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FOLDING DESIGN OF A HABITABLE SPACE

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FOLDING DESIGN OF A HABITABLE SPACE

INTRODUCTION

INTRODUCTION

OBJECT AND JUSTIFICATION

This project is titled “Folding design of a habitable space”. The purpose of the present study is to define and describe the new product that has been developed.
This product aims to present a new concept of shelter or housing in order to help people who have been displaced from their own home and therefore, lack one. Because of different factors such as war, emergencies, religion or social inequalities, an undefinable multitude of people are forced to flee their native country for an indefinable period of time, to start from scratch in a better place. These people arrive at different locations and the vast majority end up in refugee camps. In such situations crisis management needs to be responsive in terms of housing. Often refugee camps need be deployed in a matter of hours for hundreds of people and in these places the living conditions are terrible, not having, sometimes, a safe place to sleep.
The purpose of this project is to develop a new concept of shelter or housing for these people. The project will be carried out based on the analysis and research of current housing types. This analysis will be reflected in the state of art, which will compare the different types of shelters that exist nowadays. The innovation that characterizes many of them will be observed in front of more traditional ones. Nowadays the variety of shelters in these fields is immense. There are refugee camps where people lack a safe home and live in tents, to others where they live in large spaces and secure buildings such as containers. Due to extreme weather condition tents are more often than not an insufficient solution meanwhile, on the other hand, container-based housing is way too expensive regarding logistics and setting up. Therefore, regarding to dimensions, price, durability, etc. in this project is intended to develop a product that is between a tent and a container-based housing. An alternative solution to the problem: a foldable temporary house made of polypropylene packaging material.
It seeks to create an innovative product in terms of shape while simple, easy to assemble, transport and deploy and rigid enough to withstand extreme weather conditions. One aspect that will be taken into account when developing the product is the speed of assembly. This aspect has been considered one of the most important to take into account since one of the biggest problems in the refugee camps is the arrival of hundreds of people at the same time. The problem is that usually shelters for these people, take days to be deployed and conditioned in order to start living in them. Thereby, the speed of assembly becomes into the most important requirement of the product and thanks to the packaging material in which it is going to be developed, polypropylene, this problem can be solved.
The aim of this project is to create a product with a “social responsibility”, which means that it is not only a product to be sold, manufactured by an industry and aimed at consumers, but also to create a design oriented mainly towards people. The project seeks to satisfy a need of a huge current problem of the society and also wishes to create a product which has a greater benefit than just a transaction of the purchase and sale of services.

WHAT IS A REFUGEE CAMP?

- A refugee camp is created to give shelter, during a certain period of time, to a group of people who have had to leave their home and now look for a better place where they can rebuild their lives.
- In a single camp, hundreds of thousands of people can live.
- They are usually built and managed by international organizations or non-governmental organizations.
- Refugee camps are generally set up improvised and designed to meet basic human needs for a short period of time.
- The inhabitants of a refugee camp need not only a place to sleep, but also food and medical assistance.
- There are basic rules for the construction of these settlements collected by various agencies such as UNHCR or Oxfam Intermón in documents that are used as a consultation to meet this type of needs:

Emplacement: They are usually located in the vicinity of population centers, in safe areas away from war zones or borders. The ideal is to get a site with a slight slope so that it has a natural drainage.

Participation of the population in the design: To know which structure will be the one that best solves their needs, the affected people are involved in the process.

Structure: The refugee camps have a geometric layout and it is simple. The objective is to make life in the area as easy as possible. They are organized in districts and these in neighborhoods, so everyone can easily access resources.

Security: The host government usually puts in place security mechanisms for refugees, in order to prevent organized groups or other dangers from entering the refuge area. In addition, an internal protocol is also put in place to prevent theft of personal effects, assaults and the rape of women.

Housing: A minimum space of 3.5 meters per person is recommended to ensure their comfort and safety.

Administration and services: Refugee camps usually have a reception of new refugees, equipped with sanitary and administrative areas; food supply stores; sanitary equipment such as latrines and even education services.

Other services: In addition to basic sanitation, food and administration services, some refugee camps also have justice resources to solve possible problems and even a cemetery to honor the dead.

WHAT IS A REFUGEE CAMP AND HOW DOES IT WORK?

One of the main consequences of wars is that they generate forced displacements. Millions of people, mostly women and children, are forced to leave their cities of origin or residence to save their lives. In this flight, which almost never has a clear destination, they leave behind all their belongings and undertake long and dangerous routes that take them to other countries.

By the end of 2015, the number of refugees in the world - even higher than that of was recorded at the end of World War II - it was 54.9 million. In this context, refugee camps play a decisive role. So the camps are temporary settlements for the care and welcome of refugees. They are designed to provide accommodation, food, education, health services and, in general, to cover basic needs derived from the contexts of violence and displacement.

The primary objective of the refugee camps is to provide care and shelter on a temporary basis. However, the vast majority of refugees remain in them for years. The camps become cities of hundreds of thousands of inhabitants who struggle day after day to survive.The main services that are provided immediately in a refugee camp are: registration, housing, medical and psychological care, security, education, and food.

There are some basic rules for the construction and installation of refugee camps. The ones shown below are data collected from the UNHCR organization.

- Emplacement: They are usually located in the vicinity of population centers, in safe areas away from war zones or borders. The ideal is to get a site with a slight slope so that it has a natural drainage.
- Dimensions: The dimensions of each camp vary depending on the circumstances and the severity of the migration crisis. The estimated number of people is the main element to define its size, although usually they tend to welcome more people than they could.
- Security: The host government usually puts in place security mechanisms for refugees, in order to prevent organized groups or other dangers from entering the refuge area. In addition, an internal protocol is also put in place to prevent theft of personal effects, assaults and the rape of women.
- Streets: Any camp must have roads or streets for access to the main facilities such as, for example, medical centers, schools or food depots, among others. Some of these must allow the entry of vehicles that are responsible for providing goods and essential items. The most recommended is that the space occupied by the streets of a field of this type is between 20 and 30% of the total site.
- Shelters: The minimum space that each person must have in a house in a refugee camp is 3.5 square meters. In warm climates, this figure increases to 4.5 square meters. Most camps have prefabricated houses, but in cases of extreme need temporary tents are used. In other cases, the refugees themselves are responsible for building their own homes.
- Administrative facilities: Ideally, these buildings occupy between 15 and 20% of the total area.
- Meeting places: The camps must offer at least one place for the refugees meeting. Its function is to host the different events that relate to the stay and their needs.
- Sanitary equipment: It is one of the priorities of any camp. International standards speak of the installation of one health center for every 2,000 people and one hospital for every 200,000.
- Food: there must be a food deposit for every 5,000 inhabitants.
- Schools: It is recommended that one is built for every 5,000 people and that, at the same time, the continuity of the service is guaranteed.
- Markets: The most common in open fields is that there is a market. When it is a closed field, at least once a week should be opened a space for the exchange of food or essential items.
- Sanitation and waste: The ideal is that there is a latrine for each family. If this is not possible, it is necessary that at least one is installed for every 20 people. They must be safe, well lit and not be separated more than 50 meters from the shelters. There must also be an exclusive site for the accumulation and treatment of garbage produced by the inhabitants of the fields.
- Water and energy: The supply of drinking water is the great challenge of many fields. Some have their own source, for example, a river, a lake, a well or, in the best case, an artificial plant. They would have to supply 7 liters per person per day, that is, the equivalent of two gallons. Vanishing point is also planned for every 200 or 250 refugees. In terms of energy, the supply tends to the use of energy-saving lamps.
- Other services: In addition to basic sanitation, food and administration services, some refugee camps also have justice resources to solve possible problems and even a cemetery to honor the dead. As well, every camp should allocate spaces for the attention of specific issues that do not appear initially in the reception programs, but that are fundamental for effective attention such as centers aimed at people with disabilities, women victims of gender violence, the elderly and children with problems concrete.

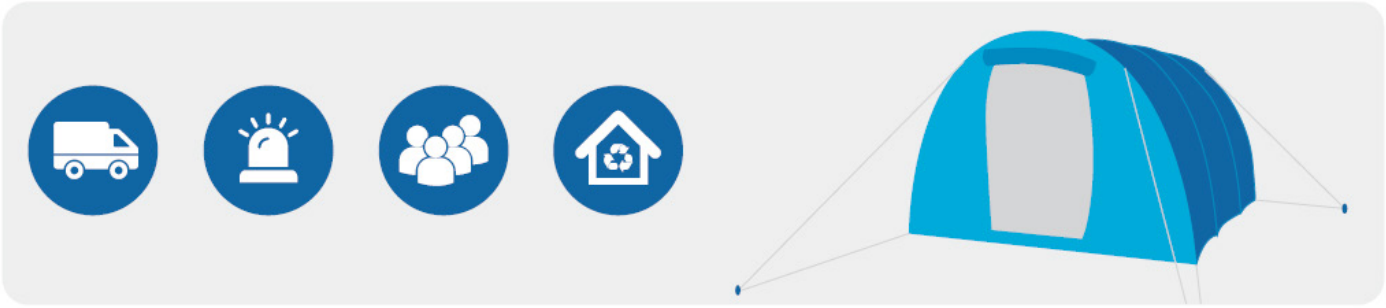
WHAT AND HOW IS A REFUGEE SHELTER?

Once how a refugee camp works has been studied, the three main problems when designing a shelter should be taken into account.

- Crises don't warn in advance, so the help must be prepared to solve any problem that may arise.
- Some refugee camps need quick shelter solutions but they also should protect from the cold and offer security and privacy to families.
- Some people spend years in a refugee camp, and they need long-term solutions.

So acording to UNHCR it can be found three types of solution for the problems mentioned above. From one to provide quick shelter to another to give a shelter to refugees who spend years in this situation.

1. EMERGENCY SHELTERS TO OFFER A QUICK SOLUTION



Designed to deal with emergency situations that must be answered immediately.
Characteristics:

They are lightweight, easy to transport and are assembled in a short time.
They have a low cost,so several units can be affordable easily.

How and when they are used:

In emergency situations.
To provide shelter in huge refugee arrivals.
They can be reused for future shelters.

2. TENTS AIMED TO A SLIGHTLY LONGER STAY.

Designed for those refugees who have to spend more time in them.
Characteristics:

They are more durable than the previous ones, since they mix cotton and polyester to resist rain and other environmental factors.
They require only basic maintenance.
They are the most used in the refugee camps.

How and when they are used

In refugee camps where the stays are longer.
In situations in which the weather conditions are complicated.
For large families or with special needs.

3. REFUGE UNITS, FOR EXTENDED STAYS AND WITH GREATER NEEDS.

Created for longer stays and with more needs.
Characteristics:

- They are suitable for adverse environmental situations.
- They are modular, and allow greater comfort to families.
- They have ventilation and electricity systems.
- They can be built on irregular terrain.
- They can be assembled by teams without great knowledge.

How and when they are used

- In longer stays and with greater needs.

2

FOLDING DESIGN OF A HABITABLE SPACE

STATE OF ART

STATE OF ART

FOLDING DESIGN OF A HABITABLE SPACE

The purpose of this section is to have a good knowlegde about the different buildings used as a shelter nowadays. With respect to this, it needs to take into account that there will be shown buildings which are subjected to different atmospheric conditions, with different functionalities and materials. But nevertheless, all of them have the same aim: being a solution in case of emergencies for an undefinable multitude of people who need shelter for an undefinable period of time.

So, this section describes the knowledge about existing products, possible materials and shape variants that will support the designer's inspiration for the project development. So, before starting with the product design, it is necessary to make a brief study in order to know the differents types of habitable spaces that are being used nowadays. This study is going to be helpful for starting the project, since it will take as a starting point different characteristics that may have in common, like durability, assembly, accommodation, etc.

BETTER SHELTER

DESCRIPTION

"'Better shelter', the weatherproof, quick-to-assemble and sustainable make-shift home for refugees is IKEA's temporary housing solution for aiding displaced families and individuals who are fleeing conflict, disaster and climate change."

CREATOR

Ikea & ACNUR.

YEAR

2016

ACCOMMODATION

Five people.

ASSEMBLY

Four hours of work.

MATERIAL

Steel frame with lightweight polymer panels.

DURABILITY

Three years.

DIMENSIONS

17,5 square meters

PRICE

No information found

REFERENCES

http://www.ikea.com/ms/es_ES/this-is-ikea/ikea-highlights/Home-for-a-refugee/index.html

https://www.20minutos.es/noticia/2950694/0/casa-refugiados-ikea-acnur-premio-diseno-arquitectura/#xtor=AD-15&xts=467263

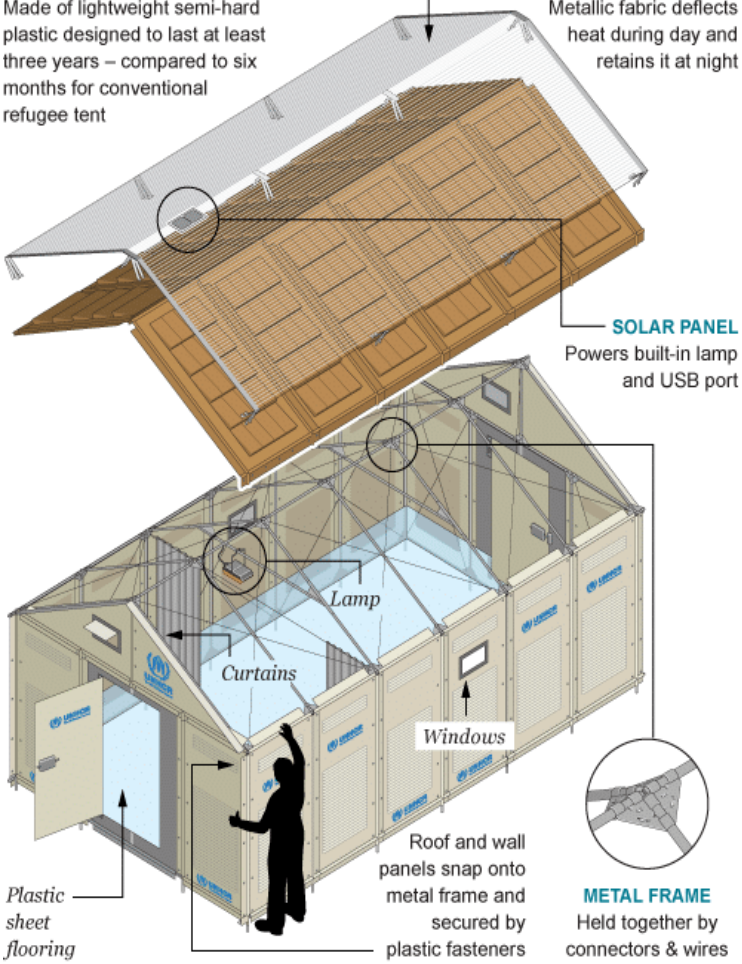
https://www.designboom.com/architecture/ikea-refugee-shelter-award-winning-construction-01-31-2017/

FEATURES & MATERIALS

ROOF AND WALLS
Made of lightweight semi-hard plastic designed to last at least three years – compared to six months for conventional refugee tent

SHADE-NET
Metallic fabric deflects heat during day and retains it at night

SOLAR PANEL
Powers built-in lamp and USB port



METAL FRAME
Held together by connectors & wires

MEASUREMENTS

SIZE
188 square feet

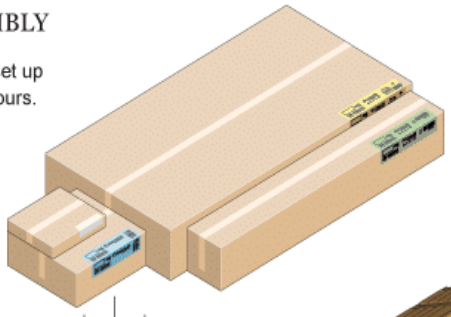
HOUSES
Five people

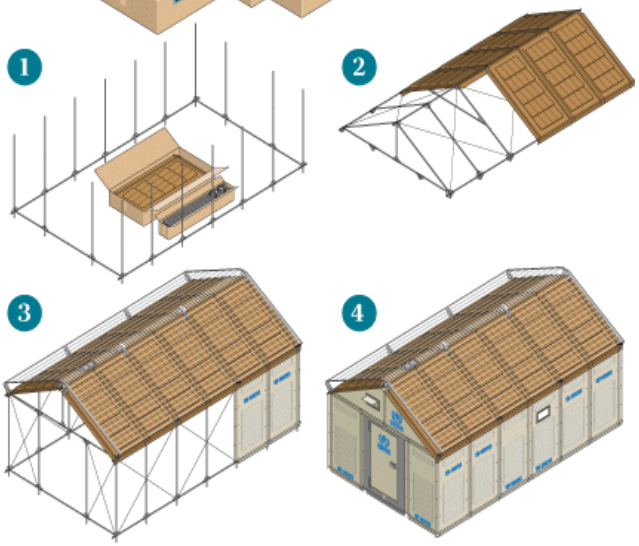
WEIGHT
100kg

COST
£638 per unit once in mass production

ASSEMBLY

Shelter set up in four hours. No tools required





ÜBER SHELTER

DESCRIPTION

“Über Shelter is an organization led by designer Rafael Smith to provide temporary shelter and transition solutions to people displaced by natural disasters or conflicts. (...) It is interesting the arrangement of this housing solution in two levels as it takes care that one of the scarcest resources in emergency situations is the ground. This development in height, also provides small spaces with greater independence and versatility that can have different uses (see the loft or the porch). First applied after the earthquake in Haiti, Uber Shelter has developed solutions that also allow us to make the transition to a more permanent home. “

CREATOR

Rafael Smith.

YEAR

2011

ACCOMMODATION

No information found

ASSEMBLY

The shelter packing unit can be sent by land, sea or air.
A group of 6 people can move each of these divided packages by hand to load a truck without the help of machinery.

MATERIAL

The walls and roof are made from corrugated polypropylene which is UV resistant, fire-retardant, and water proof. It has a steel shelter frame and laminated wood floor.
Recyclable and reusable.

DURABILITY

No information found

DIMENSIONS

The shelters are transported in a flat packing of 1.2m x 2.4m x 6.2m that transforms into a three-room shelter that offers 23 square meters on a floor of 2.4m x 4.8m.
544kg (it can be divided into three smaller packages weighing 181kg each).

PRICE

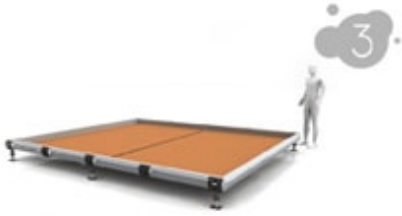
The material costs are around $ 2,000. With labor and general expenses included the final product would be around $ 3,500 per unit.

REFERENCES

http://ubershelter.blogspot.hu/
http://www.arquitecturaenacero.org/proyectos/vivienda-social/uber-shelter

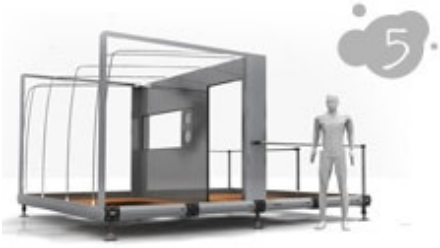
• Place shelter in desired location

• Open from encloged position to basic structure



• Set floor, attach jack stands and level the structure

• Secure I-Beam and shelter floor into locked position



• Attach fabric support rods and modular reinforcement

• Attach inner fabric lining. This includes an already interwoven mosquito net

• Attach outer fly layer of fabric. This layer helps shield from the sun and protect from the elements

• Secure top flooring to bottom structure and repeat the process

SURI (SHELTER UNIT FOR RAPID INSTALLATION)

DESCRIPTION
"The objective was to develop quick constructions "with very demanding objectives" in terms of improving issues such as logistics, easy assembly, an affordable price, the collection of water, solar energy, and above all the improvement of habitability conditions (isolation , breathability ...). The model would be called SURI (Shelter Unit for Rapid Installation)".

CREATOR
Urbana IDR

YEAR
2011

ACCOMMODATION
1 person per cabin

ASSEMBLY
Only with a single tool and it only takes two people to carry out the assembly in one hour

MATERIAL
Plastic (100% recyclabe and sustainble)

DURABILITY
10 years

DIMENSIONS
244 x 270 x 130cm = 3,5 useful square meters

PRICE
No information found

ADDITIONAL INFORMATION
Depending on the number of people and the needs, different groupings can be configured. The most repeated model - and which is called SURI Shelter - is made up of four SURI units and two facades that, by dimensions, is the equivalent of a family tent that is used in humanitarian aid.

REFERENCES

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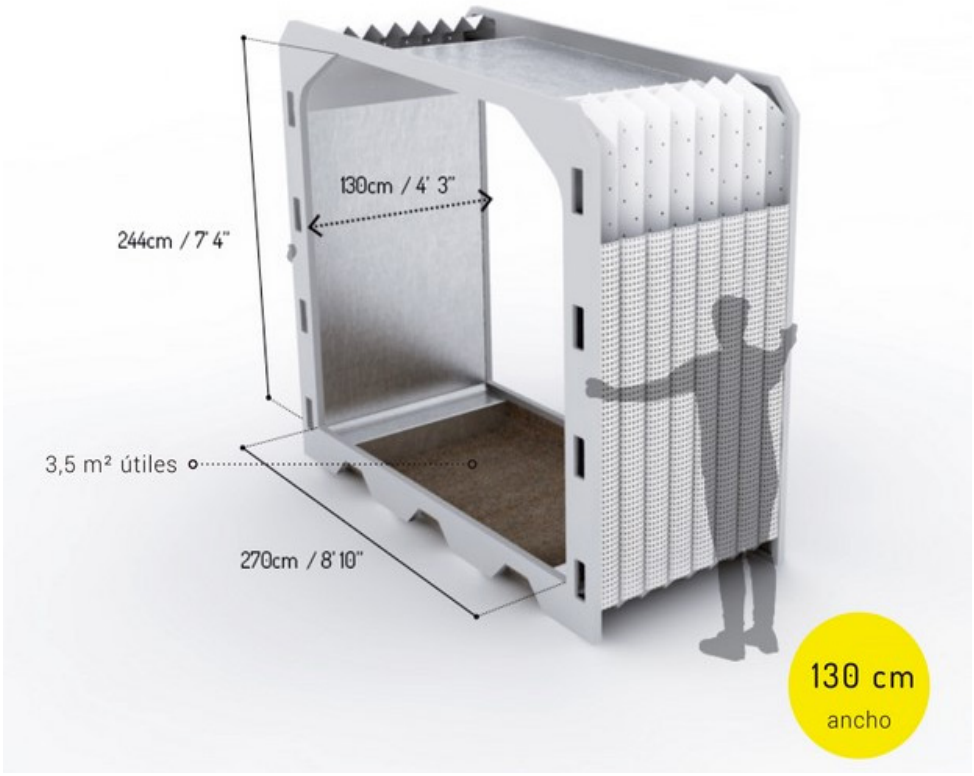
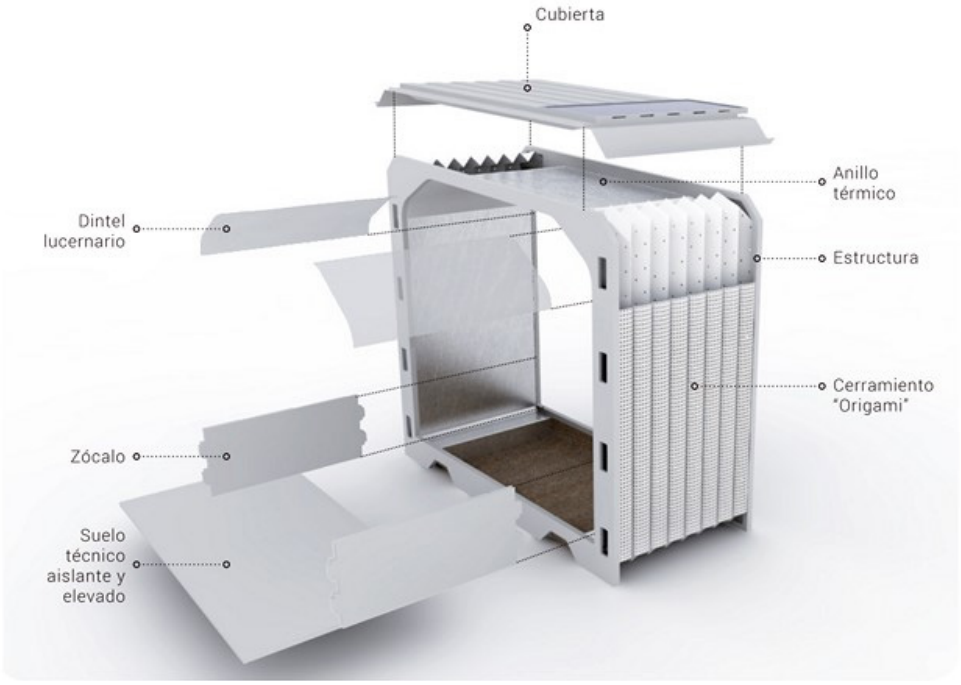
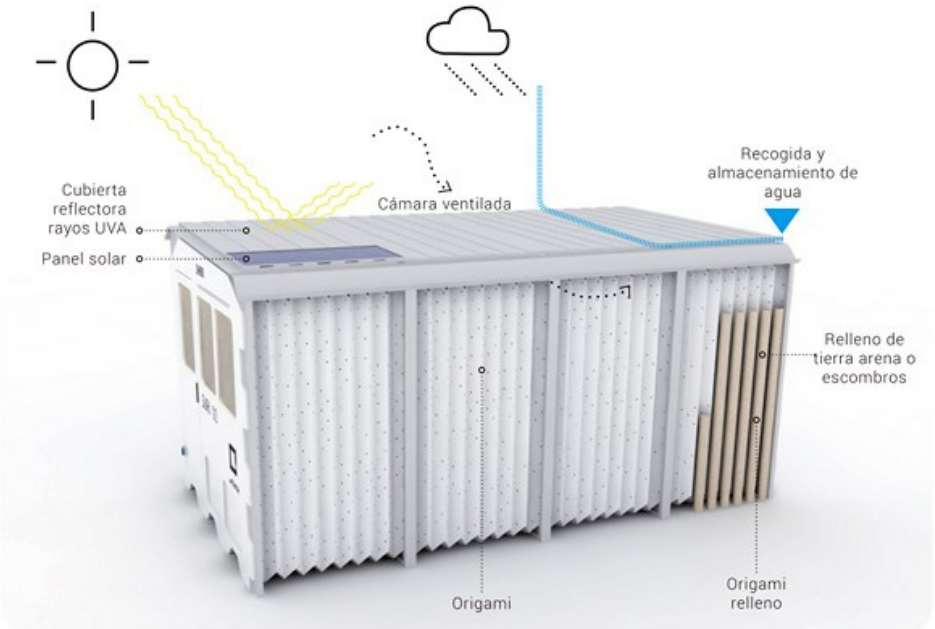
http://diariodesign.com/2015/09/suri-prototipo-alicantino-mejorar-los-campos-refugiados/
https://www.youtube.com/watch?v=Z-dEZwNpx4g
http://suricattasystems.com/documentation/suri_user_manual.pdf


130cm / 4' 3"
244cm / 7' 4"
3,5 m² útiles
270cm / 8' 10"
130 cm
ancho


Cubierta
Anillo térmico
Dintel lucernario
Estructura
Cerramiento "Origami"
Zócalo
Suelo técnico aislante y elevado


Recogida y almacenamiento de agua
Cubierta reflectora rayos UVA
Cámara ventilada
Panel solar
Relleno de tierra arena o escombros
Origami
Origami relleno

MAIDAN TENT

DESCRIPTION
“We are proposing the Maidan Tent, a covered public space designed to host all kind of activities into a refugee camp. (...) Our aim is not to create a large house but a public space. We believe that community spaces need an appropriate shape with certain psychological and aesthetic characteristics.”

CREATOR
Bonaventura Visconti di Modrone and Leo Bettini Oberkalmsteiner, with the support of the International Organization of the United Nations for Migration

YEAR
2016

ACCOMMODATION
100 people maximum

ASSEMBLY

MATERIAL
Aluminum structure covered by textiles resistant to water, wind, and fire. Those textiles are composed of 20% PU - 80% PES.
“The use of a strong Pe + Pes cover textile allows the washing and desinfectation of the tent”

DURABILITY
“Long term durability.”

DIMENSIONS
Total covered area = 200 sqm / Clear span width = 19.50 m / Eave height = 3.00 m /
Top height = 4.00 m / Bay distance = 5.70 m

PRICE
No information found

UBICATION
Refugee camp in Ritsona, Greece.

REFERENCES
https://www.plataformaarquitectura.cl/cl/872857/maidan-tent-ayuda-arquitectonica-para-la-crisis-de-los-refugiados-en-europa
https://www.maidantent.org/
https://static1.squarespace.com/static/580634a4cd0f68d84b411fc6/t/58ac79544402431f406638a6/1487698771693/Maidan+Tent_Presentazione.pdf

Multi purpose

The flexibility of the spatial organization has the quality to host a variety of different activities.

Easy to transport

All the applied materials have been carefully selected to ensure an easy trasportability of the structure.

For all climate zones

Due to its characteristic shape and thermic insulation the tent resits to all type of weather and climate conditions.

Easy to install

The components are standardized to allow easy installation and to ensure long term durability.

Fire retardant

The aluminium structure is covered with a unique fabric which is resistant to water and strong wind, and also fire proof.

Disinfectable

The use of a strong Pe + Pes cover textile allows the washing and desinfectation of the tent.

SHELTERPOD

DESCRIPTION
“There’s 53.4 million forcibly displaced in the world right now because of wars and politics. A lot of them are living in shanty shacks with blue tarps, so we’re trying to create a low-cost, easy-to-ship, easy-to-set-up unit that people can live in for up to five years.”

CREATOR
Christian Weber

YEAR
2017

ACCOMMODATION
No information found

ASSEMBLY
It can be set up in less than 2 minutes by one person with no tools needed.

MATERIAL
Utilizing a PATENT-PENDING 5-layer composite fabric technology to reflect 98% of UVA and UVB light (heat) from sun and retain the warmth on cool nights.

DURABILITY
5 years

DIMENSIONS
No information found

PRICE
No information found

UBICATION
Nepal, Japan, Ecuador, Haiti, and North Dakota, to name a few countries.

REFERENCES
https://inhabitat.com/first-designed-for-burning-man-foldable-shiftpods-now-shelter-refugees-around-the-world/
https://www.youtube.com/watch?time_continue=11&v=O8fRMcp6vdA
https://store.advancedsheltersystemsinc.com//media/downloadable/ASSI%20shelters%20catalogue%20fix%203.pdf

SHELTERPOD

FLOOR AREA:11 5.8SQUARE FEET(10.7SQ.M)
STOWED SIZE: 76"X12"X12"(193X31X31CM)
WEIGHT:57.4POUNDS(26.1KG)
QUICK DEPLOYMENT: 1 MAN 2 MINUTES
PATENTED UV AND THERMAL INSULATION
PATENTED WIND RESISTANT SHAPE
PATENT PENDING FIRE RESISTANT COMPOSITE FABRIC (CPAI-84)
INTEGRATED FIBERGLASS FRAME
HEAVY WEATHER RESISTANT
AVAILABLE AS SINGLE UNITS, SURVIVAL "GO-KITS" AND FOR BULK PURCHASE
AVAILABLE WITH HARD WALL BAG OR BULK RACK PACK
36 PER PALLET - 432 UNITS PER 40HC
INCLUDES: (DEPENDS ON FORMAT)

ADVANCED
SHELTER SYSTEMS

COMPACT SHELTER

DESCRIPTION
“In terms of layout of aid relief and providing shelter, the development of shelter goes from a tent to a marquee. There’s a market we found that’s between a marquee and transitional shelter that is basically a dwelling which has hard walls, which is our shelter.”

CREATOR
Alastair Pryor

YEAR
2015

ACCOMMODATION
2 adults and 2 children.

ASSEMBLY
2 minutes

MATERIAL
It is made out of a UV stabilized polypropylene, a durable, weather resistant and thermally insulative material.
100% recyclable.

DURABILITY

DIMENSIONS
Disassembled has the dimensions of 200 x 100 x 7 cm (79 x 40 x 2.75 inches) and when it is fully assembled, its dimensions are 2 x 2 x 2 meters (6.5 x 6.5 x 6.5 feet)

PRICE
US $ 150 per unit.

ADDITIONAL INFORMATION
Individual tents measure 2 x 2 x 2 meters and provides enough interior space for two adults and two children to sleep. However, thanks to its modular design, individual units can be joined together to create larger shelters or multiple rooms, depending on the number of family members needing shelter.

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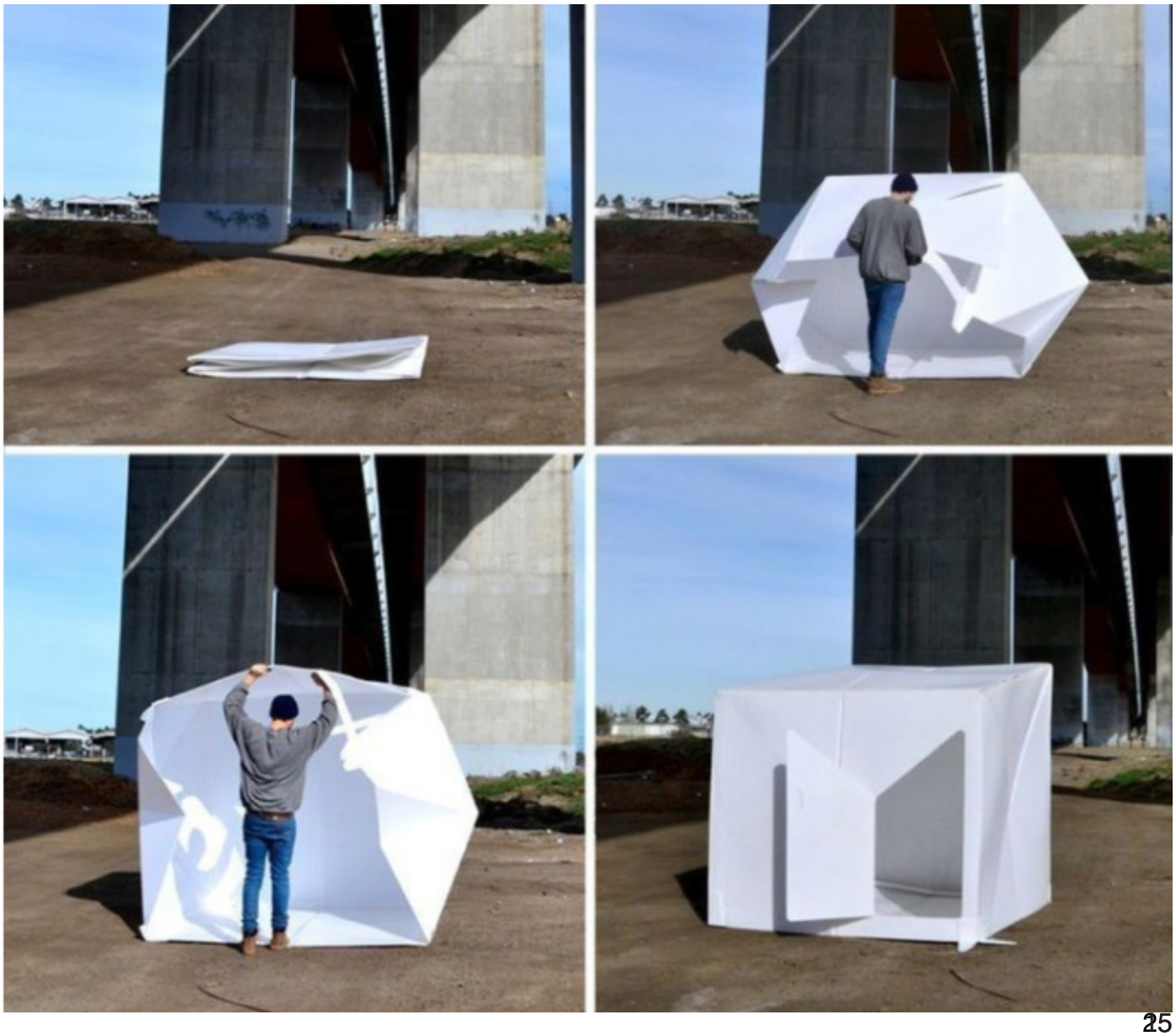
http://www.startupdaily.net/2015/05/melbourne-startup-creates-compact-shelters-help-house-people-affected-natural-disasters/



BAMBÚ MICRO-HOUSE

DESCRIPTION

CREATOR
Architecture studio AFECTA-T - Luke Hayes

YEAR
2013

ACCOMMODATION
It has a living area, kitchen, bathroom, sofa-dining table, work area, and bedrooms. Different size units can also be combined to form larger areas for things like communal canteens, games or education.

ASSEMBLY
No information found

MATERIAL
Bamboo

DURABILITY
No information found

DIMENSIONS
The micro-dwelling units is approximately 3 meters wide by 2.5 meters long and 3.7 meters tall.

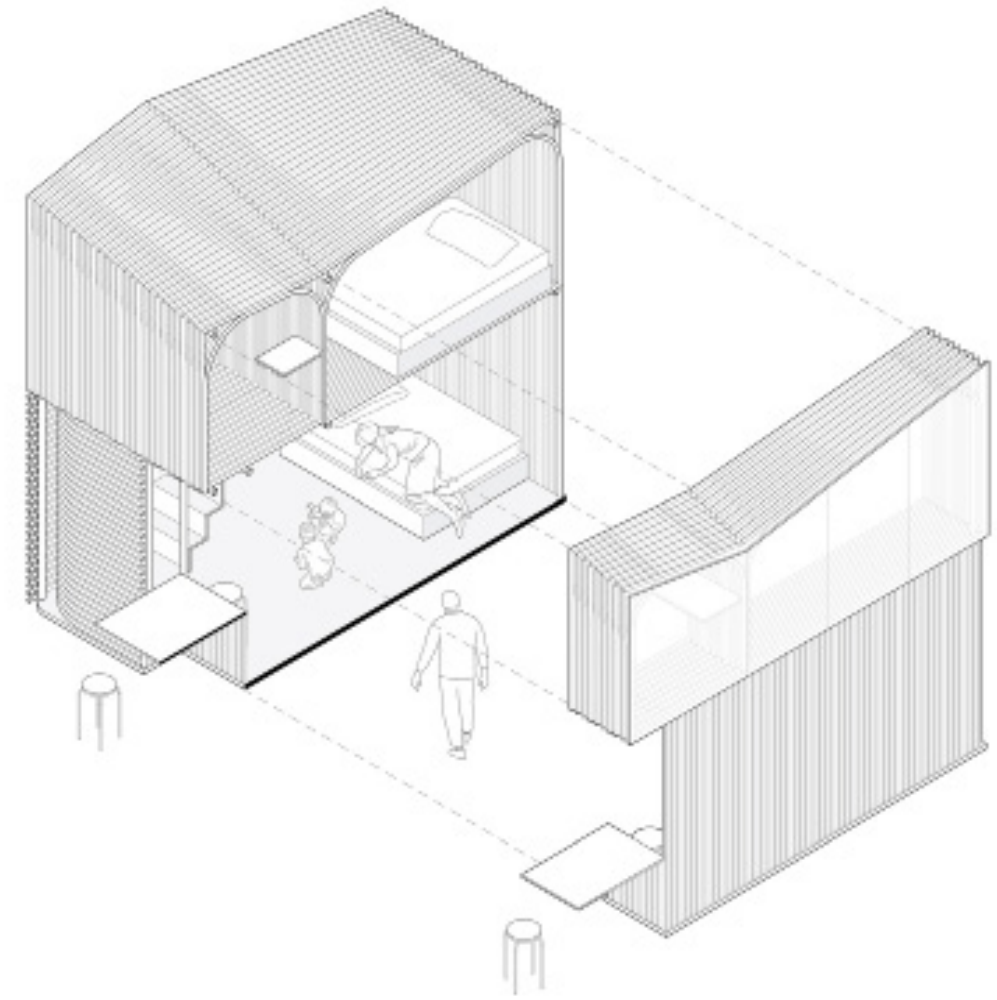
PRICE
No information found

UBICATION
Hong Kong and other cities throughout Southeast Asia

REFERENCES

http://gadgetdemagia.ru/arquitectura/1253-bamb-micro-cmara-propuso-refugio-para-desamparados.html

https://www.archdaily.com/480729/bamboo-micro-housing-proposal-affect-t



UNHCR FAMILY TENT

DESCRIPTION
“Family Tents are designed as a short term shelter solution, particularly in support to emergency situations and is not a substitute for a more permanent shelter”

CREATOR
Shelter specialists with close technical cooperation between UNHCR, IFRC and ICRC

YEAR
2014

ACCOMMODATION
3 people

ASSEMBLY
30 minutes

MATERIAL
Cotton and polyester for the outside and plastic sheets for the floor.

DURABILITY
5 year

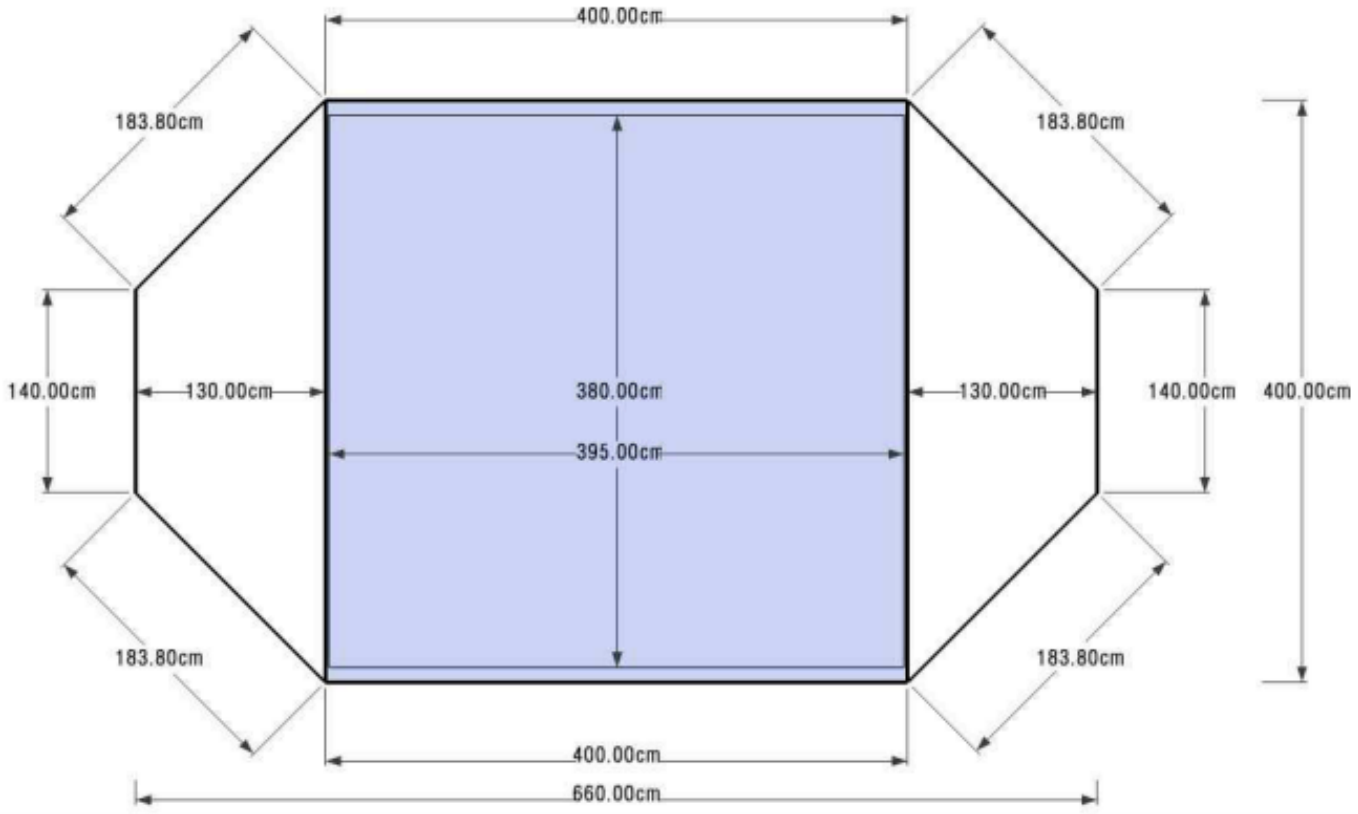
DIMENSIONS
4 x 6,6 x 2,2 m
55 kg
“The Family Tent has 16 m2 main floor area, plus two 3.5 m2 vestibules, for a total area of 23 m2”

PRICE
692€

ADDITIONAL INFORMATION
“It is a store called double crest, because it has two high points. It rises thanks to different masts (19 in total). It includes a winter kit which has insulating blankets and a protective floor to protect from the cold.”

REFERENCES
http://www.unhcr.org/53fc7df49.pdf
https://cms.emergency.unhcr.org/documents/11982/57181/Shelter+Design+Catalogue+-January+2016/a891fdb2-4ef9-42d9-bf0f-c12002b3652e

Family Tent General View



Top View

UNHCR FRAMED TENT

DESCRIPTION
“This store is designed to accommodate more people than the previous family tent, which is why it is heavier and more resistant. It is also designed to be located in urban areas. Likewise, its geometric shape allows you to attach to another store to maximize space. It is also compatible with the winter kit.”

CREATOR
Shelter specialists with close technical cooperation between UNHCR, IFRC and ICRC

YEAR
2014

ACCOMMODATION
5 people

ASSEMBLY
30 minutes

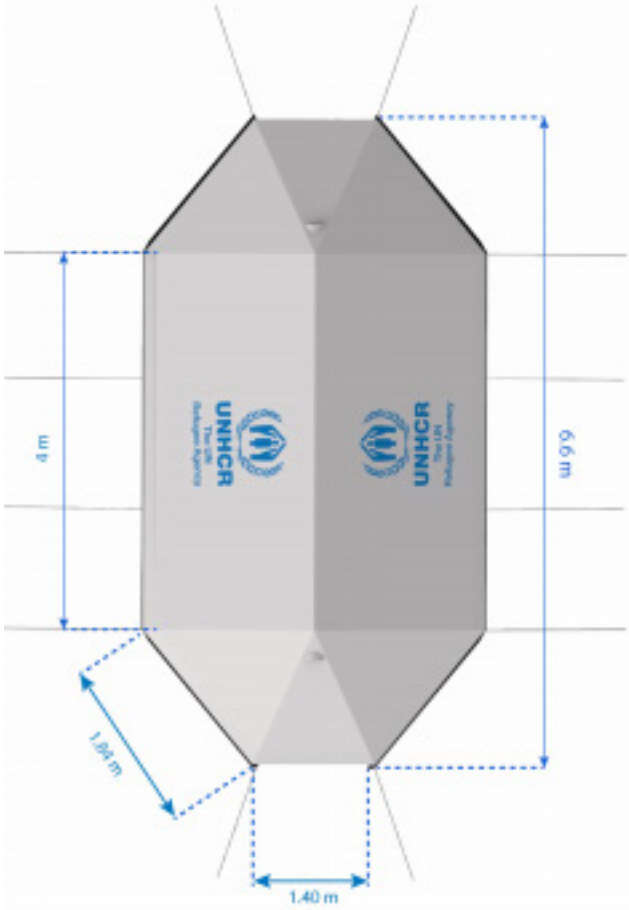
MATERIAL
Cotton and polyester for the outside and plastic sheets for the floor

DURABILITY
5 year

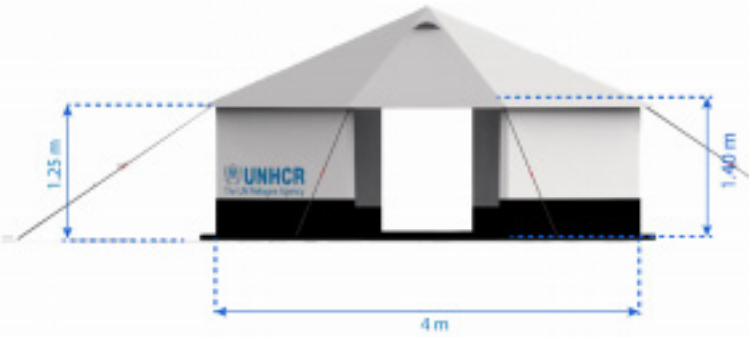
DIMENSIONS
4,15 x 4 x 2,4 m
87 kg

PRICE
650€

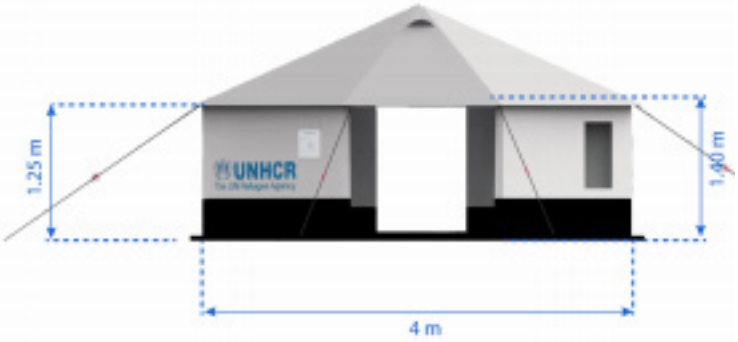
REFERENCES
http://www.unhcr.org/53fc7df49.pdf
https://cms.emergency.unhcr.org/documents/11982/57181/Shelter+Design+Catalogue+-January+2016/a891fdb2-4ef9-42d9-bf0f-c12002b3652e



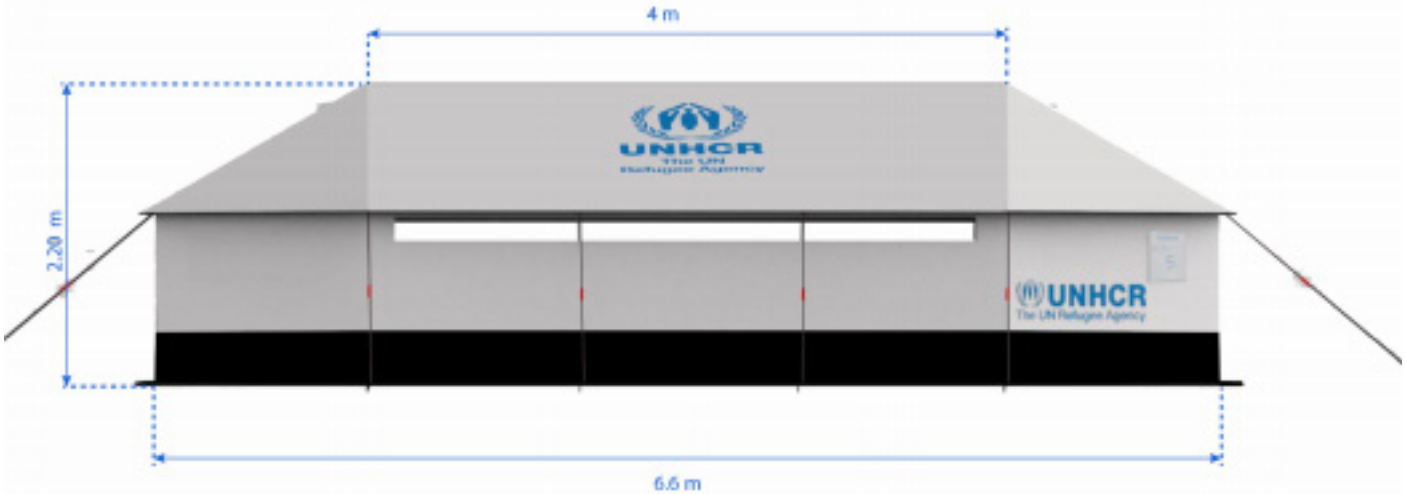
Top View



Back View



Front View



Side View

UNHCR SELF-STANDING FAMILY TENT

DESCRIPTION
“The main characteristic of this store is that it is supported by the tension of the different ropes that compose it, without the need for masts. In addition, the oval shape allows to better withstand high temperatures. Its interior is divided so as to create different rooms for greater privacy. It incorporates mosquito nets in addition to anti-dust.”

CREATOR
Shelter specialists with close technical cooperation between UNHCR, IFRC and ICRC

YEAR
2014

ACCOMMODATION
3 people

ASSEMBLY
30 minutes

MATERIAL
PE and Polyester canvas.

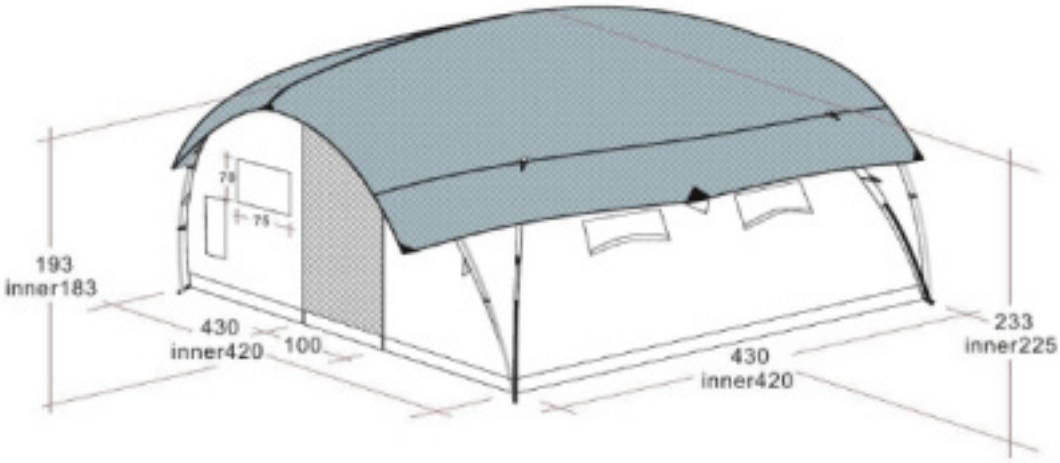
DURABILITY
5 year

DIMENSIONS
4,3 x 4,3 x 1,8 m
45 kg

PRICE
400€

ADDITIONAL INFORMATION
Fully self-standing without pegs and guy ropes

REFERENCES
https://cms.emergency.unhcr.org/documents/11982/57181/New+Self+Standing+Tent/0bf6fa33-248a-46d6-94de-4ff893772045
https://cms.emergency.unhcr.org/documents/11982/57181/Shelter+Design+Catalogue+-January+2016/a891fdb2-4ef9-42d9-bf0f-c12002b3652e


193
inner183
430
inner420
100
430
inner420
233
inner225

WOODEN GABLE FRAME SHELTER

DESCRIPTION

“The first model of this Emergency Shelter is here composed by a rectangular wooden structure, using local available materials, in this case wood poles and bush sticks. UNHCR tarpaulin, either five 4x5m sheets or equivalent length of roll*, will cover the floor, walls and roof. The shelter has a covered living area of 12m2 (4x3 m), and could be increased depending on the number of family members.”

CREATOR

UNHCR

YEAR

2015

ACCOMMODATION

3 people

ASSEMBLY

6 hours

MATERIAL

Wooden structure, using materials that can be found in the area. (Tarry cloth provided by UNHCR and local fabrics would be covered.)

DURABILITY

5 years

DIMENSIONS

3 x 4 x 2,7 m

PRICE

206€

REFERENCES

https://cms.emergency.unhcr.org/documents/11982/57181/Shelter+Design+Catalogue+-January+2016/a891fdb2-4ef9-42d9-bf0f-c12002b3652e

MODEL I

The first model of this Emergency Shelter is here composed by a rectangular wooden structure, using local available materials, in this case wood poles and bush sticks. UNHCR tarpaulin, either five 4x5m sheets or equivalent length of roll*, will cover the floor, walls and roof. The shelter has a covered living area of 12m2 (4x3 m), and could be increased depending on the number of family members.

35°C
10°C

1 SKILLED +
2 LABOURS

6 HOURS

1 YEAR

BILL OF QUANTITIES

Item	Specifications	Unit	Qty	Unit Cost US$	Total US$
UNHCR plastic sheeting	4 m x 5 m	pieces	5	12	60
Local poles (with bracket)	2 m length, Ø 8-15 cm	pieces	8	2	16
Local poles (with bracket)	3 m length, Ø 8-15 cm	pieces	2	2	4
Local poles	4,2 m length, Ø 8-15 cm	pieces	2	2,50	5
Local poles (rafters)	2,2 m length, Ø 8-15 cm	pieces	6	2	12
Local poles (trusses)	0,8 m length, Ø 6-8 cm	pieces	4	1	4
Bush sticks	3 m length, Ø 2-3 cm	bundle	8	2,50	20
Local rope / tire	5 mm	bundle	12	1	12
Nails	100 mm	Kg	3	2	6
Nails	75 mm	kg	3	1,5	4,5
Local door	bush sticks braiding, 0,9 x 1,7 m	pieces	1	5	5
Local window	bush sticks braiding, 0,6 x 0,4 m	pieces	2	2,5	5

Sub total	154 $
Transport cost 15 %	23 $
Labour cost 30 %	46 $
Total estimated cost *	223 $

TEMPOHOME

DESCRIPTION

“Many refugees still live in shelters in Berlin, because affordable housing in Berlin is scarce. In order to remedy this situation, since mid-2016, temporary living quarters for refugees in residential containers have been set up at suitable locations in Berlin, so-called “Tempohomes”. This type of accommodation will be the next step in housing until sufficient space is available in refurbished housing and new housing (Modular Accommodation for Refugee Housing - MUF) or sufficiently affordable rental housing is available.”

CREATOR

Developer on behalf of the State of Berlin is the state real estate company of Berlin (BIM).

YEAR

2016

ACCOMMODATION

4 people per unit

ASSEMBLY

This field has a total of 8 residential buildings, 2 functional buildings and an entrance house.
1 residential building = 8 housing units (apartments)
1 housing unit (apartment) = 3 individual containers (individual and kitchen sanitary cell)
3 containers = 1 apartment for 4 to 8 people
Total: 24 containers

MATERIAL

No information found

DURABILITY

3 years

DIMENSIONS

Each container has an area of approximately 13 sqm

PRICE

No information found

ADDITIONAL INFORMATION

All the buildings are formed by individual containers with an area of approximately 13 square meters. They are mainly at ground level and have only one ground floor.
Residential buildings consist of residential units, each of them autonomous and accessible from the outside on the ground floor. There is space for four people in a unit.

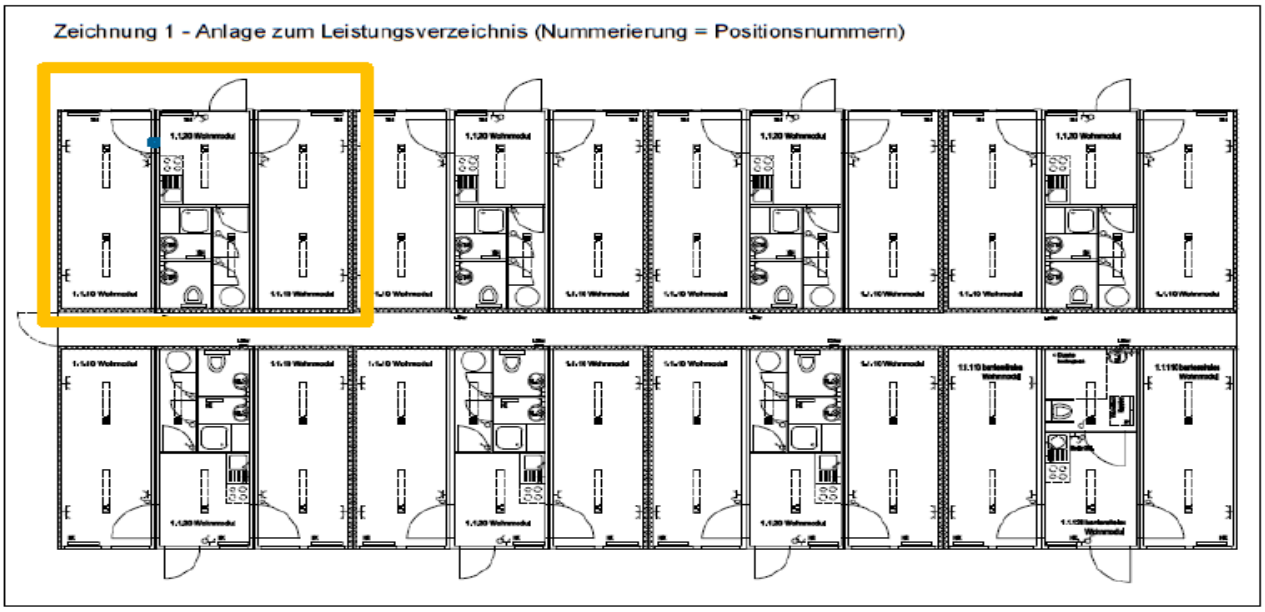
REFERENCES

https://www.berlin.de/laf/wohnen/allgemeine-informationen/tempohomes-faq/

1 RESIDENTIAL BUILDING = 8 HOUSING UNITS (APARTMENTS) = 24 CONTAINERS

Senatsverwaltung für Gesundheit und Soziales | be Berlin

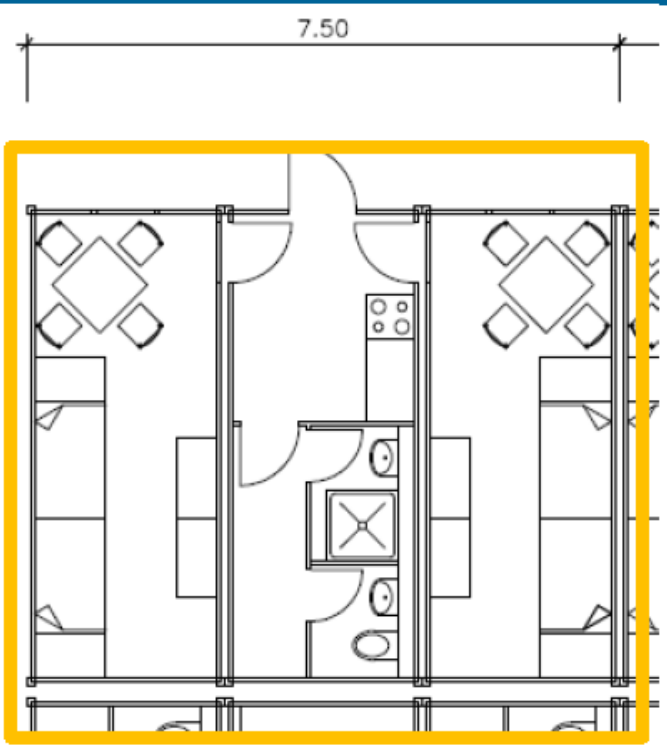
tempohome – 24 Container = 8 Wohnungen = 1 Gebäude



3 CONTAINERS = 1 APARTMENT FOR 4 TO 8 PEOPLE

Senatsverwaltung für Gesundheit und Soziales | be Berlin

tempohome – 3 Container = 1 Wohnung für 4 bis 8 Personen



PORTABLE GEODESIC YURTDOMES

DESCRIPTION

CREATOR
Shelter System Domes

YEAR
No information found

ACCOMMODATION
No information found

ASSEMBLY
Set up in 30 minutes without tools. Take down in 5 min.

MATERIAL
They are made of a strong, tear resistant fabric and non-puncturing tarp fasteners, and are guaranteed leak proof. Because of its curved shape with no corners, there are no weak points. Our patented structure is drum tight, waterproof and wind-resistant. The frame of the YurtDome is constructed of strong, long lasting, resilient, UV-stabilized, Class 200,PVC tubing.

DURABILITY
3 years

DIMENSIONS
Shown in the images below

PRICE
No information found

ADDITIONAL INFORMATION
“The 14’, 18’ and 20’ YurtDomes can be set up by most people in 30 minutes without tools. Insert the interchangeable poles into factory-attached connectors spaced evenly over the cover. The poles bend slightly when inserted, tightening the cover into a wind- and waterproof shelter. The cover is freestanding requiring no guy lines and can be moved into the desired position or location without disassembly. The YurtDome can be taken down in 5 minutes: just remove the poles and roll up the covering. “

REFERENCES

http://www.shelter-systems.com/solor-dome.html
http://www.relieftents.com/about/
Shelter system domes
http://www.shelter-systems.com/

size (diameter)	height at max.	floor size	weight	doors	windows	price
14 foot	7 ft.	154 sq. ft.	40 lb.	4	NA	$745
18 foot	9 ft.	254 sq. ft.	60 lb.	4	NA	$907
20 foot	10 ft.	314 sq. ft.	70 lb.	4	NA	$1069
30 foot	11 ft.	706 sq. ft.	190 lb.	8	NA	$2311
31 foot	16 ft.	706 sq. ft.	270 lb.	4	NA	$3380

LIFE BOX

DESCRIPTION

“So, inspired by the idea of a life-jacket, Önalan decided to build an all-in-one kit that functioned both as a shelter and a pantry full of these customized goods. The result is the LifeBox.”

“The Box comes in three versions for different needs: ‘air’, ‘land’ and ‘water’.
The ‘air’ type is for the disaster areas that can be only reached by aircraft. The outer layer of the shelter is used as parachute during airdropping.
The ‘land’ type is for disaster areas that can be reached by road. The outer layer of the shelter is placed inside the box.
The ‘water’ type is for flood-affected areas. It serves as a shelter on both water and land. It has two inflated rings around the shelter for floatation.”

CREATOR

Adem Önalan

YEAR

2013 (“Red Dot Award: Design Concept” Winner.)

ACCOMMODATION

4 people.
“Once constructed, they can be connected to form larger rooms”

ASSEMBLY

1 minute

MATERIAL

Polyethylene.
“The polyethylene foam provides comfort and insulation. It is also a good shock absorber.”

DURABILITY

2 weeks
“They’re meant to last two weeks with enough supplies for four people each.”

DIMENSIONS

LifeBoxes can be carried by two people, and weigh about 165 pounds. A 50-foot-long truck can carry up to 192 LifeBoxes, and a C17 cargo plane can store 160.

PRICE

No information found

ADDITIONAL INFORMATION

“This foldable polyethylene box includes two cardboard boxes containing food, water, sleeping bags etc. and transforms into an inflatable shelter.”

REFERENCES

http://www.wired.co.uk/article/life-box-disaster-shelter
https://www.fastcompany.com/3023120/after-a-disaster-these-inflatable-shelters-can-fall-from-the-sky


LIFE
BOX
water
DISASTER
RECOVERY


LIFE
BOX
water
03
W-0513


LIFE
BOX
land
DISASTER
RECOVERY
LIFE
BOX
air
DISASTER
RECOVERY
LIFE
BOX
water
pull the rope
DISASTER
RECOVERY


12

SHELTER PACK

DESCRIPTION

“The project was developed for the disaster and war victims within the light of recent refugee crisis of the world.Thousands of people become homeless and lose everything during natural disasters and after they starts to live in post disaster shelters. Beyond survival, shelter is an essential contributor to security, personal safety, protection from the climate and resistance to disease.
Ensuring adequate shelter provides disaster affected households with a place from which they can address their other needs, promoting the use of existing capacities, resources and social networks.”

CREATOR

Hakan Gürsu

YEAR

2013-2014 (Ankara)

ACCOMMODATION

Family of 4 people
“It can sustain a family of four. Every unit features 4 single beds, bathroom, fully equipped kitchen, and foldable dining table and storage spaces”

ASSEMBLY

It can be built in just few hours

MATERIAL

Between the fiber walls, fire and waterproof two different fabric surfaces and plywood in between are used as heat insulating materials.

DURABILITY

Some months
“It can sustain a family of four for months following a disaster.”

DIMENSIONS

12 square meter // 80 cm height, 4,5 meters length and 2,5 meters width

PRICE

No information found

REFERENCES

http://www.microsiervos.com/archivo/arte-y-diseno/refugios-plegables-mundo-postapocaliptico-diseno.html
https://competition.adesignaward.com/design.php?ID=46903

BLOOMING BAMBOO

DESCRIPTION

“Bamboo buildings are one of the forms of ecological and sustainable building that is recovering strongly in many countries where this plant grows naturally. The high growth speed of bamboo means that it can be easily used and replanted for future use, without damaging the environmental balance. Thanks to its high resistance and elasticity, bamboo is considered an ecological building material for the future.”

CREATOR

H&P Architects

YEAR

2013

ACCOMMODATION

4 rooms in two floors

ASSEMBLY

25 days

MATERIAL

Bamboo poles, woven panels of coconut fiber, palm leaves, ropes and screws.

DURABILITY

No information found

DIMENSIONS

Around 6 meters by 6 (bamboo rods of 4-5 or 8-10 centimeters in diameter, with lengths of 3.3 or 6.6 meters)

PRICE

$2.500

UBICATION

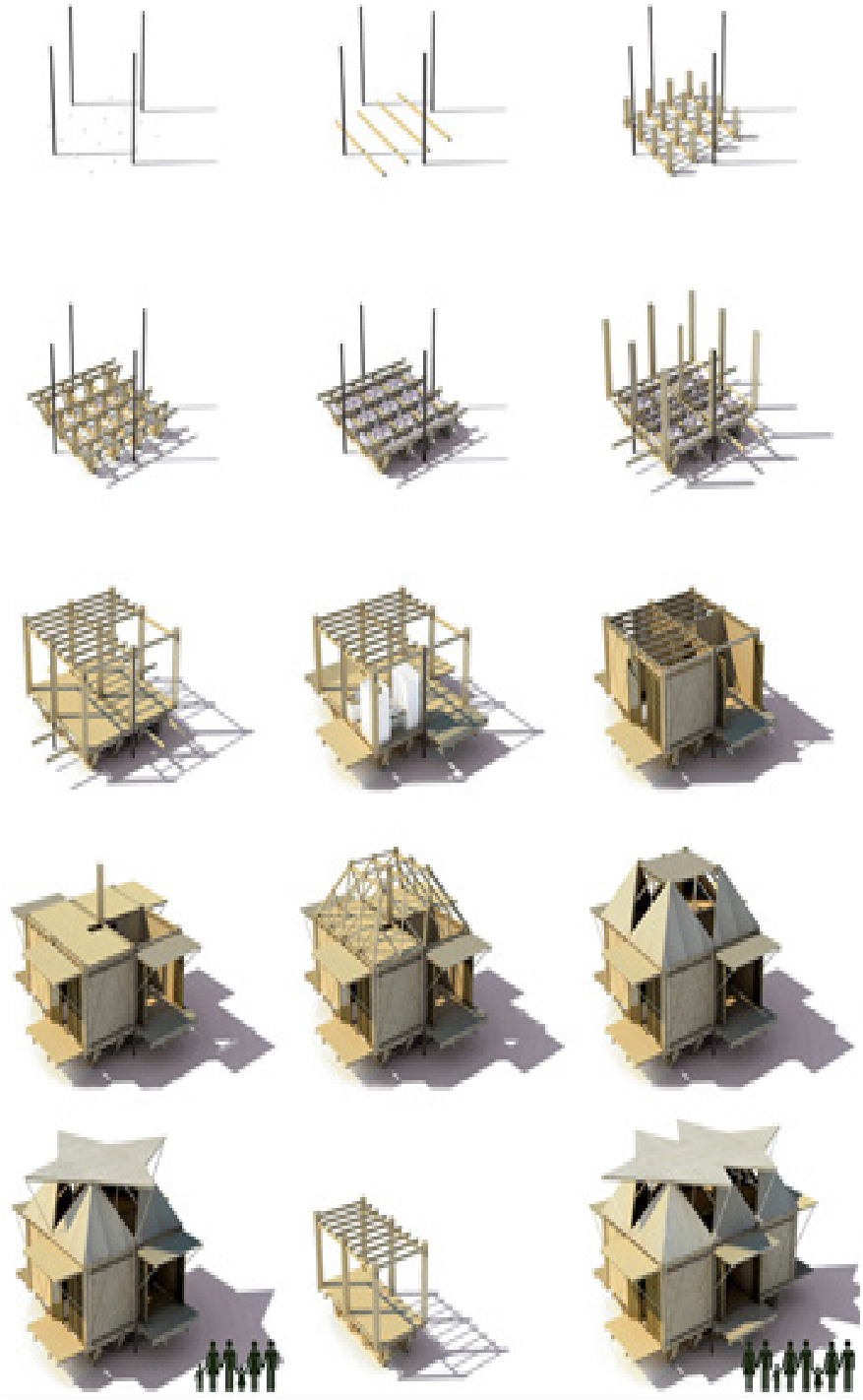
Ha noi (Vietnam)

ADDITIONAL INFORMATION

The structure is solid enough to float in the case of floods. It has an open roof and consists of modular and mobile panels, to ensure air circulation.

REFERENCES

http://www.ideassonline.org/public/pdf/BambooVietnam-ESP.pdf
http://www.arquitecturaviva.com/es/Info/News/Details/5290
https://www.homedsgn.com/2013/04/20/blooming-bamboo-by-hp-architects/



TENTATIVE

DESCRIPTION
“Tentative’ by designnobis, is a compact catastrophe unit specifically created for the front lines of aid.”

CREATOR
Designnobis - Hakan Gürsu

YEAR
2014/2015

ACCOMMODATION
2 adults and 2 children

ASSEMBLY
Easily transportable to various climates and geographical sites

MATERIAL
Fiberglass shells sealed with a durable, weather-resistant textile with thermal insulated perlite infill.

DURABILITY
No information found

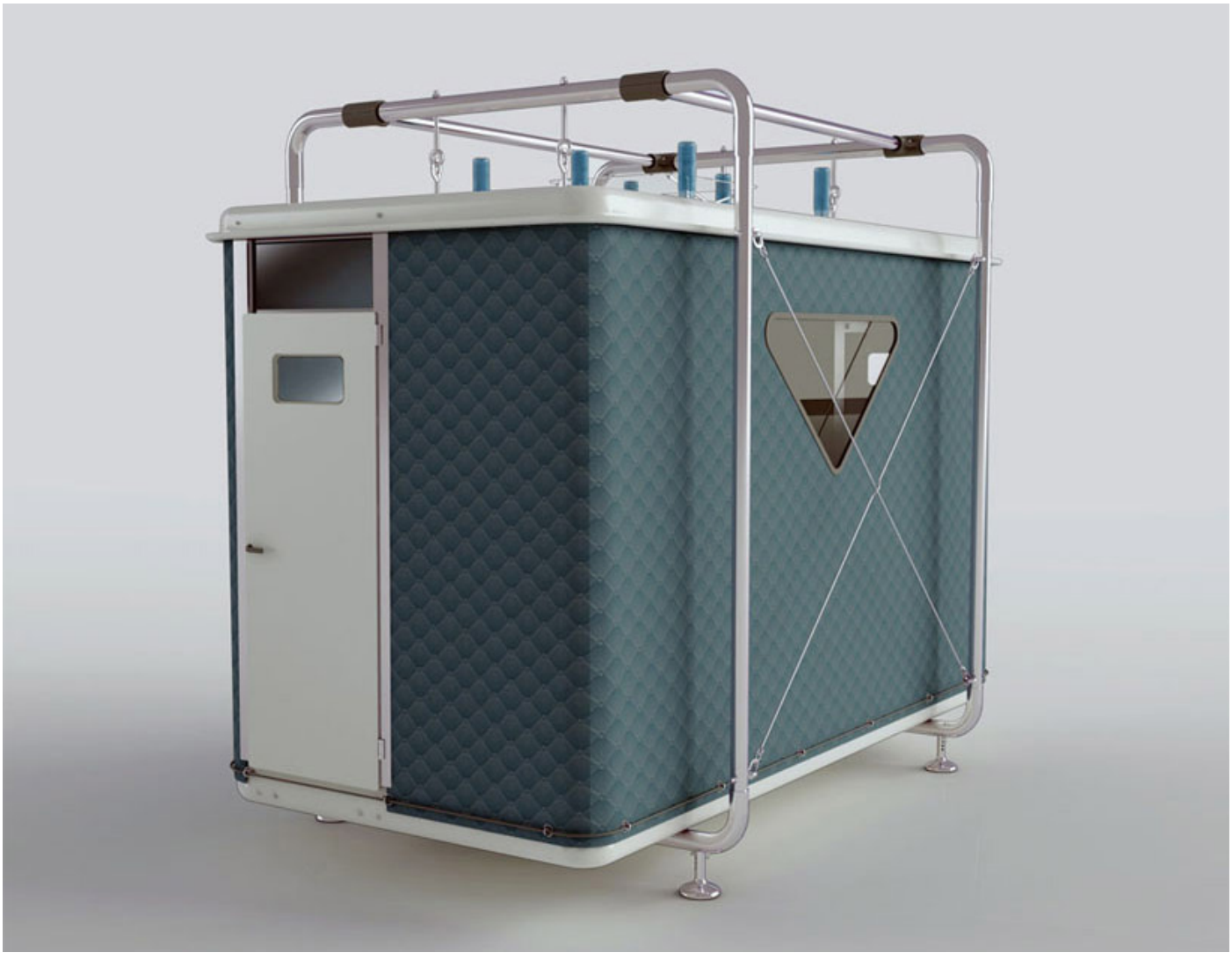
DIMENSIONS
When compacted, Tentative is 4m long, 2m wide and 30cm tall, and 24 units can be delivered by a semi-trailer truck. After expansion, Tentative stands 2.5m tall

PRICE
No information found

ADDITIONAL INFORMATION
“The structure consists of a weather-resistant textile that is quilted together, with insulating perlite sandwiched between layers, held by an aluminum frame. Water is collected via the roof, which also provides lighting and ventilation. Heat-insulating recyclable composite decks make up the floor, with legs keeping the floor above ground to prevent heat loss.”

REFERENCES

https://www.designboom.com/design/designnobis-tentative-post-disaster-shelter-07-11-2015/
http://designnobis.com/index.php?r=site/product&id=191
https://vimeo.com/145485596



CARDBORIGAMI

DESCRIPTION
“Tina Hovsepian has designed and developed a foldable, portable, emergency housing shelter based on the principles of origami.”

CREATOR
Tina Hovsepian

YEAR
2010

ACCOMMODATION
2 people

ASSEMBLY
No information found

MATERIAL
Recycled cardboard
“She settled on using recycled cardboard as the material because it was inexpensive, lightweight, sustainable, naturally insulated and had structural properties”

DURABILITY
No information found

DIMENSIONS
No information found

PRICE
No information found

UBICATION
Los Ángeles

ADDITIONAL INFORMATION
“The cardboard origami shelter can then fold down small enough to carry or even be placed on bus bike racks for long distance transport.”
“Hovespian also hopes to refine the design so it becomes waterproof, fire-retardant, more comfortable and more portable.”

REFERENCES

http://edition.cnn.com/2010/IREPORT/10/21/shelter.solutions/index.html
https://inhabitat.com/cardborigami-unfolds-into-a-portable-housing-shelter/
http://www.cardborigami.org/

TELESCOPIC TENT

DESCRIPTION

“In the event of natural disasters such as earthquakes or floods, conventional tents can offer relief for victims, however, the process of setting them up can be pretty difficult and tedious. This new concept tent offers better emergency tent that can be easily set up.”

CREATOR

Dong Jia, Wu Jiahao, Qiao Song, Feng Ming, Chen Yu, Su Fangyu, Li Siyao, and Zhao Chenyuan

YEAR

2016 (“Red Dot Award: Design Concept” Honourable Mention.)

ACCOMMODATION

2 people

ASSEMBLY

To use the tent, simply open the inlet port and stretch out the tent, and then open the zipper of the tent to enter. To meet different demands and capacity, each module can be buckled to another to form a larger module. Each unit can be stretched out in length by two people to create a nice, durable shelter. When not in use, it can be retracted back the same way for easy storage.

MATERIAL

High resistant and elastic waterproof nylon

DURABILITY

No information found

DIMENSIONS

Fully expanded, each tent module stretches out into two sections measuring 8 metres in total length. The height and width of the tent modules measure 2.5m by 2m respectively.

PRICE

No information found

ADDITIONAL INFORMATION

When in retracted mode, the thickness of compressed tent is just one-twentieth of its expanded state.

REFERENCES

http://www.tuvie.com/telescopic-tent-modular-emergency-tent-made-of-elastic-water-proof-nylon-material/

http://www.red-dot.sg/en/telescopic-tent/

FOLD FLAT SHELTER

DESCRIPTION

“Natural and manmade catastrophes are becoming increasingly common, and with them the number of people in need...Currently there are about 1000 known disaster-relief camps worldwide planned by the UNHCR. Its master plan for such camps has been in place for 50 years. In addition to the looming financial issues, these camps are simply not state of the art. Their face has changed little, regardless of whether the conditions are hot or cold, humid or dry. The point of humanitarian aid is that it be given as quickly as possible. Currently this means tents, tents, tents... or in the worst case: just a fly screen or a tarpaulin. But the causes of a disaster – or its results – usually last longer than the life of a tent. Even the most powerful economy would be hard-pressed to rebuild a city or densely populated area with hundreds of thousands of homeless in a short period of time. With this in mind, the goal is to raise the art of shelter design to a higher, contemporary level so as to do justice to real needs and create opportunities for affected persons”

“My prime motivation is to give a large number of needy people a simple but usable home that combines the advantages of a tent with a lightweight building that can be used in the long term.”

CREATOR

Adrian Lippmann

YEAR

2010

ACCOMMODATION

No information found

ASSEMBLY

2 people can fold the panels and set up the shelter in 5 hours (erected without tools)

MATERIAL

The main materials used are Dibond® or Alucobond® sheets for wall and roof with measurements of 1500mm x 3000mm x 3-6mm. The floor is made of HeliPAN, a new honeycomb panel consisting of recycled plastic between perforated metal plates. The substructure is made of an L-section of GRP (glass fibre reinforced plastic). Slide windows are made of acrylic glass. The door element - Hylite® composit is the perfect material.

“Thanks to those materials, the inhabitants are surrounded by stable walls and are thus safe from fire, rain, vermin, noise and, in the worst case, shrapnel. The material is also easy to clean to avoid epidemics and allows a stove to be used safely inside the shelter. (...) The material is highly reliable, can withstand loads, and is usable in all kinds of climates.”

DURABILITY

Permanent use

DIMENSIONS

3m x 1.5m x 0.3m. The shelter has an internal floor area of 8 sqm and a height of 2.85m.
A U-section is provided to connect the panels easily and also protects the edges.

PRICE

No information foundx

ADDITIONAL INFORMATION

FoldFlatShelters can be manufactured in many different bright colours. This feature and the shelter’s specific form might also help give people in need a new identity in their precarious situation

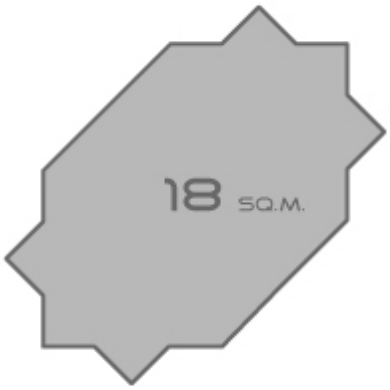
REFERENCES

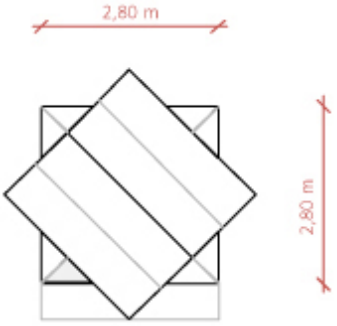
http://www.foldflat.de/

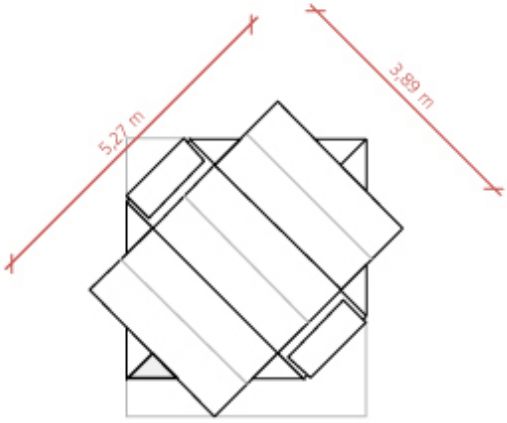
https://www.youtube.com/watch?time_continue=13&v=vaFjEOhNk0

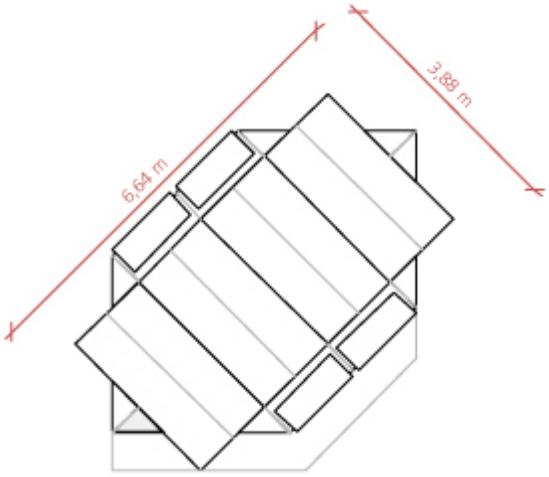
+ 5 SQ.M.

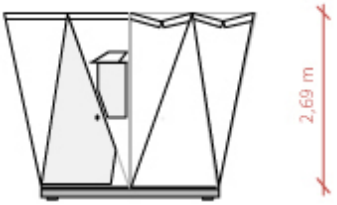
+ 5 SQ.M.

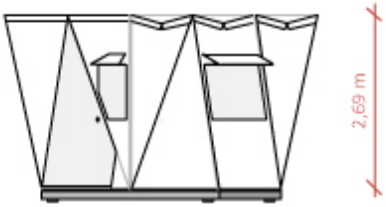


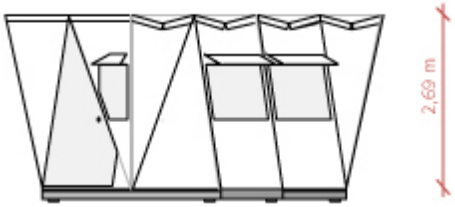












Basic Shelter 8 sq.m.

Extended Shelter 13 sq.m.

Extended Shelter 18 sq.m.

NIDO PORTABLE SHELTER

DESCRIPTION

“In the Dominican Republic, an average of 75,000 people are forced to leave their homes every year during hurricane season due to the flooding of the rivers. Unfortunately, there are not enough official shelters to accommodate all affected people. We have designed NIDO to provide safe shelters that can be installed in any open space. (...) The project was defined as a portable space equipped to allow people that has been removed from their homes meet their basic needs and preserve their privacy while taking advantage of available space. The main focus was towards disaster relief initiatives in large communities.”

CREATOR

Amanda Cuello

YEAR

2010

ACCOMMODATION

1 family per unit

“The product consists of two main modules: One individual module for sleeping and storing a certain amount of belongings, and another one for hygiene and physiological needs. This basic unit can be extended by adding more dormitory modules. The purpose is to organize people by family units.”

ASSEMBLY

It is lightweight and small in size when in disarmed mode for easy transport, allowing for it to be carried even to remote locations.

MATERIAL

No information found

DURABILITY

No information found

DIMENSIONS

100cmx80cmx30cm (one packed module)

PRICE

No information found

UBICATION

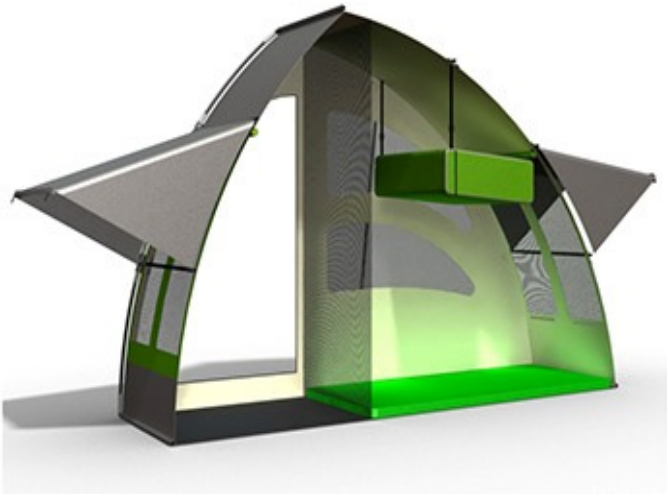
Dominican Republic

REFERENCES

https://www.trendhunter.com/trends/nido-portable-shelter
https://www.behance.net/gallery/926242/NIDO-Albergue-Portable

Dormitory
Module

Bathroom
Module



HEX HAUSE

DESCRIPTION

“The hex house is conceived as a low cost, sustainable, rapidly deployable, long stay and dignified house which is shipped in pieces and assembled by the end users. The basic building components are galvanized tube steel for the base, structural insulated metal panel for walls, floor and roof and can be customizes with conventional interior and exterior finishes.”

CREATOR

Architects for Society (The group was founded by architects and designers from the US, Spain, Canada, Jordan and The Netherlands.)

YEAR

2015

ACCOMMODATION

Each Hex House unit contains two bedrooms, a kitchen, a bathroom, a living room and a small porch. Units can be combined to form larger homes.

ASSEMBLY

No information found

MATERIAL

Steel-and-foam Structural Insulated Panels (SIPs), gypsum walls, bamboo cabinetry, and ceramic tile flooring in the bathroom.

DURABILITY

For 15 to 20 years

DIMENSIONS

40-square-metre (The design is meant to be scalable). All exterior wall panels measure approximately 10 by 13 feet (three by four metres), with some variations in the size of doors and windows.

PRICE

No information found

ADDITIONAL INFORMATION

“Units can simply be arranged next to one another in appropriate patterns or they can be joined and share walls for enhanced thermal performance,”

“Architects for Society has embarked on designing building solutions that target these populations by providing housing designs that are not only cost effective but also dignified.”

REFERENCES

https://www.dezeen.com/2016/04/14/architects-for-society-low-cost-hexagonal-shelter-housing-refugees-crisis-humanitarian-architecture/

https://www.youtube.com/watch?v=IK12vkvxUwA

http://www.architectsforsociety.org/our-work/hex-house-a-rapidly-deployable-dignified-home/

JUST IDEAS

FOLDING DESIGN OF A HABITABLE SPACE

This point also shows examples of existing products, possible materials and shape variants, as the previous one. But the ones shown below, even though they are also interesting and inspiring, have been defined as “just ideas” since it has not been possible to find enough information about them.x

COCOON

DESCRIPTION
“Cocoon is an exploration of mass-produced, easy-to-assemble and quick-to-mobilize disaster-relief shelters. A family of three objects, “Case”, “Capsule” and “Cuddle”, represent new solutions for shelter and comfort as well as provide varying levels of protection for different climates and surroundings.”

CREATOR
NewDealDesign

YEAR
No information found

ACCOMMODATION
No information found

ASSEMBLY
1 or 2 people.
“Easy to manufacture and transport, the can be delivered, even dropped from air, within a few hours. Once they arrive, they can be set up easily by the victims themselves”

MATERIAL
No information found

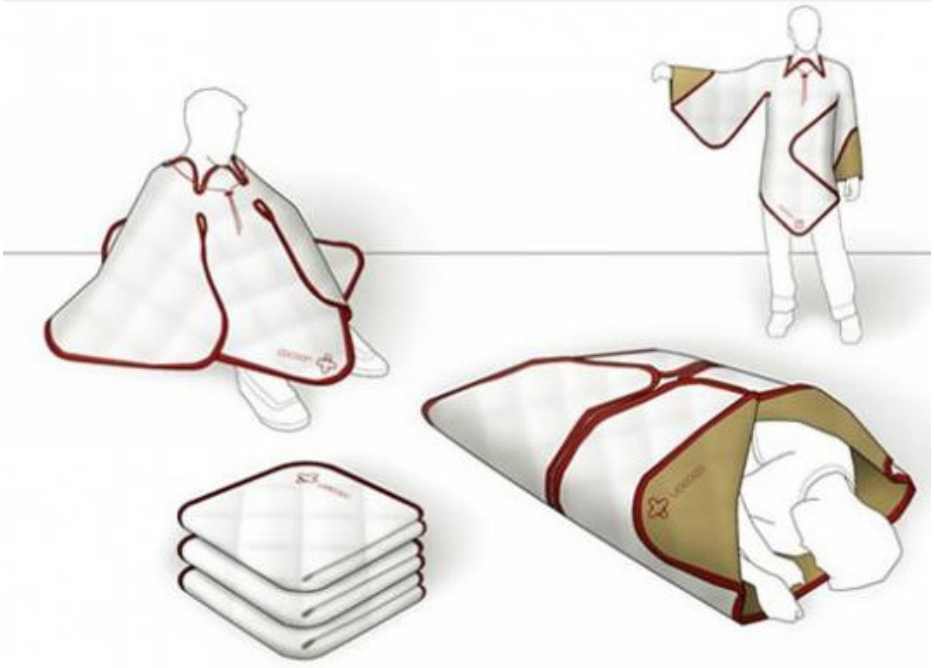
DURABILITY
No information found

DIMENSIONS
No information found

PRICE
No information found

ADDITIONAL INFORMATION
“The Cocoon objects can be mass-produced, are low-cost, and can be erected by one or two people. It’s an industrial design paradigm that can be manufactured on demand and in time”

REFERENCES
http://www.idsa.org/awards/idea/design-strategy/cocoon-disaster-relief-shelters



BOXTENT

DESCRIPTION
“Coping with the upcoming natural disorder, Turkish designer Can Koseoglu has come up with an innovative tent that provides instant shelter for the victims during calamities. Entitled Box the portable tent folds flat for easy storage as well as transportation that can easily be moved to the affected area via air or road. Made of recyclable corrugated cardboard and polyester, the tent is not only lightweight and durable, but it also helps in sustaining the environment.”

CREATOR
Can Koseoglu

YEAR
2016

ACCOMMODATION
No information found

ASSEMBLY
“The portable tent folds flat for easy storage as well as transportation that can easily be moved to the affected area via air or road”

MATERIAL
Recyclable corrugated cardboard and polyester

DURABILITY
No information found

DIMENSIONS
No information found

PRICE
No information found

ADDITIONAL INFORMATION
“The end result is a lightweight survival tent that is both durable and environmentally friendly.”

REFERENCES
https://designbuzz.com/eco-box-tent-provides-instant-shelters-in-calamities/


BOX
tent


BOX
tent


BOX
tent
BOX

SPHERE EMERGENCY SHELTER

DESCRIPTION

CREATOR
Felix Stark

YEAR
2010

ACCOMMODATION
19 units of tents offer room for 3 persons at a time, however, partition walls can be unbuttoned in order to create bigger sections for families wards and the like.

ASSEMBLY
No information found

MATERIAL
The inner tent, made of lighter nylon permeable to air, is independent from the outer part which consists of waterproof canvas. The stakes are made of fibre glass plastic and guarantee stability of the whole construction.

DURABILITY
“Long-lasting”

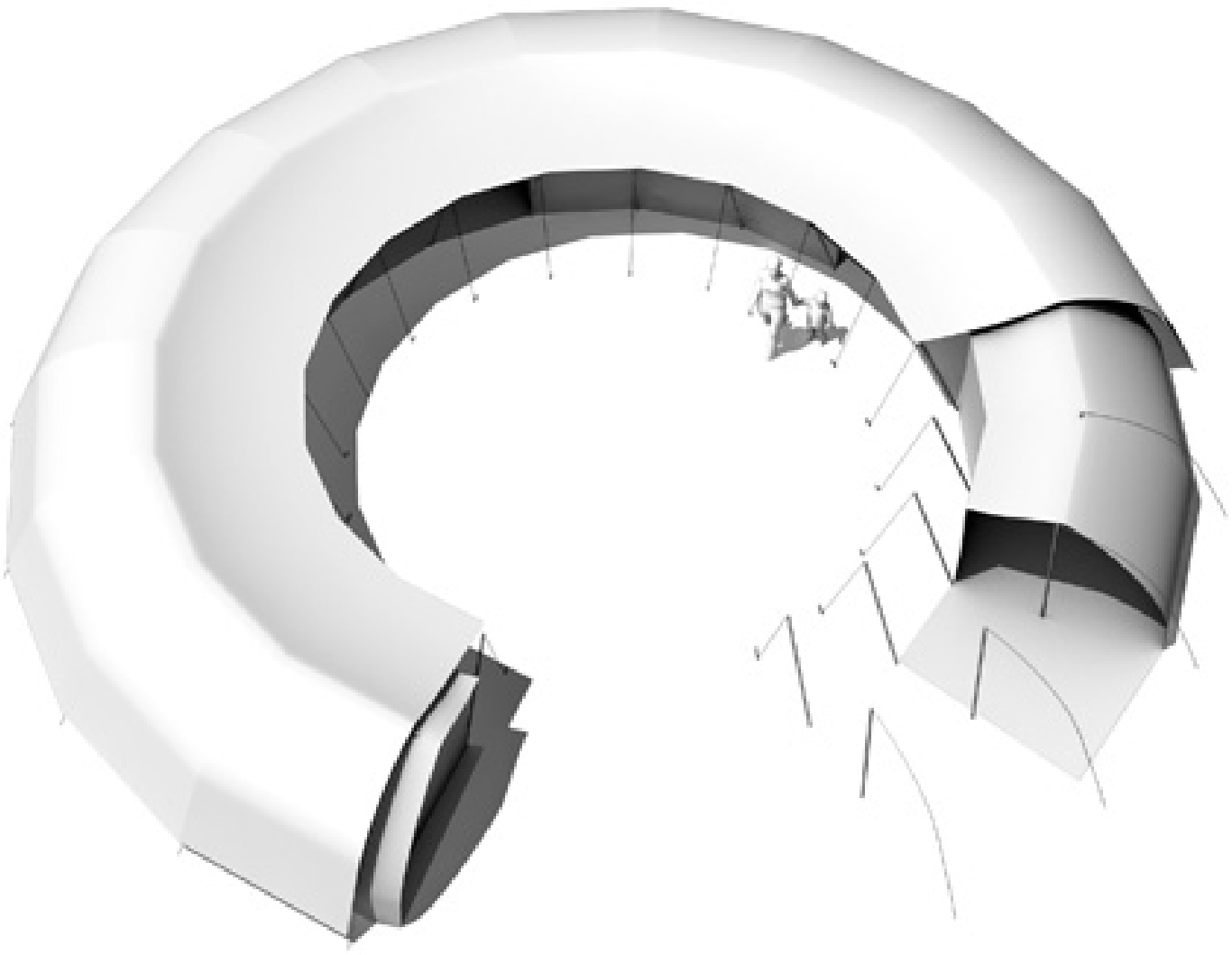
DIMENSIONS
No information found

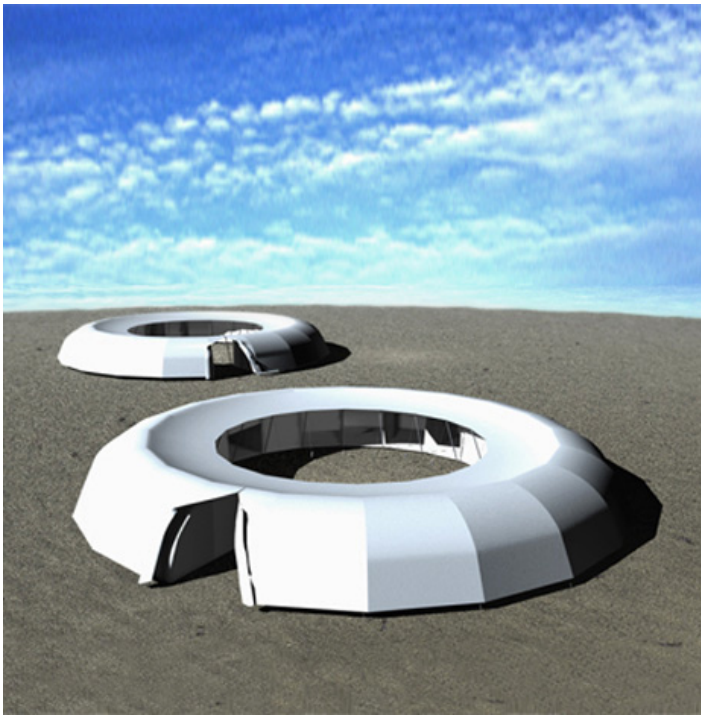
PRICE
No information found

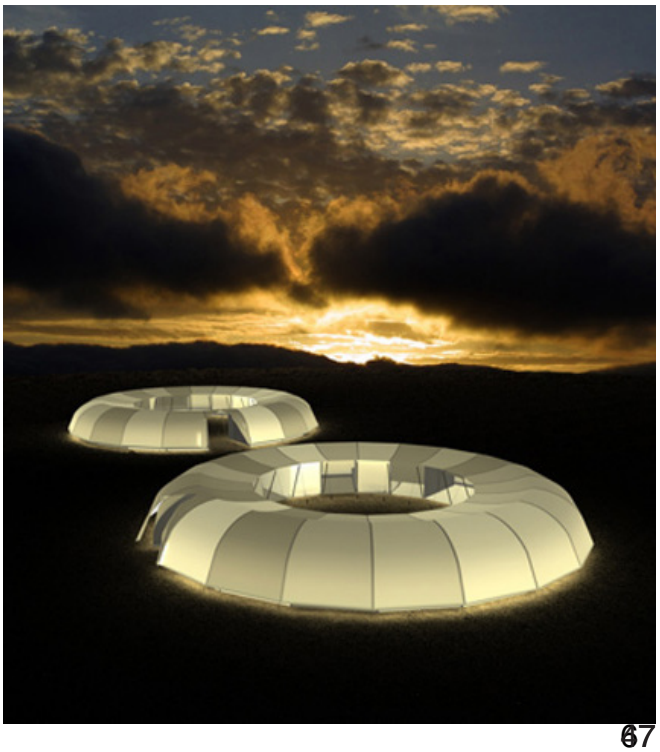
REFERENCES

https://www.yankodesign.com/2007/08/14/sphere-shaped-emergency-shelter-bonds-community/

http://www.obrasweb.mx/interiorismo/2010/07/29/la-forma-natural-de-felix-stark







FOLDABLE HALF DOME

DESCRIPTION

CREATOR
Tsukagoshi Miyashita Sekkei

YEAR
No information found

ACCOMMODATION
No information found

ASSEMBLY
Portable by hand.

MATERIAL
It's constructed with pieces of lightweight yet sturdy resin boards, shaping it into folded plates that are fixed together by bolts and pegs

DURABILITY
No information found

DIMENSIONS
6.25 sqm

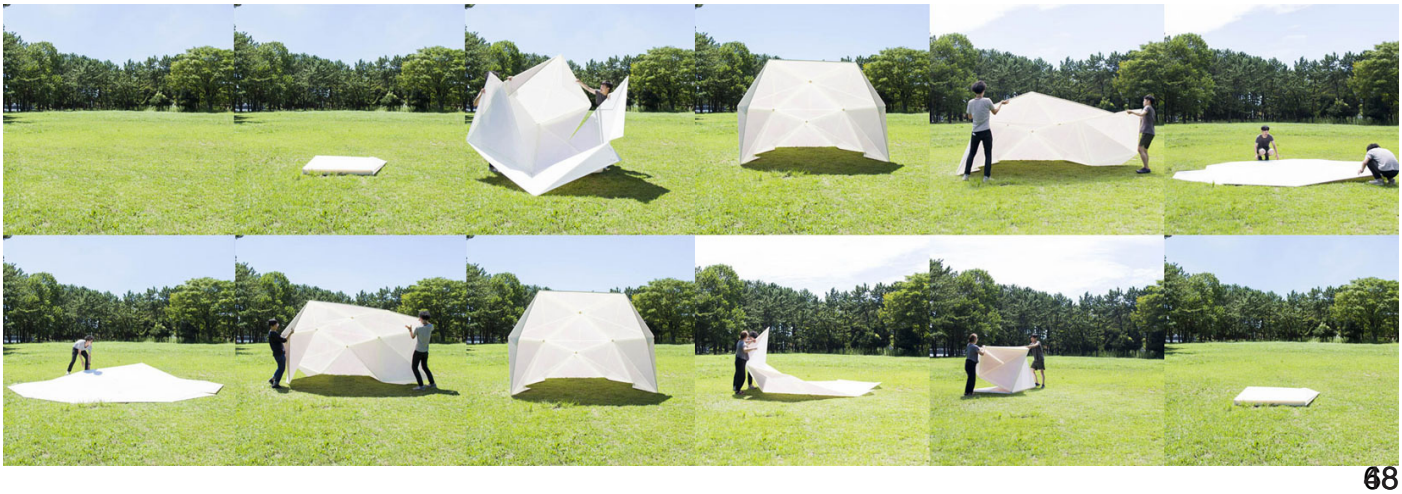
PRICE
No information found

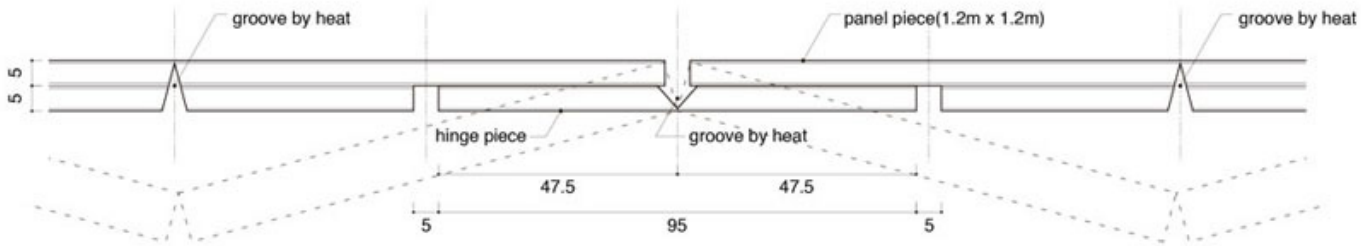
ADDITIONAL INFORMATION
Grooves incised in a regular pattern by heat make each part of the board foldable in one way. this allows users to erect the 2.5 meters high half dome just by pulling up its central part.

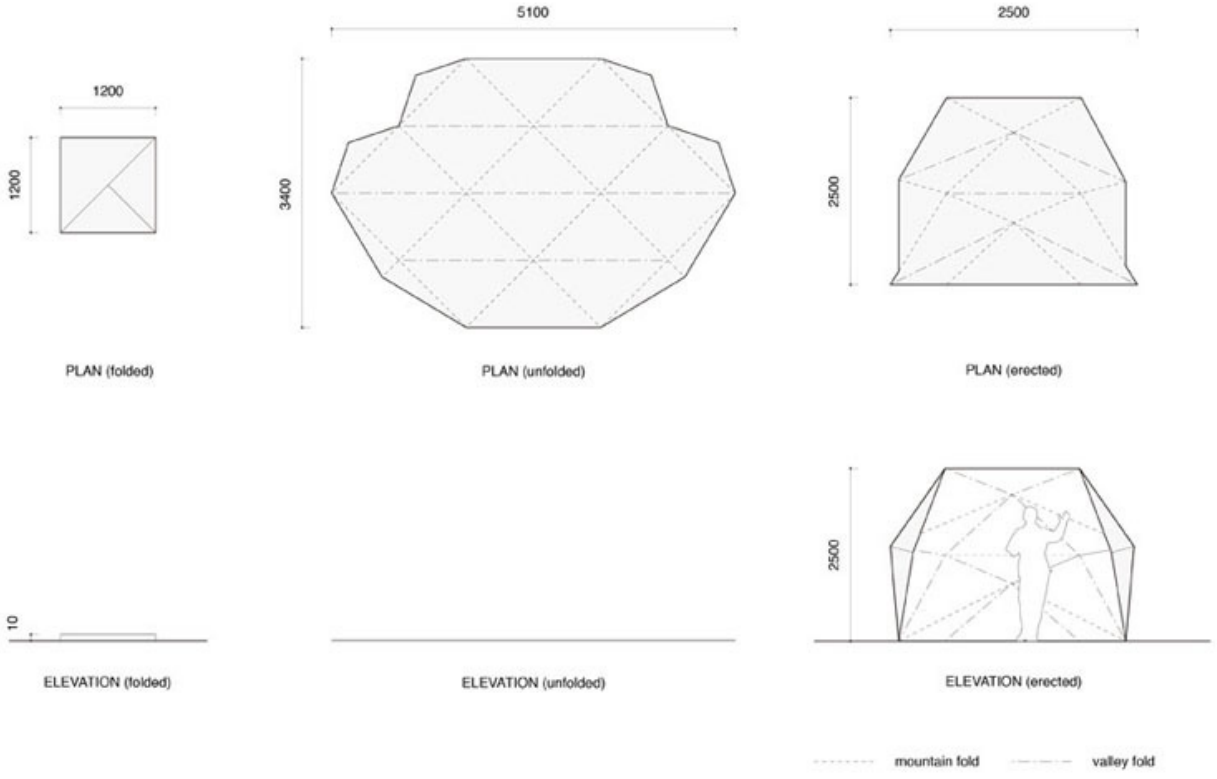
REFERENCES

https://www.domusweb.it/en/news/2017/01/24/foldable_half_dome_tsukagoshi_miyashita_sekkei.html

https://www.designboom.com/architecture/tsu-mi-foldable-half-dome-01-27-2017/




groove by heat
panel piece(1.2m x 1.2m)
groove by heat
5
5
hinge piece
groove by heat
47.5
47.5
5
95
5


5100
2500
1200
1200
3400
2500
PLAN (folded)
PLAN (unfolded)
PLAN (erected)
10
2500
ELEVATION (folded)
ELEVATION (unfolded)
ELEVATION (erected)
mountain fold
valley fold

MODULARFLEX

DESCRIPTION

CREATOR
Matias Alter and Matias Carrizo

YEAR
2012 at the Expo Logisti-k in Buenos Aires

ACCOMMODATION
No information found

ASSEMBLY
It takes half an hour (the homes can be put together in around a half an hour, and take up so little space that six or seven can be packed in a truck.)

MATERIAL
The walls are made from insulated thermal panels, similar to a supermarket cold storage room. They can stand temperatures ranging from -5° to 120° Fahrenheit, and can be customized to be added to other modules for larger dwellings as well as varying the placement of doors and windows. Each model comes with electrical wiring and LED lights.

DURABILITY
No information found

DIMENSIONS
No information found

PRICE
No information found

REFERENCES

http://cimetec.blogspot.hu/2012/01/refugio-de-emergencia-tienda-acordeon.html
https://www.good.is/articles/foldable-disaster-housing-that-literally-pops-up


MODULARFLEX
A QUICK SOLUTION FOR EMERGENCY DISASTERS
01
02
03
04
05
A flexible system is one of the objectives of th
project. By providing short modules, the shelter ca
be constructed as long as needed. A
pavilion can be shortened or a hospital enlarged to
allow more people to be hosted. Modules are
the solution in a dynamic situation where
quick and easy resolutions need to be
applied.

YAHYA IBRAHEEM'S SHELTER

DESCRIPTION

CREATOR
Yahya Ibraheem

YEAR

ACCOMMODATION
4 people. It can be modified and be able for 8

ASSEMBLY
No information found

MATERIAL
Uses a type of roof joints in a way that creates a flexible interior space that can be adapted to any number of residents

DURABILITY
No information found

DIMENSIONS
No information found

PRICE
No information found

REFERENCES
https://www.greenprophet.com/2014/03/shapeshifting-shelters-for-refugees-in-hot-or-cold-climates/


UNHCR
UNHCR


UNHCR
UNHCR
UNHCR
UNHCR
UNHCR

WEAVING A HOME

DESCRIPTION

“Weaving a home” reexamines the traditional architectural concept of refugee stores, by creating a technical and structural fabric that expands to create shelter and contracts for mobility. All this, without losing the comforts of a contemporary life: heating, running water, electricity, storage, etc.”

CREATOR

Abeer Seikaly

YEAR

No information found

ACCOMMODATION

No information found

ASSEMBLY

No information found

MATERIAL

Steel frame with lightweight polymer panels, which includes a solar panel on the ceiling capable of powering a lamp

DURABILITY

No information found

DIMENSIONS

5 meters in diameter and 2.4 meters high

PRICE

No information found

ADDITIONAL INFORMATION

The textil was designed according to the weather and is adhered to a firm, compressed and flexible plastic that can be opened to create ventilation holes or sealed to maintain heat. The tent is a firm structure that can be folded to carry it anywhere, it can collect water from rain and dew and charge a battery thanks to solar energy - through a specialized fabric.

REFERENCES

http://www.labioguia.com/notas/casas-carpas-un-hogar-para-refugiados
http://www.abeerseikaly.com/weavinghome.php
http://housingyourself.blogspot.hu/2015/04/weaving-home-tejiendo-un-hogar.html

STATE OF ART CONCLUSION

Regarding the previous state of art, it could be said that is very difficult to make a single conclusion about the different types of existing shelters.

First of all, it must be concluded that there is no standard way to develop a shelter. As it has been observed, each one of the examples shown previously are completely different from each other, to what their shape refers to. In my opinion, the only conclusion that can be said regarding the shape of them is that all have the same goal: taking advantage of the space. Making the most of the space in this kind of shelters has a great importance for people who are going to live there, because they are people who have been displaced of their own homes and are looking for a proper one.

So, these shelters should be prepared to perform all the basic functions (sleeping, eating, storage) of a house but in a reduced space.

It has been observed also, they all change in many aspects, as for example, the materials in which they are manufactured. Since there is a great variety of these, it can be assumed that the most used are the different types of polymers, plastics or bamboo thanks to its atmospheric and structural properties.

There is also huge diversity in relation to the accommodation and dimensions, but the capacity that stands out is the one made for housing four people, which it has an approximate dimensions of 4x4x2 meters. About this topic it has to be considered that it would be great to develop a shelter which could be modular, so in this way, individual units can be joined together to create larger shelters or multiple rooms, depending on the number of family members needing shelter.

Apropos of price and assembly, it is very difficult to make a conclussion because they depend on different factors.

In summary, the goal of this project is to develop a shelter made of polypropylene packaging material, aesthetically attractive and durable, for accommodating four people but with the possibility of being modular, with the least possible components for its assembly and with an affordable price.

3

FOLDING DESIGN OF A HABITABLE SPACE

LIST OF REQUIREMENTS

DISPLACED PEOPLE OVERVIEW

FOLDING DESIGN OF A HABITABLE SPACE

In order to define the requirements of the design which is going to be projected, first of all, the initial needs and the target users must be defined, in consideration of the refugees' situation nowadays.

DISPLACED PEOPLE OVERVIEW

In order to define the requirements of the design which is going to be projected, first of all, the initial needs and the target users must be defined, in consideration of the refugees' situation nowadays.

TARGET USERS

According to the United Nations Refugee Agency (UNHCR) a **refugee** is "someone who has been forced to flee his or her country because of persecution, war, or violence. A refugee has a well-founded fear of persecution for reasons of race, religion, nationality, political opinion or membership of a particular social group. Refugees are recognized under various international agreements. Some are recognized as a group or on a 'prima facie' basis. Some undergo an individual investigation before being given refugee status".

This concept is used widely and often, but it's important to discriminate between refugees and **internally displaced people** (IDPs). United Nations provides the following definition in order to distinguish both terms: "IDPS are persons or groups of persons who have been forced to flee, or leave, their homes or places of habitual residence as a result of armed conflict, internal strife, and habitual violations of human rights, as well as natural or man-made disasters involving one or more of these elements, and who have not crossed an internationally recognize state border".

SITUATION

Over the past two decades, the global population of forcibly displaced people have grown substantially from 33.9 million in 1997 to 65.6 million in 2016, and it remains at a record high. Those displacements are the result of persecutions, conflicts, violence, human rights violations, natural disasters, famine, development and economic changes.

NEEDS: FOOD, WATER, SANITATION AND HOUSING.

The common problems among refugees and internally displaced people are usually the following:

Food: Chronic malnutrition makes refugees fragile and more susceptible to a variety of diseases and illnesses. Most refugee camps do not have sufficient food to provide to their populations, and refugees are frequently dependent entirely on humanitarian aid. Moreover, it is not only the quantity of food that is insufficient. The lack of food variety, fruits, and vegetables causes many refugees to suffer from deficiencies in essential vitamins and minerals, which can lead to a variety of diseases.

Water: It is essential for refugees to receive an adequate quantity of good quality water because water has an impact on so many vital sectors of society, including nutrition, health, education and sanitation. The UNHCR estimates that more than half of the refugee camps in the world are unable to provide the recommended daily water minimum of 20 litters of water per person per day. Though it is important to provide adequate quantities of water, the water quality and hygiene is also of the utmost importance as the accessibility to it.

Sanitation: The provision of adequate sanitation services is crucial to prevent communicable diseases and epidemics while ensuring good health and dignity. Though the importance of having adequate latrines is well documented, still 30% of refugee camps do not have adequate waste disposal services or latrines. In addition to providing latrines and sanitation services, it is also important to provide the population with sufficient resources to curb diseases and epidemics.

Housing: a safely built environment, including adequate housing conditions, is one of the most elemental human needs. Nonetheless, around one billion (one-sixth) of the world's population currently live in slums and squatters and a large proportion of refugees reside in inadequate shelters. Unfortunately, housing in refugee camps is often overcrowded and of inferior quality. Designers and architects have a leading role in order to develop alternatives which allow to improve their conditions of life, providing safe homes that are free of physical hazards. But a different perspective has to be taken in consideration, a perspective that contemplates refugees' fields as a way of urbanization

with a more sustainable performance, where the refugees can continue with normality their lives without suffering; spaces which offer a better future for their inhabitants, host communities and the environment.

LIST OF REQUIREMENTS

FOLDING DESIGN OF A HABITABLE SPACE

On the basis of the above and according to the housing needs, the folllowing requirements has been detected:

			LIST OF REQUIREMENTS			1/2
			FOLDING DESIGN OF A HABITABLE SPACE			20/03/2018
Nr.	**Requirements**	**Value**	**Weight**	**Source**	**Responsible**	**Comments**
1	Simple shape		S	Appearance		
2	Minimum elements		W/s?			
3	Convey a sense of home		B			
4	Innovative		S			
5	Different aesthetic appearance to similar products in the market		S			
6	Integration in the environment		B			
7	Visually appealing		W			
8	Capacity	≤ 4 peo-ple	B	Dimensions		
9	For all sizes of people	≤ 2m	B			
10	Adaptable for any age		B	Ergonomics		
11	Physical effort		S			
12	Assemble and disassemble		B			
13	Avoid injury by assembly		B			
14	Easy to transport		S			
15	Easy to manipulate		W			
16	Easy to fold		S			
17	Resistant		B	Material		
18	Durable		B			
19	Malleable		S			
20	Recyclable and reusable		B			
21	Thermally insulative		B			
22	Weather resistant		B			
23	Stable		B			
24	Lightweight		W	Weight		
25	Easy accessibility in cleaning		S	Maintenan-ce		
26	Spare parts		W			
27	Suitable for all types of spaces and maneuvers		W			
28	Possibilty of being done by the user		S			
29	Mass production		B	Techniques		
30	Joints and assembly		S			
31	Stable and resistant structure		B			
32	Foldable		B			
33	Origami		S			
34	Modular		S			

			LIST OF REQUIREMENTS			2/2
			FOLDING DESIGN OF A HABITABLE SPACE			20/03/2018
Nr.	**Requirements**	**Value**	**Weight**	**Source**	**Responsible**	**Comments**
35	Home		B	Functiona-lity		
36	Hospital		W			
37	School		W			
38	Canteen		W			
39	Public space		W			
40	Minimum number of pieces		W	Assembly		
41	Medium term		B	Durability		
42	Quick-to-mobilize		S	Disponibility		
43	Easy-to-ship by land, sea and air		S			
44	Easy-to-set-up		B			
45	Without sharp elements		B	Safety		
46	Impact resistant		B			
47	Low cost	≤ 300 €	W	Price		
48	Affordable		W			
49	Easy storage		W	Storage		
50	Stackable		S			
51	Requires little space		W			

4

FOLDING DESIGN OF A HABITABLE SPACE

SOLUTION ANALYSIS

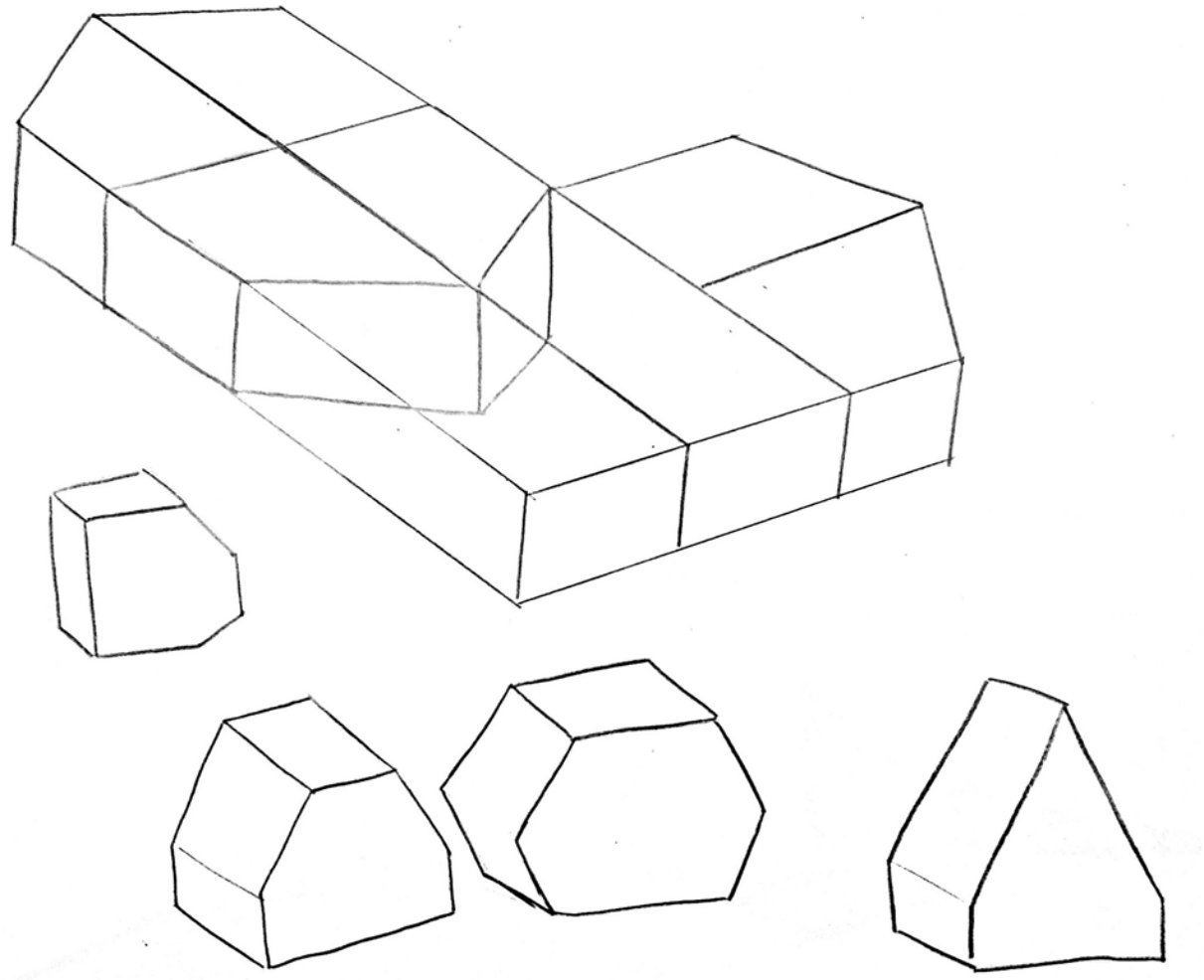
DESIGN PROCESS 4.1

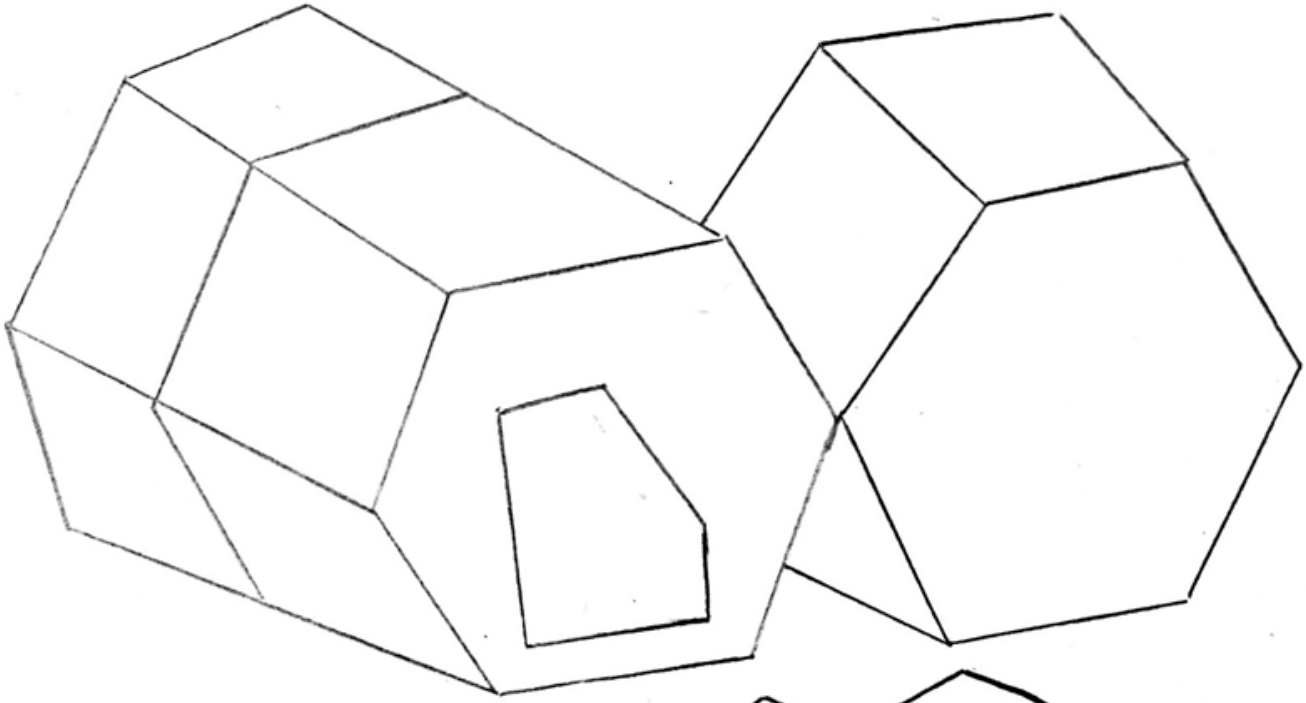
DESIGN PROCESS

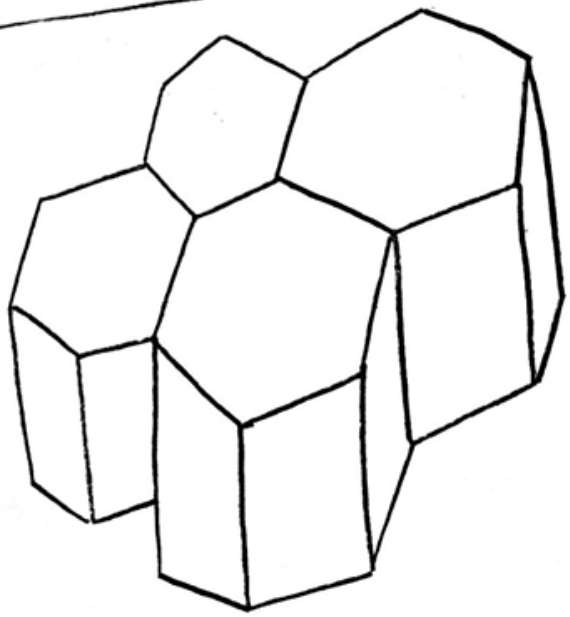
FOLDING DESIGN OF A HABITABLE SPACE

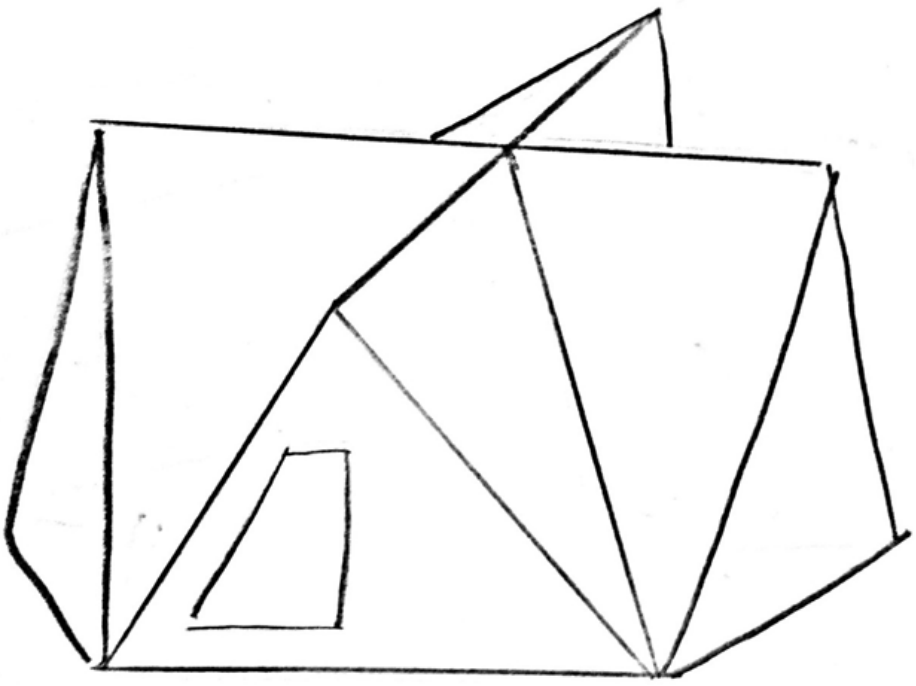
Once the information about the temporary houses has been collected and compared in order to define the state of art and after have known the design requirements that must be fulfilled with the purpose of develop that project, the creative process has to be developed.
In this point of the project, different ideas are generated at the sketch level until a final design is reached. So, from the beginning, it is sketched taking into account the design requirements mentioned above, creating different shapes and functionalities.

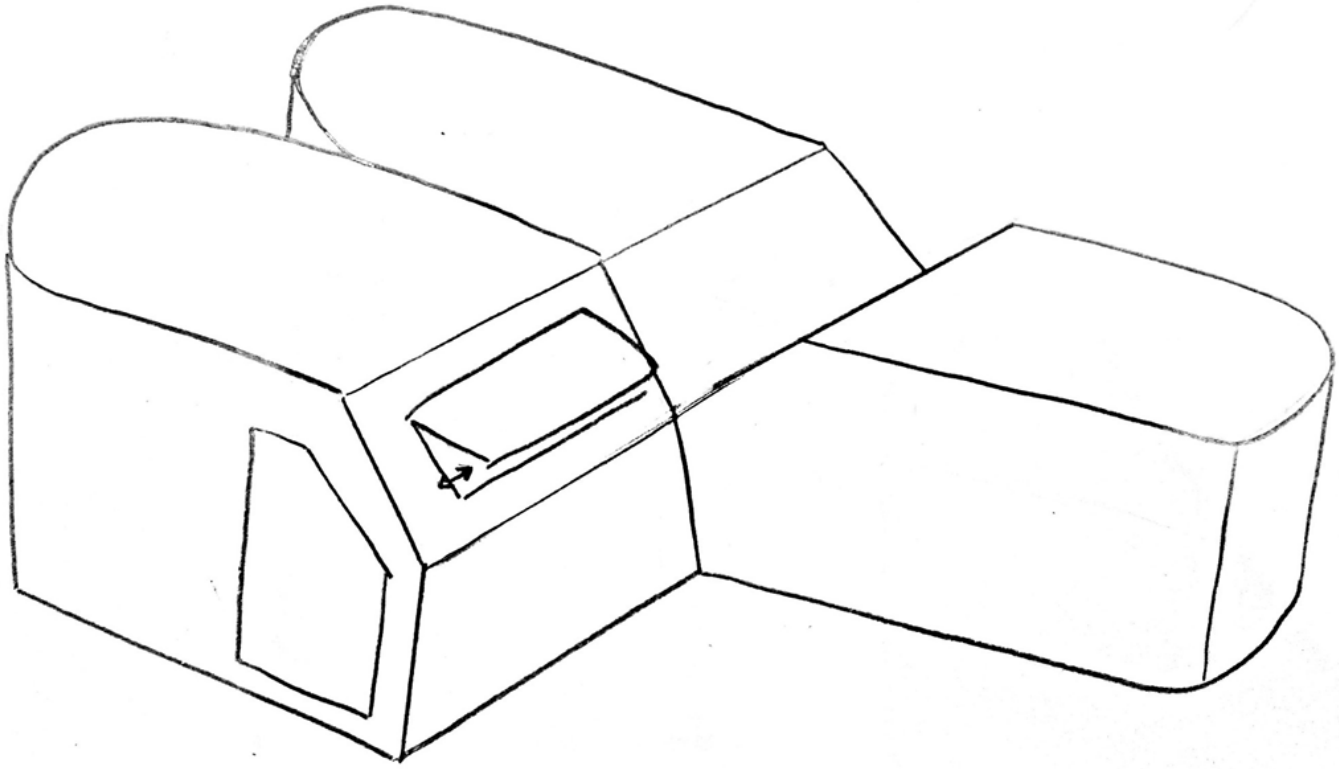
At this moment, the design creative process is carried on until reaching the desired shape of the product. It should be noted that in this process, the art of origami has had a great importance for the development of the final folding solution.
The first ideas sketched were focused on some of the requirements mentioned previously. As can be seen, the first shelters have been designed to be modular and using, at the same time, the technique of origami.

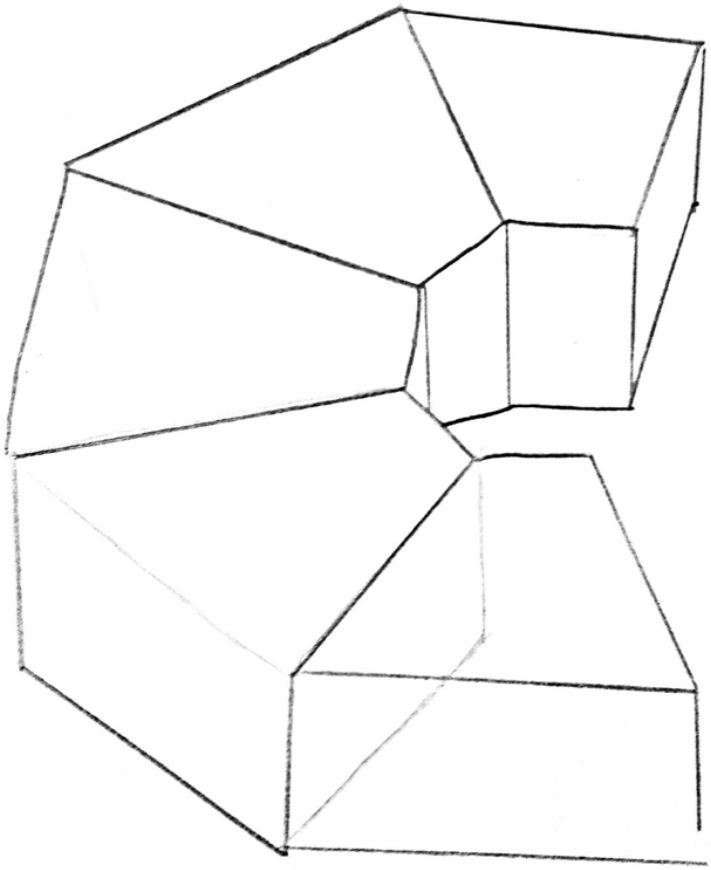


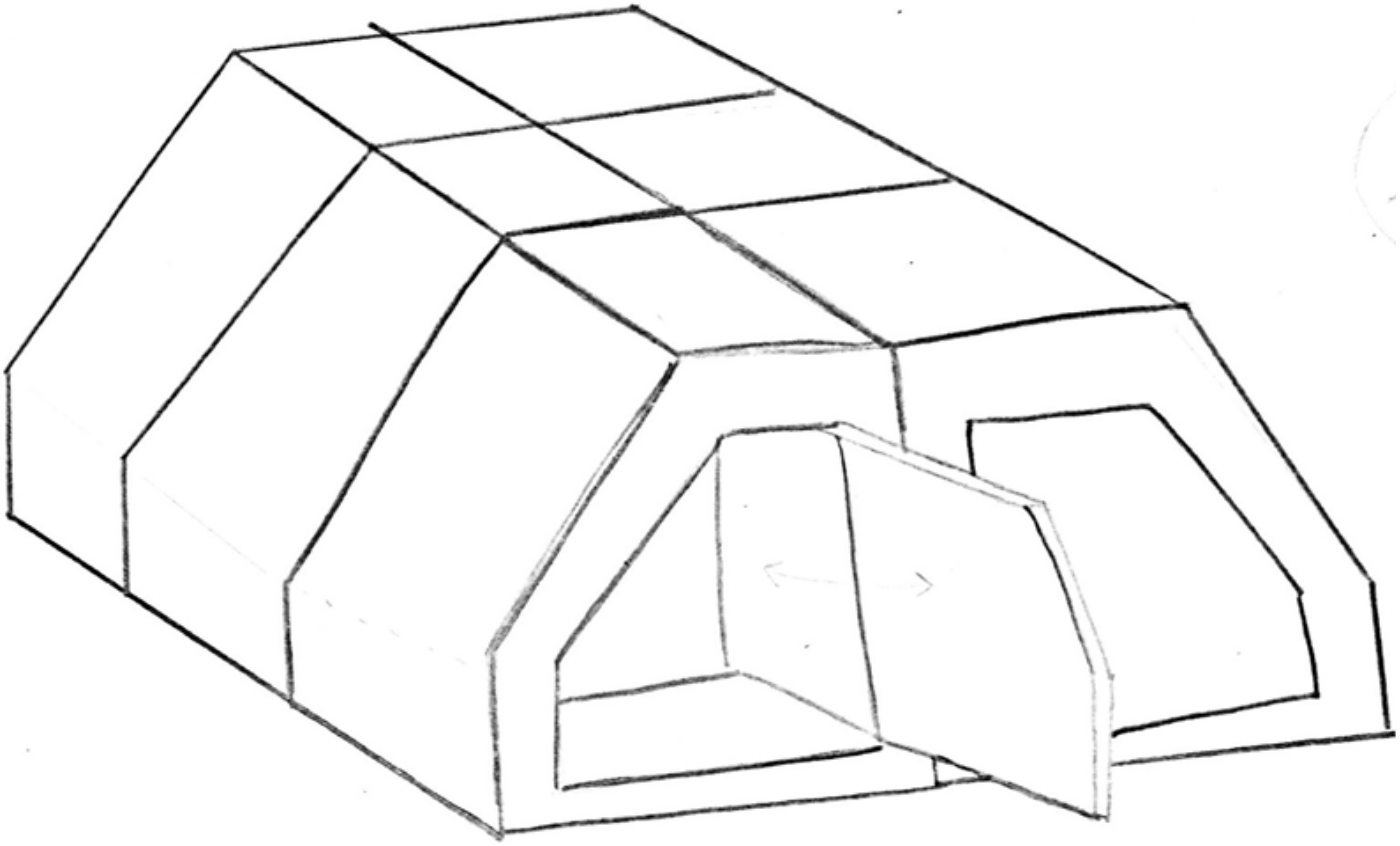


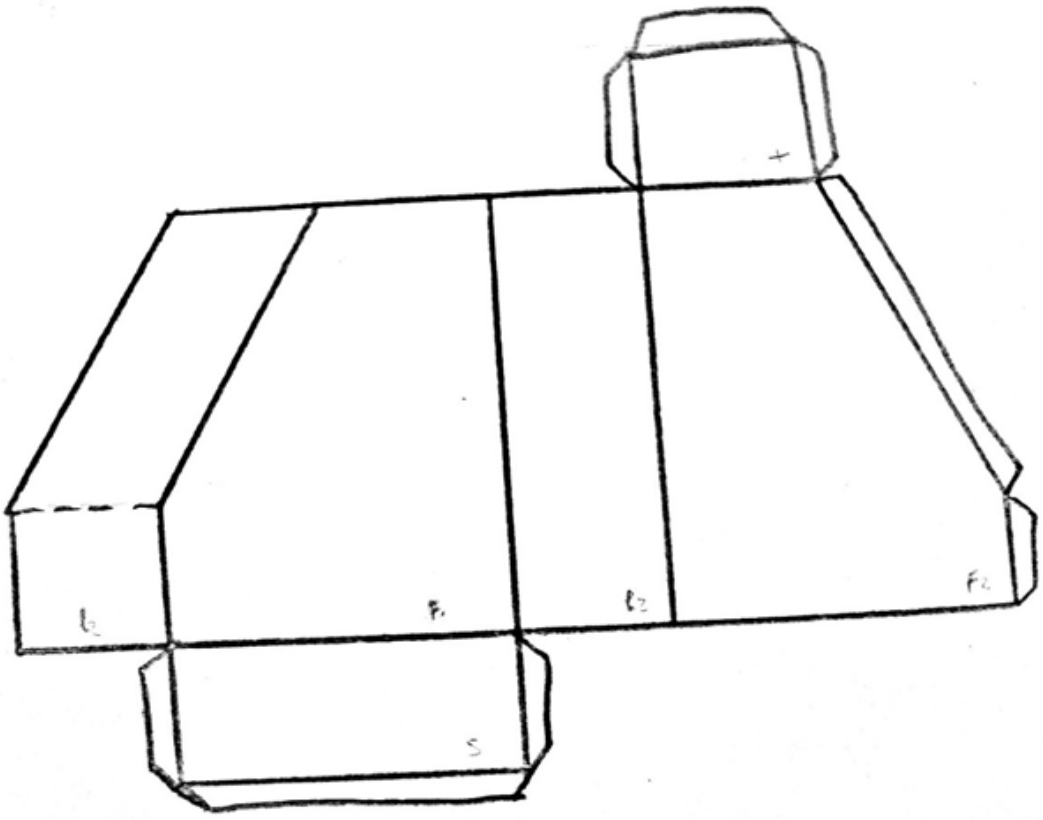


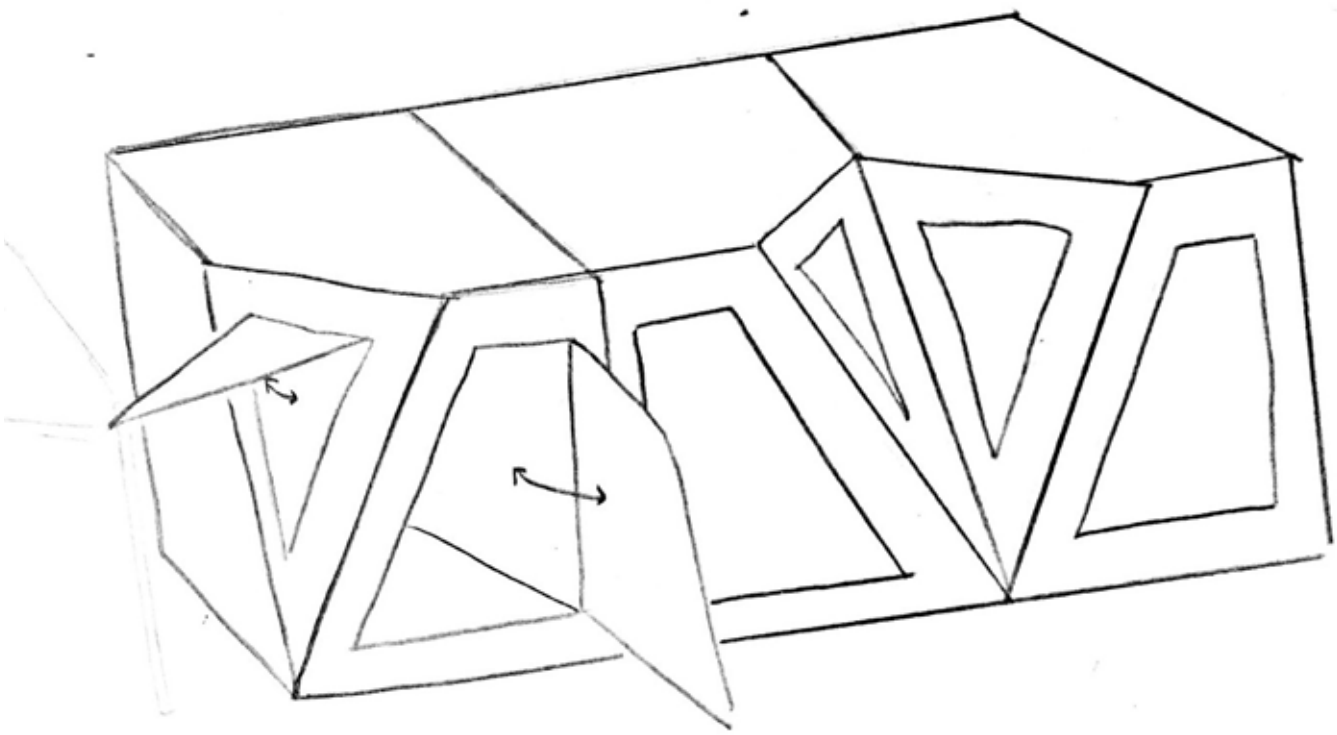


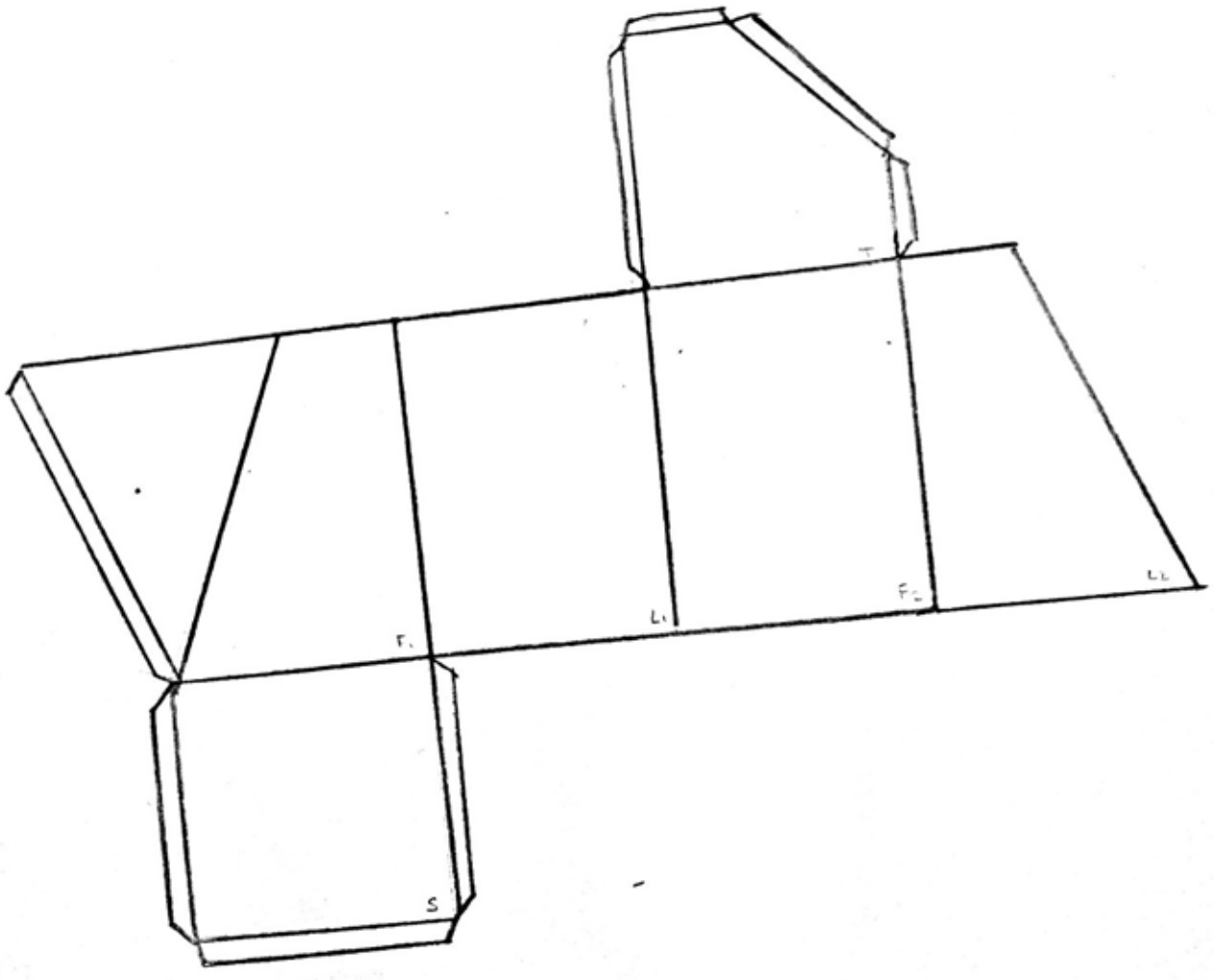


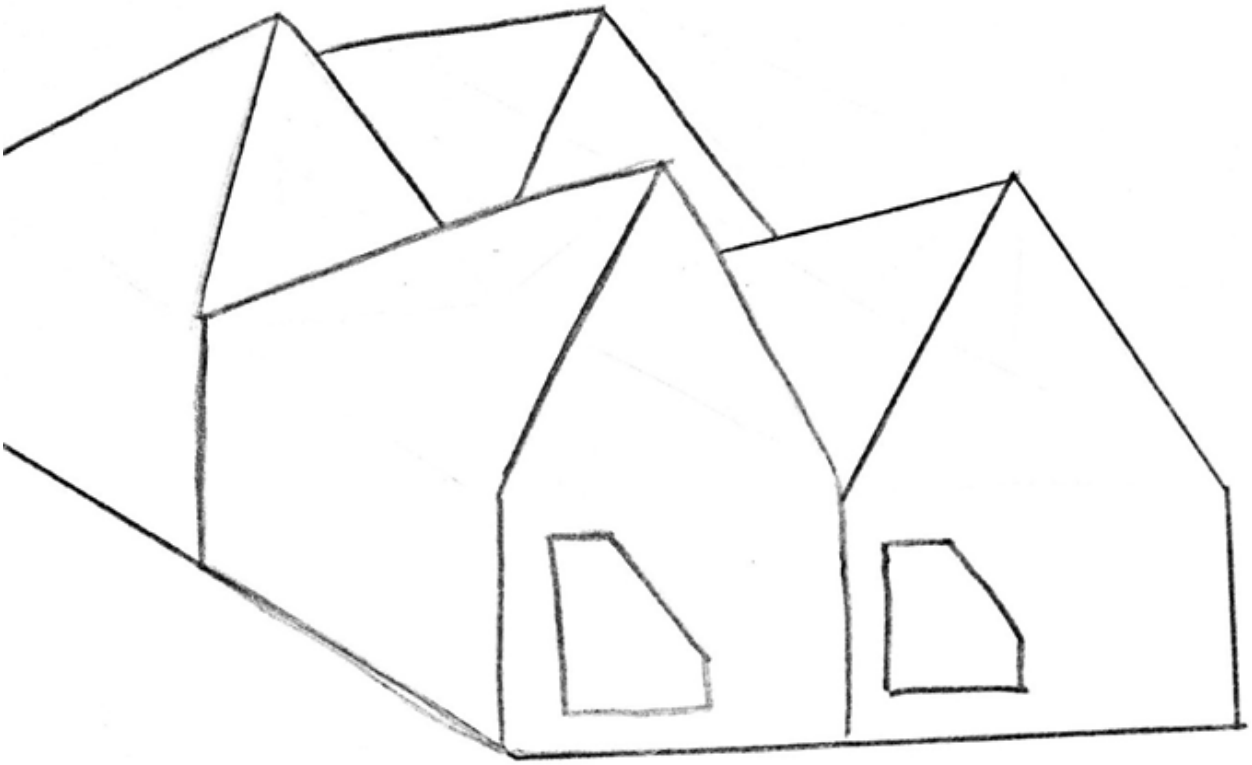


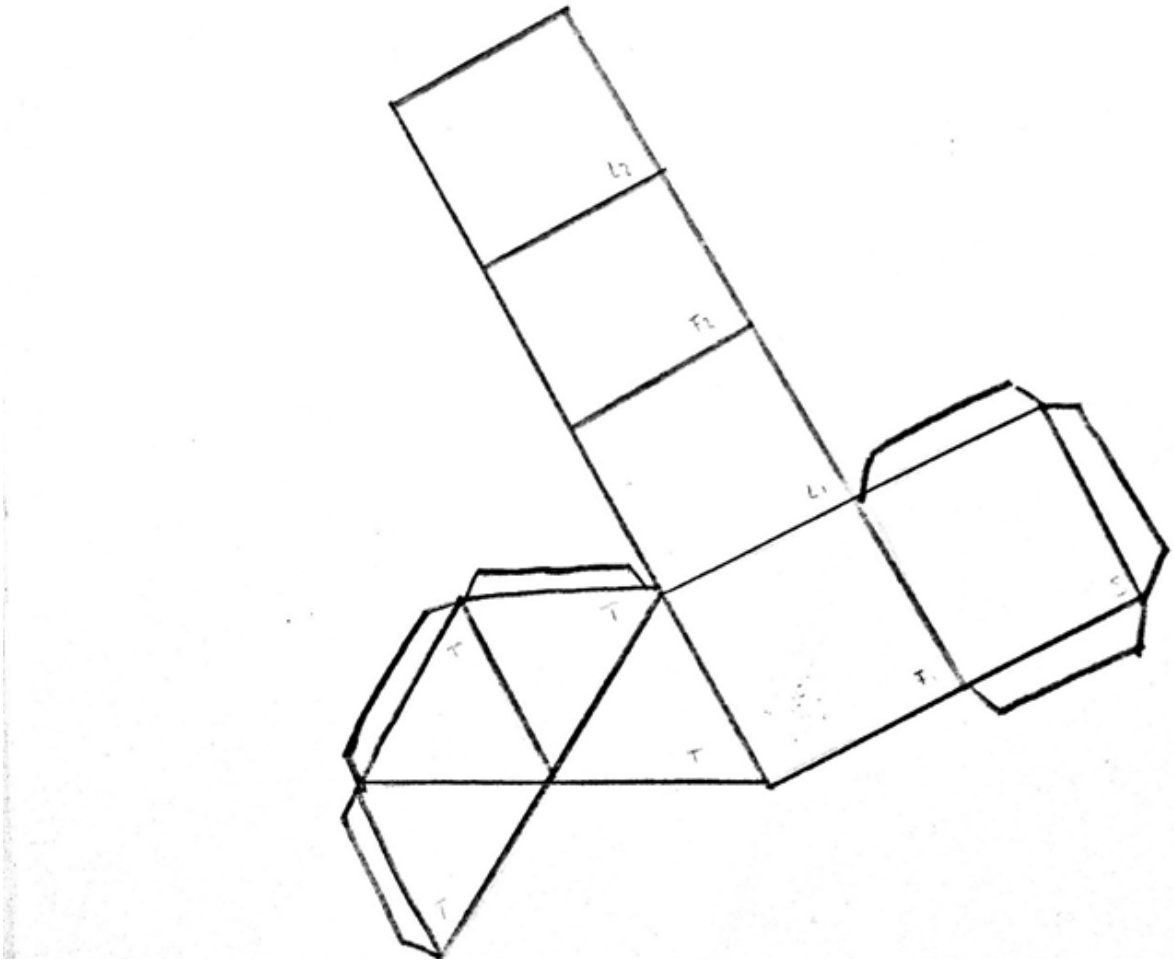



b2
F1
b2
F2
S




F1
L1
F2
L2
S




L1
F1
L1
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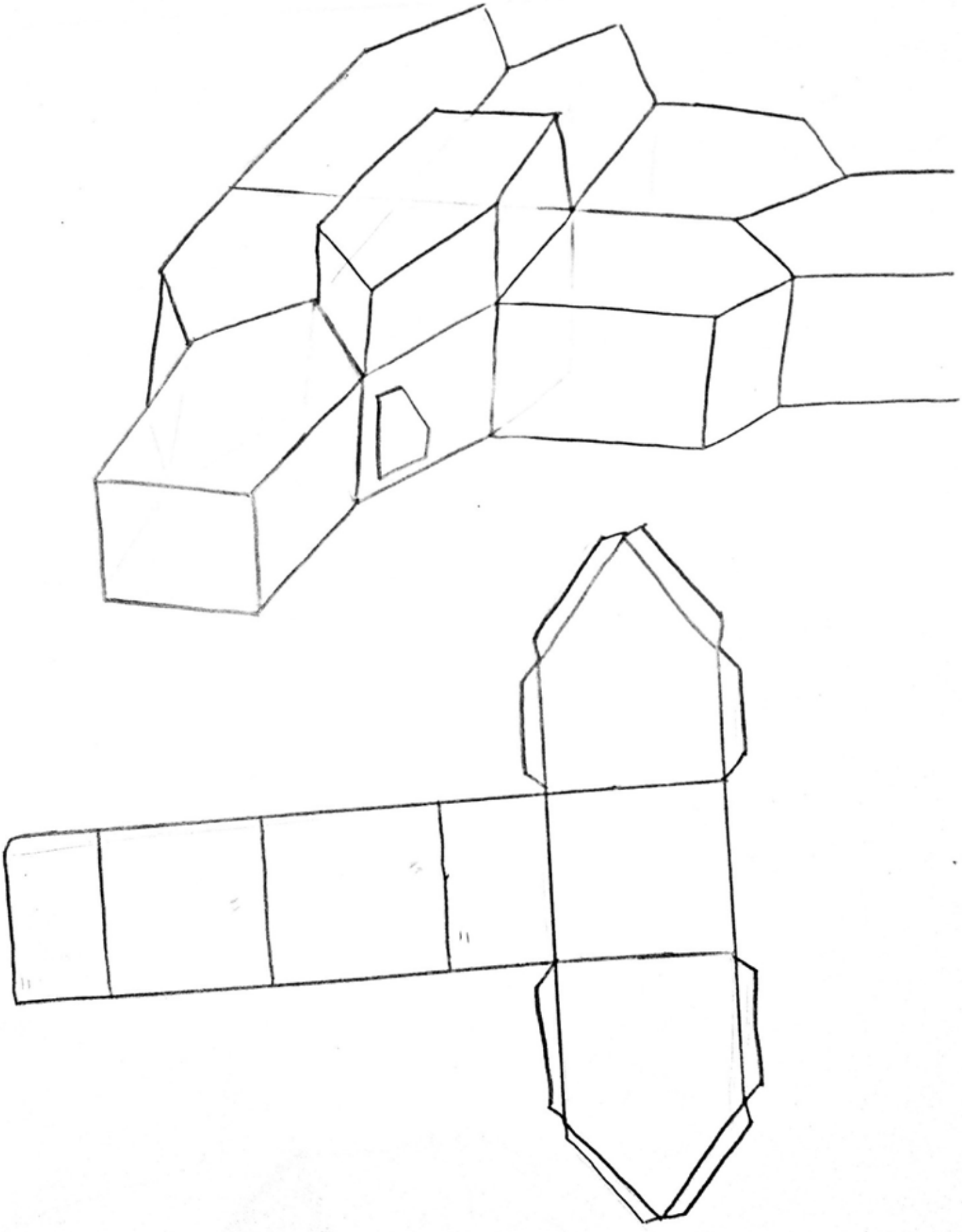
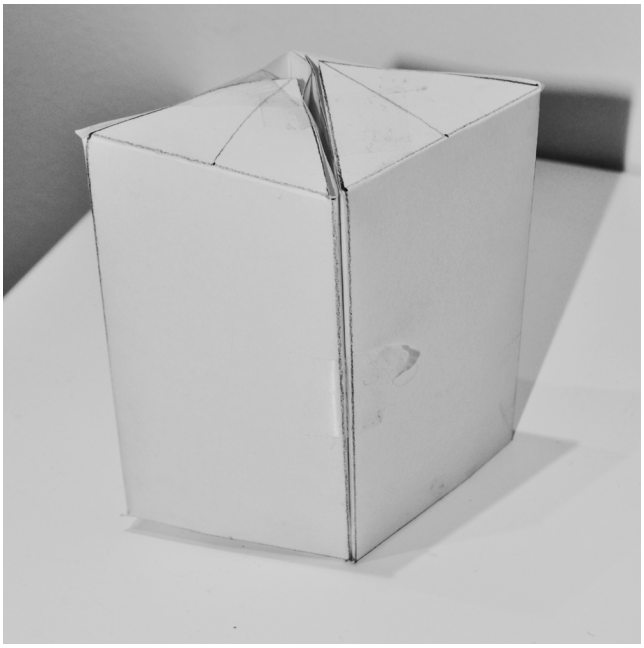
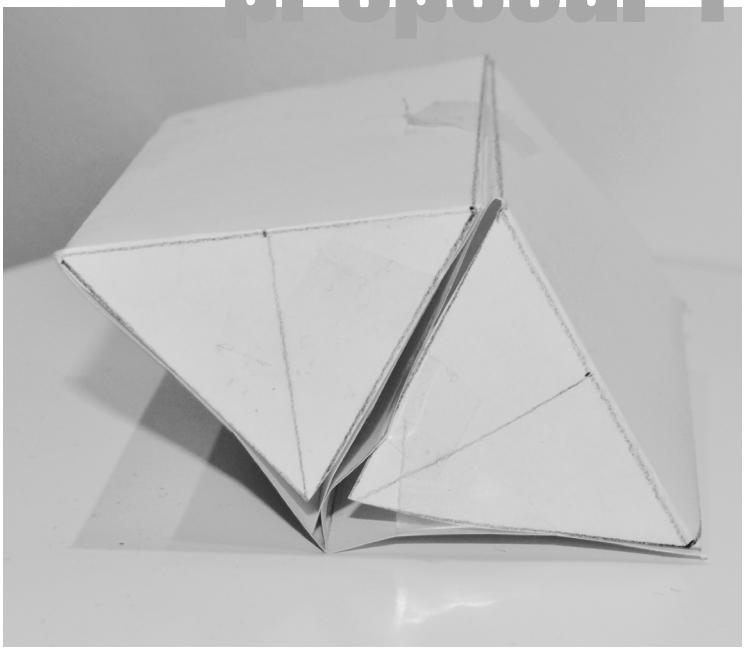
T

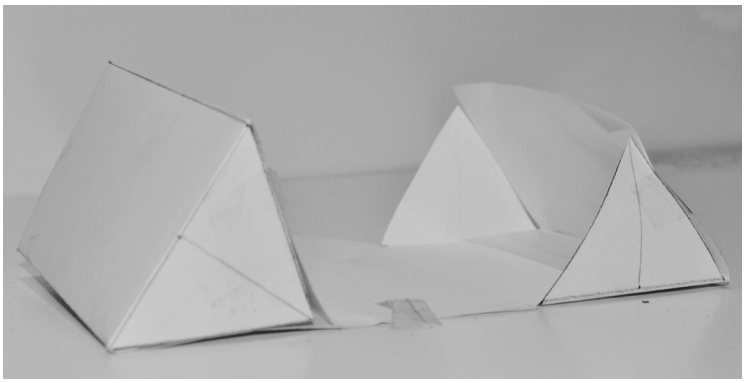


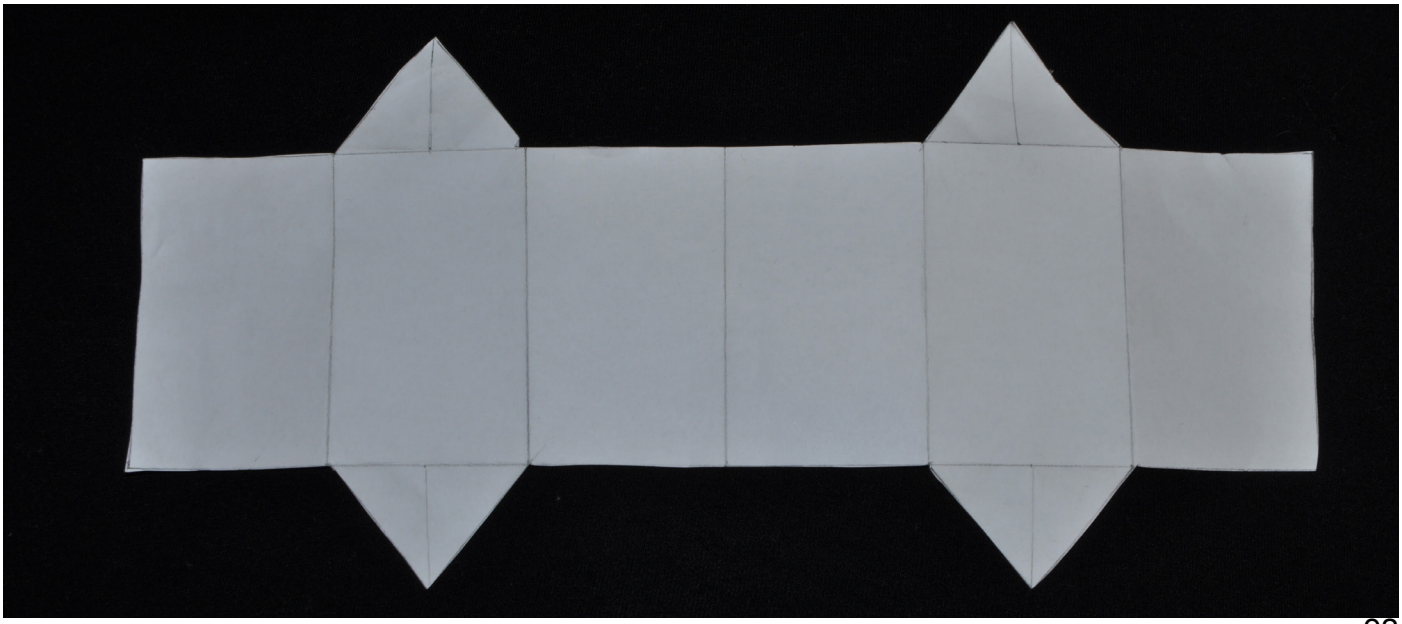
After having sketched the previous ideas, a more precise phase of the creative process began in which the product becomes more concrete. This new phase leads on to the development of small models in order to decide the best method of construction and also in order to better visualise the selection solution. In the following designs, it is possible to see a transformation of a sheet of paper in different shapes and sizes, but which always starts from an initial geometric base.
In the following images the first adopted shapes and their development are shown.

proposal 1

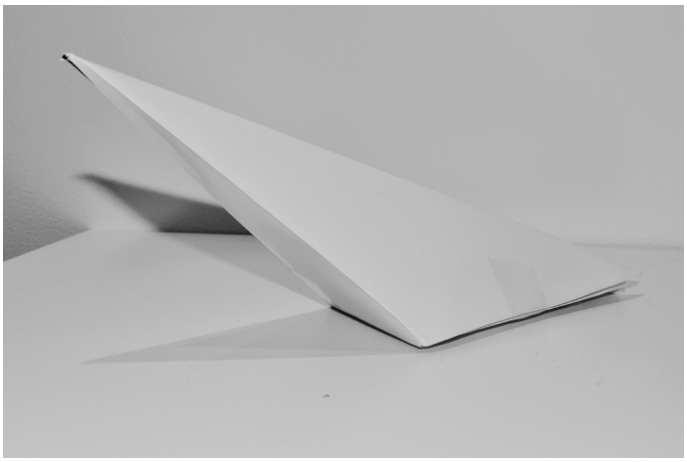


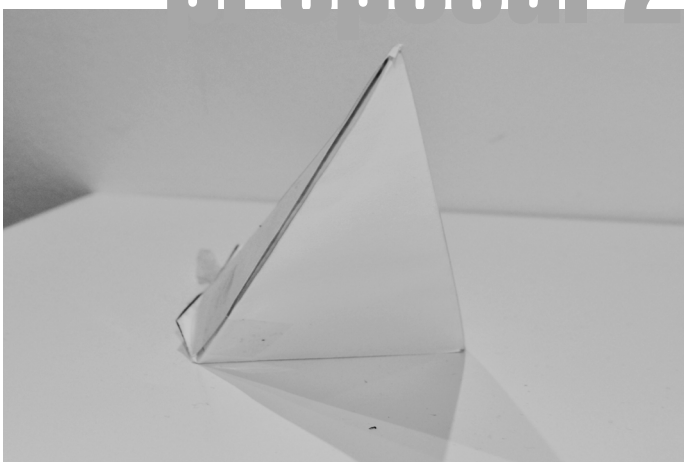


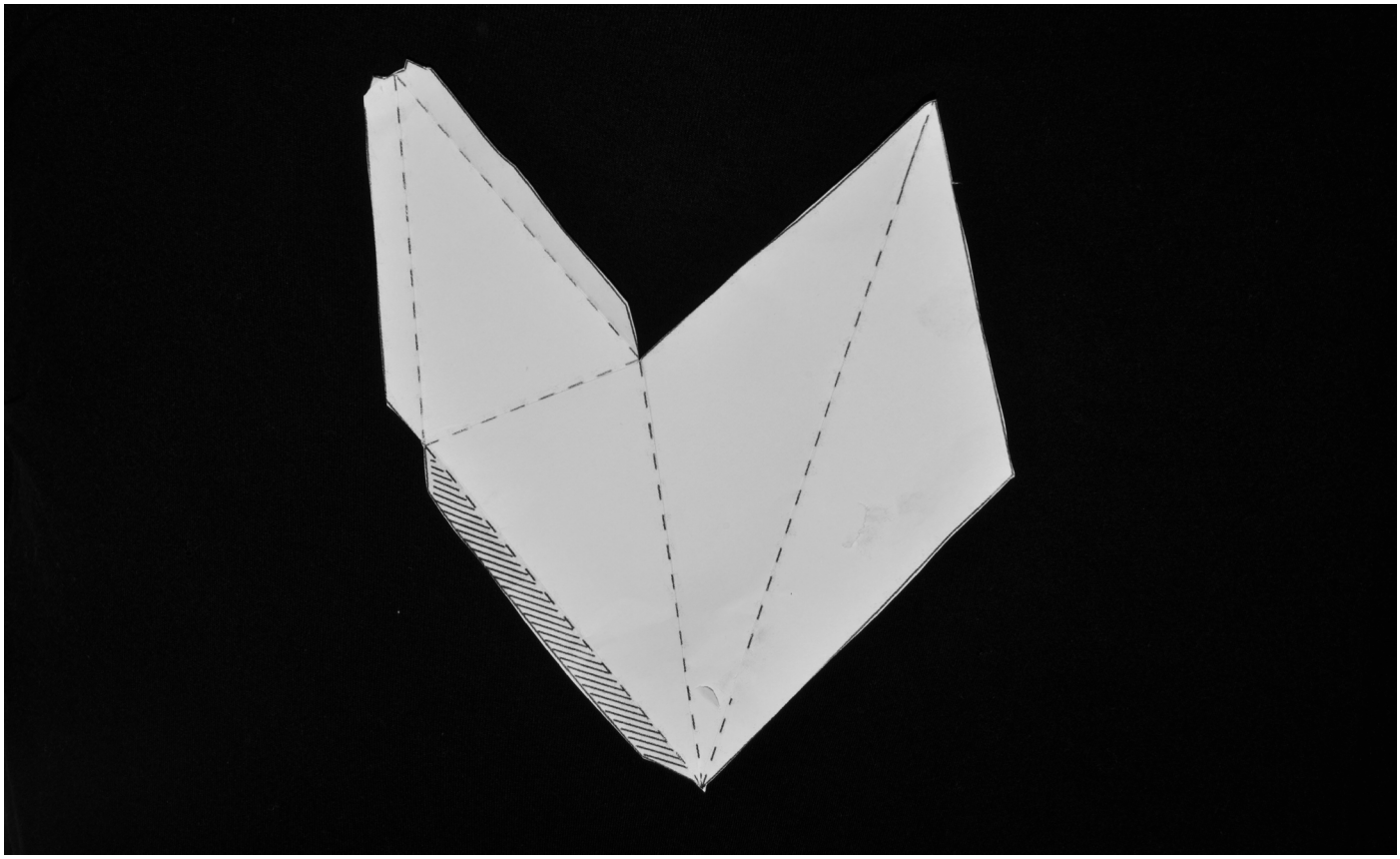




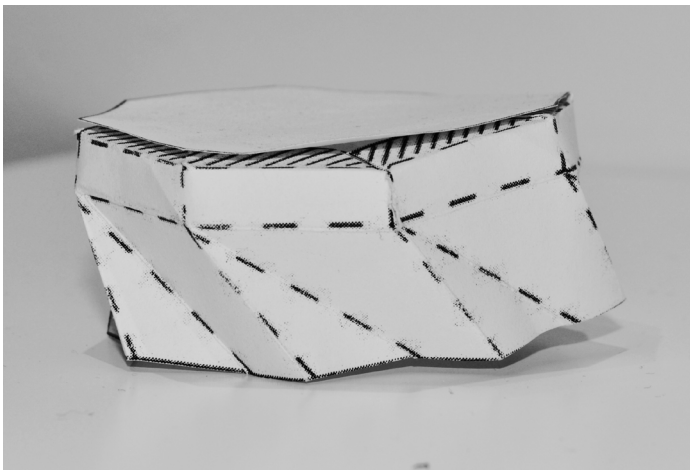
proposal 2

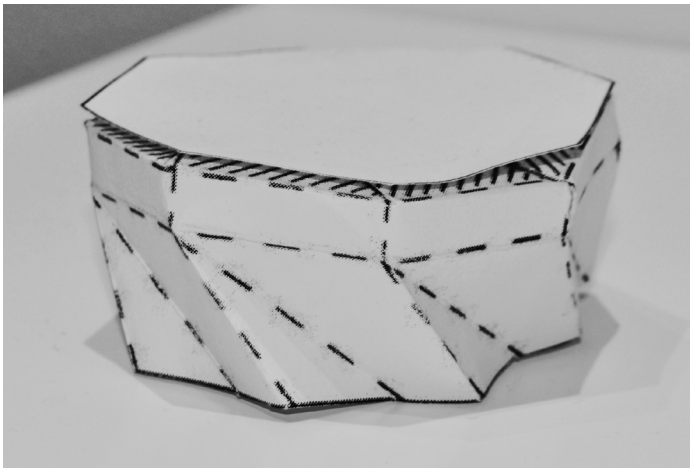


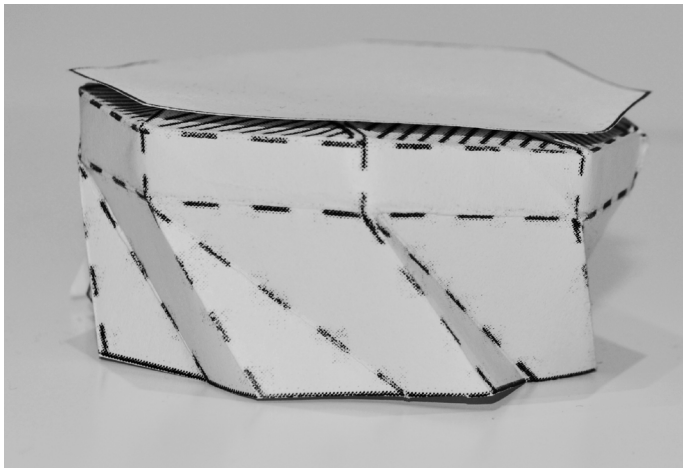


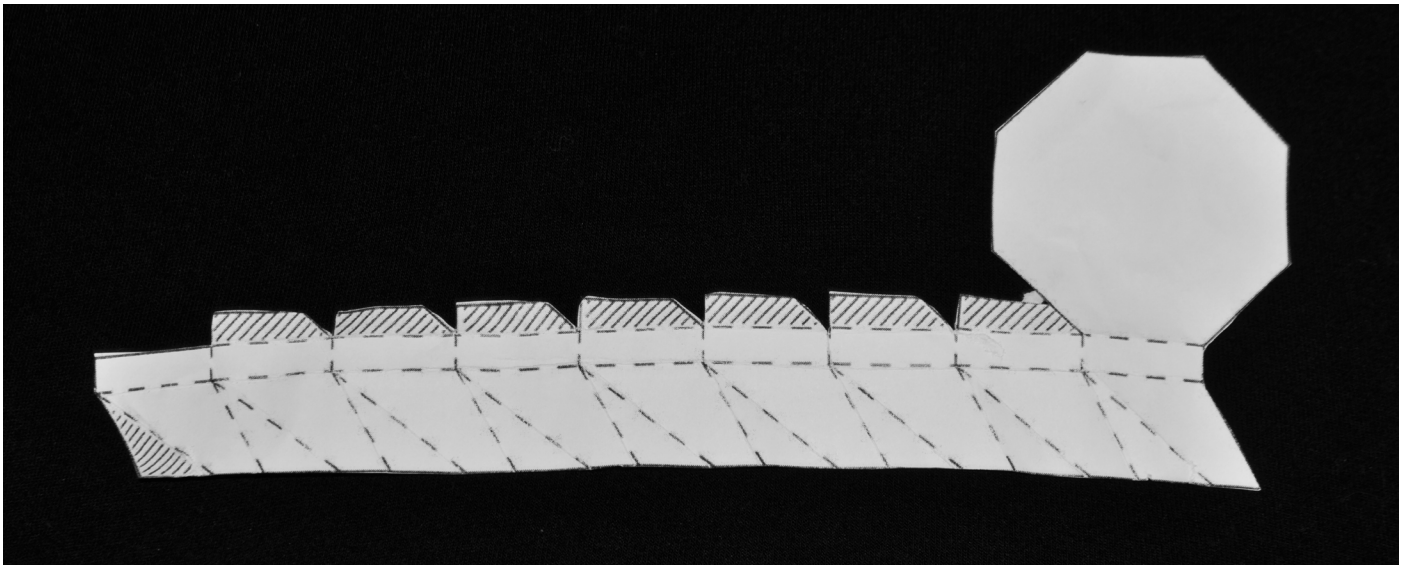


proposal 3

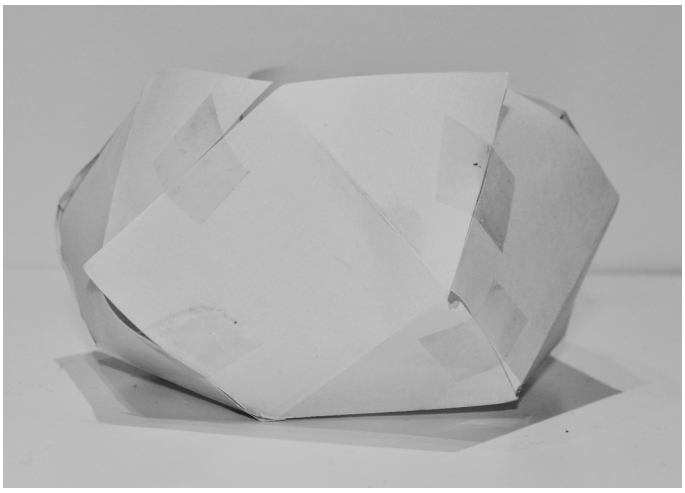


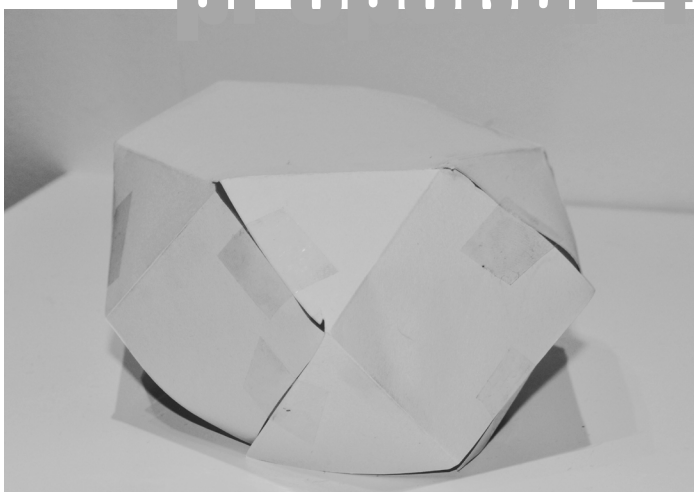


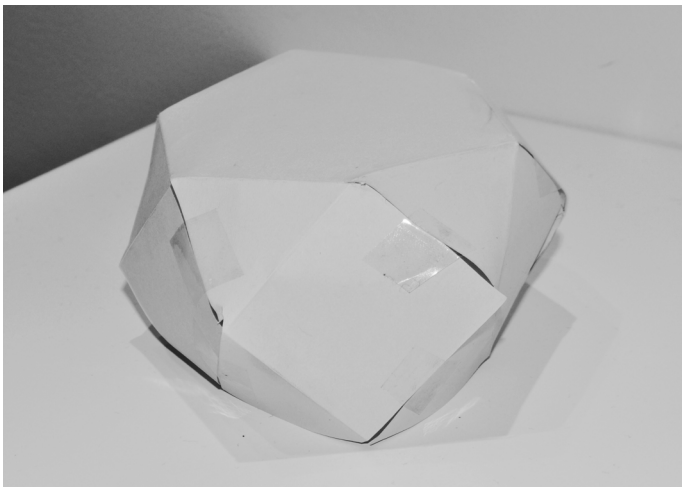


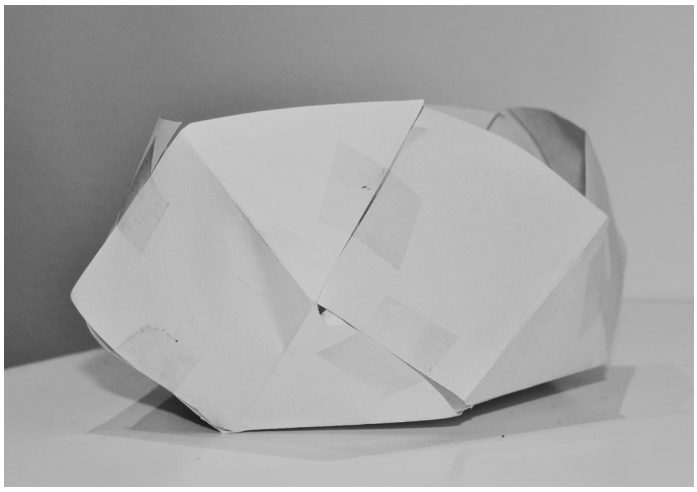


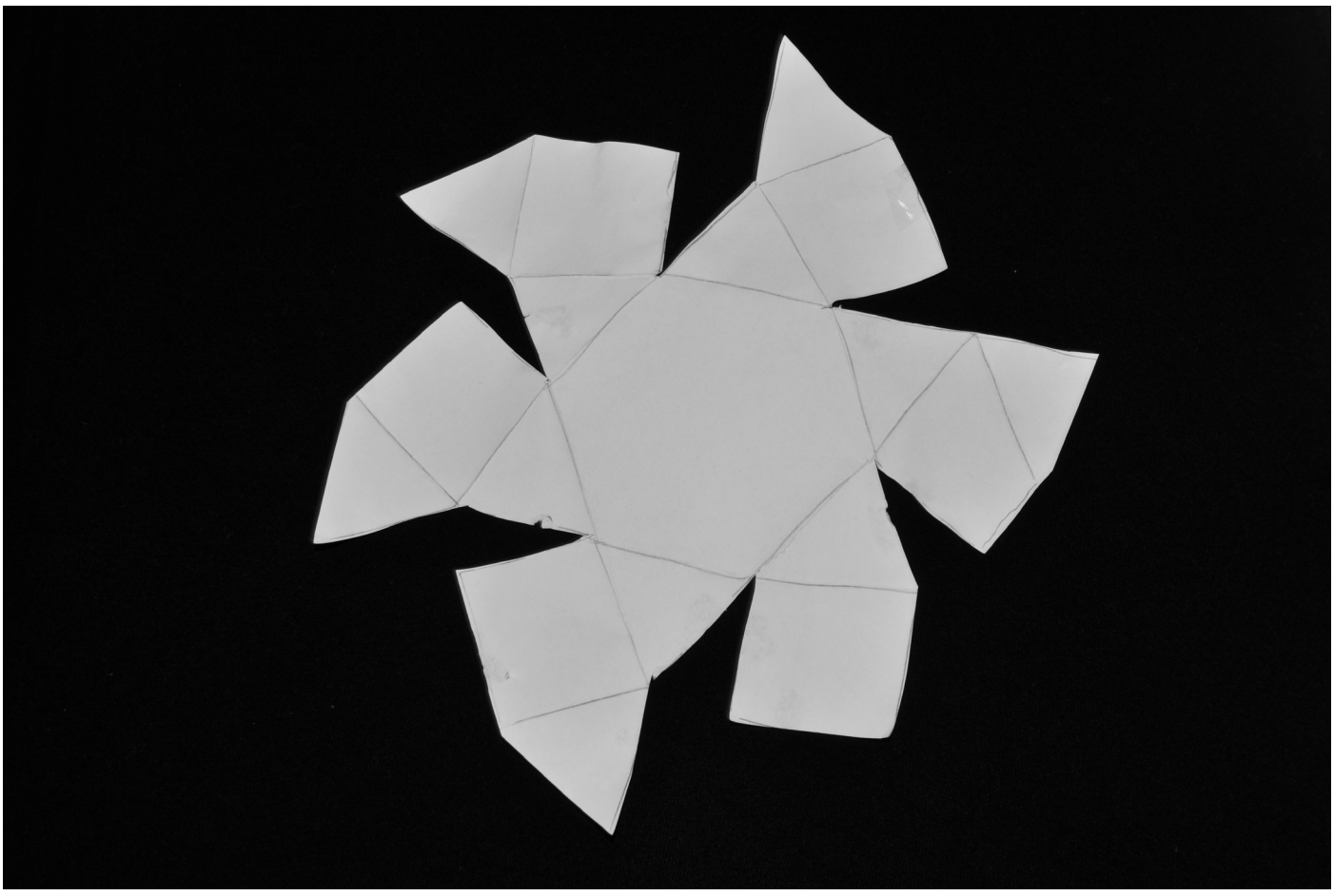
proposal 4



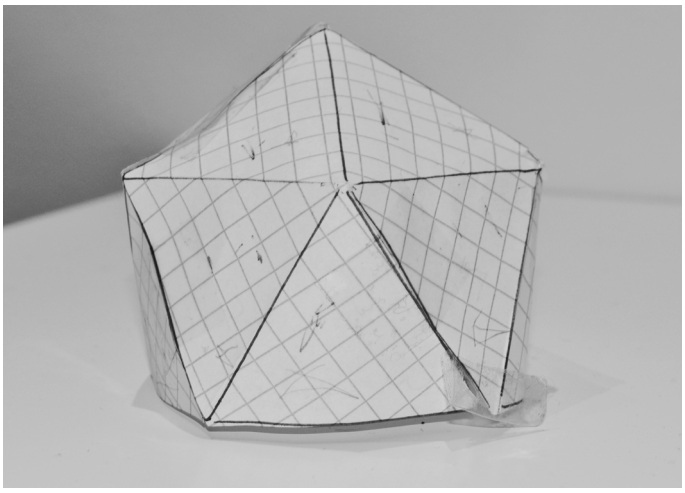


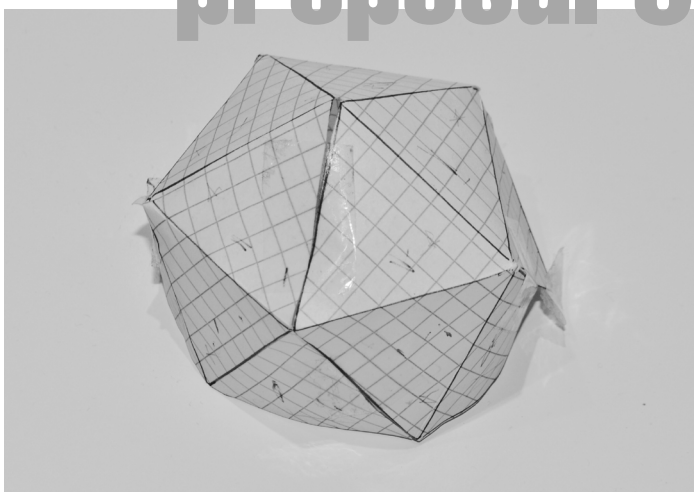


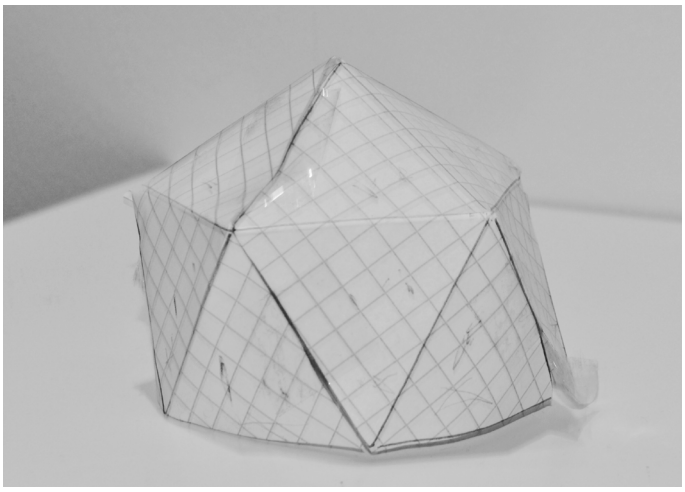


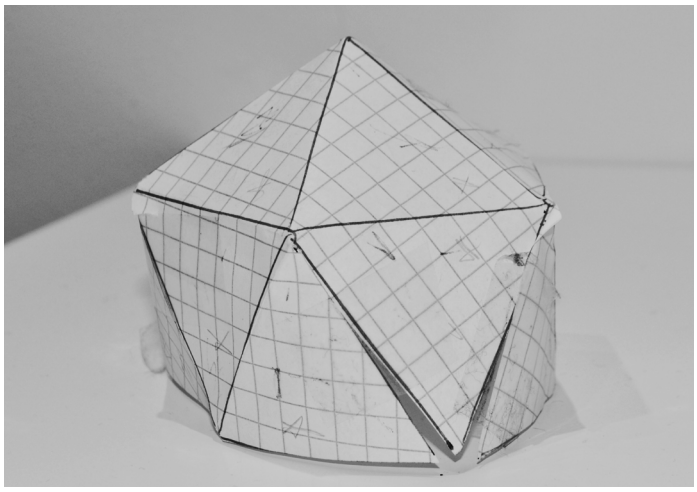


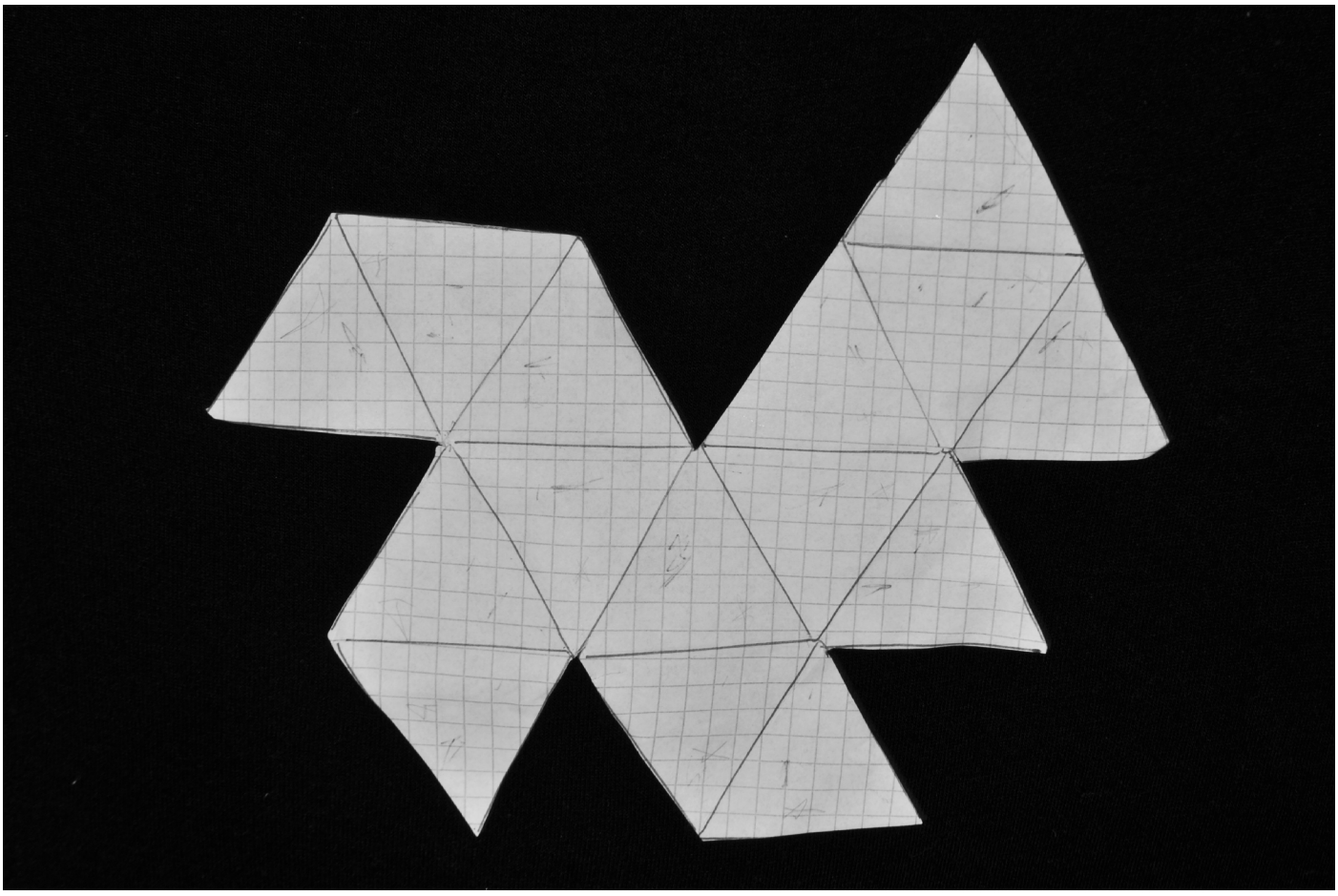
proposal 5



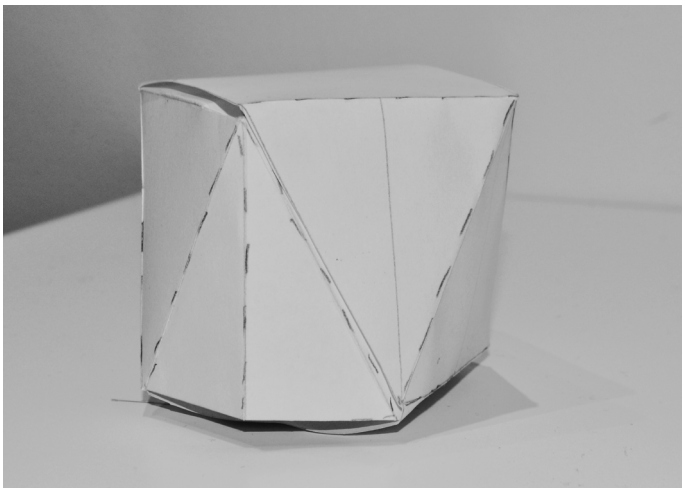


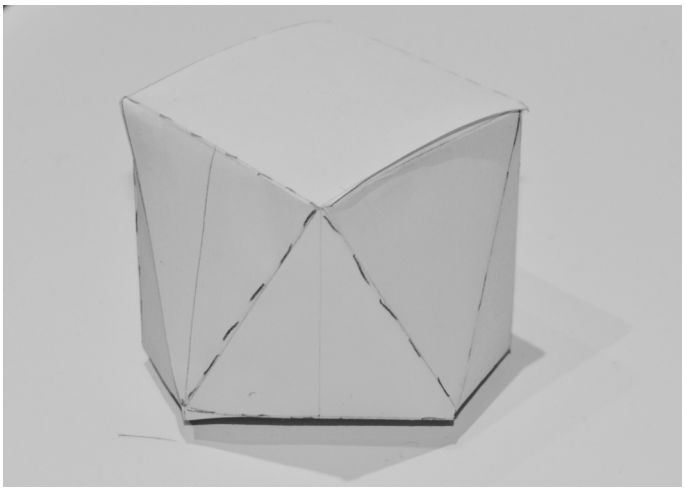


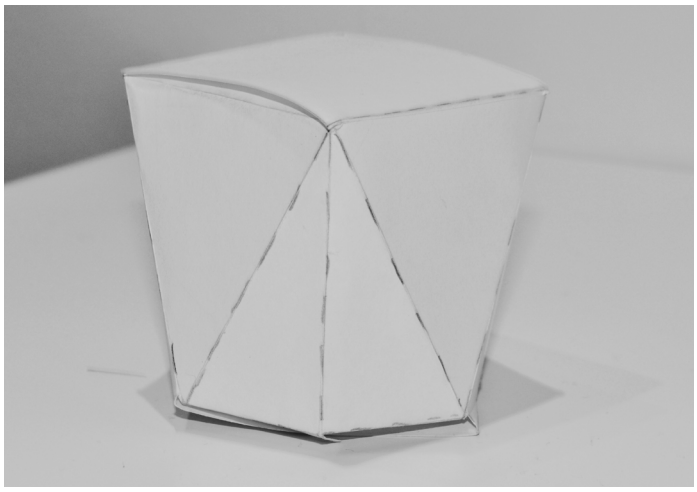


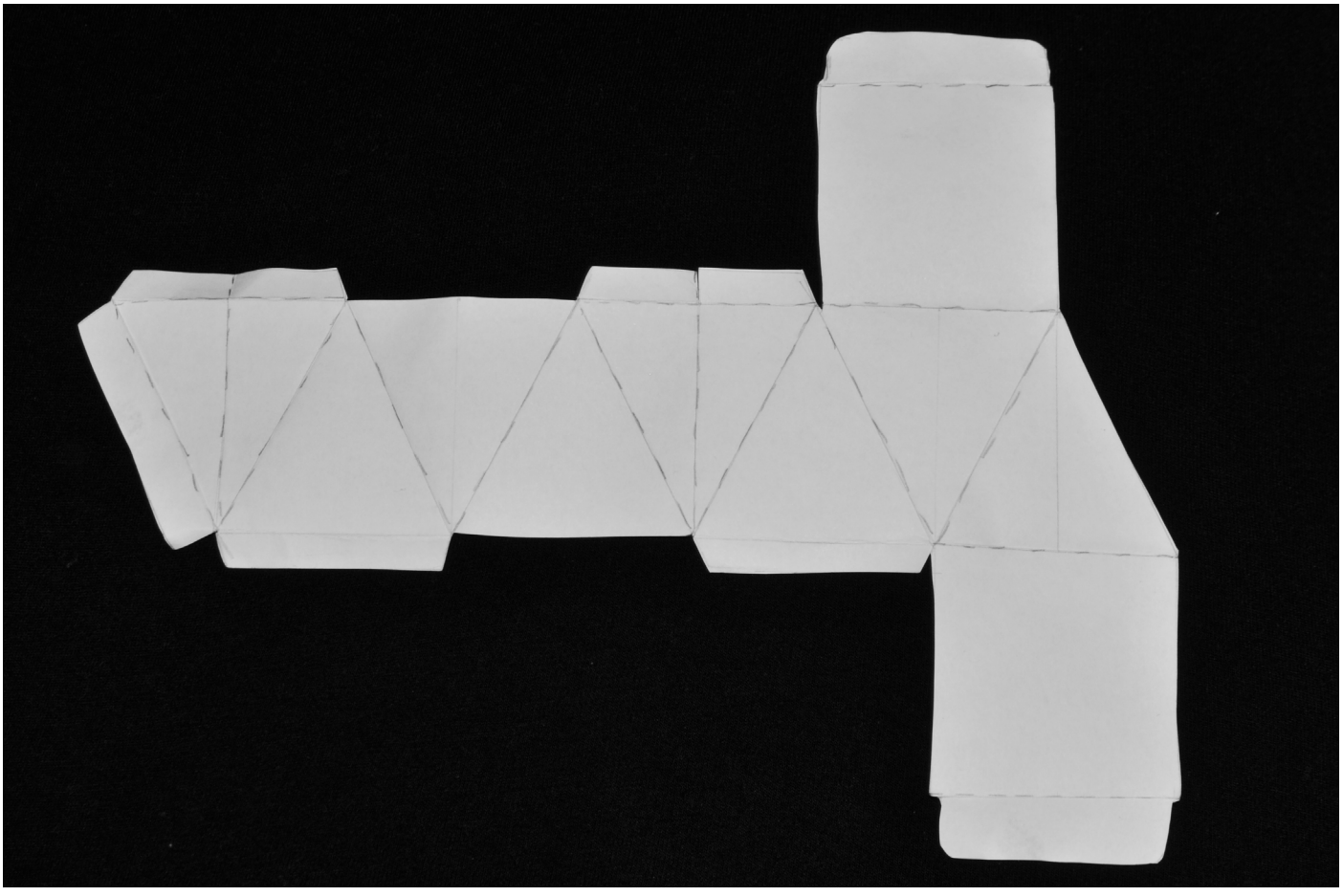


proposal 6

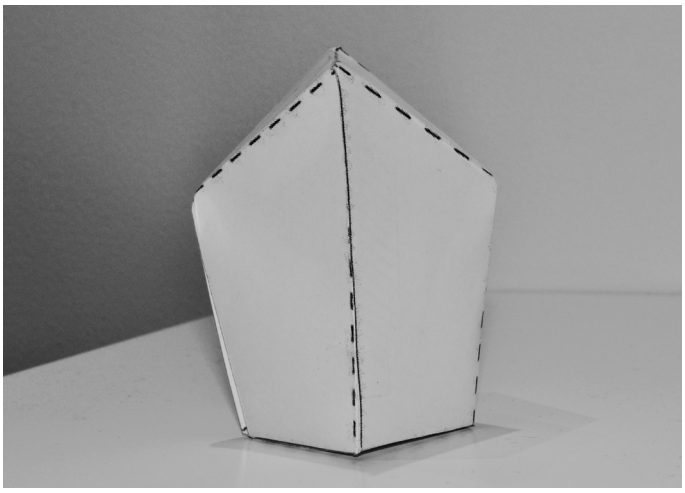


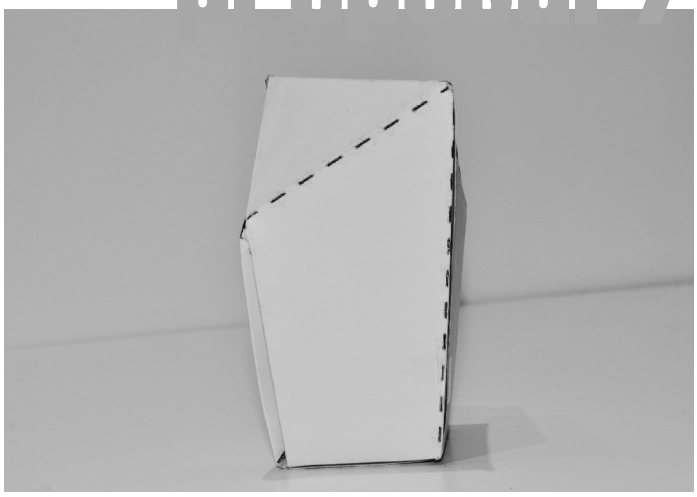


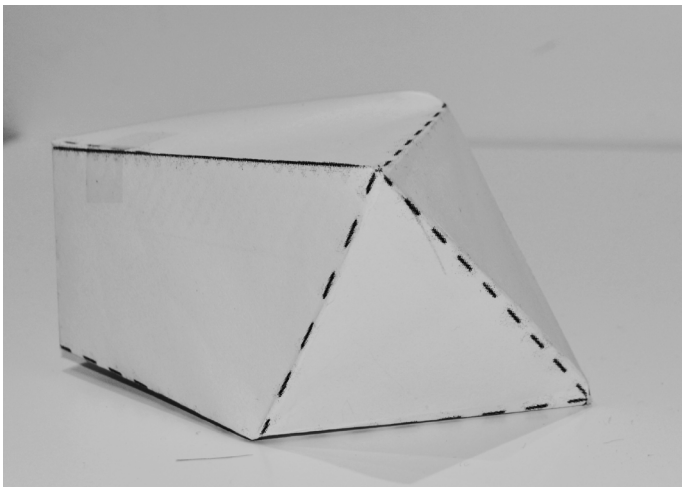


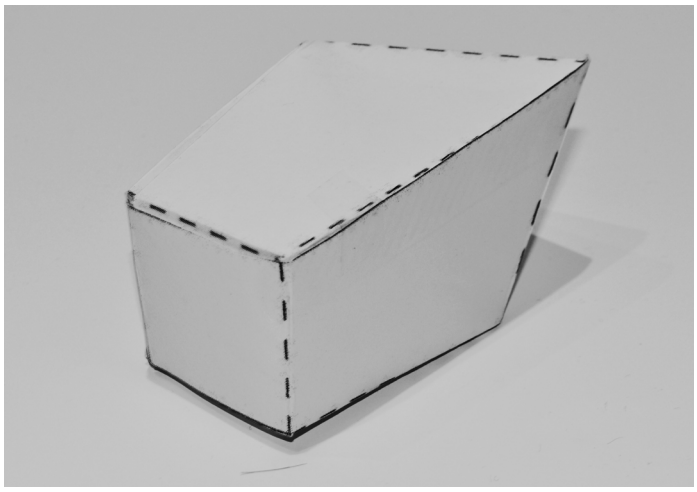


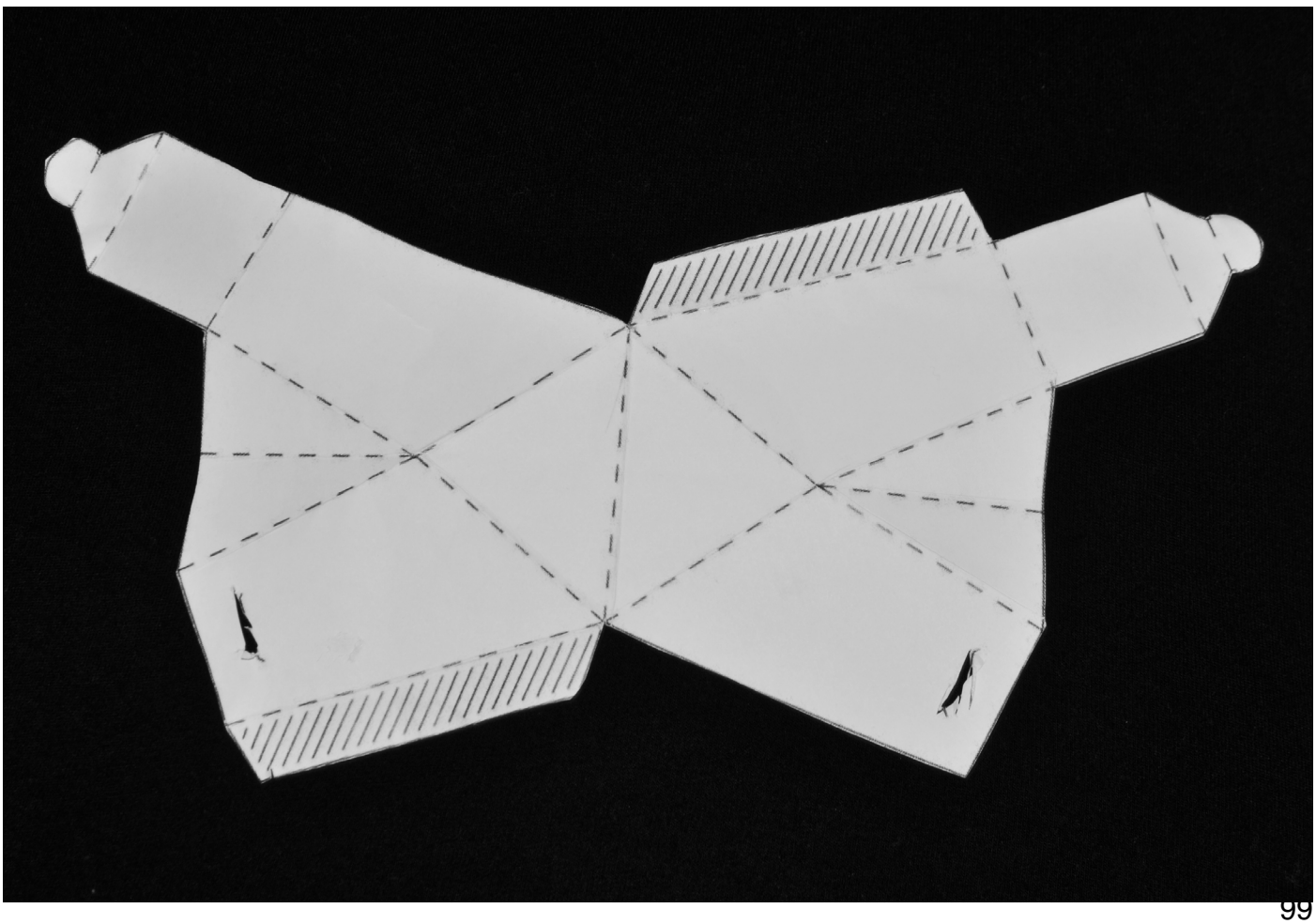
proposal 7



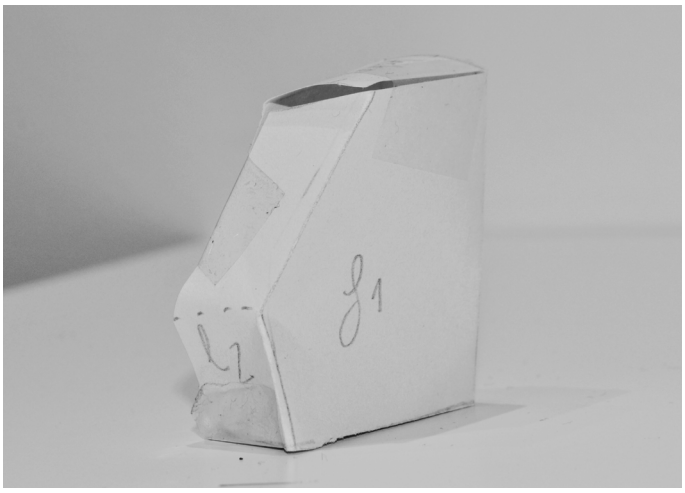


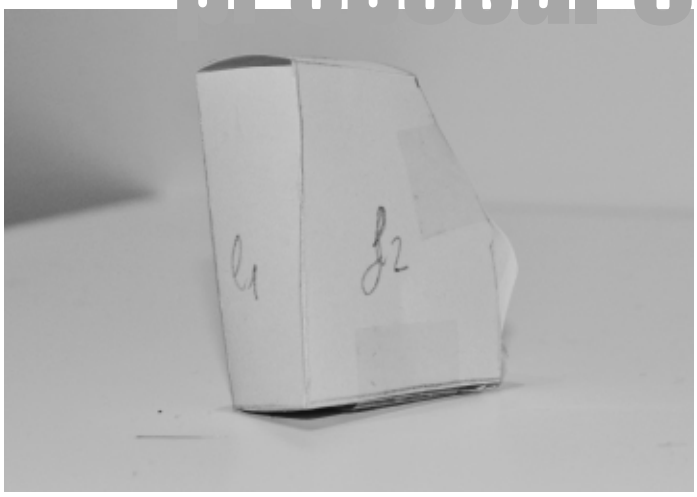


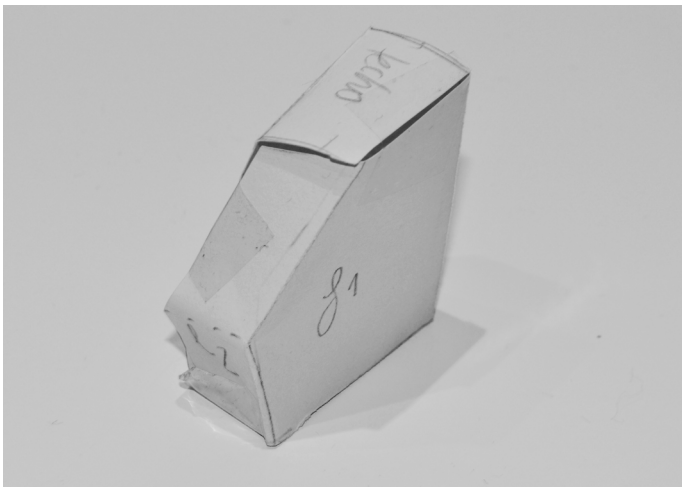


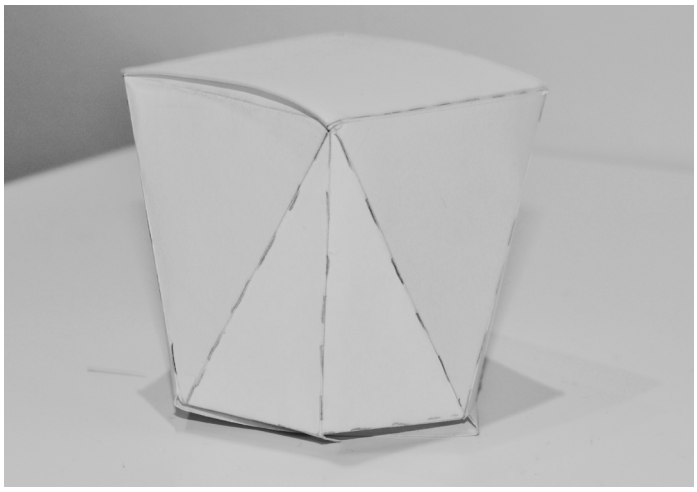


propopsal 8

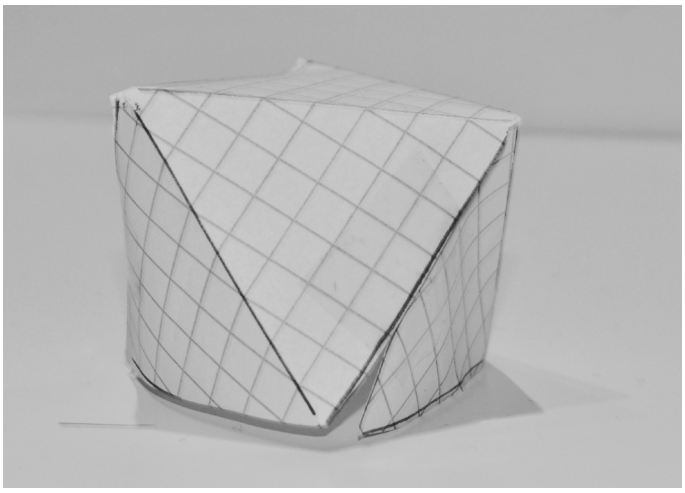


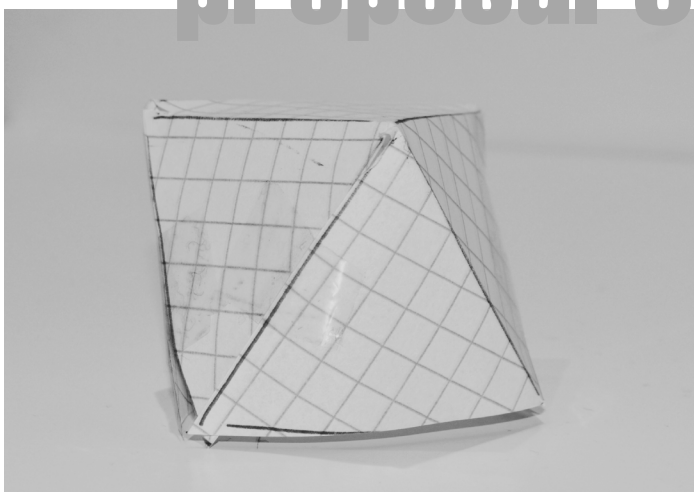


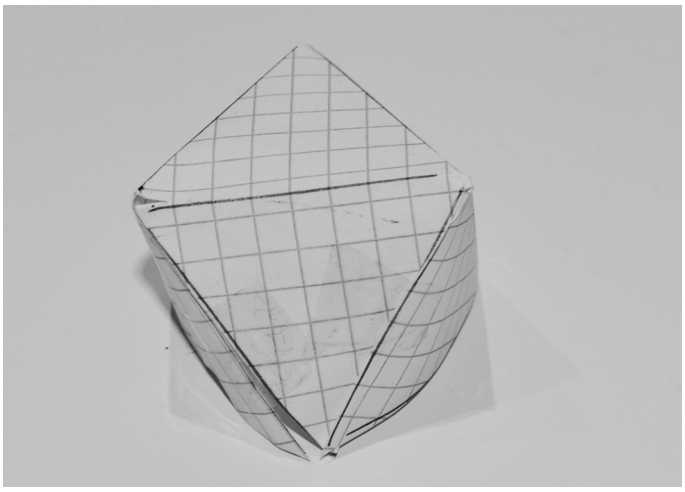


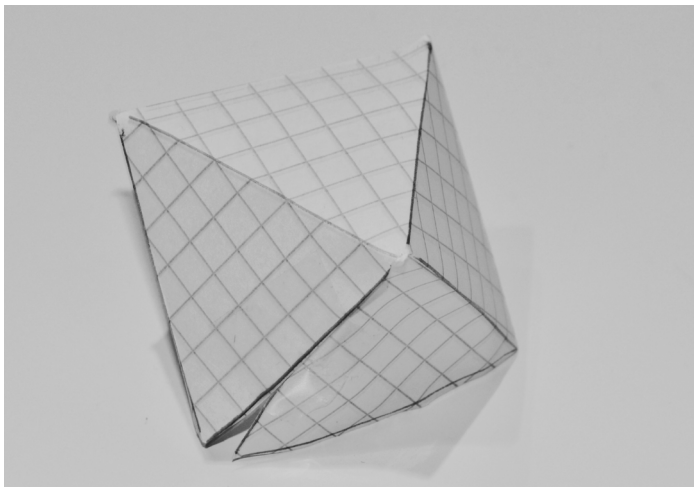


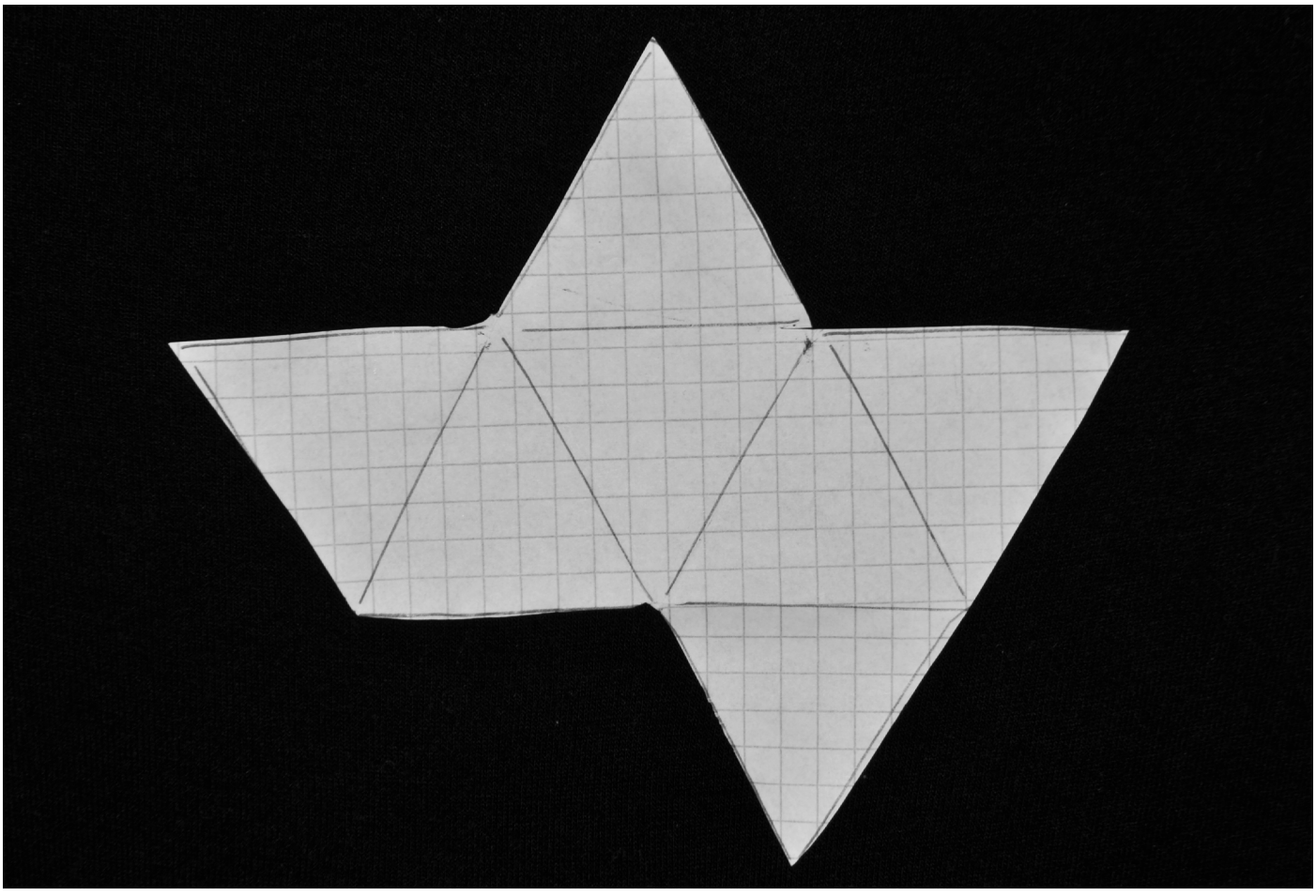
proposal 9



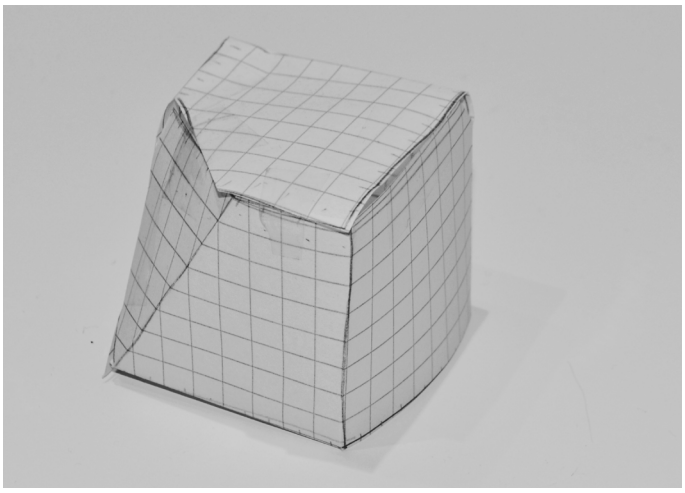


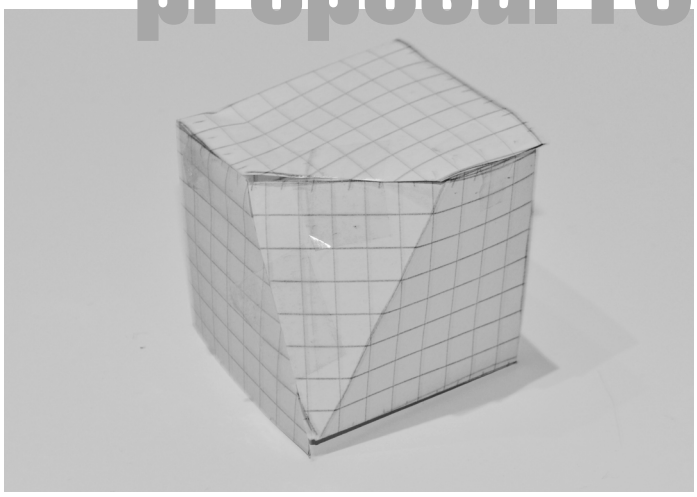


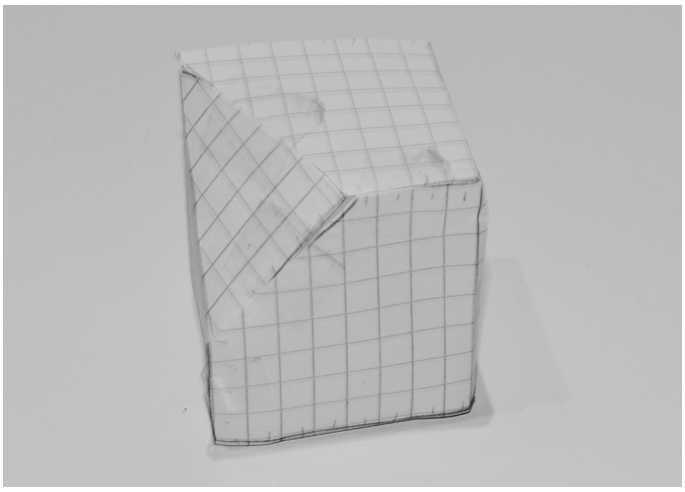


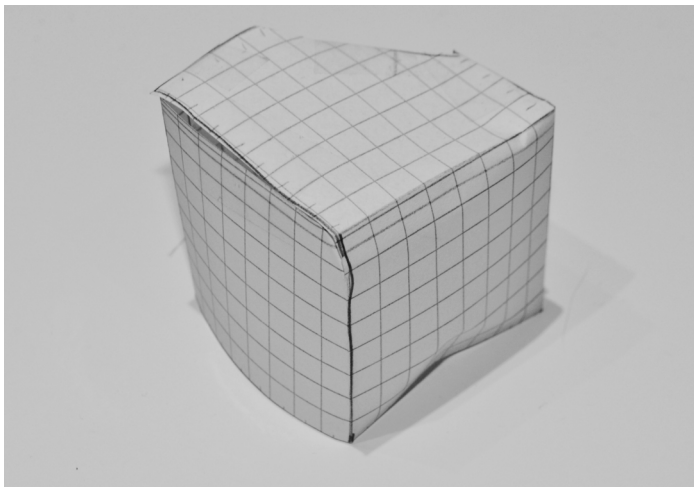


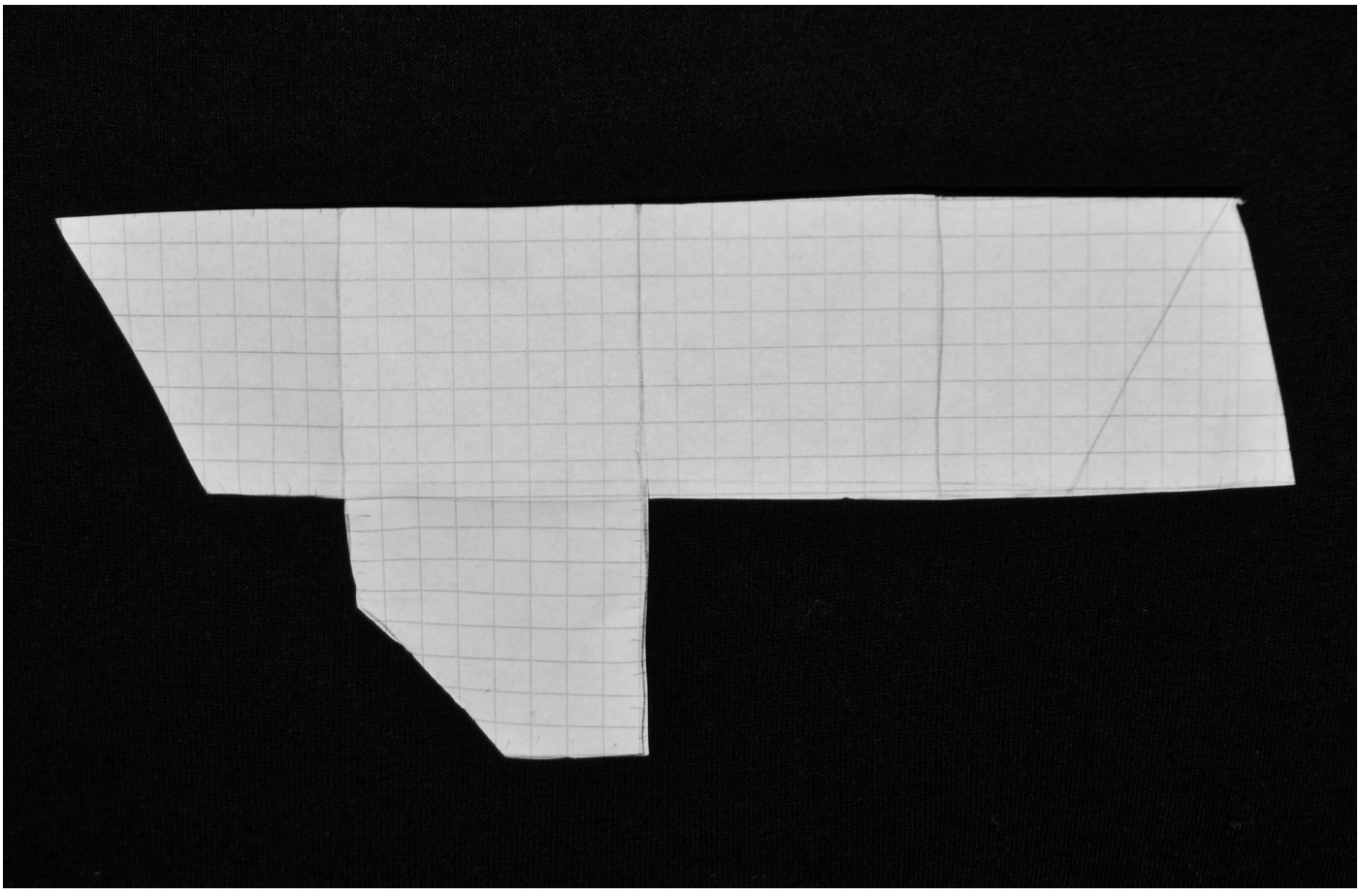
proposal 10



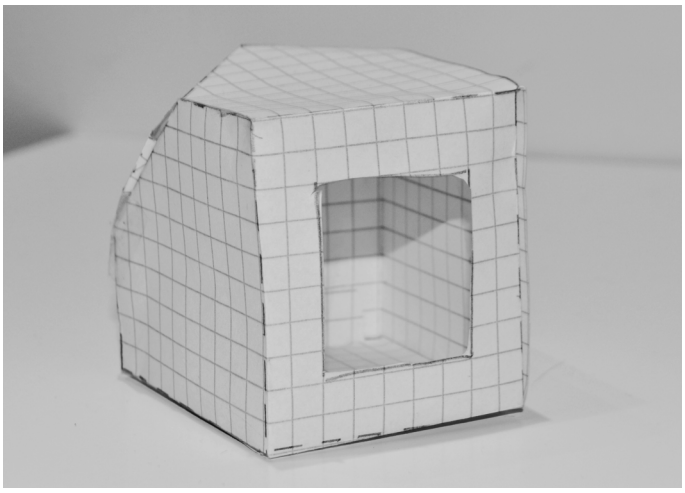


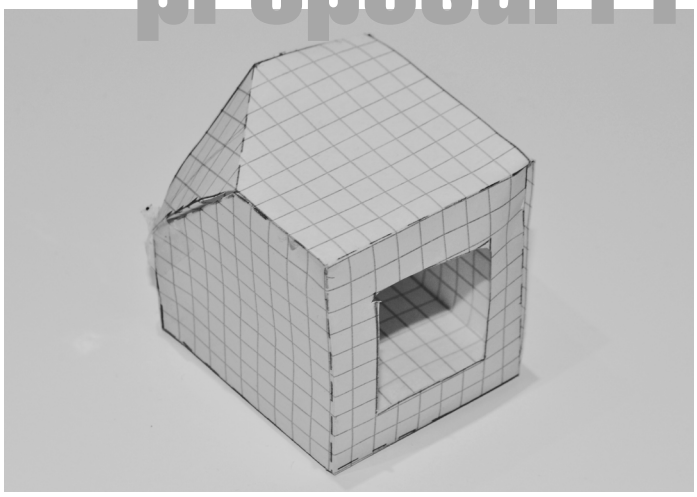


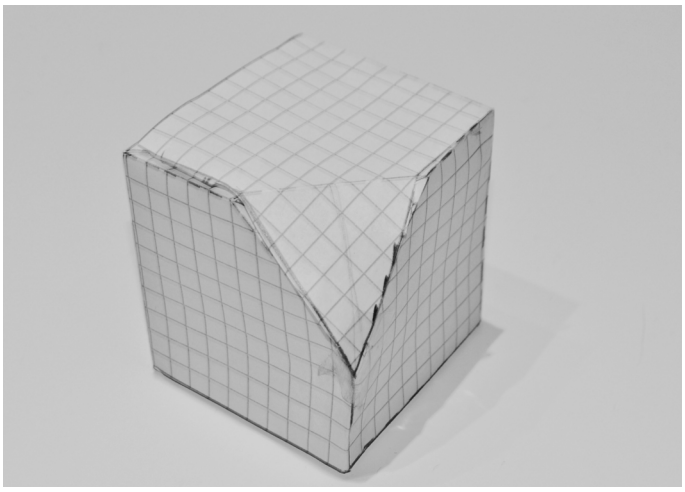


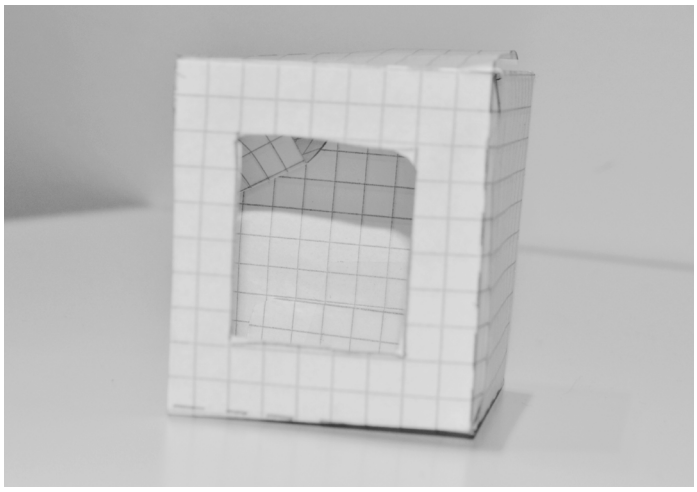


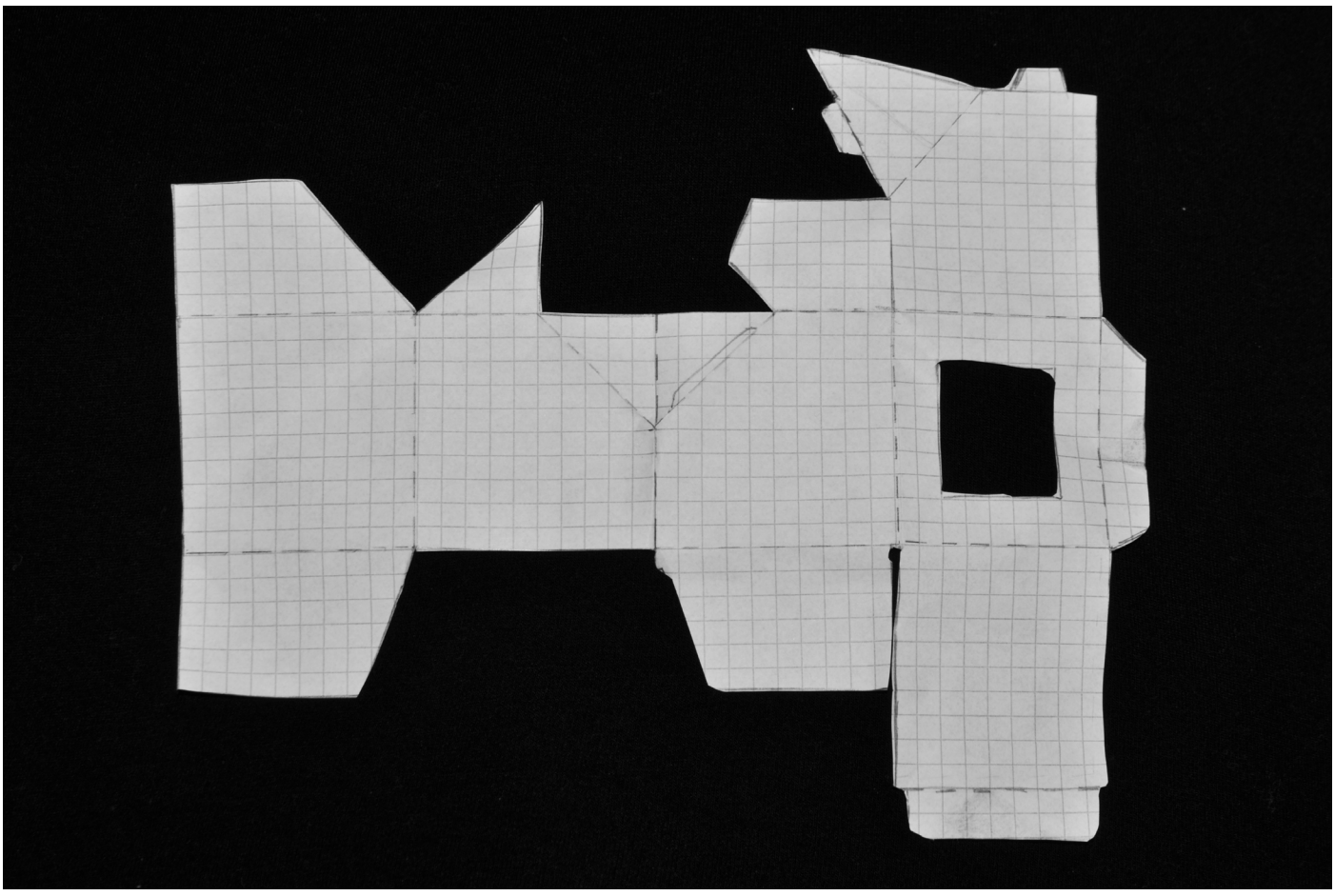
proposal11



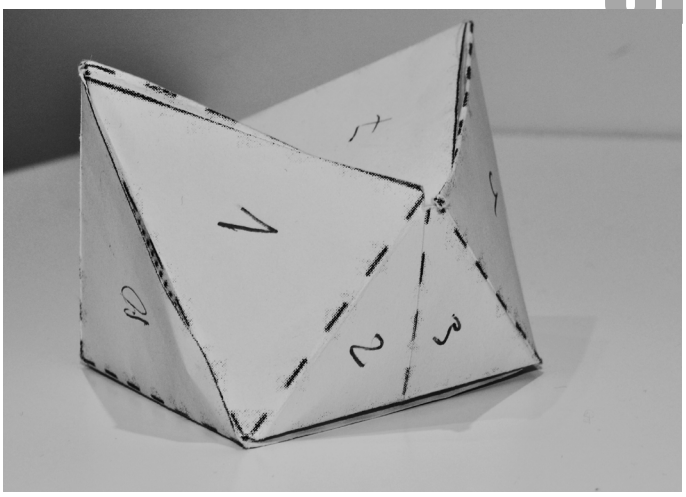


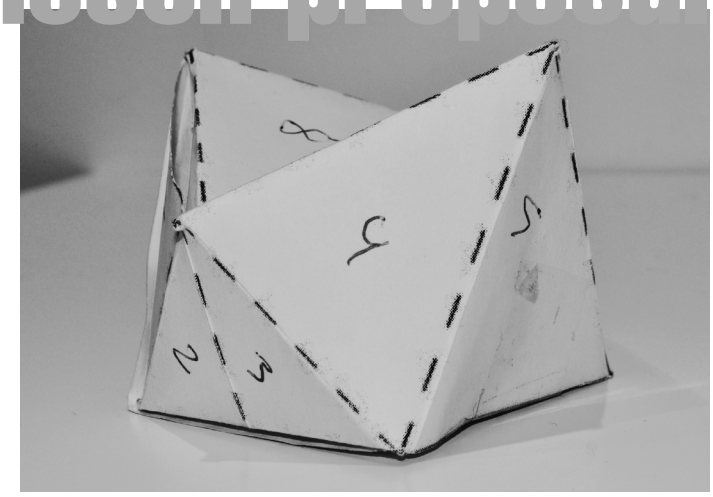


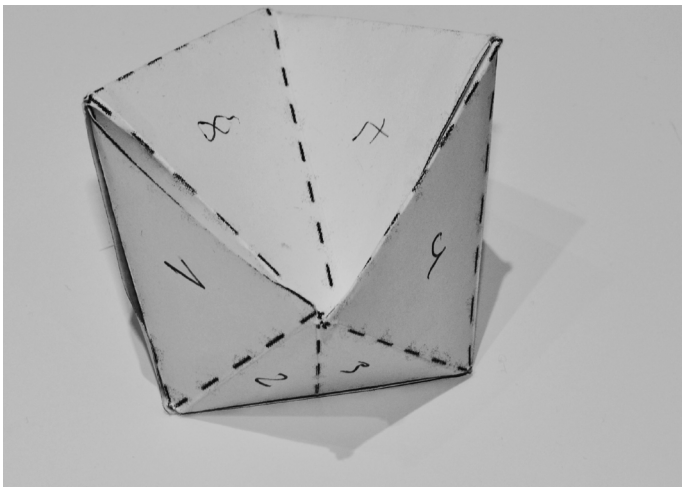


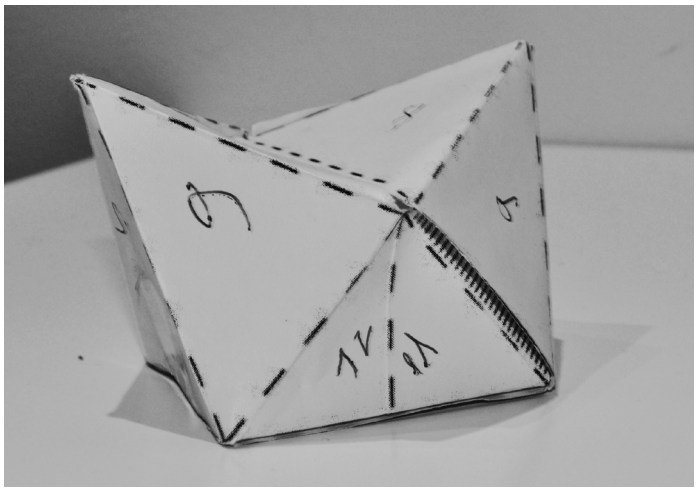


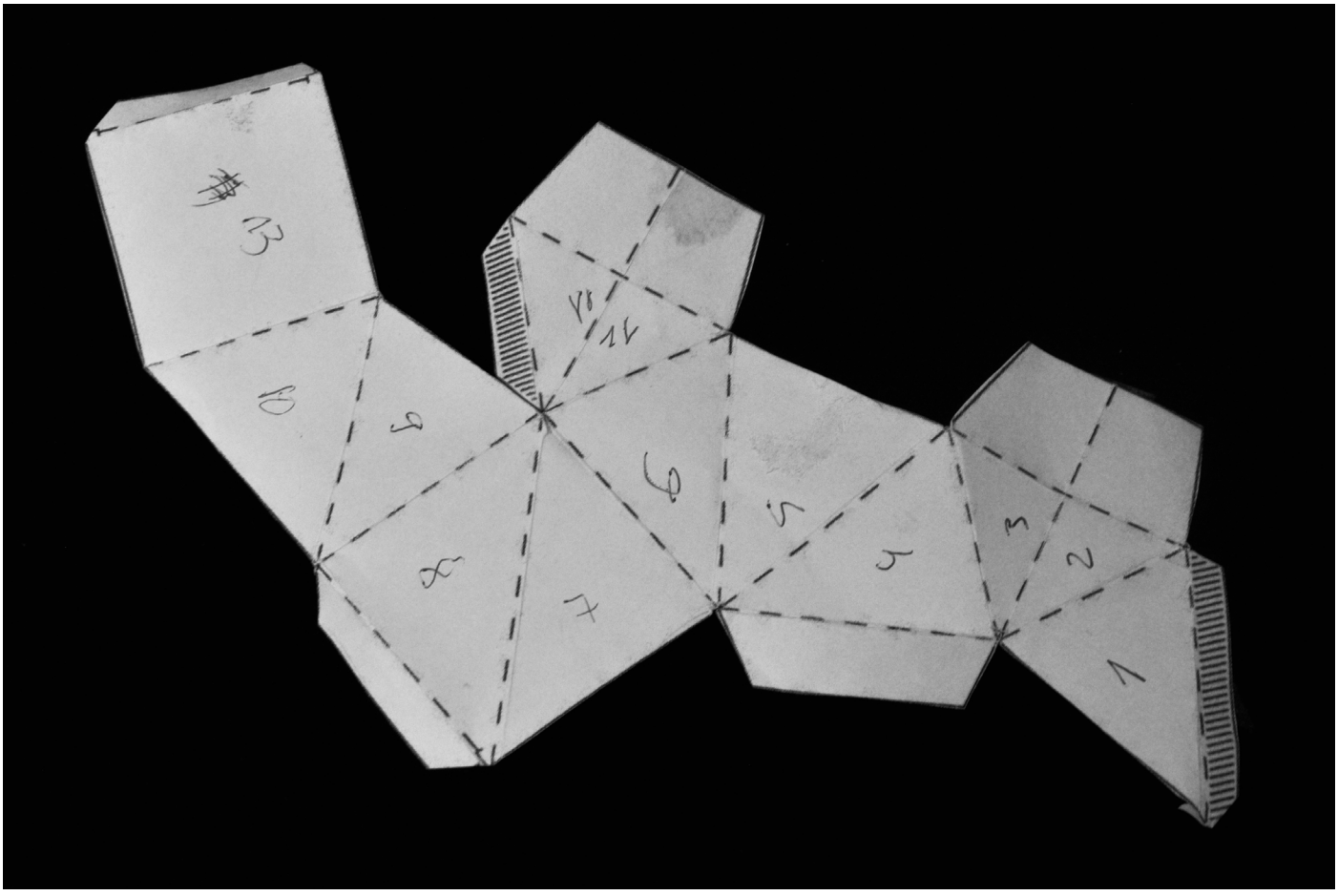
chosen proposal









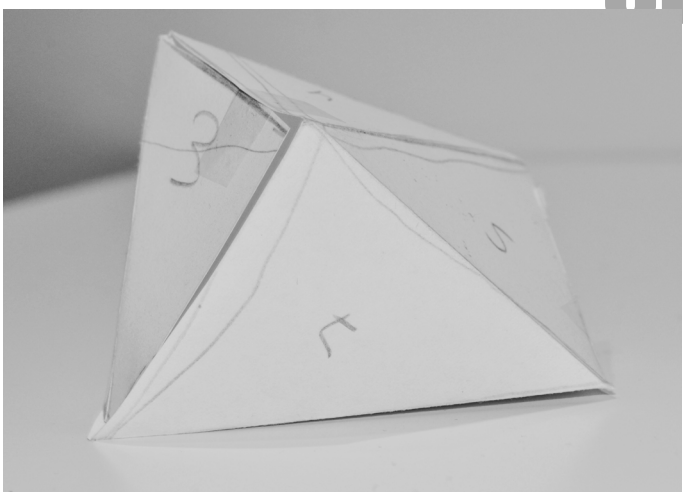


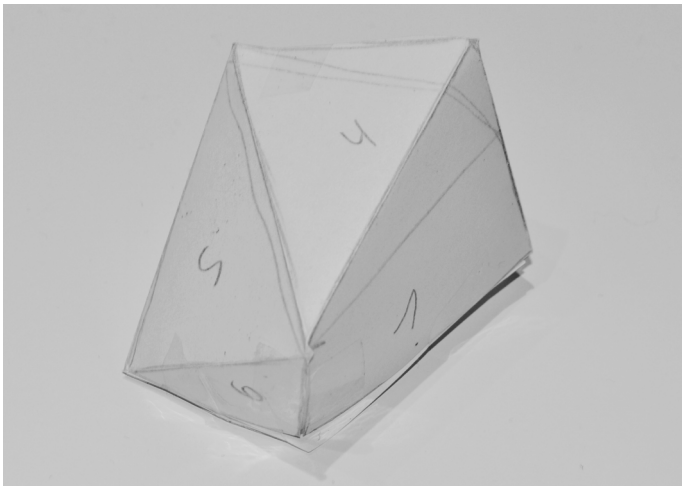
After having made the previous mock-ups, it was time to choose the most suitable for the development of this project. It has been decided to choose the aforementioned proposal due to the fact that it is the most interesting regarding its shape, structure and development. Nevertheless, it must be studied in greater depth in order to avoid certain problems detected, such as:

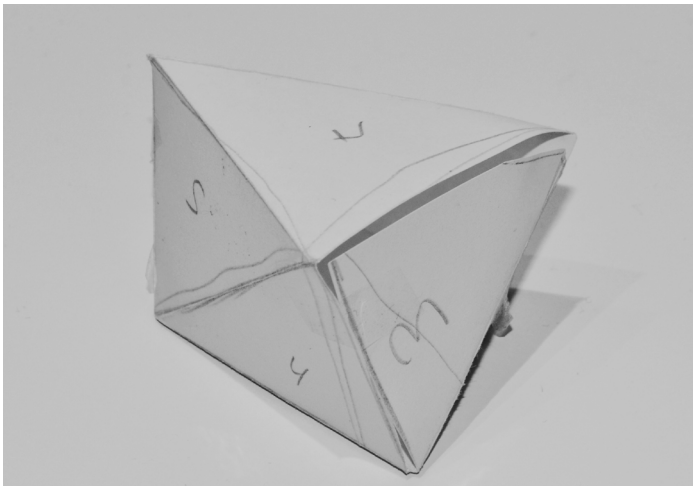
- Avoid the convex shape which can appear in the middle of the piece, since rain would gather there when the shelter is subjected to wet weather conditions.
- Avoid the angle which is made on the external sides, since in this way it cannot be modulated.
- Find a simpler development in order to have an easier assembly and reduce the amount of material required.
- Find the appropriate shelter dimensions. According to UNHCR regulations, the minimum dimension of housing per refugee is 3.5 m^2.

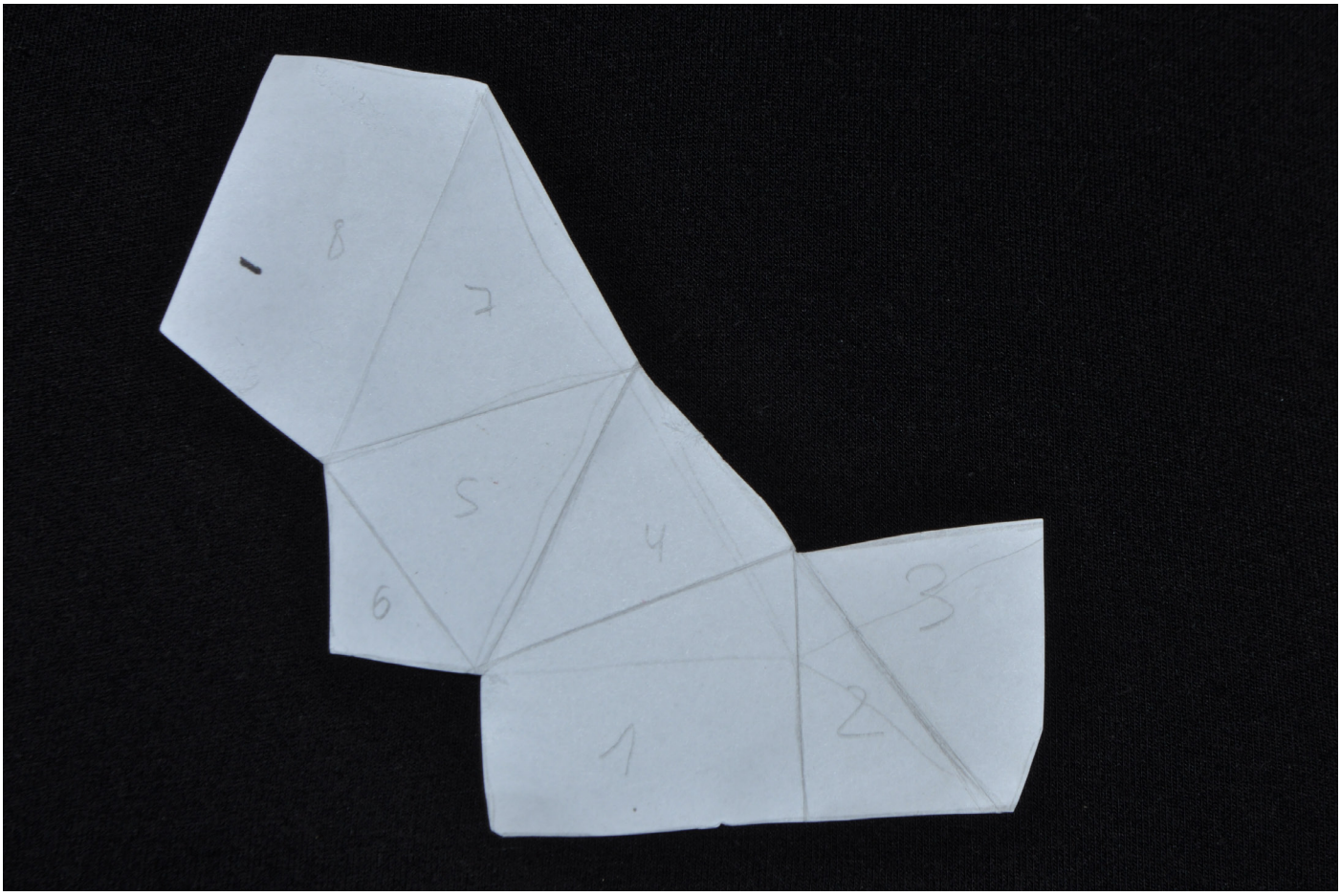
So the proposals shown below are different solutions based on the chosen proposal. All of them have solved the first problem about not having any convex part where water can accumulate. The first solution has been achieved by dividing the piece in half (since it is symmetrical). What has been obtained is a simpler piece that adequately solves the problem of water accumulation, due to having only two heights instead of three as was the case with the previous model. In this way, these two heights make the water slide from the highest point to the lowest until it reaches the ground, where the water will be accumulated instead of the roof of the piece, which is what wanted to be avoided. So, in all of them the first problem has been solved since there are no convex parts where water can accumulate. The rest of the changes that are shown in the following proposals are modifications of their dimensions, in order to find a valid proposal. The modifications of these dimensions are made to avoid extreme angles in the piece, correct heights, proportioned sides, etc.

chosen proposal
variation 1

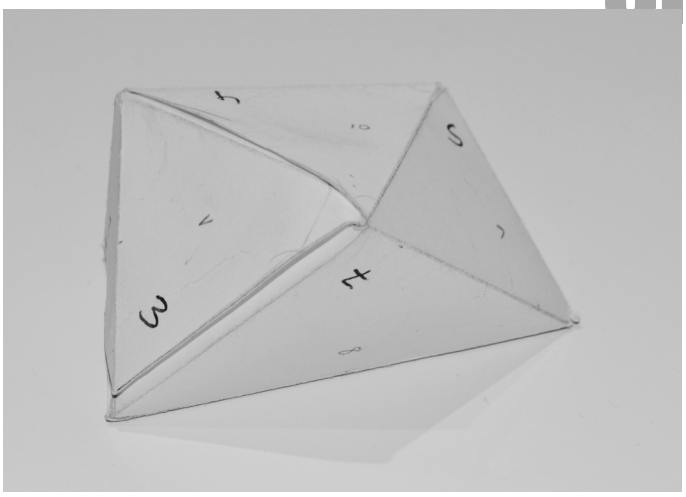


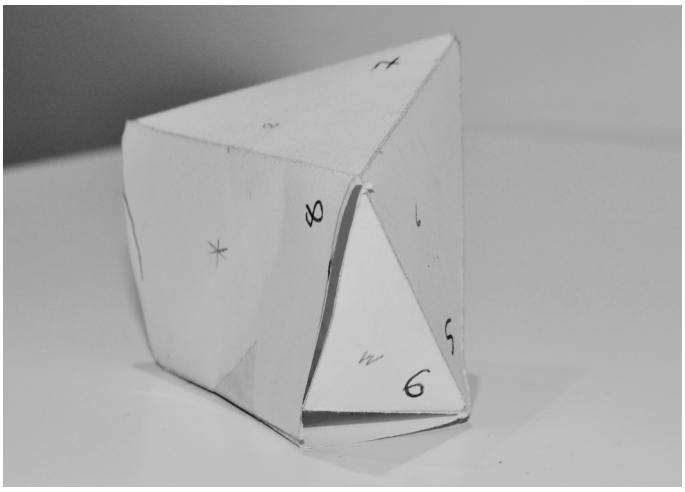


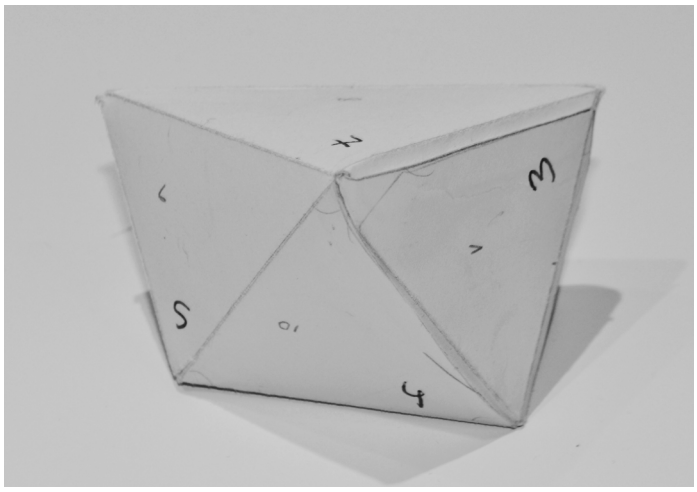


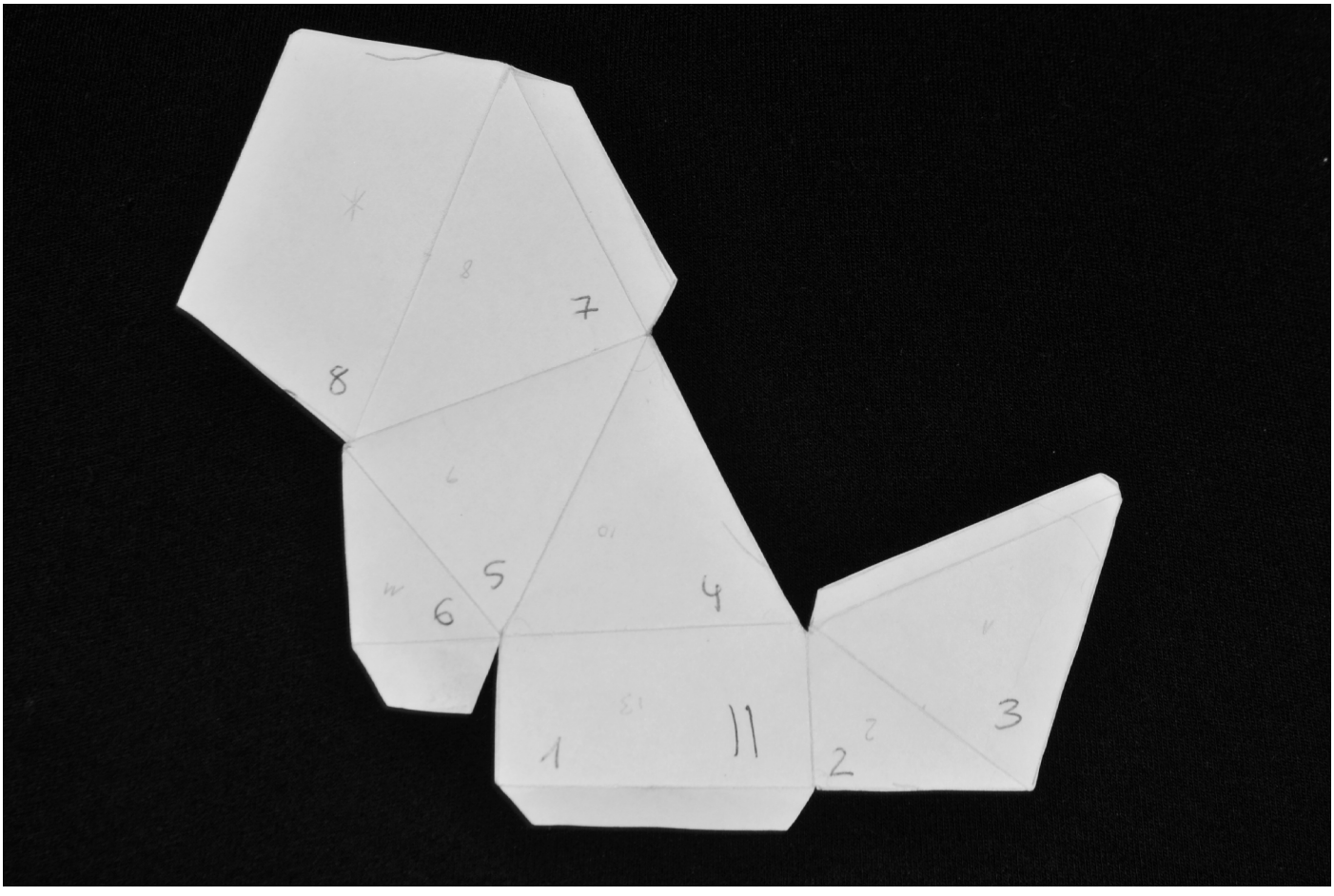


chosen proposal
variation 2



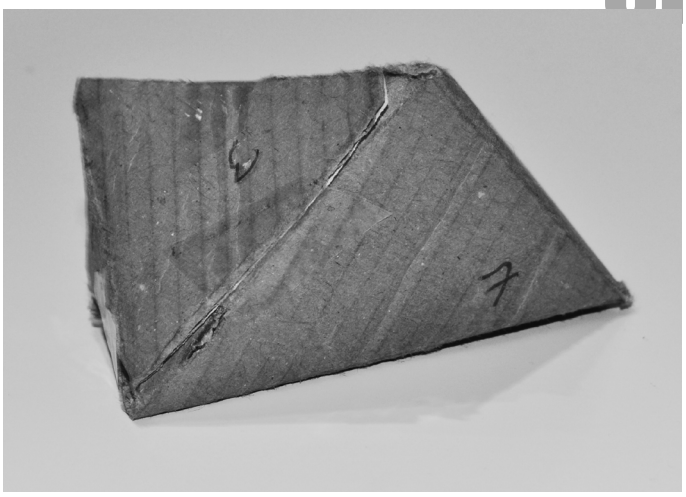


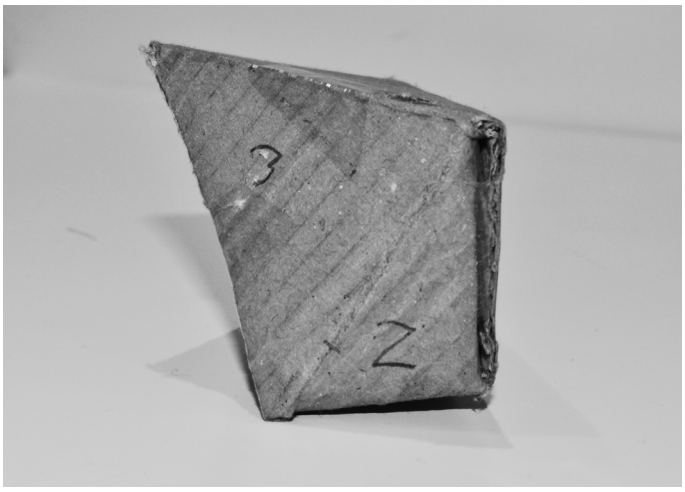


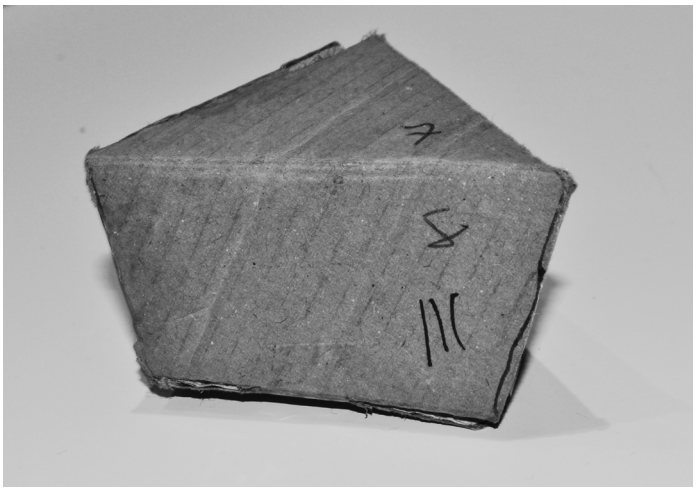


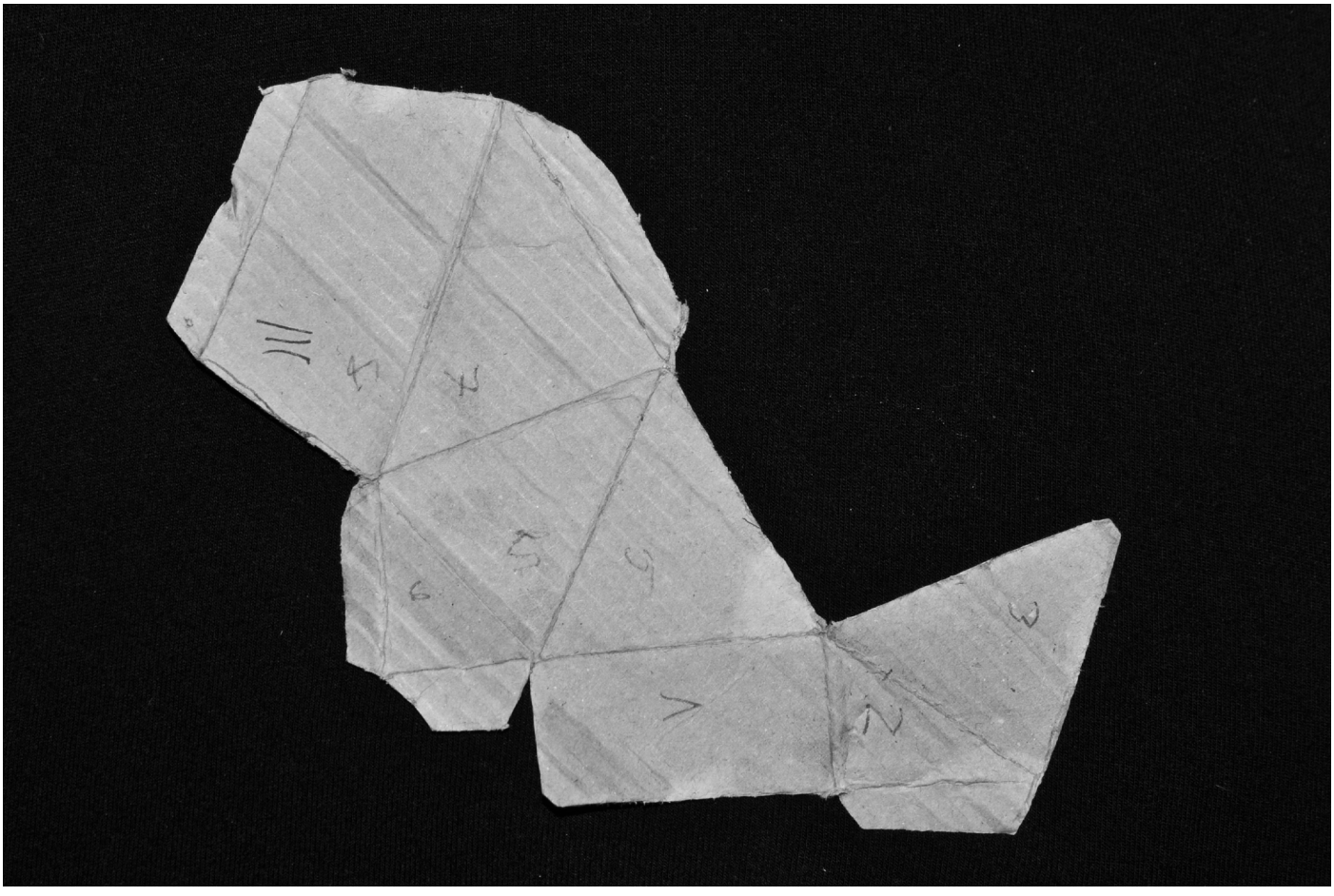
chosen proposal

variation 3

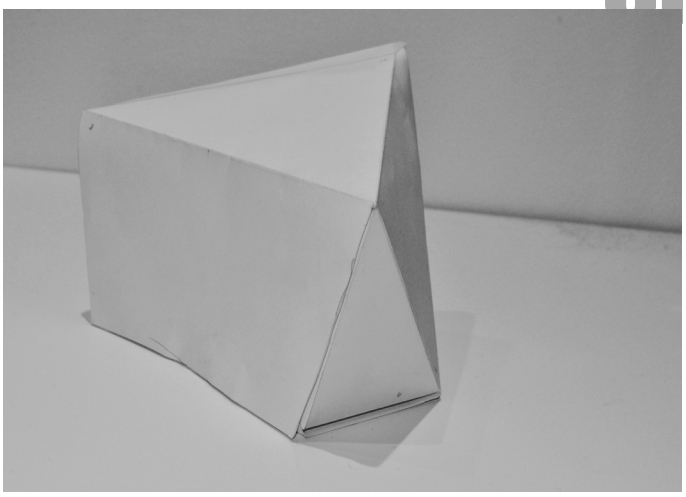


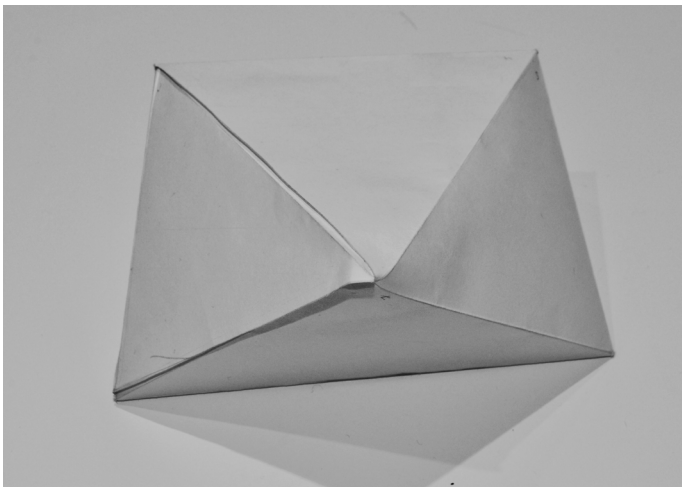


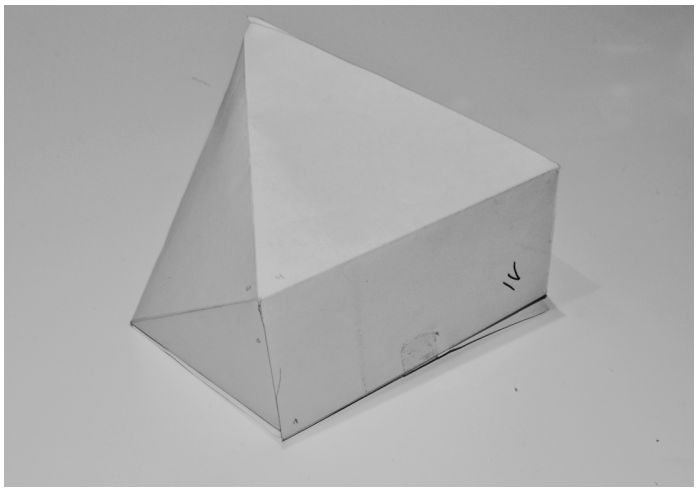


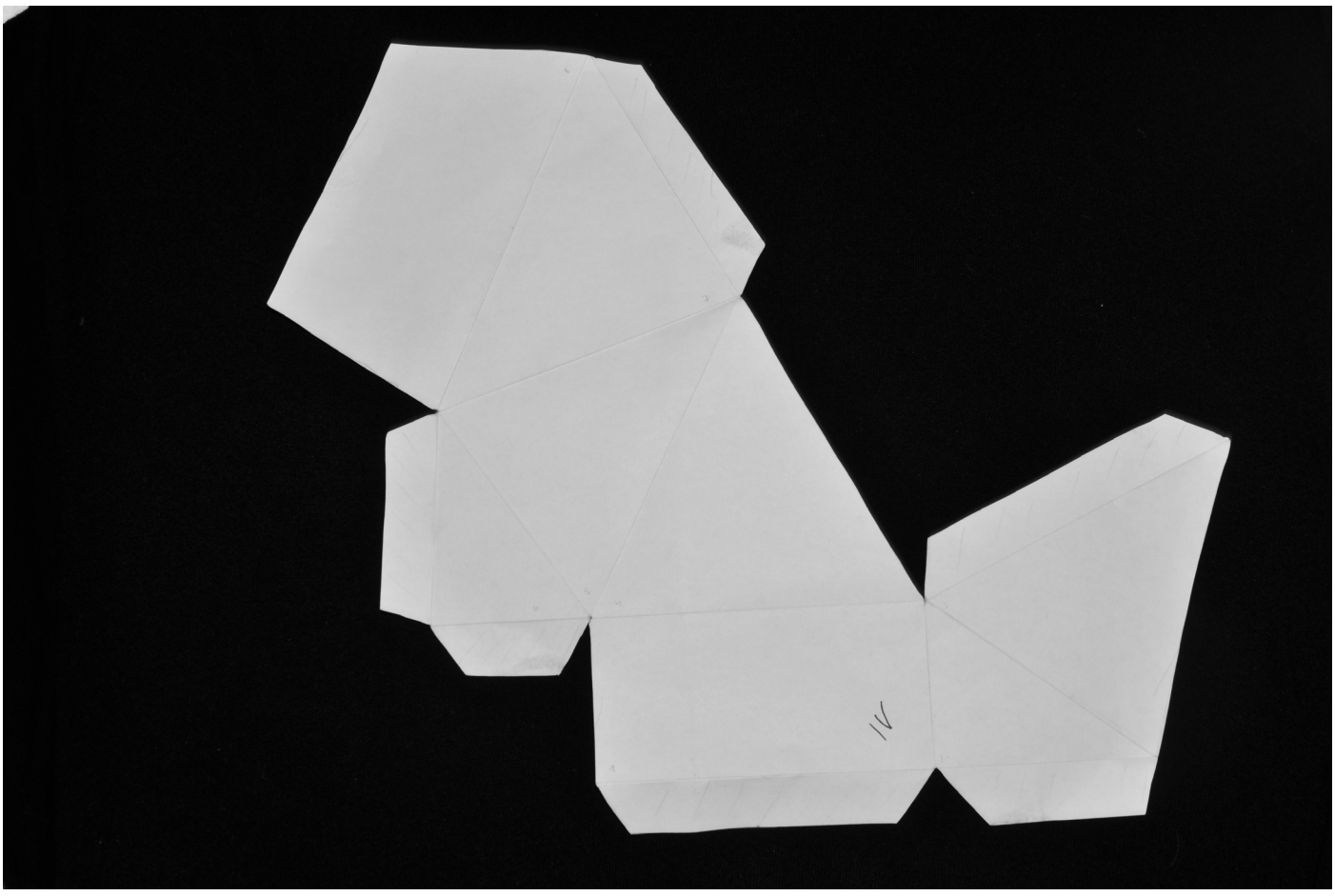


chosen proposal
variation 3

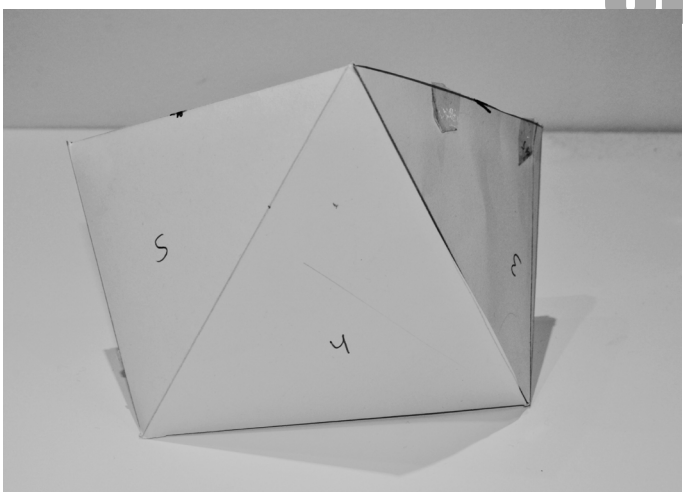


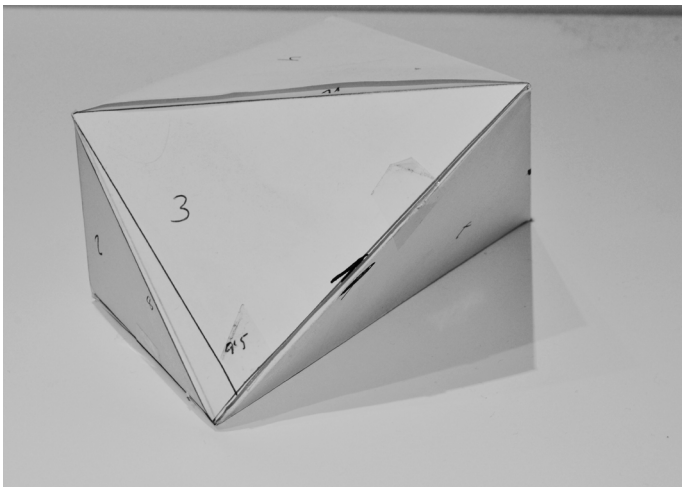


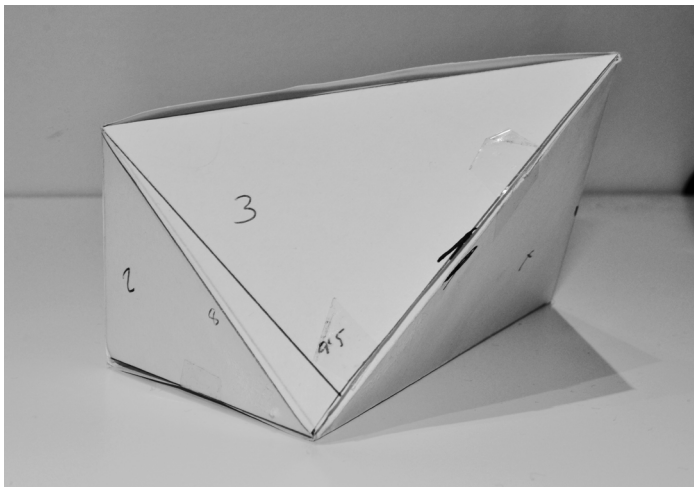


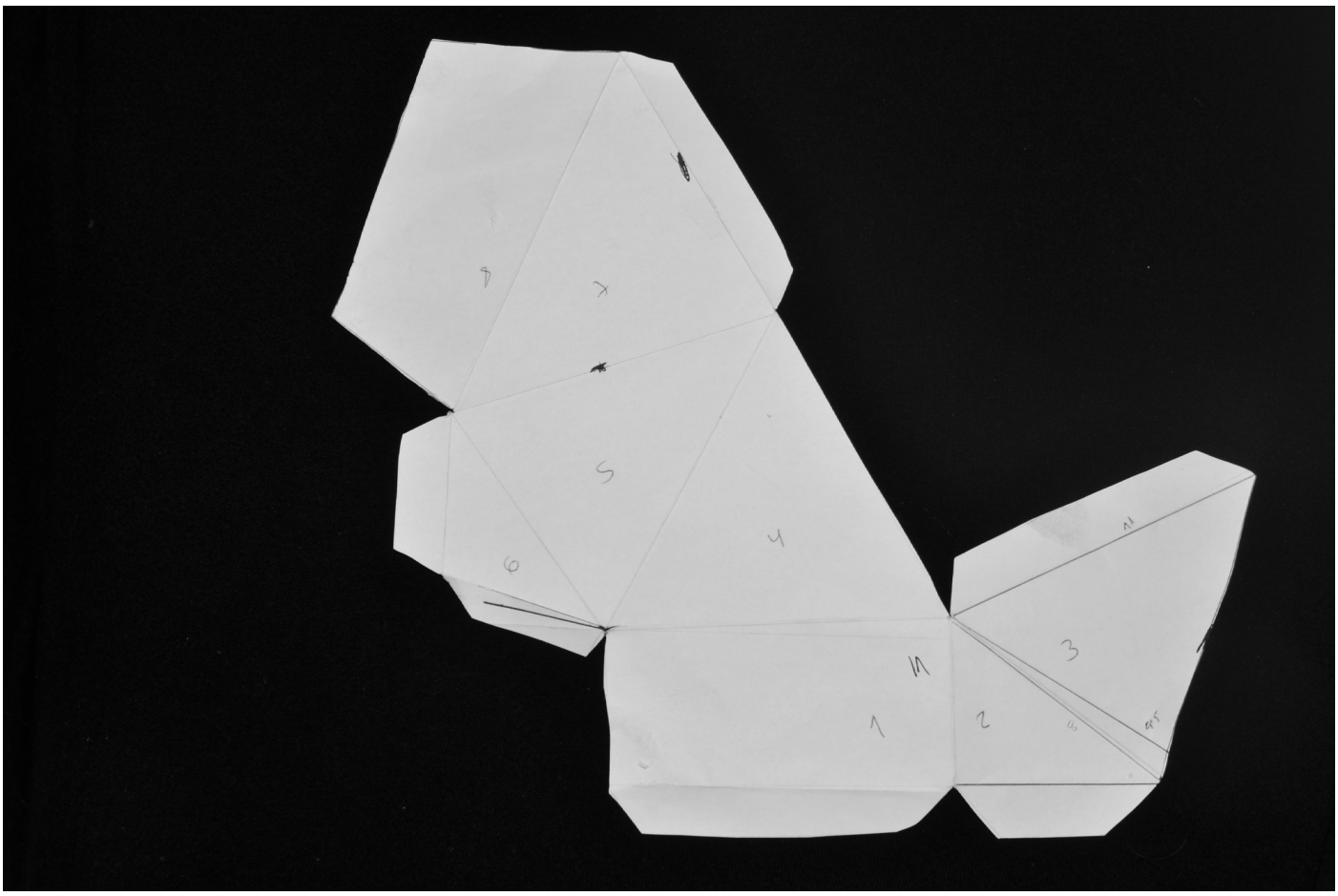


chosen proposal
variation 4



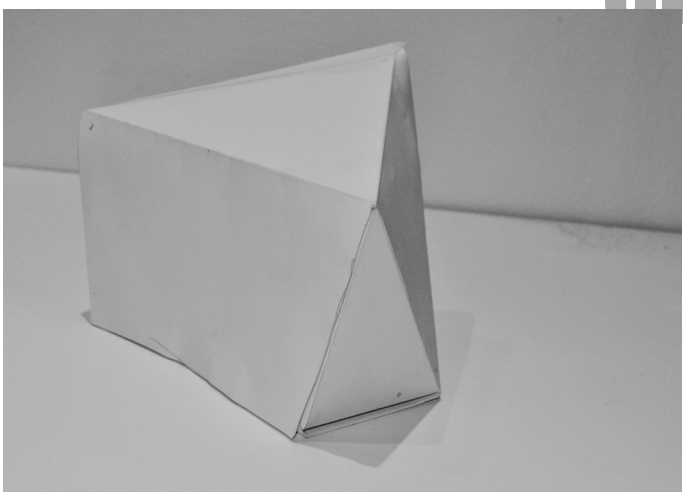


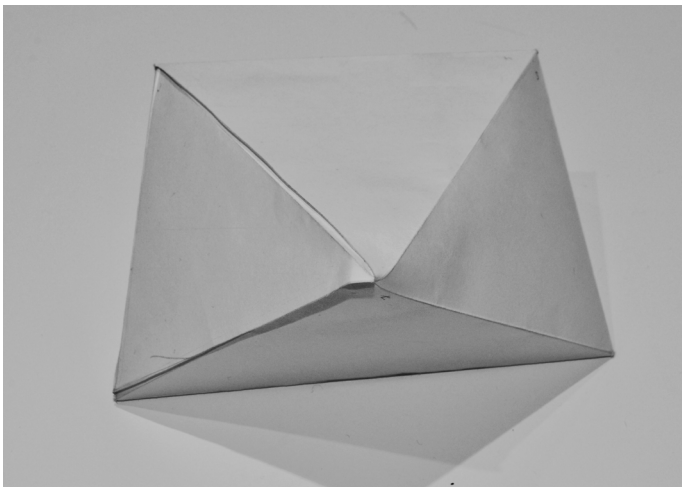


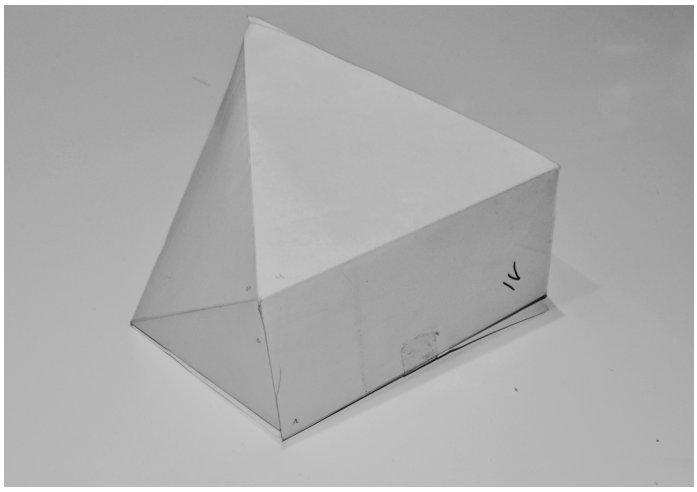


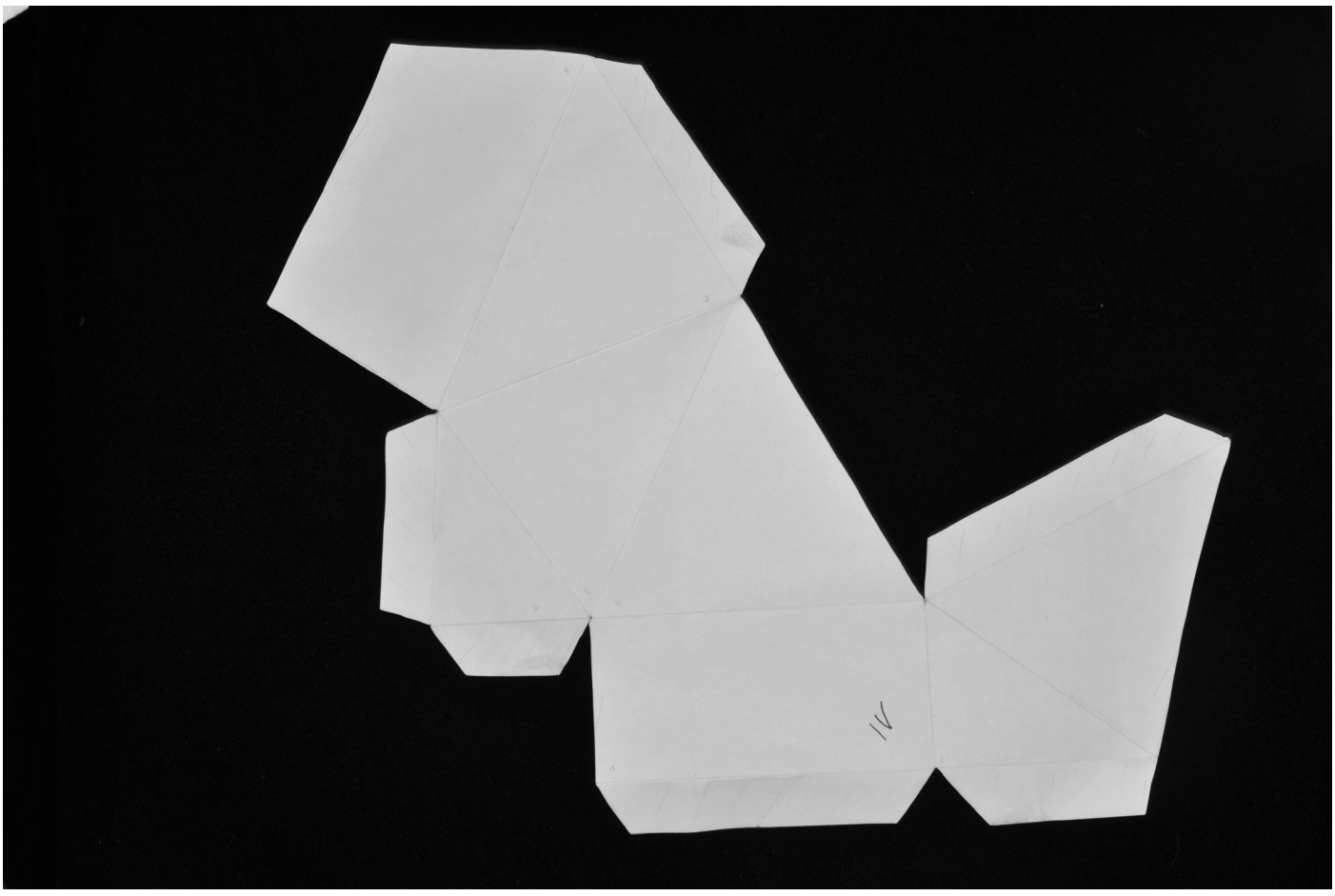
chosen proposal

variation 5









5

FOLDING DESIGN OF A HABITABLE SPACE

FINAL PRODUCT PROPOSAL

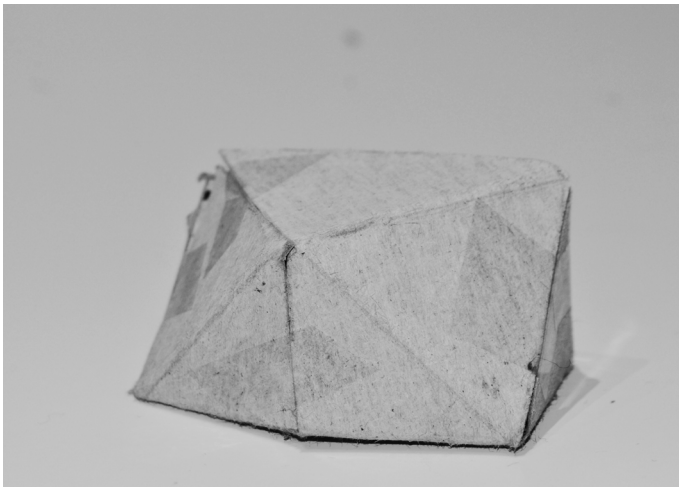
GENERAL DESCRIPTION

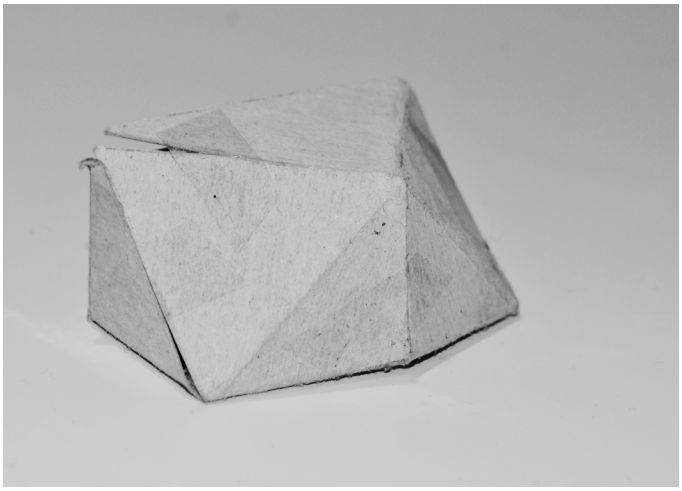
FOLDING DESIGN OF A HABITABLE SPACE

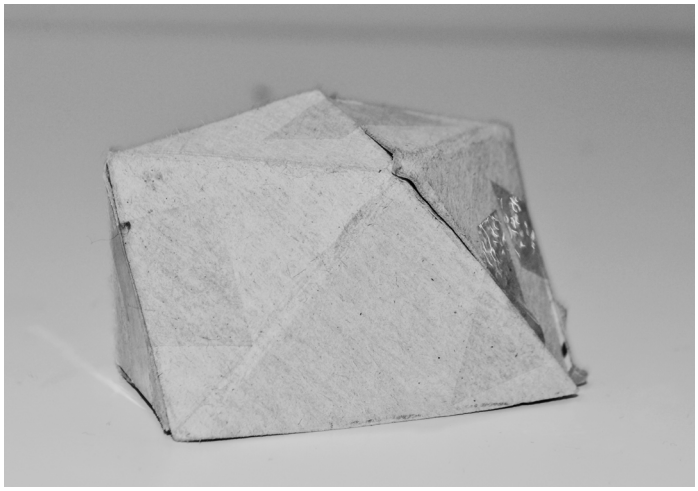
In this point is going to be explained why this was the chosen proposal. Also it going to be told how the development of it is, its measurements and the variatons that it can has.

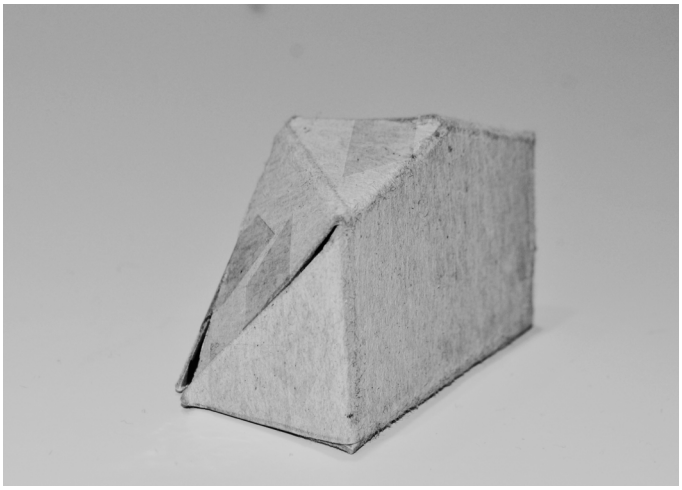
chosen proposal

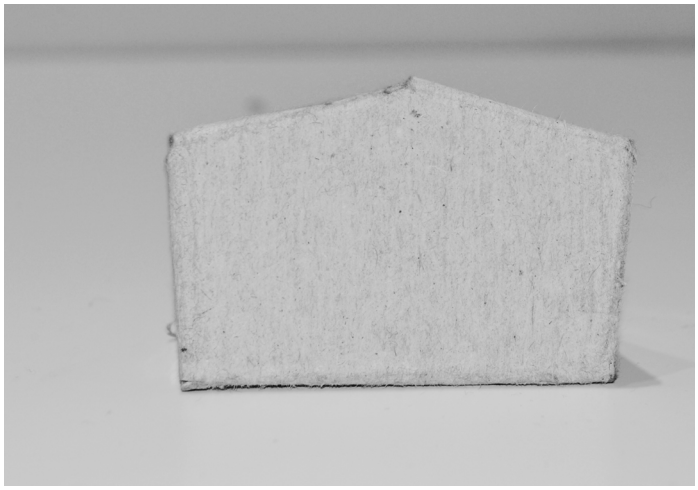
final proposal





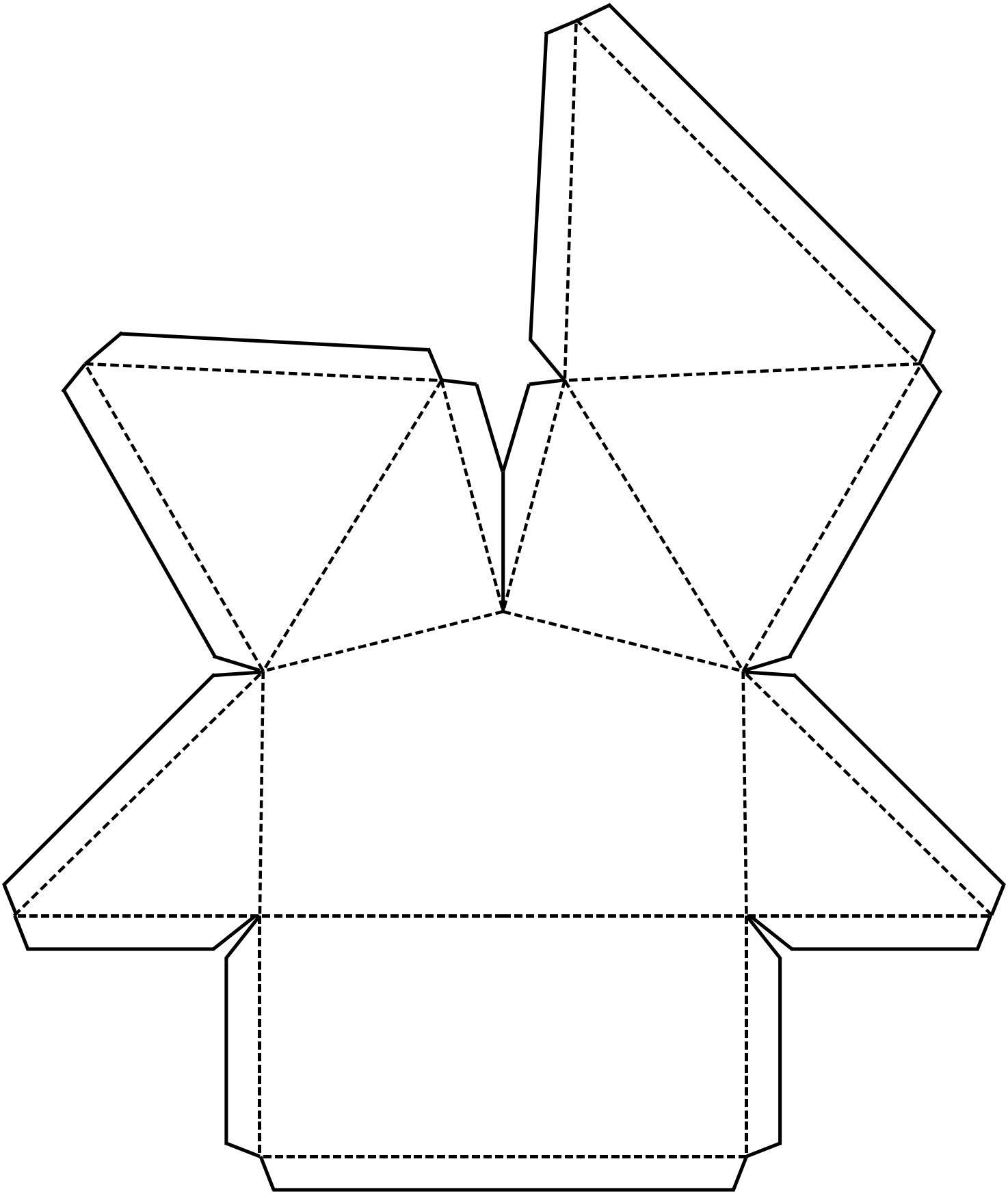


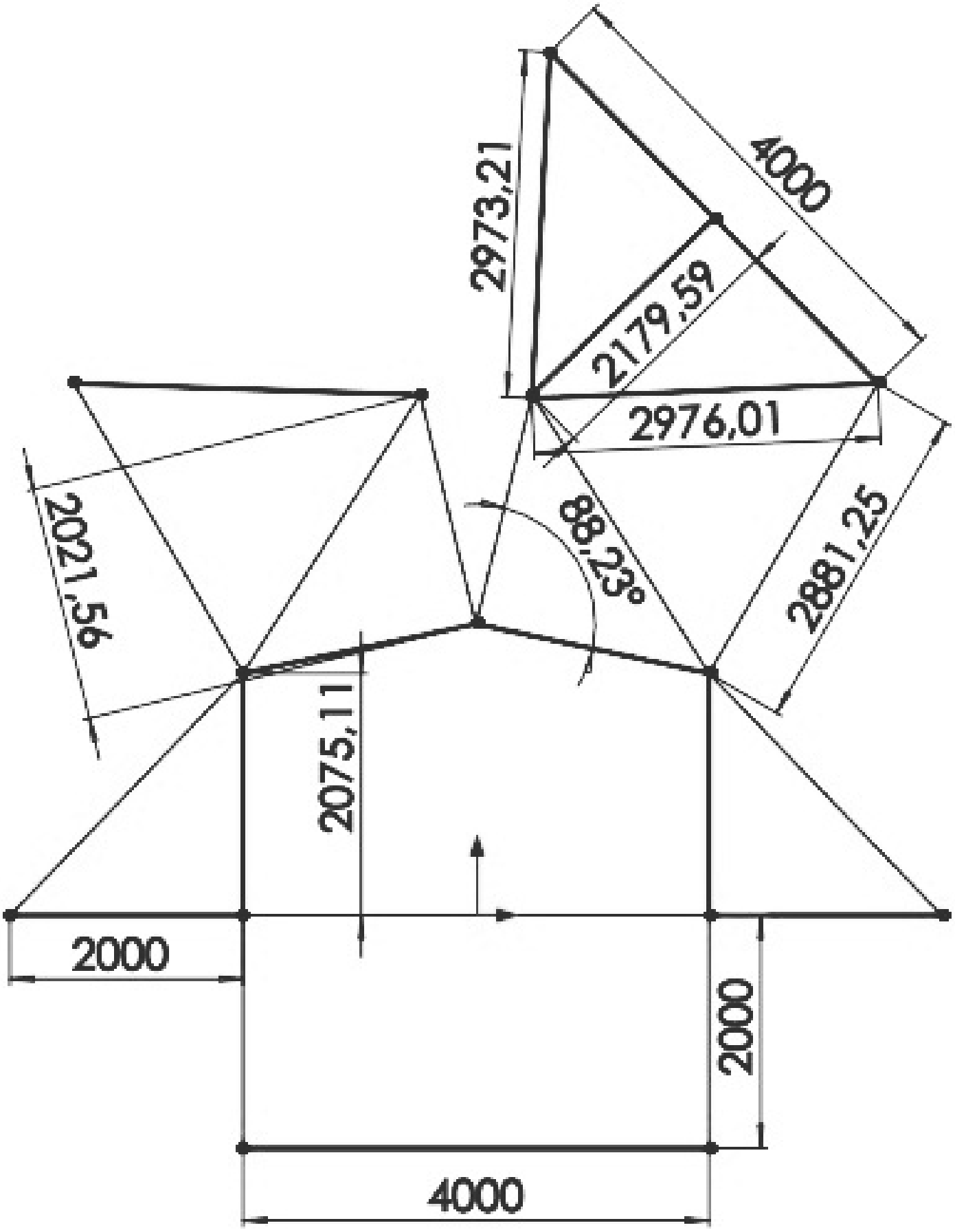




This is the definitive proposal because with it, the problems mentioned previously would be solved. The structure of this proposal, makes it stable enough to expose it to adverse weather situations (solving in this way, the problem of rain). Moreover, its dimensions are designed to shelter two people. Its shape allows the modularity of it by different sides. Even though it has completely flat surfaces, which surpasses the required dimensions for shelter two people (>7m^2), it can be placed in two different positions. The first position has as a base the rectangular side while the second one has it on the pentagonal side. Once the model is clear and after having made a mock-up, it has to be shown the development of it and make the model on SolidWorks.

The complete development of the piece is shown below. As it can be seen it has nine sides. Although it has two positions, it can be said that the main one is the one which has a rectangular base, and its sides are formed by two right triangles, an isosceles triangle and a pentagonal side.

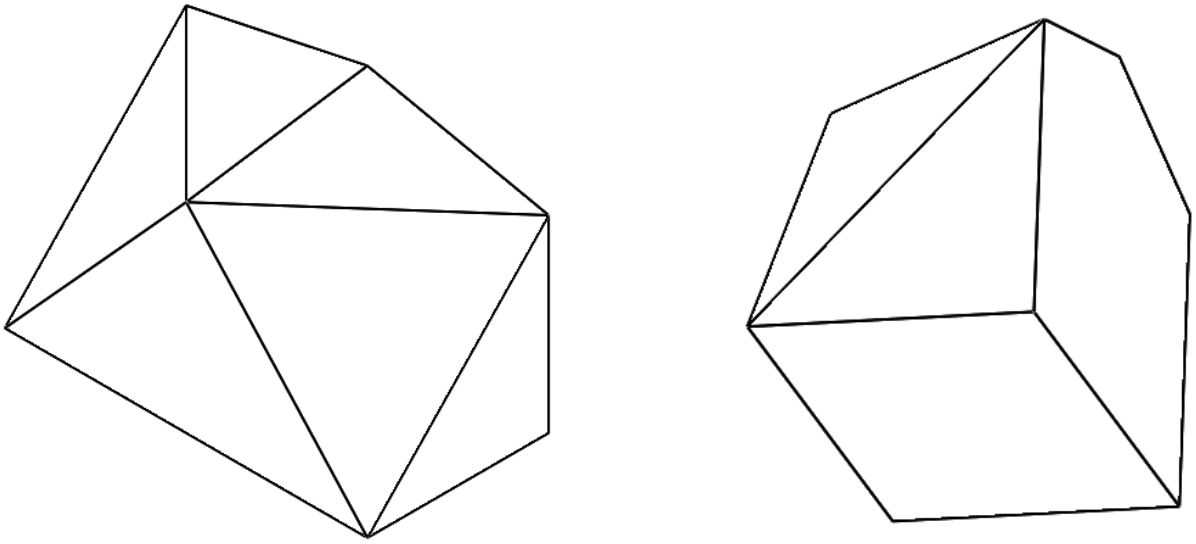



2973,21
4000
2179,59
2976,01
2021,56
88,23°
2881,25
2075,11
2000
2000
4000

Once the final shape of it has been reached, it has to be developed in Solidworks. The piece has two position variations due to its flat faces as it is shown below.
For its realization, the product has been endowed with ergonomic and functional measures, taking as reference the UNHCR standards and the dimensions of similar products studied in the state of art.

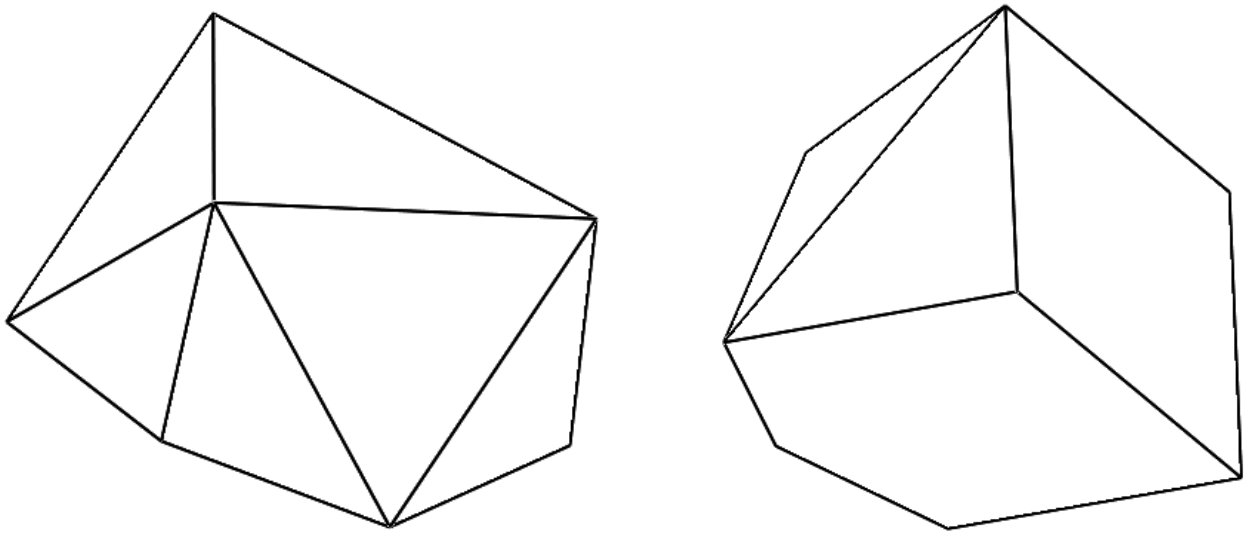
FIRST VARIATION

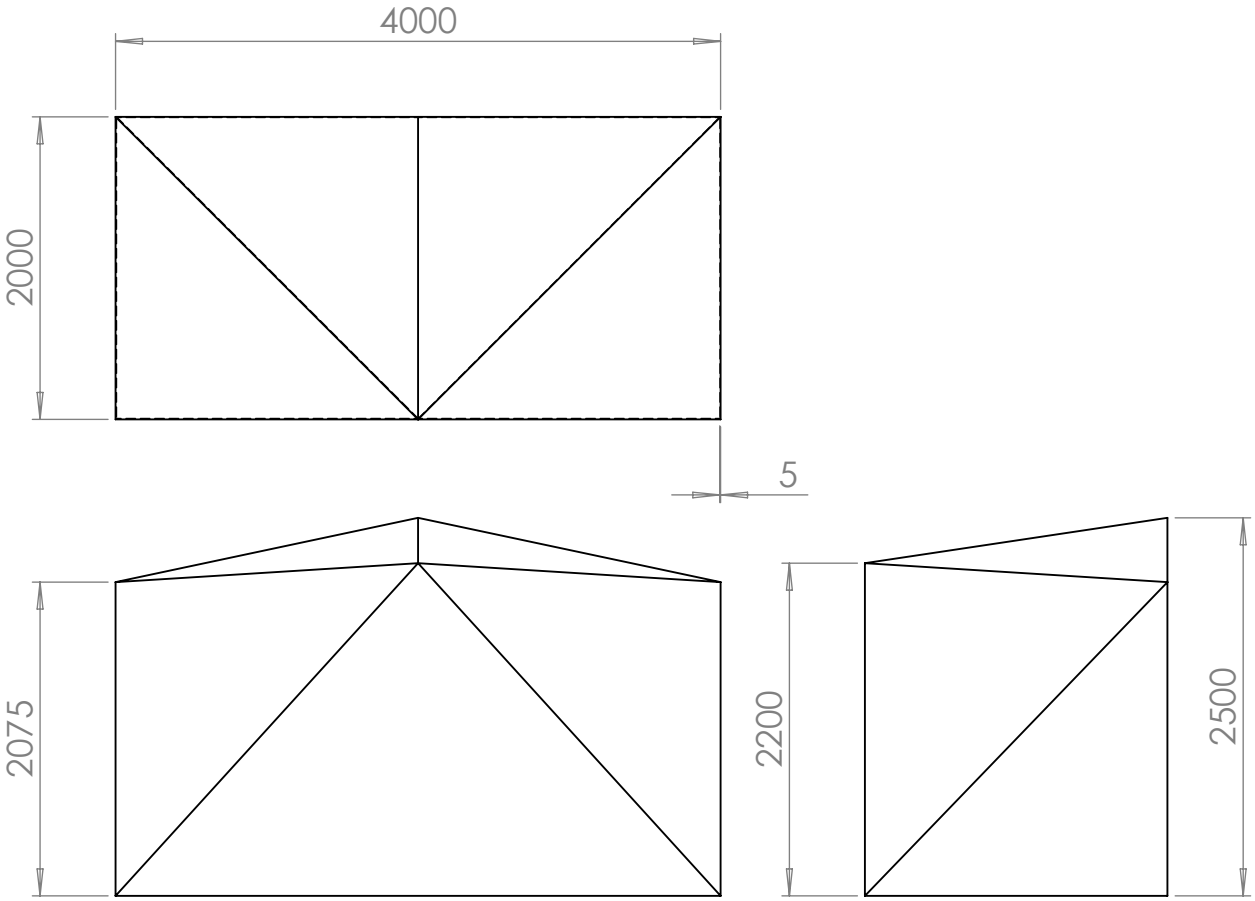
Rectangular base.

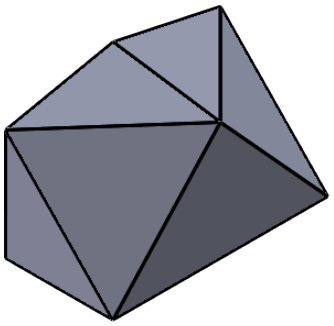


SECOND VARIATION

Pentagonal base.







SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.			
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL:

N.º DE DIBUJO

PRUEBA4bien

A4

PESO:

ESCALA:1:100

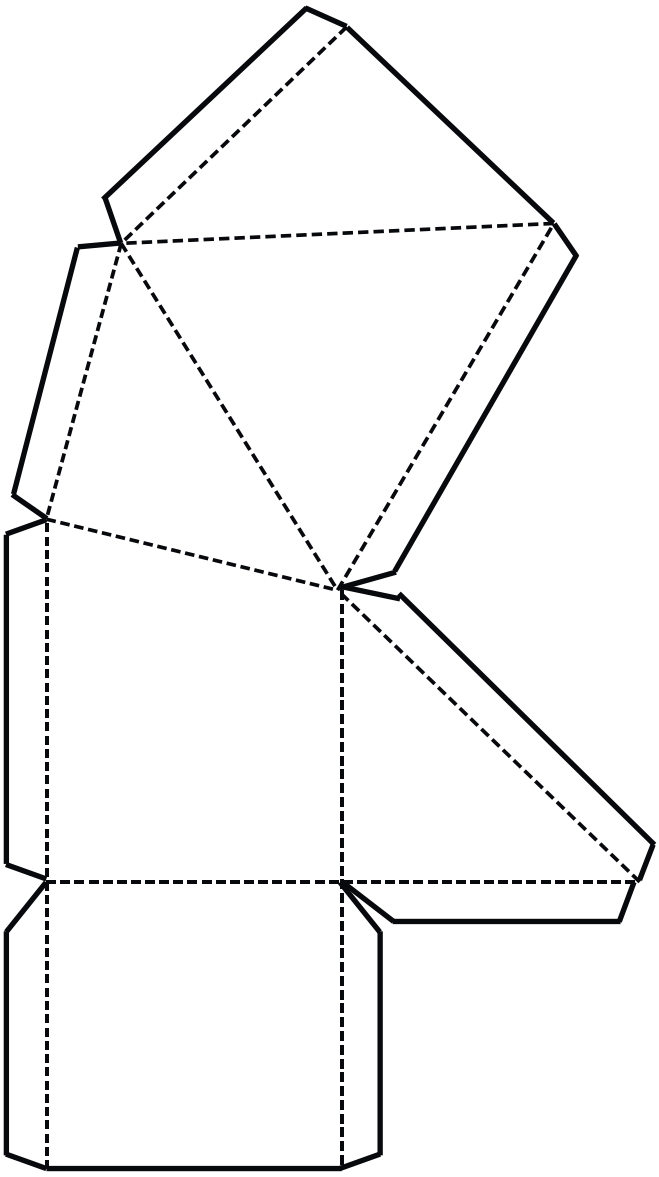
HOJA 1 DE 1

POLYPROPYLENE MODELING

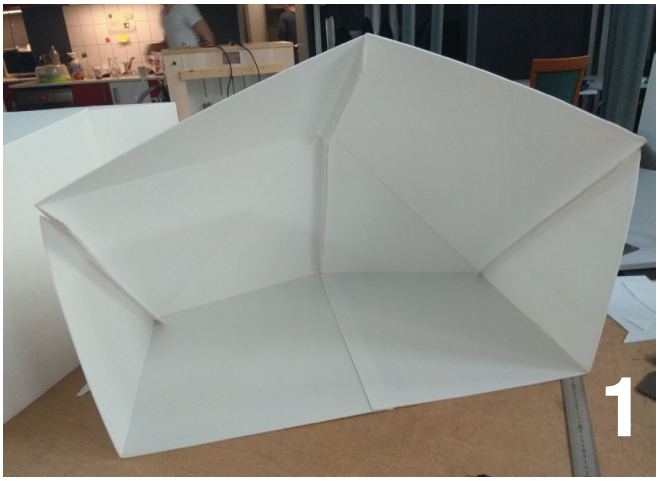
FOLDING DESIGN OF A HABITABLE SPACE

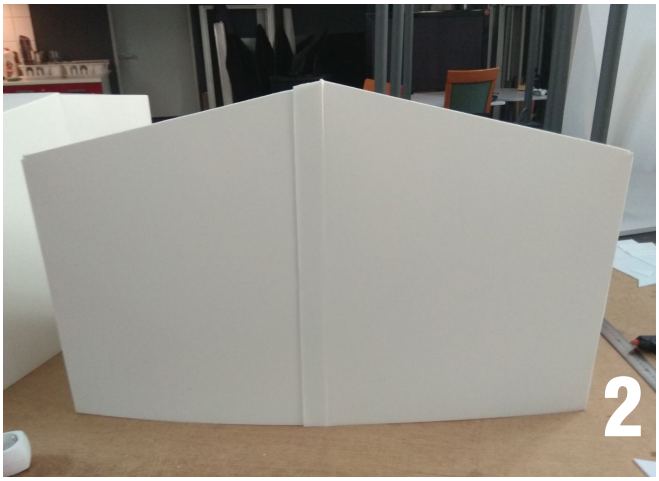
At this moment of the work, is time to make a model with the material in which the project will be developed (polypropylene) to observe the behavior of the material in the shape of that wanted piece.

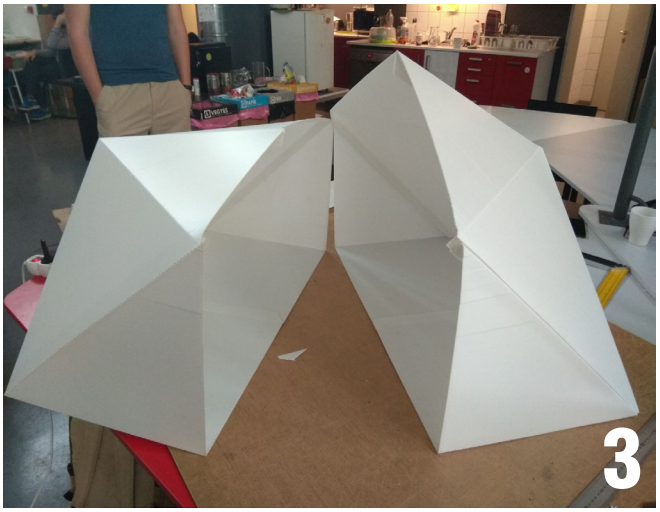
For the purpose of making a real model, polypropylene packaging material sheets have been used, on which the development has been drawn. It has been decided to make the piece in two parts, since the sheets were not large enough, so the development of the piece has been separated in half thanks to its symmetry. In this way, the development has been drawn on the sheet, then it was cut out and glued to the other half, which was made on a different sheet.
The following one is the development used for model which is shown below. The scale used has been 1: 5. So the measures used for the following model correspond to those shown before but scaled a fifth.



As it can be seen in the following images, the model has finally been tested in polypropylene. This material has a very simple manipulation and allows making models easily.
As mentioned and shown above, the construction of this model has been made from the half of the development, joining both halves (thanks to the realization of flaps and silicone) to get the piece. This decision was made in order to achieve an easier and faster execution of it. This union and execution, can be seen in image number 1.
Once the first model was obtained, a second one was made following the same procedure. As can be seen in the images, the first model has less height than the second one due to a failure in the dimensions of the height. So, the second one was made with the correct height. The realization of two models was made to find out the correct modularity of the model.


1


2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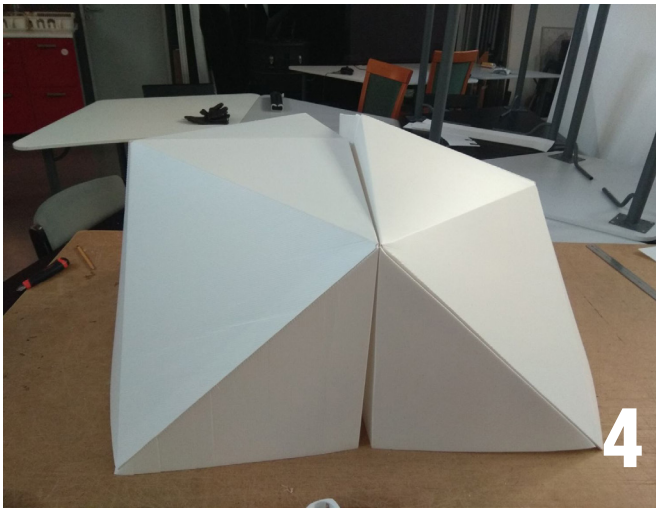
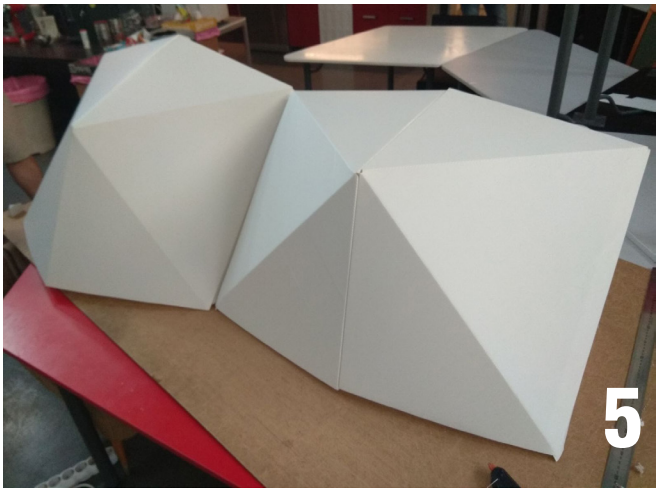
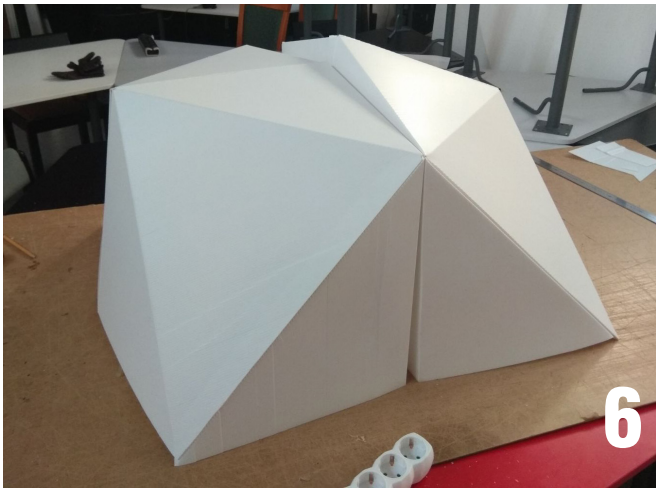
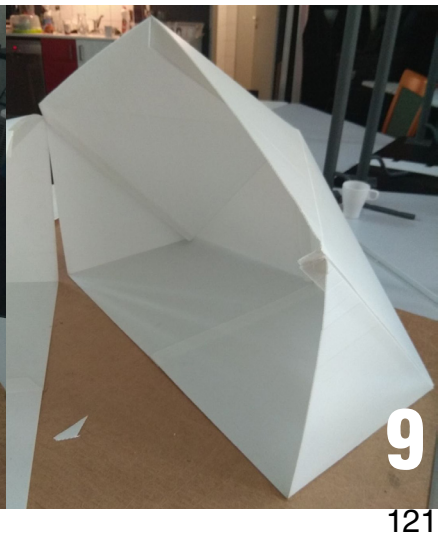

4


5


6


7


8


9

CORRECTIONS IN THE MODEL

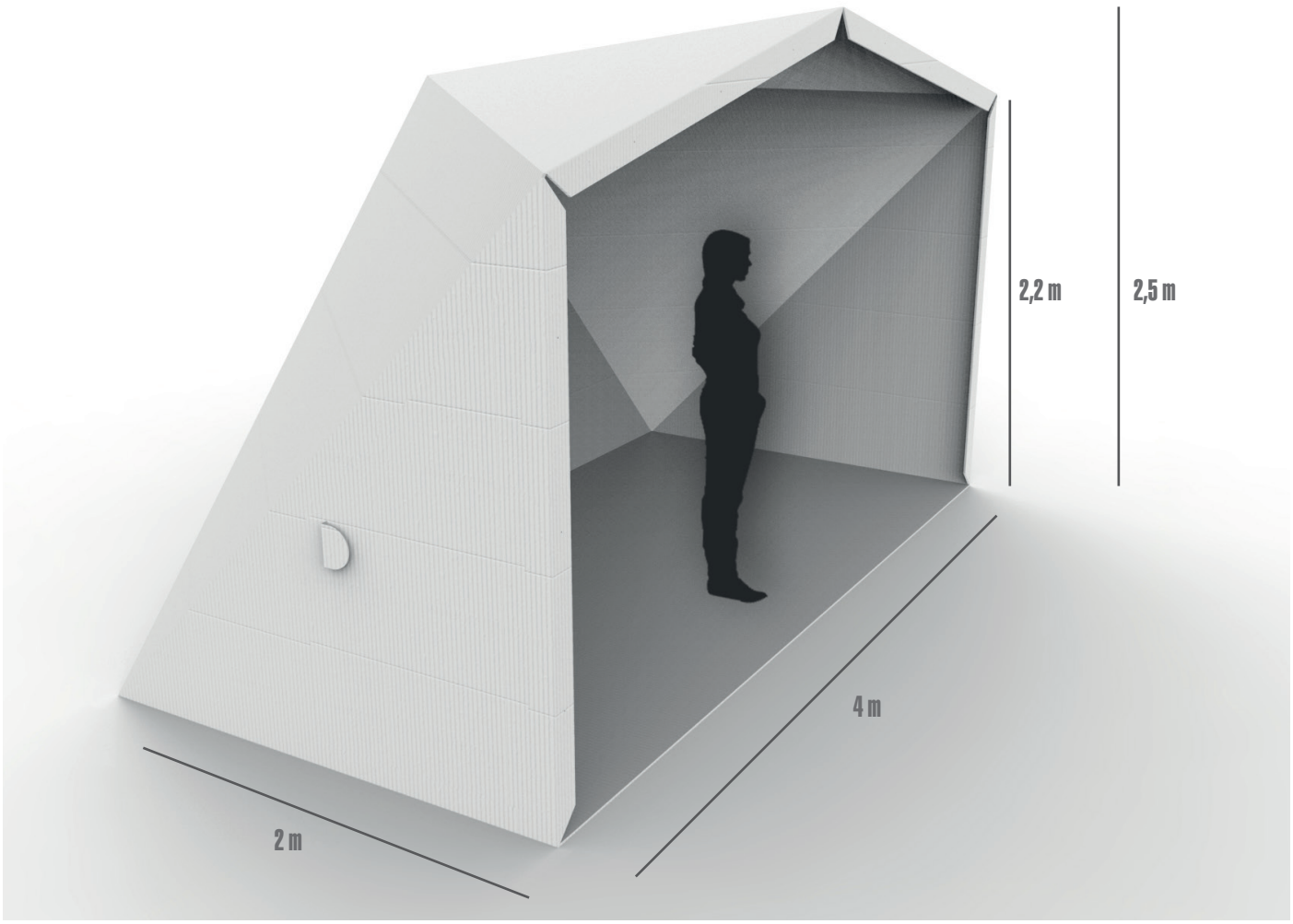
FOLDING DESIGN OF A HABITABLE SPACE

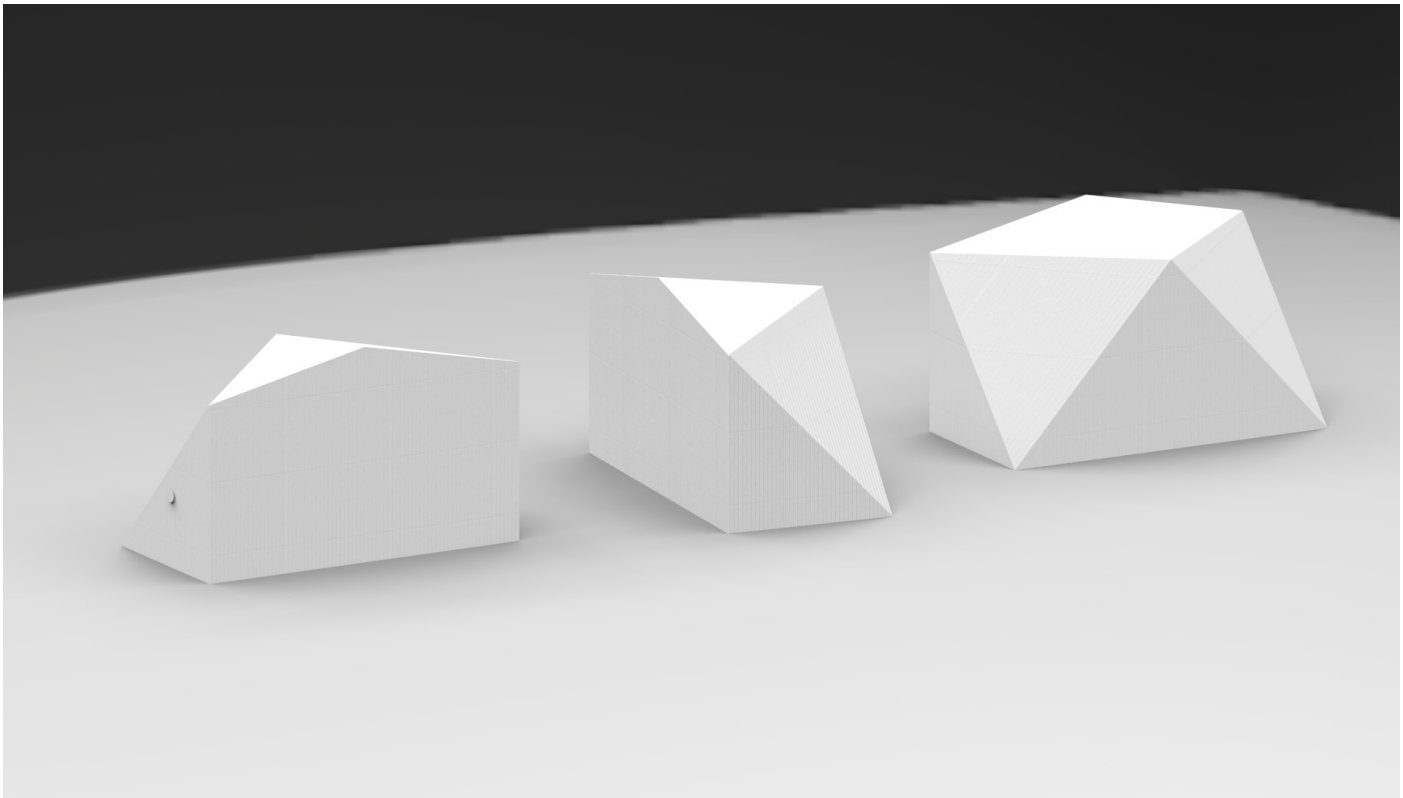
In this section is going to be explained the corrections that have been made in the model to find its final shape. So the pictures shown above about the shape of the shelter, the development of it or the different positions, will no longer be valid. The aesthetics and the principal shape will be preserved, but the problems found when the model was being made in poplypropylene, have to be solved. The new dimensions, the door, the assemblies and how its modularity is working are going to be shown from now on.
So then it can be seen how a “folding design of a habitable space” concept is.

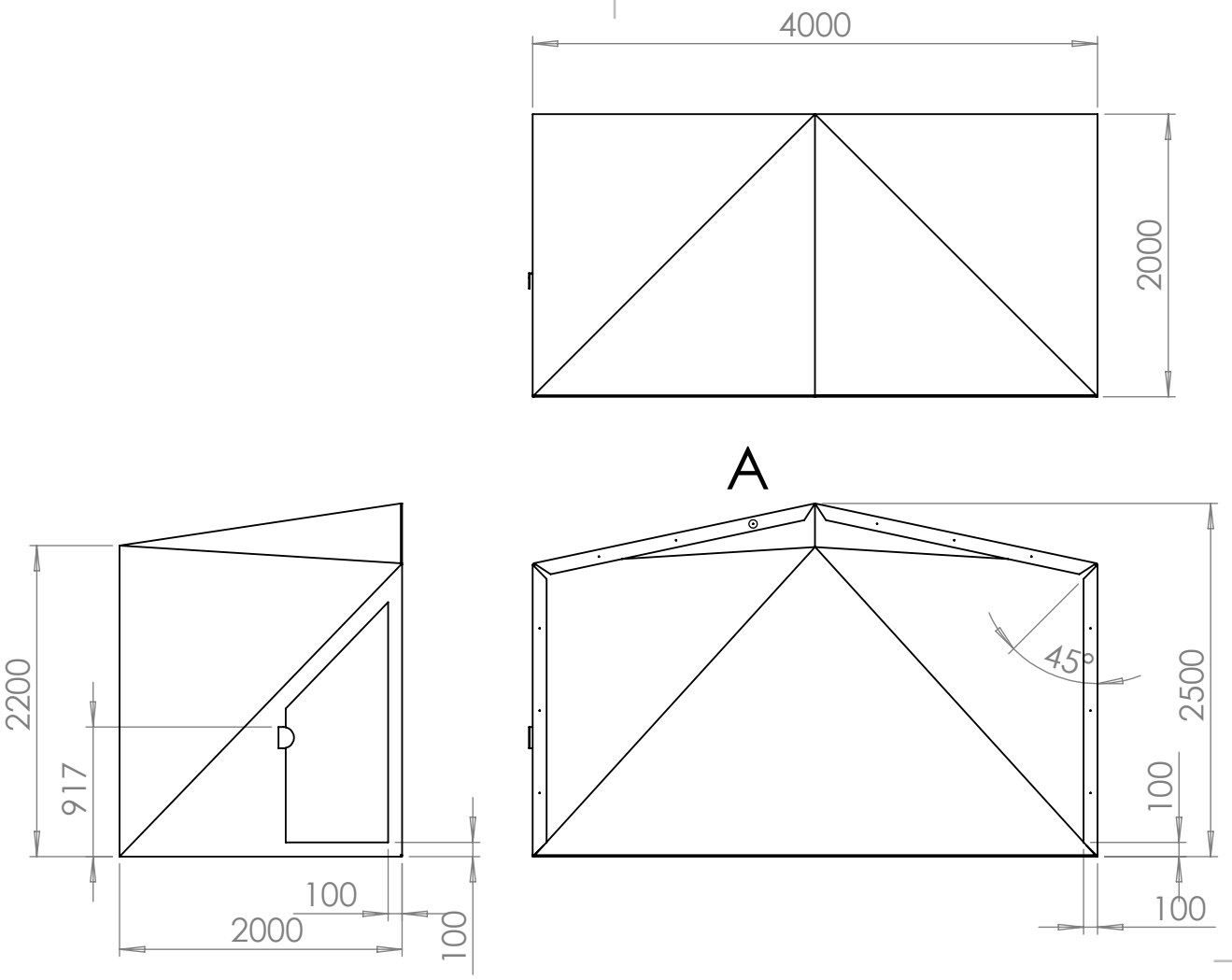
After having tested the material and have realized that the model still having some problems to be solved like modularity, or the placement of the door or how the assemblies are going to be, it was decided to test everything in the 3D model. So at this point, the complete CAD model should be done. As it has been said, the CAD model made before is not appropriate enough due to it still has problems which should be solved. Those problems were detected once the real model was done as it has been said before.
For example, one mistake from the real model was the different heights which the models had, but through the development of the product in solidworks, this mistake will be completely corrected since it consists of two exactly identical pieces with all the dimensions well defined.

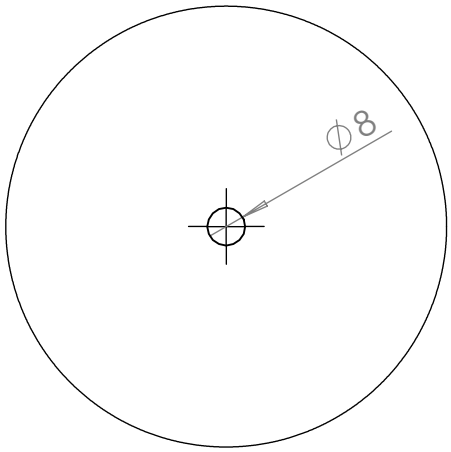
At this point the modularity requirement has to be solved as well. For achieving this point, many possibilities have been thought since the piece has all its faces straight, which allows all the addition of a module in each of them. So the important thing about it was to think about which face will be the one for let this modularity happen and how the assemblies were going to be.
It has been thought that the most appropriate face for it will be the large and pentagonal one. This was thought because the pentagonal face is the one which has the higher point of the piece, so when two modules will set up together there no will be problems about water acumulation. Also it has been thought that having the largest face as connector between the two modules was the best idea. In that way the space created between both would be the biggest one that two faces of it could set. If another face would have been chosen the conexion space would have been smaller and also it would be noticed the difference between both modules, but in the pengatonal face case, this is not going to happen because it looks like an only conformed space.
So once the pentagonal face has been chosen like the one which will allow the peice being modulable, the assemblies have to be thought. The assemblies are going to be made through the flaps of the faces and bolts, nuts and washers.
But there was a problem which was difficult to solve. It has been tried to get a piece that could have a removable wall in some way to connect another module when it was wanted, but at the same time it was intended that the same wall could be closed and form a single module. This was thought in order to have the possibility of housing a different number of people depending on the situation. But the possibilities of having only one single module or two modules together was not possible to achieve in the same development. So the best solution thought was to make an individual face which is appart of the development of the piece (the pentagonal one) for conforming a single module. In that way the piece will always have an open face and adding another module or closing it, will be the user decision.
So the final product design can be observed in the following pictures. In the first picture the dimensions of it can be observed and at the same time in the following drawings.
And as well, in the following part called “assemblies” the components of the product will be explained deeply.

Below the general dimensions of the final proposal are shown. The shelter has measures of 2.5 meters high as the highest point of the shelter, 2 meters wide and 4 meters long. These measures, with a total of 8 square meters, make the shelter become in one able for hosting as minimum two people.



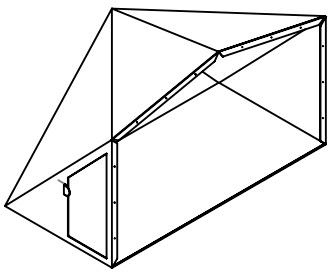




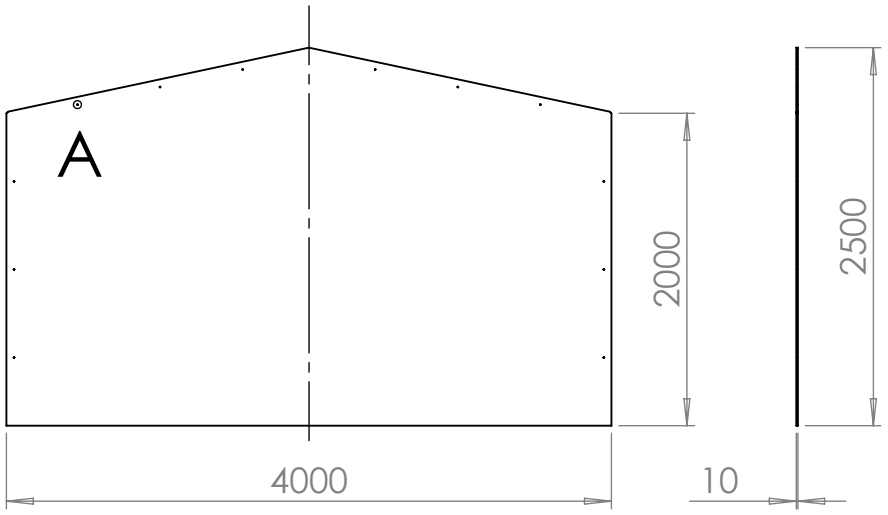


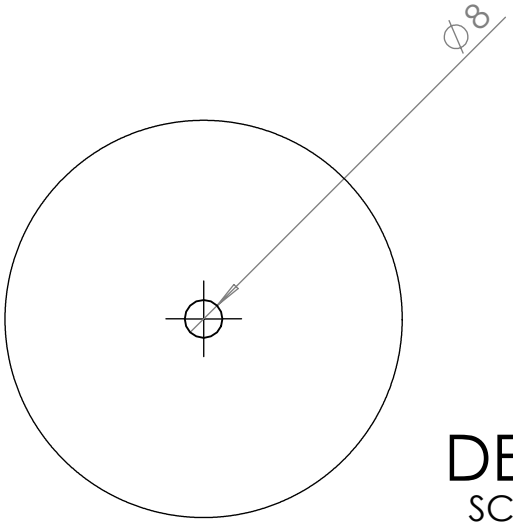
DETAIL A

SCALE 1 : 1



UNIVERSIDAD POLITÈCNICA DE VALÈNCIA CAMPUS D'ALCOI		TITLE: Folding design of a habitable space	
Revised by:	Unit:	1º SURNAME: SÁNCHEZ	DATE: 10/06/18
	SCALE:	2º SURNAME: VÁZQUEZ	
		Name: Paula	PAGE:
Mark:		Degree: Industrial Design	

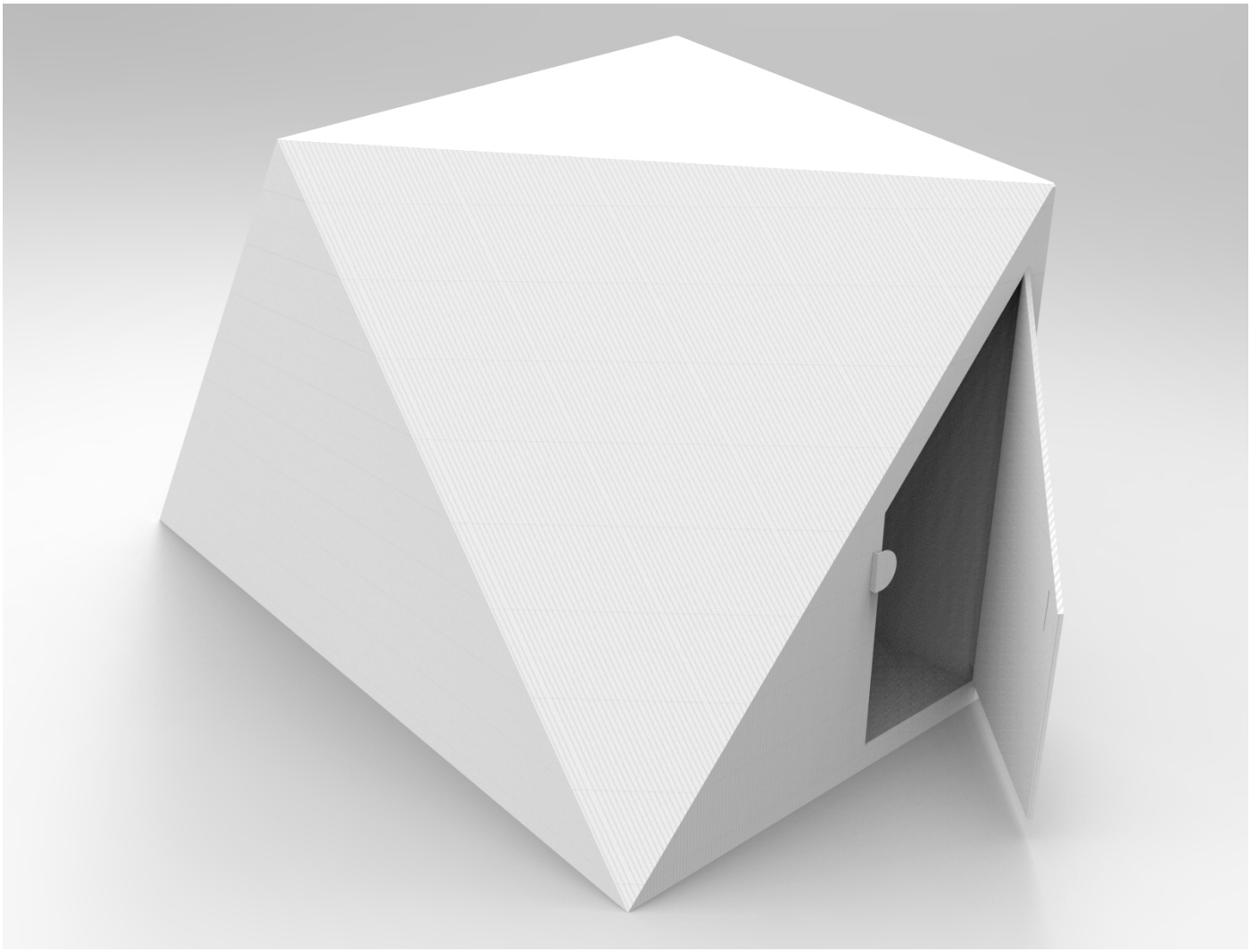


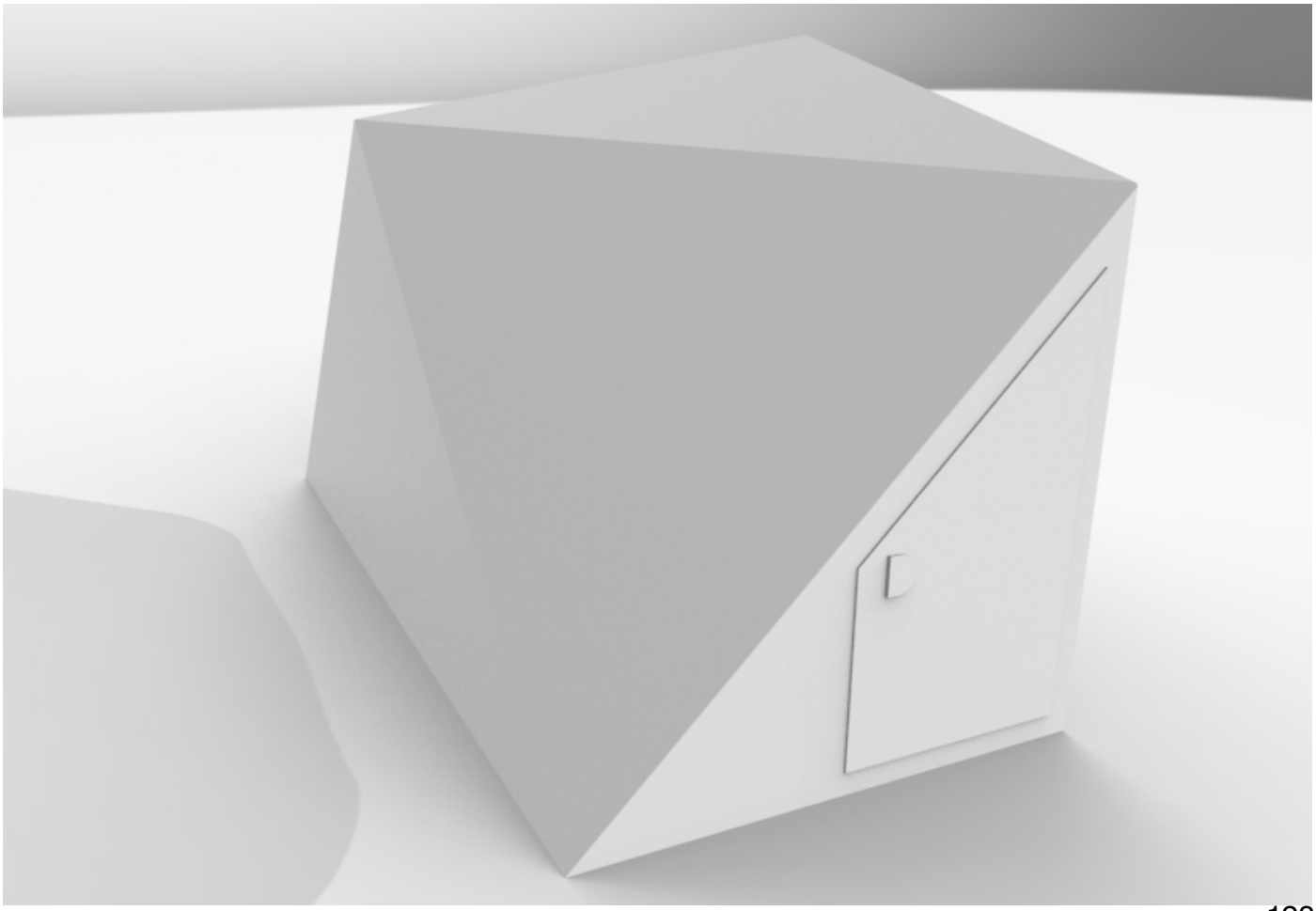


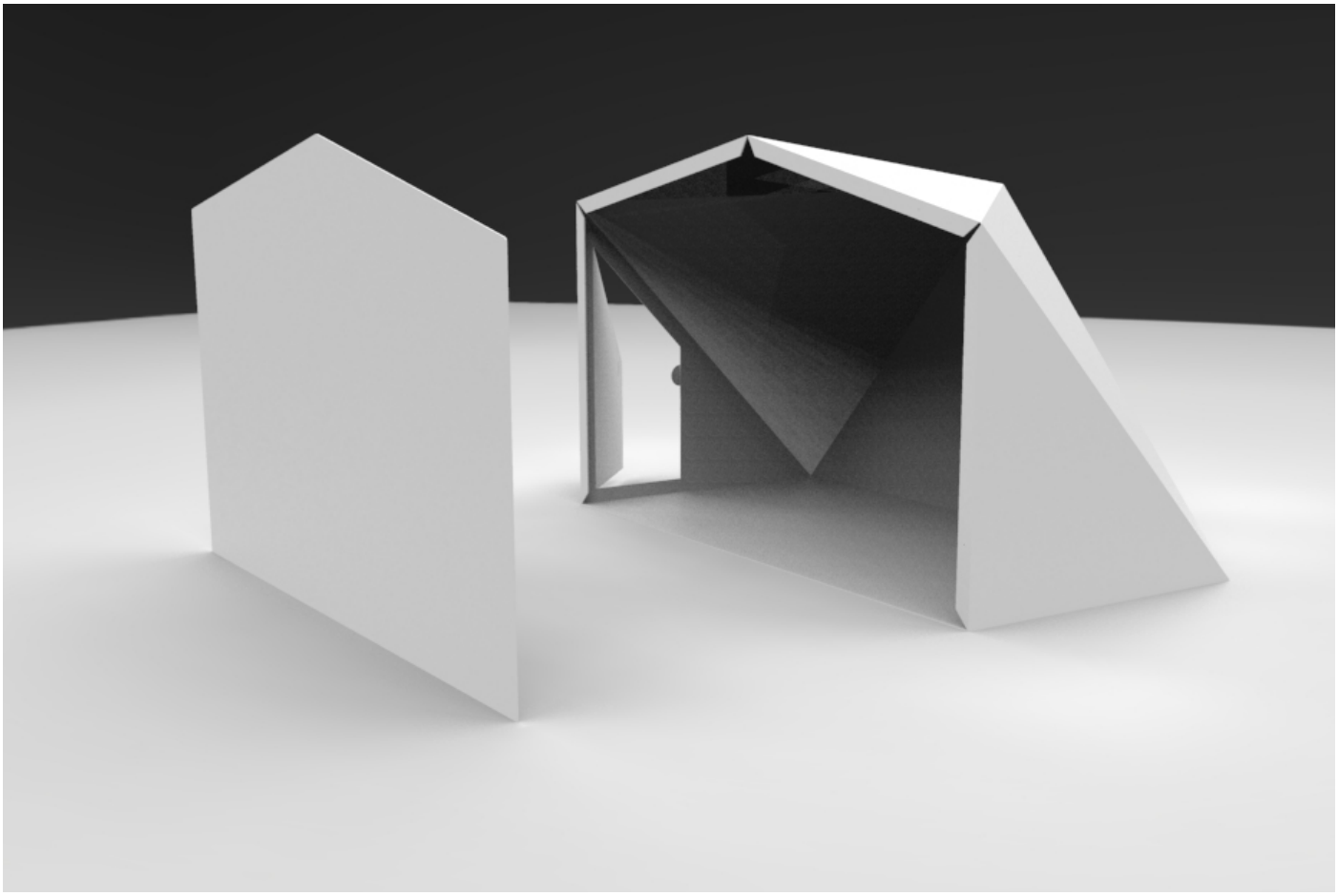
DETAIL A
SCALE 1 : 1

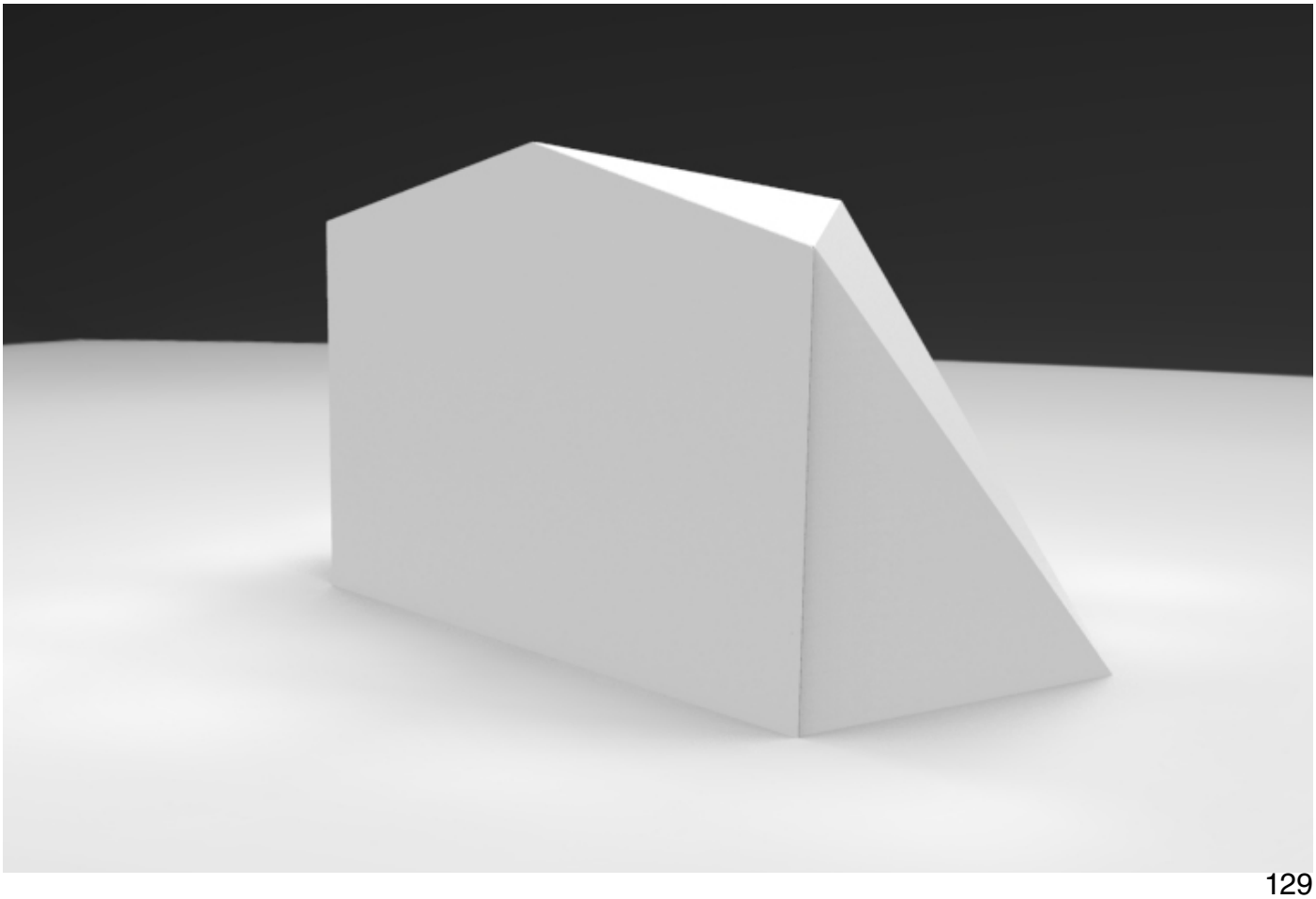
UNIVERSIDAD POLITÈCNICA DE VALÈNCIA CAMPUS D'ALCOI		TITLE: Folding design of a habitable space Individual wall	
Revised by:	Unit: mm	1º SURNAME: SÁNCHEZ	DATE: 10/06/18
	SCALE: 1:50	2º SURNAME: VÁZQUEZ	
		Name: Paula	PAGE:
Mark:		Degree: Industrial Design	

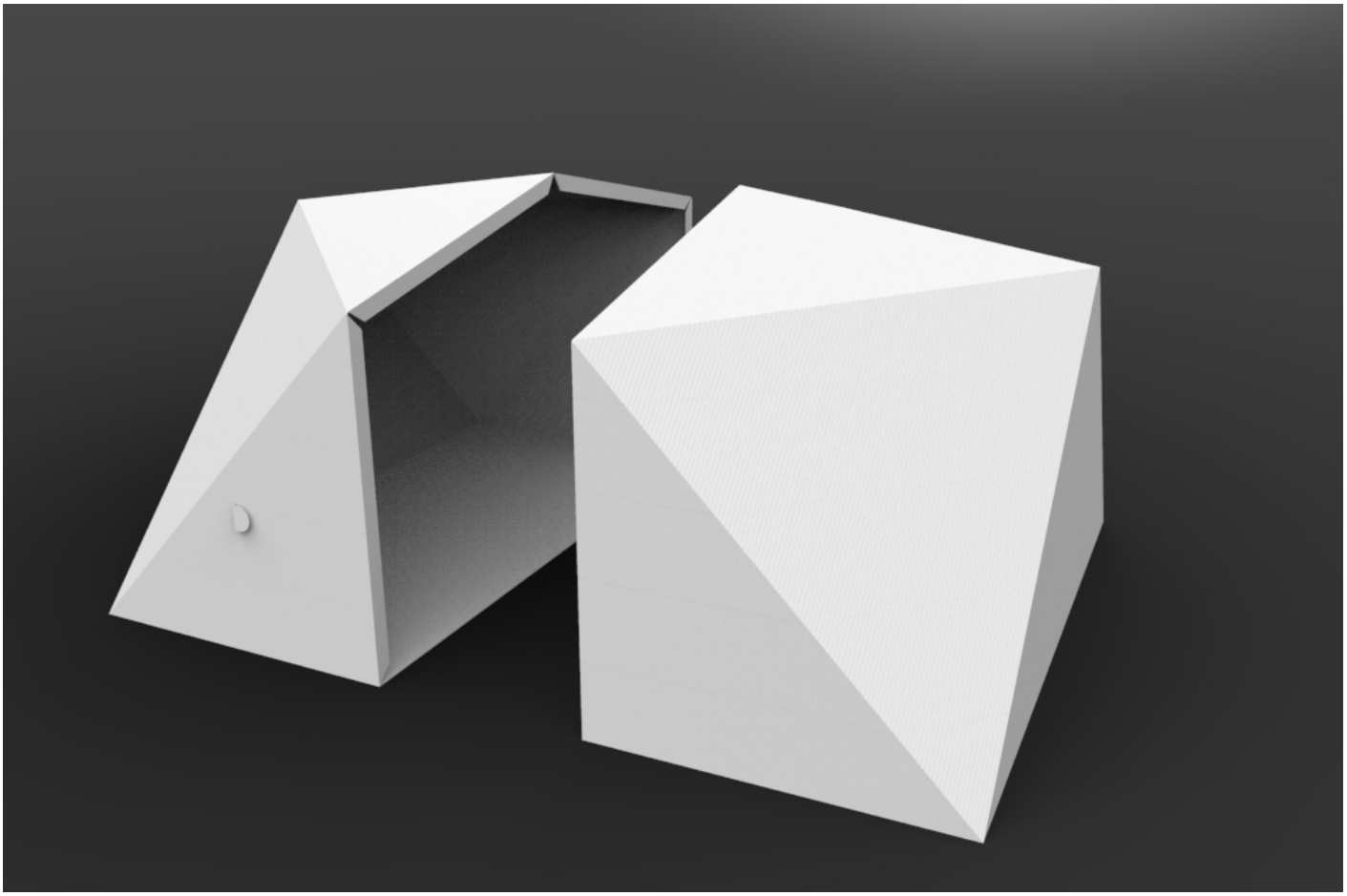
After the measures were shown, in the following pictures it is shown how the shelter looks like individually, without being modulable. Just one module.
It must also be explained how the shelter is assembled because it is done in a simple way. The user receives the shelter as a set of folded polypropylene sheets which will be joined together to form the shelter. The assembly is carried out on the flaps of each face with the help of bolts and nuts. The reason for assembling the flaps instead of the face itself, is that it is thought to create a stronger structure and also a more aesthetic piece. But it also should be noted that the shelter has an additional wall (in the case of the shelter which comes in a pentagonal shape). The fact that this wall is separate and does not go together as the rest do, gives the refuge the opportunity to be modulable. Thus, the shelter itself has the opportunity to work individually or in turn, attach to another identical by removing the pentagonal wall. The union of this additional wall must be added as another assemblie, which will be joined by four of its faces like the rest do, joining the flaps from the shelter with the wall with the help of nuts and bolts. So, when the shelter is set up - using the origami technique - it will quickly acquire its shape and only a total of 8 (one for join the individual wall, one for the handle door, and the rest are for joining the walls between them) identical assemblies will be needed to be able to construct it.

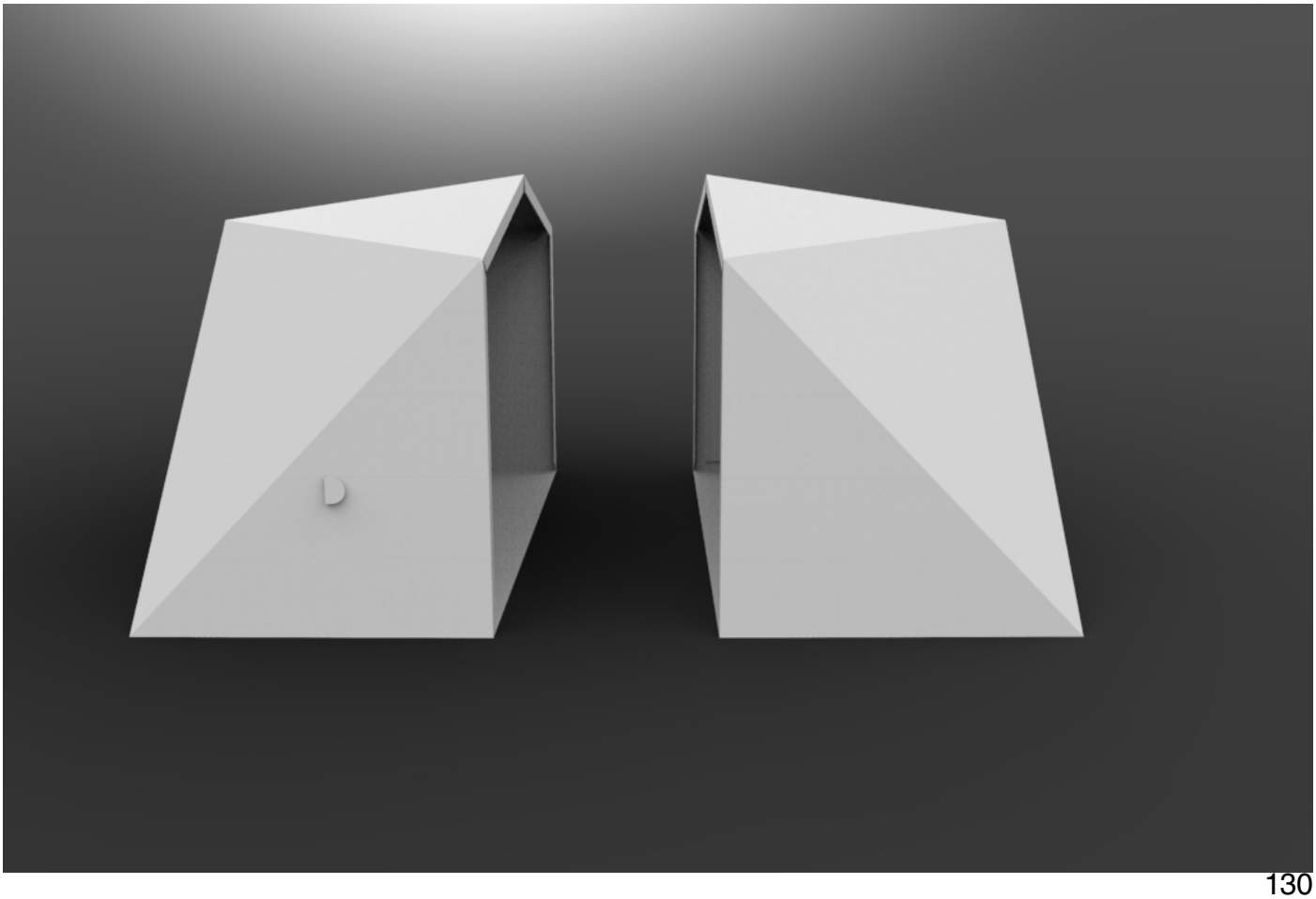


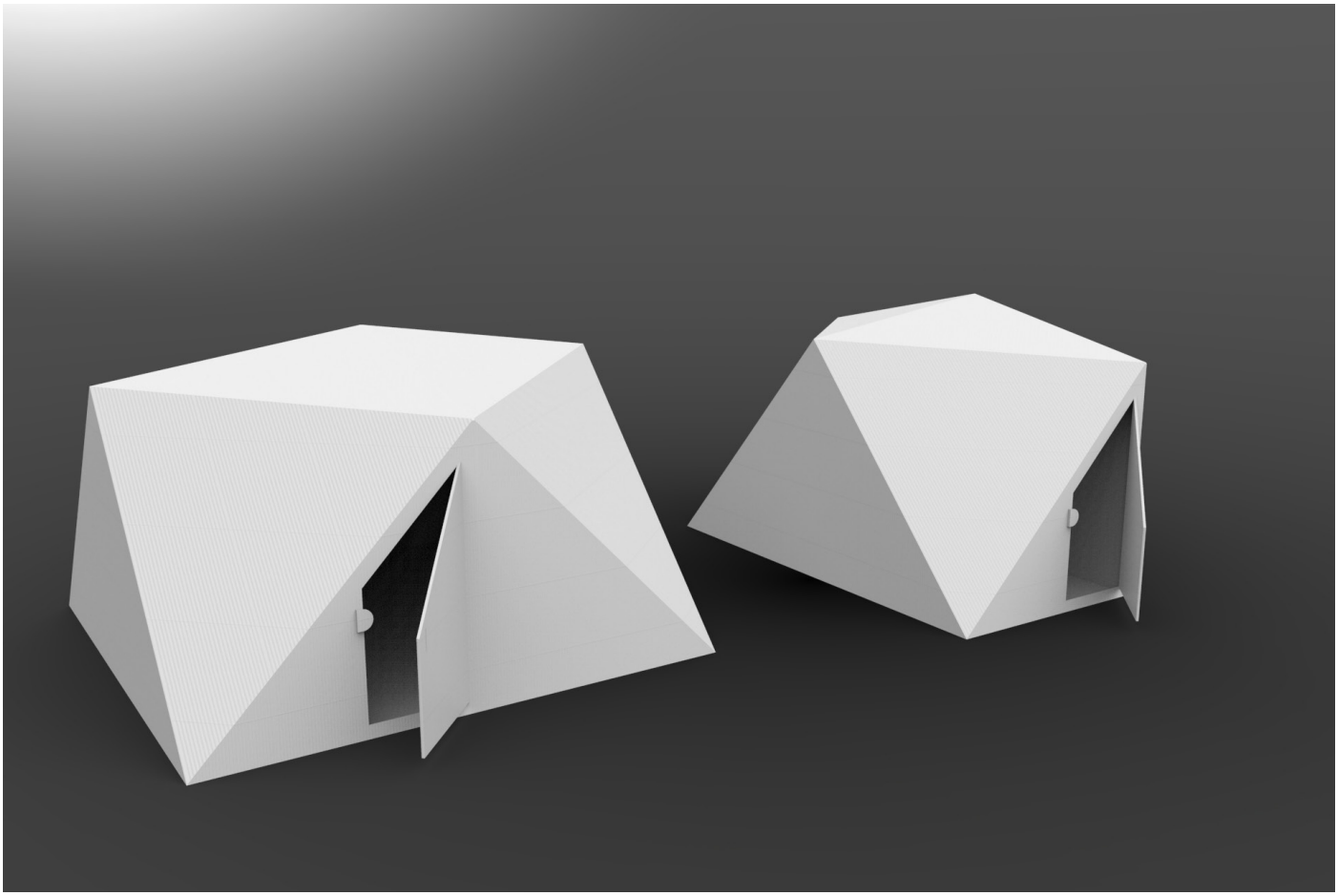


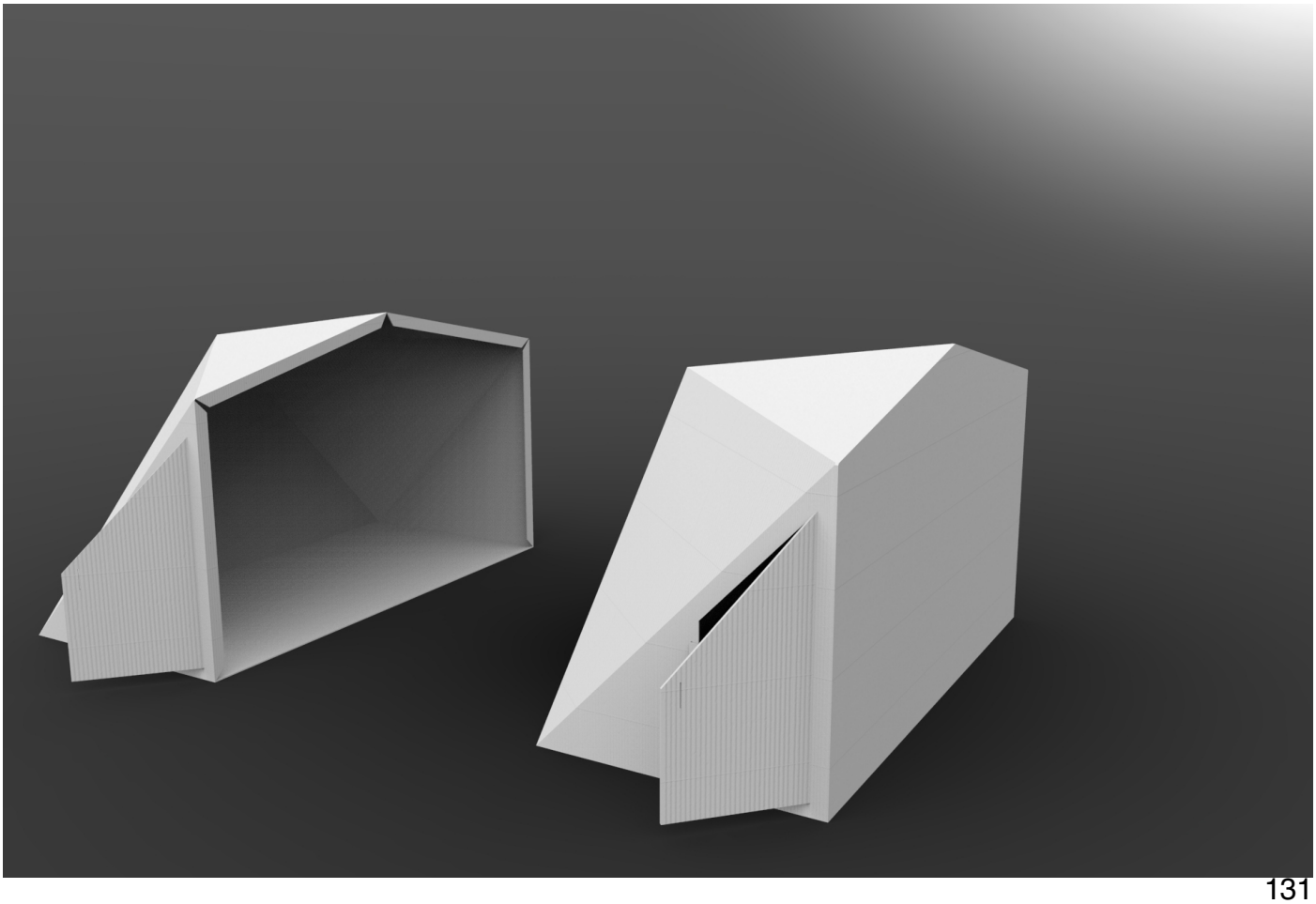


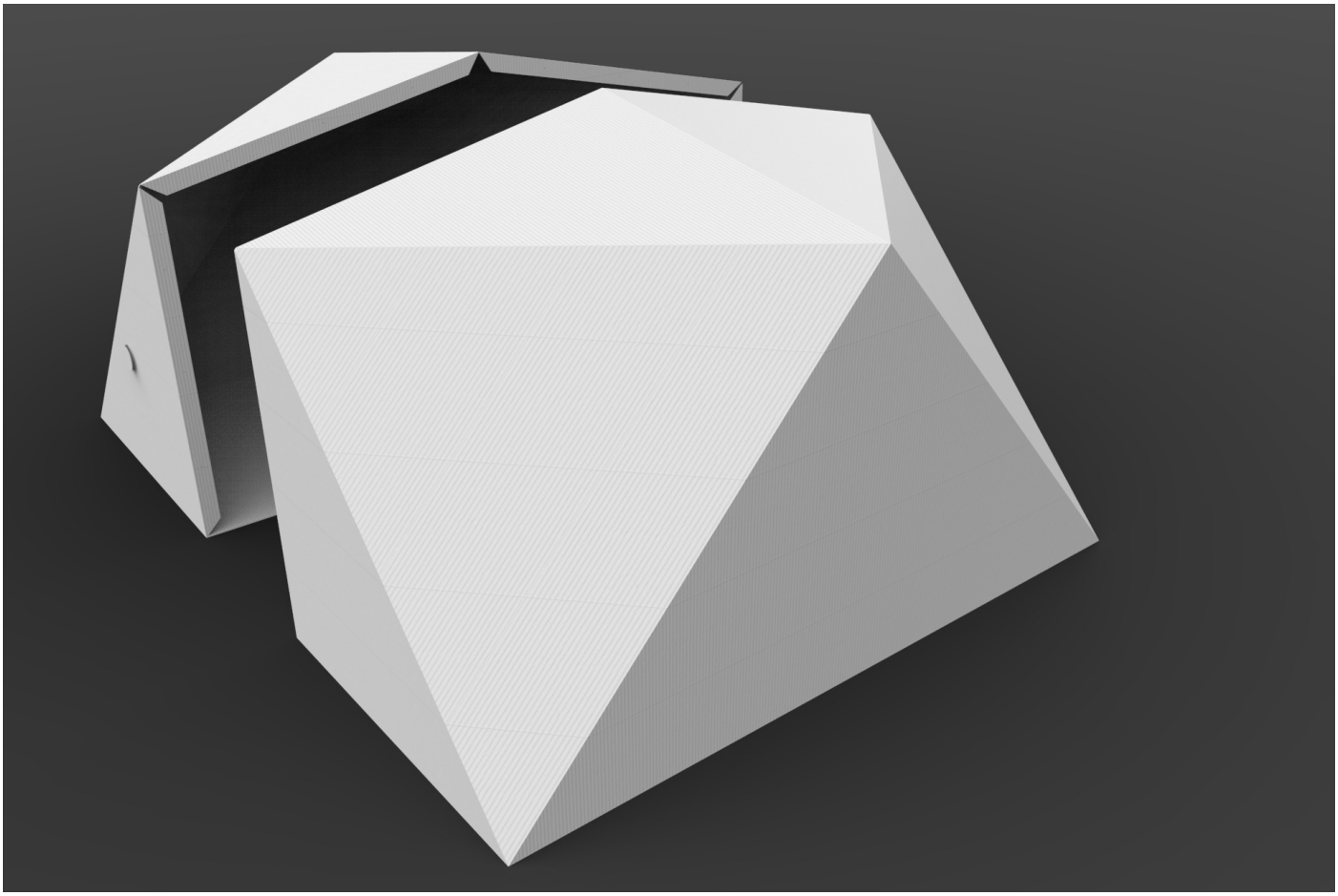


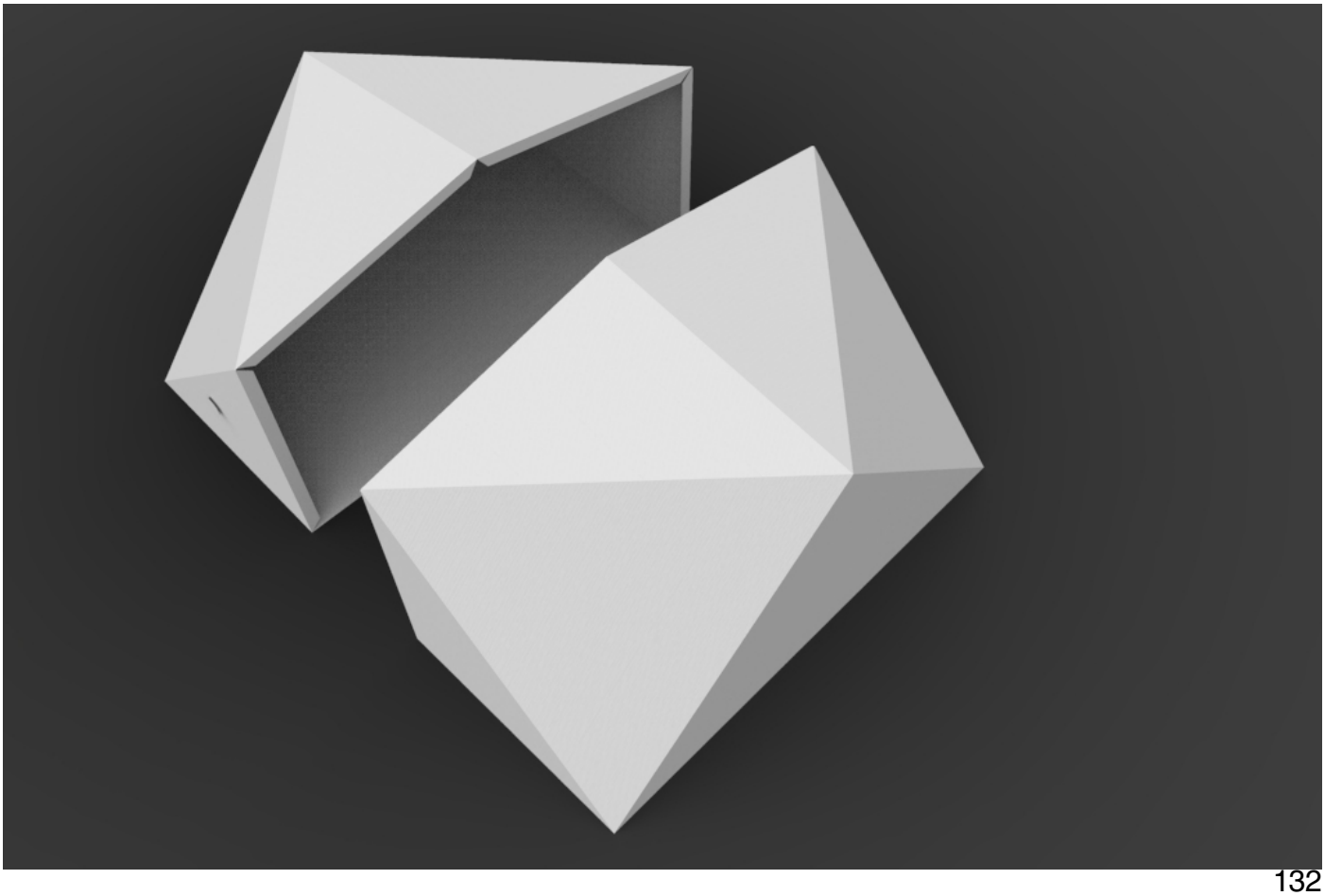


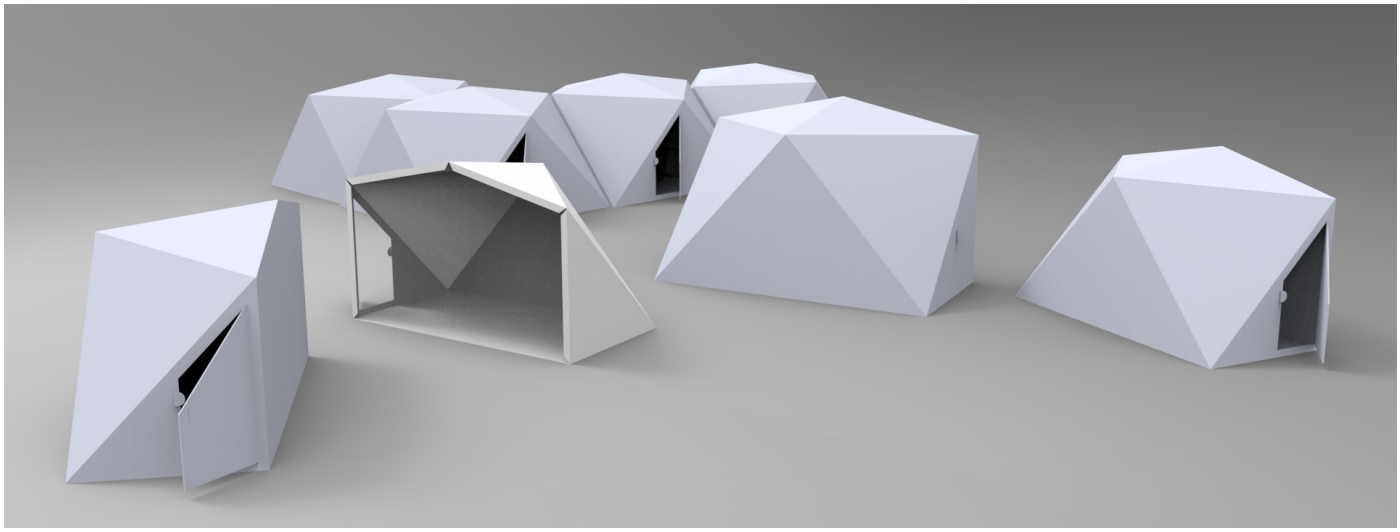


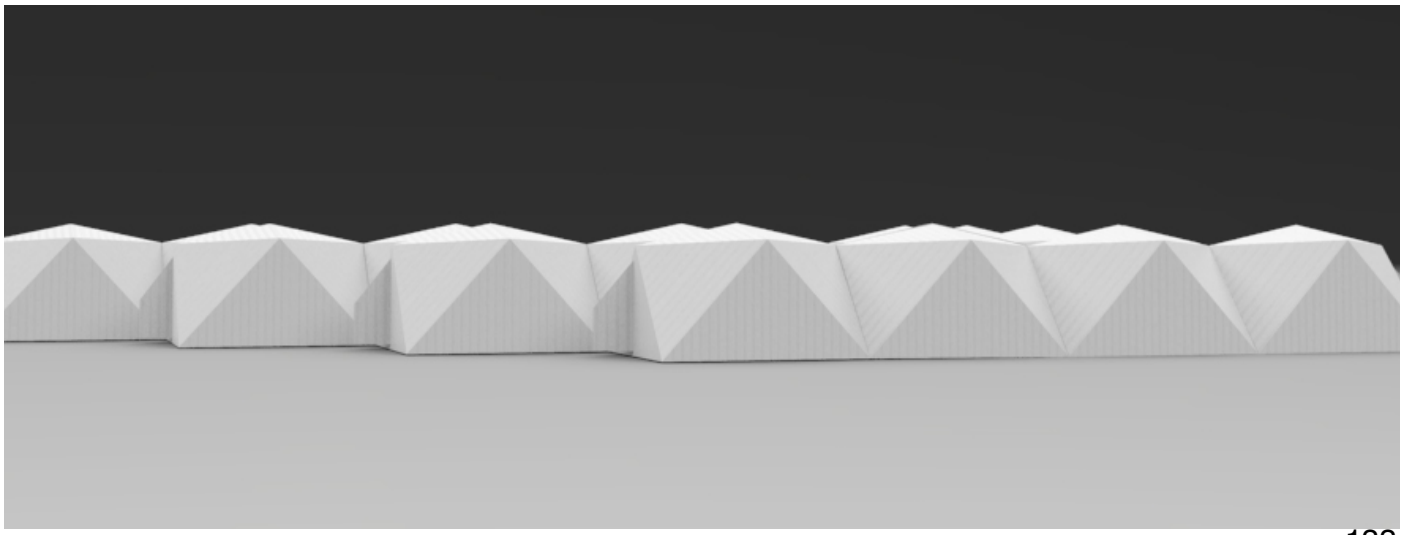










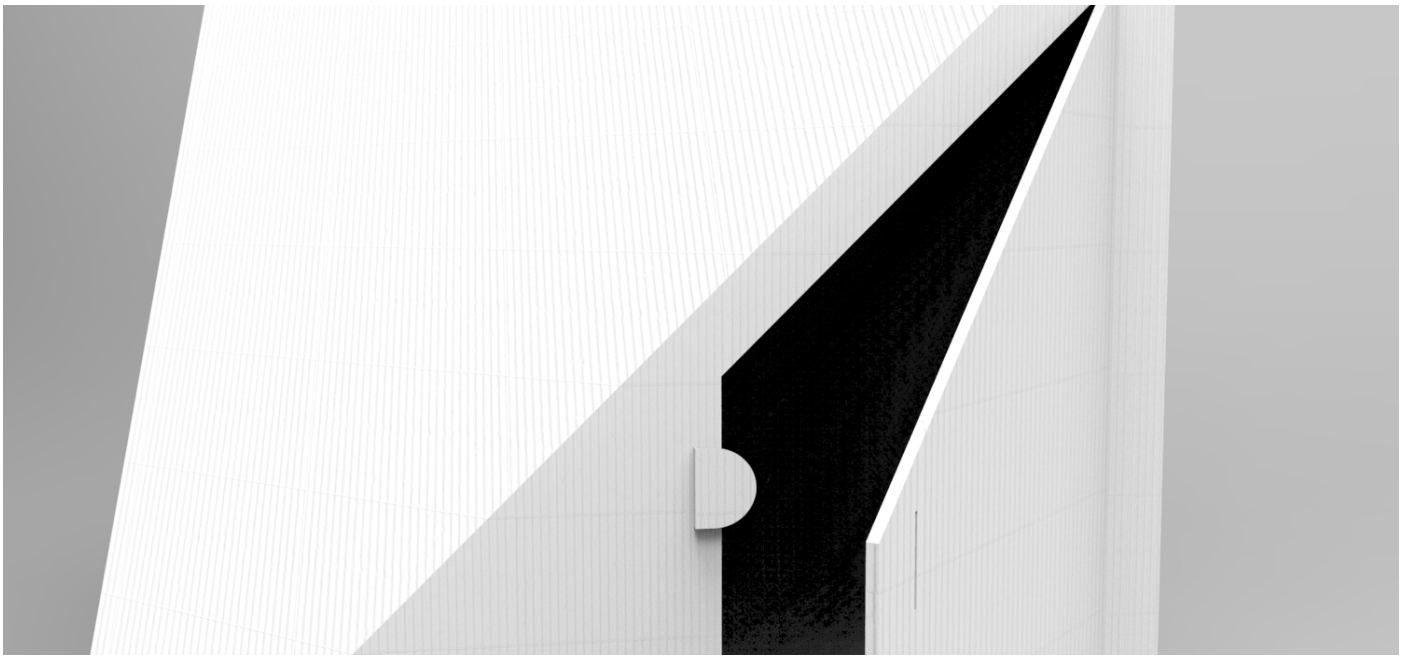


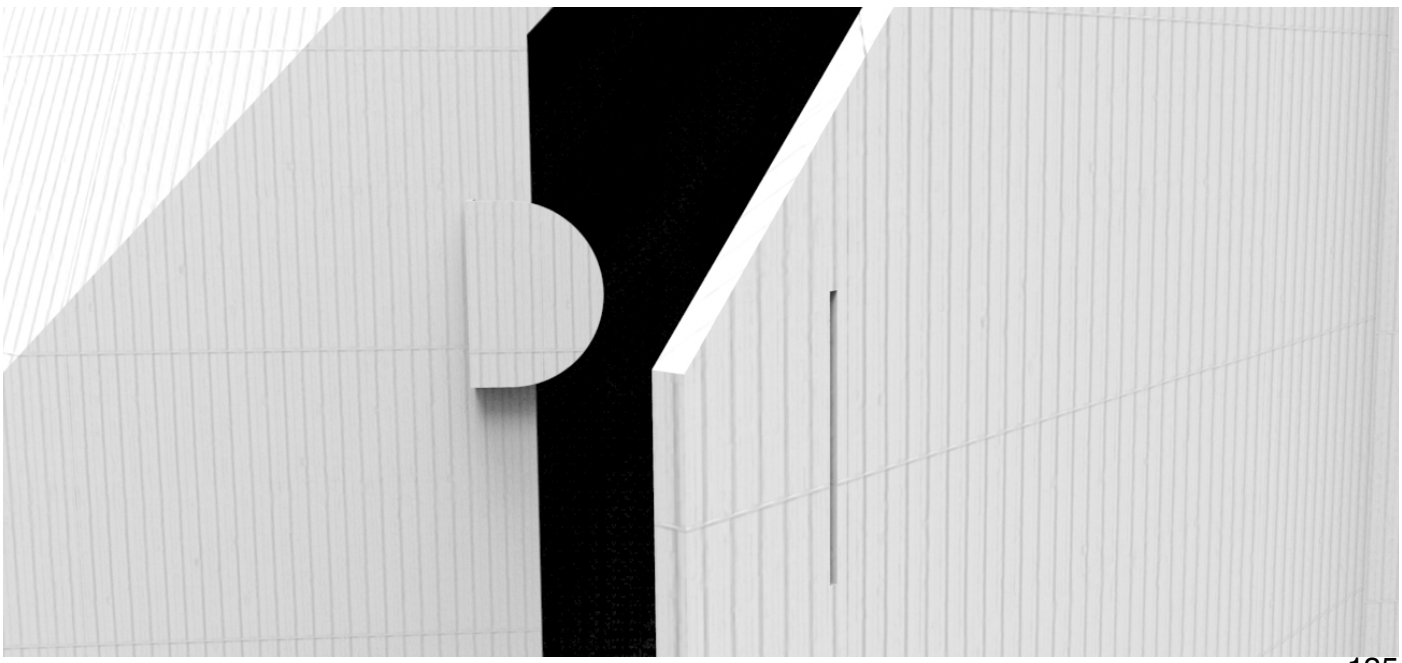
ASSEMBLIES

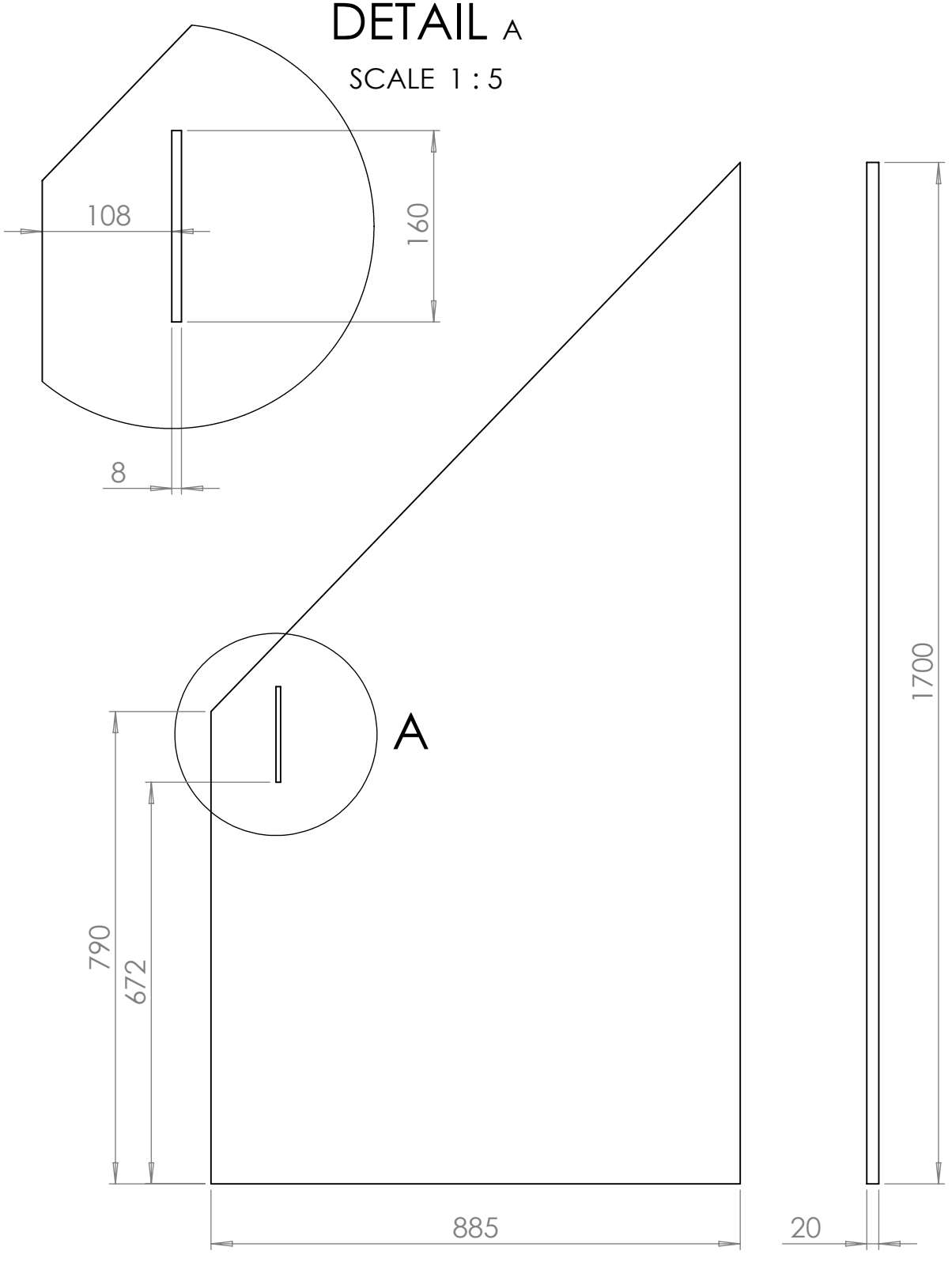
FOLDING DESIGN OF A HABITABLE SPACE

In this section is going to be explained how the assemblies of the shelter work. First of all is going to be explained how the door is working as the door handle as well.
It also can be observerd information about which kind of bolts, nuts and washers were selected for the assemblies of the shelter.

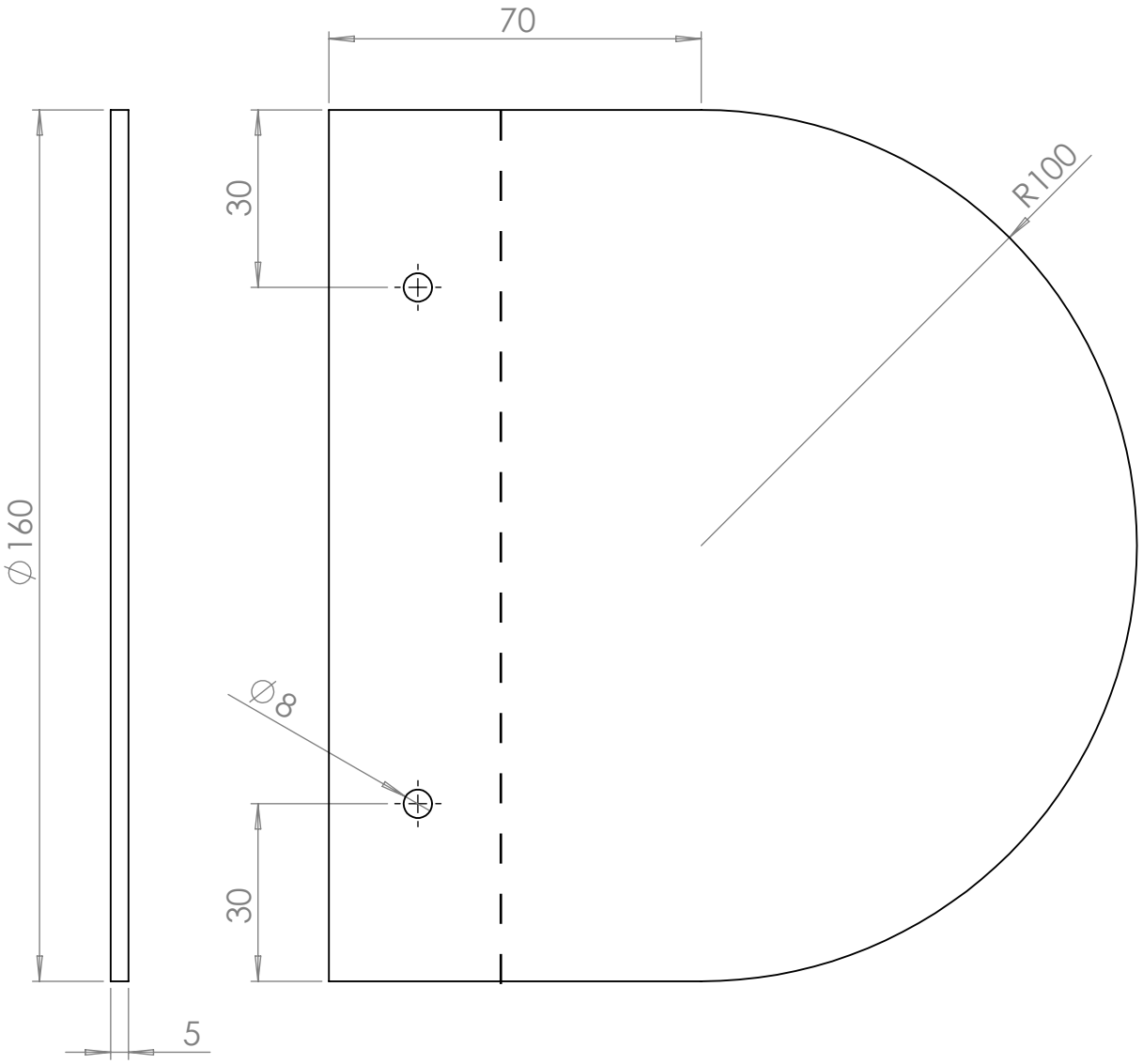
About the placement of the door it can be said that it has been thought in detail since depending on the placement of it in the product, the modularity may not work. What it means is that depending on which wall the door was placed, another module on that wall could be attached or not.
The door is included in the lateral triangular side (in the same sheet of material), what means that it is not a separate piece. That side of the product (that sheet of polypropylene) will have the shape of the door already cut except for the larger side, which will be folded and will allow the movement to open and close.
Regarding to the way to keep the door closed, it has been designed on the same wall, a door handle that will be attached to the wall through the use of screws, nuts and washers and that will work to hold the door and to prevent it from opening inwards or outwards unintentionally.
The shape of this door handle is a polypropylene sheet with a “D” shape which has two holes through which it will be joined with the wall of the shelter. In addition, it must be clarified that in order to be functional, this sheet must be bent where it is indicated by dashed lines in the following drawing. In that way, the door handle will go through the hole made in the door (the hole has the same shape and dimensions as the door handle).This movement can be possible thanks to one of the most important characteristics of this material, which is super easy to handle it and it allows the creation of thing that with another material couldn’t be done.
In the following pictures, the result of it and the correspondent drawings can be observed.







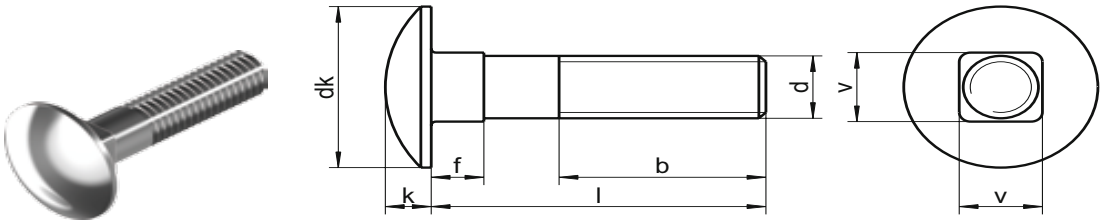
UNIVERSIDAD POLITÈCNICA DE VALÈNCIA CAMPUS D'ALCOI		TITLE: Folding design of a habitable space Door	
Revised by:	Unit: mm	1º SURNAME: SÁNCHEZ	DATE: 10/06/18
	SCALE: 1:10	2º SURNAME: VÁZQUEZ	
		Name: Paula	PAGE:
Mark:		Degree: Industrial Design	



UNIVERSIDAD POLITÈCNICA DE VALÈNCIA CAMPUS D'ALCOI		TITLE: Folding design of a habitable space Door handle	
Revised by:	Unit: mm	1º SURNAME: SÁNCHEZ	DATE: 10/06/18
	SCALE: 1:2	2º SURNAME: VÁZQUEZ	
		Name: Paula	PAGE:
Mark:		Degree: Industrial Design	

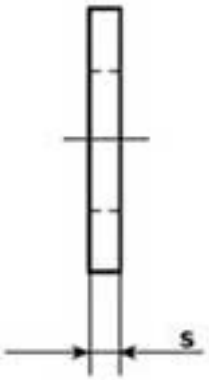
Regarding to all the assemblies of this product, it could be said that only one type of each element is valid for all the assemblies. The assemblies are going to be done between two flaps or between two walls, what means that all of them are going to be done between two sheets of popypropylene. So the elements needed will be bolts, nuts and washers.
The reason of why the assemblies were thought to be done with those elements is because is a easy and fast type of assembly that everyone could do.
The election of a square head bolt is because a bolt with that shape could support the tensions in a better way than any other. As well the dimensions of it were chosen because the thickness of one sheet of poplypropylene is about 5 mm, so in all the cases the assembly will be done between a 10 mm space what it should be added the dimension of the washers. So the lenght wanted in one bolt is about 15 mm as minimum, but it was thought that maybe was not enough so the decision was made chosing the M8x20 square head bolt . About the nuts and the washers, they were chosen according to the bolt so they will be M8.
All specification could be observed in the following pictures.

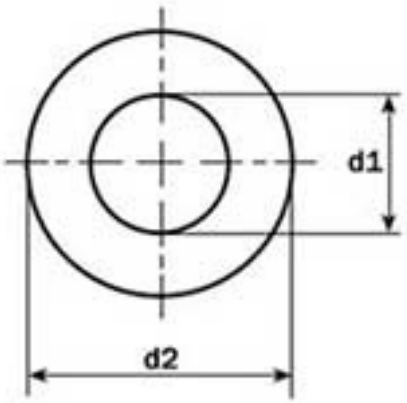
DIN 603 - sim. ISO 8677
Mushroom head square neck bolts



dk min.	12,45	15,45	19,35	23,35	29,35	37,20
f min.	2,90	3,40	4,40	5,40	7,25	11,10
k min.	2,70	3,12	4,12	4,62	6,05	8,05
v min.	4,52	5,52	7,42	9,42	11,30	15,30
b≤125	16	18	22	26	30	38
b>125	22	24	28	32	36	44
Length /Ø	**M5**	**M6**	**M8**	**M10**	**M12**	**M16**
12		▲●				
16	▲●	▲●	▲●	▲●		
20	▲●	▲●	▲●	▲●		
25	▲●	▲●	▲●	▲●	▲●	
30	▲●	▲●	▲●	▲●	▲●	
35	▲●	▲●	▲●	▲●	▲●	
40	▲●	▲●	▲●	▲●	▲●	▲●
45	▲●	▲●	▲●	▲●	▲●	▲●
50	▲●	▲●	▲●	▲●	▲●	▲●
55	▲●	▲●	▲●	▲●	▲●	▲●
60	▲●	▲●	▲●	▲●	▲●	▲●
65	▲●	▲●	▲●	▲●	▲●	▲●
70	▲●	▲●	▲●	▲●	▲●	▲●
75	▲●	▲●	▲●	▲●	▲●	▲●
80	▲●	▲●	▲●	▲●	▲●	▲●
90		▲●	▲●	▲●	▲●	▲●
100		▲●	▲●	▲●	▲●	▲●
110		▲●	▲●	▲●	▲●	▲●
120		▲●	▲●	▲●	▲●	▲●
130		▲●	▲●	▲●	▲●	▲●
140		▲●	▲●	▲●	▲●	▲●
150			▲●	▲●	▲●	▲●
160			▲●	▲●	▲●	▲●
170			▲●	▲●	▲●	▲●
180			▲●	▲●	▲●	▲●
200			▲●	▲●	▲●	▲●
SU	200	200 ≥ 60 100	100 ≥ 70 50	100 ≥ 50 50	50	25

■ A1 / ▲ A2 / ● A4 | SU: Sales unit | All measurements in mm | Other dimensions on request.
Example item no. 603-2-8X40 DIN 603 - A2 - M8 - l = 40mm

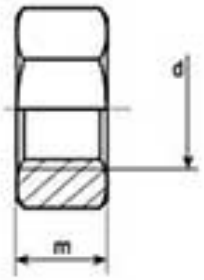


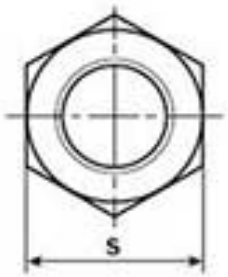


d	M 3	M 4	M 5	M 6	M 7	M 8	M 10	M 12
d1	3,2	4,3	5,3	6,4	7,4	8,4	10,5	13
d2	7	9	10	12	14	16	20	24
s	0,5	0,8	1	1,6	1,6	1,6	2	2,5
Peso/weight 1000ud . Kg.				Peso/weight 1000ud . Kg.				
	0,12 kg	0,31 kg	0,44kg	1,02 kg	1,39kg	1,83kg	3,57kg	6,27kg

d	M 14	M 16	M 18	M 20	M 22	M 24	M 27	M 30
d1	15	17	19	21	23	25	28	31
d2	28	30	34	37	39	44	50	56
s	2,5	3	3	3	3	4	4	4
Peso/weight 1000ud . Kg.				Peso/weight 1000ud . Kg.				
	8,6kg	11,3kg	14,7kg	17,2kg	18,4kg	32,3kg	43,7kg	53,6kg

d	M 33	M 36	M 39	M 42	M 45	M 48	M 52	M 56
d1	34	37	40	43	46	50	54	58
d2	60	66	72	78	85	92	98	105
s	5	5	6	7	7	8	8	9
Peso/weight 1000ud . Kg.				Peso/weight 1000ud . Kg.				
	75,3kg	92,1kg	133kg	183kg	220kg	294kg	330kg	425kg





d	M 3	M 4	M 5	M 6	M 7	M 8	M 10	M 12	M 14
P	0,5	0,7	0,8	1	1	1,25	1,5	1,75	2
m	2,4	3,2	4	5	5,5	6,5	8	10	11
s	5,5	7	8	10	11	13	17/16	19/18	22/21
Peso/weight 1000ud . Kg.				Peso/weight 1000ud . Kg.			Peso/weight 1000ud . Kg.		
	0,39 kg	0,81 kg	1,23 kg	2,5 kg	3,12 kg	5,2 kg	11,6 kg	17,3 kg	25 kg

d	M 16	M 18	M 20	M 22	M 24	M 27	M 30	M 33	M 36
P	2	2,5	2,5	2,5	3	3	3,5	3,5	4
m	13	15	16	16	19	11	24	26	29
s	24	27	30	30	36	41	46	50	55
Peso/weight 1000ud . Kg.				Peso/weight 1000ud . Kg.			Peso/weight 1000ud . Kg.		
	33.3 Kg	49.40 kg	64.40 kg	79.00 kg	110.00 kg	165.00 kg	223.00 kg	288.00 kg	393.00 kg

d	M 39	M 42	M 45	M 48	M 52	M 56	M 60	M 64	M 68
P	4	4,5	4,5	5	5	5,5	5,5	6	6
m	31	34	36	38	42	45	48	51	54
s	60	65	70	75	80	85	90	95	100
Peso/weight 1000ud . Kg.				Peso/weight 1000ud . Kg.			Peso/weight 1000ud . Kg.		
	502 kg	652 kg	800 kg	977 kg	1220 kg	1420 kg	1690 kg	1980 kg	2300 kg

BENDING PROCESS

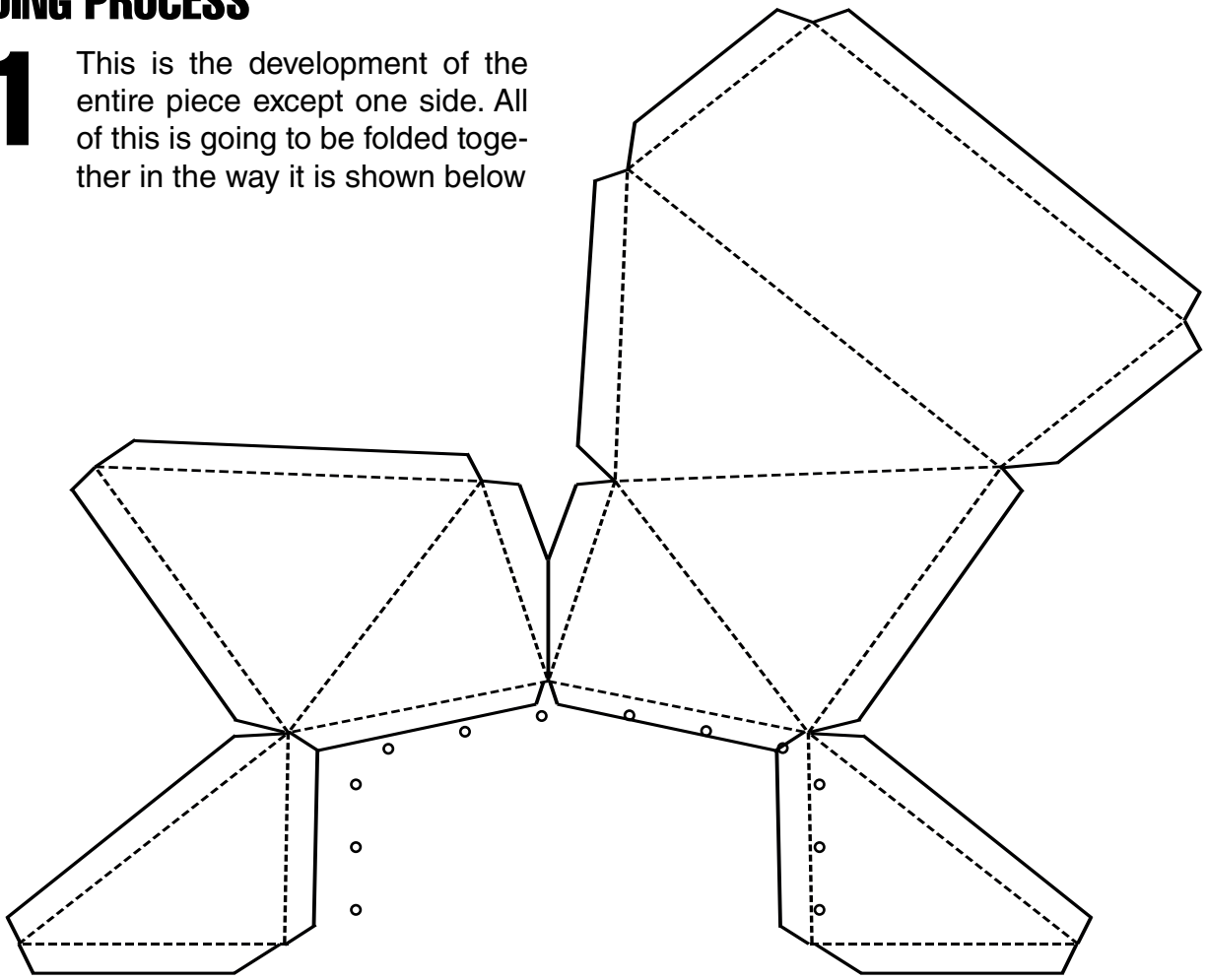
FOLDING DESIGN OF A HABITABLE SPACE

Hereunder, the bending process will be explained. This process is important in order to know how the user will find the product when he receives it and how the product is going to be transported. In the next pictures, the bending process of the polypropylene sheets is going to be shown.
For the bending process, it should be noted that there are three independent parts in the product which are shown in the following page.

BENDING PROCESS

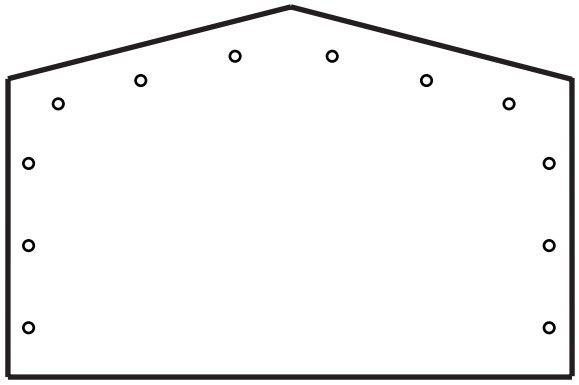
part 1

This is the development of the entire piece except one side. All of this is going to be folded together in the way it is shown below



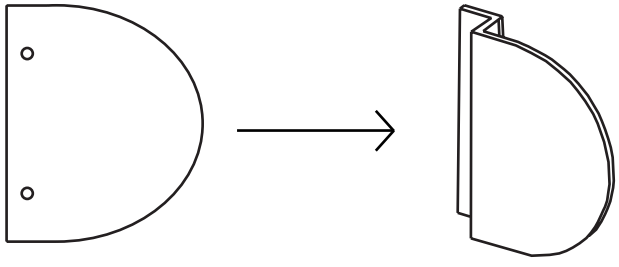
part 2

This is the side which is individual to the development shown before. The reason why this side is appart of the others is becuse it was wanted to make a modular shelter. So to keep this face separate from the rest, was the most appropriate way to achieve this modularity.



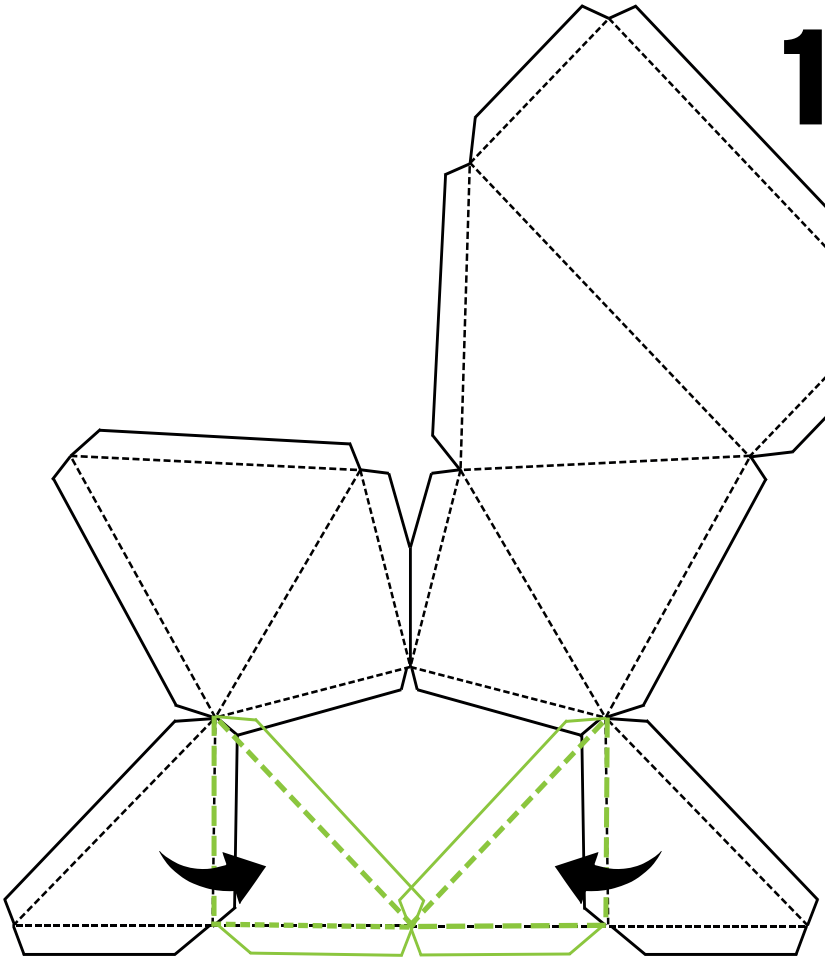
part 3

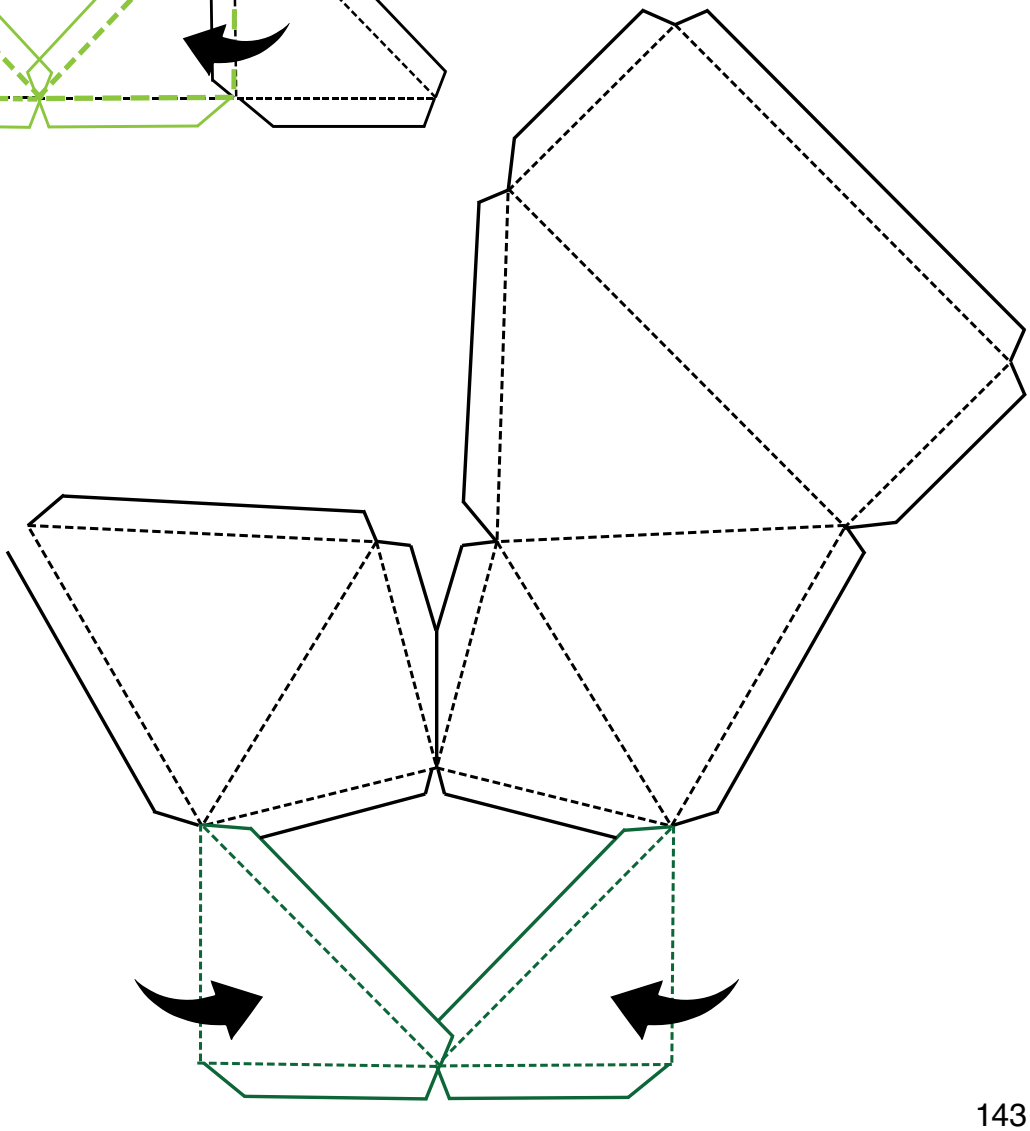
The third part is the element which is going to works as a door handle.



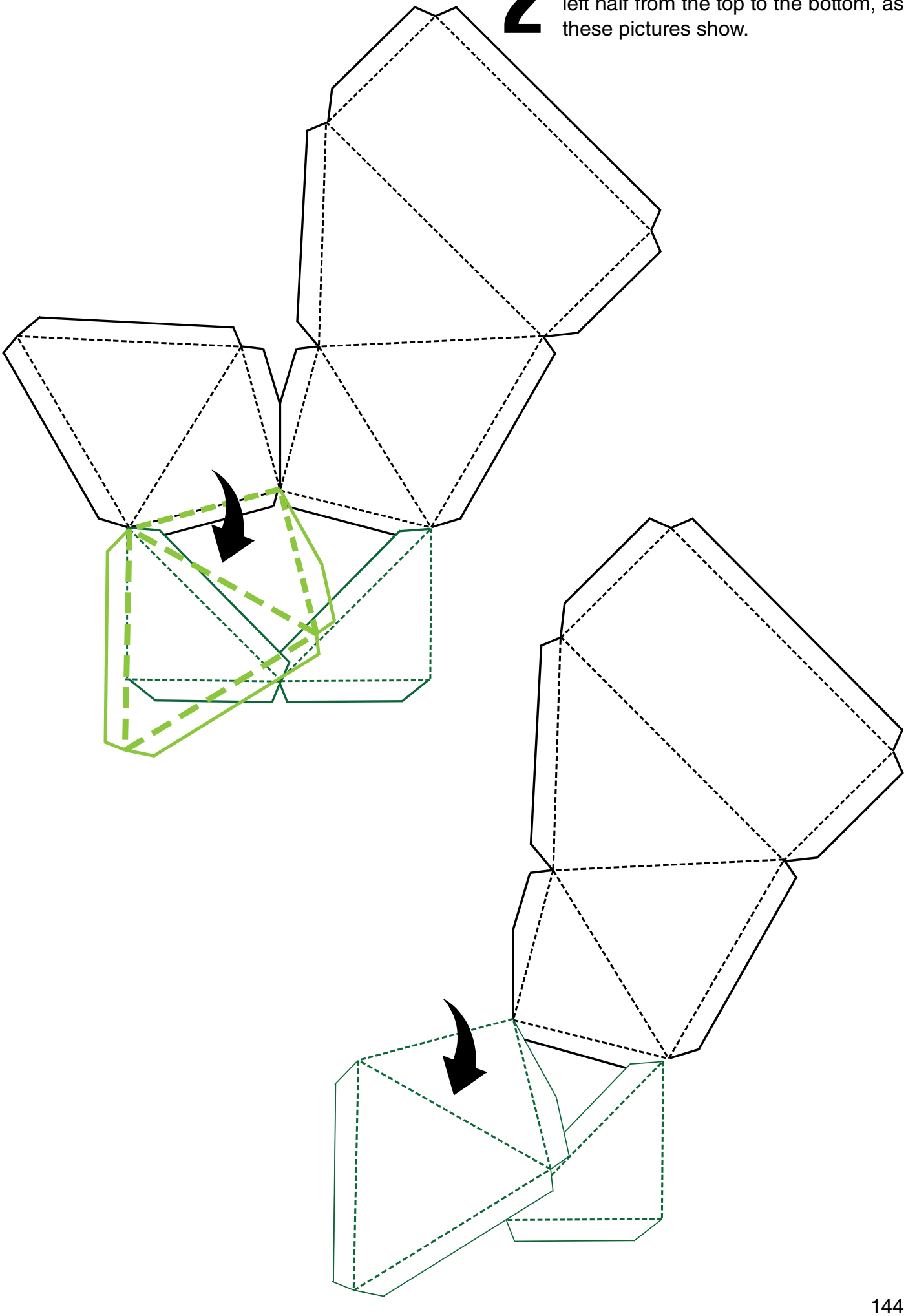
Here, it is explained how the bending of the walls of the shelter work. The order of the following steps is followed by the manufacturer to prepare the product for its delivery. In turn, the user will receive the product as shown in step number 6, so he will have to deploy it and then assemble it.

1 The first step is to fold the two lateral triangles inwards, one by one, as these pictures show.

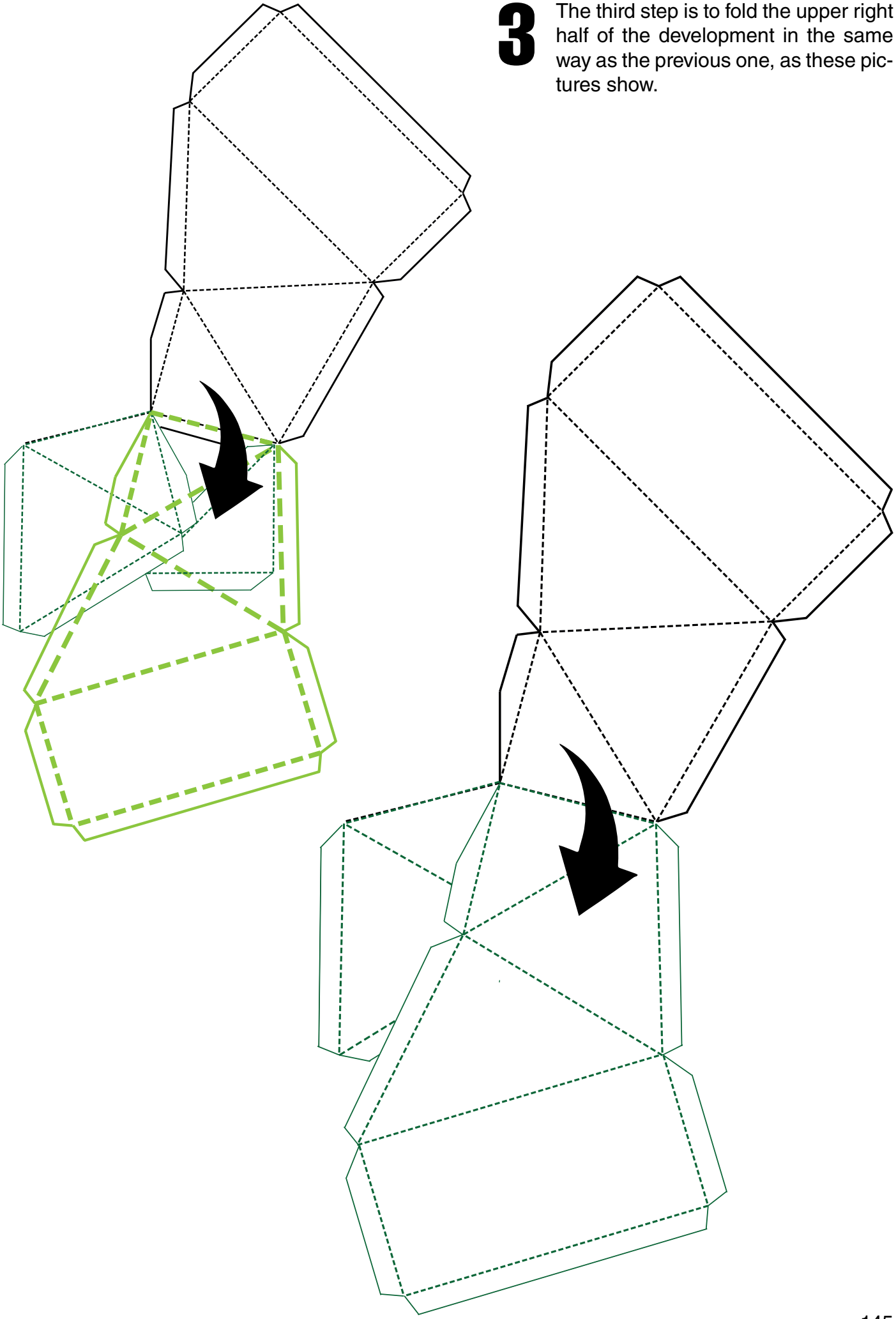




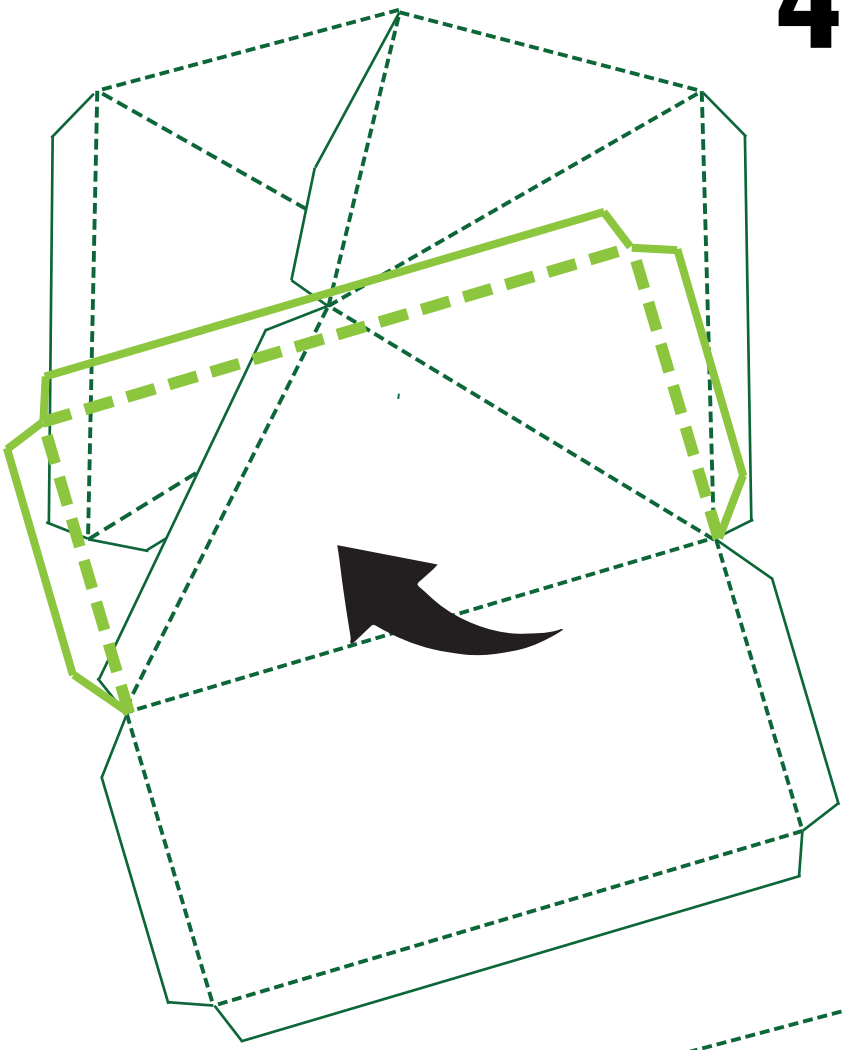
2 The second step is to fold the upper left half from the top to the bottom, as these pictures show.

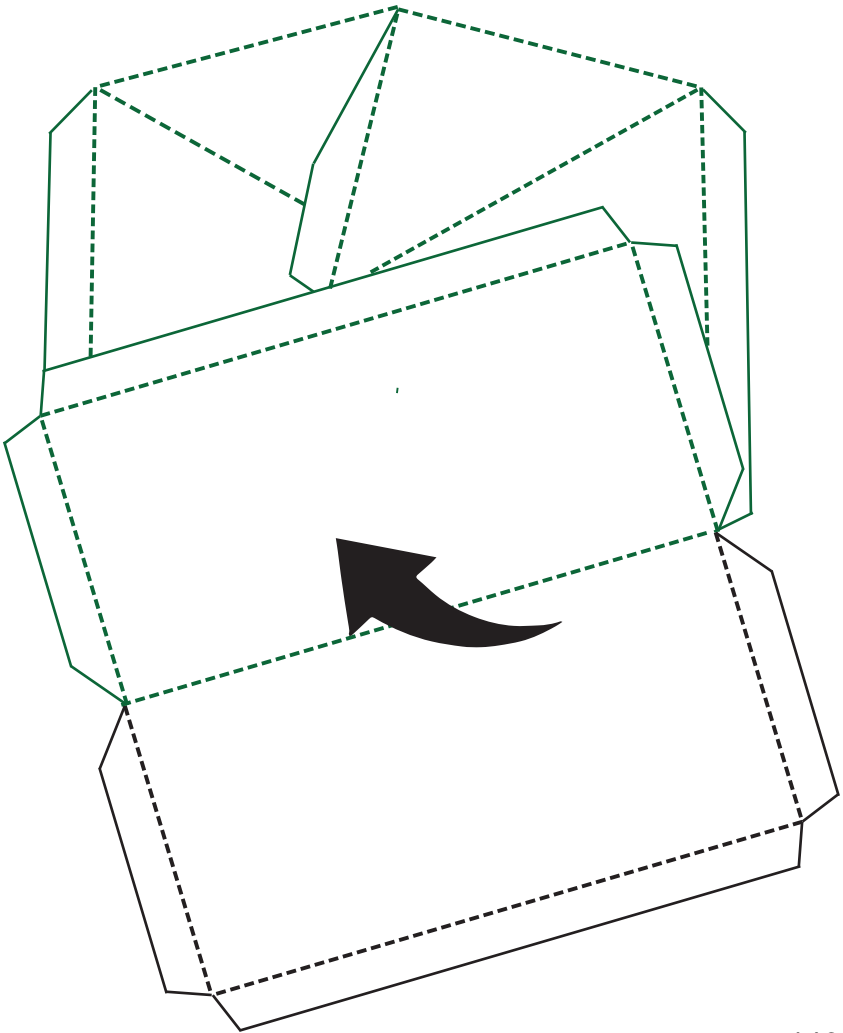


3 The third step is to fold the upper right half of the development in the same way as the previous one, as these pictures show.

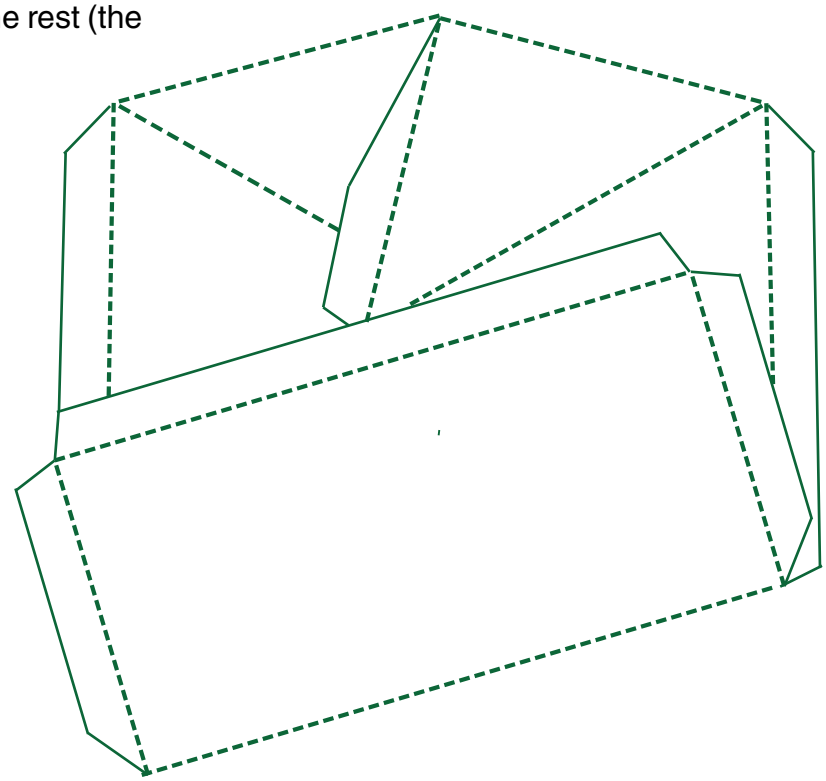


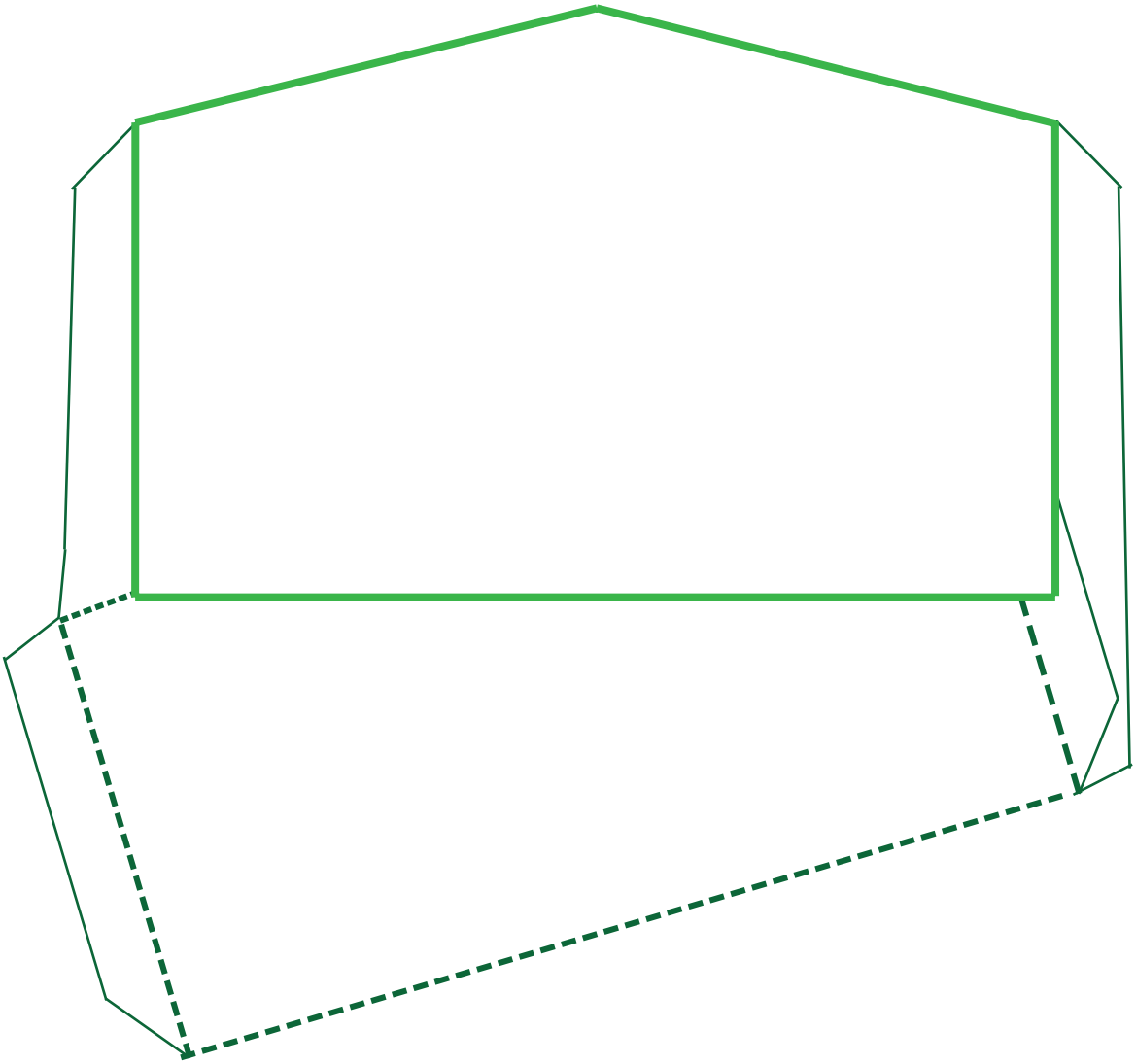
4 The fouth step is to fold the square base from the bottom to the top in order to be on top of the other sides, as these picture show.



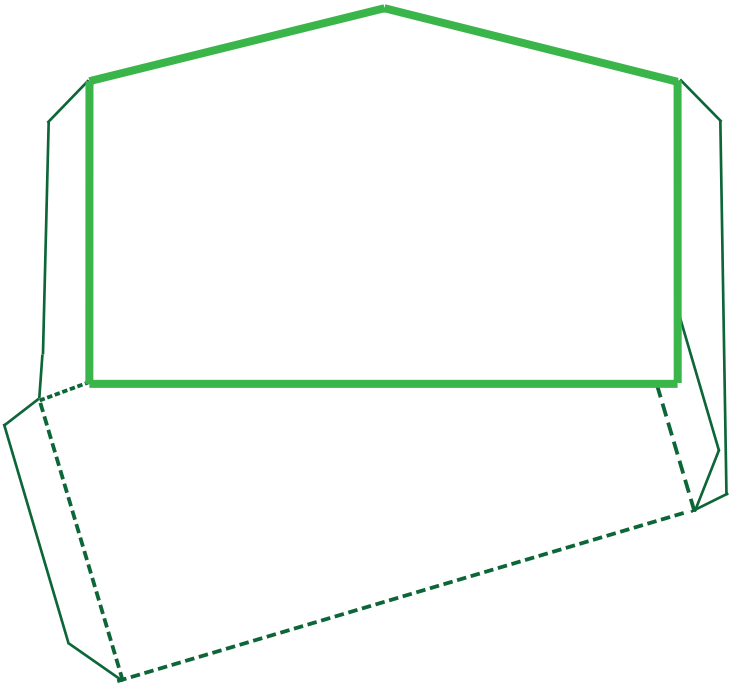


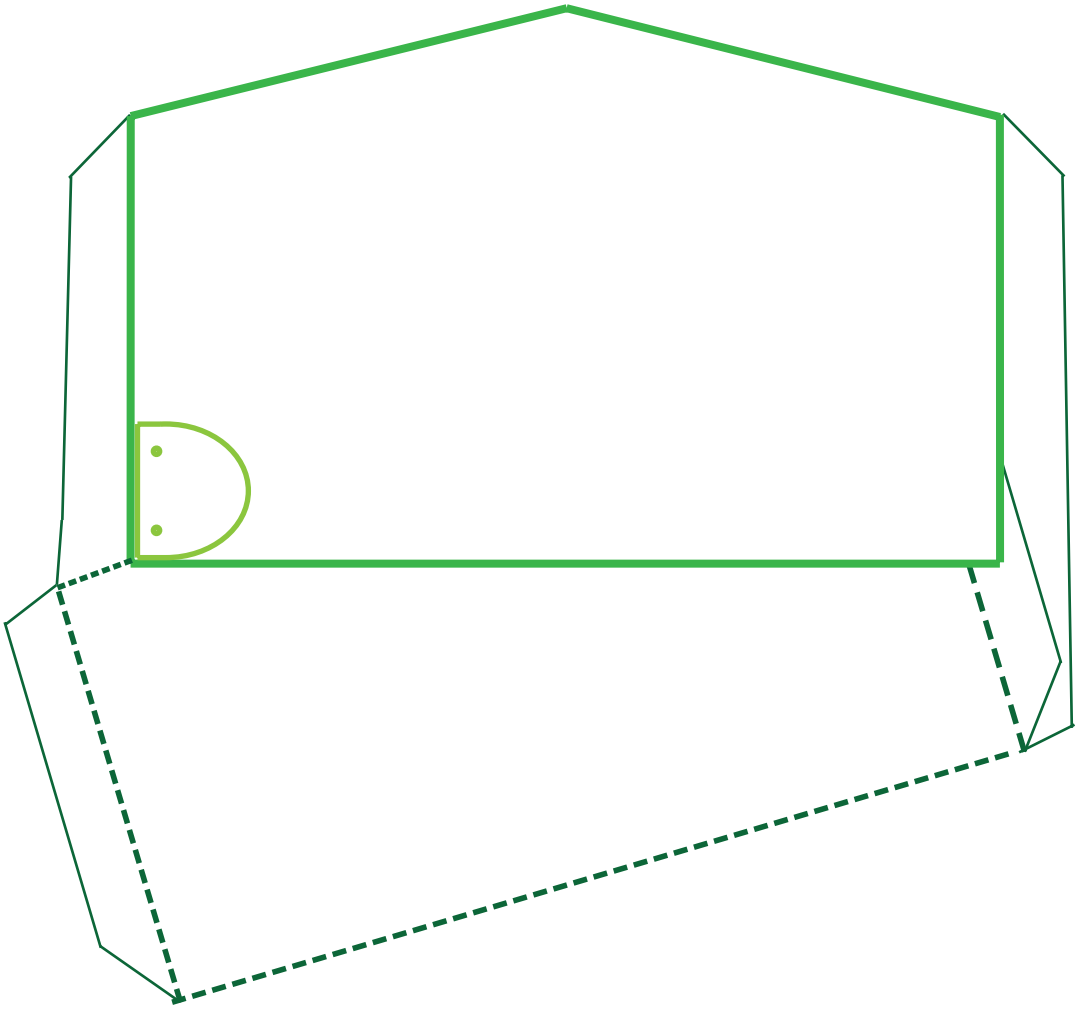
5 The sixth step is almost the final one. It is just to put on the top the independent side, which is part of the rest (the pentagonal one).





6 The seventh step is the final one. It is the same than the step before. Just to put on the top the handle door sheet, which is also made appart of the others.





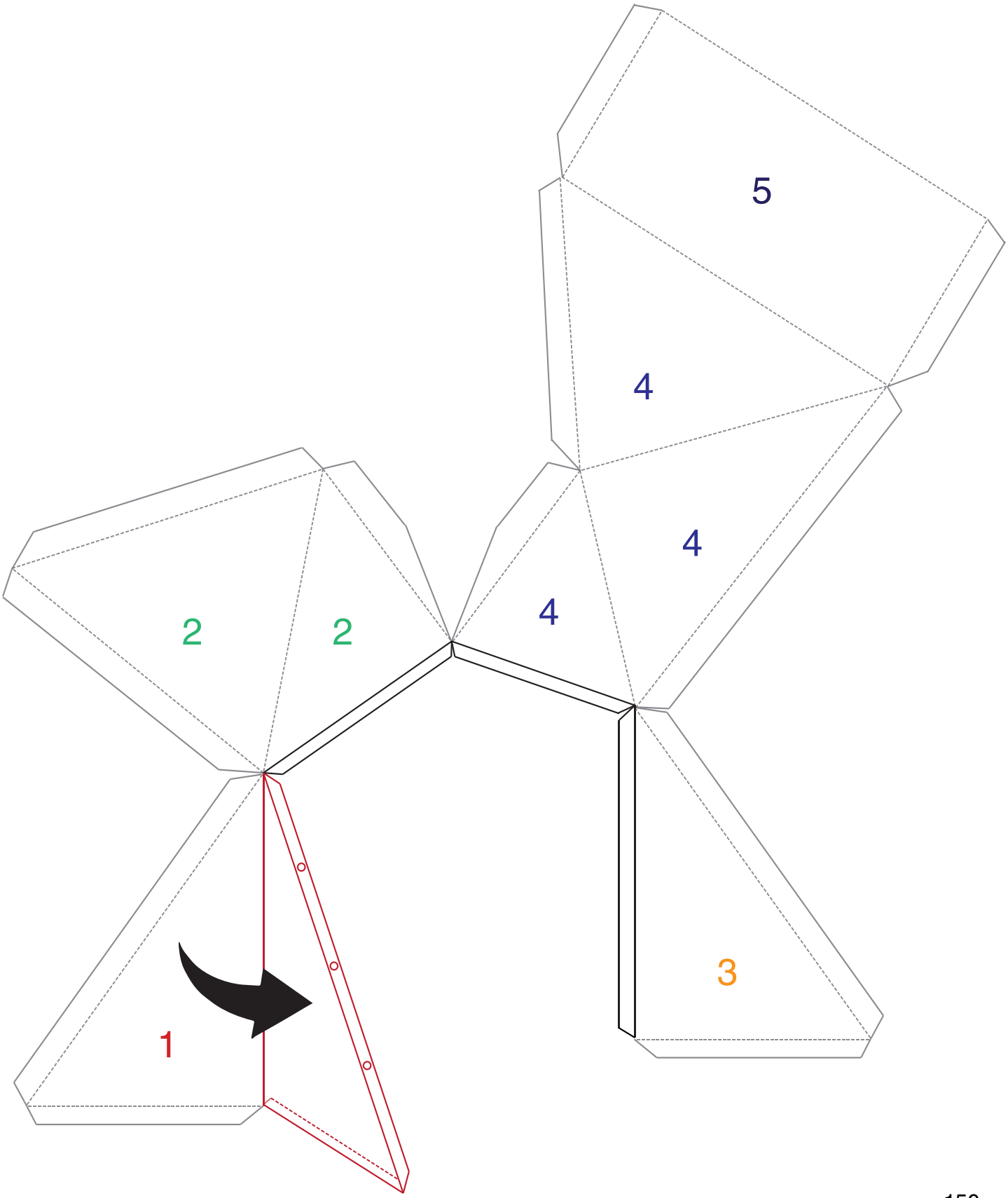
SHELTER SET-UP

FOLDING DESIGN OF A HABITABLE SPACE

Hereunder, the setup process of the shelter will be explained. This process is made of eight diferent steps that the user will have to follow in order to fold it in the properly way. The user will receive the set with the polypropylene sheets, a total of 33 nuts, the same amount of bolts and 66 washers next to the product instruction manual. And the only implement which is going to be needed is a wernch, in this case two of them, one to tighten and another to hold the assembly.
The design of the development of the piece is designed to make the least number of possible joints. It should be noted that these unions are simple since it is a matter of joining the flaps of the different faces with the help of a screw, a nut and two washers for each hole. So as indicated in the following steps, the assembly will consist of bending the faces in the specified direction and making the assembly.

step 1

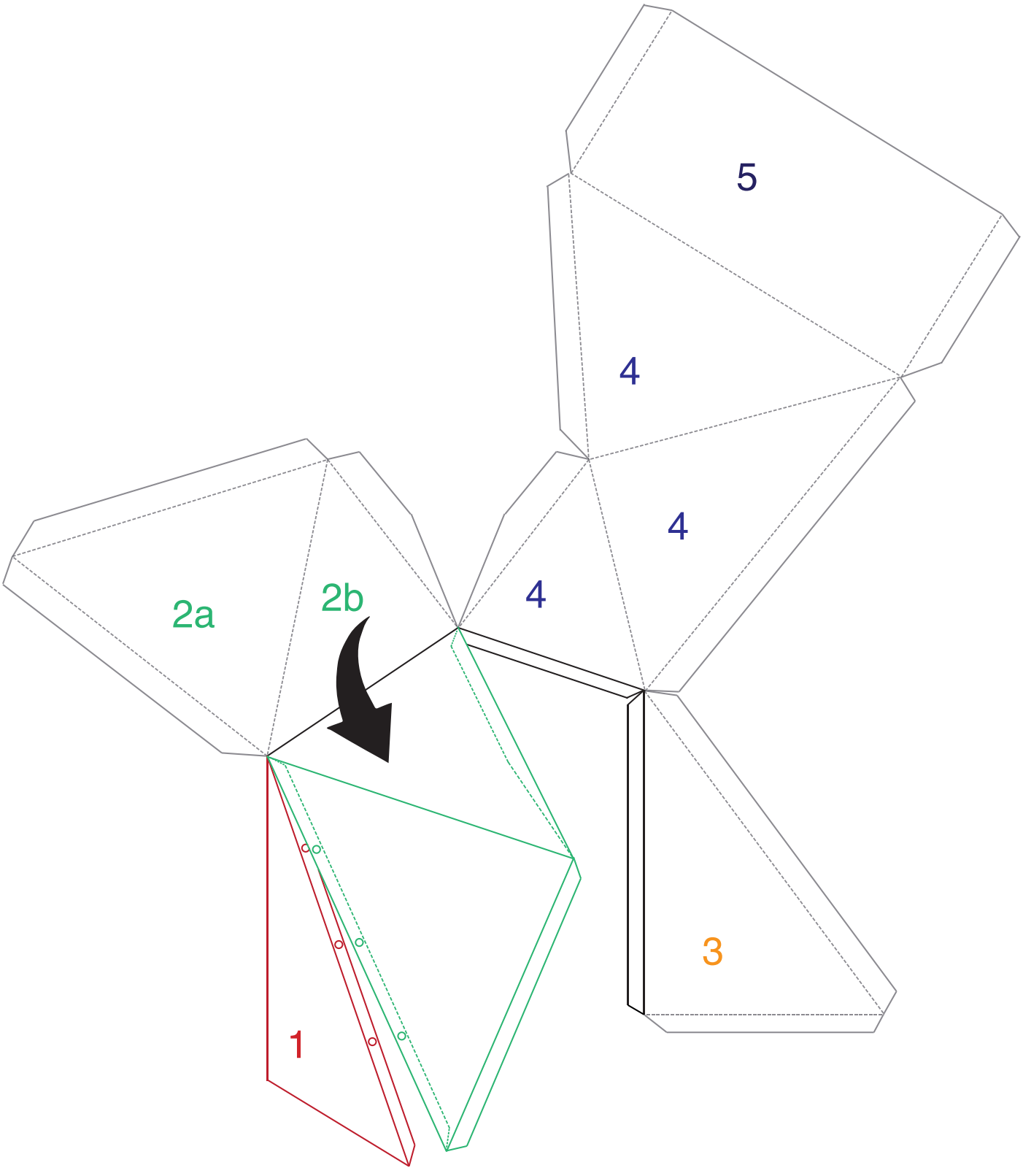
First mark the fold on the corresponding edge.
Fold the face number 1 inward until forming 90 degrees.
Fold its flaps in the direction shown in the picture (inwards).



step 2

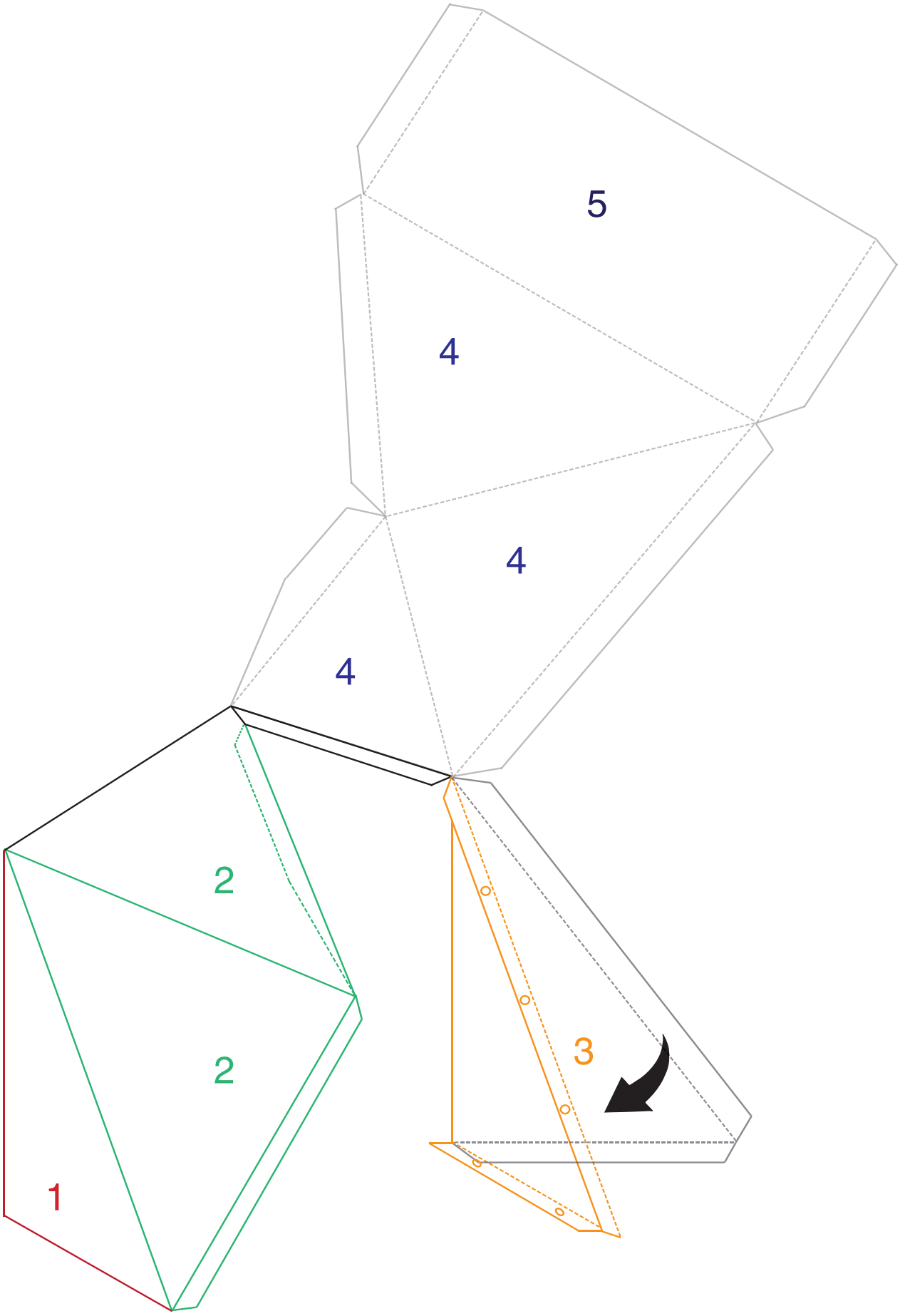
First mark the fold of the joining edge between the two faces.
Fold the face number 2 (2a+2b) inward.
Fold its flaps in the direction shown in the picture (inwards).
Assemble face 1 and face 2a

Three bolts
Three nuts
Six washers



step 3

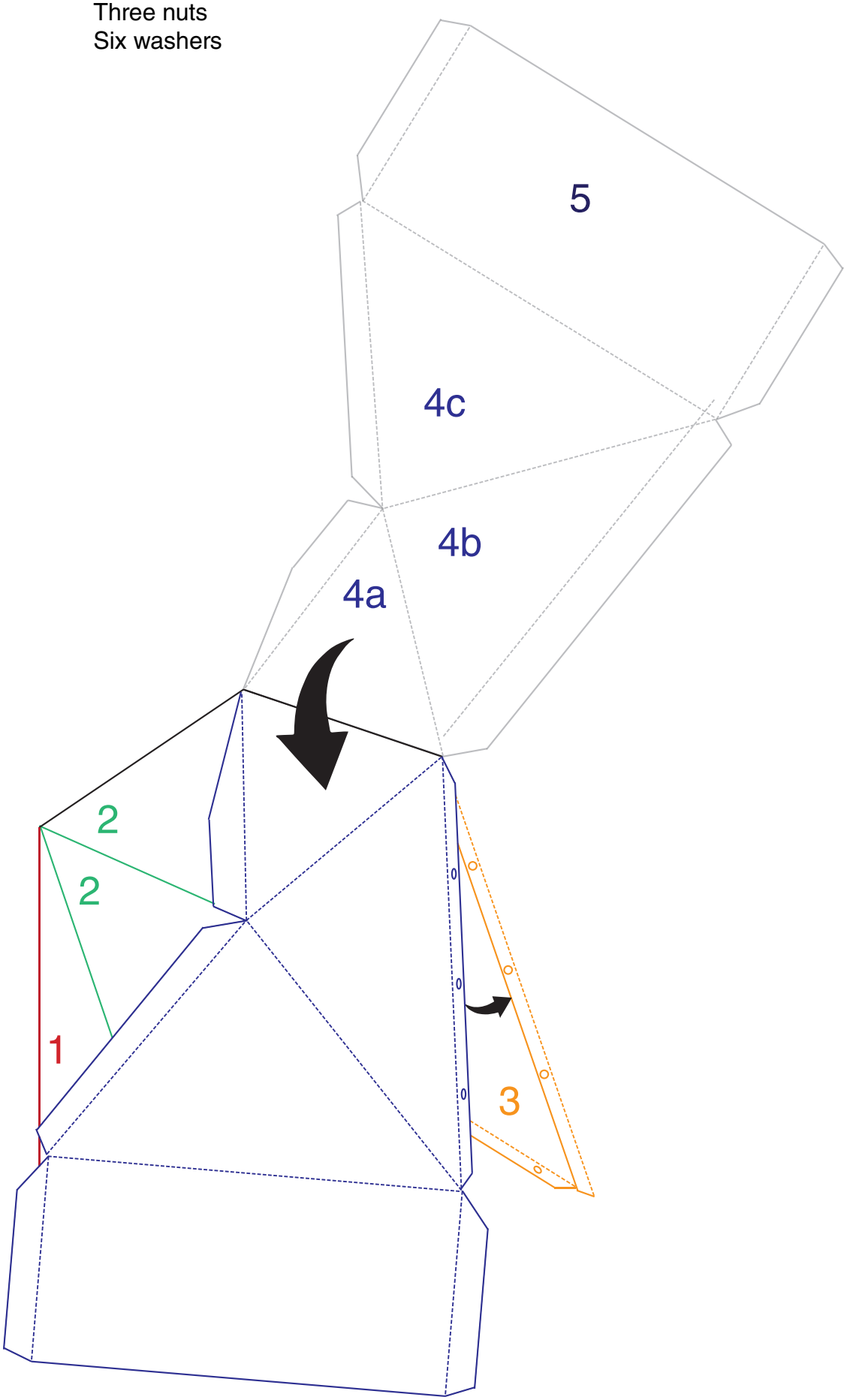
Like the Step 1.
First mark the fold on the corresponding edge.
Fold the face number 3 inward until forming 90 degrees.
Fold its flaps in the direction shown in the picture (inwards).



step 4

First mark the fold of the joining edge between the four faces (4a,4b,4c and 5).
Fold the face number 4a inward.
Fold all the flaps in the direction shown in the picture (inwards).
Assemble face 4b and face 3.

Three bolts
Three nuts
Six washers



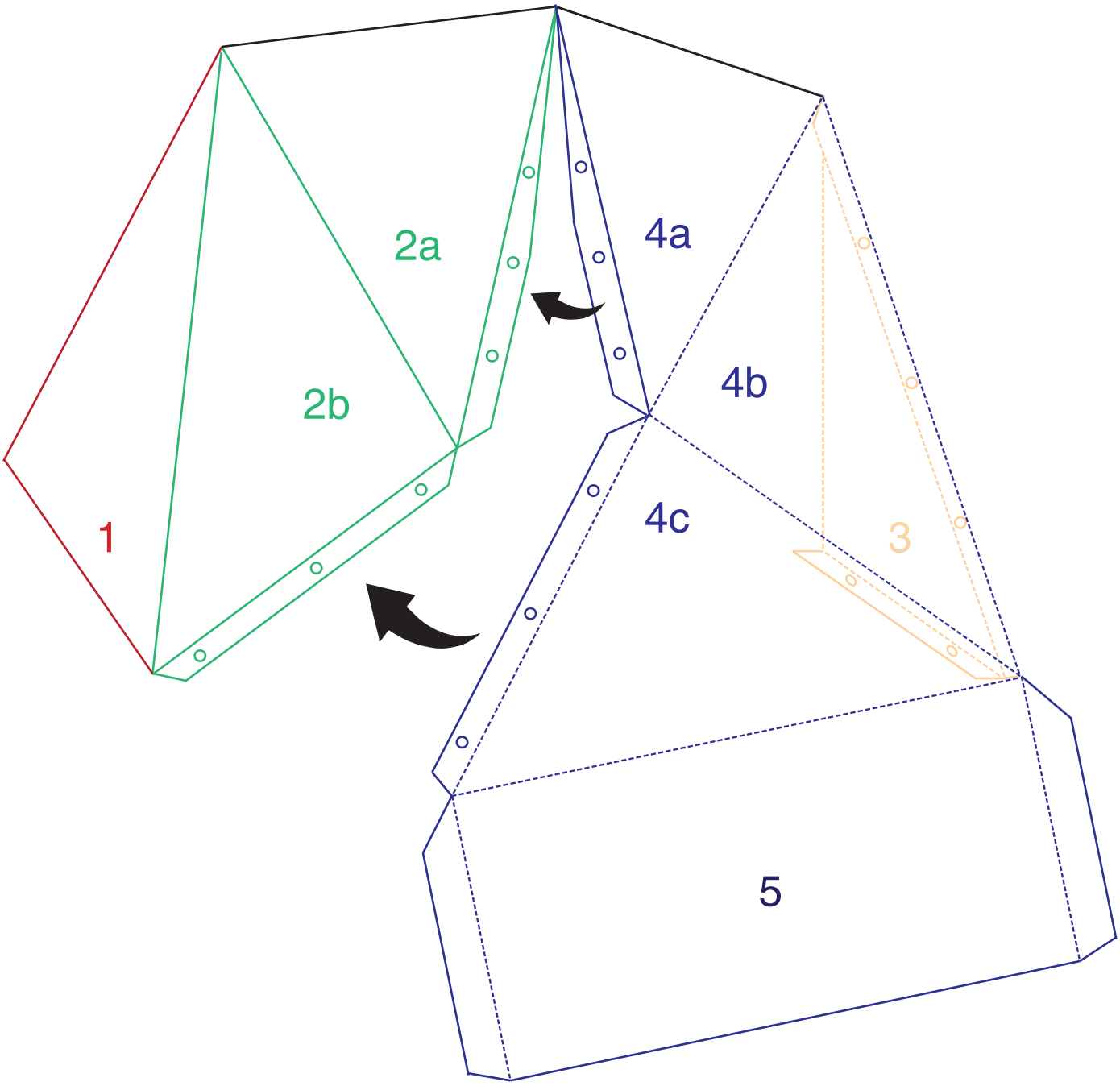
step 5

Fold again the flaps of the face 4a and 4c in the direction shown in the picture (inwards).
Assemble face 4a and face 2a.

- Three bolts
- Three nuts
- Six washers

Assemble face 4c and face 2b.

- Three bolts
- Three nuts
- Six washers



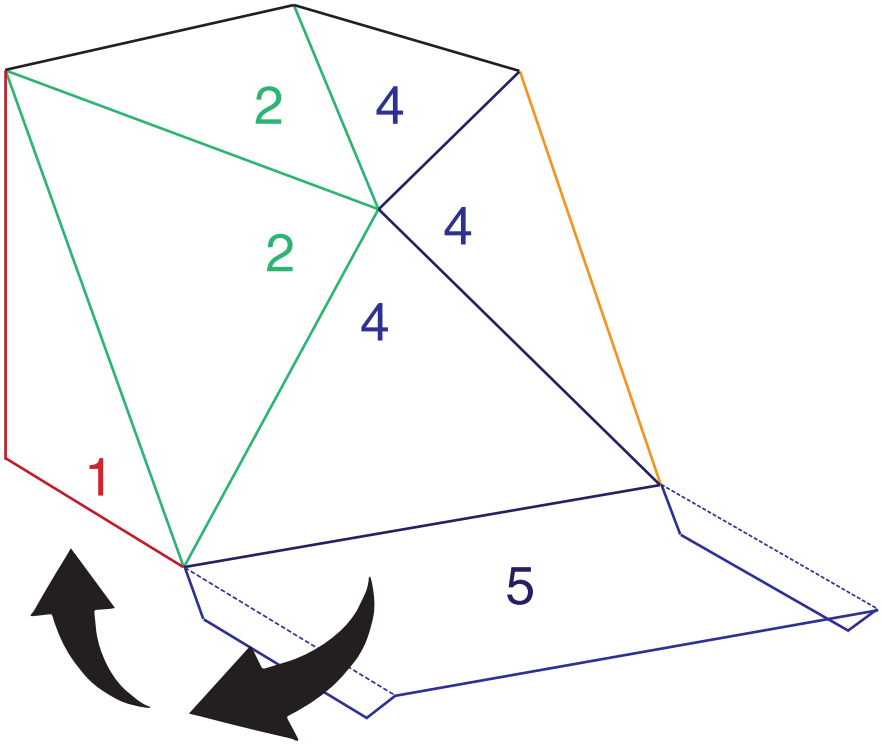
step 6

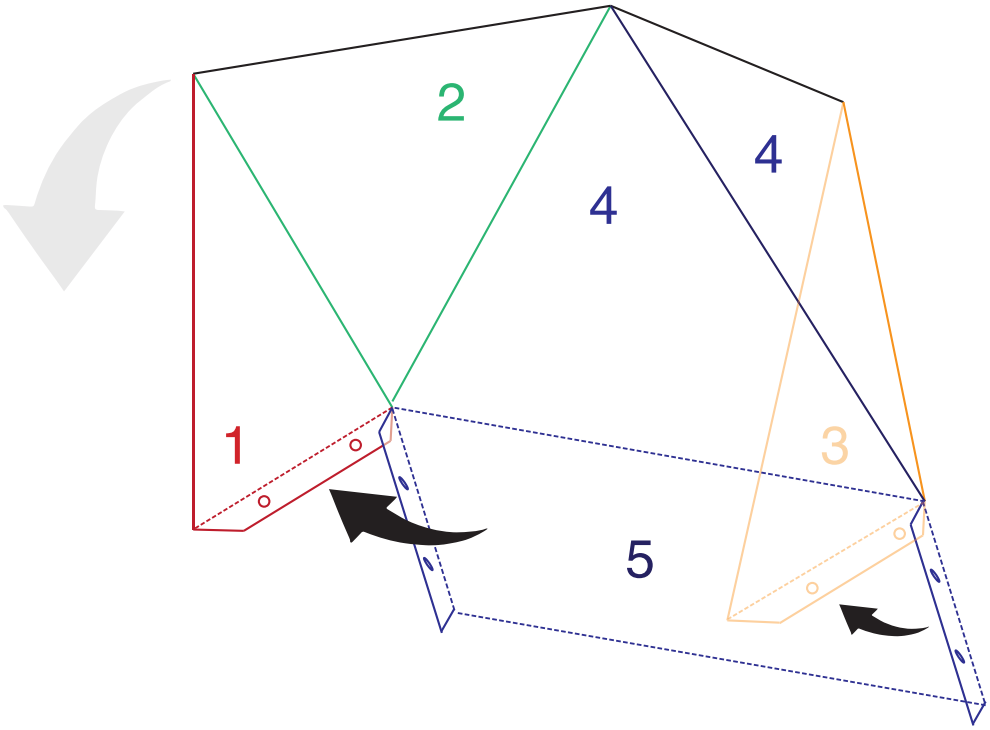
Tilt back the piece to make the next assembly.
Assemble face 5 and face 1.

- Two bolts
- Two nuts
- Four washers

Assemble face 5 and face 3.

- Two bolts
- Two nuts
- Four washers

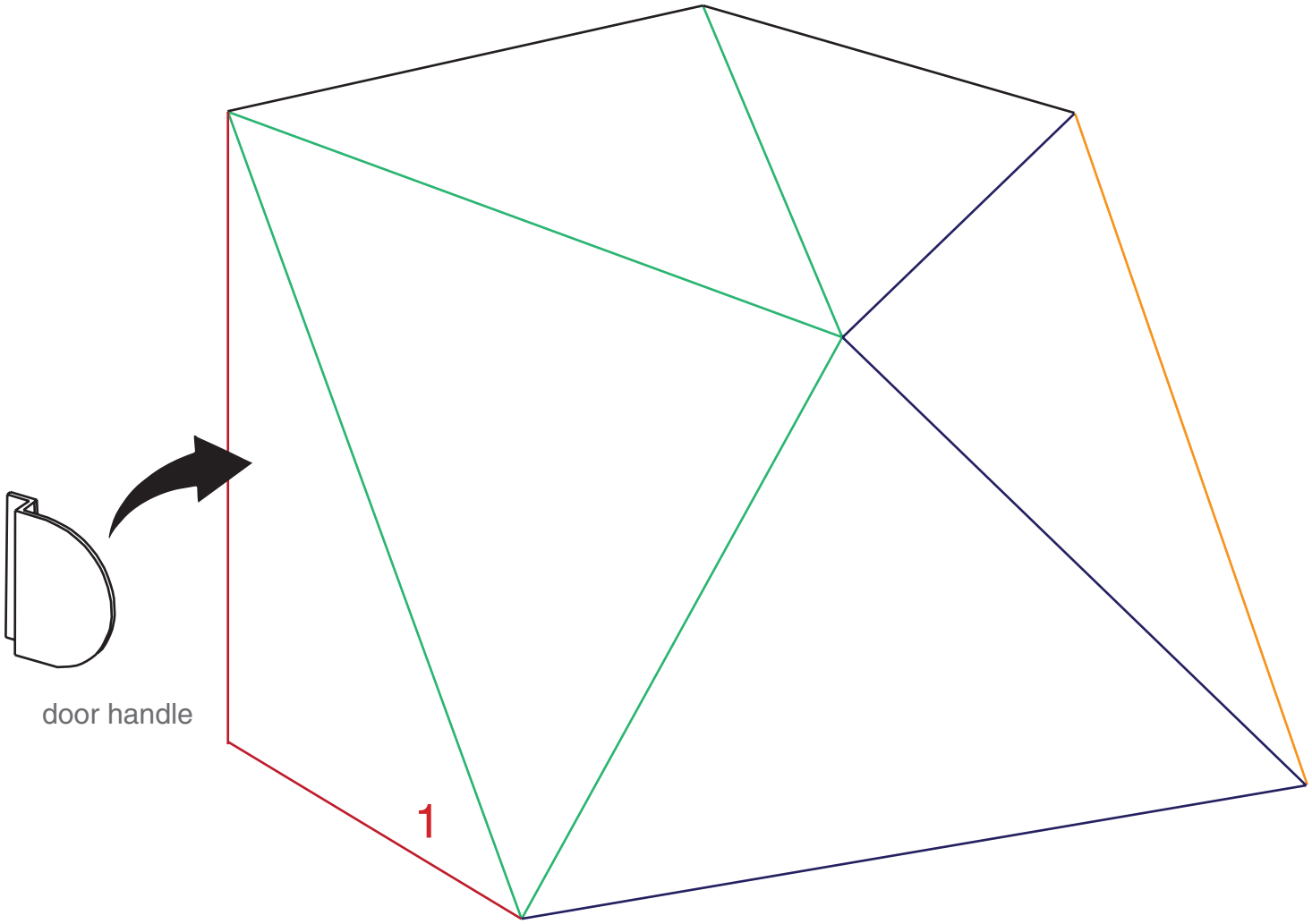




step 7

Assemble the door handle and face 1.

Four bolts
Four nuts
Eight washers

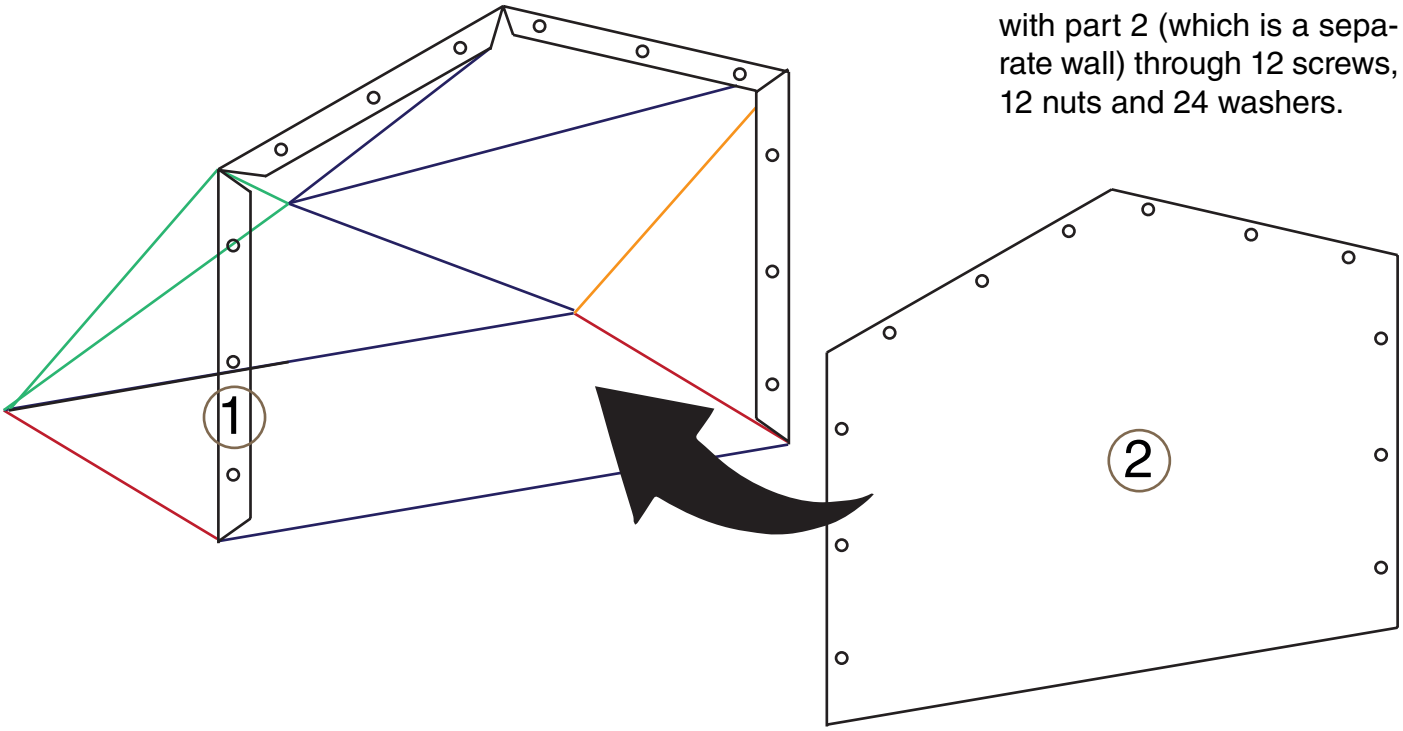


step 8

This is the last assembly of the product.
There are two different possibilities (7a and 7b).

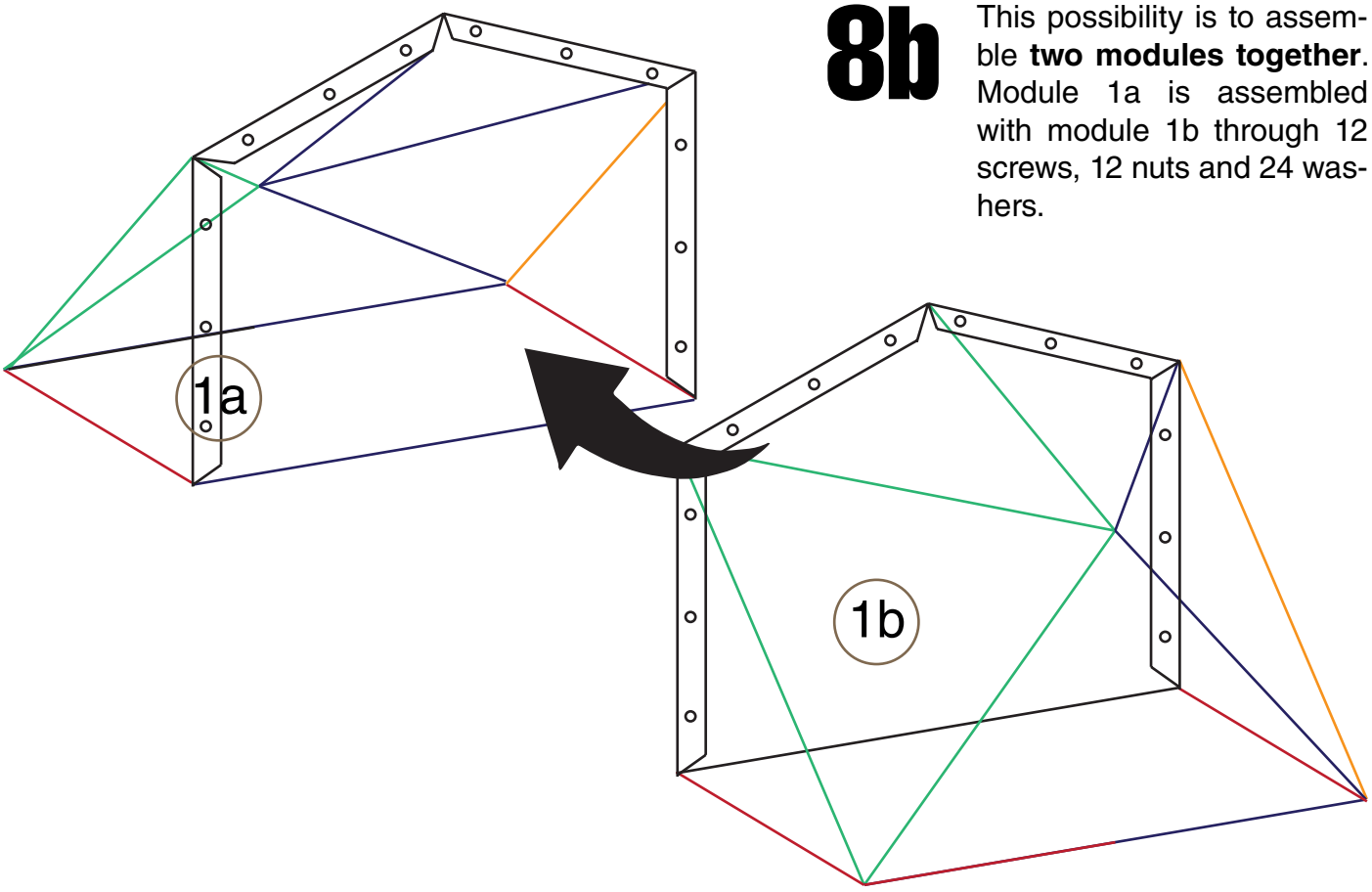
8a

This possibility is for the assembly of an **individual module**. Part 1 is assembled with part 2 (which is a separate wall) through 12 screws, 12 nuts and 24 washers.



8b

This possibility is to assemble **two modules together**. Module 1a is assembled with module 1b through 12 screws, 12 nuts and 24 washers.



POSSIBLE IMPROVEMENTS & CONCLUSION

FOLDING DESIGN OF A HABITABLE SPACE

This section describes possible improvement or future proposals changes to be made in the product.

This product has not been fully developed, but rather it is a conceptual product. Therefore, this section is considered important enough to know how this product could work better.
As the main possible improvement for the best functioning of the product, it must be told about the door and the way it is kept closed. This concept must be worked in greater depth since the proposed solution is not the most suitable. The material is strong and the way designed for its funtionallity works, but it could be done in a better way since it is believed that the handle of the door may not be durable enough for so much use.
Another possible improvement would be the inclusion of beams (made in the same material) inside the shelter to obtain a much more rigid structure and better support the stresses.
It should also be taken into account as a possible improvement, the way of fastening the shelter to the ground. It has been thought about the inclusion of some winds in the upper corners of the shelter as the tents have. Thus, the winds would be tensed and fastened to the ground through pegs, giving the product greater stability.
Regarding to the modularity of it, it has also been thought that it could be improved. Which means that the shelter could be modulated more easily or by more parts. For this it has been thought that it could work better if all the faces were independent. This would lead to a greater number of assemblies in the product but in turn would allow the addition of modules for all faces, since they would all work as the “independent face” does. Therefore, if the user wishes to obtain a bigger shelter, he could add a module in each face since they are all independent (what means, 4 modules added to the first one). The concept is the same as the the pentagonal face of the shelter has, but applied to the rest of the faces.

As a conclusion, it can be said that the present conceptual project meets the requirements previously mentioned. The result obtained is a concept for an unique “folding habitable space” in a market in development and with multiple possibilities whose niche is still little exploited.
The product presented is composed of two main elements, the shelter itself and the independent wall. It is possible to articulate the product in two different ways, thus fulfilling the function of housing a different number of people according to the user’s desire. The first is as mentioned above, the “shelter + independent wall = 2 people” or in case of desiring a larger one “shelter + shelter = 4 people” thus sheltering a greater number of people for whom it has been conceived.
The product has been thought as a multi-purpose space in terms of its different uses and locations. Since it is mainly thought of as a shelter for refugees, it can be delivered to people around the world and in turn, although the main use is for refugees, it can work as a shelter in campsites, festivals, or similar events, adapting easily to wishes and needs of the user.
Finally, it can be concluded that the present project is a conceptual project where the objectives at the time of designing the product have been satisfactorily fulfilled. It has been achieved a quite different aesthetic to similar products in the market nowadays, with an appeal to the greater sale, using geometric shapes and a single material.
A product that will facilitate life and help the homeless in a faster and cheaper way than other options that exist today, has been obtained. It is a product designed by and for people.