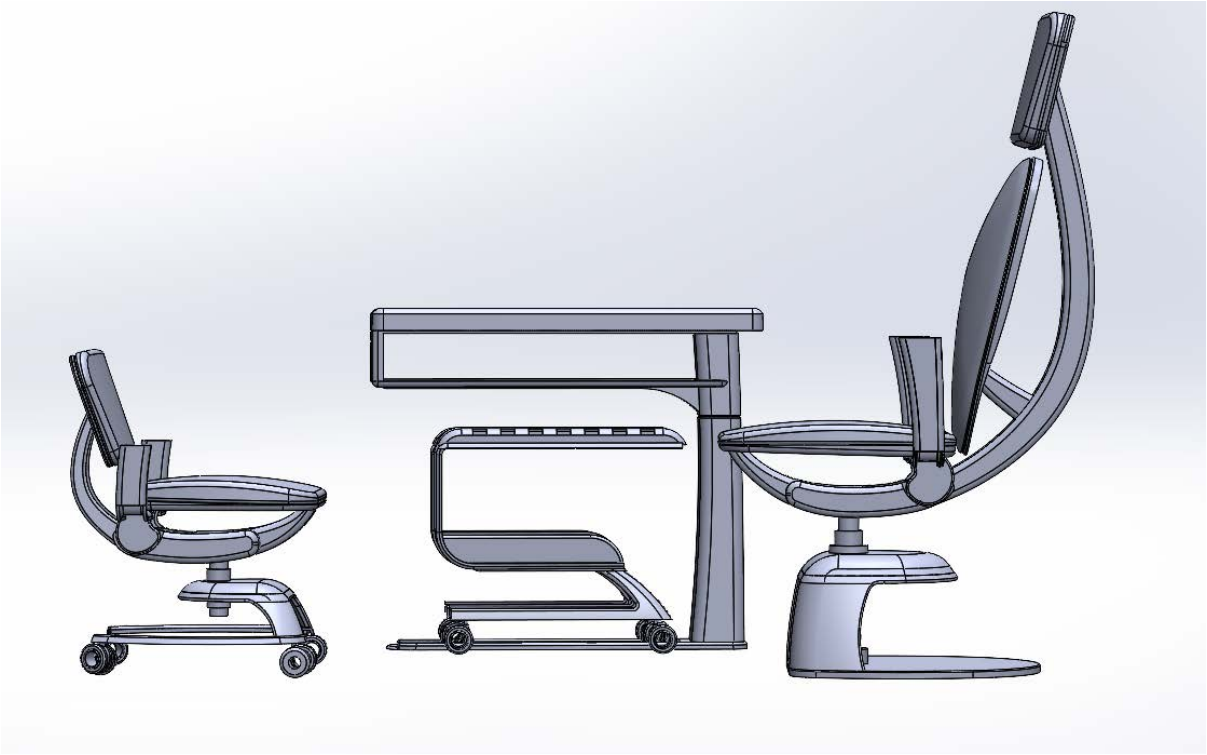


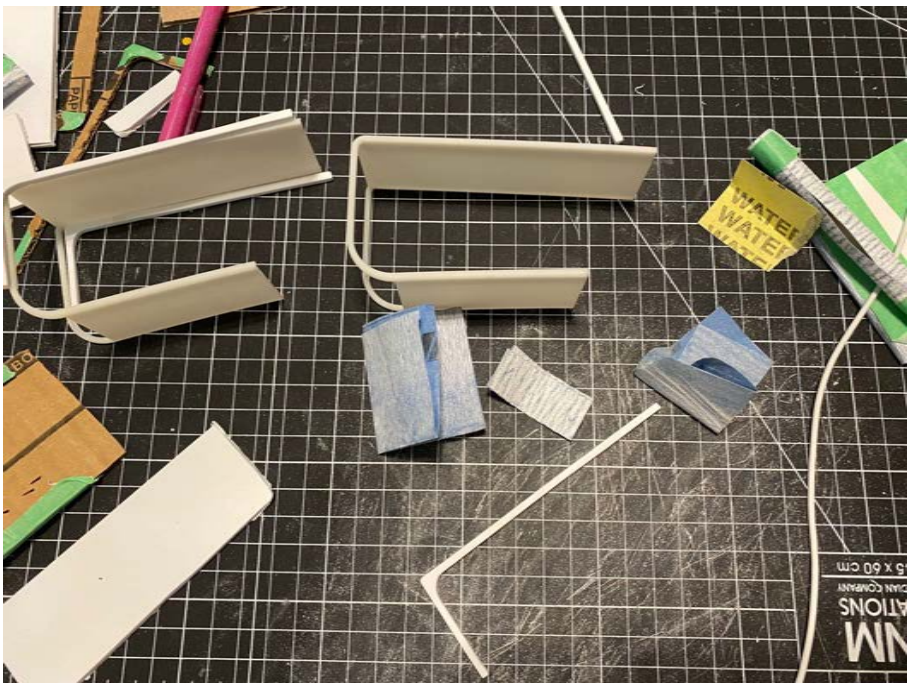
Figure 58 - All components together

4.8 Physical Model Fabrication

The following section is the building process of the physical model.

3D printed parts delivered from Agile manufacturing.

Parts are primed then spray painted.



Additional modifications were made to some parts to keep them sturdy.

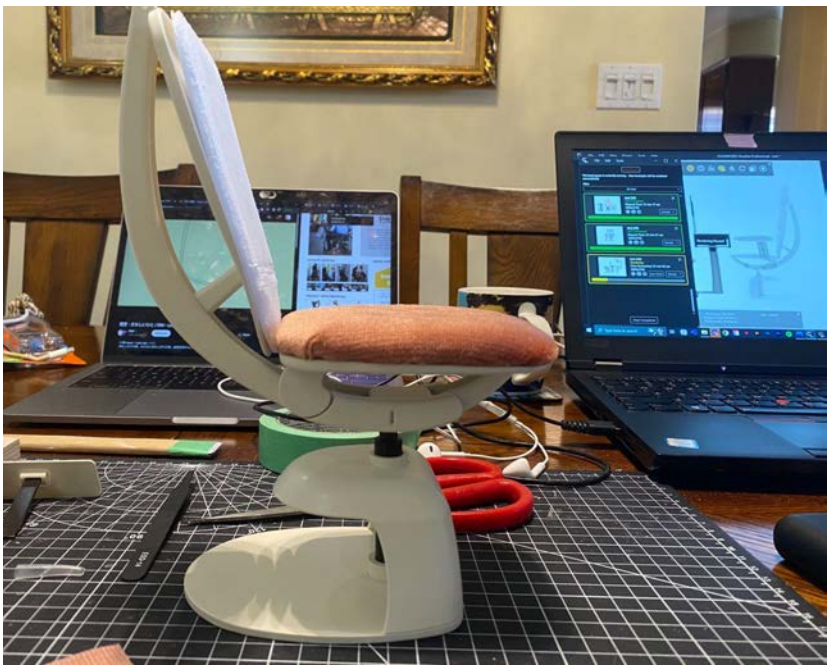
Glueing and dry fitting pieces together.

Adding little details to parts of the model that were not 3D printed.

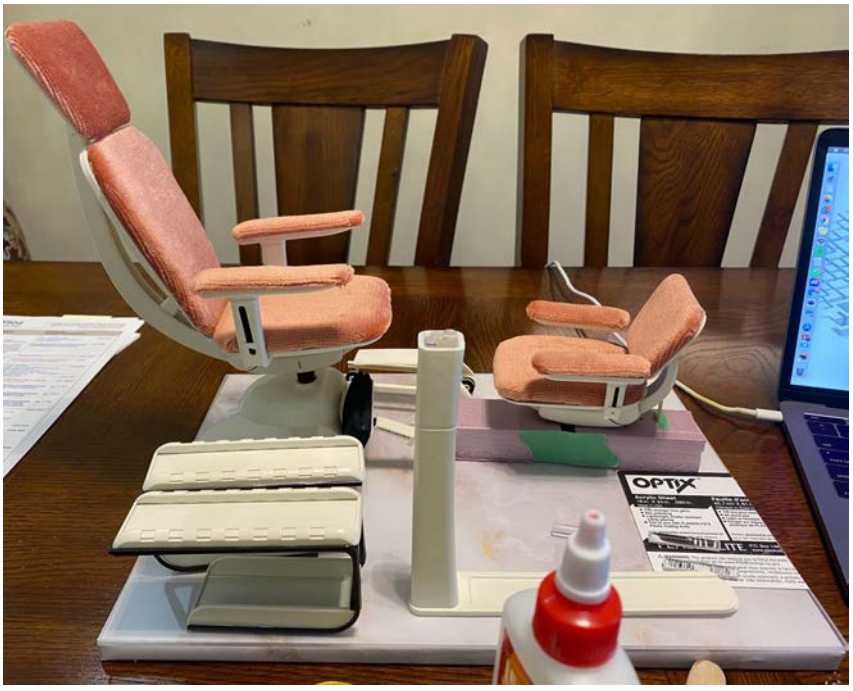
Mini rubber washers were glued onto these printed pieces to imitate tiny caster wheels.

Cutting out fabric pieces for the upholstery.

Cushioning was made of foam core and wrapped in the fabric using a hot glue gun.



Fabric placed on pedicure chair.



Test placing parts on base.

Base was wrapped in adhesive paper with marble texture then covered with an acrylic sheet.

Parts fully assembled and ready to glue onto base.

CHAPTER 5: FINAL DESIGN

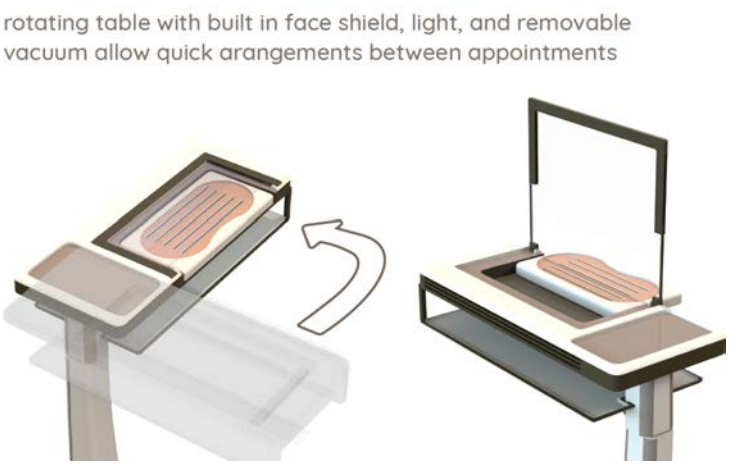
5.1 Design Summary

Description

Aureum is a modular nail station designed to allow nail technicians to work the way they want to. Aureum promotes modularity, comfortability, and efficiency in the nail salon work environment.

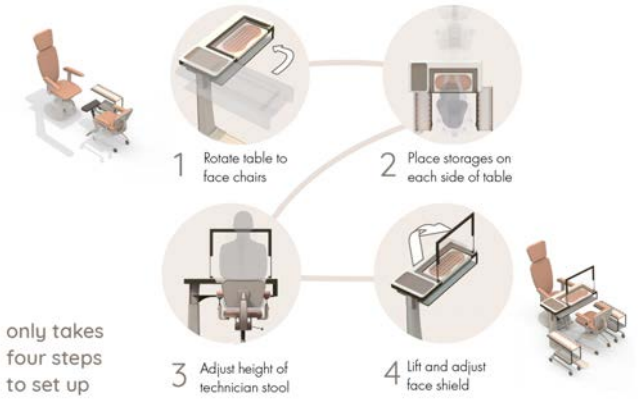
Explanation - Enhancement of Human Lifestyle

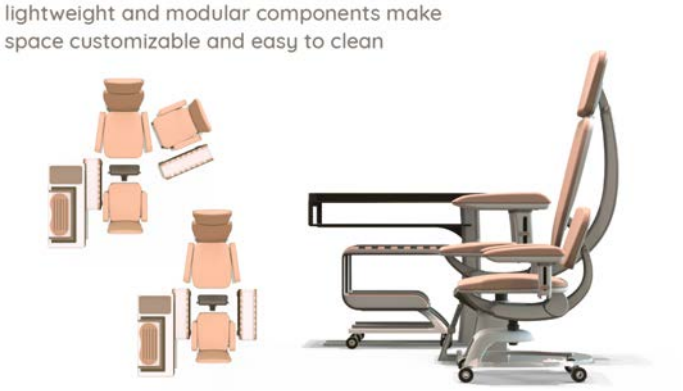
modular workstation that functions in two states

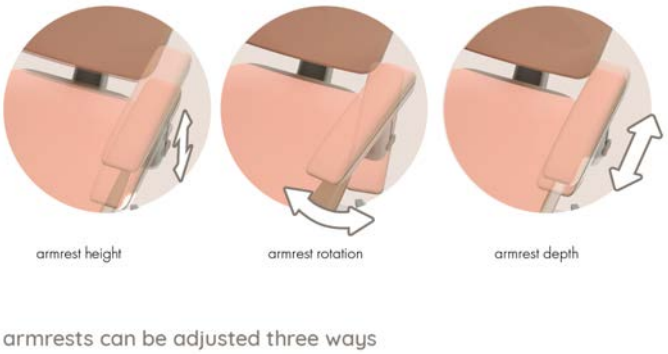


The aureum nail station is modular, accessible, and efficient. Designed to provide an open space where nail technicians can customize their setup according to their work habits and workflow, aureum is made up of modular parts that can be moved around and accessed at various locations around the workspace.

Benefit Statement - Human Interaction and User-Centric Design







Nail technicians have complete control over how they wish to set up their workspace with the aureum nail station. With four simple steps, aureum can switch between states suitable for manicures, pedicures or both depending on the service being provided. Clients

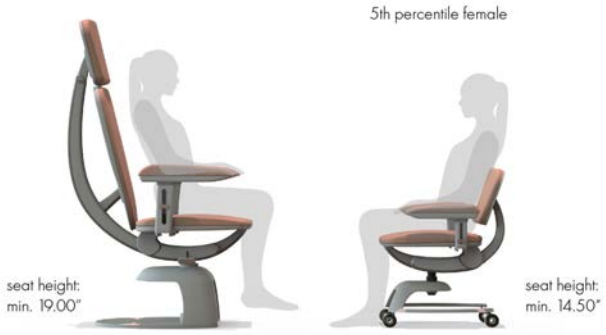
no longer need to move between stations during an appointment and technicians will have less work to clean and prepare their station between appointments.

5.2 Design Criteria Met

5.2.1 Full Bodied Interaction Design

chair tilts according to user's sitting position

chair and armrest height adjusted to suit
a wide percentile range of users



chair and armrest height adjusted to suit
a wide percentile range of users

The aureum pedicure chair and technician stool includes adjustable parts designed to accommodate a wide range of users seated in various positions. Aureum's form changes to follow the user's seating position, helping users maintain a natural working and seated position for long periods of time.

5.2.2 Materials, Processes And Technology

Larger and Complex Parts: Polypropylene (PP)

Larger and more complex parts of aureum's design (ie., its frame and housing) are manufactured from injection molded polypropylene (PP) scraps. Not only is injection molding a more cost-efficient and efficient manufacturing method because the same mold can be reused to produce the same part many times, the process also involves less energy consumption and waste to produce when forming more complex parts.

Accents and Mechanical Parts: Aluminum Alloy 6061

Mechanical parts that involve adjustment are die-cast aluminum alloy 6061. Die casting is another cost-efficient and efficient forming method that is also sustainable in which molds can be reused and recycled.

Finishing: Solvent-free Powder Coating

Powder coating parts helps enhance the durability and longevity of aluminum and PP as well as consumes less energy to perform by using less air pollution control equipment to contain toxic vapours from paint.

Caster wheels: Texin® TPU

Texin® is both a durable and versatile thermoplastic suitable for manufacturing caster wheels that require a lot of strength and wear resistance when transporting many weights and travelling on different surfaces. Texin® can be extruded and formed over solid surfaces when blended with Desmopan®.

Figure 59 - Caster wheels, (source https://www.walmart.com/ip/Caster-Wheel-TPR-5-in-280-lb/567893521)

Upholstery - AppleSkin Leather

AppleSkin leather is a more sustainable approach to synthetic leather. Imitating the appearance and properties of natural leather, AppleSkin leather is water resistant and wear resistant. This vegan leather is also a breathable material that is hypoallergenic, durable, and more wear resistant than synthetic leather. Despite being costly to produce, the leather is long lasting and is a suitable material for withstanding overuse.

Fig 60 - AppleSkin Leather, (source:https://www.appleskin.com/)

5.2.3 Design Implementation (BOM)

*** - used for more than one component of system**

Pedicure Chair

Part #	Description	Material	Manufacturing	Qty
1	Back support	Polypropylene (PP)	Injection molded	1
2	Backrest support	PP	Injection molded	1
3	Headrest support	PP	Injection molded	1
4	Headrest angle adjustment knob*	PP	Injection molded	5
5	Armrest support	PP	Injection molded	2
6	Armrest Adjustment (outer piece)	Aluminum alloy 6061	Die Cast	2
7	Armrest Adjustment (inner piece)	Aluminum alloy 6061	Die Cast	2
8	Armrest	PP	Injection	6

	adjustment knob*		**molded**	
9	**Tilt control mechanism (housing)**	**PP**	**Injection molded**	**1**
10	**Hydraulic gas lift cylinder**	**Aluminum alloy 6061** **PP**	**Die Cast Injection molded**	**1**
11	**Chair height and tilt adjustment handle**	**PP**	**Injection molded**	**2**
12	**Base (top)**	**PP**	**Injection molded**	**1**
13	**Base (side pieces)**	**PP**	**Injection molded**	**2**
14	**Base (bottom piece)**	**PP**	**Injection molded**	**1**
15	**Upholstery***	**Appleskin Leather**		**9**

Technician Stool

Part #	Description	Material	Manufacturing	Qty
16	**Back support**	**Polypropylene (PP)**	**Injection molded**	**1**
17	**Headrest support**	**PP**	**Injection molded**	**1**
18	**Backrest support**	**PP**	**Injection molded**	**1**
19	**Armrest support**	**PP**	**Injection molded**	**2**
20	**Armrest Adjustment (outer piece)**	**Aluminum alloy 6061**	**Die Cast**	**2**
21	**Armrest Adjustment (inner piece)**	**Aluminum alloy 6061**	**Die Cast**	**2**
22	**Tilt control mechanism**	**PP**	**Injection molded**	**1**

	(housing)			
23	Hydraulic gas lift cylinder	Aluminum alloy 6061 PP	Die Cast Injection molded	1
24	Base (top)	PP	Injection molded	1
25	Bottom legs	PP	Injection molded	2
26	Caster Wheels*	Texin®	Injection molded	12

Side Storage (Individual)

Part #	Description	Material	Manufacturing	Qty
27	Top tray	PP	Injection molded	1
28	Handle pieces	PP Texin®	Injection molded	2
29	Bottom tray	PP	Injection molded	1
30	Base	PP	Injection molded	1

Side Table

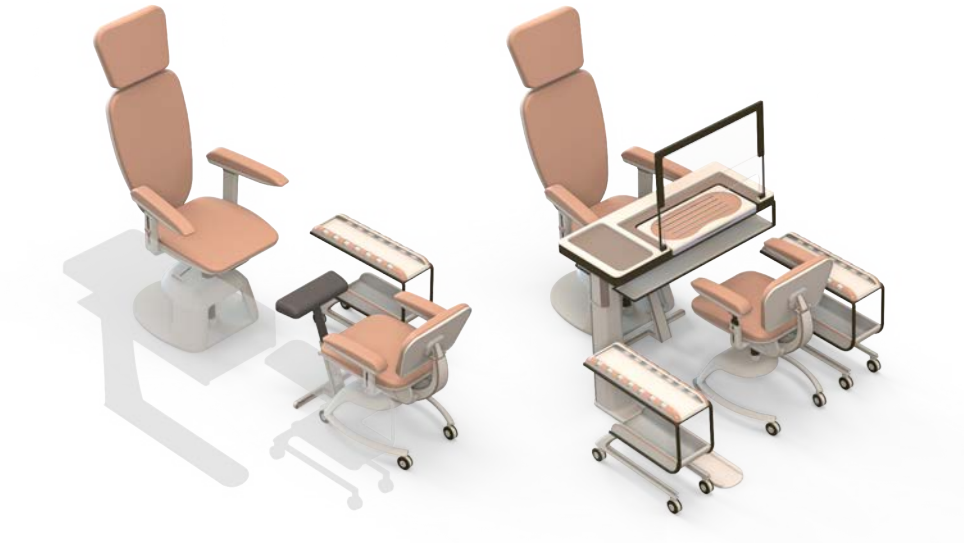
Part #	Description	Material	Manufacturing	Qty
31	Leg	PP	Injection molded	1
32	Handle/ support piece	PP Texin ®	Injection molded	1
33	Storage tray	PP	Injection molded	1
34	Rotating mechanism (hidden)	PP	Injection molded	1
35	Table top	PP	Injection molded	1
36	Fan motor housing (top	PP	Injection molded	2

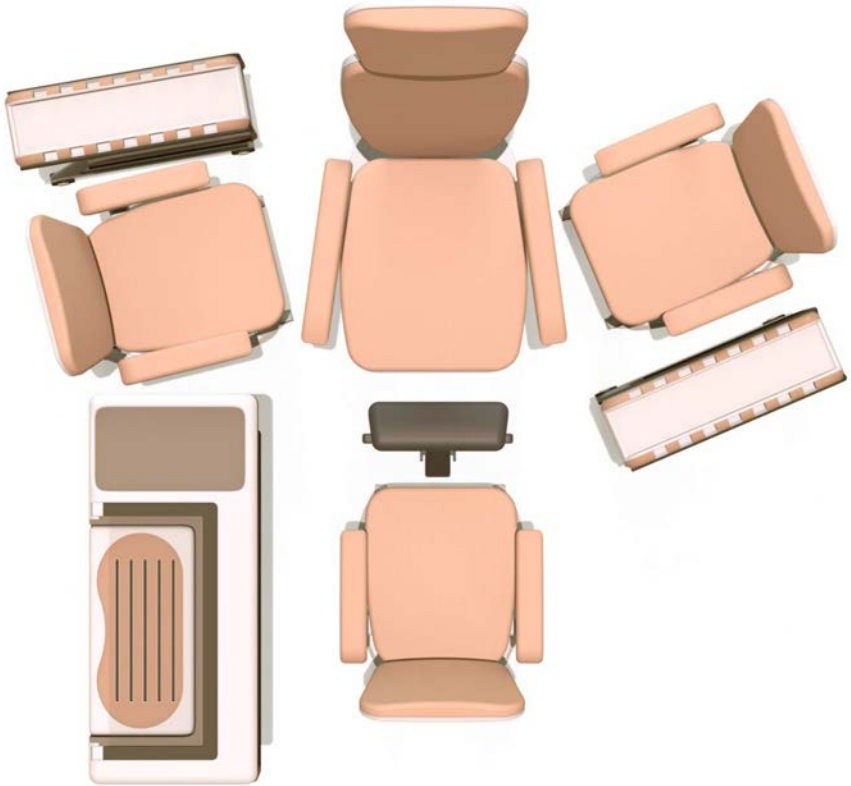
	and bottom)			
37	**Face shield**	**Makrolon ®**	**Injection molded**	**2**
38	**Shield Frame**	**Makrolon ®**	**Injection molded**	**1**
39	**Shield adjustment pieces**	**Makrolon ®**	**Injection molded**	**2**

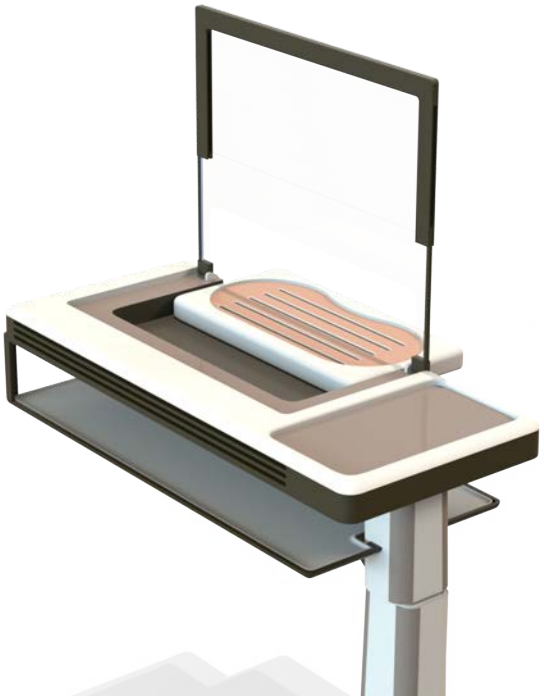
Footrest

Part #	Description	Material	Manufacturing	Qty
40	**Housing**	**PP**	**Injection molded**	**1**
41	**Adjustment piece**	**PP**	**Injection molded**	**1**
42	**Footrest cushion frame**	**PP**	**Injection molded**	**1**

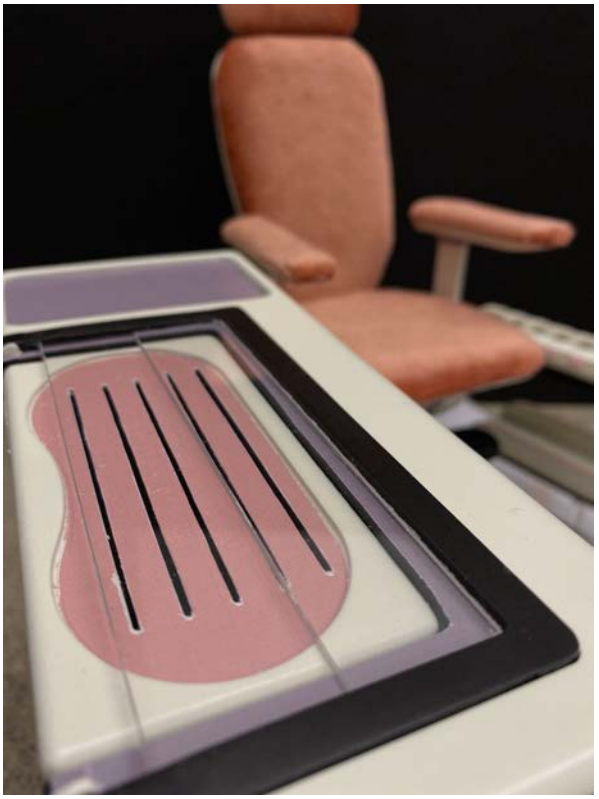
5.3 Final CAD Rendering

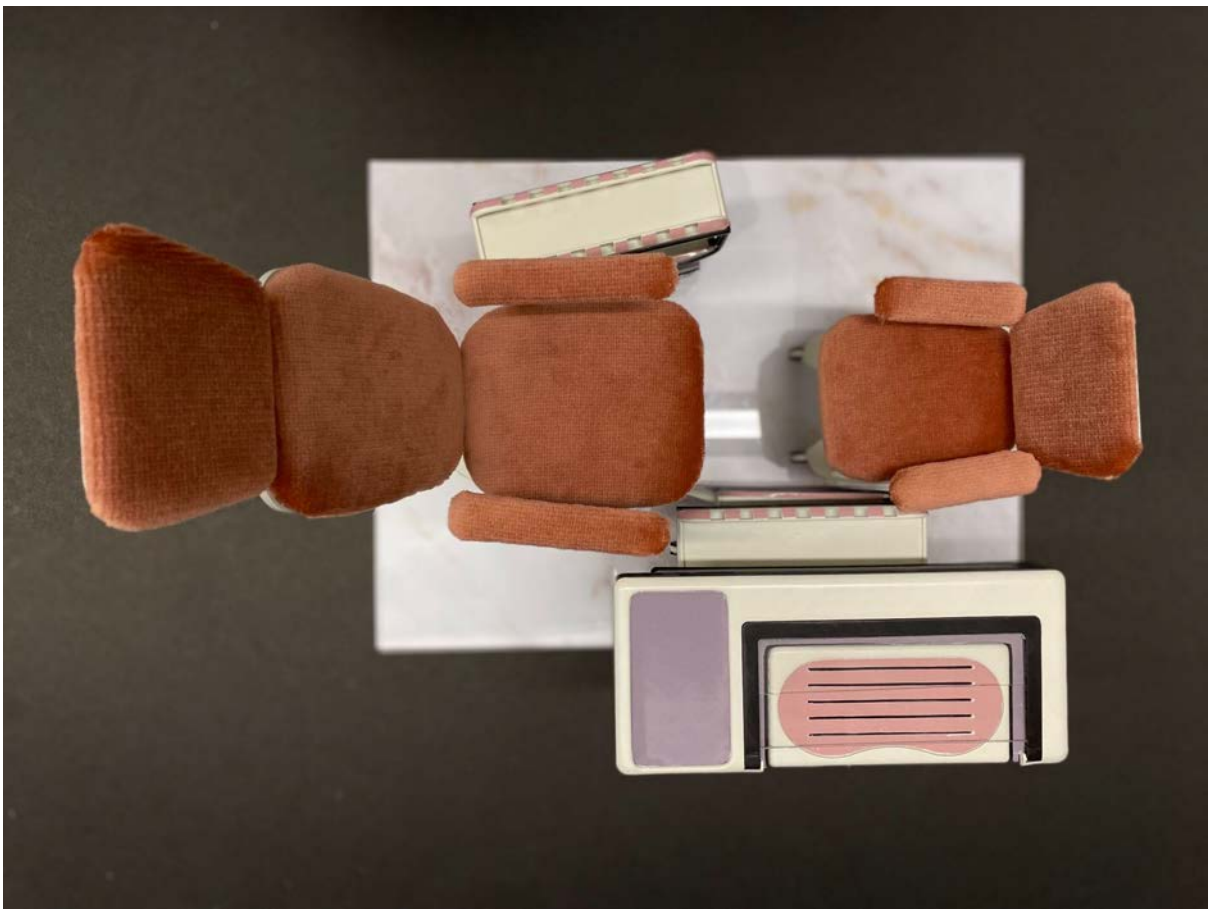






5.4 Physical Model





5.5 Technical drawings

5.6 Sustainability

Sustainability Statement for Final Design

Nail salon workstations consist of multiple components that work together to enhance the working and leisure experience for both technicians and clientele. Most nail salon furniture undergo constant use and thorough cleaning and thus require materials that can withstand overuse. To do so, all components should be durable, easy to clean, lightweight, and aesthetically pleasing. Nail equipment tends to be expensive depending on the quality of materials being used. Therefore, the materials chosen for the final design must further enhance the quality and longevity of the overall product in order to make its purchase justifiable to managers.

More cost-efficient and repurposable materials such as 6061 aluminium and PP would be beneficial to use for larger and more complex parts of the final design. Processing and finishing 6061 aluminum and PP require less energy consumption and product waste, making it easier to manufacture replaceable parts and further prolonging the lifespan of the product. Using more costly materials such as AppleSkin leather or Covestro’s engineered plastics such as Makrolon and Texin for smaller parts such as upholstery, handles or hinges would reduce the need to replace those parts due to their high strength and resistance.

By incorporating these materials and processing methods, the aim is to introduce a more sustainable approach to a nail workstation with a long product life. A long lasting workstation allows salon managers to invest in reliable and sturdy equipment without sacrificing the appearance, comfort, and safety technicians and clients look for.

CHAPTER 6 - CONCLUSION

Current workstations in nail salons do not accommodate the working conditions of nail technicians. Designed for the comfort of the client, manicure tables and pedicure chairs often lack a comfortable working and storage space for nail technicians. Working in these types of spaces for prolonged periods of time have caused work-related injuries that are ergonomic, physical, and biological in nature to occur in technicians and worsen overtime. The lack of initiative to improve the current work environment in nail salons will degrade technicians' performance and quality, place technicians and clients at further risk of injuries and health problems, and negatively impact client satisfaction, affecting the salon's business and technicians' reputation.

Aureum responds to these issues by providing a comfortable, accessible, and efficient space for technicians to work in that suits their habits and preferences. When working in the aureum modular nail station, technicians can perform confidently and effectively.

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APPENDIX

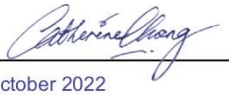
Appendix J - Approval Forms And Plans

TOPIC APPROVAL - FTA-2 (B)

Student Name:	**Hannah Dumancas**
Topic Title:	**How may we improve the working environment for nail salon technicians?**

Despite heavy media coverage on the health hazards associated with working in nail salons, this issue has yet to be resolved. Nail technicians are at risk of developing serious health conditions in the workplace. Poor workstation design has subjected technicians to hazards that range from prolonged chemical inhalation to work-related musculoskeletal disorders (WMSDs) that affect work performance and client satisfaction. Majority of nail technicians are immigrants who rely on the nail industry as their main source of income and tend to leave their health issues unreported due to fear of cutting hours. Faulty equipment, overworked technicians, and insufficient training results from poor salon maintenance that influences the quality of service provided by technicians, decreases client loyalty, and increases chances of exposure to hazards. This thesis topic hopes to provide an in-depth study on the technician's work environment through user observation and conducting one-to-one interviews to address the challenges associated with workplaces in nail salons. A full scaled model will be produced to ensure a feasible product that encompasses full-bodied human interaction and ergonomic design. The final design solution will reduce the risk of health hazards in nail salons while promoting a productive and safe working environment for nail technicians.

Student Signature(s): 	
Date:	**30/09/2022**

Instructor Signature(s): 	
Date:	06 October 2022

Thesis Topic Approval

IDSN 4502
SENIOR LEVEL THESIS TWO

Humber ITAL / Faculty of Applied Sciences & Technology
Bachelor of Industrial Design / WINTER 2023
Catherine Chong / Fredric Matovu

CRITICAL MILESTONES: APPROVAL FOR CAD DEVELOPMENT & MODEL FABRICATION

Student Name:	Hannah Dumancas
Approved Thesis Title:	Improving Nail Salon Work Environment

THESIS PROJECT – DESIGN APPROVAL FORM

Design is reviewed and approved to proceed for the following:	X	**CAD Design and Development Phase**
Comment: Continue design refinement in CAD development, need to iron out detailing and product's features, pay attention to surfacing, components, and assembly methods for design feasibility. Viable holistic design thinking in conjunction with considerations into sustainability aspects. CAD development must be at least 75% complete for review before approval for fabrication.		

Design is reviewed and approved to proceed for the following:	X	**Model Fabrication Including Rapid Prototyping / 3D Printing and Model Building Phase**
Comment: Waiting for CAD development review (as of Feb-21). CAD progress well, design completed, continue detail refinement, once refined, fabrication of model can begin.		

Instructor Signature(s):	Catherine Chong F.K. Matovu
Date:	07 March 2023

1

Chong, Kappen

Thesis Design Approval (CAD Development & Model Fabrication)


PANEL ON RESEARCH ETHICS
Navigating the ethics of human research

TCPS 2: CORE 2022

Certificate of Completion

This document certifies that

Hannah Dumancas

successfully completed the Course on Research Ethics based on the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2: CORE 2022)

Certificate # 0000842069 16 September, 2022

Proof of TCPS-2-CORE certificate

Survey & Interviews

Surveys (with clients) and 1:1 interviews (with technicians or salon owners) will be conducted to gain several opinions about the current work environment in nail salons.

Survey (clients)
- Sent out via surveyswap.io and through family/friends to share with others
- Open from OCT 6 - OCT 14

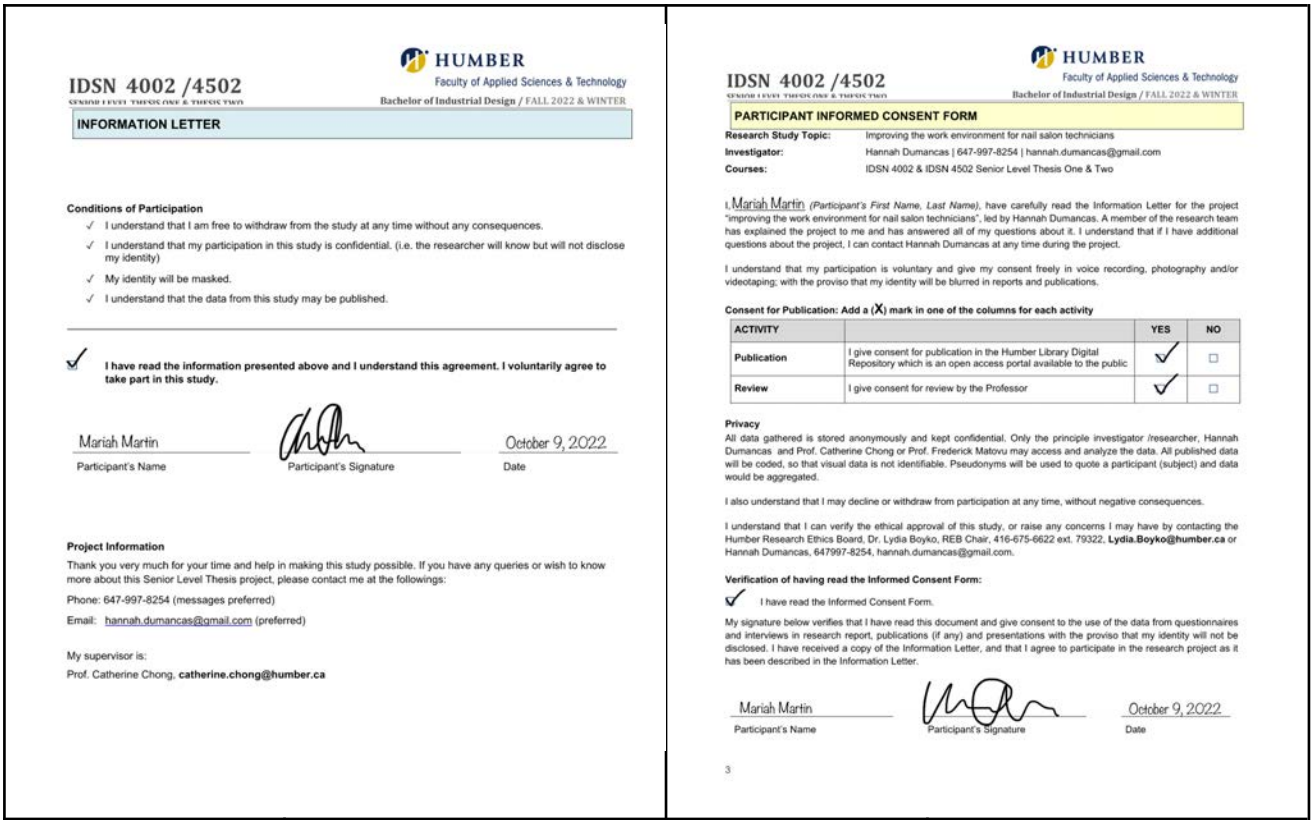
1:1 Interview (technicians)
- Conducted via zoom/webex call/messaging
- Answers may be recorded upon permission

Possible Contacts - Nail Technicians for information interview			
Personal Contacts (Warm Call)			
Potential contacts suggested by friends and family members			**Status**
Sunny Nhat	**Nail Technician Angelic Nails and Spa**	cunhatlinh09032000@gmail.com	Contacted (Oct 14); no response
Pamela	**Nail Technician**	416-837-0729	Contacted; in-person interview/possible in-field observation Thursday Oct 20 @

			4PM
Linkedin - Potential Contacts			
Mariah Martin	**Nail technician/salon administrator at Tangles Hair Salon & Spa**	https://www.linkedin.com/in/mariah-martin-/	Interview 1 complete (Sept 22) May do a follow up interview (email/message) to answer additional questions (Oct 14-
~~**Helen Vu**~~	~~**Nail Technician at Kuko House (Permanent Parttime)**~~	~~https://www.linkedin.com/in/helen-vu-338b741a1/~~	~~Contacted (Oct 7); no response~~
Kristy Yang	**Founder/Salon Owner of Allure Nail Bar**	https://www.linkedin.com/in/kristy-yang-579277207/	Contacted oct 20
Other Social Media - Potential Contacts			
Olivia	**Glam Pro Nail Technician**	https://www.instagram.com/olivia_nail_salon/?hl=en	Contacted (Oct 14); no response
Slobotka	**Nail Technician**	https://www.instagram.com/applausetheclaws/?hl=en	Contacted (Oct 14); no response
The Ten Spot	**Nail salon in toronto**	497 Bloor St W, Toronto, ON M5S 1Y2 https://www.thetenspot.com/	Contacted oct 20

Potential Advisor/ Expert Engagement

Advisor	Contact Info	Status	Contribution to Research
Advisor One: **Mariah Martin** Nail technician/ salon administrator at Tangles Hair Salon & Spa	**https://www.linkedin.com/in/mariah-martin-/** **mariahmartin25@yahoo.ca**	**Confirmed** ***have already contacted for 1:1 interview** Possible follow up interview (cover questions that were added)	**Experience with equipment, procedures, and client behaviour beneficial for providing feedback.** - Evaluate design development (preliminary-final stages) - May help with product styling and features (placement, feasibility)
Mariah's Signed Consent/Information form:			



HUMBER
Faculty of Applied Sciences & Technology
Bachelor of Industrial Design / FALL 2022 & WINTER

IDSN 4002 /4502

INFORMATION LETTER

Conditions of Participation

- ✓ I understand that I am free to withdraw from the study at any time without any consequences.
- ✓ I understand that my participation in this study is confidential. (i.e. the researcher will know but will not disclose my identity)
- ✓ My identity will be masked.
- ✓ I understand that the data from this study may be published.

✓ **I have read the information presented above and I understand this agreement. I voluntarily agree to take part in this study.**

Mariah Martin — Participant's Name
Participant's Signature
October 9, 2022 — Date

Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more about this Senior Level Thesis project, please contact me at the followings:

Phone: 647-997-8254 (messages preferred)

Email: hannah.dumancas@gmail.com (preferred)

My supervisor is:

Prof. Catherine Chong, **catherine.chong@humber.ca**

HUMBER
Faculty of Applied Sciences & Technology
Bachelor of Industrial Design / FALL 2022 & WINTER

IDSN 4002 /4502

PARTICIPANT INFORMED CONSENT FORM

Research Study Topic: Improving the work environment for nail salon technicians
Investigator: Hannah Dumancas | 647-997-8254 | hannah.dumancas@gmail.com
Courses: IDSN 4002 & IDSN 4502 Senior Level Thesis One & Two

I, Mariah Martin *(Participant's First Name, Last Name)*, have carefully read the Information Letter for the project "improving the work environment for nail salon technicians", led by Hannah Dumancas. A member of the research team has explained the project to me and has answered all of my questions about it. I understand that if I have additional questions about the project, I can contact Hannah Dumancas at any time during the project.

I understand that my participation is voluntary and give my consent freely in voice recording, photography and/or videotaping; with the proviso that my identity will be blurred in reports and publications.

Consent for Publication: Add a (X) mark in one of the columns for each activity

ACTIVITY		YES	NO
Publication	I give consent for publication in the Humber Library Digital Repository which is an open access portal available to the public	✓	☐
Review	I give consent for review by the Professor	✓	☐

Privacy

All data gathered is stored anonymously and kept confidential. Only the principle investigator /researcher, Hannah Dumancas and Prof. Catherine Chong or Prof. Frederick Matovu may access and analyze the data. All published data will be coded, so that visual data is not identifiable. Pseudonyms will be used to quote a participant (subject) and data would be aggregated.

I also understand that I may decline or withdraw from participation at any time, without negative consequences.

I understand that I can verify the ethical approval of this study, or raise any concerns I may have by contacting the Humber Research Ethics Board, Dr. Lydia Boyko, REB Chair, 416-675-6622 ext. 79322, **Lydia.Boyko@humber.ca** or Hannah Dumancas, 647997-8254, hannah.dumancas@gmail.com.

Verification of having read the Informed Consent Form:

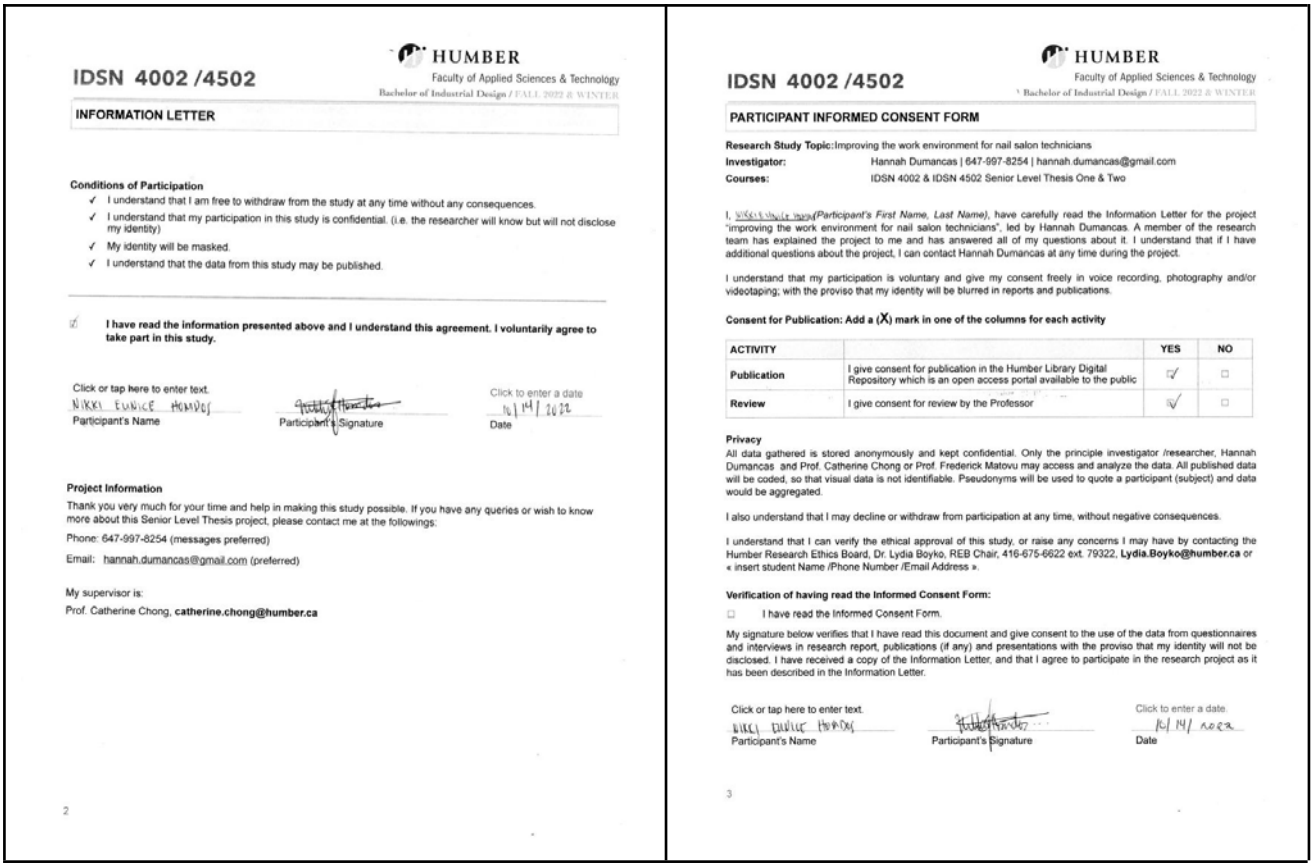
✓ I have read the Informed Consent Form.

My signature below verifies that I have read this document and give consent to the use of the data from questionnaires and interviews in research report, publications (if any) and presentations with the proviso that my identity will not be disclosed. I have received a copy of the Information Letter, and that I agree to participate in the research project as it has been described in the Information Letter.

Mariah Martin — Participant's Name
Participant's Signature
October 9, 2022 — Date

3

Advisor Two: **Nikki Homdos** Bachelors in Physiotherapy (studied for 5 years), currently PSW	Relative; lives in the same house. nikkieuniceph12@gmail.com	**Confirmed**	**May provide useful feedback for user observation and ergonomic analysis:** - Identifying major touchpoints - Working posture (ideal seating positions) - Reducing repetitive strain injury (RSI) or musculoskeletal disorders while working
Nikki's Signed Consent/Information form:			



HUMBER
Faculty of Applied Sciences & Technology
Bachelor of Industrial Design / FALL 2022 & WINTER

IDSN 4002 /4502

INFORMATION LETTER

Conditions of Participation

- ✓ I understand that I am free to withdraw from the study at any time without any consequences.
- ✓ I understand that my participation in this study is confidential. (i.e. the researcher will know but will not disclose my identity)
- ✓ My identity will be masked.
- ✓ I understand that the data from this study may be published.

☑ **I have read the information presented above and I understand this agreement. I voluntarily agree to take part in this study.**

Click or tap here to enter text. NIKKI EUNICE HONDO
Participant's Name

Participant's Signature

Click to enter a date 10/14/2022
Date

Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more about this Senior Level Thesis project, please contact me at the followings:

Phone: 647-997-8254 (messages preferred)

Email: hannah.dumancas@gmail.com (preferred)

My supervisor is:

Prof. Catherine Chong, **catherine.chong@humber.ca**

2

HUMBER
Faculty of Applied Sciences & Technology
Bachelor of Industrial Design / FALL 2022 & WINTER

IDSN 4002 /4502

PARTICIPANT INFORMED CONSENT FORM

Research Study Topic: Improving the work environment for nail salon technicians
Investigator: Hannah Dumancas | 647-997-8254 | hannah.dumancas@gmail.com
Courses: IDSN 4002 & IDSN 4502 Senior Level Thesis One & Two

I, NIKKI EUNICE HONDO *(Participant's First Name, Last Name)*, have carefully read the Information Letter for the project "improving the work environment for nail salon technicians", led by Hannah Dumancas. A member of the research team has explained the project to me and has answered all of my questions about it. I understand that if I have additional questions about the project, I can contact Hannah Dumancas at any time during the project.

I understand that my participation is voluntary and give my consent freely in voice recording, photography and/or videotaping; with the proviso that my identity will be blurred in reports and publications.

Consent for Publication: Add a (X) mark in one of the columns for each activity

ACTIVITY		YES	NO
Publication	I give consent for publication in the Humber Library Digital Repository which is an open access portal available to the public	☑	☐
Review	I give consent for review by the Professor	☑	☐

Privacy

All data gathered is stored anonymously and kept confidential. Only the principle investigator /researcher, Hannah Dumancas and Prof. Catherine Chong or Prof. Frederick Matovu may access and analyze the data. All published data will be coded, so that visual data is not identifiable. Pseudonyms will be used to quote a participant (subject) and data would be aggregated.

I also understand that I may decline or withdraw from participation at any time, without negative consequences.

I understand that I can verify the ethical approval of this study, or raise any concerns I may have by contacting the Humber Research Ethics Board, Dr. Lydia Boyko, REB Chair, 416-675-6622 ext. 79322, **Lydia.Boyko@humber.ca** or « insert student Name /Phone Number /Email Address ».

Verification of having read the Informed Consent Form:

☐ I have read the Informed Consent Form.

My signature below verifies that I have read this document and give consent to the use of the data from questionnaires and interviews in research report, publications (if any) and presentations with the proviso that my identity will not be disclosed. I have received a copy of the Information Letter, and that I agree to participate in the research project as it has been described in the Information Letter.

Click or tap here to enter text. NIKKI EUNICE HONDO
Participant's Name

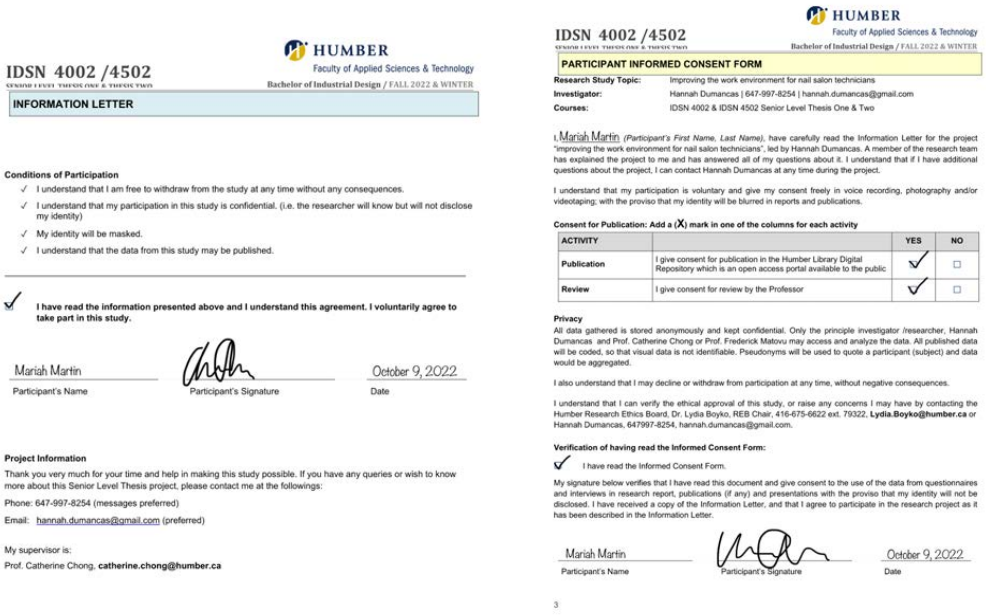
Participant's Signature

Click to enter a date. 10/14/2022
Date

3

Research Plan and Advisor Initiatives

Appendix K - Advisor Meetings And Agreement Forms



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IDSN 4002 /4502
SENIOR LEVEL THESIS ONE & THESIS TWO

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Mariah Martin — Participant's Name
Participant's Signature
October 9, 2022 — Date

Project Information

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Research Study Topic: Improving the work environment for nail salon technicians
Investigator: Hannah Dumancas | 647-997-8254 | hannah.dumancas@gmail.com
Courses: IDSN 4002 & IDSN 4502 Senior Level Thesis One & Two

I, Mariah Martin *(Participant's First Name, Last Name)*, have carefully read the Information Letter for the project "improving the work environment for nail salon technicians", led by Hannah Dumancas. A member of the research team has explained the project to me and has answered all of my questions about it. I understand that if I have additional questions about the project, I can contact Hannah Dumancas at any time during the project.

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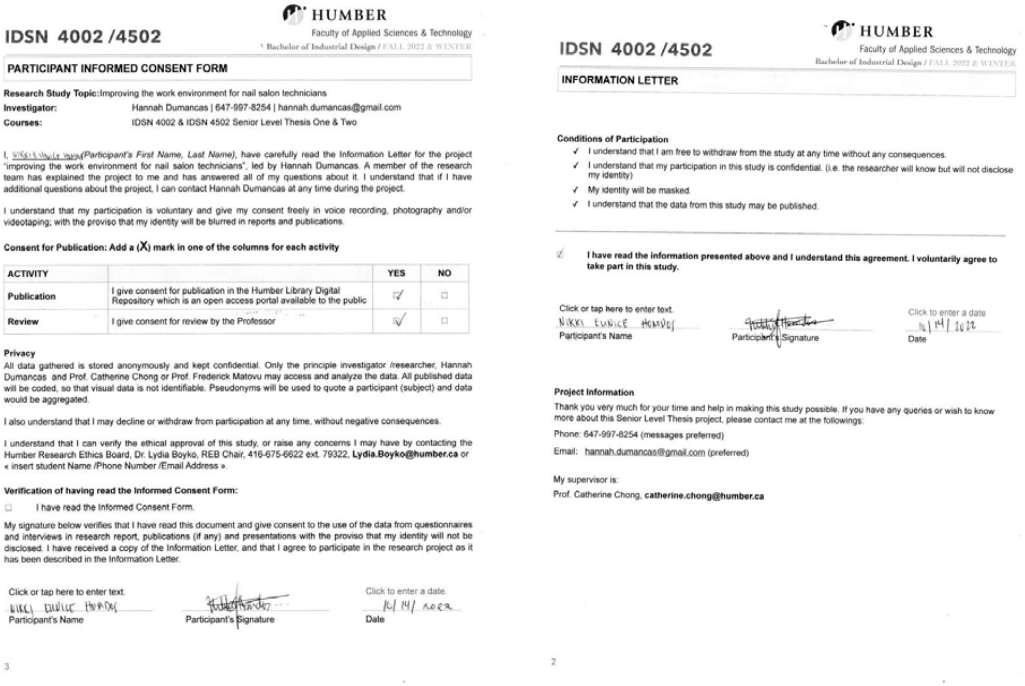
Mariah Martin — Participant's Name
Participant's Signature
October 9, 2022 — Date

3

Advisor 1 Informed Consent + Information Letter



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Courses: IDSN 4002 & IDSN 4502 Senior Level Thesis One & Two

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NIKKI EUNICE HOWE — Participant's Name
Participant's Signature
Click to enter a date.
10/14/2022 — Date

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2

Advisor 2 Informed Consent + Information Letter

Record of Correspondent (Advisor 1)