AEON

P5 Thesis Presentation

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SUPERVISORY TEAM - Dr. S. Asut , Ir. R.R.J. van de Pas

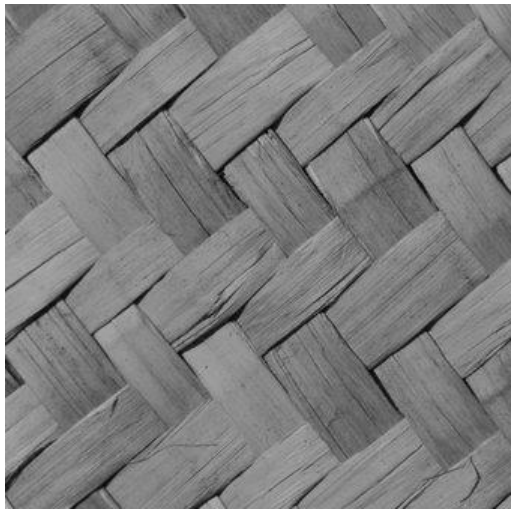
Noun – An indefinite and very long period of time

Philosophy – A power existing from eternity; an emanation or phase of the supreme deity.

AEON

Weaving is a technique to produce cloths with simple to very complicated patterns. The principle is that horizontal and vertical threads are interlaced, crossing each other at right angles. The longitudinal threads are called the warp and the threads that are laterally woven into these are called the weft.

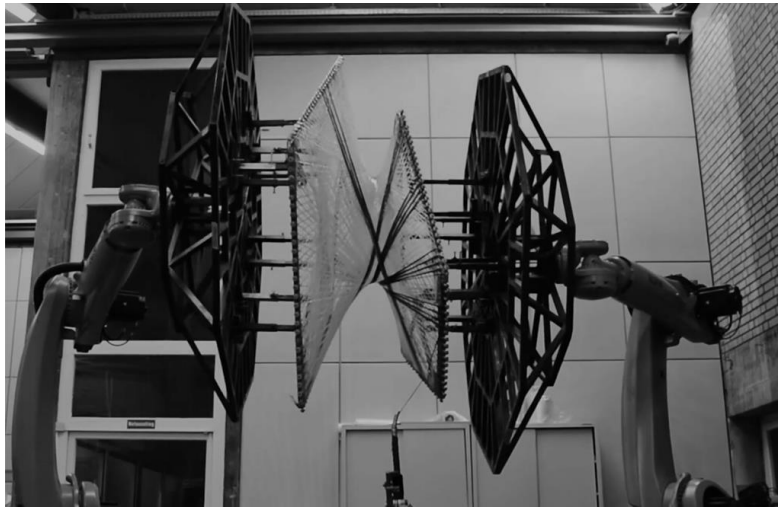
Dorze Chencha Woven Bamboo Houses



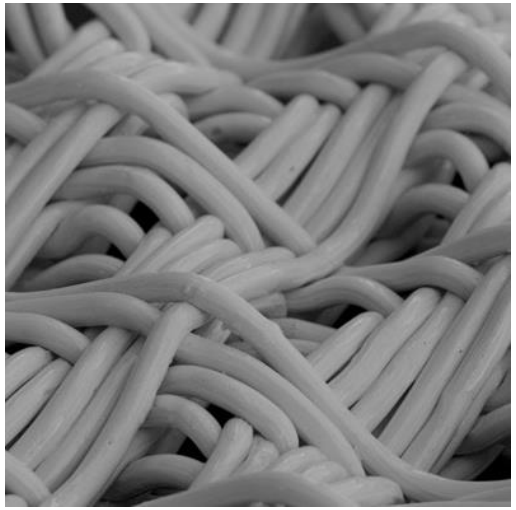
Harakeke Weaving

Old weaving tool

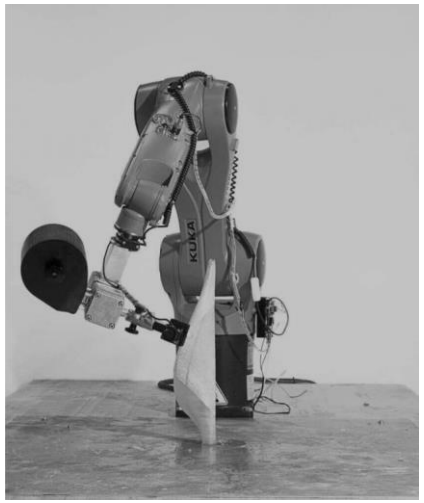
In architecture it is difficult to define what a robot is. The word is inclined to refer to anything from robotic arms to CNC milling machines to 3D printers. Basically, robots are programmable automated mechanisms that help out in the process of digital fabrication.



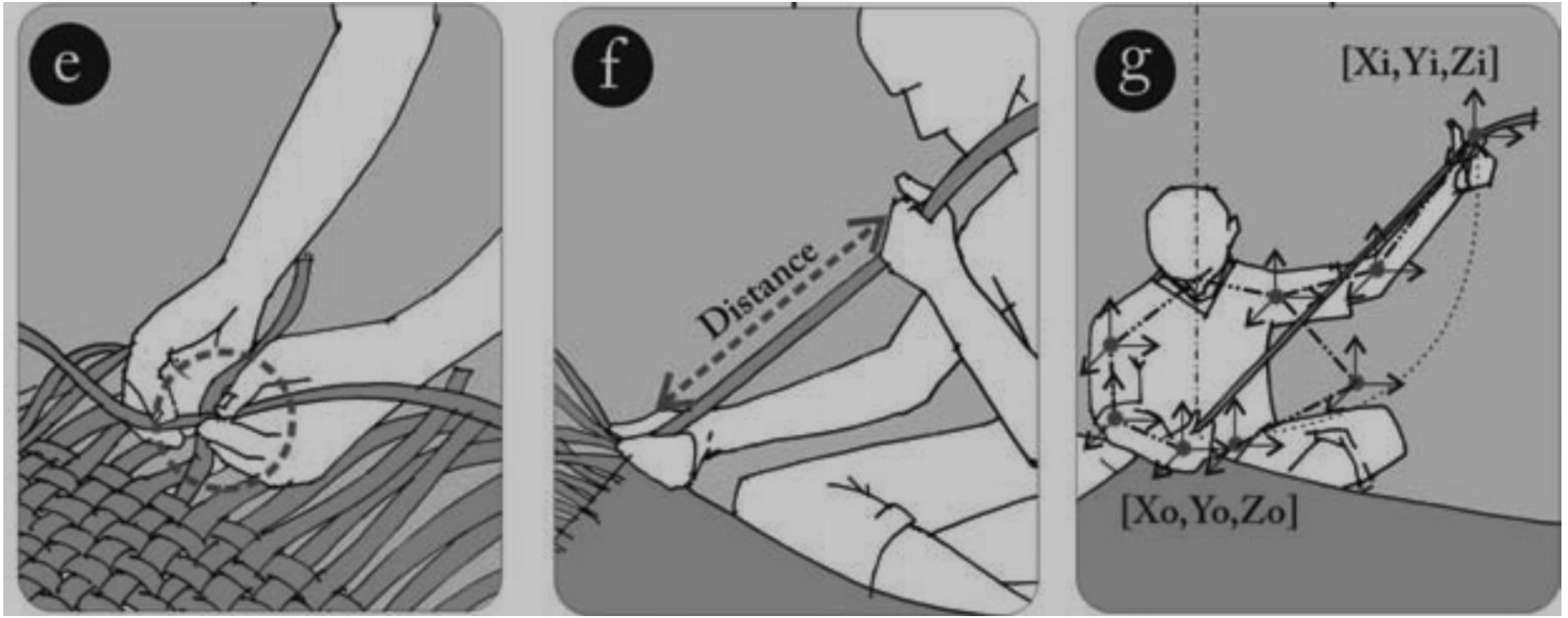
Robotic weaving – TCD Stuttgart



3D – Printed Clay



Robotic arm



Process of weaving imagined as a Euclidean process

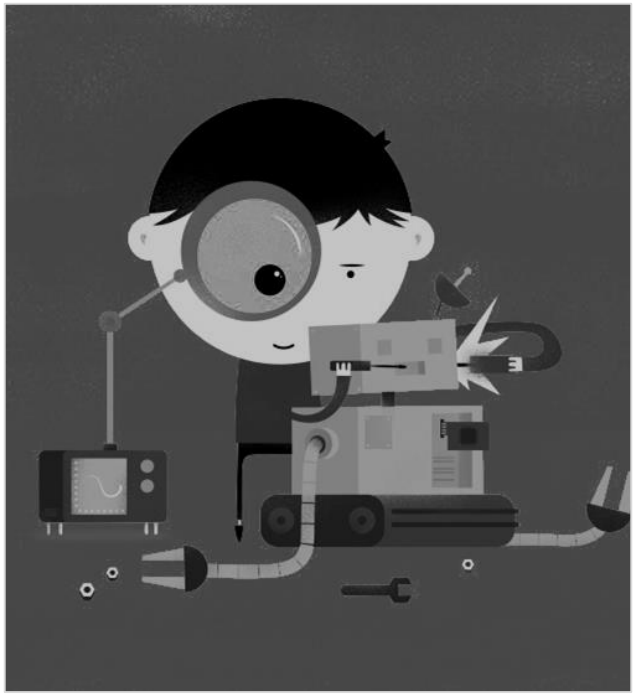
Process of weaving,Image credits – Rizal Muslimin

Process of weaving imagined as a Non - Euclidean process

Robotic weaving – TCD Stuttgart

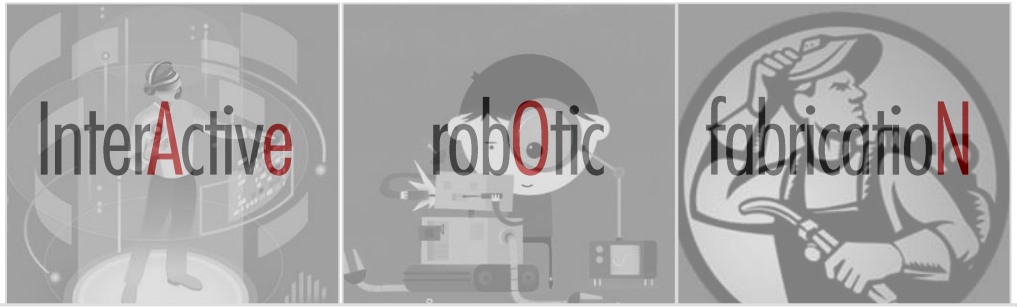
INTERACTION

ROBOTICS



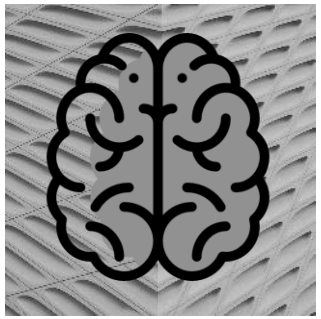
FABRICATION

AEON



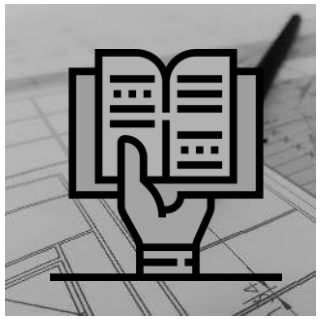
A design tool and process which aims at embedding the designer inside digital design matrix and fabrication process by using physical gestures.

The Story so far. . .



Phenomenology and Inception

To Understand Role of an architect when it comes to creating Spaces



Learning

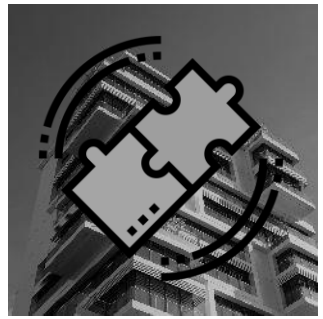
Techinical know how of robotics and weaving

Design

Using the knowledge from previous two chapters a design will be developed

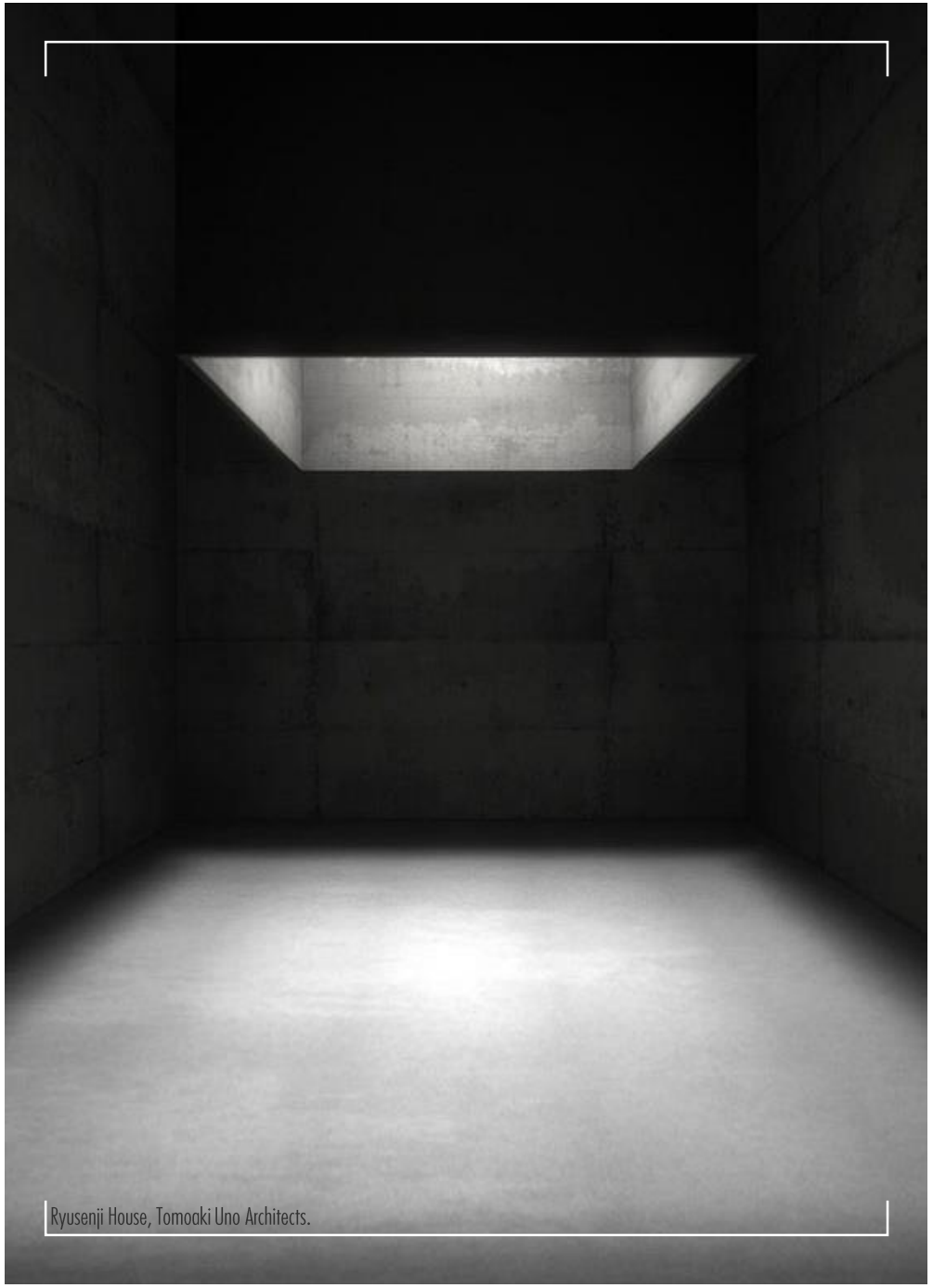
Process

A backward process deconstructing the proposed design to develop working techniques



Proof

Application of developed process on a local scale to provide a proof of concept



Ryusenji House, Tomoaki Uno Architects.

Chapter 1

Phenomenology of me, architecture and technology

What is Phenomenology of architecture and how can understanding this aspects can improve the spatial quality

Phenomenology

As human beings we learned to draw first before we could talk so how can this aspects influence the conceived design tool and process

Hands that talk

If thers a gap between my mental image and digital image which is produce of computer, how can we bridge it

Technology

Phenomenology

The Phenomenology of architecture is the philosophical study of architecture which states the idea of a built space is more than just pleasing the eye, it should go beyond the ocular perception and evoke a sense of emotions.

Influence

How or Can Phenomenology of architecture influence computer aided design ?

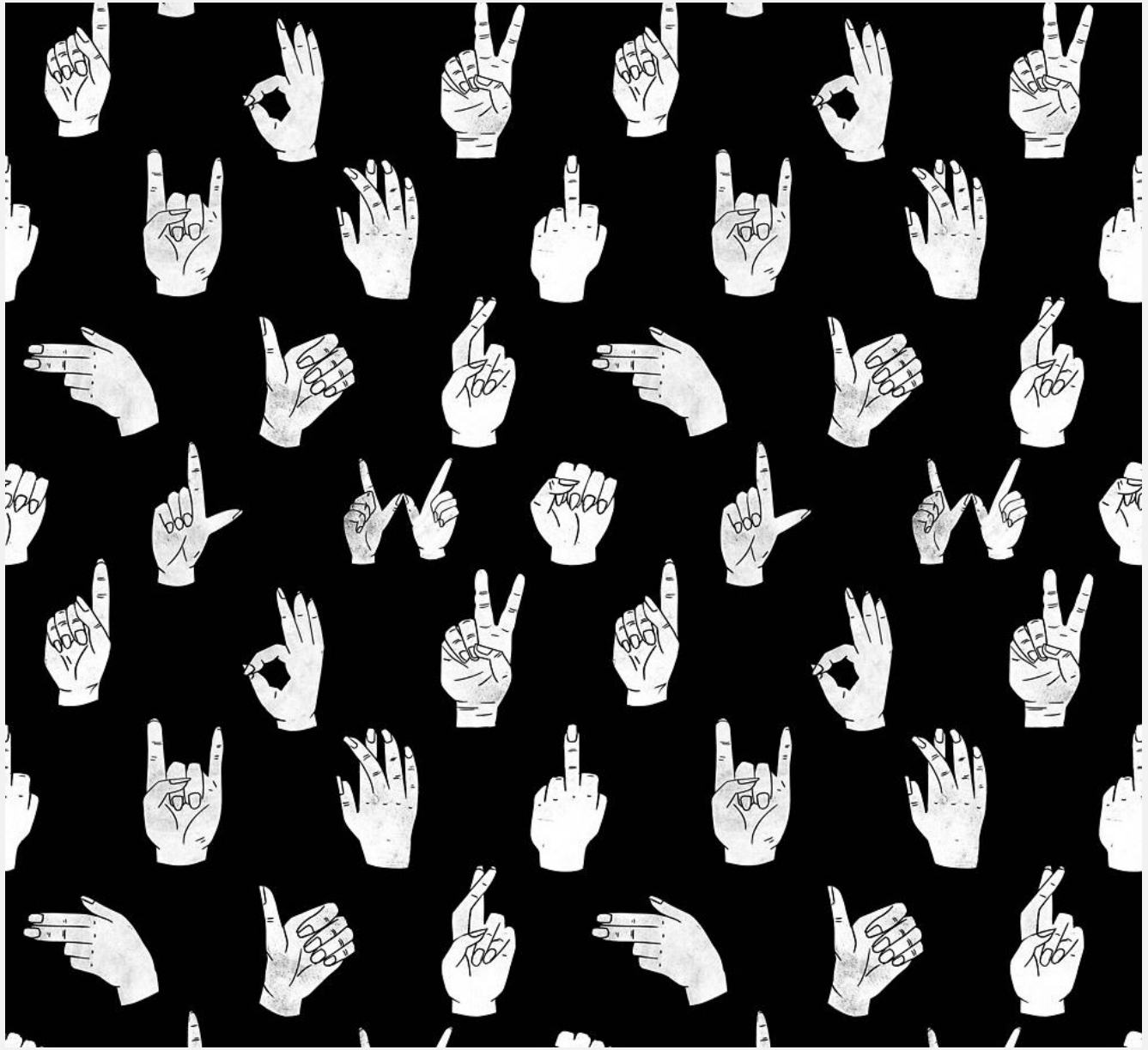
serra da capivara paintings

Hands that talk

Cave paints by early men, before we learned to talk, we learned how to draw

Hands of a carpenter

Hands of a sculptor

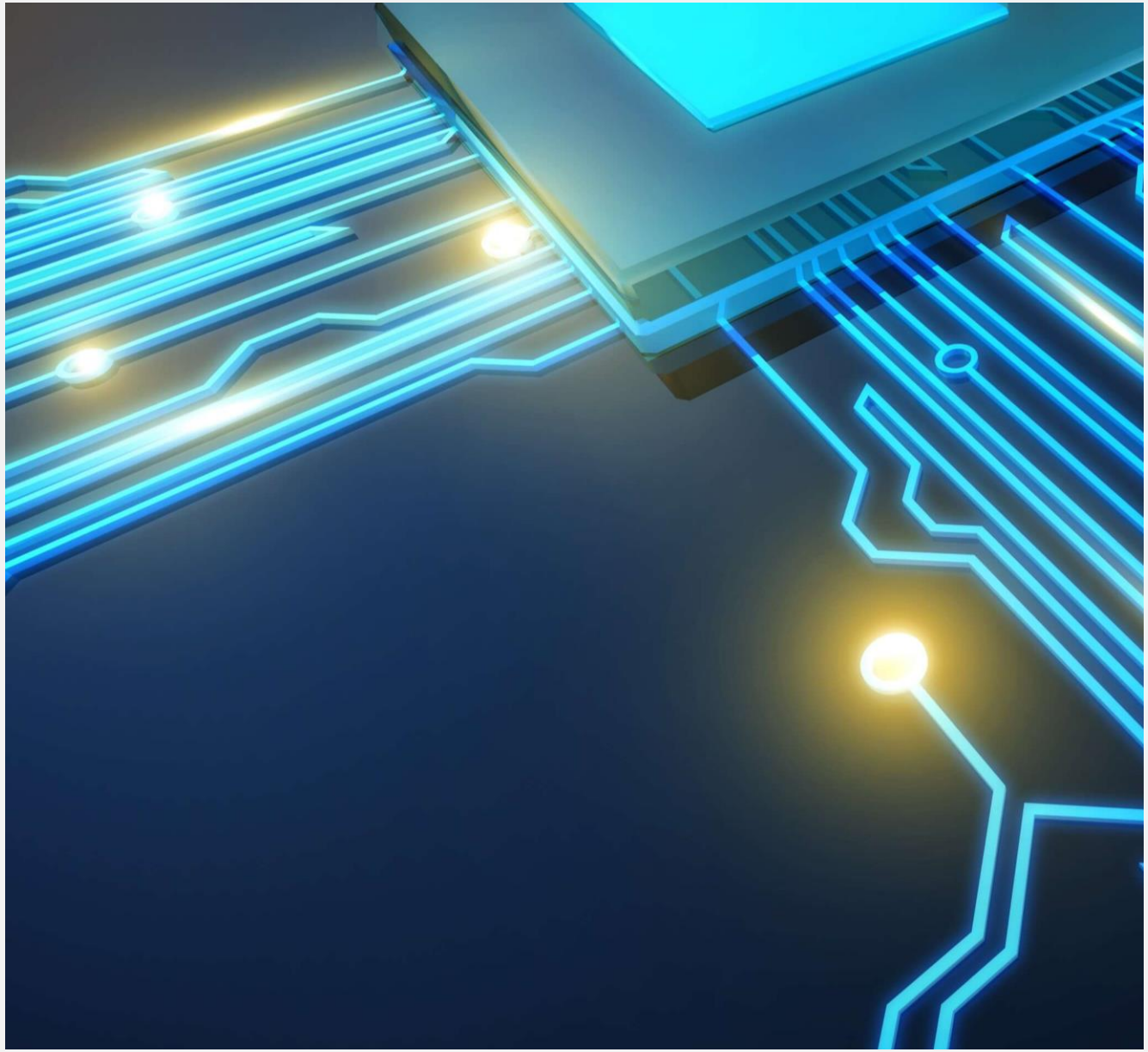


Symbols for sign language

Role of hand ?

- What role would the hands play in this design tool ?

- Can we use hands to convey information to this digital tool ?



Mind of technology

Technology

"A lot of hand-work nowadays is replaced by machines and computers. Even designers, artists and architects tend to start their research and sketching process behind the computer. The sociologist Richard Sennett fears we are getting out of touch."

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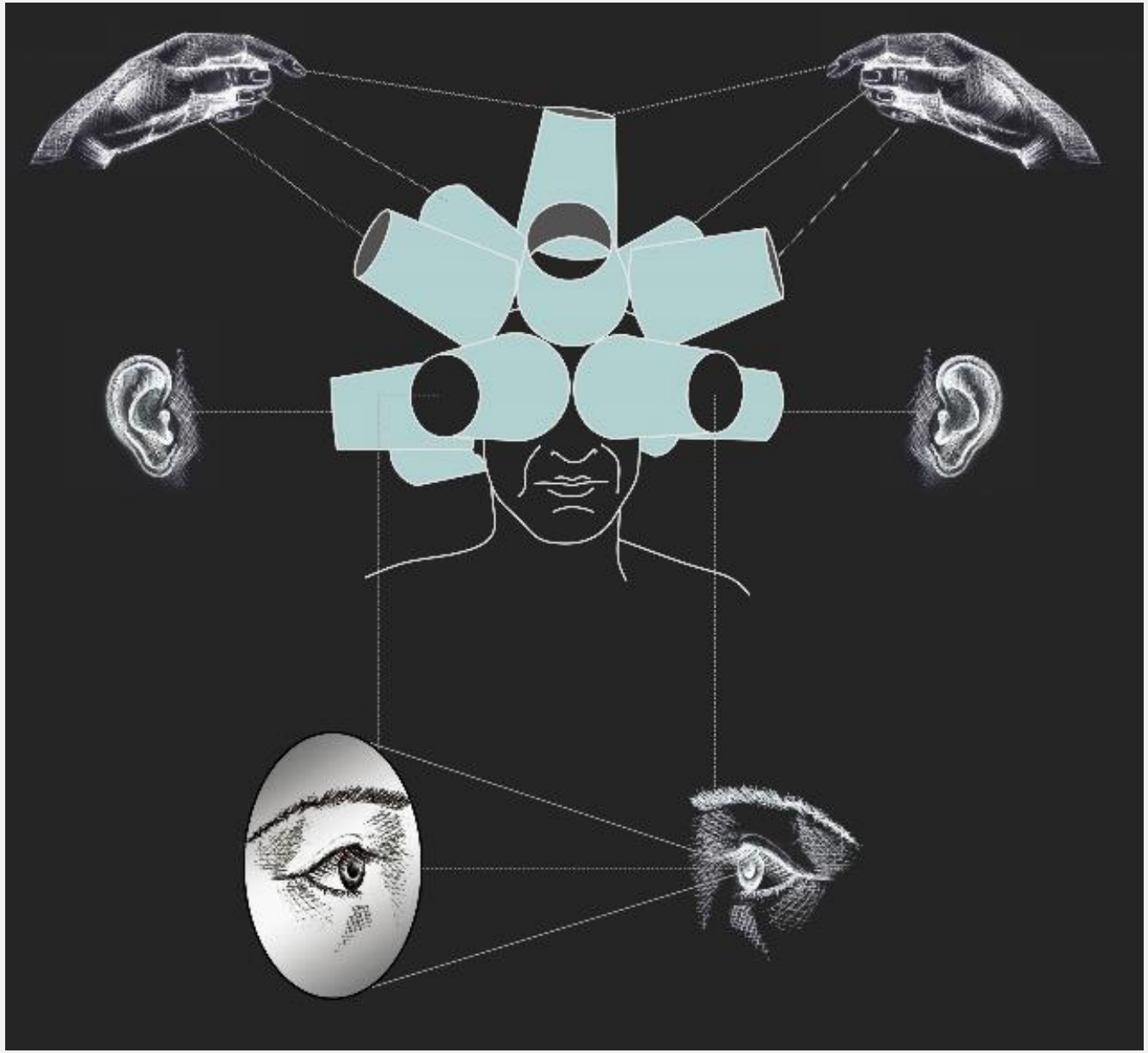


Illustration by Zarya Vrabcheva

Bridge ?

architect and theorist Bernard Tschumi (1975) noticed before: there is a gap between the mental world in which architects design and the physical world in which they build

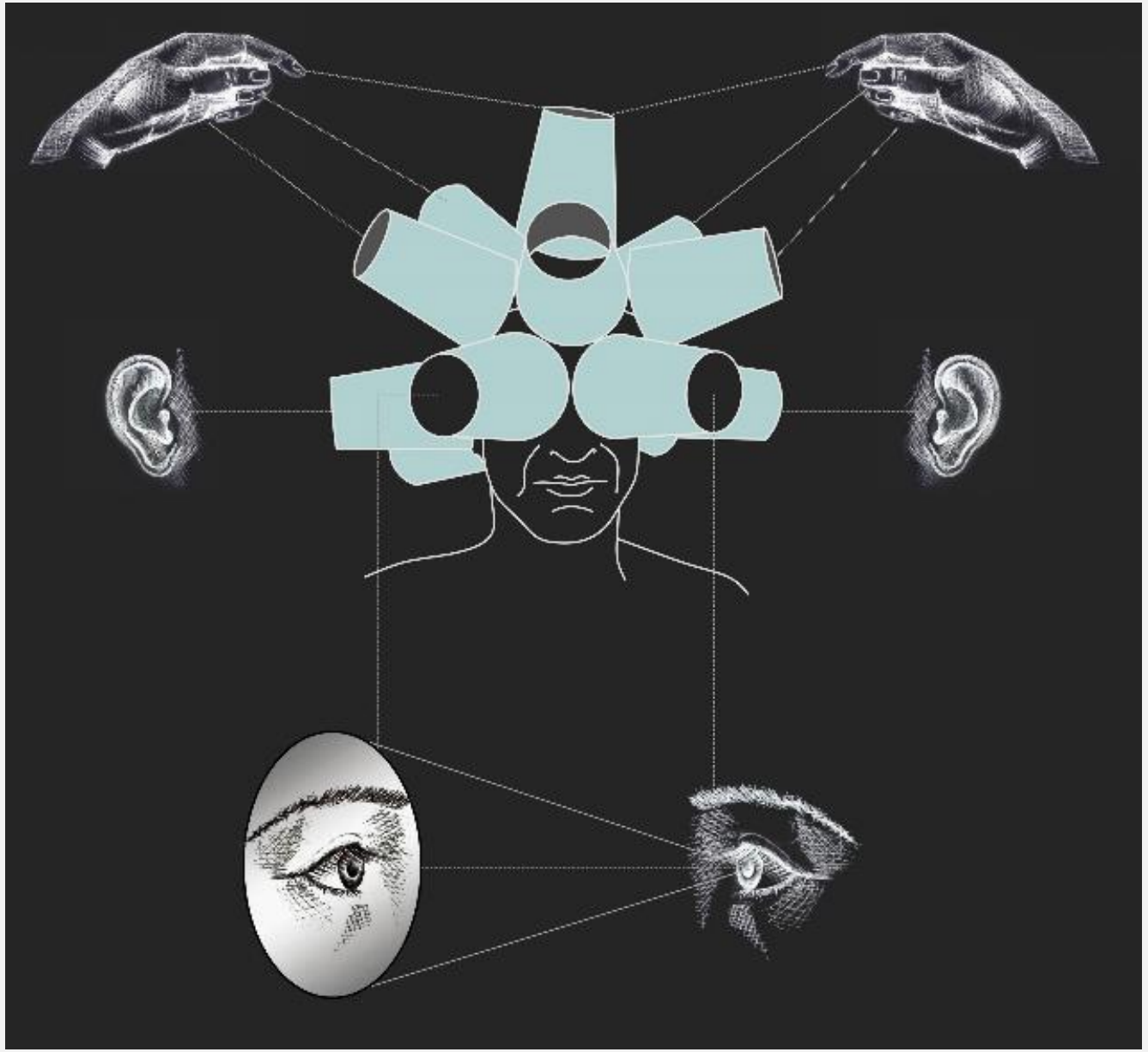


Illustration by Zarya Vrabcheva

Bridge ?

How can we bridge this gap between technology and architecture ?

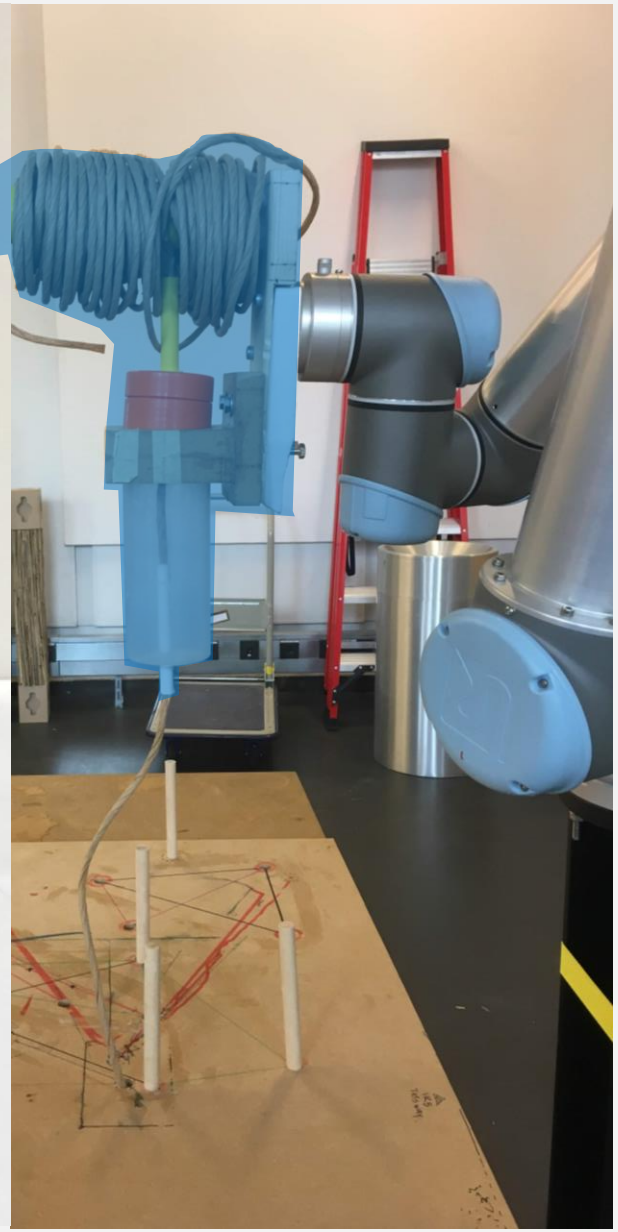
Chapter 2

Taming robotic arm and deconstructing gestures

How to use and what are the parameters and limitations of robotics in architecture

Understanding role of end – effector in robotic fabrication

How different hand gestures and movements work in weaving and how to use them in design process

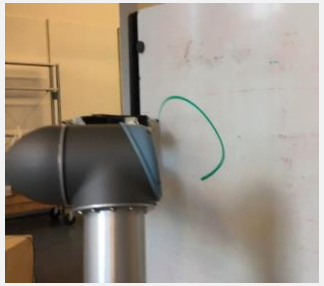
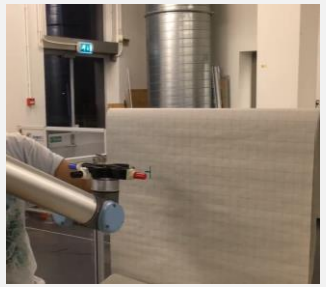
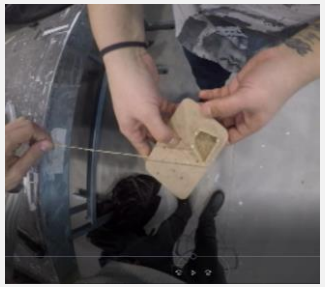
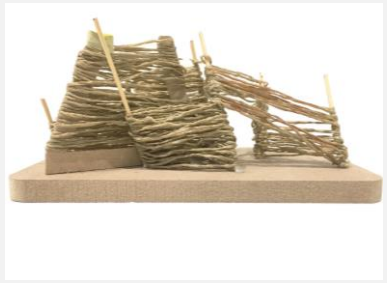
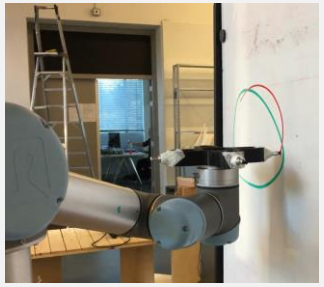
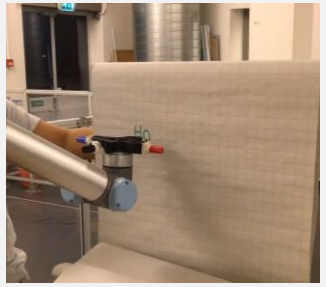


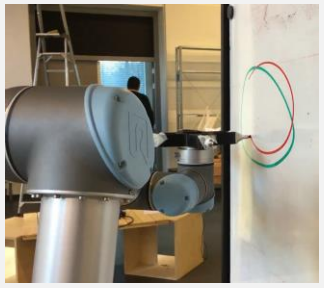
Learning

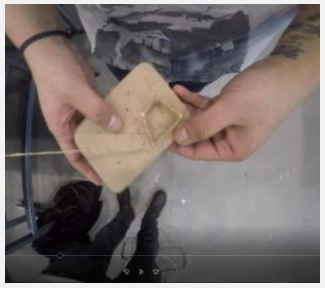
To develop a design process incoprating interaction, robotics and weaving several experiments and test were made to famlirailse with technical know how of robotics and weving

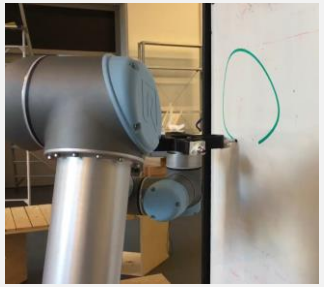
Type of end effectors

Various End-Effectors, UR5 Product catalogue





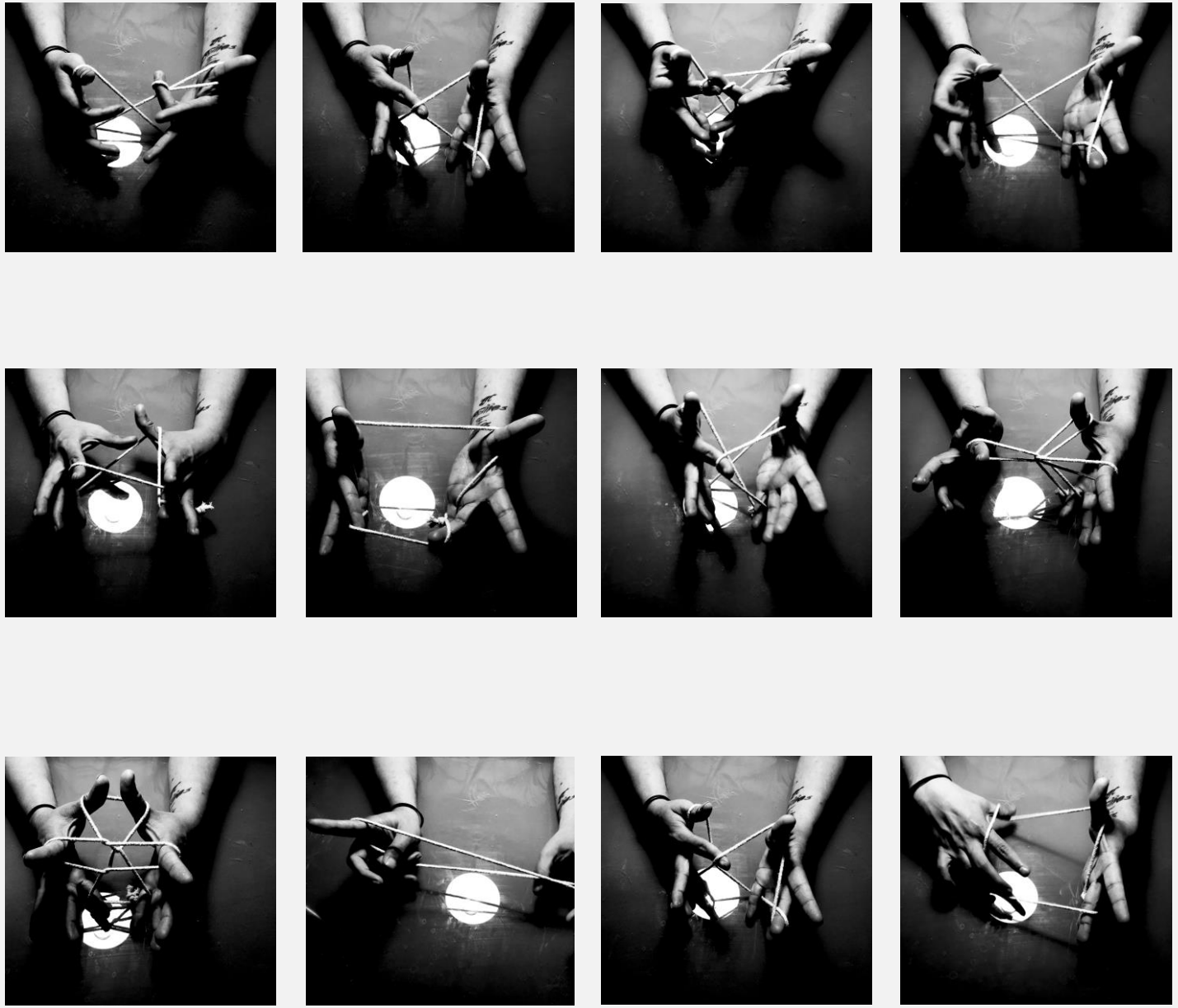
Experiments and models

Experiment 1 – Teaching robot how to draw Curves.

Experiment 2 – Teaching robot to write

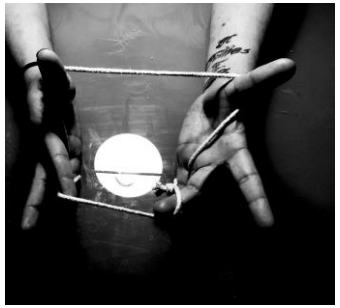
Experiment 3 – Understanding role of hands in fabrication process.

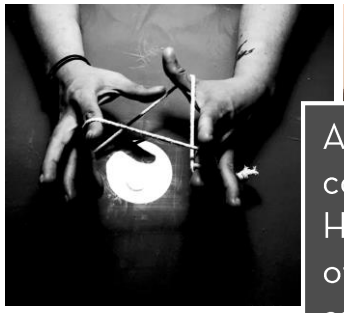
Experiment 4 – Developing physical models based to understand weaving.



Experiments and models

Experiment 5 – exploring different hand gestures and form finding.

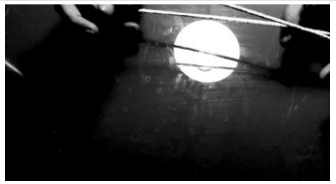




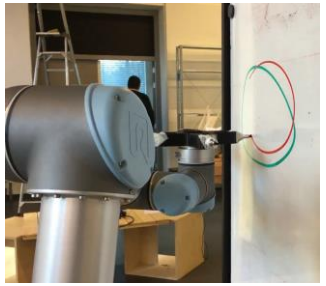






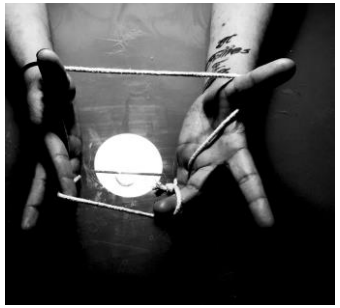


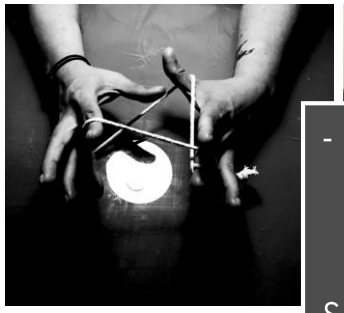


Problem statement

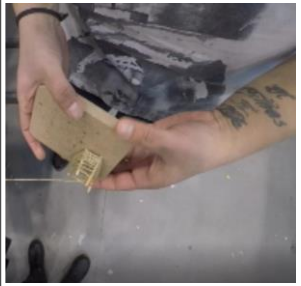
Architecture is experienced in a multi-sensory way. A work of architecture which is designed or considered only from the exterior ceases to be architecture and becomes a mere object. However, the use of digital tools and computer imagining focuses mainly on the visual aesthetics of architecture. This visual dependency could be the result of a disconnect between the designer and the fabrication process, to bridge this gap between the two actors a variant method could be adopted which incorporates intuitive design capabilities of the user and the precision of digital fabrication process.

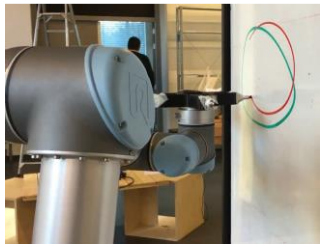








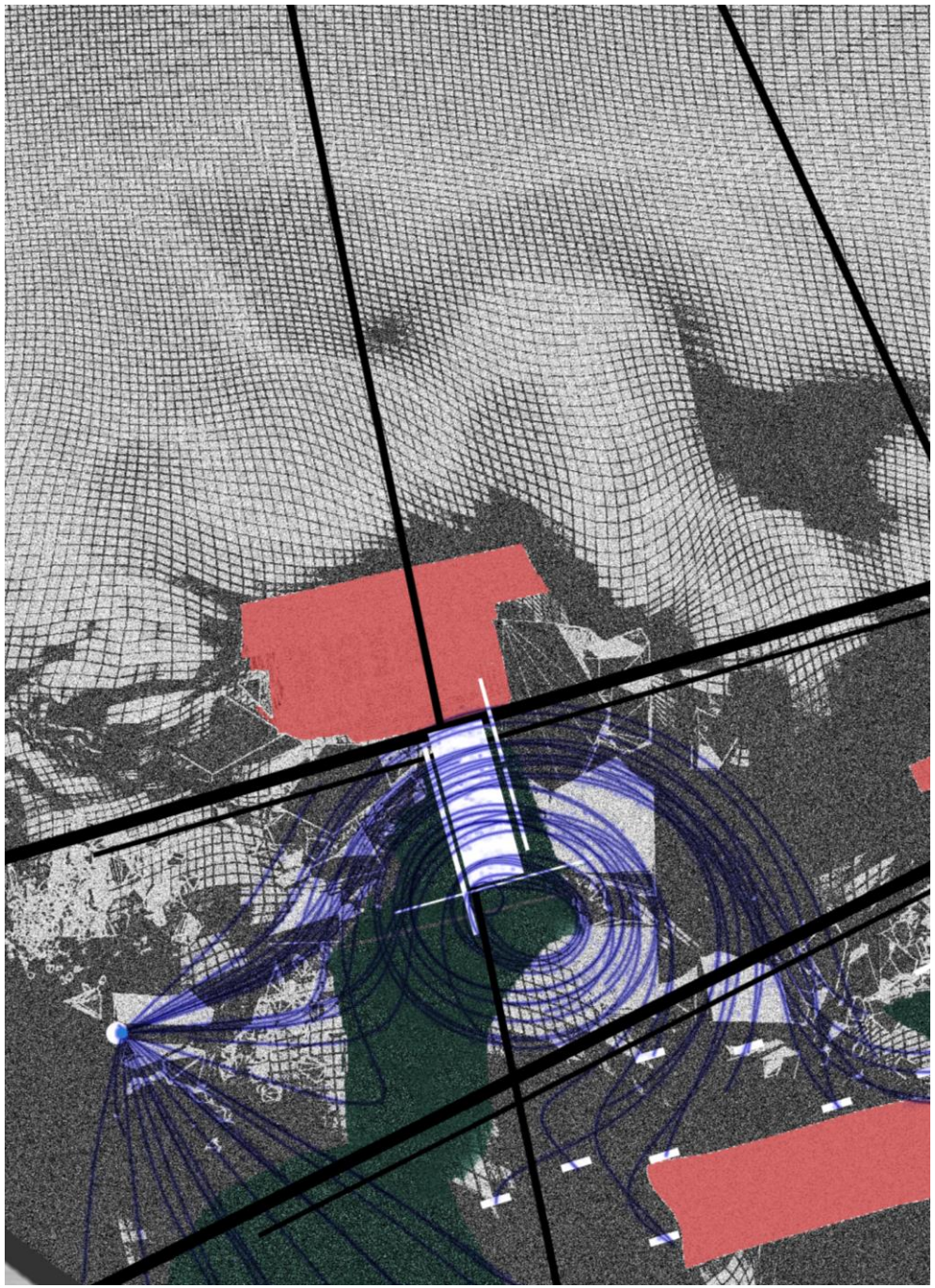


Research question

- How can robotic fabrication and human-machine learning inform the design process to develop architectural elements for a dwelling unit which incorporates both the intuitiveness of the designer and precision of digital fabrication?

Sub – Questions

- How or can Phenomenology of architecture influence computer aided design ?
- How can we bridge this gap between technology and architecture ?
- What role would hands play in this design tool ?
- Can we use hands to convey information to this digital tool ?



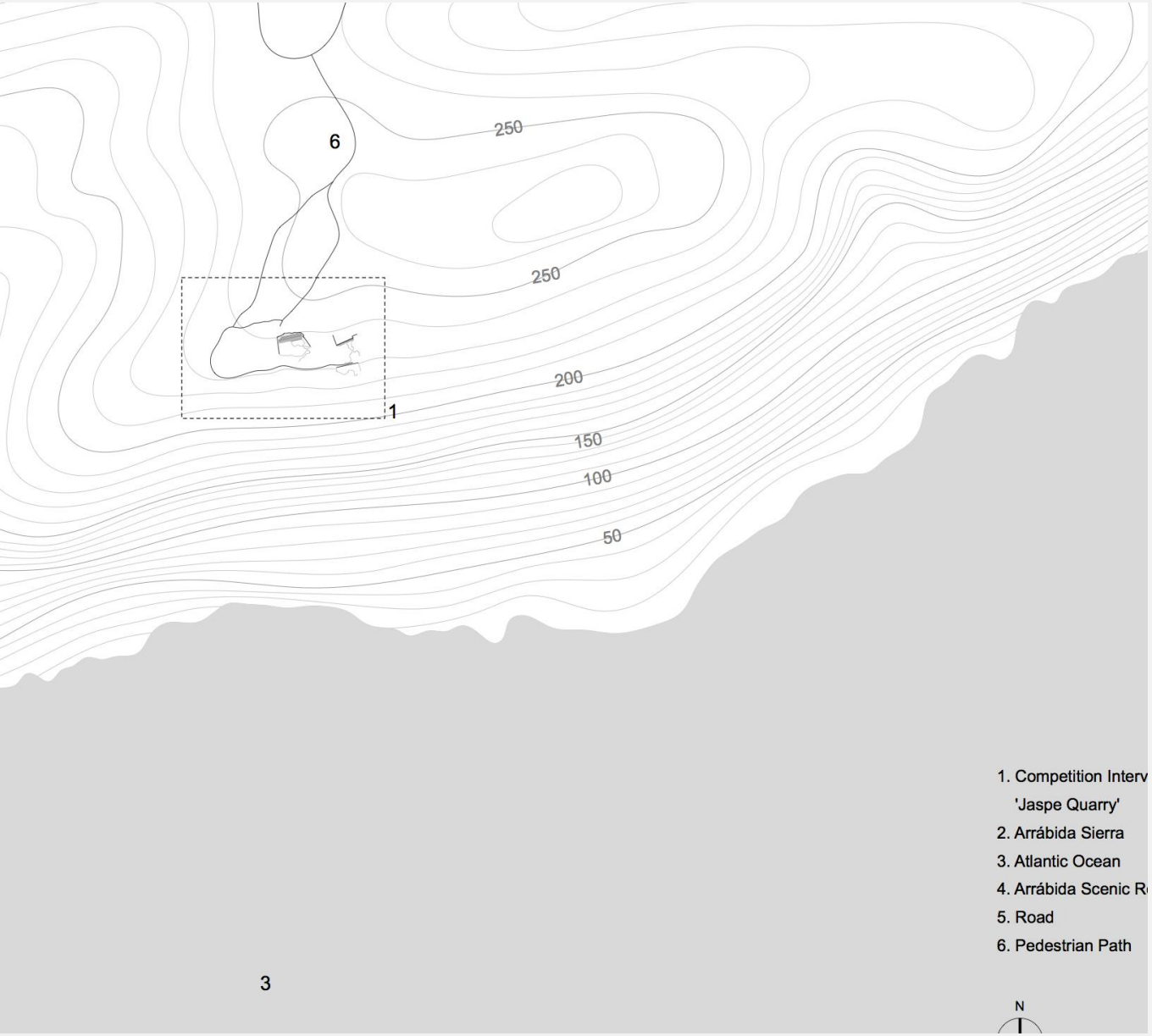
Chapter 3

Design – Conceptualizing on a global scale

Developing a design apporach based on results and observations from previous chapters

Case Study and architectural concept to apply this design ideas

Speculative visualtizations and drawings to represent these concepts



Case Study

Site Description
Latitude: 38°27'28.38"N
Longitude: 9°00'37.63"W
Altitude:235 m
Winds: Predominant winds are from the north.
Climate: Warm and temperate climate.
The annual average temperature is 16.6 °C.
Relative Humidity: The annual average relative humidity is around 68%.
Rainfall: Total average annual precipitation is 679 mm.

Site views, ARKxSite

Site Pictures

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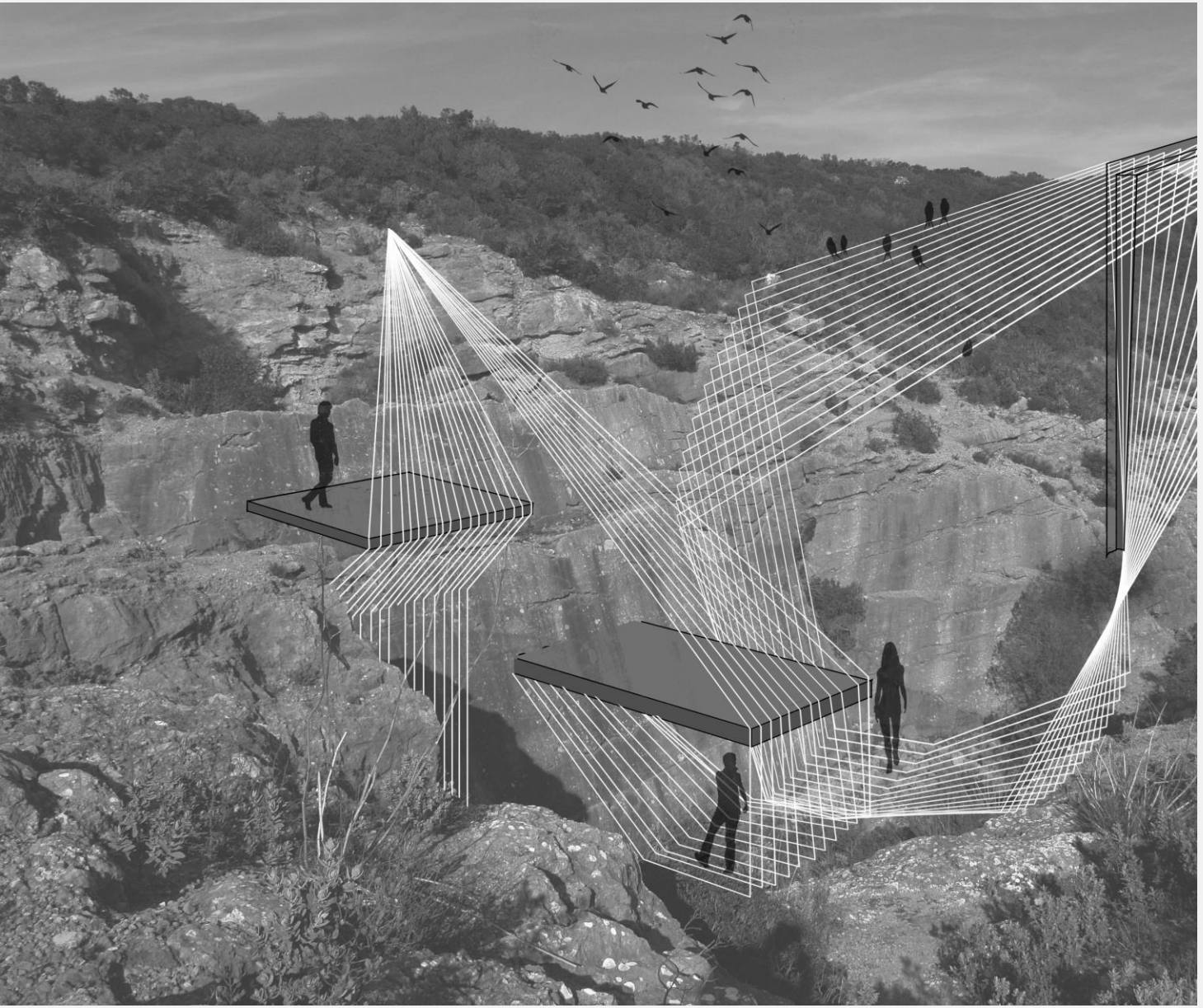
Architectural Concept



Architectural Concept

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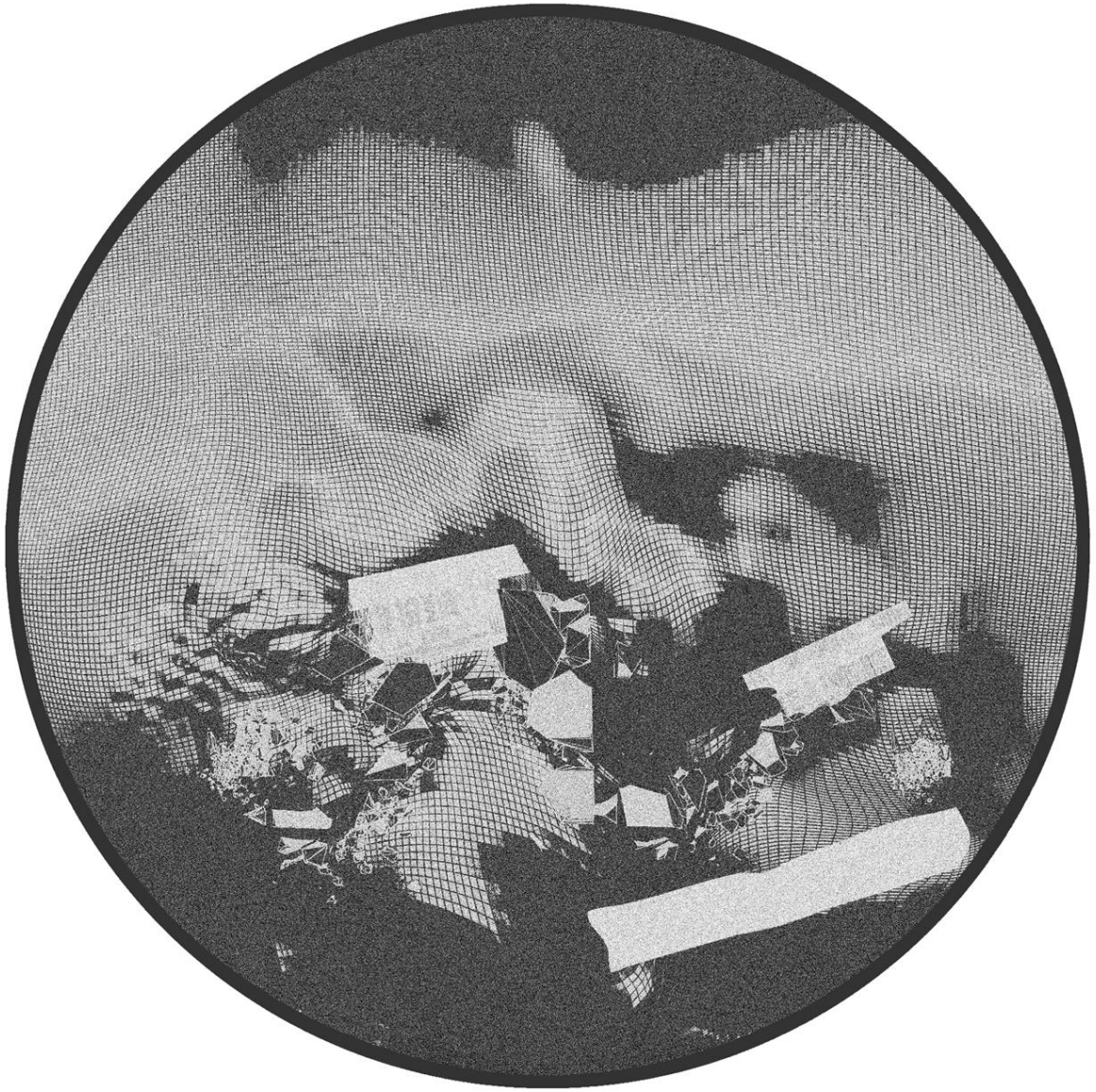

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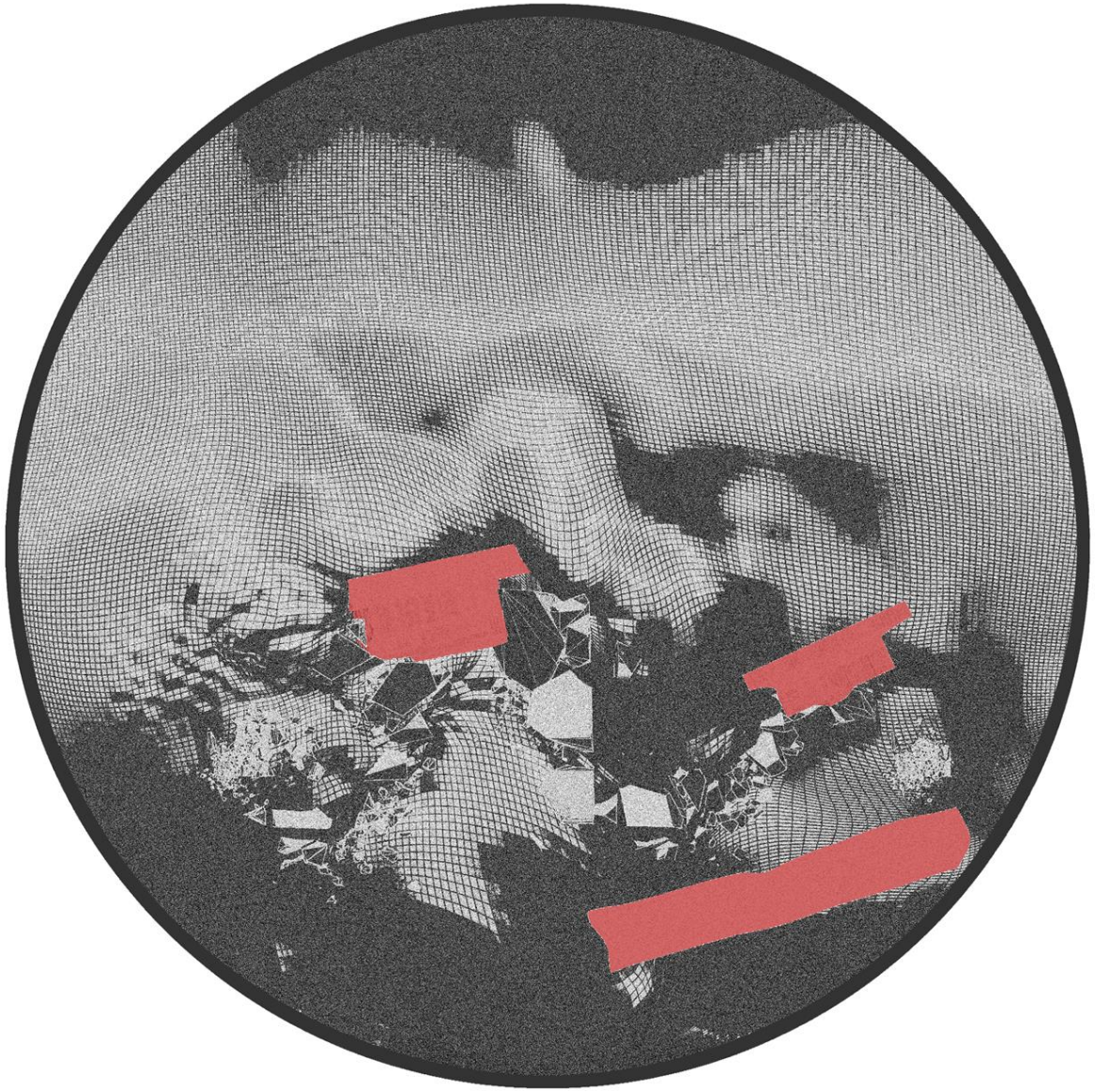

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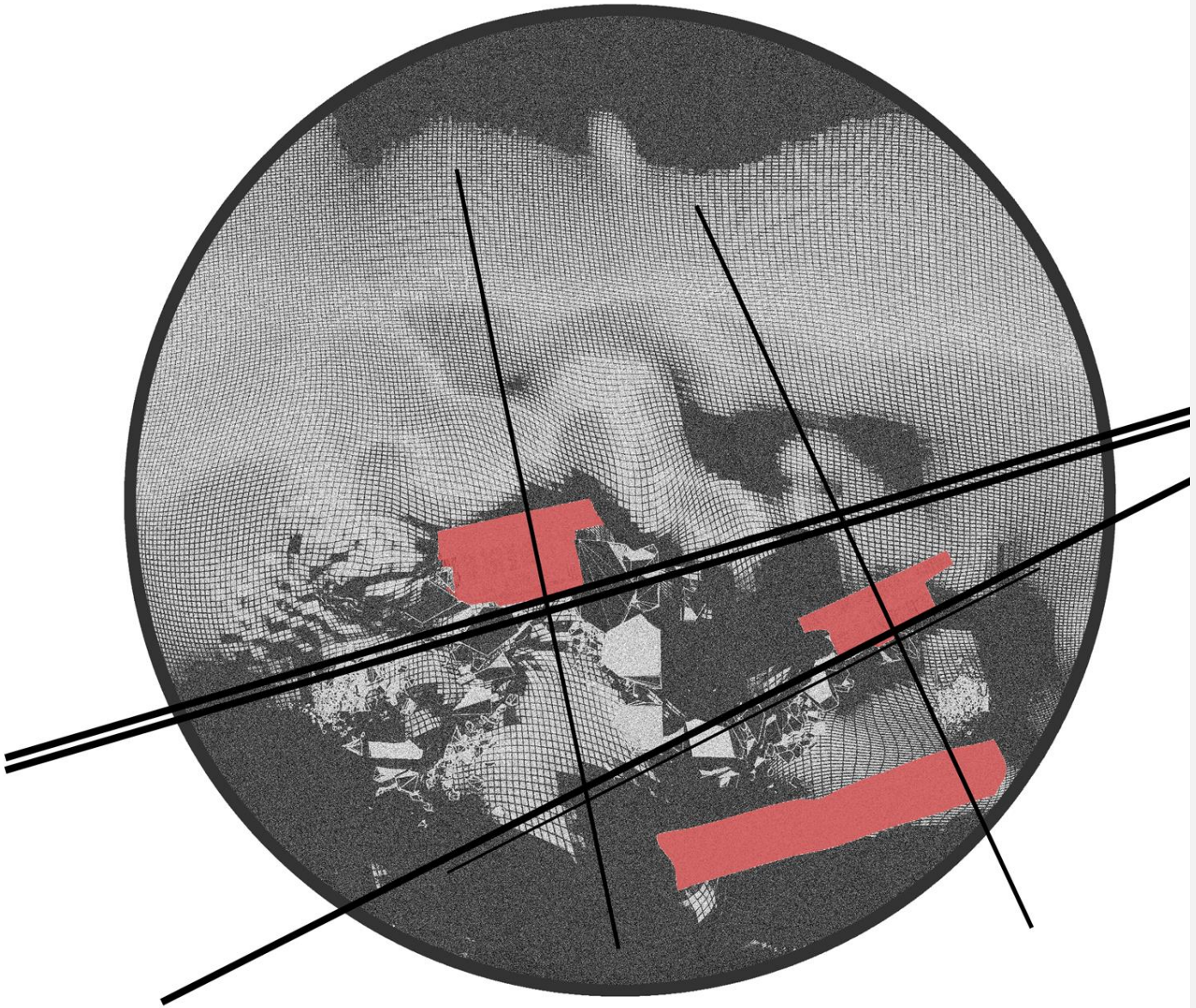

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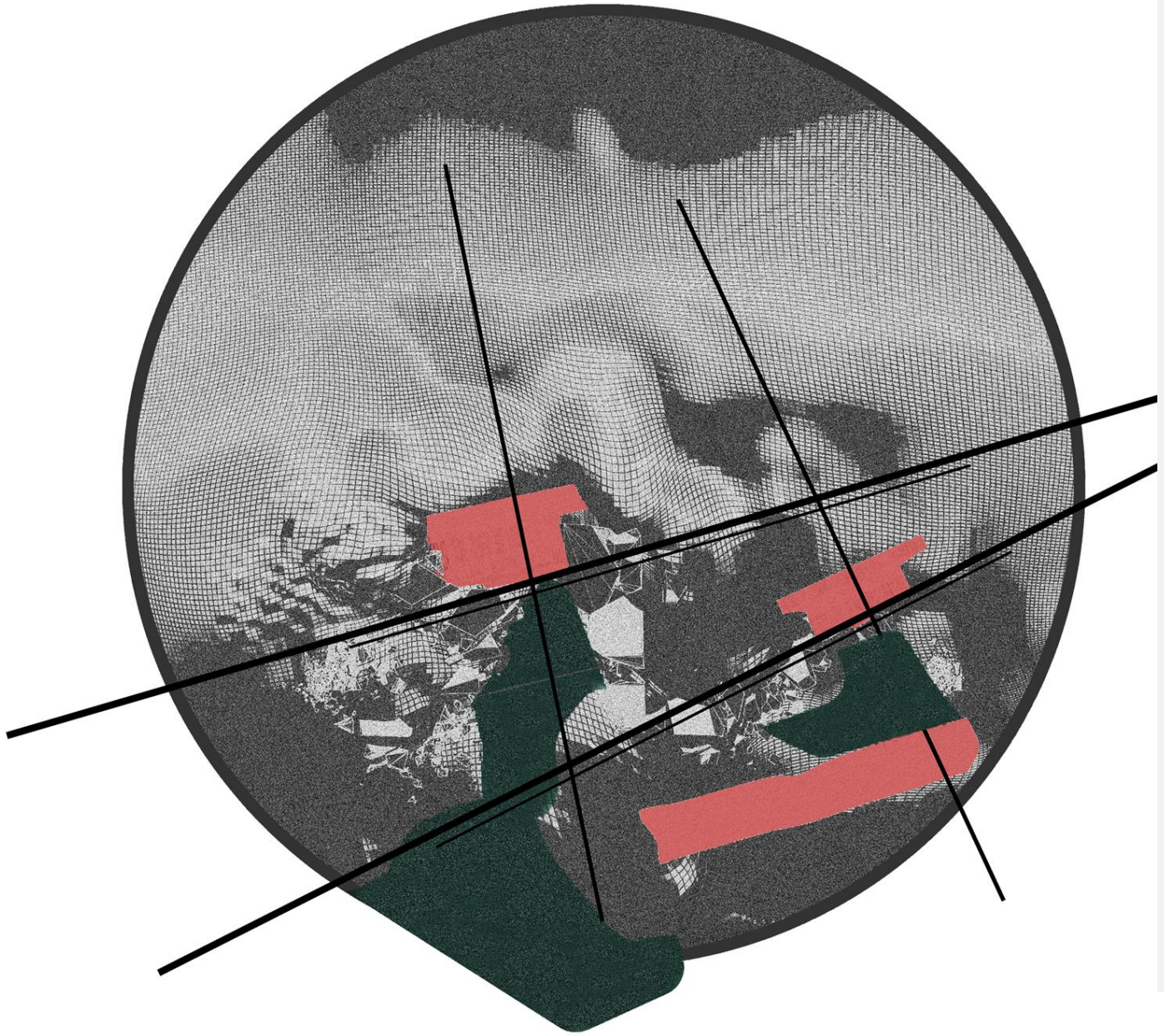

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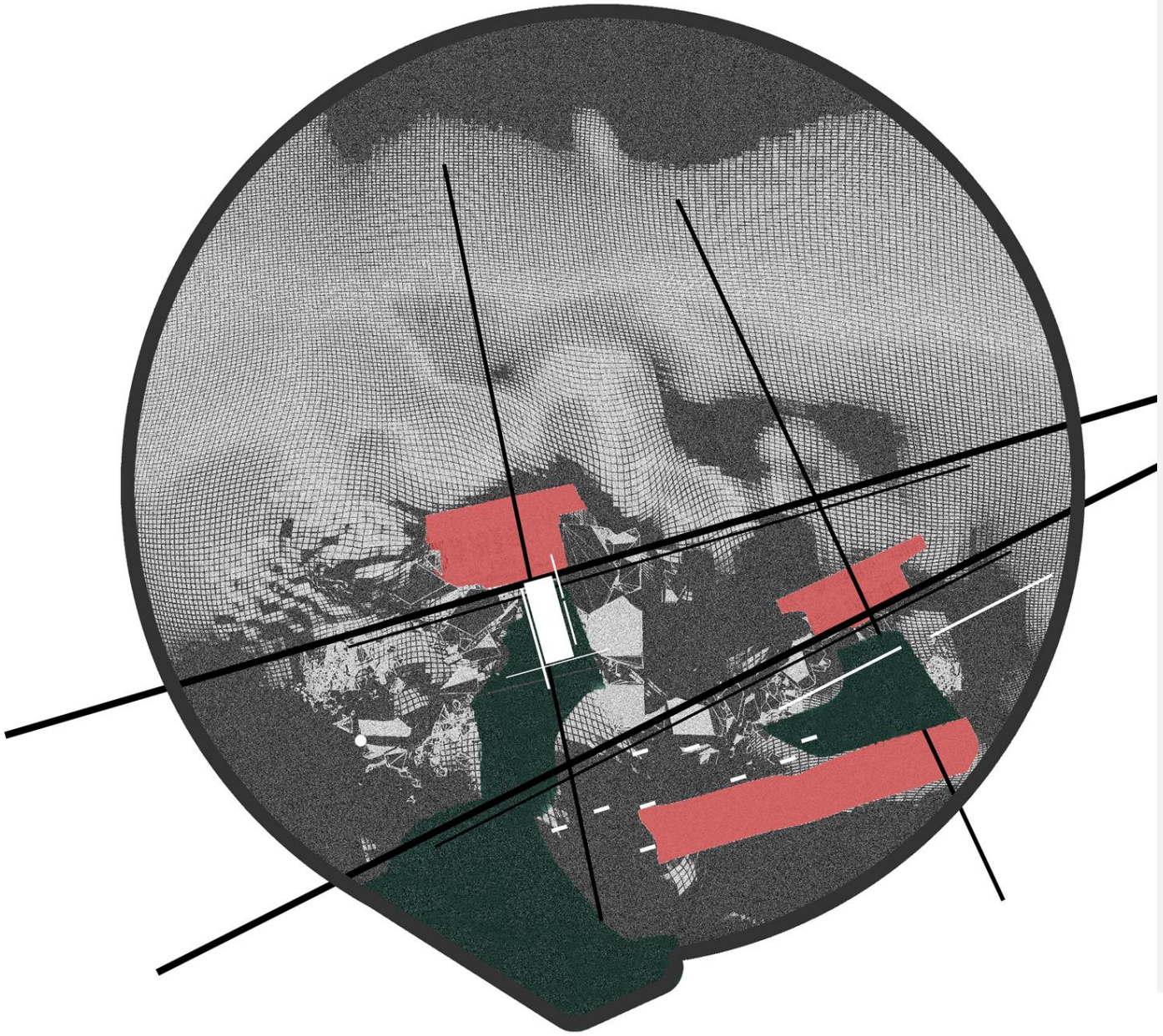
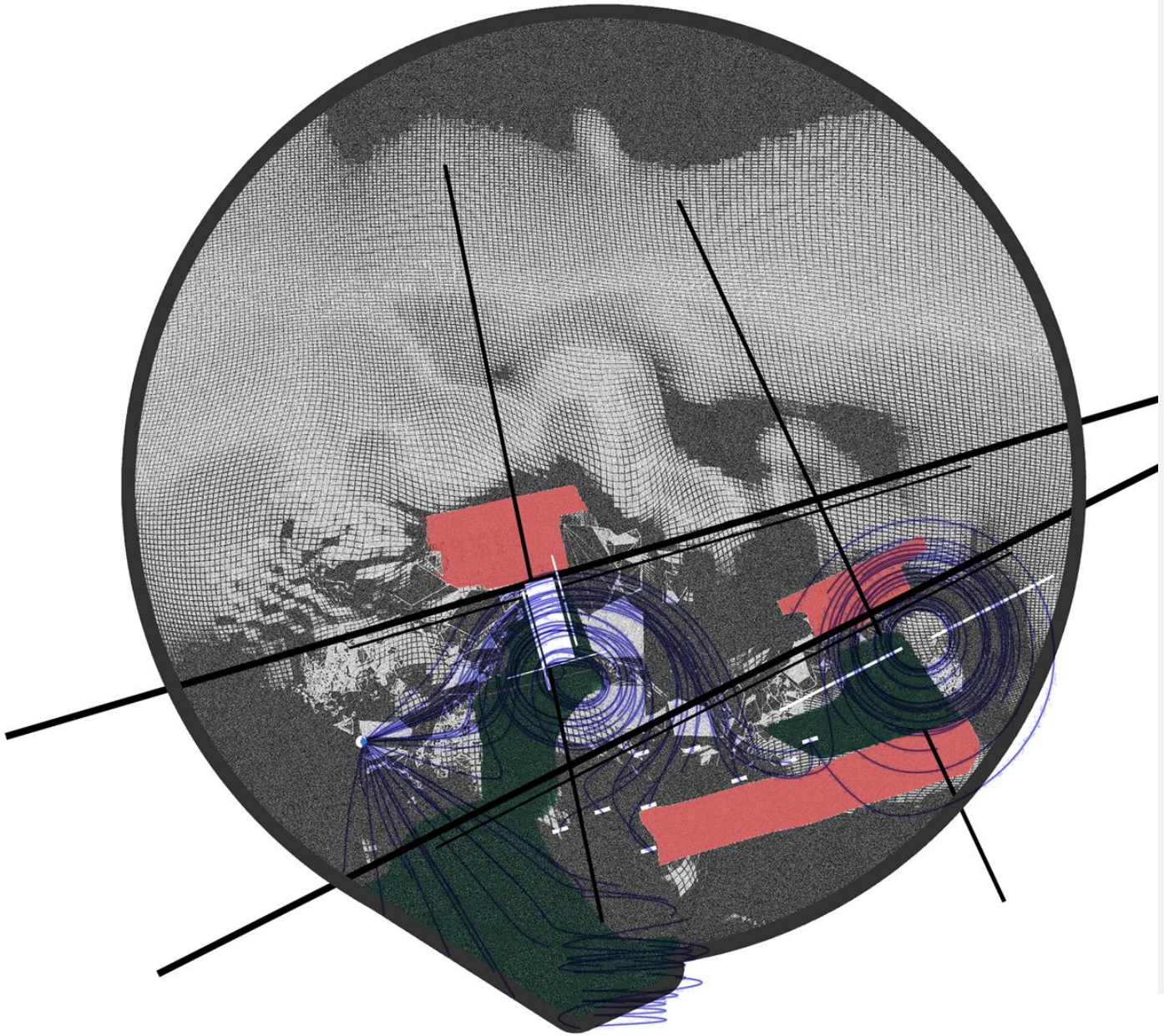
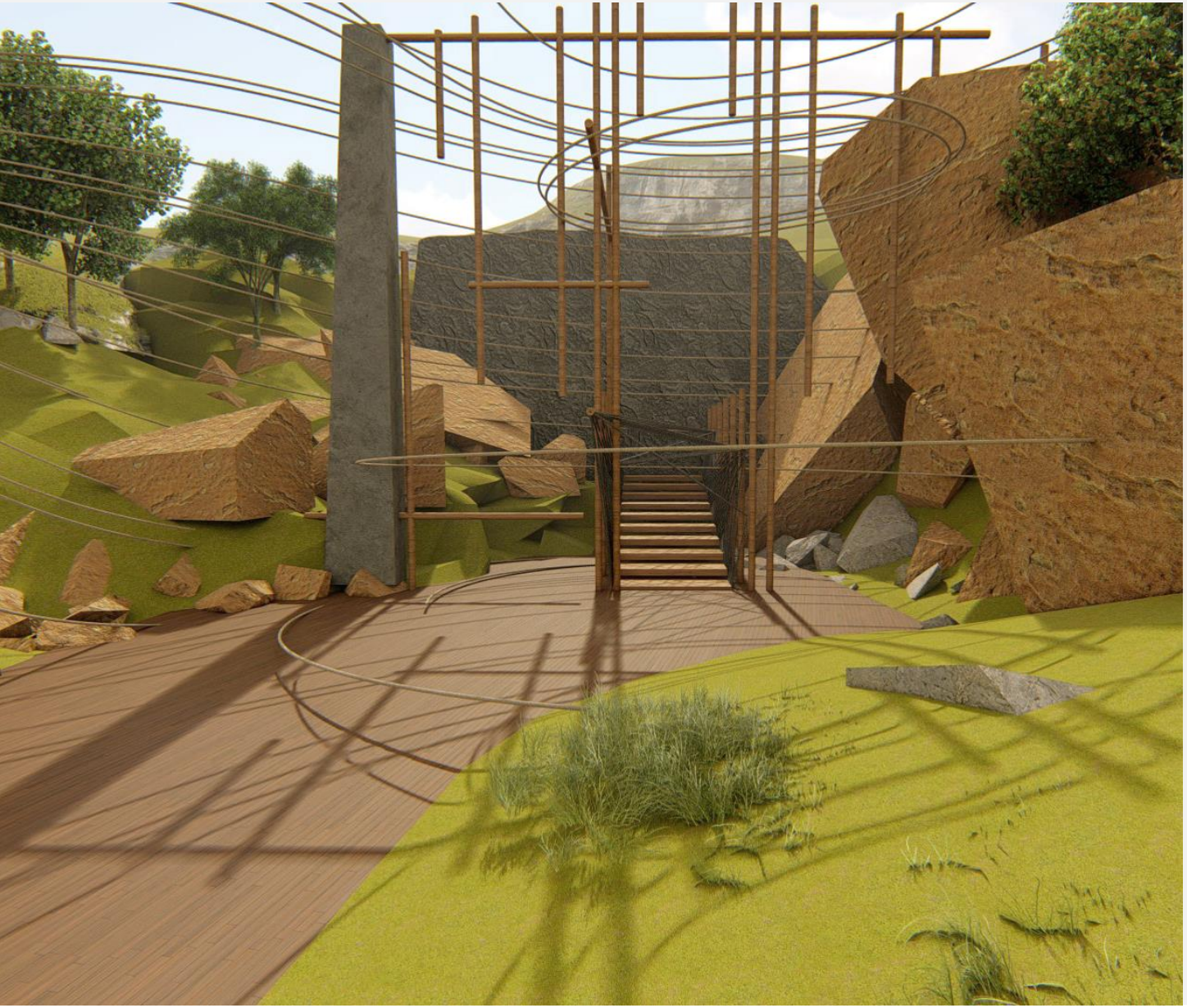


Architectural Concept



Architectural Concept

Speculative visualizations



Speculative visualizations

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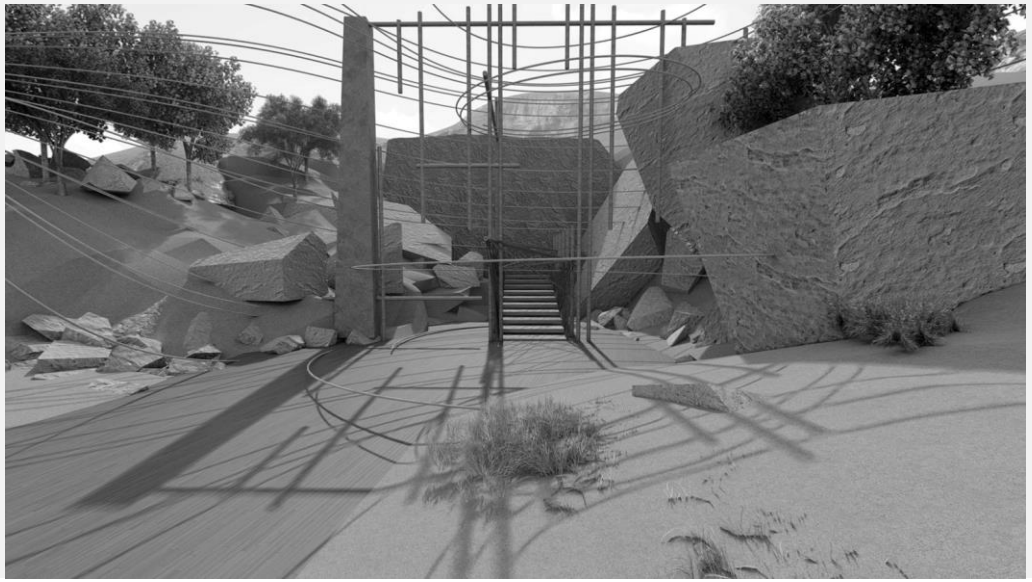
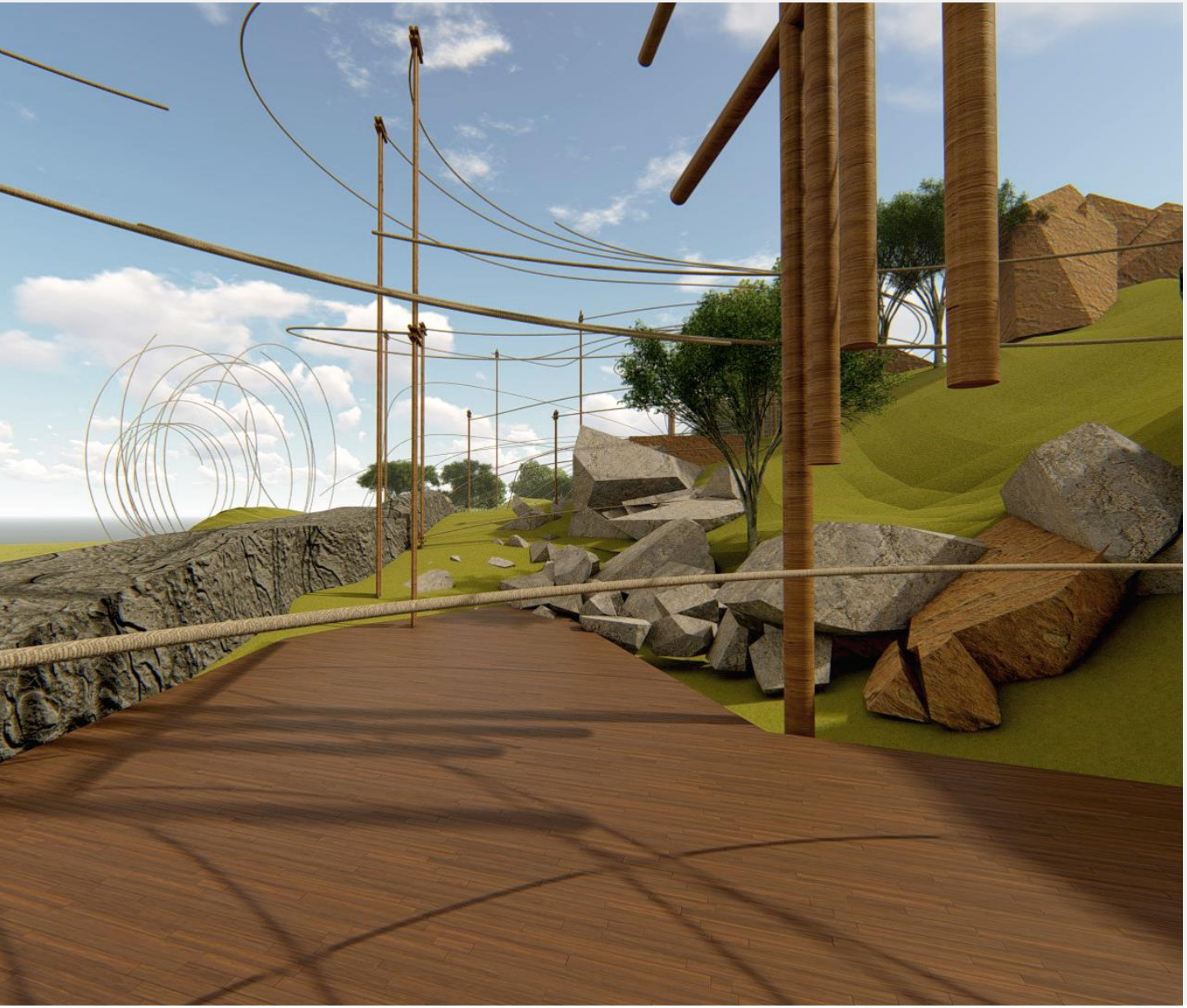
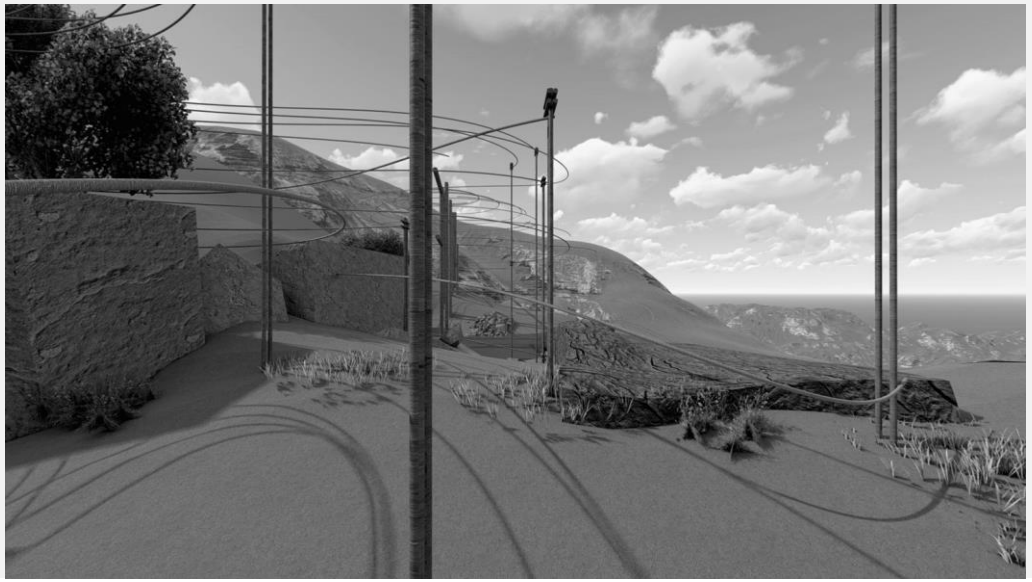
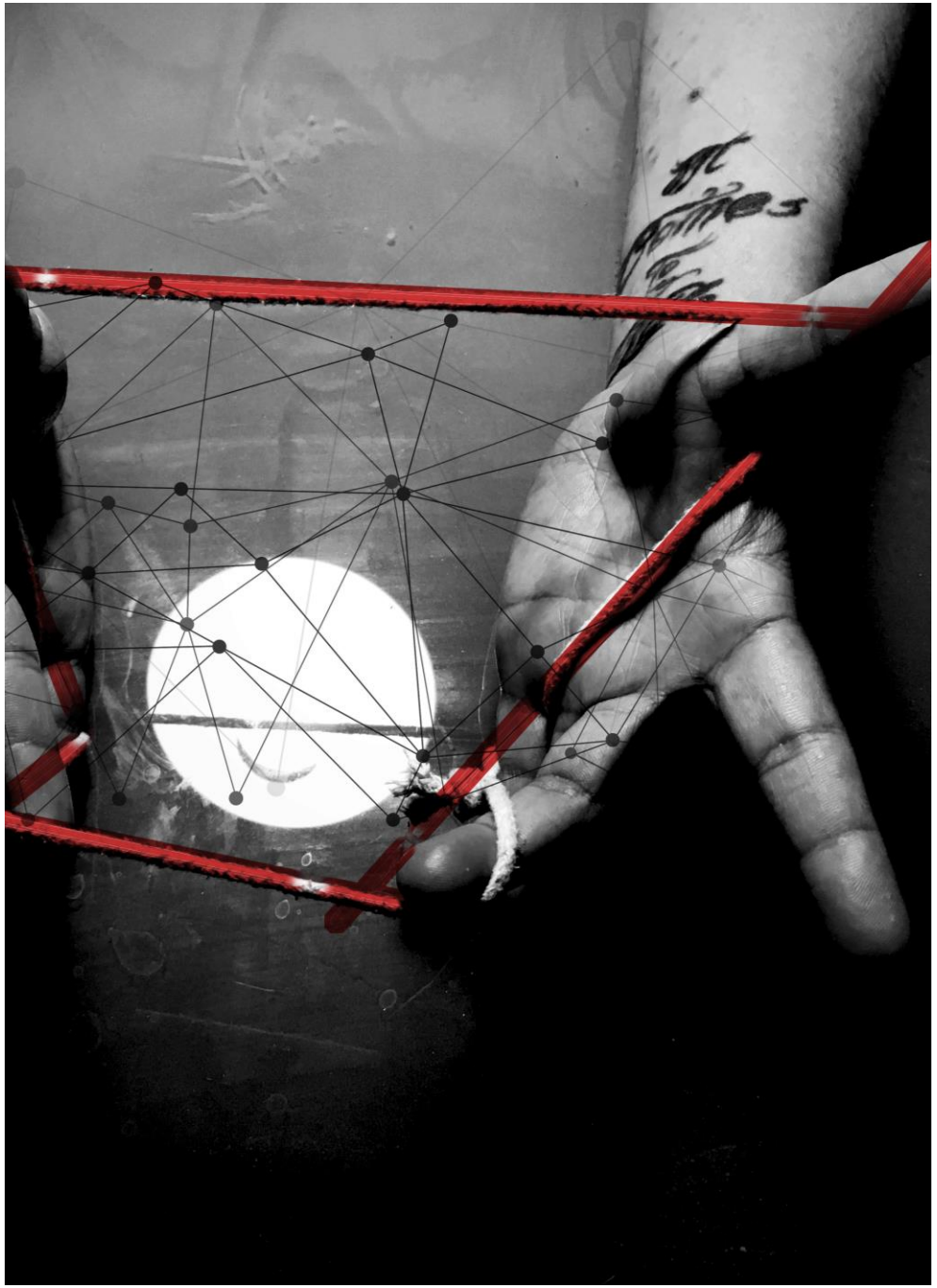




Speculative visualizations





Chapter 4

Process - Conceptualizing process for proposed design and developing instruction manual for developed design tool

Design Process based on learning of previous chapters applied on the proposed architectural design

Drawing paralles between the developed tool and other entertainments industry to further simply tool useage

Instruction manual containing steps and gesturs combinations to create different design forms

Robotic weaving as an architectural performance

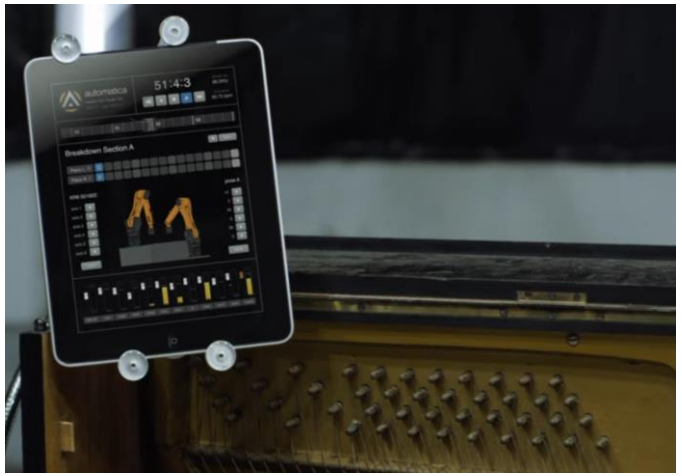
Robotics as an Musical Performance

Automatica - robots vs. music - Nigel Stanford

Robotics as an Musical Performance

Automatica - robots vs. music - Nigel Stanford

Robotics as an Musical Performance



Automatica - robots vs. music - Nigel Stanford

Robotics as an Musical Performance

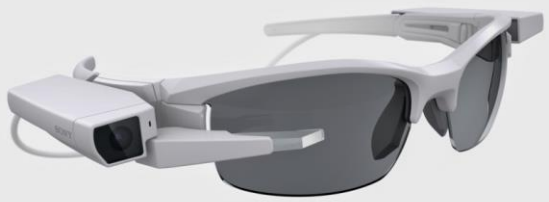
Automatica - robots vs. music - Nigel Stanford

Robotic arm

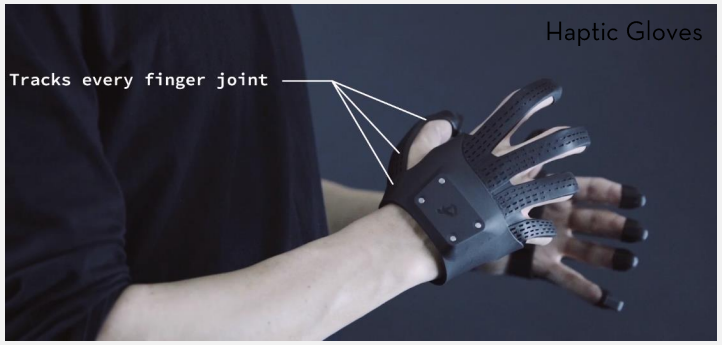
End Effector

A computer

AR Glasses

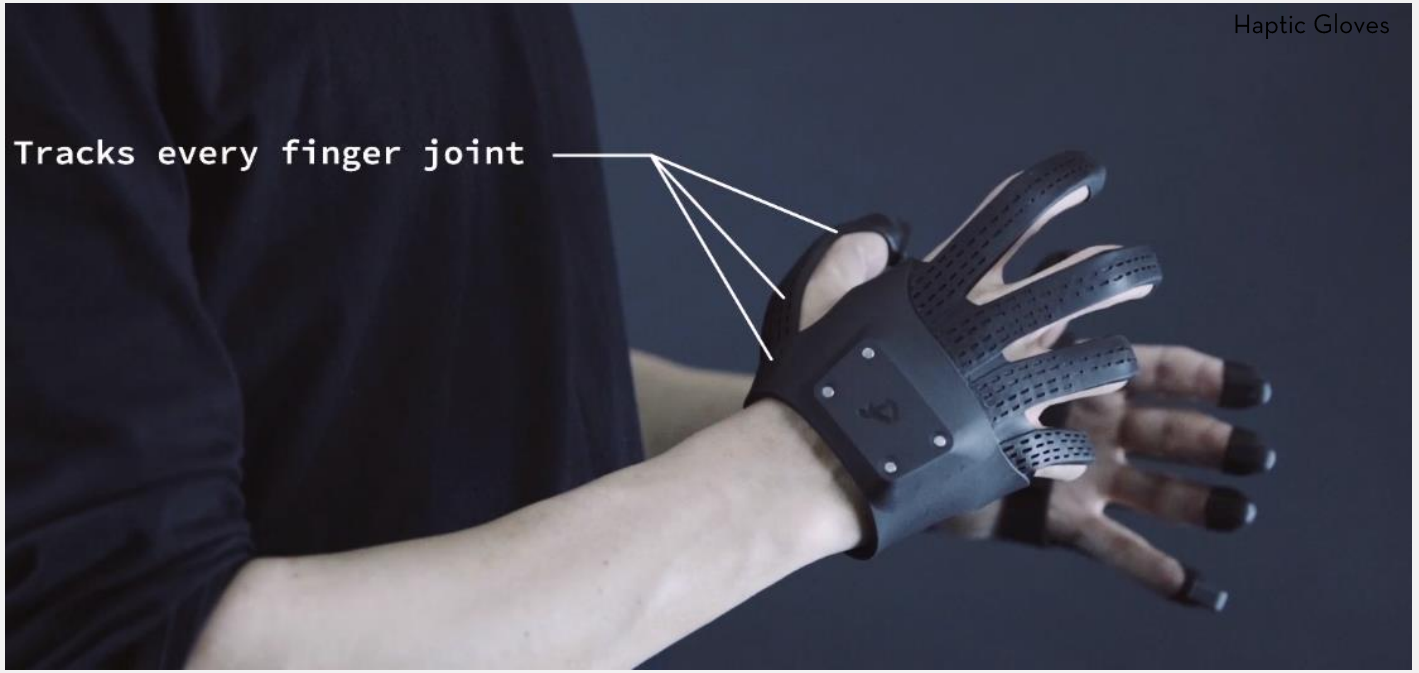


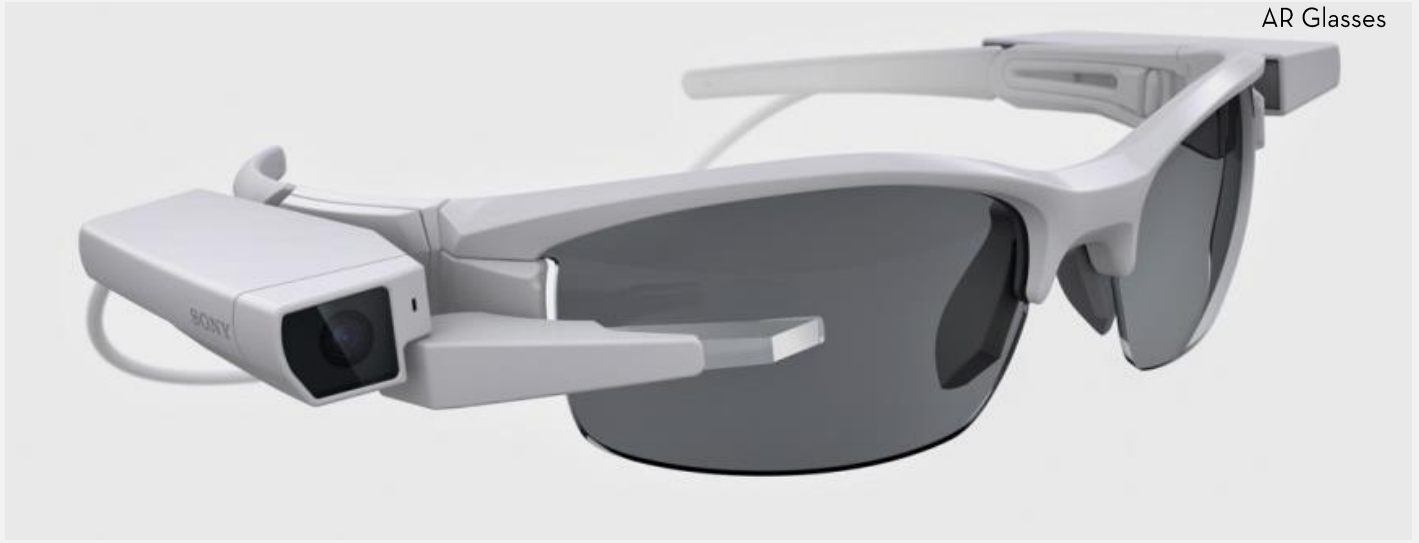
Haptic Gloves



Tools and Equipment

- Robotic Arm
- End Effectors
- A Computer
- AR Glasses
- Haptic Gloves
- Hands





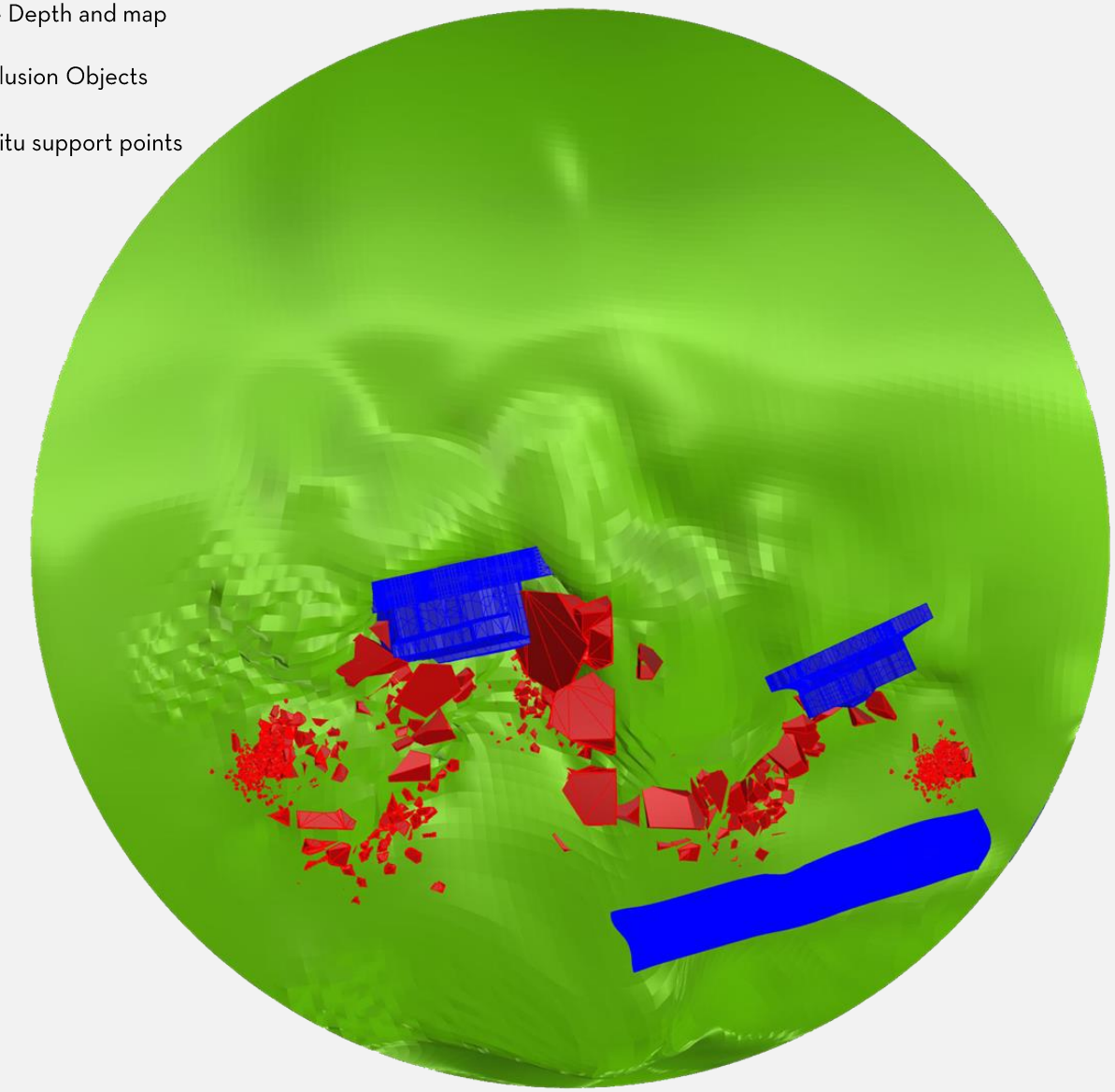
Quick Intro to Haptic gloves and AR glasses

- Haptic Gloves - haptic gloves, users can feel the shape and texture of objects, while benefiting from finger-specific input data when interacting with the assets. Tactile Feedback. Haptic gloves tracked in 3D space will allow designers to more accurately and precisely manipulate objects, which is pertinent to their craft.
- AR Glasses – AR Glasses are wearable computer glasses that add information alongside or to what the wearer sees. Alternatively AR glasses are sometimes defined as wearable computer glasses that are able to change their optical properties at runtime

Site Depth and map

Collusion Objects

In-situ support points



Design Process – Setting up Digital environment

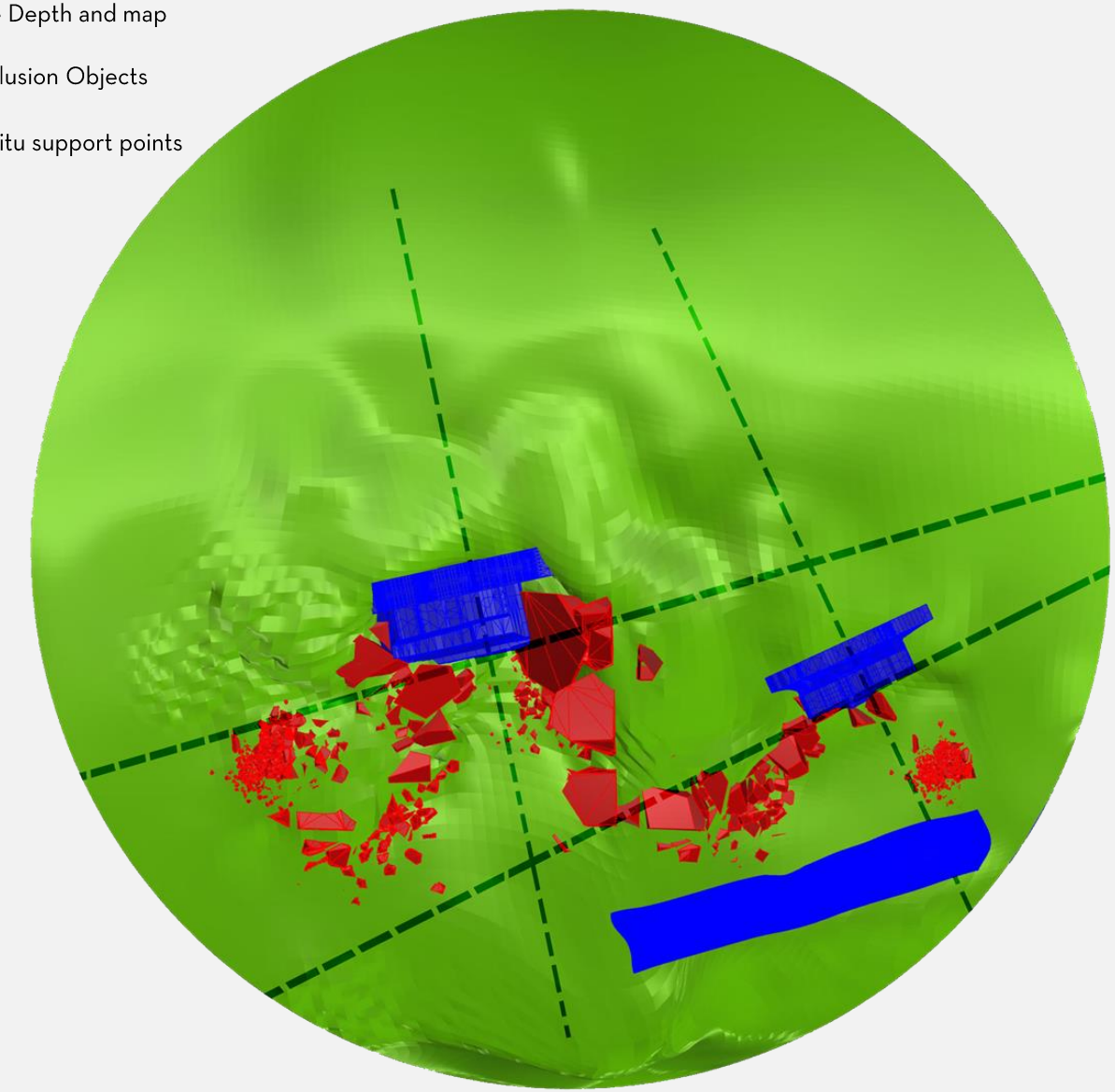
- At initial stage, virtual information containing site data, depth map, collusion objects and in-situ support points are uploaded in the digital program

- This information is then converted into a digital model, AR glasses project this information in form of a digital model of the site to the designer

Site Depth and map

Collusion Objects

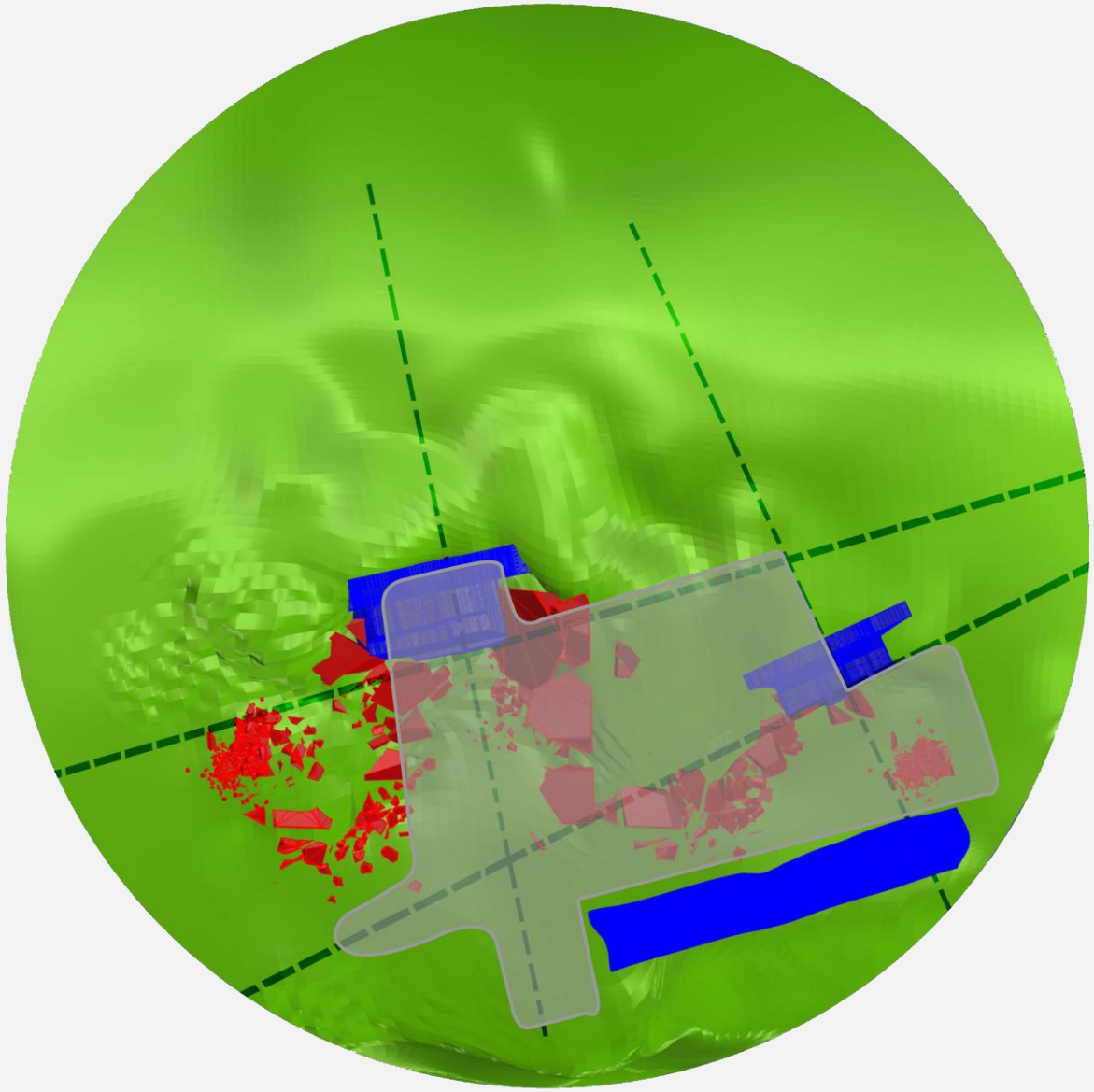
In-situ support points



Design Process – Defining Operable area and working axis

- Robotic arms has a specific reach and operable area, also a defined working axis has to be established to teach the robot's its location in the environment

- Based on concept lines from architectural concept, working axis and operable zone are fixed.



Design Process – Defining Operable area and working axis

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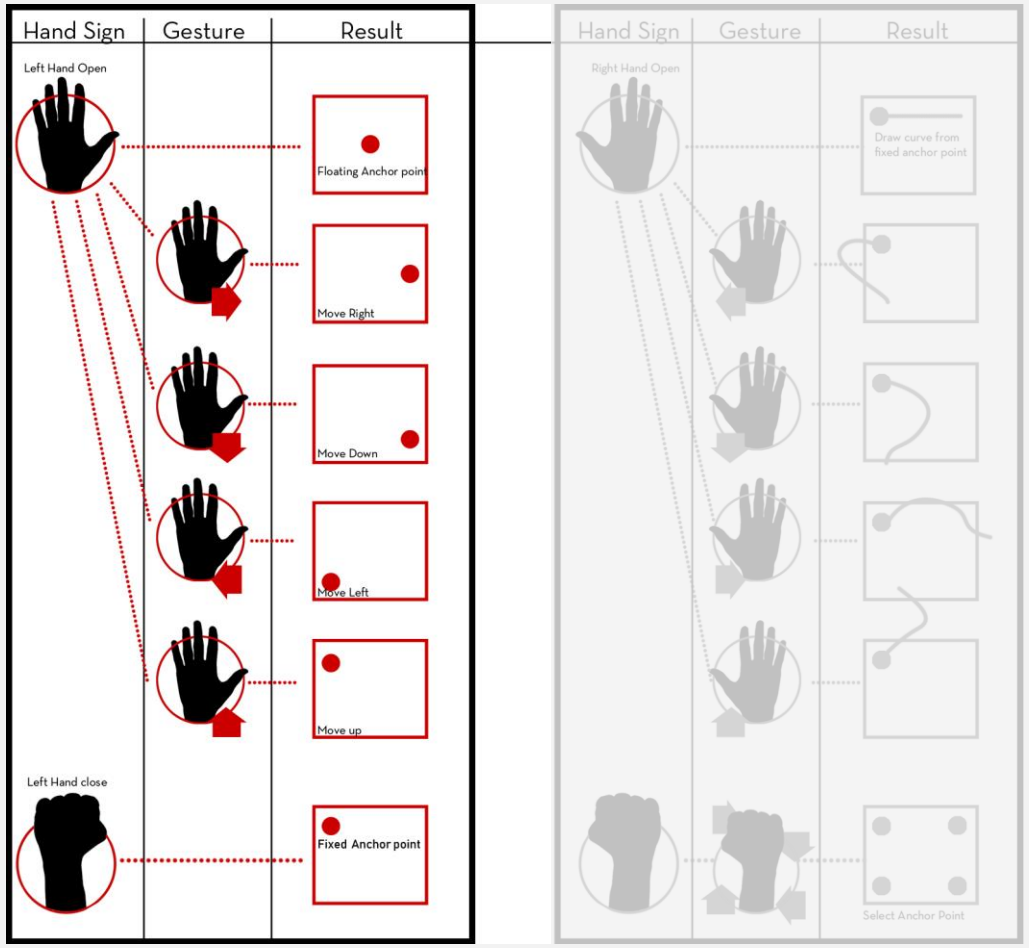
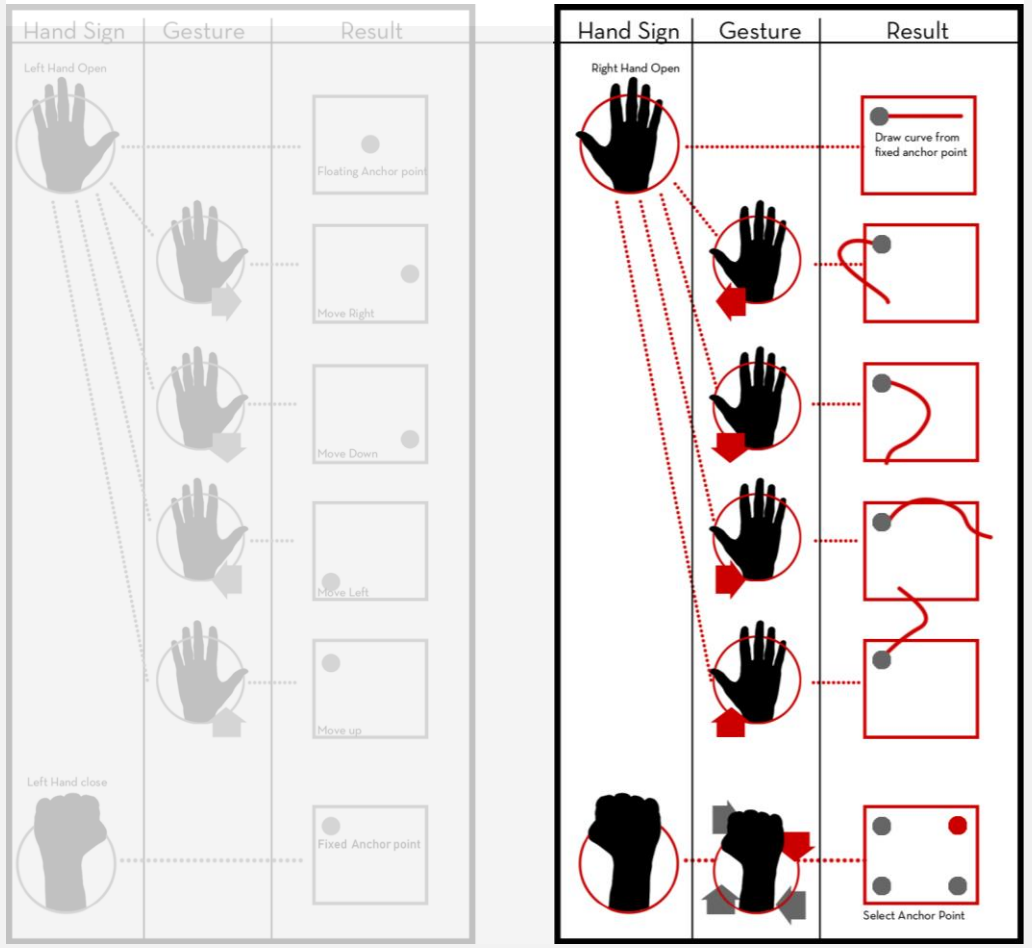
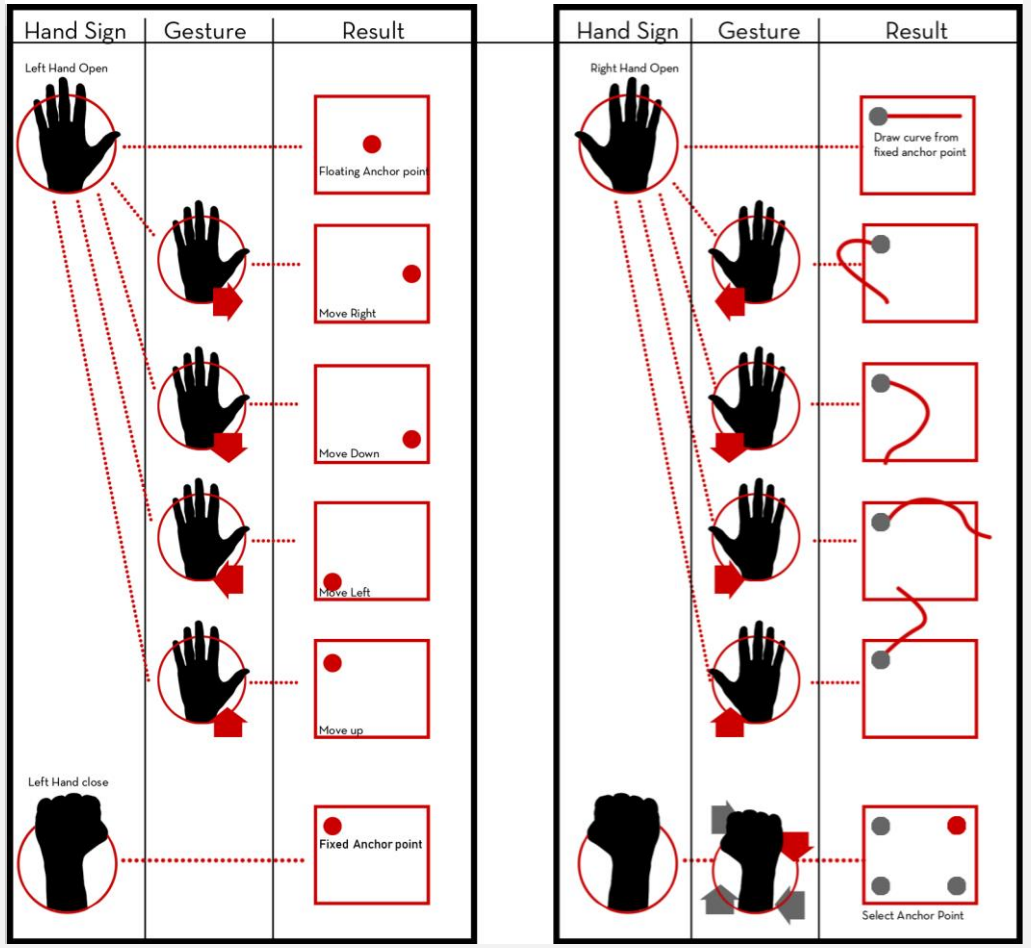
- Based on concept lines from architectural concept, working axis and operable zone are fixed.

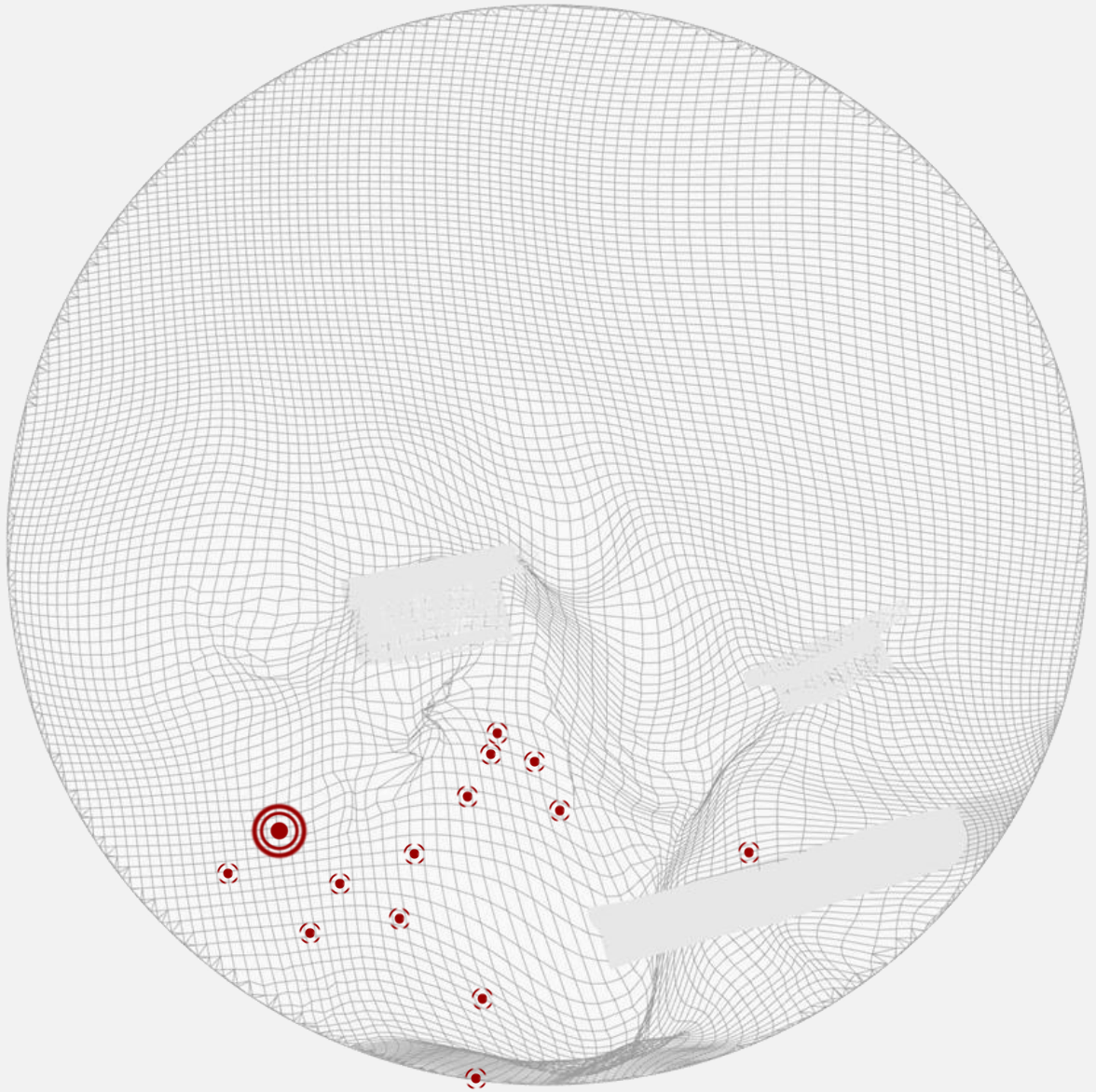
Design Process – Instructions



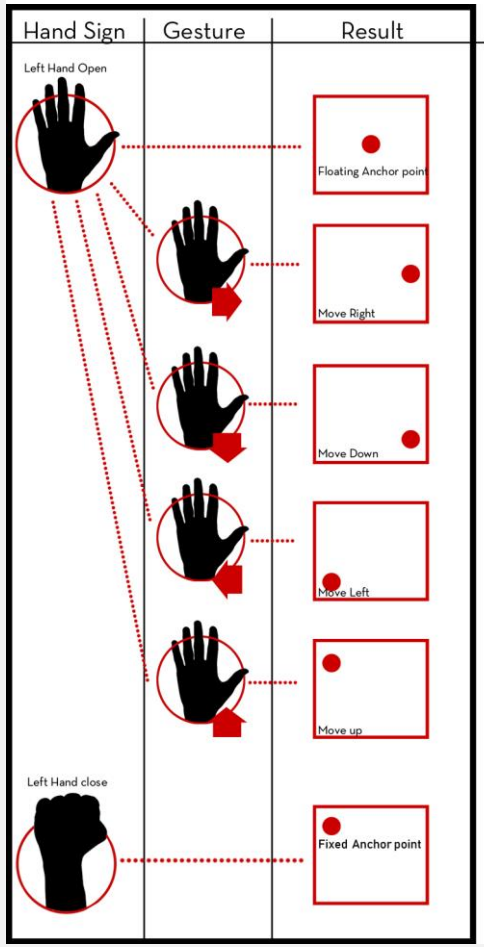


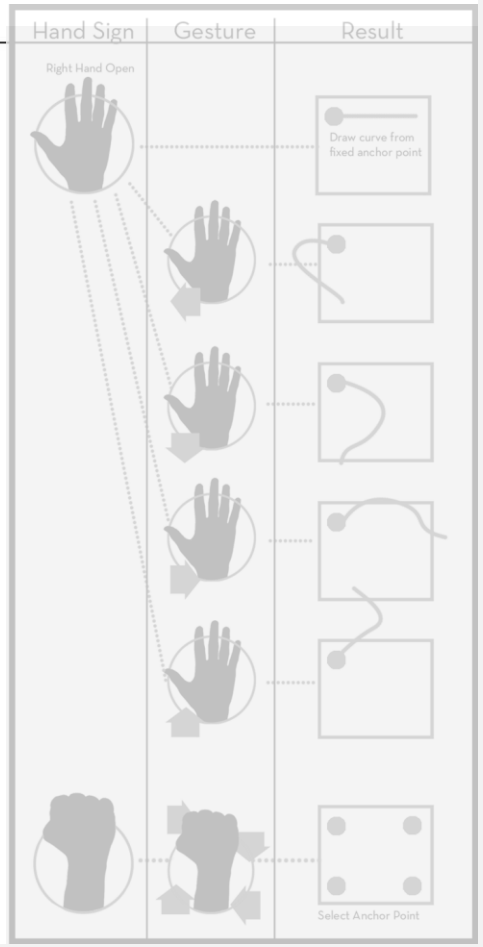
Design Process – Sketching

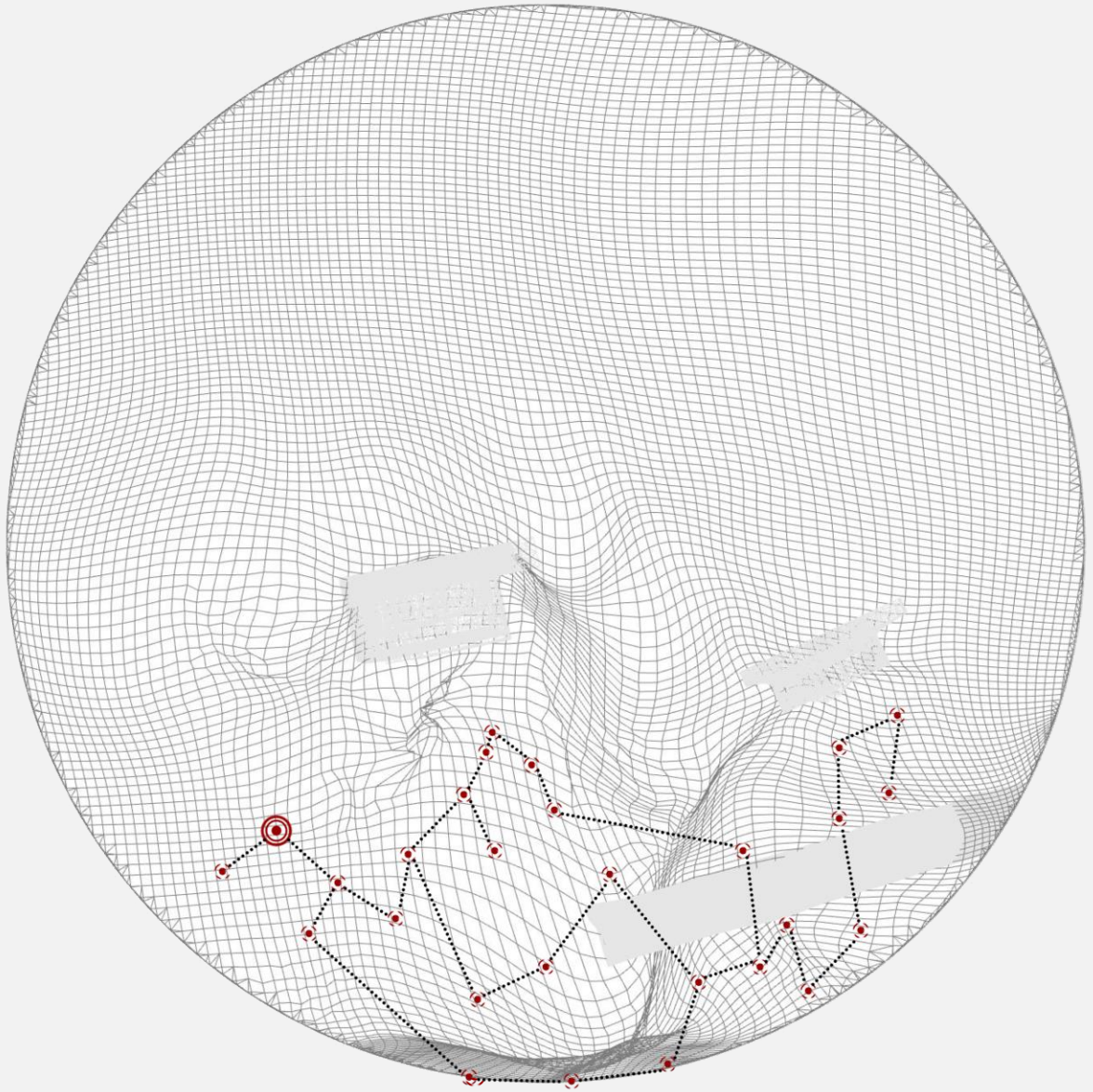




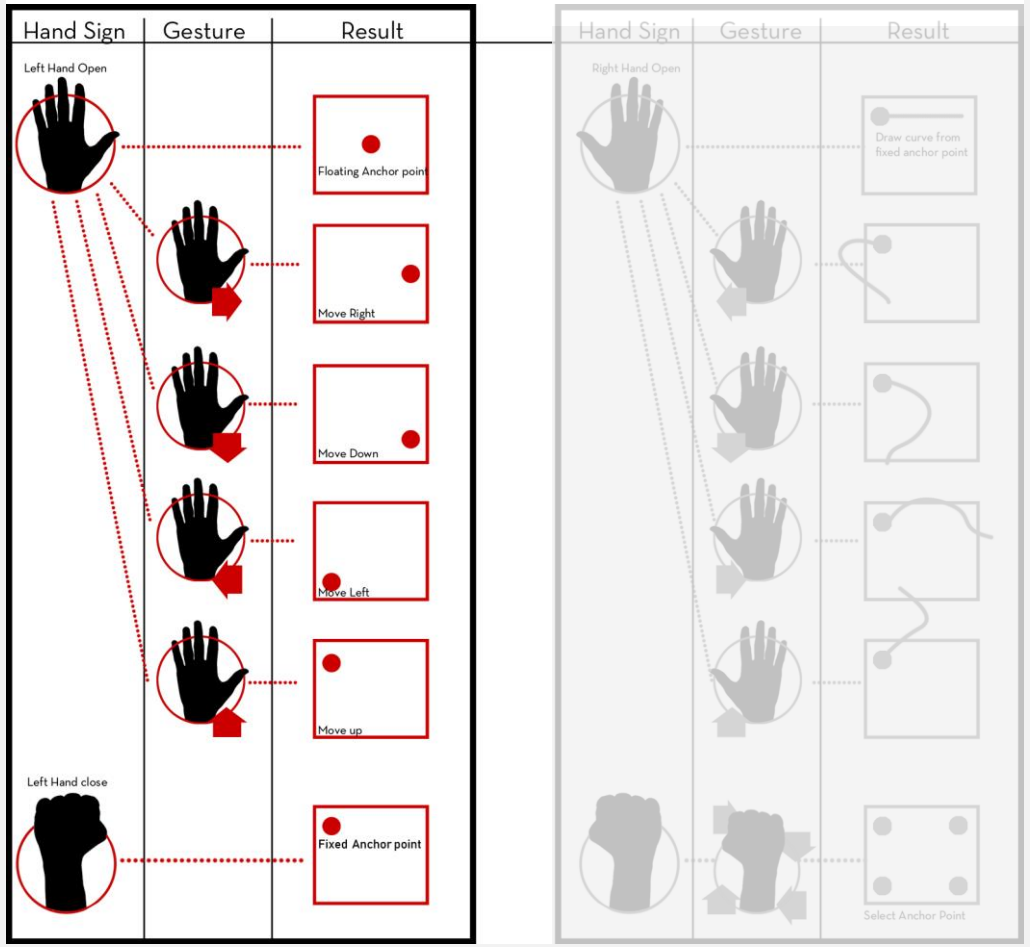
Design Process – Sketching

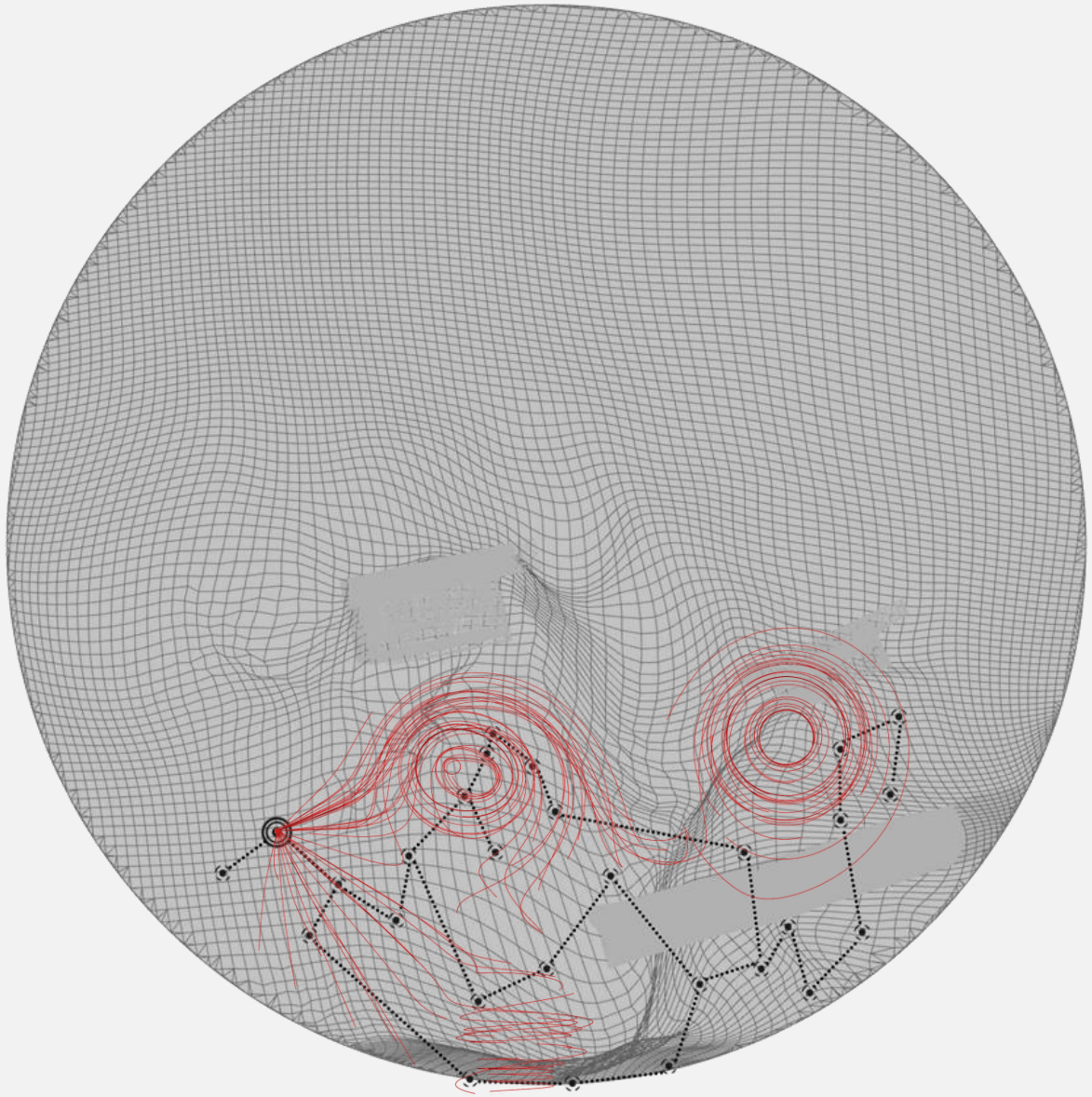




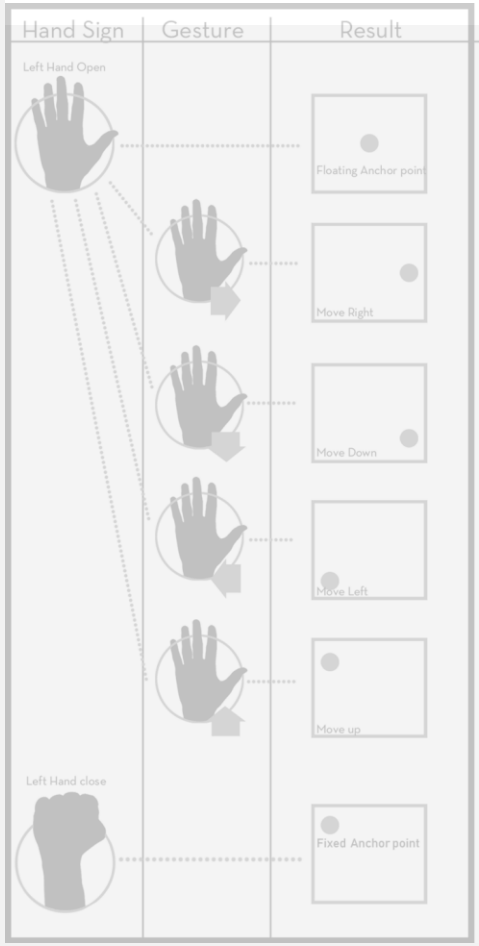


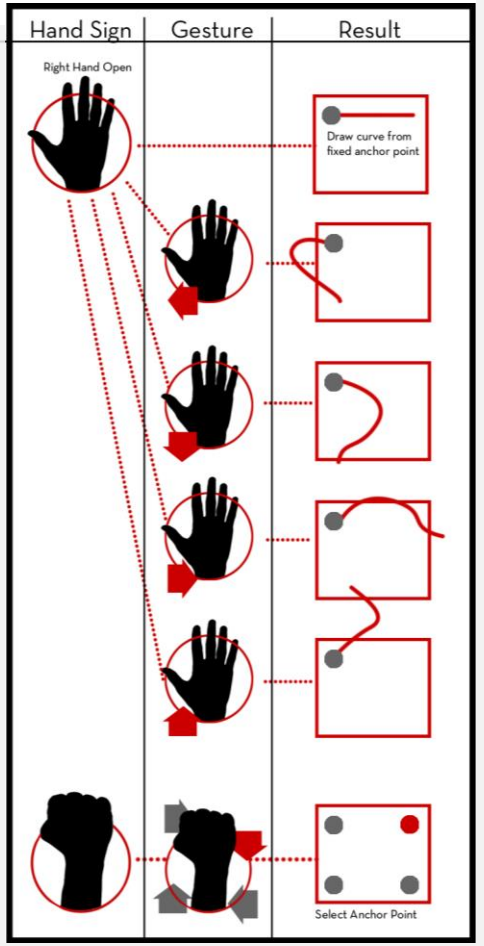
Design Process – Sketching





Design Process – Sketching

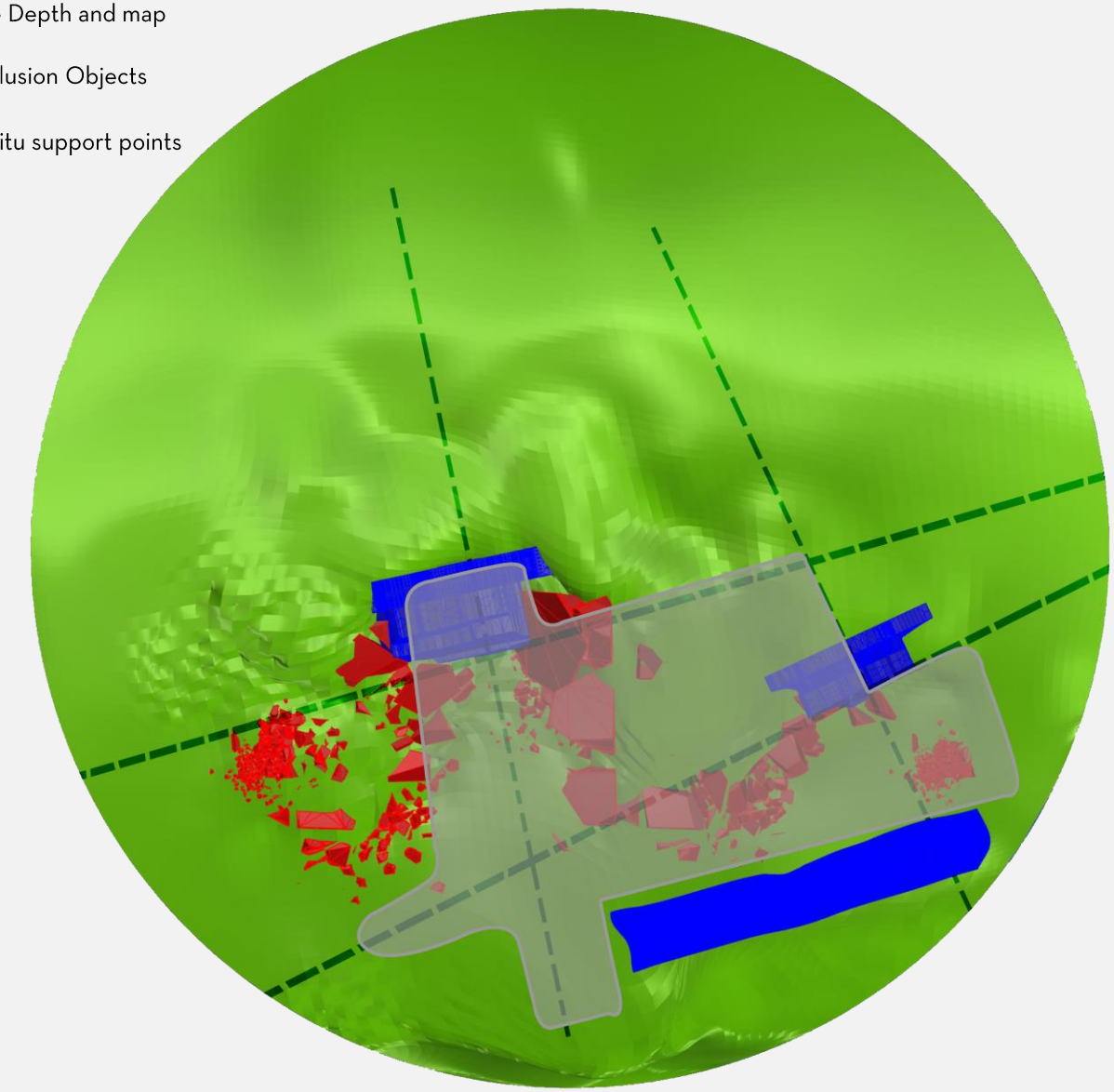




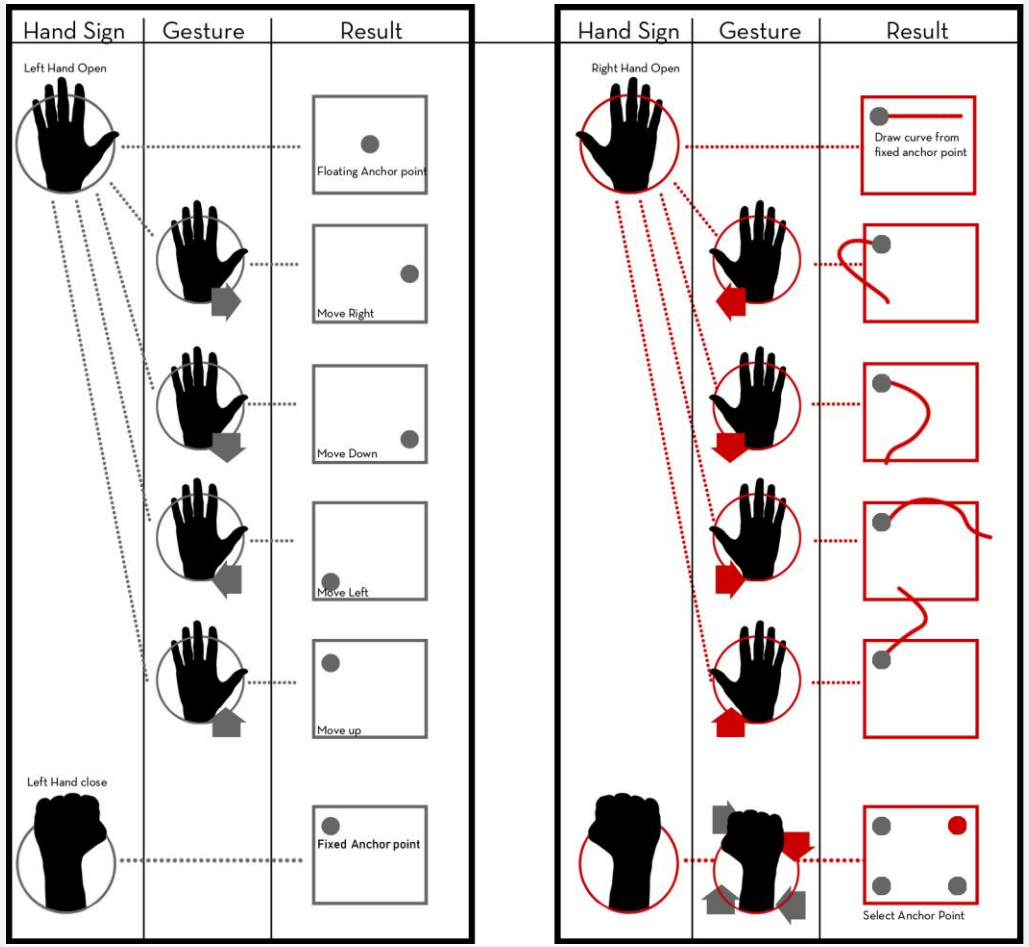
Site Depth and map

Collusion Objects

In-situu support points



Design Process – Sketching



Combination of different hand gestures

Combination of different hand gestures

Combination of different hand gestures

Design Process – Performance

Chapter 5

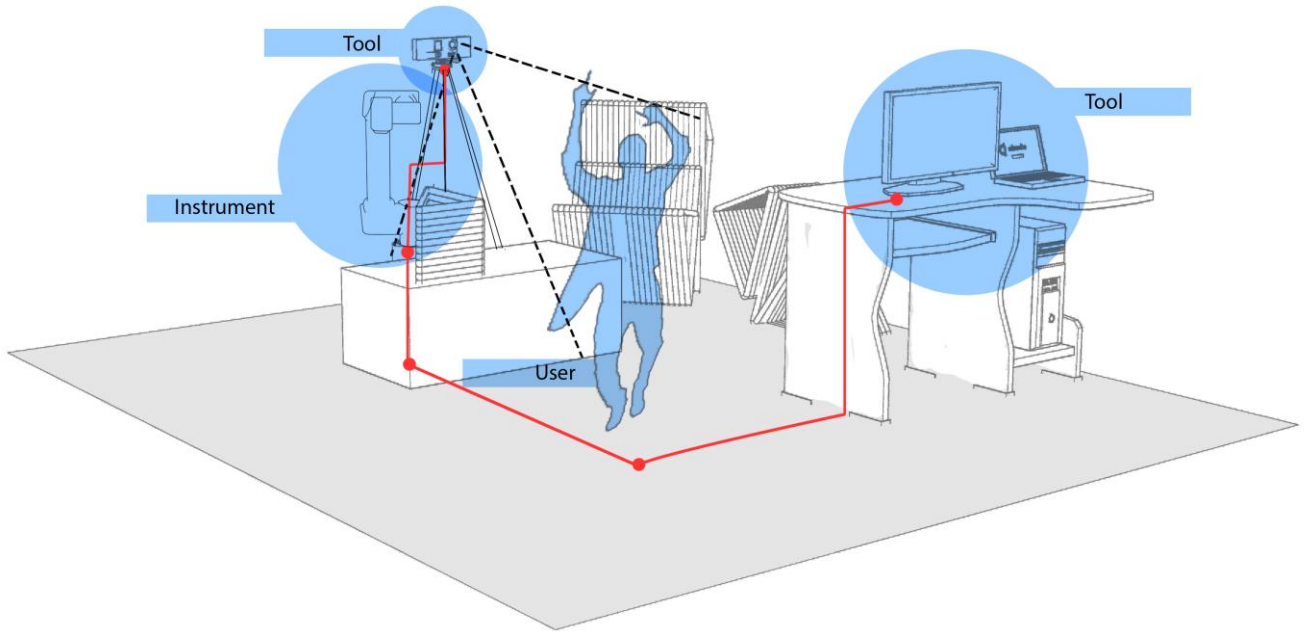
Proof of concept

Using robotic arm to weave a chair module

Developing Script and programe visualisations for proposed digital tool

Documenting Final resualts

Working environmet



Tools and Equipment

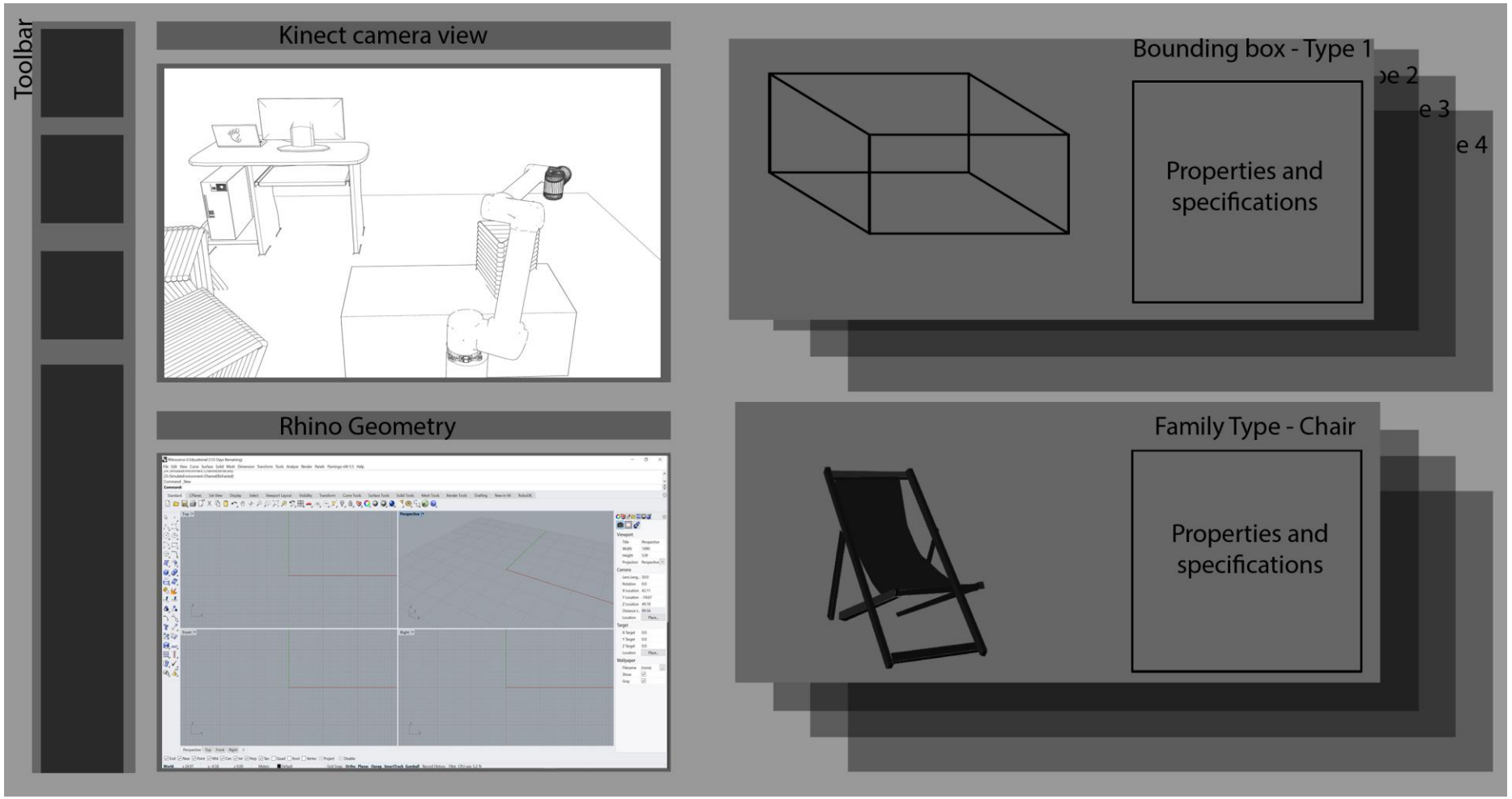
- Robotic Arm
- End Effectors
- A Computer
- Kinect camera

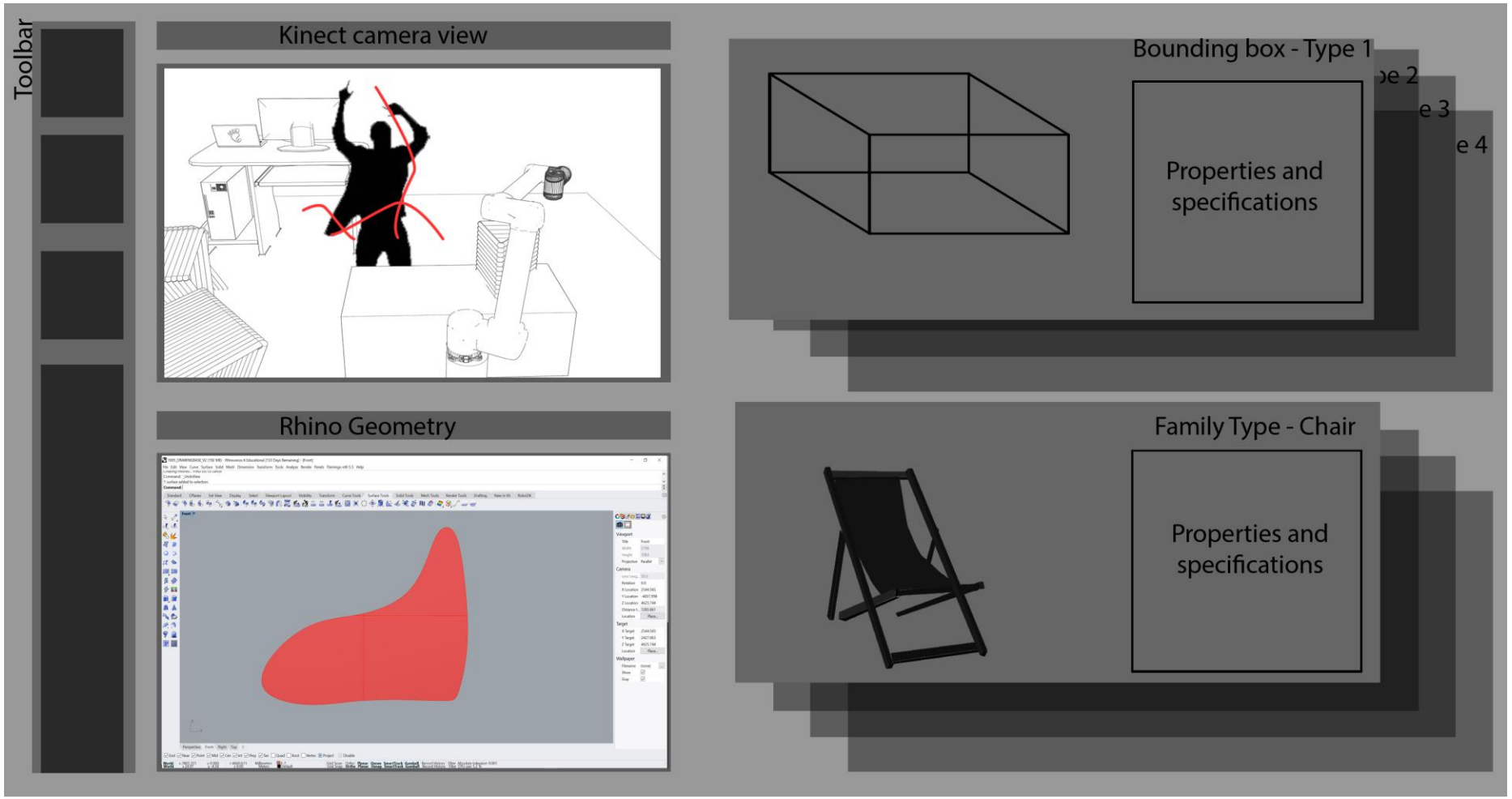

End effector

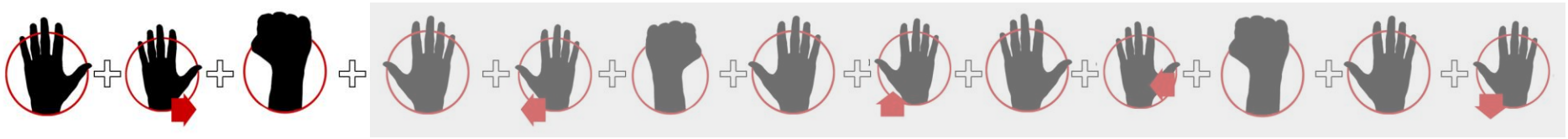

Kinect camera

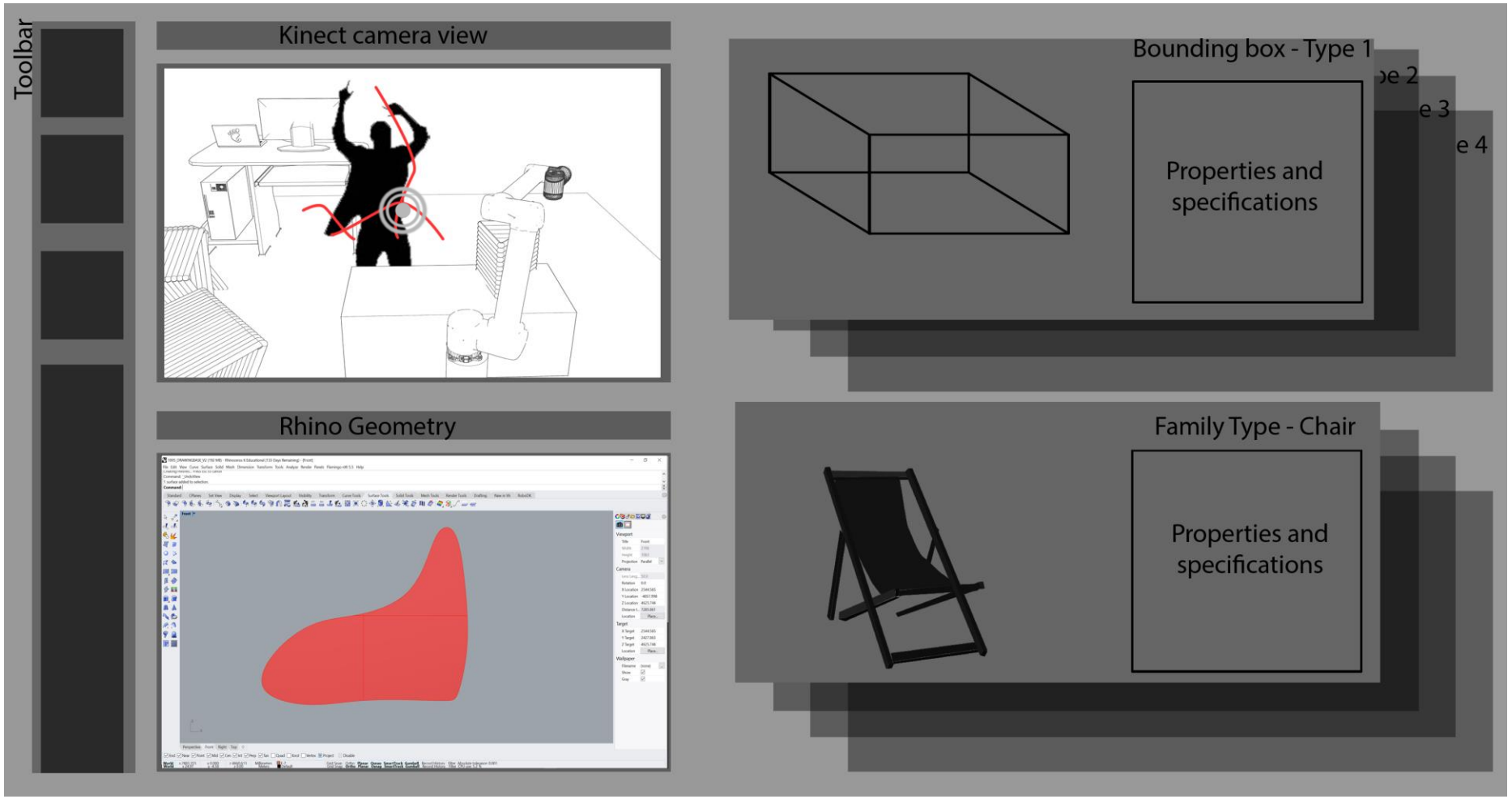

A computer


Robotic arm


Toolbar
Kinect camera view
Rhino Geometry
Bounding box - Type 1
Properties and specifications
Family Type - Chair
Properties and specifications


Toolbar
Kinect camera view
Rhino Geometry
Bounding box - Type 1
Properties and specifications
Family Type - Chair
Properties and specifications

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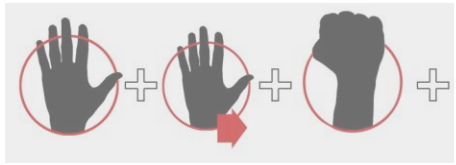
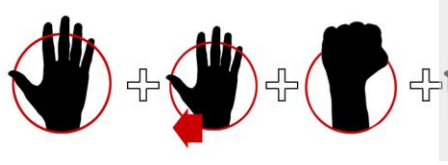
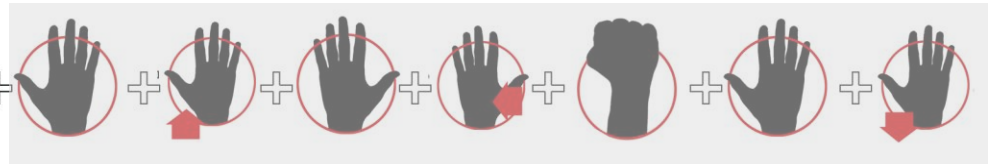
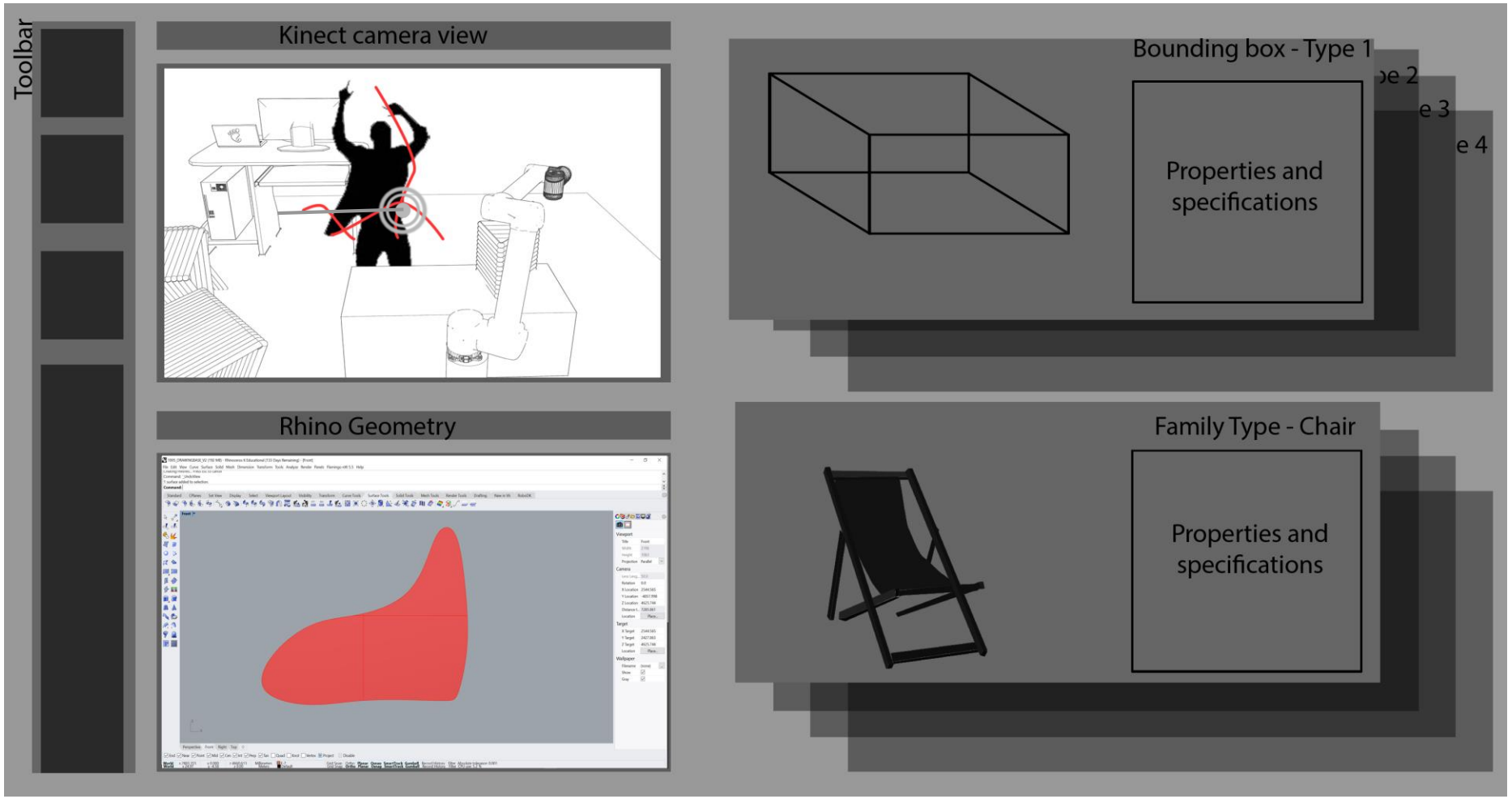
Kinect camera view
Rhino Geometry
Bounding box - Type 1
Properties and specifications
Family Type - Chair
Properties and specifications





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Bounding box - Type 1
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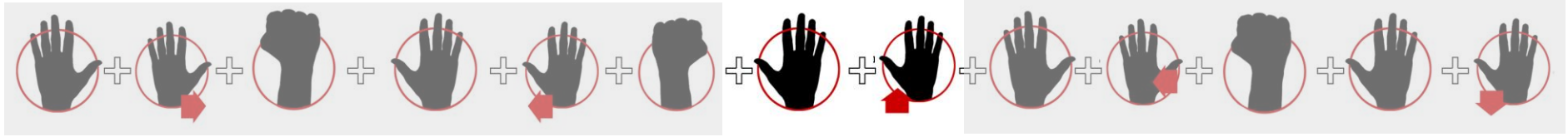

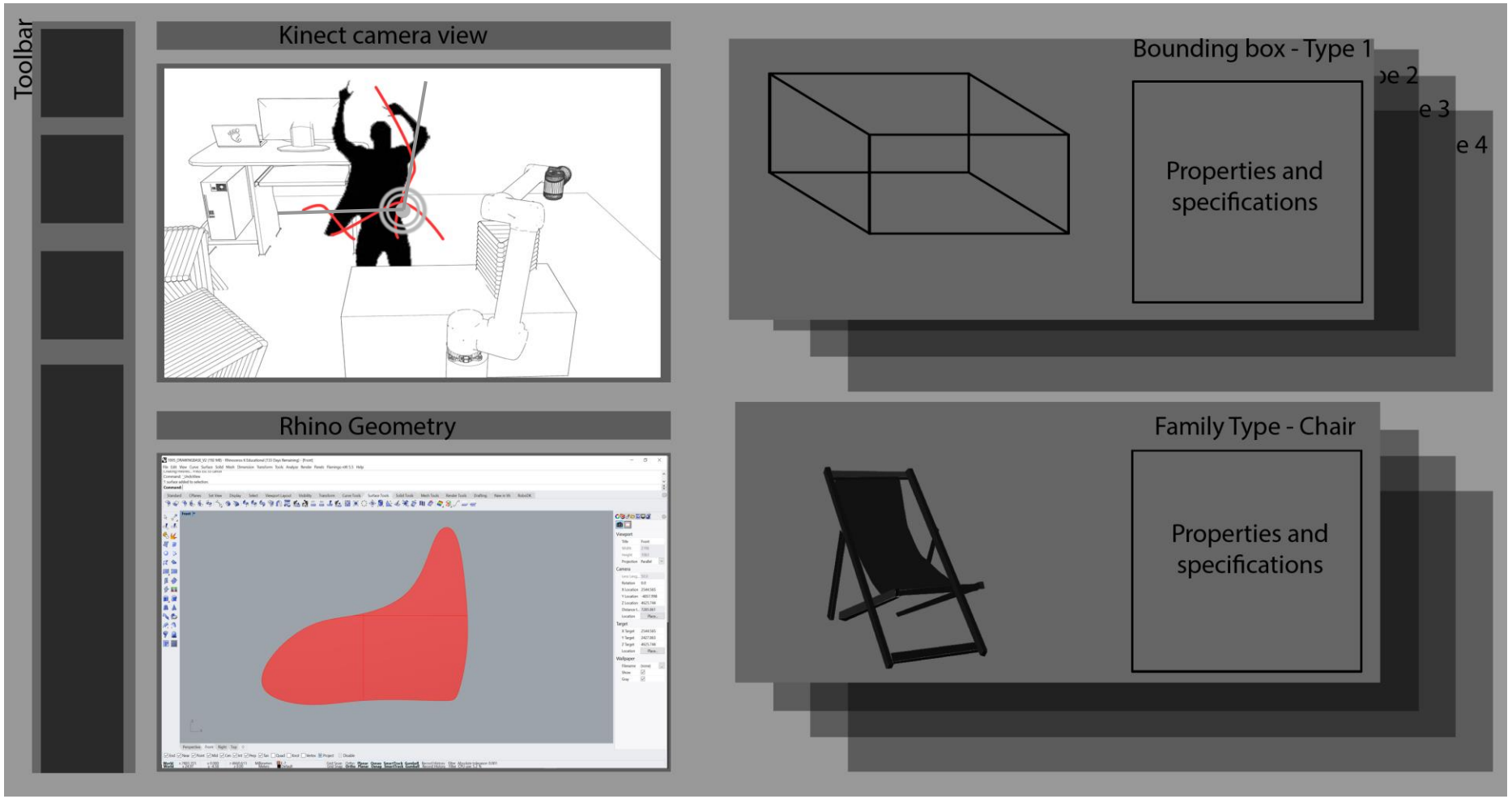
Toolbar
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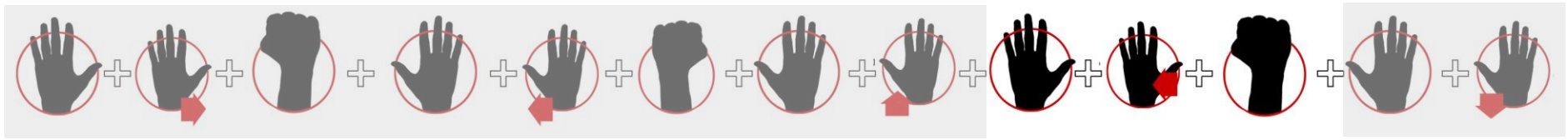

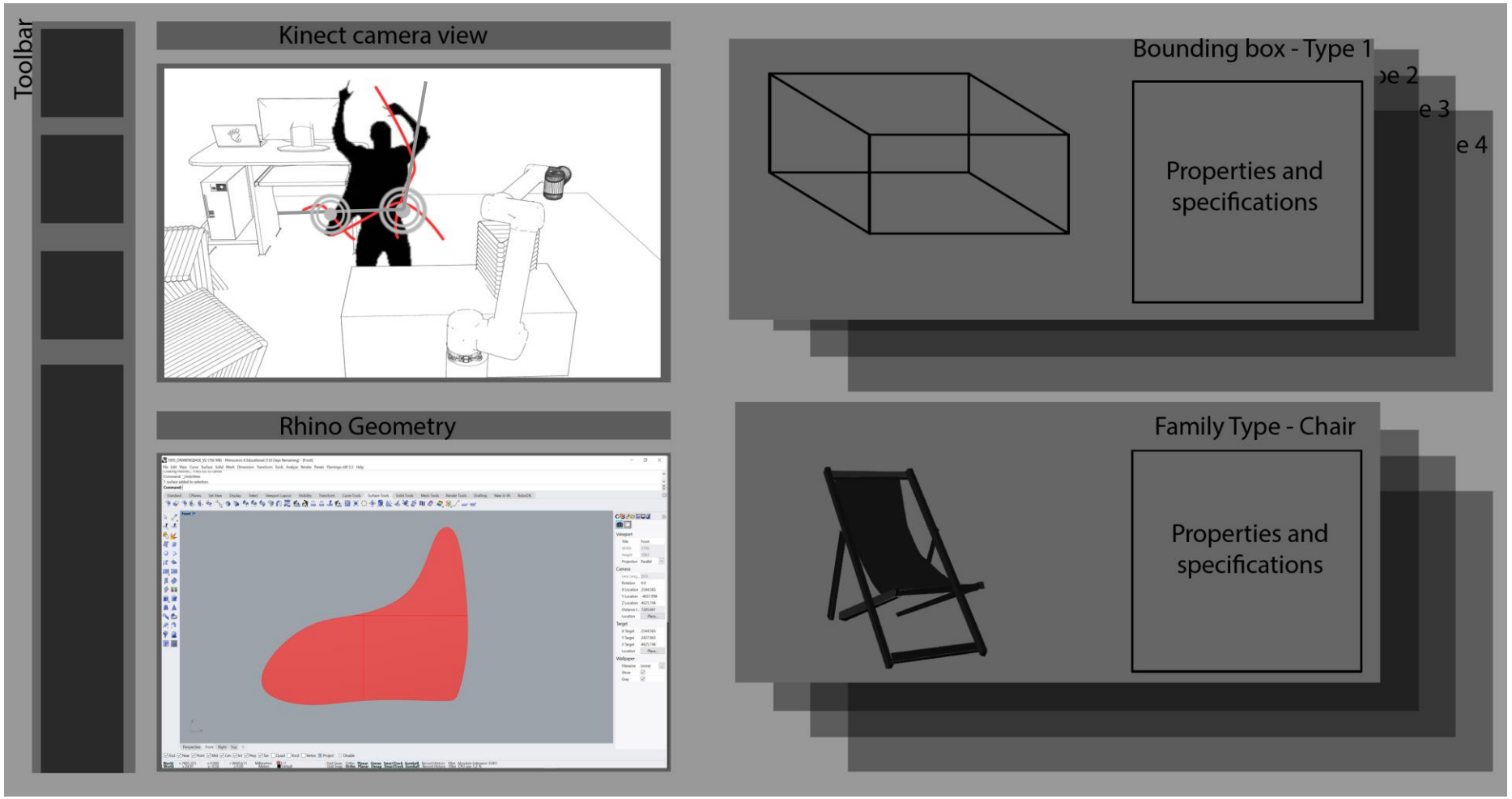
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Kinect camera view
Rhino Geometry
Bounding box - Type 1
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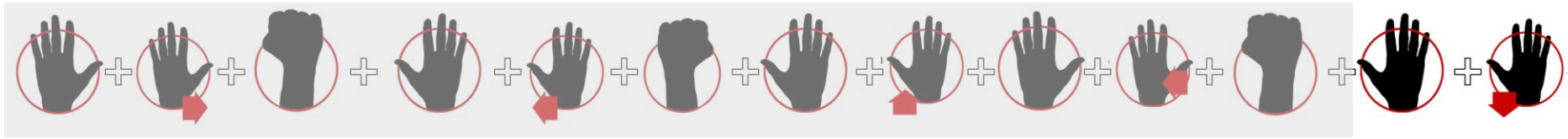
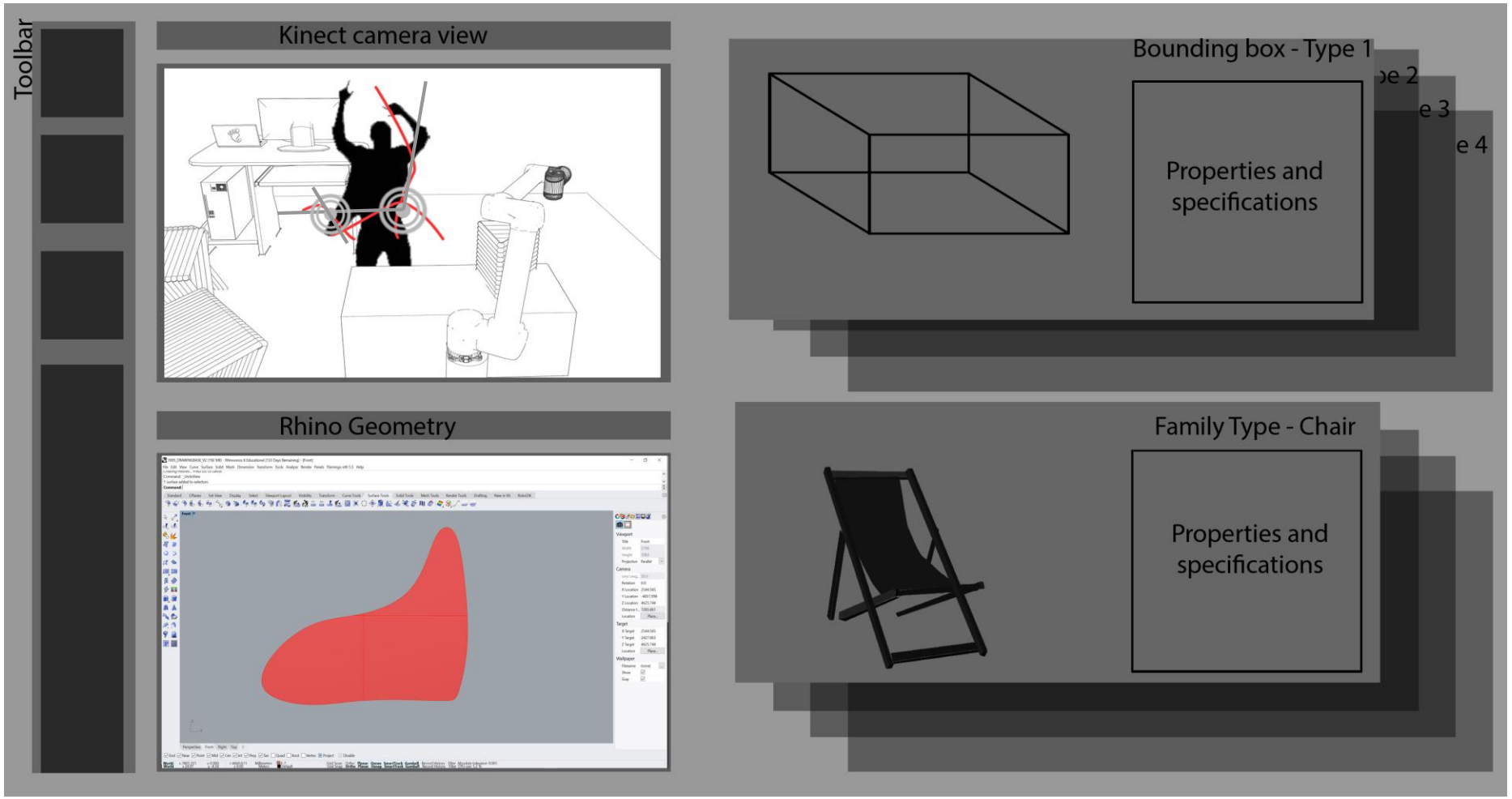
Family Type - Chair
Properties and specifications




Toolbar
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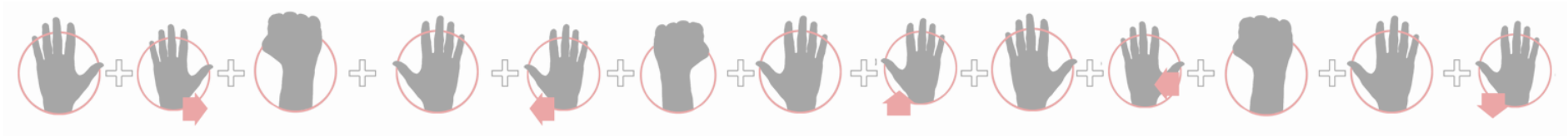

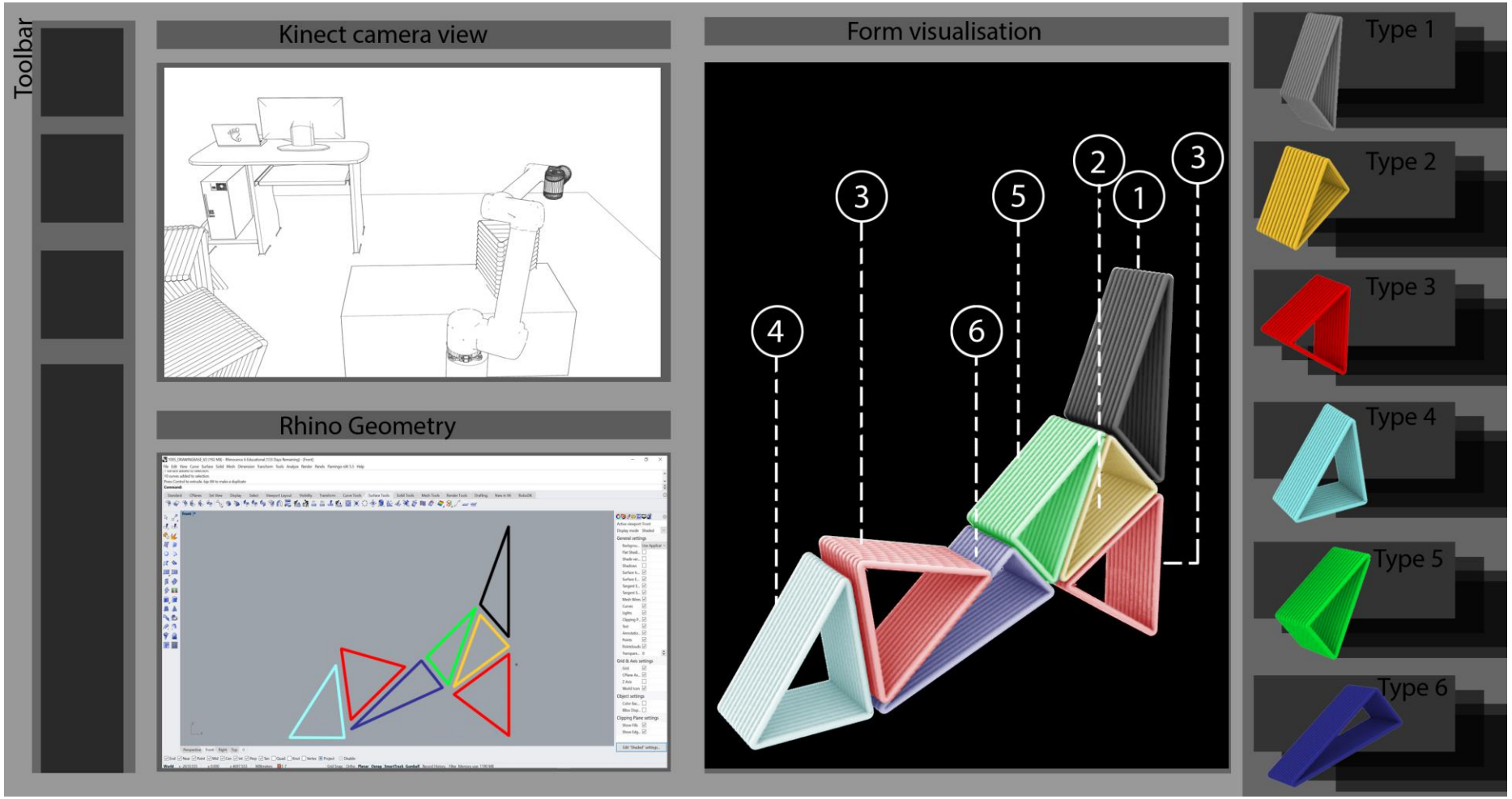
Toolbar
Kinect camera view
Rhino Geometry
Form visualisation
3
5
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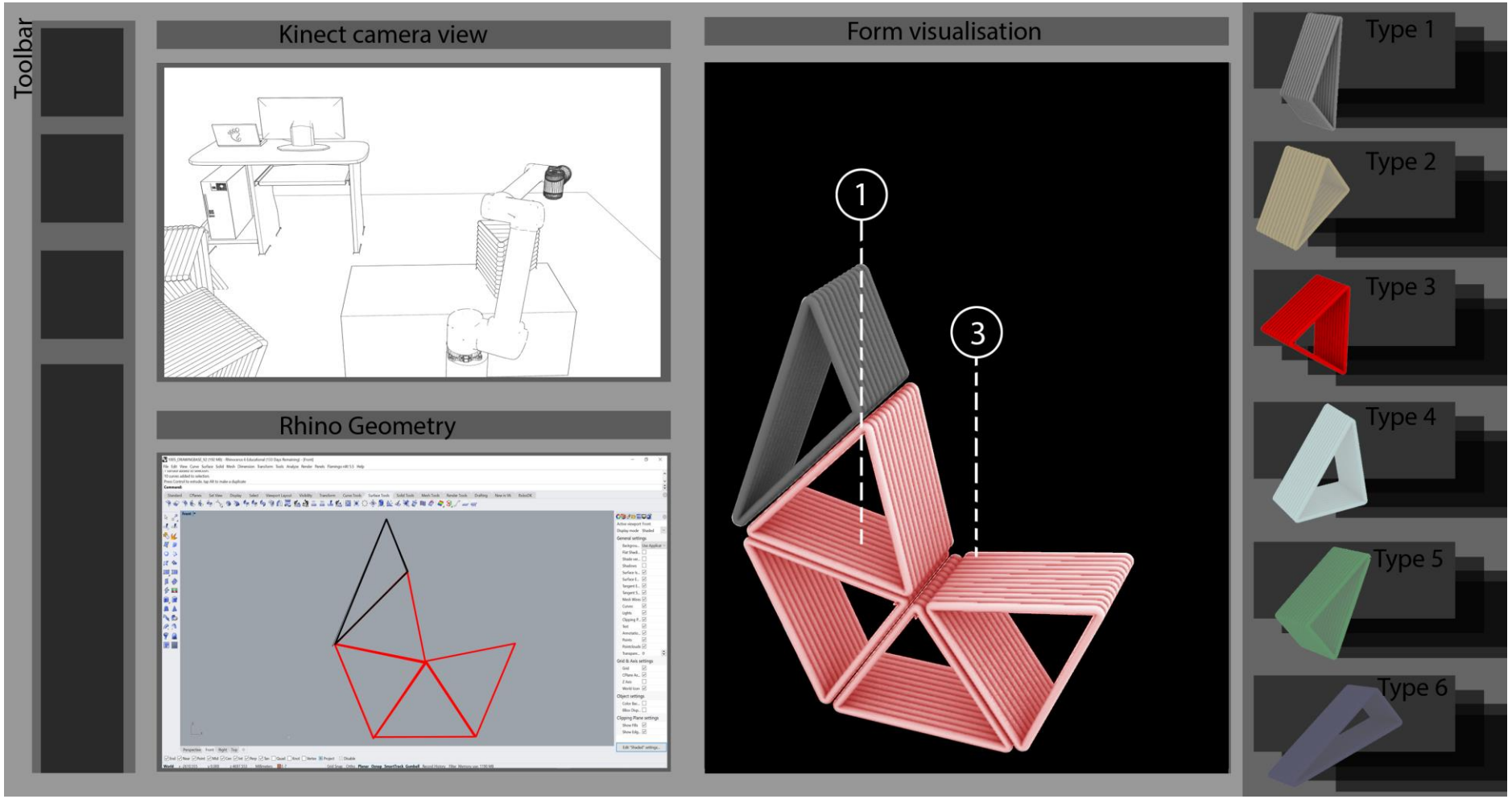
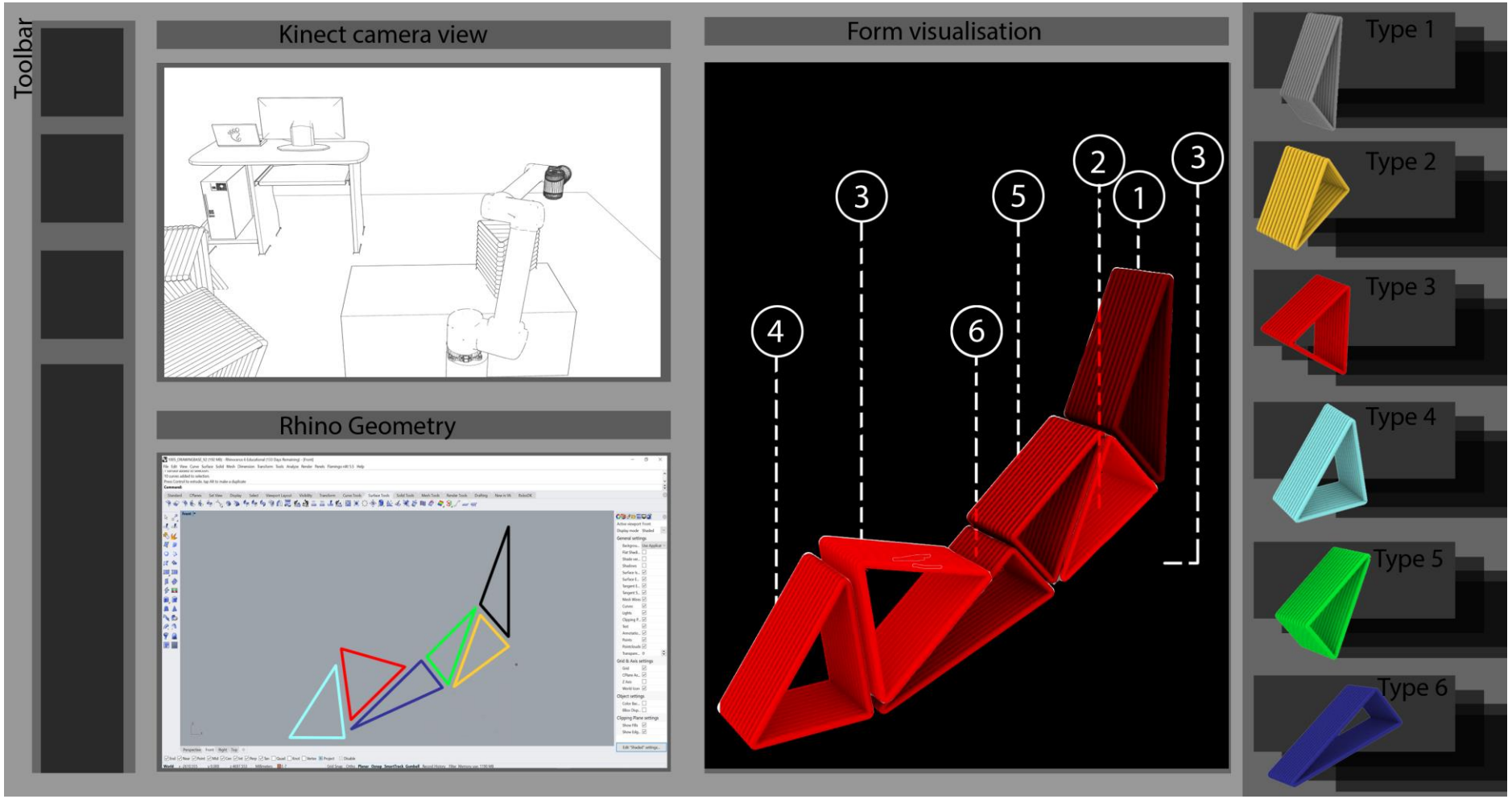
3
4
6
Type 1
Type 2
Type 3
Type 4
Type 5
Type 6


Toolbar
Kinect camera view
Rhino Geometry
Form visualisation
1
3
Type 1
Type 2
Type 3
Type 4
Type 5
Type 6


Toolbar
Kinect camera view
Rhino Geometry
Form visualisation
3
5
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Type 1
Type 2
Type 3
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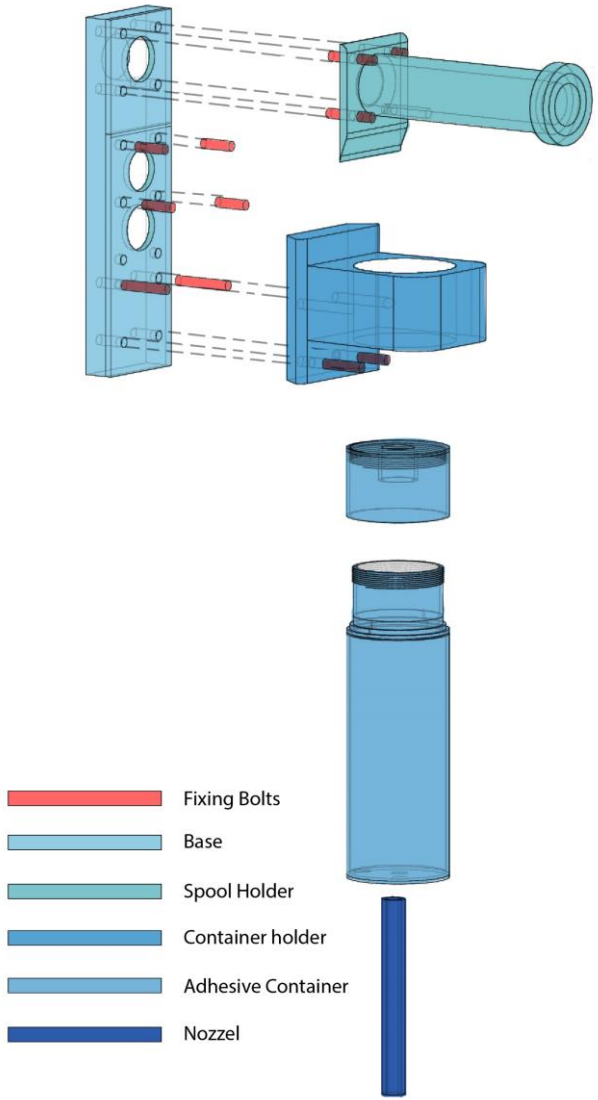
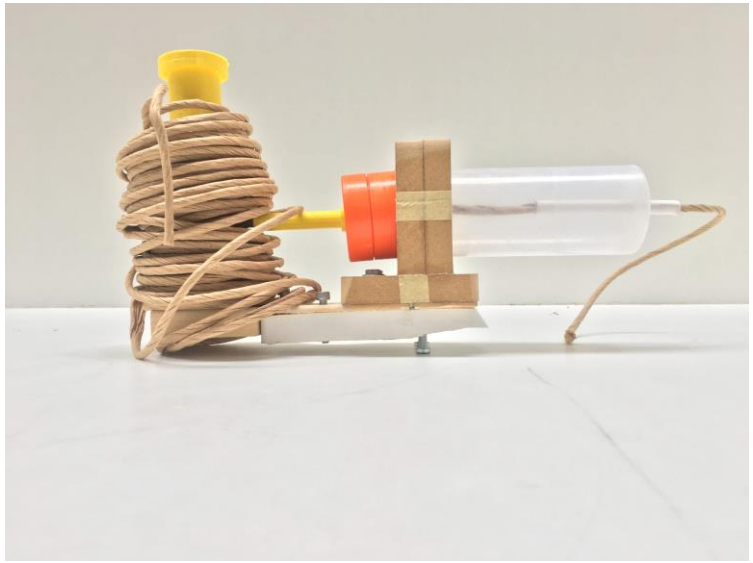
Type 5
Type 6

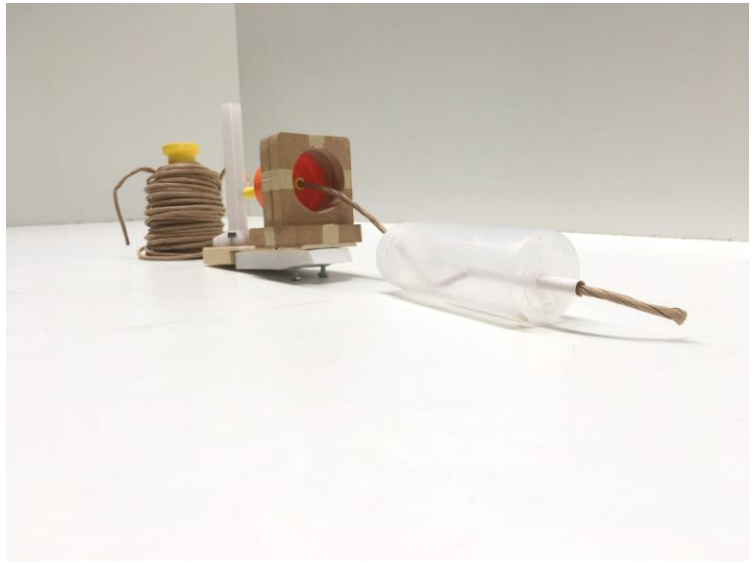
Fabricated elements

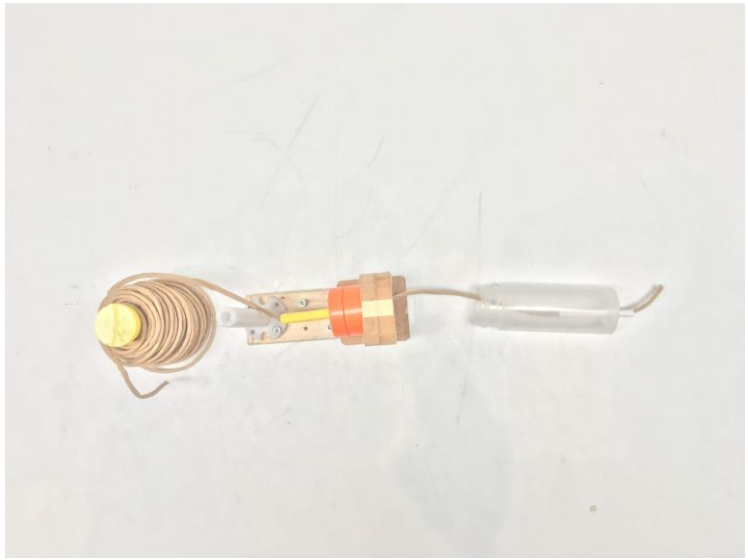
Interlocking elements

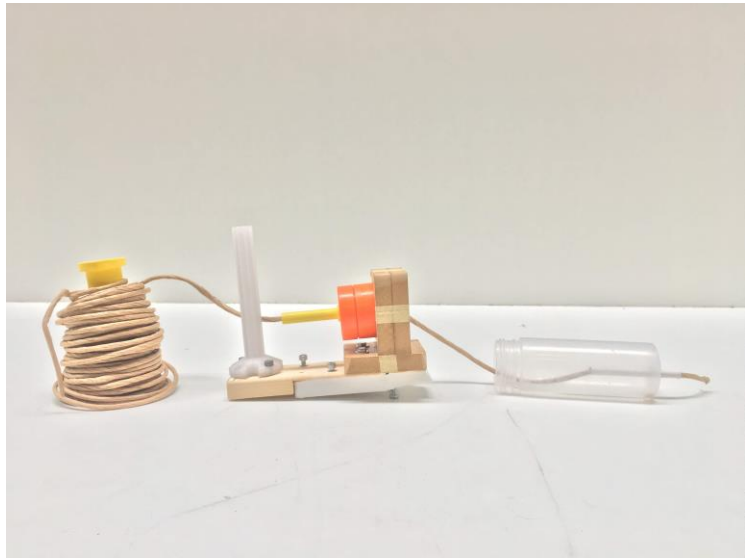
End effector



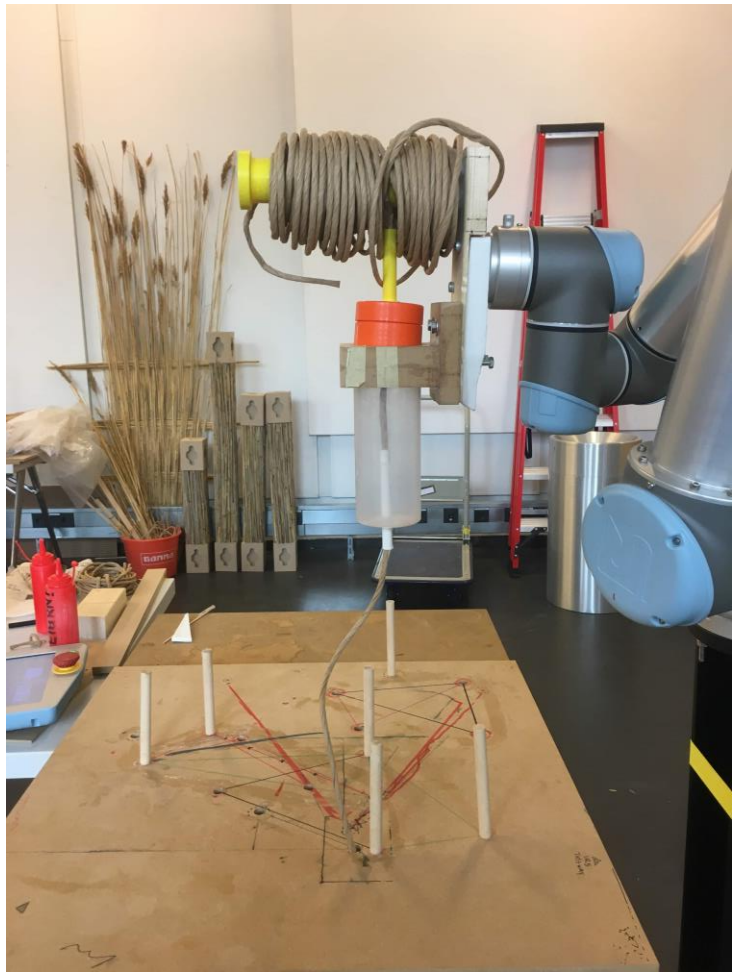


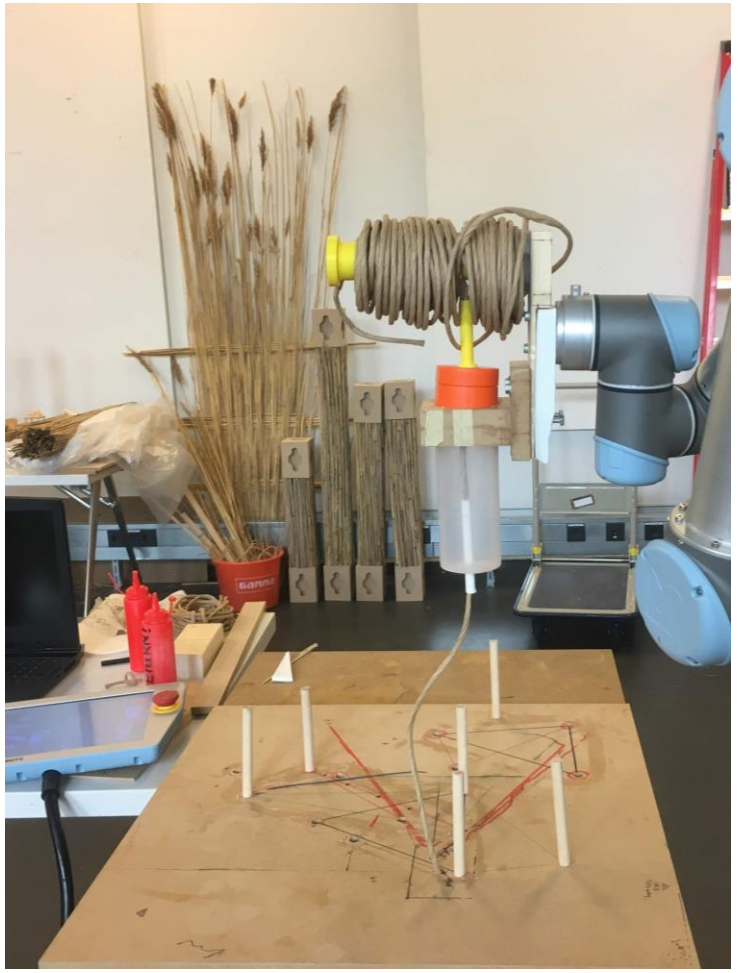


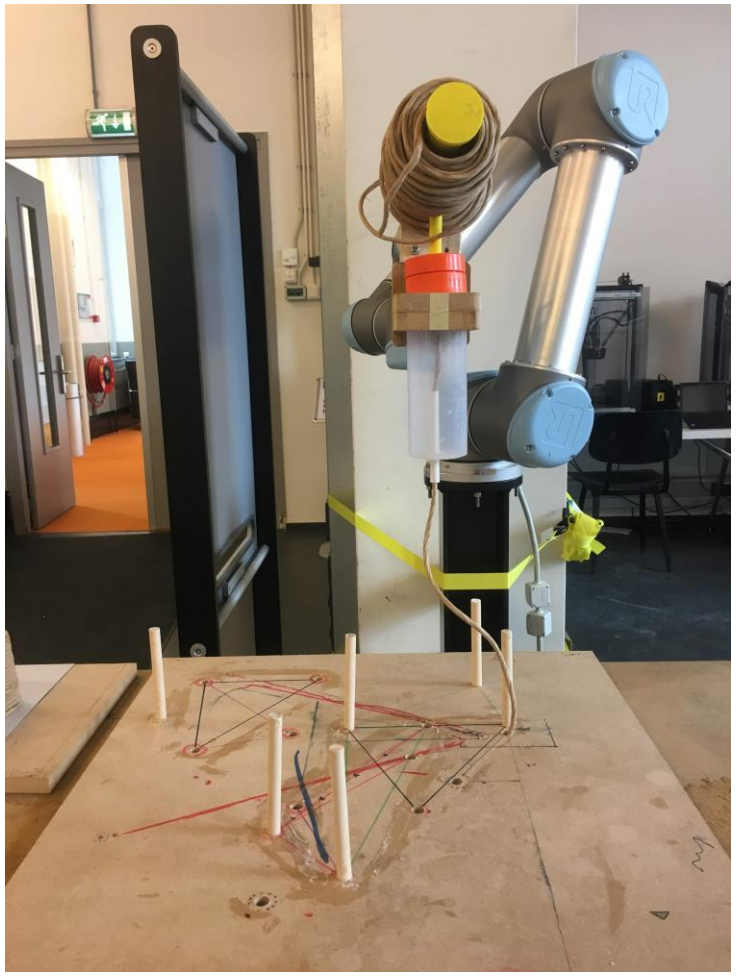




Controlled environment

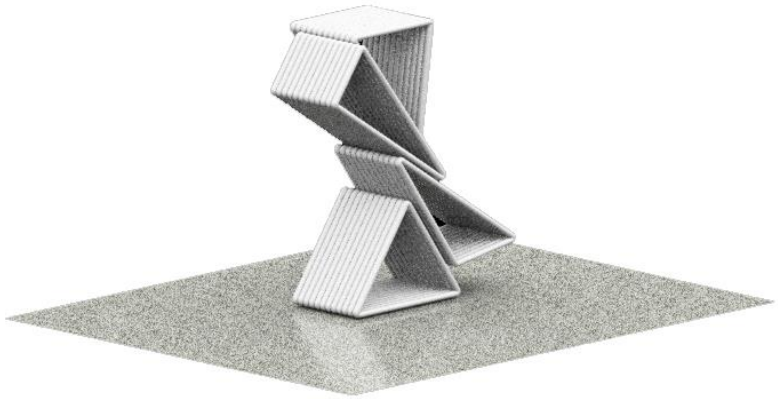


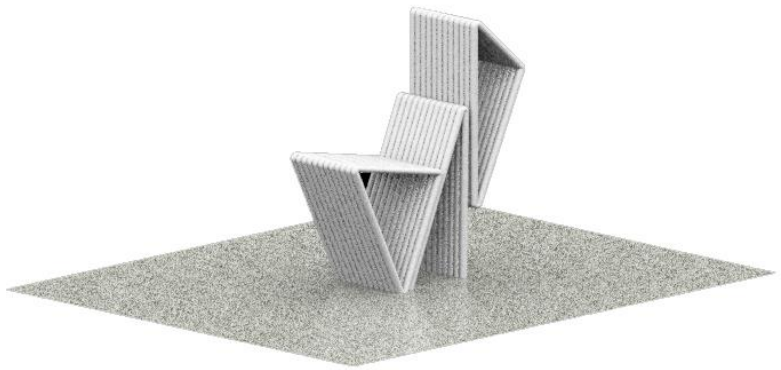


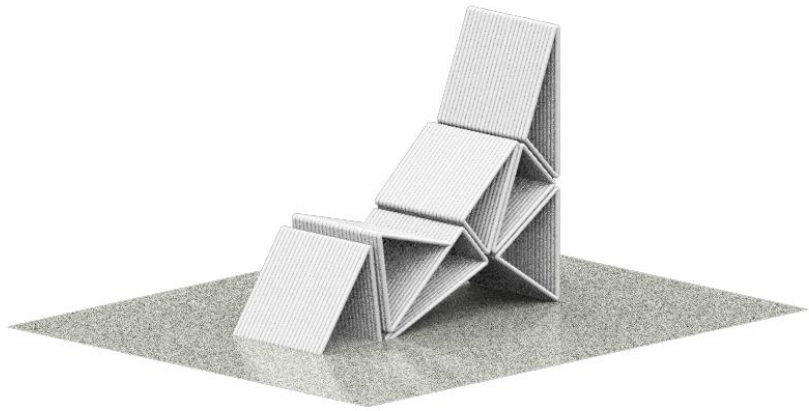


Results

Variations







Variations

Variations

Variations

Conclusion

THANK YOU !