

## Research Report: Projection Mapping

Student's name: Gabriel Gibbon

Student number: 220000120

Name of lecturer: Martin Bolton

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*Figure 1- Head Sculpture, Johannesburg, 2022 (Created by author)*



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## 1. Introduction

The fusion of 3D physical models and 2D digital images create sculptures and artworks that blend and overlap the digital space and the physical world. Digital designs, renders, models and videos can be brought into the real world through projection. This report will show how real-life objects or people can be scanned into digital models, manipulated through computer programs like Blender and Solidworks and then recreated in the physical world through digital fabrication techniques such as laser cutting and 3D printing but most importantly at any scale. A head that can fit in the palm of your hand or a head that can take up an entire room. When these sculptures are projected back onto, they blend virtual space and reality seamlessly. This report will show the entire process from initial scanning, model refinement, rapid prototyping, mock-up making and the construction of a 2.5m tall model of a head. This will lead to a series of images and videos showing the various projection experiments that have taken place so far.

## 2. Face Scanning

3D printingsystems.co.za came to the University of Johannesburg to scan various objects as well as two students. They used a hand-held scanner that emitted light and various rays to digitally map real life objects into the digital realm. The objects were placed onto a rotating platform covered in patterns. The patterns helped orientate the object in the digital realm. To scan the students faces they were placed on a chair and the scanner was manually moved around them. It was very important to keep a consistent distance away from the subject to make sure it was in focus and being properly scanned.

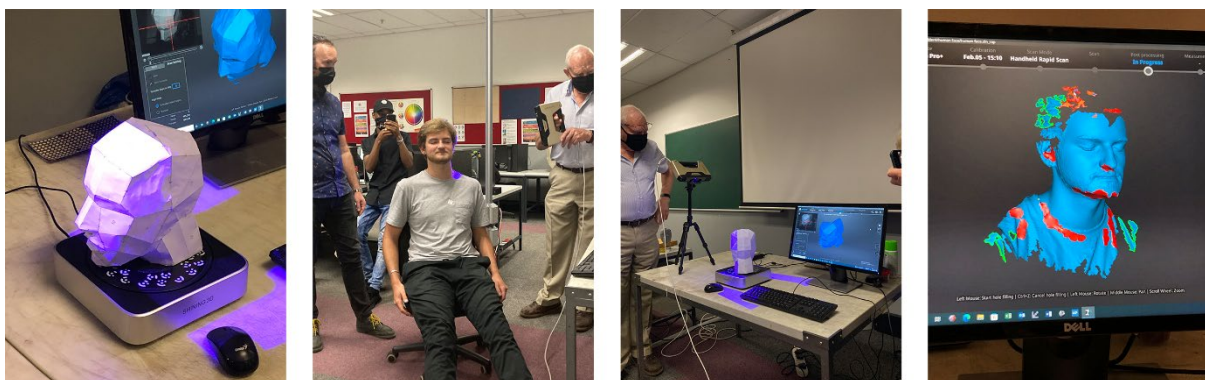


Figure 3-Head Scanning, Johannesburg, 2022 (Scan of Author)

In real time the model was being created on the connected computer. Allowing the operator to see if there were elements that were missed or any errors in the scan. The scanner emitted a very bright and harsh purple light while scanning so the subjects both had headaches after the scanning process. This also meant that the subjects needed to have their eyes closed for the duration of the process. The scans were created as both Stl and Obj files.

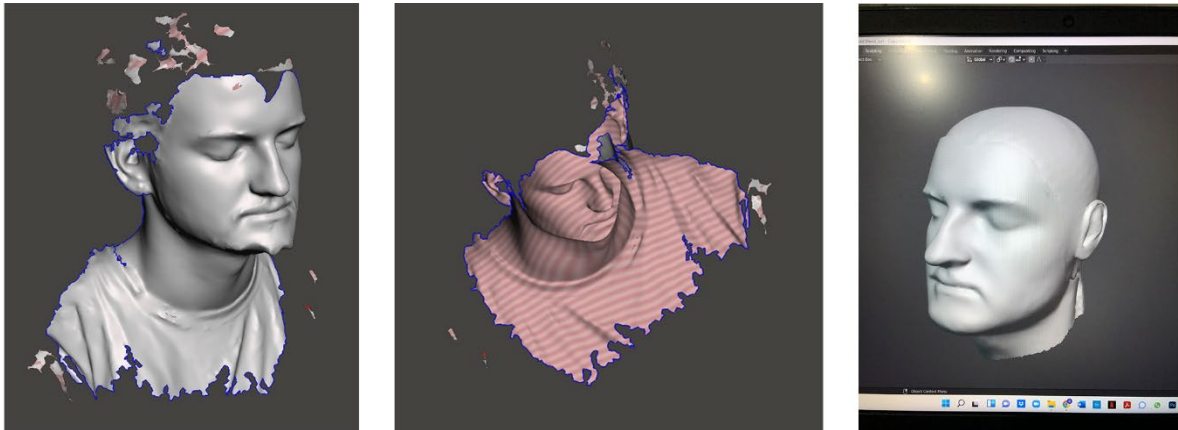


Figure 4-Head Scan, Johannesburg, 2022 (Model of author)

### 3. 3D model/Scan refinement

Once the scan had been completed it needed to be refined. The scanning software is unable to pick up hair and creates strange geometries as a result. Due to the head being scanned having a beard and a full head of hair there were large areas that needed to be repaired. The face scan is also just a surface level hollow face rather than a whole solid head. A model of a full 3D head was imported alongside the face model into blender. The models were scaled to match and the models were joined. By using digital sculpting tools, the models could be smoothed to match one another and become seamless. Certain elements were removed to allow for a more seamless join.

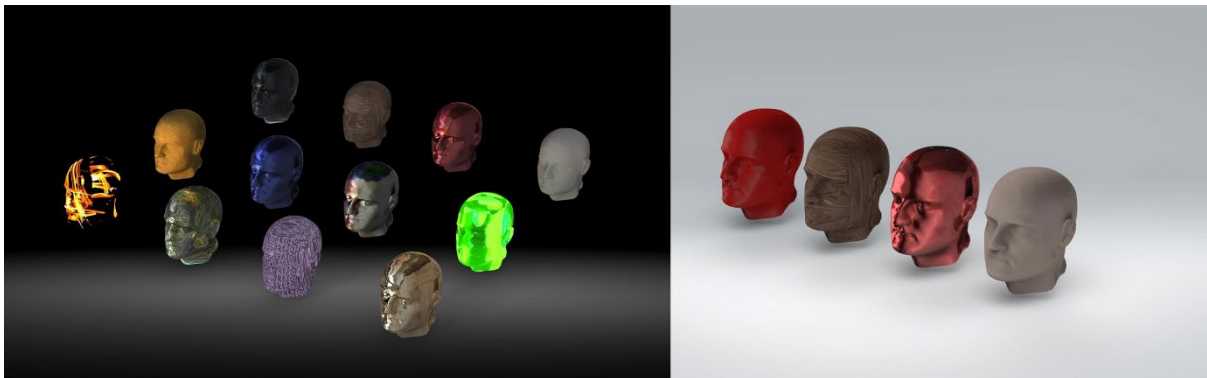


Figure 5-Head model, Johannesburg, 2022 (Modelled by author)



The chin and cheeks required large amounts of work as the subject's beard made them bumpy and uneven. The program Mesh Mixer was also used and its smoothing feature works particularly well. The model even after all this work is still hollow and has gaps. Mesh Mixer has a Solidify and Fill Gaps command that is used to create a solid model. The model was then exported as a 3D Obj and Stl. File. After the initial digital sculpting process a shoulder and neck model was also added to the head model using the same process. Ideally a full scan would be completed of the entire subject clean shaven and ideally bald or with a bald cap.

This completed solid digital model then has a wide variety of uses in both the digital and physical space. Initial experiments applied a variety of finishes and textures to the model and then rendering them to produce the illusion of solid wood or glass sculptures. This model has been brought from the 3D space (Real world scanning) into the 2D space (Blender) and can then be brought back into the 3D space (Real world) through a variety of methods that will be explored in the following section of this report.



*Figure 6-Head render, Johannesburg, 2022 (Rendered by author)*

#### **4. Digital fabrication techniques**

##### **i. 3D printing**

FDM 3D Printing (Fused deposition modelling) deposits a small layer of plastic on a surface through a nozzle. The movement of this nozzle and the print bed create a 3D part through the process of additive manufacturing. The Stl file is imported into a slicing software Cura. This software places the model on the print bed and helps generate supports for the model. The supports are plastic frameworks that help support overhangs allowing a successful print without sagging or drooping elements. These supports are designed to be snapped off of the part once complete. Supports

were needed underneath the chin as this was a large overhang. The head model was printed on an Ender 5 3D printer by a fellow student and cost R200.00.

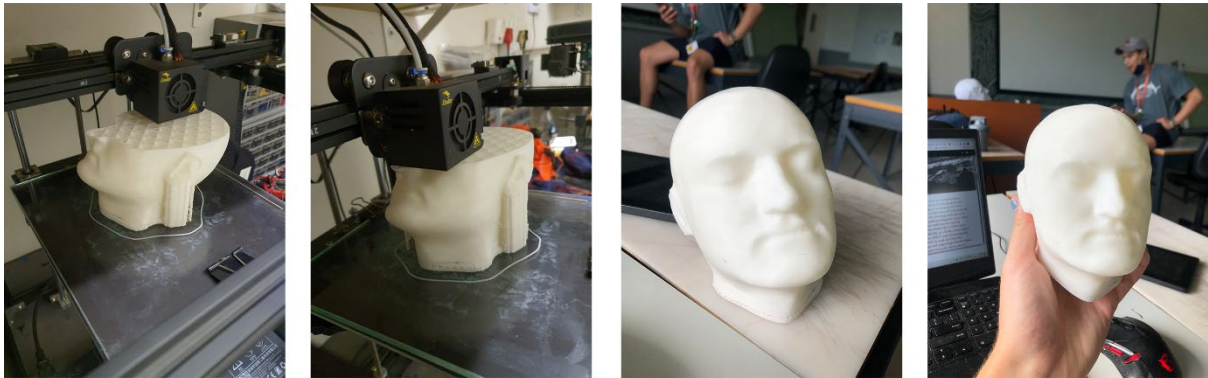


Figure 7-3D print, Johannesburg, 2022 (Model of author)

3D printing is a very accurate method of bringing 3Dm models into the physical space but is very time and material intensive. The size of the model is also limited by the bed size of the 3D printer with most entry level printers having maximum print sizes of 250mm by 250mm.

## ii. Laser cutting

Another method of bringing the 3D model into the physical realm is using a laser cutter. The software: Slicer for Fusion 360 allows the user to slice the model into a series of profiles that can be cut out of flat material and stacked onto of one another.



Figure 9-Head laser cut 2, Johannesburg, 2022 (Created by author)

The software allows the slicing of the model into vertical and horizontal stacks. Cardboard was used as the flat material as it works very well with the laser cutter. Slicer also allows the model to be cut into a series of interlocking layers which was explored below.



It is essential to recreate the material that the pattern is being cut out of digitally to match the one in real life. Below was a model designed to be cut out of 3mm cardboard that was actually cut out of 4mm cardboard. This slight discrepancy distorted and stretched the entire model. While this wasn't planned it did create a very interesting effect that will be explored in future projects.

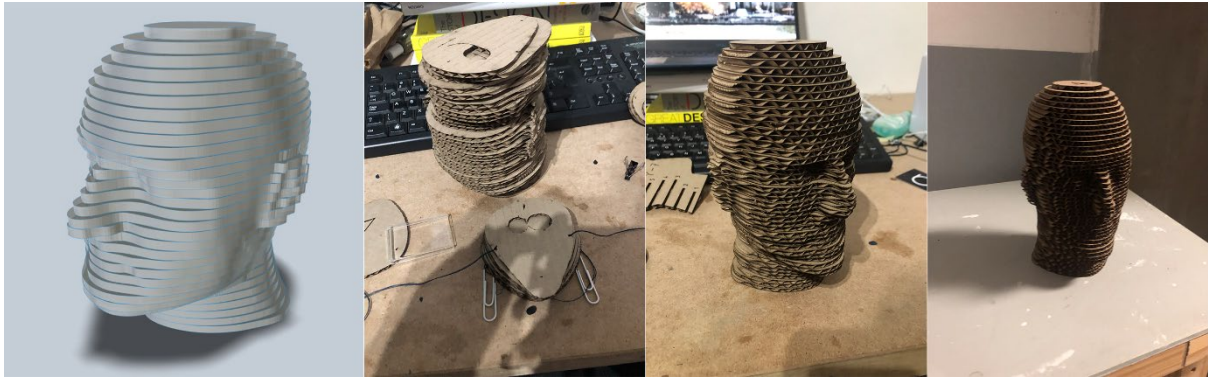


Figure 10-Head laser cut 3, Johannesburg, 2022 (Created by author)

## 5. Pepakura and mock-up development

Pepakura is a software that allows the user to 'unfold' a 3D model into a series of flat triangles (<https://tamasoft.co.jp/pepakura-en/>). These individual pieces can then be printed out, cut out and then refolded and stuck together to recreate the 3-Dimensional model in real life. While in principle this is very simple it is actually very difficult to do. Most 3D models (stl, obj files) tend to have lots of curves. Due to paper only being able to fold in 1 direction the software unfolds every single curve into a huge array of overlapping triangles that can't actually be cut out and folded together (Figure below).

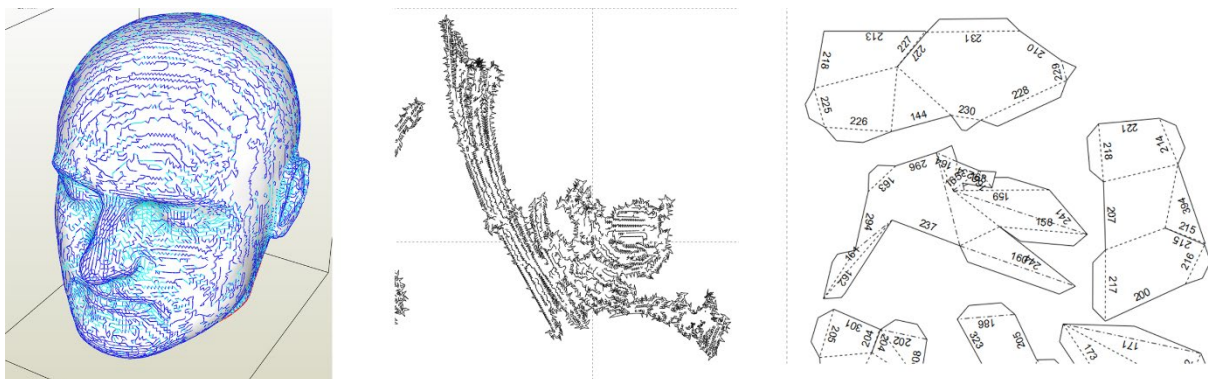


Figure 11-Pepakura model, Johannesburg, 2022 (Created by author)

To account for this the polymer count of the model needs to be reduced, ie the model needs to become simplified and more geometric. The term Low-poly is used. In Blender the command Decimate allows the user to simplify the model by specifying the number of polygons the model is made from. Too few and the model loses all detail and becomes an abstracted form, too many and the Pepakura file cannot be cut and folded.

Secondly Pepakura is a computer software and doesn't account for material thickness when creating the patterns. It assumes 1-pixel thick material which doesn't exist in the real world. Paper, card and cardboard all have thicknesses that need to be accounted for in order to correctly assemble the model (Chan 2022: [sp]).

Pepakura has a very easy system of model assembly. Each joining edge has a corresponding number (Edge 344 corresponds to 344). Tabs can be added to faces to allow space for glue. These tabs extend from the joining edge so that the alternate edge can overlap with glue in between the joint. Similar to how premade cardboard boxes are assembled.

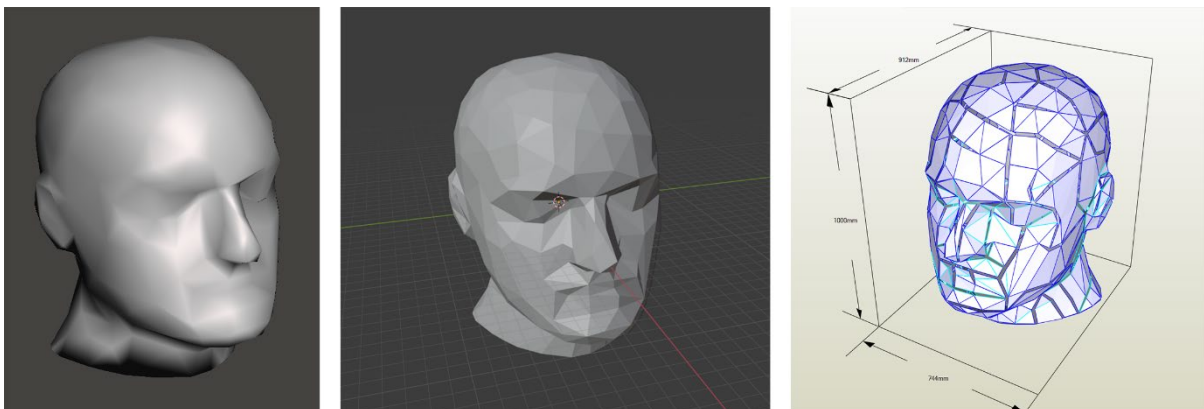


Figure 12-Low-poly Model, Johannesburg, 2022 (Created by author)

When the part is unfolded through the software the parts become a series of triangles made up of joining edges and fold lines. That when assembled; create 3D concave and convex models. To do this paper needs to be folded along two types of fold lines printed on each part. Mountain folds [Λ] are represented by a dashed line ( - - - - - ) and valley folds [V] are represented by a dotted and dashed line ( \_ . \_ . \_ . \_ ). Pepakura also includes a model of both the unfolded pattern and the model. On this model mountain folds are shown in a dark blue line and valley folds in a turquoise line. It is essential to have this digital model available while assembling the pattern.

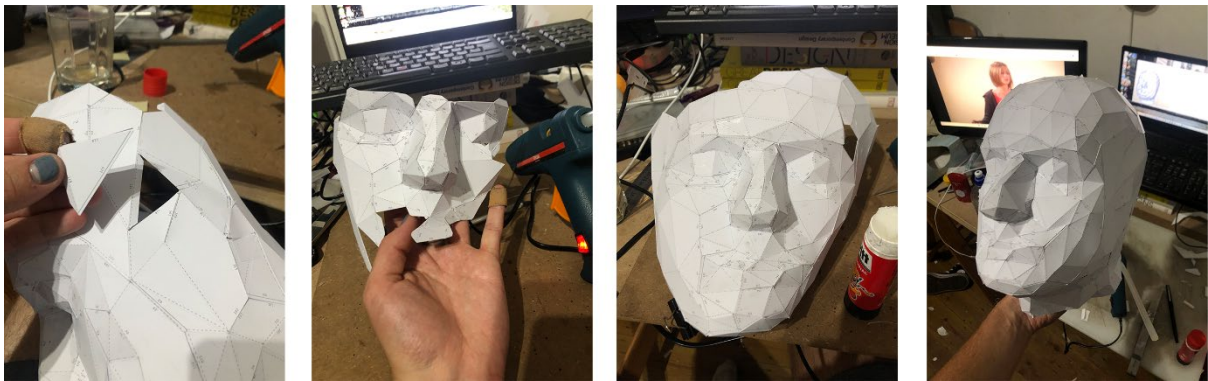


Figure 13-Paper mock-up, Johannesburg, 2022 (Created by author)

The assembly of these various separate triangles is a very straight forward process but is very tedious as accuracy is essential in cutting, folding and gluing. Small imperfections add up and can ruin the assembly as parts will no longer fit together. The model of the first head was comprised of 15 pages.

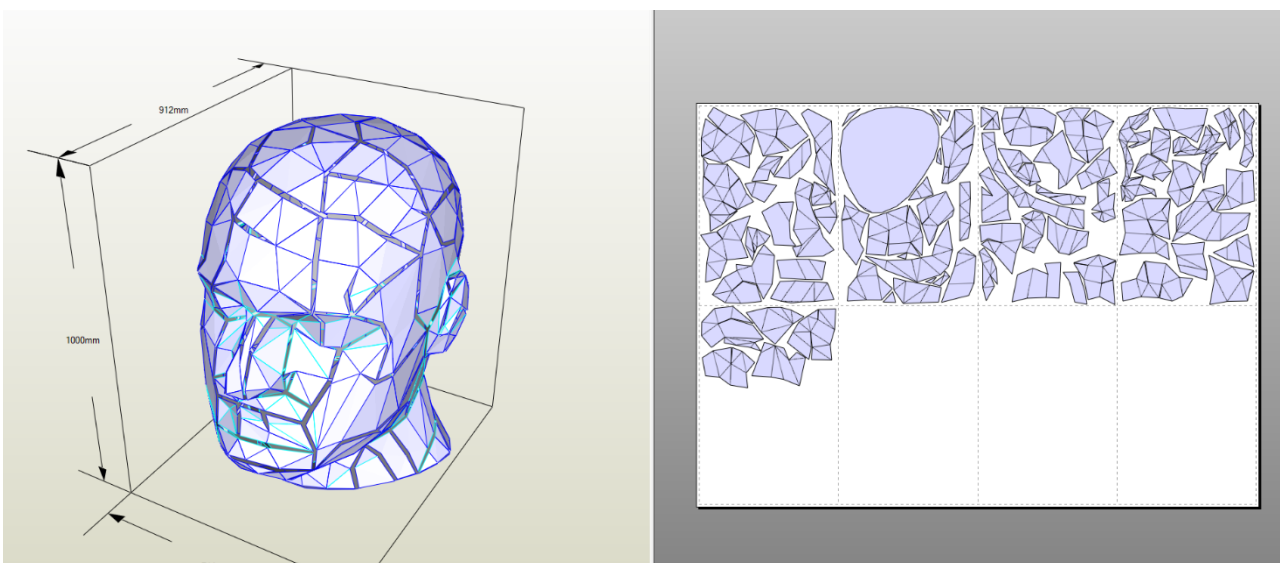


Figure 14-Pepakura model, Johannesburg, 2022 (Created by author)

In previous Pepakura projects a craft knife and a metal ruler was used successfully to cut out parts but this is incredibly time consuming and not always accurate. A modern electronic vinyl cutter is a far faster and more accurate automated solution. The Silhouette Cameo 4 vinyl cutter was used to cut out every part. The pages were first printed at Postnet on Heavy 8 cardboard at R8.00 per page. In order to align the cutting software and machine with the printed pages a software add on is required: Pepakura Viewer 4 for Silhouette Cameo 4. This exports the pdf file of the parts with registration marks in the corner of each page. These registration marks match the printed marks on the card pages. The software also exports the file as a DXF which the vinyl cutter is compatible with. The machine is then able to scan these marks to cut along the correct edges corresponding with both the dxf file and the printed card. Each page needs to be manually attached to the Vinyl cutter's adhesive cutting mat and the correct file loaded. It took about 60 seconds per sheet as opposed to 1-2 hours of hand cutting it would usually take if a manual approach was taken.

Once cut each piece can then be collected in a folder ready for assembly. For this mock-up the fold lines were specifically ignored by the cutter and were instead hand scored using a blunt scalpel and a metal ruler. The process for assembly involves cutting out the part, locating it on the computer model, identifying the mountain and valley folds and then folding accordingly. The corresponding piece is then found and the two parts are lined up.



Figure 15-Paper mock-up model, Johannesburg, 2022 (Created by author)

A wide variety of glues are suitable for this process although they must fit into a few criteria. The glues must be fast drying, as there are so many pieces to glue together it would take far too long to wait a few minutes per joint. The glues must also be very thin to not create unnecessary thickness in the joints affecting the accuracy of the part. Finally, the glue must



be non-toxic/ not release fumes. The assembly of these models requires the user to work in very close proximity to the glue for extended periods of time (Chan 2022: [sp]). The ideal glue for this job is Pritt paper adhesive. Pva glue also works well but has a longer drying time. Superglue is also a good option but is significantly more expensive and doesn't impart any extra strength or assembly convenience.

Each model requires a different order of assembly that can only be found with practice. Although working from the middle and starting with the most details areas tends to work the best. In the case of this head the nose, eyes, forehead and mouth were assembled first before the rest of the head was assembled (Chan 2022: [sp]). The further along the user gets in the process the more difficult it becomes as parts begin to get in the way of other parts. The weight of the model also increases which can pull apart previously glued seams or not fully dry seams. Masking tape and small clamps such as bulldog clips are extremely useful during this assembly process.

Once the head was assembled it tended to droop and collapse into itself. Paper is not a particularly strong material so it needs to be reinforced once assembled. An inner frame of foam core and triplex was created and attached to the model using hot glue. The outer frame of the neck was also created from foam core to reinforce the perimeter of the model. By attaching the outer frame to the inner foam core assembly, the whole model was made significantly stronger and could be handled with ease.



Figure 16-Mock-ups, Johannesburg, 2022 (Created by author)



## 6. Big Head Model

The large model was created virtually the same as the smaller model but on a significantly larger scale. The size of the model was limited by the FADA door size at the University of Johannesburg as this sculpture was assembled in the workshop and then transported to the studio for the future projection projects. The size of the sculpture was then scaled to be 2.5m tall, 1.6 metres wide and 1,15m deep. 3mm corrugated cardboard was chosen to be the most suitable material for this process as firstly it is cheap, at R10.00 per 1100mm by 900mm sheet, the material is strong but lightweight and finally it is able to be cut on a laser cutter. With these parameters in place the model could be modified to become suitable for this form of assembly. The model was sliced in front of the ear leaving just the face to reduce the size, scale and scope of this project. The file was then imported into Blender and decimated to reduce the polygon count. This obj. file was then imported into Pepakura and unfolded. The cut lines need to be manually chosen and are illustrated below as orange lines.

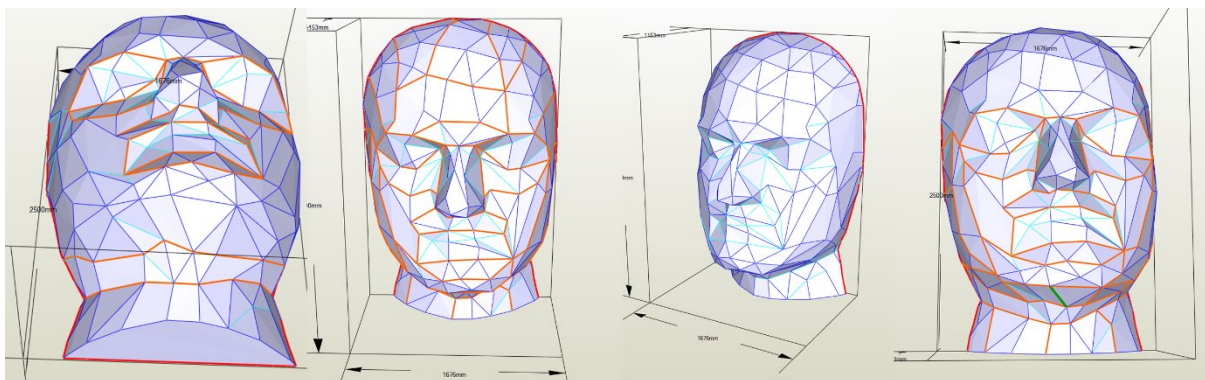


Figure 17-Pepakura digital model, Johannesburg, 2022 (Created by author)

Keeping the pieces as large as possible is very useful to reduce assembly time, keeping in mind the size of the cardboard sheet that they must fit onto. Pieces that are too thin, delicate or unnecessary complicated were simplified using the smooth edge and join/disjoin face commands in Pepakura. Once each separate piece was created, they were then organised to fit onto the cardboard sheet's pages in the software. Filing up the the page with as many pieces as possible while leaving 15-20mm gap between each for easier cutting.

As the eventual model needs to be folded along demarcated fold lines there are two methods that were explored. Firstly, the laser was set to half the standard power to score along the

fold lines and full power for the edge (Thompson 2007: 249). This would work well for a solid material but as corrugated cardboard has a series of ridges throughout its inside the depth of the score line was uneven and folding was not always accurate. The second method was far simpler and more successful. All fold lines were converted into dashed lines. 20mm dash followed by a 20mm gap and then a 20mm dash. Then all lines were cut on the laser cutter. The dashed lines guided the fold but had enough material between each piece to add strength and accuracy to the model.

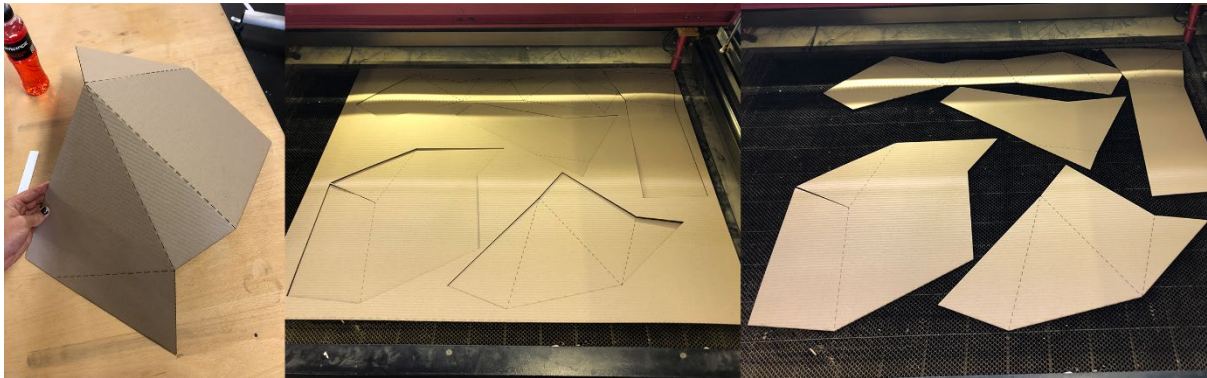


Figure 18-Lasercut cardboard pieces, Johannesburg, 2022 (Created by author)

Due to the 3mm thickness of the cardboard flaps would not be suitable for the assembly as they were when paper was being used. The flaps would raise the mating faces too much creating an inaccurate model. Instead, the flaps were removed and hot glue was used. The numbers used to align the pieces were unable to be cut/scored in the cardboard so as soon as each cardboard piece was cut, they were all hand labelled according to the digital document. This process was essential as assembly would be impossible without them.

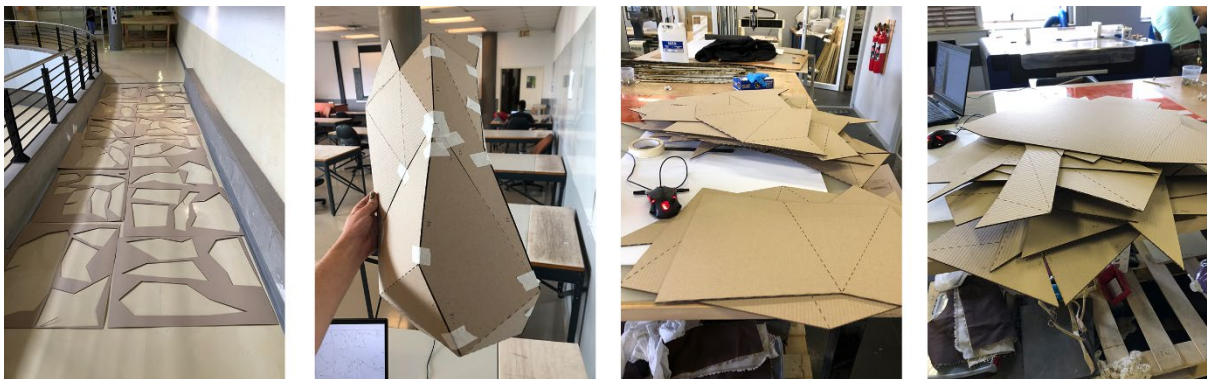


Figure 19-Lasercut cardboard pieces, Johannesburg, 2022 (Created by author)

The assembly of the model was straight forward and followed the following steps.

1. Two mating cardboard pieces were found
2. Their matching pieces were located digitally
3. Each piece was folded according to the digital template
4. Masking tape was placed on the outside of the pieces
5. Hot glue was used to attach the edges together
6. Small strips (100mm by 50mm) of cardboard were placed along each edge to reinforce the seam. The cardboard pieces needed to be folded along their length in line with the corrugations to properly fit the folds of the model and not distort it.
7. This process was repeated for every part.



Figure 20-Head sculpture progress, Johannesburg, 2022 (Created by author)

Due to the scale and weight of the cardboard sculpture it was unable to be self-supporting. The sculpture was then clamped to a heavy wooden display stand for both assembly and viewing. To address this lack of strength a frame work needed to be created. The model sagged and the cardboard flexed so an accurate frame work needed to be created *before* attaching it to the sculpture. The bottom neck perimeter was able to be cut out on the laser cutter and attached using a series of folded 90-degree pieces of cardboard. This reinforced the shape of the neck but also made sure it didn't flex or warp. The same process could not be made for the back of the head due to its significant scale. Instead, the perimeter of the back of the face was placed onto 28 separate pieces of A3 paper. Registration marks were placed on each page's corner for later alignment. Once printed the pages were then attached together using masking tape and print and taped to the workshop floor. Tension was



created in each corner with tape to make sure the layout was flat and that the paper was not lifting up which would affect the scale and accuracy of the final framework.



Figure 21-Steel Frame Assembly, Johannesburg, 2022 (Created by author)

3mm by 32mm flat mild steel bar was chosen as the frame material as it was readily available, The University of Johannesburg Industrial Design Department had large amounts on hand. The workshop also had a metal shear, metal brake and a 5mm metal punch. This allowed the entire fabrication of the framework to be done manually and without any electronic tools. Once laid out on the floor the outer perimeter was divided into various straight sections and individually measured. These measurements were duplicated on to the steel and marked with a set square and a permanent marker. Each measurement was individually labelled to make sure bends were done correctly.

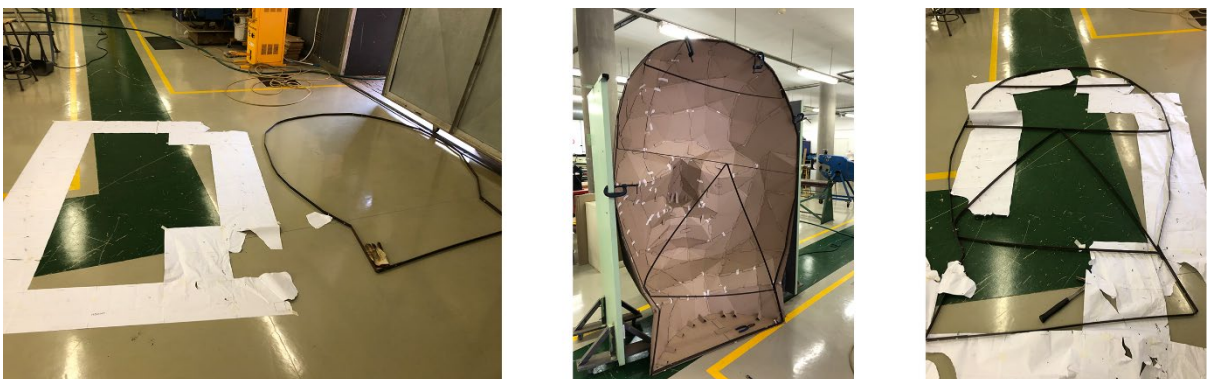
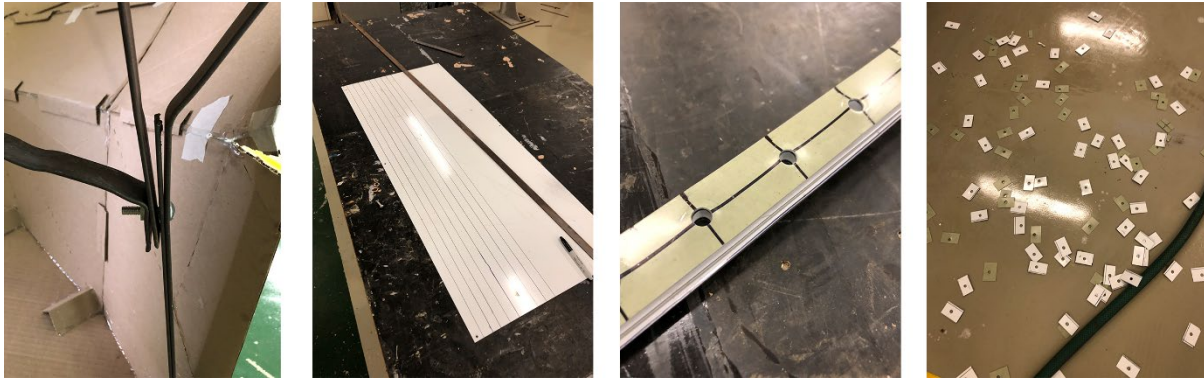


Figure 22-Steel Frame Assembly, Johannesburg, 2022 (Created by author)

A sliding bevel square was used to match the folds on the paper to the folds on the steel. The steel was placed in the steel brake and was folded until it corresponded with the bend on the square. A large hammer was used to persuade the metal to match the correct bend angle. The max length of the steel sections was 3000mm so 4 pieces needed to be used to make the entire perimeter. They were joined together using nuts and bolts through punched holes in

the steel. Each joint was made 1 section larger so that there was always a minimum over lap of 200mm. Once the frame was created straight sections of steel were needed to prevent warping. The lengths were found using the edge-to-edge measuring tool in Pepakura and were duplicated onto the steel. By folded up each end and punching a hole in both the edge and the frame work these stretchers could be bolted into place. This frame work was still flexible so triangulation was used to reinforce it. Metal was bent and bolted into place forming triangles throughout the frame.



*Figure 23-Washer making, Johannesburg, 2022 (Created by author)*

To attach the frame to the cardboard sculpture a variety of methods were discussed. From high strength construction adhesive to a series of clamps. Finally nuts and bolts and custom washers were settled on. The washers were cut from sheet steel on a hydraulic sheet steel shear. 32mm strips were marked out and then divided into 40mm by 32mm rectangles. The centre of each of these were punched followed by being cut on the sheer. This created 50 custom washers. A hammer and an anvil were used to flatten each washer as the force of the punch distorted them.

50 holes were punched around the frame work to accommodate these nuts, bolts and washers. This frame was then placed inside the cardboard head sculpture and temporarily clamped in place. The steel frame was clamped to another display stand to keep it upright as it is front heavy. A drill was used to drill through the punched holes and through the cardboard. Bolts were then placed through the cardboard using a washer to compress the cardboard and to stop the bolt ripping it.

Once attached the sculpture was far stronger and due to the outer perimeter mimicking the digital model the proportions of the face weere now perfect. The nose and eye area still sagged inward so more reinforcing was required. 3 x 3000mm strips of 22mm pine brandering



were attached with bolts, hot glue and screws to both the cardboard and the steel framework to properly reinforce the head. Once this final reinforcing step was finished the head was complete. It took 3 people to carry the head from the workshop to the studio. The head is still very light although due to its large scale it is very cumbersome to move around.

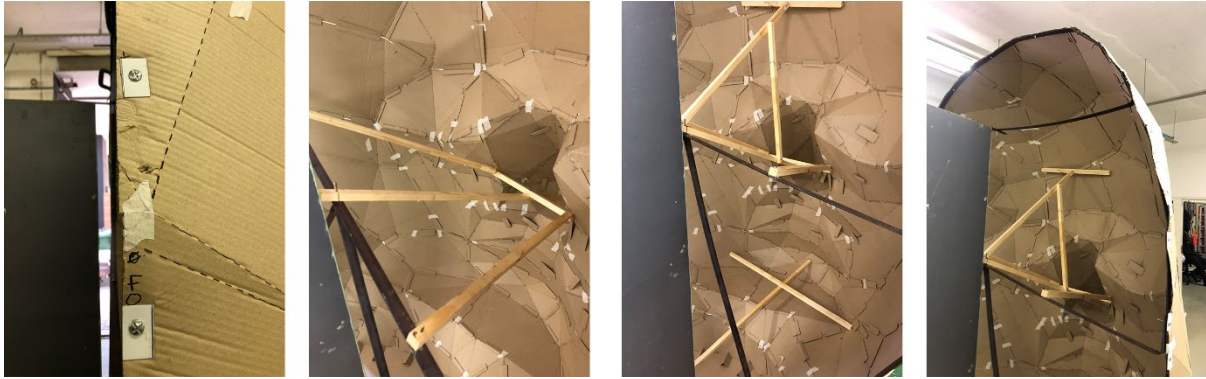


Figure 24-Internal framework, Johannesburg, 2022 (Created by author)

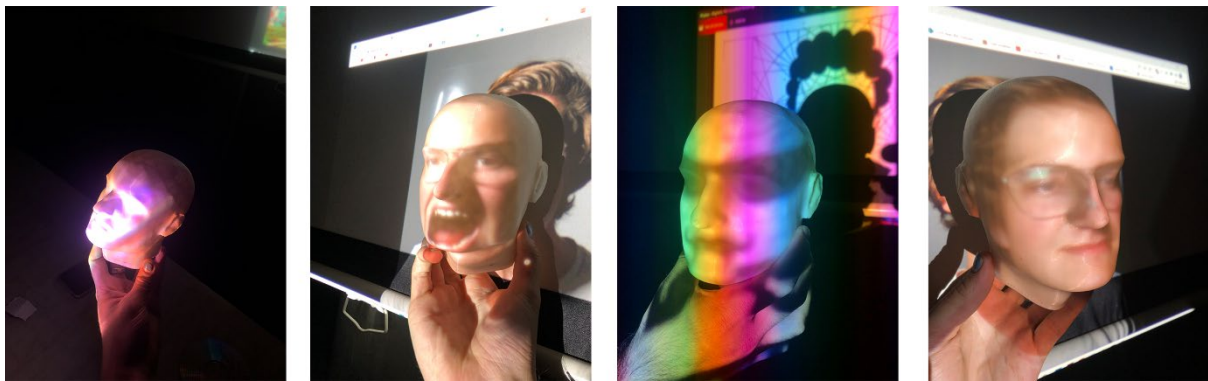
Future additions to the sculpture to improve its strength and longevity would be to use polyester resin and fiberglass. This would both waterproof the sculpture and make it far stronger, perhaps even removing the need for the supporting inner frame work. This would also allow the sculpture to be painted white which would make projecting clearer and easier.

## 7. Projection Experiments

After the sculpture was completed, it was finally able to be projected onto. The sculpture was placed inside a large studio against the back wall. The studio has a row of windows along one side which let in sun light. A series of display stands were used to block this light from falling onto the sculpture. The studios lights were turned off and all the doors were closed to make the rooms as dark as possible. A standard overhead projector was mounted on a wooden base and focussed on the sculpture. It was placed around 5 metres away from the model and placed on its side so that the beam of light covered the entire head sculpture. A variety of images were projected onto the sculpture. Firstly, my face, of whom the sculpture is based off of was projected onto it. As they are both the same face the eyes, mouth, chin and cheeks all line up creating an enormous 3D model of the person's head. Various other faces were projected onto the sculpture. The following images show these projections. Some faces align better with the sculpture than other. A template in Photoshop was created using gridlines for the eyes, nose and mouth lines. This allowed all of the various projections to be as correctly aligned as possible.

By projecting flat images of textures onto the model they warped around the face creating depth and a very realistic appearance. A skull was projected onto the face which could lead to experiments using this model and projection for teaching about anatomy and the human head and brain in greater detail without the need for physical specimens or microscopes. Instead, the x-rays or dissections can be directly projected on to the body part the students are learning about. Other textures such as fire and gravel were also projected leading to some interesting results. Giving the cardboard the look and texture of other materials.

The cardboard sculpture was created from a 3D scan and model. The face model was then imported into Solidworks visualize and various textures and materials were applied. Including Gloss red, blue plastic, cork and steel. The digital model aligned with the physical model allowing the cardboard to appear as other materials.



*Figure 25-Mock-up projection experiments, Johannesburg, 2022 (Created by author)*

Technology lets all avenues of ideation possible and this project was the perfect platform for that. A video was taken of my head from a head on angle. For 60 seconds I blinked, looked around and make various face movements. Once projected onto the head this video aligned perfectly and the result is a startling and very realistic depiction of a 2.5m tall face. Virtually coming to life.





Figure 26-Projection experiments, Johannesburg, 2022 (Created by author)

## **8. Conclusion**

The images above and this report showed the overlap and blending of the virtual digital space and the physical tangible space. How scale can be changed to contrast reality and what we think of as normal. The report explored the process of scanning physical objects and people, manipulating them digitally and then bringing them back into the physical realm through a variety of digital fabrication techniques. The report concluded with a collage of the various projection experiments that have taken place so far exploring form, material, texture and realism. Projection is a platform with virtually limitless opportunities in fashion, art, stage design and rapid prototyping. This report gave a small glimpse into the diverse and exciting world of both the virtual and physical space in regards to digital fabrication and projection mapping.

## **SOURCES CONSULTED**

Chan, N. How To Make Your Own Giant Papercraft Head. [O]. Available:  
<https://www.tested.com/making/461440-how-make-giant-papercraft-head-yourself/>

Accessed 17th March 2022

Thompson, R. 2007. *Manufacturing Processes for Design Professionals*. London: Thames & Hudson Ltd.



Software, machinery and tool costs		
Software	Link	Cost
Pepakura	<a href="https://tamasoft.co.jp/pepakura-en/download/index.html">https://tamasoft.co.jp/pepakura-en/download/index.html</a>	R570.00
Pepakura Viewer 4 for Silhouette CAMEO	<a href="https://tamasoft.co.jp/pepakura-en/download/viewer_cut/index.html">https://tamasoft.co.jp/pepakura-en/download/viewer_cut/index.html</a>	R220.00
Blender	<a href="https://www.blender.org/">https://www.blender.org/</a>	Free
MeshMixer	<a href="https://www.meshmixer.com/">https://www.meshmixer.com/</a>	Free
Cura	<a href="https://ultimaker.com/software/ultimaker-cura">https://ultimaker.com/software/ultimaker-cura</a>	Free
Slicer for Fusion 360	<a href="https://knowledge.autodesk.com/support/fusion-360/troubleshooting/caas/downloads/content/slicer-for-fusion-360.html#:~:text=Aug%2013%202020Download,both%20Mac%20OS%20and%20Windows.">https://knowledge.autodesk.com/support/fusion-360/troubleshooting/caas/downloads/content/slicer-for-fusion-360.html#:~:text=Aug%2013%202020Download,both%20Mac%20OS%20and%20Windows.</a>	Free
Photoshop	<a href="https://www.adobe.com/africa/products/photoshop.html">https://www.adobe.com/africa/products/photoshop.html</a>	R10740 per year
RD Works V8	<a href="https://rdworks.software.informer.com/8.0/">https://rdworks.software.informer.com/8.0/</a>	Free
<b>Machines/tools</b>		
Laser cutter	<a href="https://m.made-in-china.com/product/100W-CO2-Laser-Cutting-Engraving-Machine-Motorize-Table-1000mm-600mm-Water-Chiller-1954600275.html">https://m.made-in-china.com/product/100W-CO2-Laser-Cutting-Engraving-Machine-Motorize-Table-1000mm-600mm-Water-Chiller-1954600275.html</a>	>R30 000
Ender 5 3D printer	<a href="https://www.creality3dofficial.com/products/creality-ender-5-plus-3d-printer">https://www.creality3dofficial.com/products/creality-ender-5-plus-3d-printer</a>	R8600.00
Silhouette CAMEO 4	<a href="https://www.takealot.com/silhouette-cameo-4-die-cutting-machine/PLID66380204">https://www.takealot.com/silhouette-cameo-4-die-cutting-machine/PLID66380204</a>	R7400
Sheet metal Brake	<a href="https://www.adendorff.co.za/product/mac-afric-1220-mm-sheet-metal-brake/">https://www.adendorff.co.za/product/mac-afric-1220-mm-sheet-metal-brake/</a>	R10 000
Sheet metal Punch	<a href="https://www.adendorff.co.za/product/mac-afric-hp-20-hand-punch-excluding-dies/">https://www.adendorff.co.za/product/mac-afric-hp-20-hand-punch-excluding-dies/</a>	R7500.00
Sheet metal Shear	<a href="https://www.adendorff.co.za/product/mac-afric-steel-cropper-for-round-angle-plate-steel/">https://www.adendorff.co.za/product/mac-afric-steel-cropper-for-round-angle-plate-steel/</a>	R5000.00
Hot Glue gun	<a href="https://www.takealot.com/yobi-glue-gun-in-carry-case-80w/PLID38160008">https://www.takealot.com/yobi-glue-gun-in-carry-case-80w/PLID38160008</a>	R200
<b>Total cost</b>		R80230
<b>University facilities/access</b>		R71 840.00
<b>Actual Cost</b>		<b>R8390</b>

Material costs					
Material	Size	Quantity used	Cost per unit		Cost
Corrugated cardboard	1100mm x 900mm	20 sheets	R10.00	20 x R10.00	R200*
Heavy 8 Cardboard	210mm x 297mm	15 sheets	R8.00	15 x R8.00	R120
Pritt Glue stick	Stick	1 stick	R38.00		R38.00
Hot glue sticks	Stick	20 Sticks	R4.00	20 x R20.00	R80.00*
Masking Tape	Roll	1 roll	R33.00		R32.00
3mm by 32mm mild steel flat bar	3mm x 32mm x3000mm	7 lengths	R80.00	7 x R80.00= R560.00	R560*
Pine branderling	22mm x 22mm x 3000mm	3 x 3m lengths	R30.00	3 x R30.00	R90.00*
				<b>Total cost</b>	R1120
				<b>UJ covered cost*</b>	R930
				<b>Actual Cost</b>	<b>R190</b>

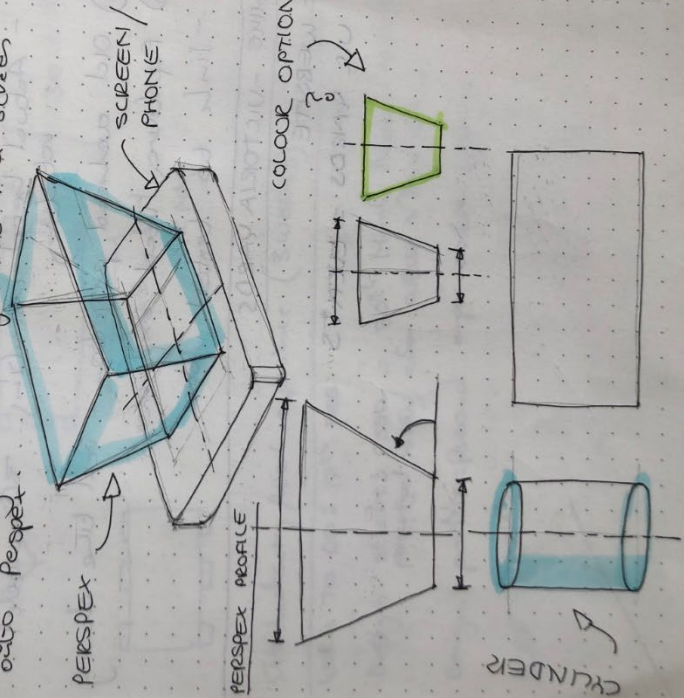
DESIGN PRACTICE - 3RD YEAR  
PROJECTION PROTECT

EXPLORING HOLOGRAMS

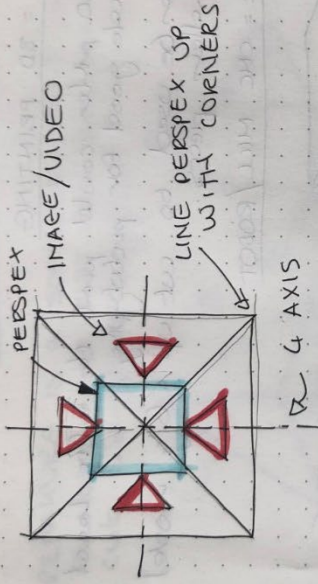
1) Holograming is a photographic recording of a light field. Are virtual three dimensional images created by the interference of light beams that reflect real physical objects

EXPERIMENT

By reflecting an image from a screen onto perspex.



HOLOGRAPHIC PROTECTION = PROFILE  
VIDEO SHOT INTO 4 MIRRORED PARTS



3D - PROJECTION

EXPLORING VARIOUS METHODS OF 3D MAPPING

THE GOAL IS TO CREATE A 3D MODEL (.OBJ/.STL) FROM A REAL LIFE OBJECT/PERSON

METHOD 1: LIDE

↳ THIS TECHNOLOGY SCANS REAL WORLD OBJECTS AND USES SENSORS TO CREATE 3D MODELS

METHOD 2: SCANNING APPS

↳ PHONE APPS / PROFESSIONAL SCANNERS ALSO TURN REAL LIFE OBJECTS INTO 3D MODELS

- CONS - EXPENSIVE, LARGE FILE SIZE  
PROS - ACCESSIBLE

METHOD 3: 1000+ PHOTOGRAPHS

↳ BY TAKING 1000+ PHOTOS AROUND AN OBJECT AND ALIGNING THEM TOGETHER CREATES A 3D MODEL



CREATING REAL LIFE MODEL

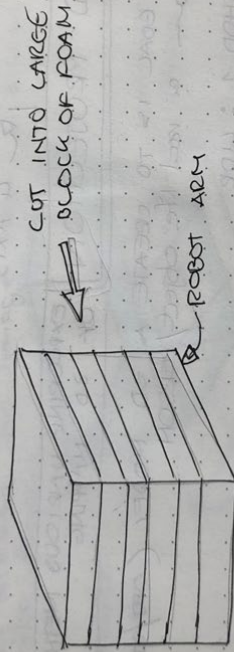
↳ FROM 3D MODEL

METHOD 1 = 3D PRINTING

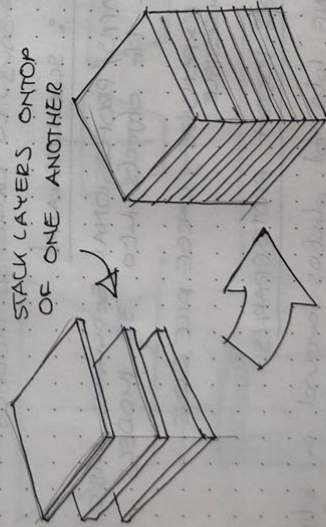
A large 3D printer could print the entire head to small scale good for prototyping.

A slicer can be used to cut up a big model into smaller pieces.

METHOD 2 = CNC MILL / ROBOT



METHOD 3 = SLICING + LASER CUTTER



METHOD 4: PEPAKURA

PEPAKURA IS A SOFTWARE THAT UNFOLDS 3D MODELS INTO FLAT NETS THAT CAN BE CUT AND GLUED TOGETHER.

