METHODS AND APPLICATIONS OF

HIGH-DENSITY POLYETHYLENE PROCESSING

IN SOUTH AFRICAN DOMESTIC HOUSEHOLDS

https://youtu.be/03X_U8J1yyM

“Have nothing in your house that you do not know to be useful, or believe to be beautiful.”

- William Morris

DECLARATION

In accordance with Chapter 8 of the 2018 Prospectus (Rules and Regulations for students), I, Eugene de Beer, declare that this dissertation, which I hereby submit for the degree Master of Architecture in Architectural Technology (Structured) at the Tshwane University of Technology, is my own work and has not previously been published by me for a degree at this or any other higher education institution.

I further state, to the best of my knowledge, that no part of my dissertation has already been, or is currently being, published for any such degree, diploma or other qualification.

I further declare that this dissertation is substantially my own work. Where references are made to the works of others, the extent to which the work has been used is indicated and fully acknowledged in the text and list of references.

Referencing, using the Harvard system, has been done to substantiate all source of information for the dissertation.

Eugene de Beer

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METHODS AND APPLICATIONS OF HIGH-DENSITY POLYETHYLENE PROCESSING IN SOUTH AFRICA DOMESTIC HOUSEHOLDS

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ABSTRACT

Recently, there has been a greater awareness of the effects of plastic on the environment, wildlife, and humanity. As the production and distribution of plastics is such an essential part of modern society, the need to rethink and re-evaluate the utilisation and disposal of plastic products has gained more significance.

This study departs from the point of view that recycling is a significant step in the right direction, is essential in the preservation of the planet, and will be necessary to ensure a healthier environment. It is imperative that the whole concept of recycling is explored. The study is based on the premise that knowledge of the different types of plastic can assist in making well-informed decisions in the recycling process.

This study determines the feasibility of the relocation of recycling practices from an industrial sphere to a domestic one.

Furthermore, the study investigates the possibilities of transforming a kitchen, which is considered a production space for consumption, into a production space for crafting.

Households do not necessarily have access to industrial recycling processes and practices. The kitchen can, however, be transformed into a space where the household can venture into an order of recycling and productivity for crafting.

This study also investigates and explores the feasibility and possibilities of melting and redesigning HDPE in a household environment, specifically focusing on the kitchen as a controlled and safe environment for production.

The hypothesis of this study depends on the fact that high-density polyethylene plastic can be recycled and reprocessed without diminishing its properties.

Keywords: Recycle; reuse; HDPE; craft; transform.

CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS

SPI – Society of the Plastics Industry

PETE or **PET** – Polyethylene Terephthalate

HDPE – High-Density Polyethylene

PVC – Polyvinyl Chloride

LDPE – Low-Density Polyethylene

PP – Polypropylene

PS – Polystyrene

TCPA – Town and Country Planning Association

LTD. – Limited

LIST OF DEFINITIONS

Polymer
/ˈpɒlɪmə/
A substance which has a molecular structure built up chiefly or completely from a large number of similar units bonded together, e.g. many synthetic organic materials used as plastics and resins.

Linear polymer
A long, continuous chain of carbon–carbon bonds with the remaining two valence bonds attached primarily to hydrogen or another relatively small hydrocarbon moiety.

Non-biodegradable
adjective. /ˌnɒn ˌbaɪəʊdɪˈgreɪdəbl/ /ˌnɑːn ˌbaɪəʊdɪˈgreɪdəbl/

A substance or chemical that cannot be changed to a natural state that does not harm the environment by the action of bacteria.

01
CHAPTER

INTRODUCTION

1

.1 INTRODUCTION

Plastic is used for many purposes, such as storage containers and packaging, and is an essential part of modern society. However, the disposal of these products once they have served their purpose has a devastating effect on the environment, ecosystems, and humanity as a whole. Most people are blind to and ignorant of the plastic pollution causing a climate crisis and that is threatening our environment (Pasquali, 2020:online). Given the devastating consequences on the environment by the convenience humanity enjoys by using plastics in all its forms, this predicament can no longer be ignored. The need to reconsider and re-evaluate the disposal of plastic polymers has become greatly more significant.

Image 1: Blind To Plastic Pollution (Pasquali, 2020:online)

1.2 PROJECT CONTEXT

The mismanagement of disposed plastic has many undesirable consequences on the environment (Parker, 2019). Addressing the destructive impact of plastic on the environment and ecosystems does not necessarily mean eliminating plastic entirely, but rather emphasises the need to co-exist with plastic in a more positive and less harmful manner. This includes the exploration and investigation of new and effective approaches to recycling and ultimately reusing plastic at a significant source of plastic waste itself – the domestic context.

The possibility of households partnering in recycling efforts depends largely on the capability of municipalities to render effective refuse removal services. While 80% of municipalities have already implemented some kind of recycling programme, these programmes are hampered by a lack of capacity or infrastructure (Stats SA, 2018).

Image 2: Wrinkled Plastic Wrap (Freepik, 2020:online)

This study was set up to investigate and explore the possibilities of recycling high-density polyethylene in a domestic setting. The possibilities were evaluated through various experiments by designing and manufacturing objects from high-density polyethylene and also considered the production procedures of these objects.

Furthermore, the study considered and explored the prospects of transformation in a domestic kitchen. The transformation derives from the fundamental concept of what a kitchen is, which is a point of production in the household.

There is much focus on the HDPE material at hand. The material properties and the relations of the room have something in common. The kitchen space is the point of production in which the selected material is crafted, thus establishing a direct relationship between the kitchen and the material. A twofold approach will determine not only how the material can transform the kitchen when viewed within the context of crafted objects, but also how the space could be transformed during the production as it responds to new programming and performance criteria.

1.3 SUB-PROBLEMS AND THEIR ASSOCIATED HYPOTHESES

Table 1: The Specific Sub-Problems, and Their Associated Hypotheses

Sub-problem 1 There is a lack of general awareness that some plastics can easily be recycled.	**Hypothesis 1** Too many people view used plastic as waste that can only be disposed of in conventional waste disposal; awareness can be created by illustrating the ease with which non-industrial recycling can be significantly effective.
Sub-problem 2 While the harmful effects of plastic are mostly known, most people do not know how to dispose of plastic in a non-hazardous way.	**Hypothesis 2** People understand that the conventional disposal of plastic is not beneficial to the well-being of the environment and society. There is, however, a lack of a determined effort to dispose of plastic in an effective and non-hazardous manner. This is due to a lack of interest, as well as a lack of awareness of possible methods of disposal.
Sub-problem 3 There is a lack of awareness and creativity in terms of the possibilities of recyclable plastic.	**Hypothesis 3** Most people see used plastic as an unwanted product that has reached the end of its usefulness and must therefore be disposed of without comprehending the possibilities of recyclable plastic in a different form. This could be addressed either by illustrating some of plastic's applications and/or critiquing the ideology of Modernism, which connects usefulness to being.
Sub-problem 4 There is a lack of awareness and creativity in households as to the possibilities of recycling plastic in a domestic setting.	**Hypothesis 4** Most people view the household space, specifically the kitchen, through conventional perspectives without comprehending the possibilities of utilising the architectural space of the kitchen in a new and unconventional way. It is hypothesised that through selected interventions in the conventional kitchen, users could be made aware of new possibilities.

1.4 DELIMITATIONS

The following delimitations apply to the study:
- The study will collect information from numerous experiments executed which used high-density polyethylene.
- The study will be directed to focus only on recycled high-density polyethylene plastic.
- The study research and experimentations will be focused on domestic household applications.
- The study will focus on the form and function of the material in a domestic context.
- The study will not include industrial applications for the recycling of HDPE, since these have already been well-resolved.
- The study will focus on the manufacturing and performance of recycled high-density polyethylene.
- The research and experimentations will exclude any supplementary plastic polymers that are not embossed 'HDPE' and/or do not visibly indicate the resin code '2'.

1.5 PURPOSE OF THE STUDY

While the concept of recycling HDPE in a household environment may not significantly contribute to the eradication of plastic pollution, this study explores new possibilities in the recycling and reusing of plastic in a domestic environment while transforming the space of production.

The research aims to evaluate and demonstrate some potentials of high-density polyethylene by way of exploring methods and applications for its transformation in a domestic household.

THINK OUTSIDE THE ~~BOX~~ BIN

People in general seem to believe that once something is thrown into the rubbish bin, they have effectively disposed of the waste and, for the most part, given no thought to the disposal process following. One of the major causes of waste pollution is the “out of sight, out of mind” mindset. The garbage bin is not a black hole where waste vanishes, and people must accept that waste must be disposed of somewhere. In today’s culture, throwing something away and obtaining a new one has become common, but people must understand that there is no such thing as “away”.

The study believes that some people have become mindful of this predicament. People’s awareness has grown over time, but awareness in itself has no meaning without action.

This study investigates the possibility of eradicating the disposal of plastic through innovative design and crafting procedures. These procedures consist of HDPE being recycled and then moulded, extruded, and/or pressed into a solid matter.

> “There is no such thing as away. When we throw anything away it must go somewhere.”
>
> - Annie Leonard

RE
duce
use
cycle
peat

1.6 DESIGN RESEARCH

The design research illustrates the structure of the design procedures and the questions that emerged from it:

Plastic pollution

- Plastic pollution has become an alarming environmental concern.
- What can be done to reduce the impact of plastic on the environment?

Recycling

- Recycling is a significant response to the environmental challenges caused by plastic.
- What different types of plastics are there?

Types of plastic

- There are noticeable differences between the different types of plastic.
- Not all plastic polymers are considered easily recyclable.
- What plastic is the most-commonly recycled?

HDPE

- HDPE is the most commonly-recycled and is considered to be the safest type of plastic.
- Can HDPE be recycled in a domestic household setting?

Kitchen

- HDPE is widely used in domestic kitchens and is therefore easily accessible for collection and recycling.
- How can HDPE be recycled in a domestic kitchen?
- How is the kitchen transformed when implementing HDPE?

Craft

- HDPE can easily be melted in a domestic kitchen oven.
- What are the potentials and possibilities of HDPE?

02
CHAPTER

THEORY OF MATERIAL

02 THEORY OF MATERIAL

2.1 INTRODUCTION

In the documentary A Plastic Ocean, the negative and harmful impact of the disposal of plastic was visually documented. Where plastic was once considered a scientific phenomenon, it can now be characterised as an environmental challenge (Rente, 2018).

The mismanagement and ill-use of plastics has essentially resulted in a continuous negative and downward spiralling effect on the environment, ecosystems, and humanity.

With that said, it would be unrealistic not to state that plastic has transformed modern society and the significant benefits to multiple industries cannot be denied or ignored.

According to Ian Jamie, managing director of Staeger Clear Packaging, “[p]lastic is an amazing substance, an amazing invention... [i]t’s lightweight, it’s tough, transparent, [and] waterproof” (cited in Plummer, 2018:1).

2.2 LITERATURE

2.2.1 Plastic pollution and the importance of recycling

Plastic pollution has become a serious environmental concern, mainly because the demand for and production of plastic products, even disposable ones, far exceeds our ability to effectively manage or dispose of them. The production of plastic products has increased rapidly – from 2.3 million tons to 448 million tons in just 65 years – and production is expected to double again by 2050 (Parker, 2019).

Plastics usually contain additional components that allow for an increase in strength and durability. These additives can also increase the life span of a product which results in plastic products staying in circulation for a longer period (Parker, 2019).

Non-recycled waste can have a harmful impact on our environment in many ways. Waste can emit greenhouse gases, which contribute to global warming and climate change. Likewise, non-recycled waste can contribute to air and water pollution, endangering the already fragile ecosystems and thereby risking the future of humanity and the natural world. Recycling plastics into functional, unharmful products can greatly reduce pollution in all its expressions (Osmanski, 2020).

Furthermore, plastic can rarely be broken down naturally as most plastics are non-biodegradable. Alarmingly, 30 million tonnes of plastic are disposed of every year; since plastic can take many years to disintegrate, waste disposal is escalating at a rapid rate, which further contributes to the environmental crisis. This, in effect, means that humanity has to contribute to the transformation of disposed plastics into practical, harmless products (Osmanski, 2020).

The ever-growing predicament of waste in contemporary society is underlined by the fact that the disposal of waste in landfills is totally ineffective. A 2011 study, conducted in South Africa, concluded that 90% of an estimated 59 million tonnes of general waste ended up in landfills, while only 10% of the waste was recycled. The rate at which solid waste is generated, coupled with the fact that there is limited land that is appropriate for the disposal of that waste, is escalating the quandary of waste disposal in South Africa. This problem is further amplified by the fact that studies conducted in 2015 indicated that only 5,2% of households recycled waste (Stats SA, 2018:1).

Efforts to accentuate the necessity of recycling to reduce the detrimental impact of waste on the environment have been pointed out in recent years with a deliberate attempt to create awareness. In 1998, the National Environmental Management Act (NEMA) stated that “waste is to be avoided, or where it cannot be altogether avoided, minimised and reused or recycled where possible or otherwise disposed of in a responsible manner” (Stats SA, 2018:1).

2.2.2 Different types of plastic

In creating awareness of the problems of pollution and in an effort to create a culture of recycling and re-using plastic, it is important that the uninformed user of plastic becomes informed and educated.

Identifying and understanding the different plastic types can assist an individual in making informed decisions when recycling. An individual must obtain comparative knowledge of the different plastics and their definite resin code or SPI (Society of the Plastics Industry) code. This resin, or SPI code is used to categorise the different types of plastic in order to identify and separate different plastic polymers at the recycling stage (Mertes, 2020).

Many industries deal with the recycling of the various plastic polymers in South Africa with each one specialising in a particular polymer according to their area of expertise (SAPRO, 2019).

A variety of plastic polymers are considered easily recyclable and others less so. See Table 2 for a more comprehensive understanding of the different types of plastic.

Table 2: Different Plastic Types

Recycling number	Symbol	Abbreviation	Polymer name	Typical applications	Recyclable
1		PETE or PET	Polyethylene Terephthalate	Water bottles, soda bottles, peanut butter jars, jelly containers	PETE or PET can be recycled
2		HDPE	High-Density Polyethylene	Milk containers, juice containers, shampoo and conditioner bottles, detergent containers, motor oil containers, bottle caps	HDPE can be recycled
3		PVC	Polyvinyl Chloride	Plumbing pipes, flooring, gutters, windows frames, ducts, footwear	PVC can rarely be recycled (call your recycler)
4		LDPE	Low-Density Polyethylene	Dispensing bottles, washing bottles, shopping bags	LDPE is not often recycled, but can be recycled (call your recycler)
5		PP	Polypropylene	Tupperware, yogurt containers, margarine tubs, butter tubs, sweet wrappers, stadium cups, toys	PP can be recycled (call your recycler
6		PS	Polystyrene or Styrofoam	Disposable coffee cups, take away containers	PS is not usually recycled (call your recycler)
7		N/A	Various Plastics (polycarbonate, polyctide, acrylic, acrylonitrile butadiene, styrene, fibreglass, and nylon)	Baby bottles, water cooler bottles, sippy cups, car parts	Not usually recycled (call your recycler)

2.2.3 Characteristics of HDPE

A significant physical property of high-density polyethylene is that the internal structure of the polymer is dense and compacted. HDPE is considered a linear polymer, which means that branching does not occur (Taylor-Smith, 2020). A linear polymer consists of a chain in which all carbon-carbon bonds occur in a straight line – see figure 1 (Carr, 2018). From this, we can deduce that the density of a linear structure is higher than that of a branched structure. This higher density makes the polymer significantly stronger (Madhusha, 2017).

High-density polyethylene is relatively durable and impact-resistant. Furthermore, HDPE can be exposed to temperatures as high as 120 °C without having any effect on the plastic. HDPE is also resistant to various chemicals and substances including acids, alcohols, and various oils (Taylor-Smith, 2020).

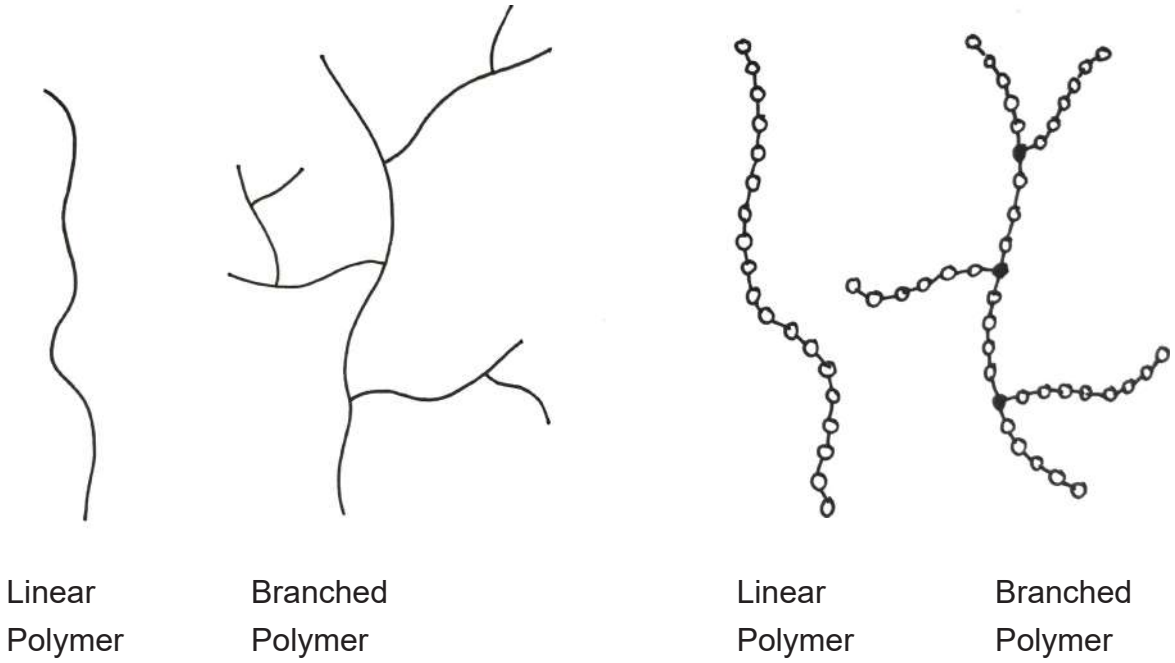


Figure 1: Linear vs Branched Polymer Structure (Author, 2021)

2.2.4 Recycling HDPE

An important quality and at the same time an alarming consequence of HDPE is the fact that it is non-biodegradable, which ultimately means that the plastics can take centuries to decompose, so it is critical that these plastics must be recycled and reused (Taylor-Smith, 2020).

ESE World B.V., Europe's leading manufacturer of temporary storage systems for waste and recyclables, carried out the first practical experiment in this field, and established that high-density polyethylene plastic can be recycled at least ten times. ESE discovered that the plastic shredding procedures and the moulding process do not alter the properties of the plastic material (Goldsberry, 2018).

One crucial aspect of HDPE is the fact that the material can be melted at a relatively low temperature without emitting toxic fumes. This characteristic points to the possibility that HDPE can easily be recycled and reused in a domestic setting.

The following table illustrates the characteristics of HDPE and underlines the possibility that HDPE can be recycled and reused in a domestic setting.

Table 3: : Thermophysical Properties of High-Density Polyethylene

High Density Polyethylene (HDPE)	
Density	940 kg/m^3
Melting point	130.8°C
Temperature of crystallization	111.9°C
Latent heat of fusion	178.6 kJ/kg
Thermal conductivity	0.44W/m°C at °C
Specific heat (solid)	1.9kJ/kg °C
Crystallinity	60%

(Thakare, Vishwakarma & Bhave, 2015:93)

2.3 CONCLUSION

The incorporation of plastic in the manufacturing of nearly every possible product has become so entrenched in contemporary society that it would not be an overstatement to argue that there is hardly any household that does not use some form of plastic every day.

The use of plastic is part of modernisation and adds to the culture of convenience to which contemporary society has become accustomed and, in the process, has become oblivious to the detrimental consequences of this so-called convenience. While plastic products are symptomatic of this mentality of convenience, it is at the expense of something that cannot be replaced: the environment. While plastic is convenient, the environmental challenges caused by its relative durability are often ignored and neglected by those who benefit from the production, sales, and distribution of plastic.

When recycling plastic, it is crucial to be cognisant of the fact that not all plastic polymers with resin codes are recyclable. The specific number inside the triangle will be an indication of whether the specific plastic is recyclable or not (Miller, 2019).

However, high-density polyethylene is recyclable with the added incentive that it can be recycled within the domestic household at a relatively low temperature without emitting any toxic fumes. HDPE is lightweight and is proven to be much stronger and more stable than the other plastics. The study focuses on the recycling of HDPE. Recycling high-density polyethylene in a domestic setting can additionally reduce (and possibly even remove) resin code 2 plastic (HDPE) from the waste stream.

03
CHAPTER

PILOT STUDY

03 PILOT STUDY

3.1 INTRODUCTION

In order to confirm and demonstrate the theory of the viability of recycling HDPE in a domestic household, specifically within an architectural understanding of space, investigations into the designing and manufacturing of particular objects from HDPE plastic, which is considered recyclable, were conducted.

These experiments were conducted in a safe and controlled household environment.

High-density polyethylene plastic was collected throughout this study. The collection of HDPE was reliant on the accessibility and availability of plastic in surrounding environments.

Practical phases were set out and followed in a domestic household setting in order to recycle HDPE.

The research is designed to illustrate and propose the various possibilities whereby the domestic space can be transformed into a space of production through the recycling of HDPE and essentially the production of various crafted objects.

3.2 PHASE ONE

3.2.1 Identifying and collecting

Identifying plastic to collect may become challenging if an individual has limited knowledge on the topic. Becoming familiar with the various plastic polymers is an important aspect of the study as this knowledge will essentially assist the prospective manufacturer.

Plastics are labelled with a resin code which simplifies the process of recycling and will assist the manufacturer in ascertaining the usability and recyclability of a suitable plastic product. The resin code is a specific number between one and seven that is usually visible on the bottom of a plastic product and/or inside a small triangle fashioned by three arrows. Each number is assigned to different plastic polymers to aid in separating plastics at the recycling stage (Miller, 2019).

The seven different plastic polymers are identified by their unique resin code (Mertes, 2020):
(1) Polyethylene Terephthalate (PET);
(2) High-Density Polyethylene (HDPE);
(3) Polyvinyl Chloride (PVC);
(4) Low-Density Polyethylene (LDPE);
(5) Polypropylene (PP);
(6) Polystyrene (PS); and
(7) Other.

The study focuses only on the recycling of HDPE, which is marked with the resin code 2.

The domestic household offers ample opportunity to engage with the process of recycling plastic. Collecting HDPE plastic can occur within the convenience of the household as many household necessities are packaged in HDPE containers. These automatically enter the household when the necessary household supplies are bought and stored.

The empty containers need to be discarded after the products are used; at the same time, they need to be replaced as part of the household's weekly or monthly purchases.

Given the convenience of the collecting process, since these containers already enter the household, this amounts to a continuous supply of plastics. This continuous supply of HDPE plastic renders a constant supply of material to be used in the manufacturing of crafted objects.

Typical applications of HDPE include a various number of cleaning detergent bottles, milk containers, shampoo, and conditioner bottles, plastic bottle caps, etc.

Figure 2: High-Density Polyethylene Containers (Author, 2021)

The following containers are examples of HDPE that are typically used in a domestic household:

Name:
Handy Andy
Weight:
54g
Colour:
Purple

Name:
Window Cleaner
Weight:
57g
Colour:
Translucent

Name:
Vanish
Weight:
70g
Colour:
Pink

Name:
Clover Milk
Weight:
46g
Colour:
Light blue

Name:
Ultra Bleach
Weight:
52g
Colour:
Green

Name:
Body Wash
Weight:
25g
Colour:
Black

Name:
Sunlight
Weight:
100g
Colour:
Yellow

Name:
Shampoo
Weight:
20g
Colour:
White

3.2.2 Cleaning and cutting

1 After identifying and collecting the HDPE bottles, the bottles were cleaned thoroughly and all labelling removed.

2 The top and bottom of the HDPE bottle were cut off, and the bottle was then cut in half.

3 Furthermore, the bottle was cut into relatively thin strips as indicated.

4 Lastly, the HDPE strips were cut into smaller pieces, as shown in the image.

The same cutting procedures were followed on a variety of HDPE bottles and containers as indicated in the images below:








3.2.3 Melting

- After cutting the HDPE containers into small manageable strips, it was separated into different colours.
- HDPE plastic strips were placed on baking paper in a stainless-steel baking tray.

- The kitchen oven was heated to a temperature of 180°C.
- The stainless-steel baking tray was placed inside the oven and the oven door was closed.
- The HDPE plastic strips can be seen deforming and melting inside the oven in the image alongside.

- The stainless-steel tray with the melted plastic was removed from the oven.
- Additional plastic particles were added to the melted plastic, and the tray was placed inside the oven again.

- When the plastic in the tray was melted throughout, more plastic was added and the tray was placed inside the oven once more.
- The tray was then removed from the oven in order to proceed to the next step.

3.2.4 Shaping

- The baking paper needed to be replaced regularly due to the discolouration caused by the heat from the oven.
- The melted plastic was pressed together and twisted with the use of oven mitts.
- The tray was then placed back into the oven.

- The tray was removed from the oven when the plastic was melted throughout.
- The plastic was then folded over and compressed.
- This process was continued until the plastic was completely melted, and in a flexible state.

- The plastic was removed from the oven for one last time.
- The melted plastic was then twisted again.
- Finally, the melted HDPE was placed inside the home-made press.

3.2.5 End result

- The flexible plastic was then compressed to the desired thickness with the use of the home-made press.
- This process can take up to three hours as time is needed to allow the plastic to set and harden in the process of cooling down.

3.3 PHASE TWO

3.3.1 Refining

The unfinished HDPE plastic surface was sanded down with an abrasive material. This was done to create a smooth surface finish and, furthermore, to acknowledge and celebrate the pattern design. The object was then refined and sawn with a hacksaw into a preferred shape.

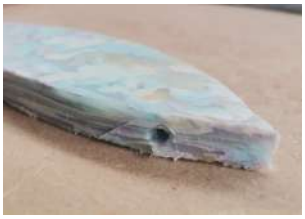
3.3.2 Cutting

Further experiments were performed and the following was observed:

- The object is effortlessly cut using a hacksaw.
- It is relatively easy to follow a guide when cutting the HDPE object with a hacksaw.
- The hacksaw cuts the HDPE appropriately and presents a clean and smooth finish.

3.3.3 Fixing method

- A soldering iron was used to melt a circular hole into the HDPE plastic.
- A threaded rod was then pressed into the hole.
- This led to the threaded rod being firmly fixed to the HDPE plastic.

3.3.4 Welding

The HDPE plastic was cut in half with a hacksaw to demonstrate the possibility of welding two pieces of HDPE plastic together.






- The two pieces of HDPE plastic were heated and melted using a heat gun.
- The HDPE plastic pieces were then pressed together thoroughly for approximately 2-3 minutes to allow for an effective bond between the pieces.
- The additional plastic that had oozed out was cut off with a utility knife and was further refined through sanding down, creating a smooth surface finish.

Observing the end result, it can be concluded that the welding experiment was successful and effective.
The pattern acknowledges the procedure without having any dismissive structural implications.

3.4 CONCLUSIONS

There are numerous potentials and possibilities of the HDPE material that were explored regularly and the experiments tested those possibilities. Some conclusions were drawn on the procedure and outcome of the first experiment conducted:

- HDPE plastic can easily be collected and has recycling properties that make it ideal for domestic applications.

- HDPE does not degrade when melted and can be re-used and reformed liberally.

- HDPE melts at temperatures that are easily achievable with a common household oven.

- HDPE can mostly be formed and crafted with domestic appliances already present in the kitchen (scissors, knives, baking trays, baking paper, and oven mitts among them).

- The melting equipment, such as the oven, is used at high temperatures, so a pair of oven mitts is required when handling the melted plastic.

- While an oven was used as part of this experiment, shifting to an ordinary sandwich press could possibly be an improvement as it would simultaneously melt and compress the plastic.

- While the use of oven mitts assisted in handling the heated plastic, it was established that additional protection was required. Heat resistant safety gloves can easily be obtained at any outlet store selling safety clothing.

- The use of ordinary baking paper in the melting process was not that effective since the paper turned brown due to the heat of the oven, and the brown colour was absorbed by the melted plastic. It is for that reason that a silicone baking sheet is much more effective.

- While a small hydraulic jack press is used, the plastic can also be compressed using two pieces of wood and G-clamps, which can be gradually tightened to gradually compress the plastic.

04
CHAPTER

THE DOMESTIC KITCHEN

04 THE DOMESTIC KITCHEN

4.1 INTRODUCTION

The experiments were conducted in a domestic kitchen setting; the study therefore focuses on the kitchen as the subject of transformation from a conventional setting to an alternative operational production space.

It may be argued that the conventional perception of a kitchen refers to a specific form and a specific order inside a space. The opportunity for spatial transformation is possible through questioning the order of the definite space.

The study illustrates how a conventional space's use as well as the function can be transformed by exploring alternative procedures and implementing the concept of recycling HDPE plastic.

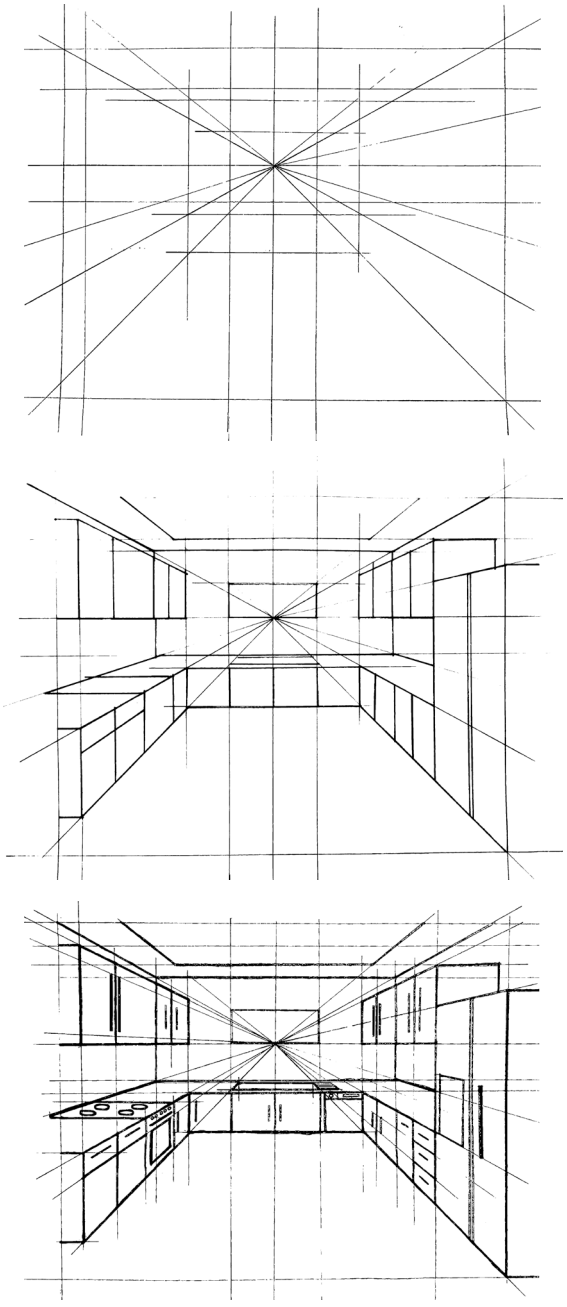


Figure 3: Kitchen Perspective (Author, 2021)

4.2 LITERATURE

4.2.1 The Garden City

The Garden City movement, initiated by Ebenezer Howard from the United Kingdom, is a process of urban planning in which independent towns are surrounded by open land with balanced amounts of dwellings, industries, and agriculture. Howard proposed this concept in 1898 with the goal of preserving the fundamental benefits of both the countryside and the city environment while circumventing the disadvantages of both.

Howard established the Garden Cities Association, later known as the Town and Country Planning Association, or TCPA, in order to obtain finance for this concept. The TCPA established “First Garden City, Ltd.” in 1899 to build the garden city of Letchworth (Howard,1902). During Howard’s lifetime, Brentham Garden Suburb and Welwyn Garden City were also built in and around London, and, encouraged by this concept, many other Garden Cities have subsequently been constructed all over the world.

The Garden City concept was widely adopted throughout the United States. Mariemont, Ohio, began as the vision of an American woman who wished to create a new community for the working-class people of Cincinnati. In 1921, Mary Emery recruited planner John Nolen to design the village. The construction of this American Garden City began in 1925 and was uniquely based on Howard’s 1898 Garden City concept (Cross, 2004).

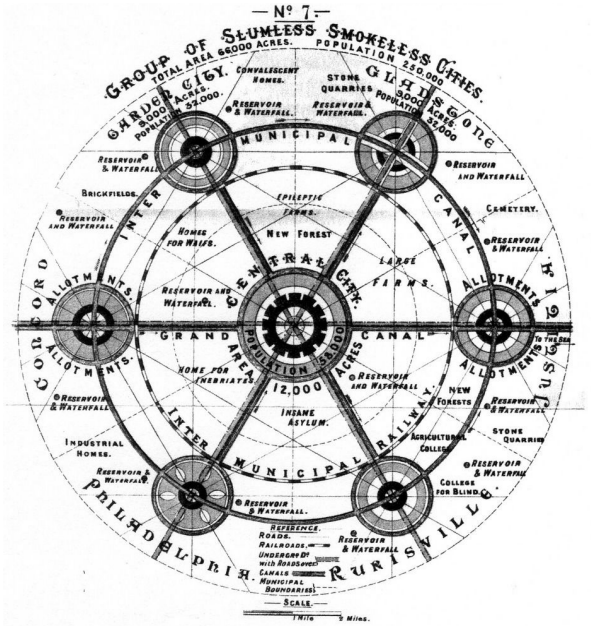


Figure 4: The Garden City Movement (Howard, 1902)

4.2.2 The suburban kitchen

During World War II, an enormous number of men were absent from home as they were fighting in this war. This resulted in women on the "home front" starting to work at military factories and volunteering for war-related organisations while maintaining their households. While their men were fighting in the war, the women became expert chefs and housekeepers, learned to fix and maintain vehicles, and worked in defence factories for the first time (Zweiniger-Bargielowska, 2001).

Since the effective execution of rationing and other home economy procedures were critical to the health and confidence of the public during the war, the responsibilities of the housewives were recognised as of national importance. Their obligations were no longer seen as a private matter, but as an important part of the war efforts and, afterwards, post-war reconstruction. Consequently, it was framed as though a housewife's "daily battle on the kitchen front" was just as important to a victory as that of a soldier on the battlefield (Zweiniger-Bargielowska, 2001).

After World War II, as prosperity grew in the United States of America, the New Towns Act, established in 1946, prompted the creation of various new towns based on Howard's democratic beliefs. This ideology of a new way of life was formalised in the history of architecture and it became standard for households to move to the suburbs (Ngo, 2010).

This study will necessarily cascade into another aspect of the kitchen space with the underlying social critique of gender, as a significant shift pertaining to gender and the suburban kitchen space took place.

4.2.3 Gender roles

There are possible risks with regards to generalisation, specifically generalisations about gender. This section is uniquely based on historical observations related to gender roles and how those roles have progressed. Specifically, it is about a historical critique of the gendered nature of domestic space and production space and how that has changed.

During the 1950s, in the United States, the preparation of food adopted an even more specific gender-defining element. The domestic kitchen became the sole space of women, where it was their responsibility, as housewives, to manage the space and prepare meals for their husbands (Vega, 2016).

According to Jessamyn Neuhaus (1999:542), this gender ideology is further exemplified by the fact that "backyard barbecues established a new masculine culinary sphere" where men were only responsible for making fire and cooking meat on the grill (Neuhaus, 1999).

The image of a woman was colligated to her role and function in the kitchen space and this role was exploited to such an extent that a woman in the kitchen was characterised as beautiful (Vega, 2016). According to Betty Friedan (1963:30), the magazines from the early 1960s contributed to the specific image of a housewife portraying a woman as someone who does not work, unless it involves housework and duties to keep their bodies attractive.

The cookbooks fabricated the belief that if a young lady understands how to cook, she would be able to keep a man and if she could cook competently, she would be an ideal wife and able to meet her husband's requirements (Friedan, 1963).

The cookbooks and magazines of that era was specifically intended for new brides and young women, and this established a specific gender identity in the kitchen space, creating the social construct of the woman's role as belonging in the kitchen and being a housewife (Neuhaus, 1999).

The researcher will argue that the changing perceptions on gender dynamics and domestic space can also be interpreted in the concept of this study. During the 1940s and 1950s, specifically in the United States of America, there was an idealistic ideology defined as “the American dream”, where houses were considered to be a place for women and children, which the men would only occupy after arriving home in the evening from work (Neuhaus, 1999).

The following diagram demonstrates a perceived gender division between the domestic (feminine space) and the industrial (masculine space) and the way in which those “worlds” are actually connected to one another.

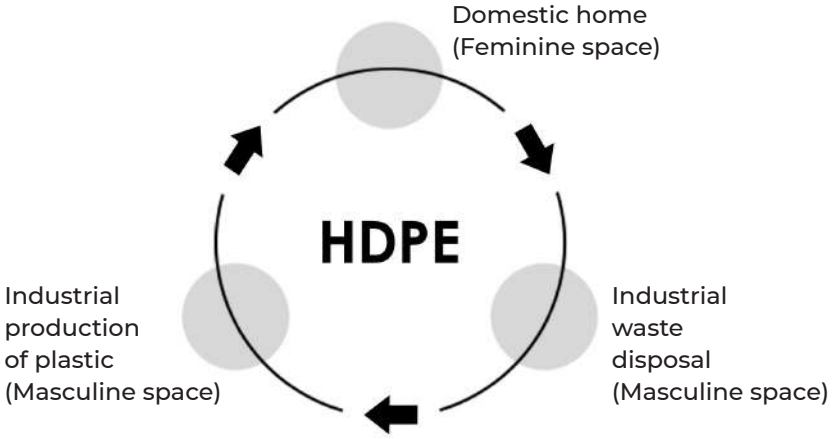


Figure 5: HDPE Cycle (Author, 2021)

4.2.4 Craft in the kitchen

The conventional understanding of the kitchen space has been challenged over the last few decades with numerous experiments conducted to include new programmes which contribute to the expanding role of a domestic space.

The kitchen was considered a space in which raw food materials were used, mostly by women, to produce meals; her activity in this space was intentionally referred to as “her-craft” (Ngo, 2010).

The definition of the kitchen coupled with gender roles and activities has been challenged and redefined as new activities were introduced due to modernisation and affordability. As technology became more accessible and affordable, people started developing new interests.

One such interest was amateur photography but with this came specific space challenges where there was no specific space to exercise this new activity or craft (Ngo, 2010).

PICTURE MAKING BEGINS when cooking ends in this model kitchen. Built-in features enable photographer to get going without wearisome preparation. Counter top resists chemicals.

Kitchen Doubles as Photo Darkroom

Built-ins ease the photographer's job without disturbing the cook.

Figure 6: The Kitchen as a Darkroom (Ngo, 2010)

As amateur photography became very popular, companies (such as the General Electric Home Bureau and F-R Corp) can be considered to have become pioneers in re-creating the kitchen space by designing a kitchen that could also function as a darkroom. Even though the integration of a darkroom in a kitchen can be seen as improbable, these innovations methodically considered the required equipment and space the photographers would need without hindering food preparation (Ngo, 2010).

An impenetrable green fabric was used to completely darken the kitchen and photographers could replace specific lightbulbs in the kitchen with safelights. The broom closet was utilised as a space for drying film, with an electric fan heater installed at the bottom of the cabinet (Ngo, 2010).

In a separate study conducted in 2013 (Wills, Meah, Dickinson & Short, 2013), it was established that the kitchen space could further be utilised for various other activities such as socialising, school and office work, repairing bicycles, and arts and craft activities.

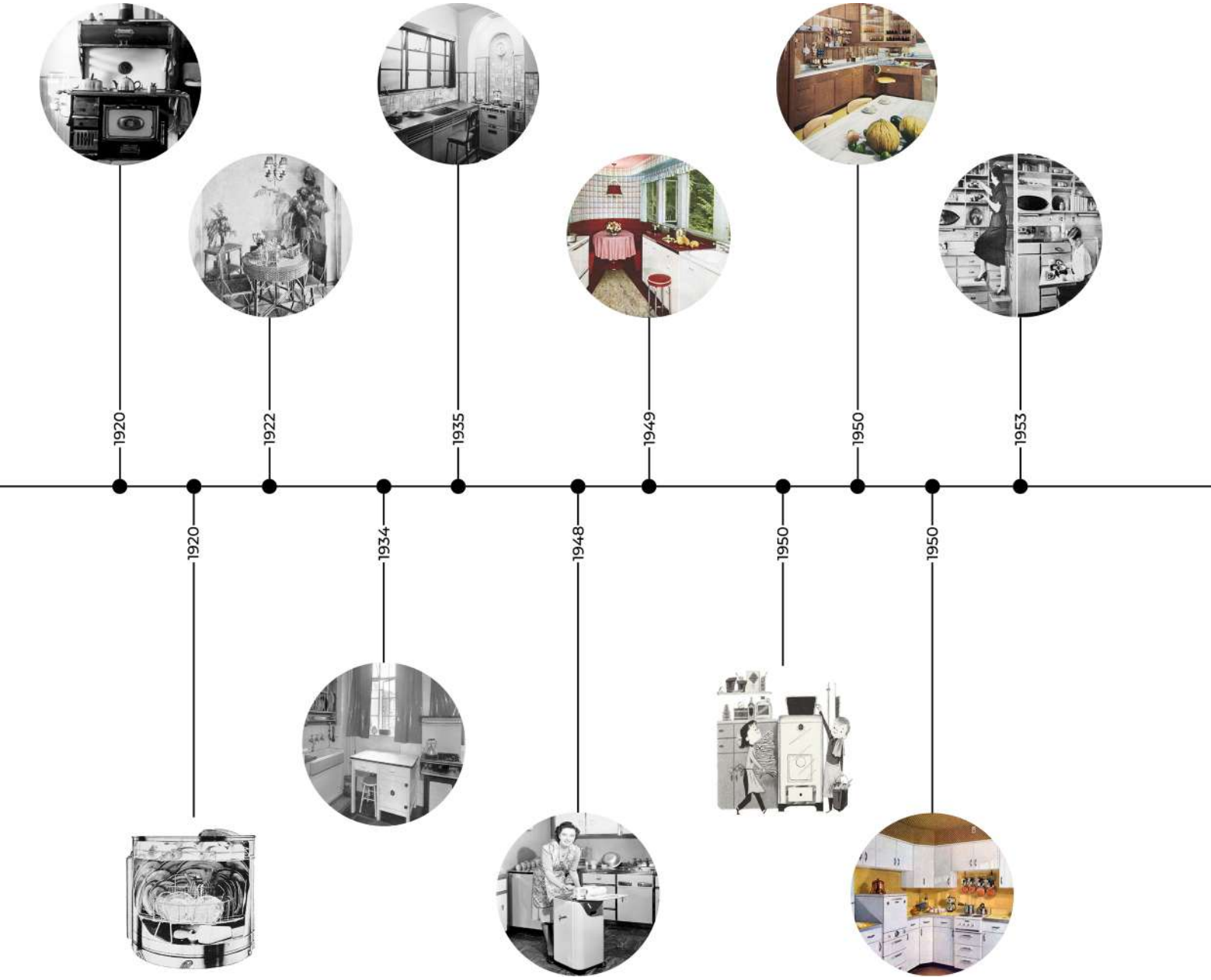
For example, a retired couple was monitored and they demonstrated how they utilised their kitchen space for their personal crafting activities. These included cutting fabric with a rotary cutter to make cushion covers (Wills, Meah, Dickinson & Short, 2013).

From these examples, it is possible to conclude and assume that the conventional understanding of what the kitchen space is can be misleading. The domestic kitchen is usually characterised as a space for food-related activities where raw food products are transformed into meals for human consumption.

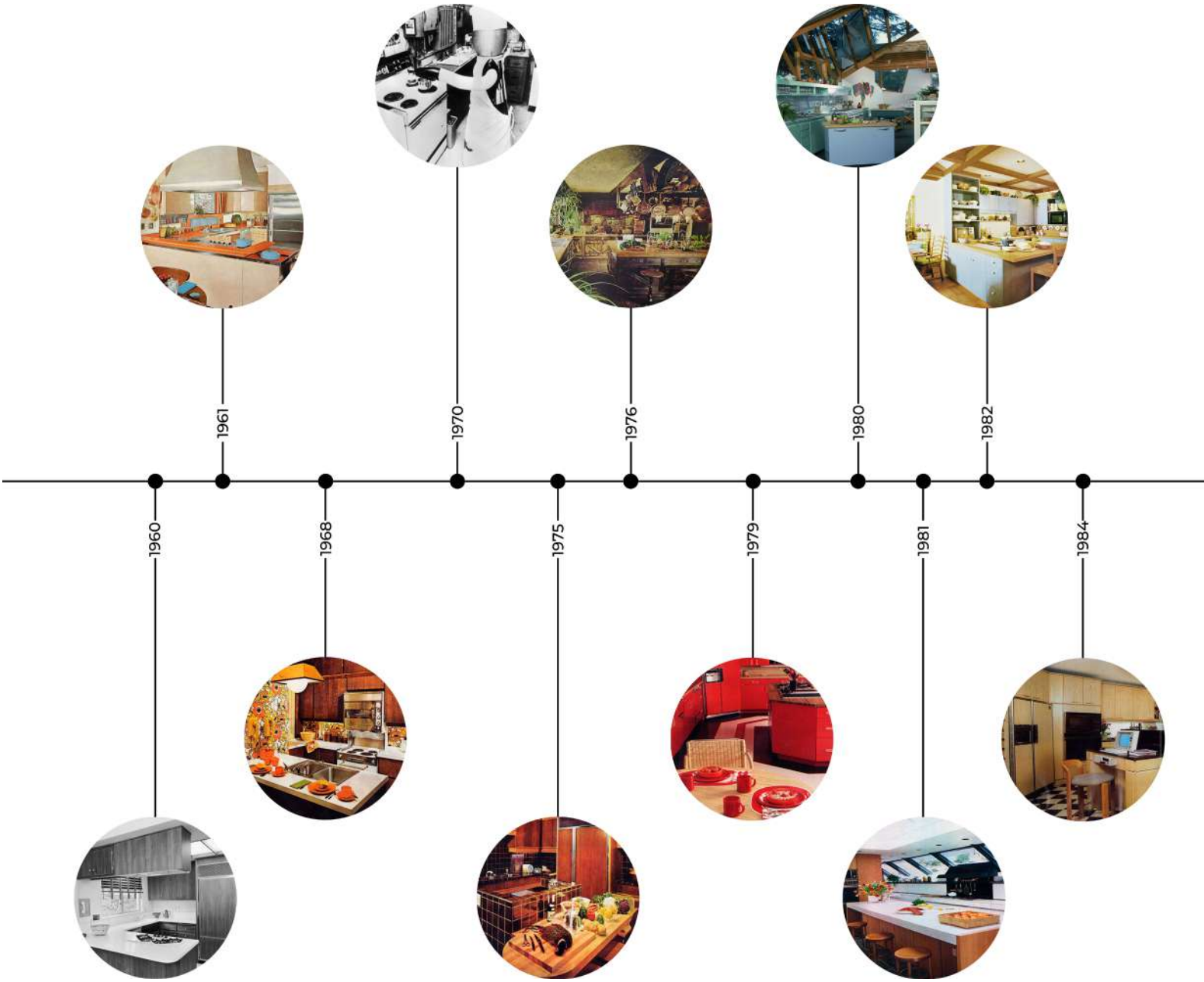
These studies revealed the various possibilities of alternative practices that can be performed in a domestic kitchen space. The kitchen space can, therefore, represent various implications beyond food-related activities and can often be transformed into a production space for alternative activities and procedures.

4.2.5 Designs, innovations, and technologies in the American kitchen

(100 Years of the American Kitchen, 2016)



1920 - A cooking stove with multiple burners allowed for various tasks to be carried out simultaneously.
1920 - Electric dishwasher substituted housewives and undertook the labour of washing dishes and cutlery every day.
1922 - Appliances like waffle irons, toasters and percolators became popular and were even displayed on dining tables.
1934 - Efficient gas stoves, small-scale cabinets and dish storage displayed above the kitchen sink were introduced.
1935 - The stylish designs of the Art Deco period were introduced into the kitchen with a lot of prominence on natural light, smooth lines and geometric decorations.
1948 - A firm washing machine and wringer was introduced and utilised in the kitchen.
1949 - Though it was first introduced in 1920, the built-in dining corner became popular in 1949 and was typically used for family dinners.
1950 - Interesting innovations were exemplified with an “at-home incinerator” in the kitchen.
1950 - The concept of allocating a chair at the kitchen sink for washing dishes was proposed.
1950 - Electric range stoves became the feature and indication of a technologically-advanced kitchen.
1953 - “Hidden helpers”, steps that would slide out from the kitchen cabinets and would function as a surface for sitting on and eating meals, were introduced.

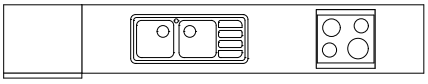


1960 - U-shaped kitchen designs became popular and provided additional space for cooking and storage.
1961 - Pegboards were used in the kitchen to display pans and were additionally considered to be a decorative component.
1968 - Landlines were introduced into the kitchen.
1970 - The kitchen robot, which assisted with daily kitchen tasks, was introduced.
1975 - Kitchen islands were an innovative feature in the 1970s and became increasingly popular with each decade.
1976 - Rustic wood, stone cladding and a lot of plants became features of nature-inspired kitchens.
1979 - Refrigerators developed over time and the feature of a water and ice dispenser was included.
1980 - Open shelves and skylights maximise the amount of natural light entering the kitchen of Frank Gehry.
1981 - The kitchen island design took off in the 1980s, mainly because of the fact that the kitchen was unfolding into a more social space.
1982 - With this, the countertops were utilised for homework or to watch television.
1984 - In the 1980s the kitchen was frequently utilised for work therefore large computers made their way into the kitchen.

4.2.6 Different kitchen layouts

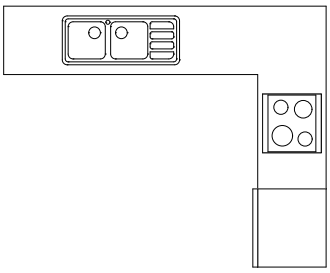
The one wall kitchen:

This is a basic arrangement, which is typically found in smaller kitchens. This specific design saves space without sacrificing functionality.



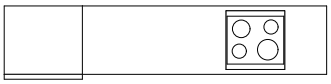
The L-shaped kitchen:

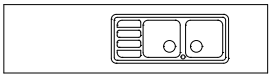
The L-shaped kitchen features cabinets on two perpendicular walls and is a useful and effective layout design for small as well as big kitchens. The L-shaped kitchen design allows plenty of versatility in terms of the placement of kitchen equipment and the workflow between the different zones.



The galley kitchen:

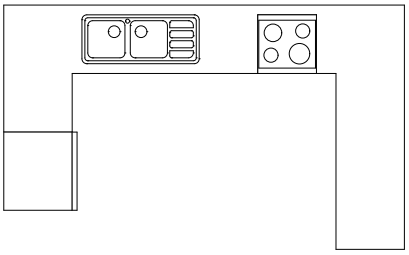
The galley kitchen consists of two rows of cabinets facing each other. This design forms an inner passage, or galley, between them. This type of layout maximises the workspace as it eradicates the need for any additional corner cupboards.

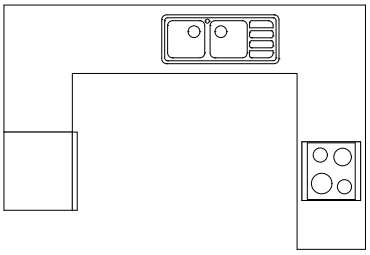




The U-shaped kitchen:

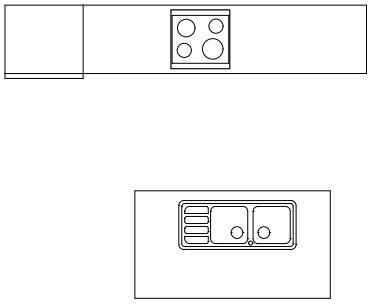
The U-shaped kitchen design is usually used in bigger kitchens. The design consists of cabinetry that runs along three neighbouring walls. This design allows for a lot of storage as well as efficient workflow in the kitchen and is spacious enough for numerous occupants at the same time.

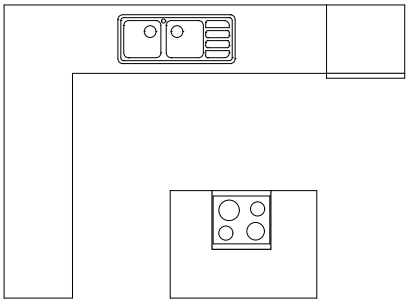




The island kitchen:

The island kitchen is very common, especially in open plan homes. This design provides a significant workspace, as well as storage area, in the centre of the kitchen. This island space can also be utilised as a preparation station and a surface area where the household can eat. Furthermore, the design and setting of the island creates a sustainable traffic- and work-flow in the kitchen.





4.3 KITCHEN ERGONOMICS

Ergonomics plays an important role in the kitchen. Kitchen ergonomics is essentially the discipline of designing space to be appropriate for the people utilising it, not the other way around.

It is important to ensure that there is adequate space for optimal workflow and movement throughout the kitchen, as well as the placement of appliances in the kitchen.

4.3.1 The working triangle

The working triangle, or the “golden triangle” was developed in the 1920s as one of the first procedures of efficiency in a domestic kitchen. It is a concept that positions a kitchen’s three main work areas.

The sections of the triangle illustrate the movements within a kitchen such as cooking food on the stove, rinsing and cutting up food at the sink, and storing food in the refrigerator (Blakeley, 2018).

The principles of the working triangle include the following:
- According to the specific views, each leg of the triangle should be between 1.2 meters and 2.7 meters. Thus, the distances between the working points are neither too far apart nor too close together.
- The collective length of all three legs of the triangle should be between 4 meters and 7.9 meters.
- The appliances and/or any cabinetry should not obstruct any of the three legs of the triangle (Landie, 2016).

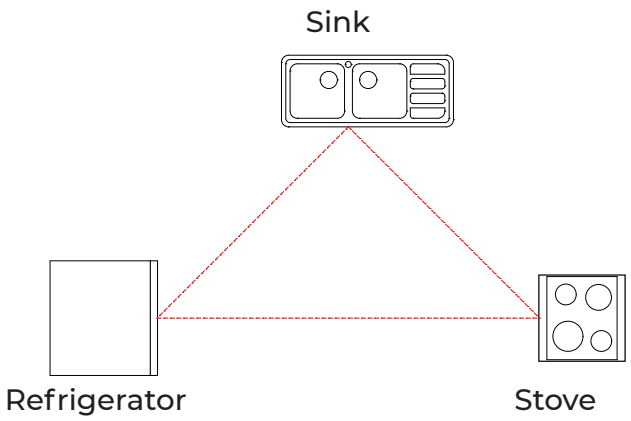


Figure 7: The Working Triangle (Author, 2021)

A study was conducted at Cornell University on the movements of users in the kitchen in view of the theory that people should reconstruct their kitchen layout in order to maximise their mobility before installing the latest technology. This study concluded that unhampered movement in the kitchen space contributed to making the kitchen a more efficient and productive space. It is imperative to ensure that nothing in the kitchen will hinder the movements and tasks preformed in the space (Ngo, 2010).

A critique of the working triangle is that it creates the impression that there is no waste. This essentially forms part of the global problem of waste, because there is not a perceptual acknowledgement of its existence.

The working triangle, in fact, is always a rectangle, because almost every step in the procedure includes something going into the bin.

The following floor plans are examples of the different domestic kitchen designs that visually indicate the three main work areas as well as the route between them.

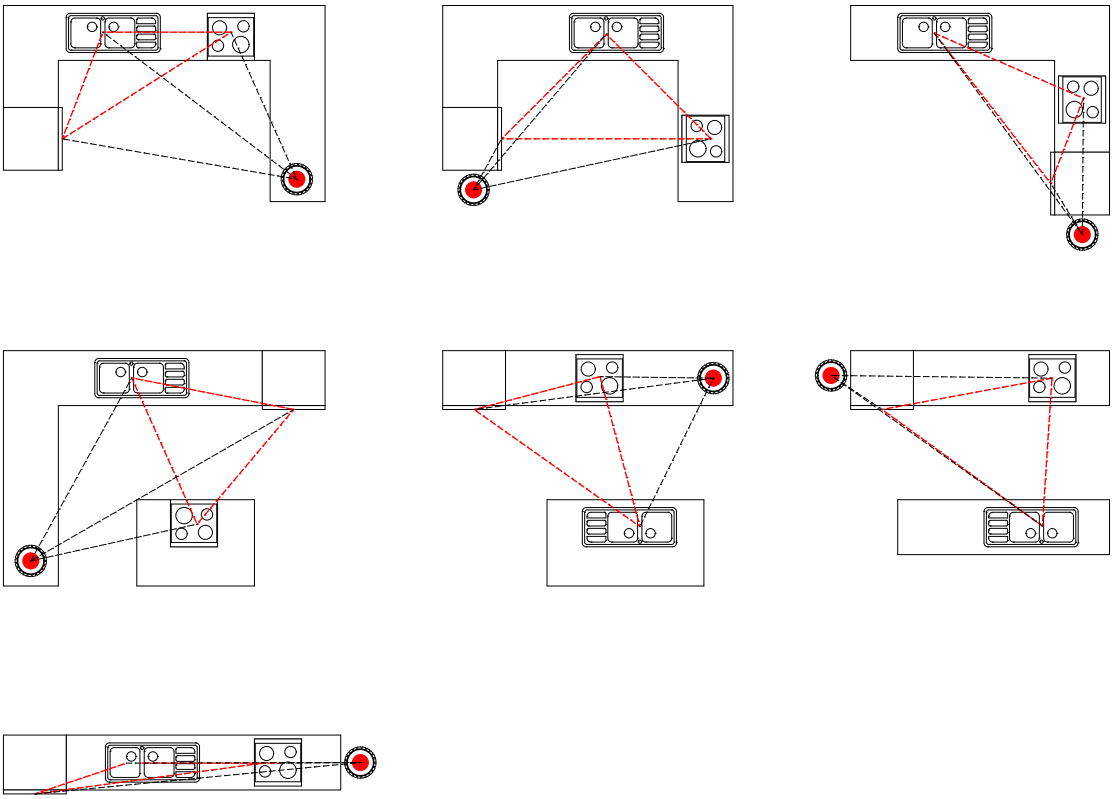


Figure 8: The Acknowledgement of the Bin (Author, 2021)

4.3.2 From conventional to unconventional approaches to the kitchen

The perception of a kitchen refers to a specific form and a specific order within the space. Opportunity for spatial transformation is uncovered through questioning the existing order of this defined space. Where the kitchen is usually considered a production space for human consumption, it can now be transformed to include production space for crafting – see Figure 9. Thus, by changing the relation and function of the kitchen, the order of the space fundamentally changes.

The unconventional approach suggests innovative techniques and technologies that are incorporated into the domestic kitchen. This approach introduces new materials and practices. The proposed concept includes domestic appliances for recycling and processing plastic, storing plastic, washing plastic, and essentially transforming plastic.

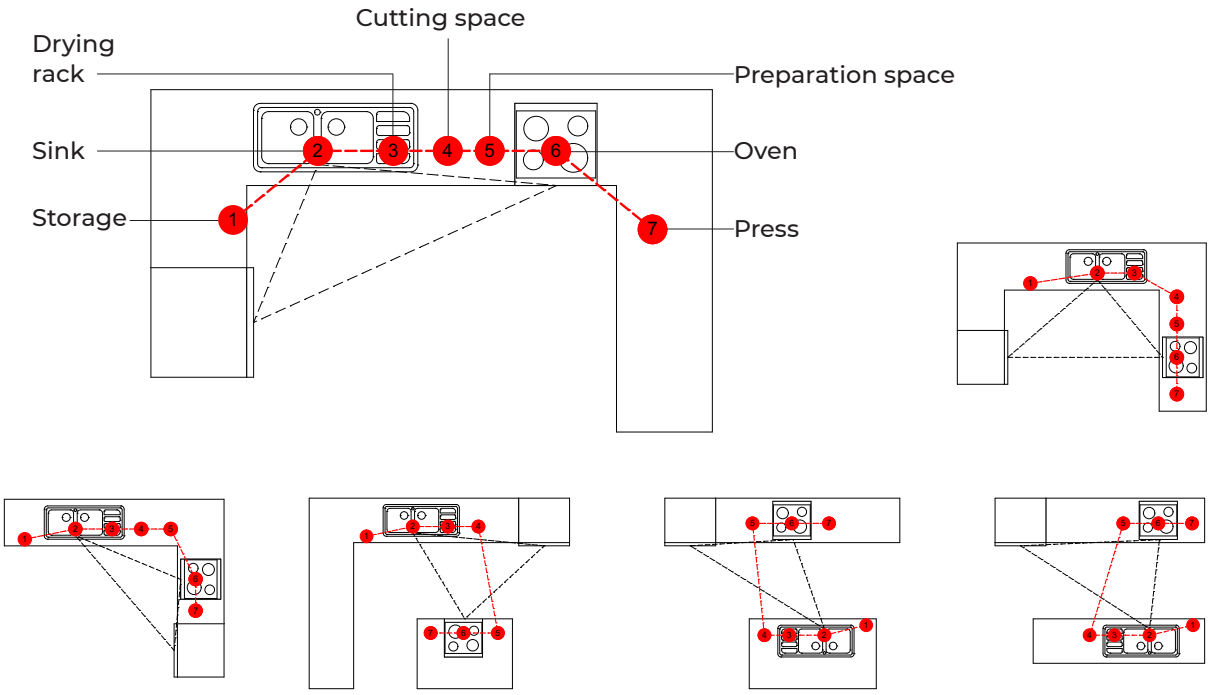


Figure 9: From Conventional to Unconventional (Author, 2021)

1. - Storage - To store empty HDPE bottles in a cupboard or drawer.
2. - Sink - To wash recycled HDPE containers.
3. - Drying rack - To allow the HDPE to dry.
4. - Cutting space - To cut the dry HDPE containers.
5. - Preparation space - To weigh and prepare the HDPE for the melting process.
6. - Oven - To melt the cut HDPE particles.
7. - The press - To flatten and compress the melted HDPE (the press is home-made).

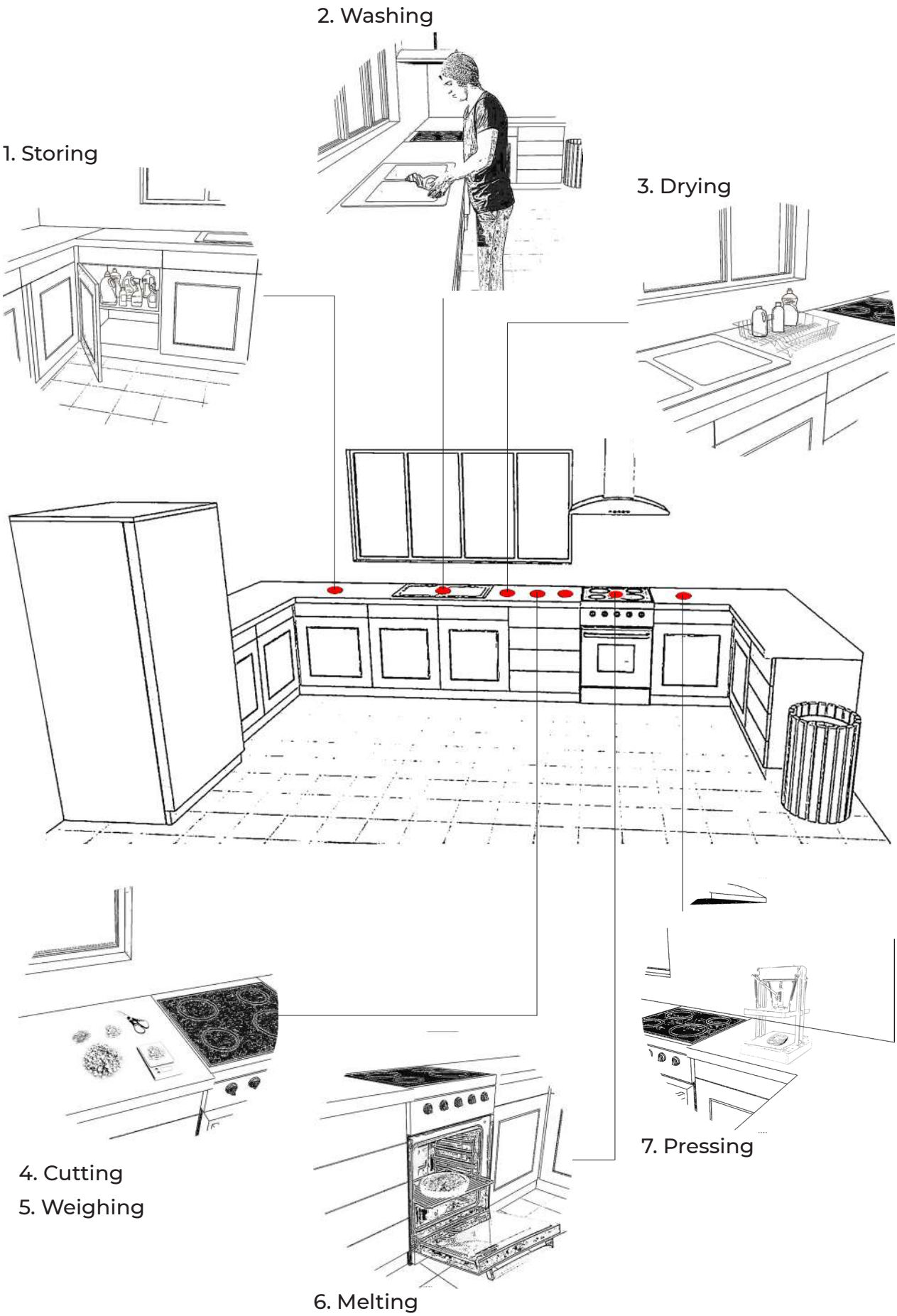


Figure 10: The Kitchen: A Production Space for Crafting (Author, 2021)

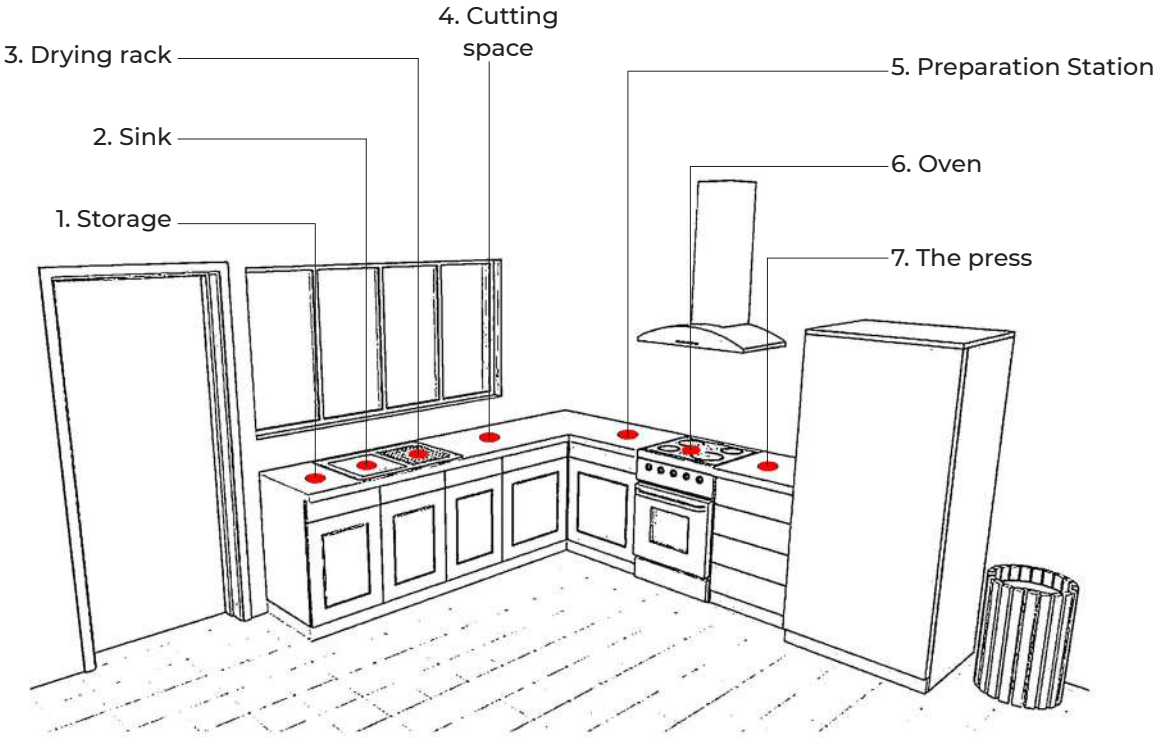


Figure 11: Kitchen Perspective 2 (Author, 2021)

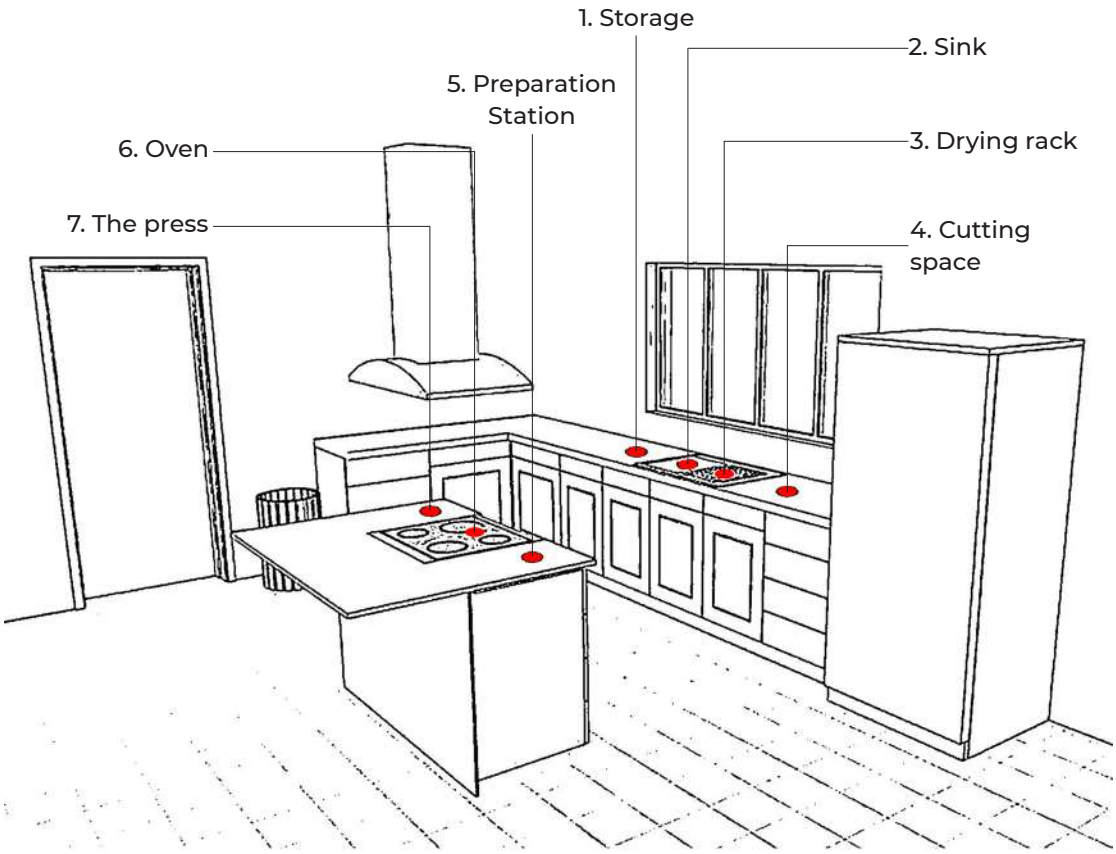


Figure 12: Kitchen Perspective 3 (Author, 2021)

4.4 CONCLUSION

Conventional production activities in the kitchen can be characterised as a production cycle. The cycle can be framed around production, consumption, and disposal. While the waste bin is acknowledged as part of the production cycle, it does not become a detail in the new production cycle as plastic containers are no longer disposed of in the bin.

The conservative production cycle in the kitchen can be considered as the production and consumption of food and the disposal of waste. By redefining the production cycle, it now entails production procedures in crafting and the consumption of plastic. – See Figures 10-12.

In 2020, the reality of the Covid-19 pandemic required a new way of viewing the kitchen space as part of the domestic household environment. During the first period of a nation-wide lockdown, families were confined to their homes and had to alter their domestic setting as families were required to share the domestic household 24 hours at a time, over a period.

As lockdown regulations were relaxed, many did not return to their usual work environment and the household, in many instances, also became the working space. This illustrates humanity's adaptability in transforming spaces into new dimensions. The kitchen can, therefore, just as easily be transformed from a conventional production space to an alternative production space in view of recycling.

05 CHAPTER

THE CRAFT

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5.1 INTRODUCTION

This section of the study explores the possibilities of recycling HDPE as well as eradicating the disposal of HDPE plastic through innovative design and craft procedures.

The hypothesis is that craft and crafting procedures have immense value. Crafting is not only valuable, but also vital.

Through crafting, we gain knowledge of ourselves and our relation to our environment. It stimulates us to be creative, innovative, and constructive.

Figure 13: Elysian (Author, 2021)

5.2 LITERATURE

5.2.1 What is craft?

A delicate connection with technology complicates any agreement around terminologies like “skill” or “handmade.” Craft, for the writer, is simply being engaged in making and understanding things. Craft procedures will bring about questions on how objects have been made, by who they were made, and what they reveal to us about the cultures for which they were crafted (Rossi, 2017).

Rossi (2017:1) points out that the making of craft needs to be redefined due to the vagueness of disciplinary boundaries and digital realities. While the making of crafts can be considered universal, Rossi argues that craft is experiencing a periodic resurgence in the United Kingdom after having been delimitated in the industrialised economies of the 19th century (as cited by Rossi 2017:1) as “modern craft”.

Modern craft, considered by some as inferior in status or quality or “subaltern alterity” due to its handmade origins, needs to be rescued in a time of a faster industrialised economy driven by machined based manufacturing and economic realities (Rossi, 2017).

Much of craft’s modern currency stems from its distinction from mass-produced industrial products, which are becoming increasingly toxic and widespread. Modern culture can, in some way, be characterised as a “throwaway culture” where our demand for things is constantly powered by irreversible and unrestorable items that are outsourced to dense global supply chains and that hide the working situations that are harmful to the people and the environment. A perceivable solution to this predicament may suggest a new way of living that will reduce this harmful influence.

At present, craft can often be viewed as a concrete moral compass with moral implications of authenticity together with a promise of hands-on participation in a somewhat hands-off economy. Making crafts or purchasing items from artisans allows for an expressive connection and relationship with the material world.

In his book *The Craftsman* (2008), sociologist Richard Sennett argues that craftsmanship defines a continuing basic human desire "to do a job well for its own sake". A historically inherited morality underpins the need to re-examine the dynamics and implications of contemporary craft. This is preferable at a time when concerns of humanity and human responsibility are becoming increasingly relevant (Rossi, 2017).

5.2.2 Material consciousness

In a society that relies on convenience, without necessarily being aware of the consequences and impact this convenience comes with, humanity could benefit from being more materially conscious. The researcher agrees with Sennett (2008:120) when he argues that it is useful to develop "material consciousness", for it would result in greater interest in the various possibilities in which things can be transformed.

Sennett (2008:120) rightly points out that it is useful to invest thought into things that can be changed, and identifies three key principles that form part of the process – metamorphosis, presence, and anthropomorphosis.

Metamorphosis is the concept of consciously doing things differently, "a change in procedure". Presence alludes to the application of the personal presence of the designer or creator by making his or her "mark" on the product, such as a stamp or signature.

Anthropomorphosis is the imputation of "human qualities" to raw material, for example, when "primitive cultures imagine that spirits dwell in a tree" and so impute that meaning when cutting a spear from that tree (Sennett, 2008:120).

Sennett's principles can clearly be incorporated as an underlying detail in recycled art, where "trash" is transformed into "treasure". Plastic, that would usually be disposed of, can be recycled and melted (metamorphosis), before being crafted into various objects that reflect the worldview and perspectives of the artist (presence), and when this the case, a new meaning and value is added to the plastic (anthropomorphosis).

5.2.3 Craft as a form of architecture

Craft, it is said, lies at the heart of architecture since craft, in and of itself, includes critical thinking (Rossi, 2017).

Ettore Sottsass was one of several architects who founded their careers on craft. There are numerous anecdotes about craft throughout architectural history that provide insight into both the architectural profession and craft (Rossi, 2017).

Using craft to discuss architecture requires paying attention to essential, though sometimes unpopular, notions. Craft is built on skill, as writers like Peter Dormer and David Pye recognised in the twentieth century. The capacity to achieve skill is what Pye (a trained architect) referred to as the "workmanship of risk," and this in itself takes time to develop (Rossi, 2017).

According to Malcolm Gladwell (2008:39,40), the journey from beginner to master artisan or craftsman takes 10,000 hours of practise (Gladwell, 2008). The 10,000-hour theory is a general principle, but, according to Anders Ericsson, this rule is a misinterpretation of Gladwell's research. Furthermore, Ericsson states that the research on the 10,000-hour rule is completely arbitrary because it is neither scientifically accurate nor based on any substantial discipline (Miller, 2018).

The researcher is of the opinion that the focus should not be on the number of hours specified but rather contemplating the concept of devoting a substantial amount of time and energy into becoming a master of a distinct skill. There is a philosophical meaning and a mysterious value in spending time on something and engaging in the making and crafting of objects.

5.2.4 The Arts and Crafts Movement

William Morris, a designer and artist, and Philip Webb, an architect, aspired to alter the society they observed around them, which was a result of the industrial revolution, with the reintroduction of handmade designs and arts. The negative consequences of industrialisation on both art and the life of workers were revealed by John Ruskin and William Morris (Harkness, 2014). People were employed in various industries that produced far more than they could possibly want or need. As a result of this, the wealthy became even wealthier, while the working-class became even poorer (Nardinelli, 2008).

Morris was critical of the industrial revolution and how it separated the designer and the maker. His idea of the ethical dominance of the handmade or the craft was one of the most well-known legacies of the Arts and Crafts Movement (Krugh, 2014).

Artists and designers who aspired to make a difference perceived “factory-made” items as deceitful and false; they, therefore, sought to make objects that were “truthful” to craftsmanship and that honoured the processes of craft itself.

The guild system was an essential component of Morris and his contemporaries’ philosophy. Morris turned to the medieval era’s craft guild system to juxtapose the oppressive precision of capitalist machines with the “beauty and pleasure” of craftwork (Harkness, 2014). He was well-known for emphasising the significance of beauty in the house, but solely focusing on beauty that came from crafted objects.

The arts and crafts design aesthetic can usually be characterised as clean, practical and truthfulness to materials. The designs acknowledge the natural beauty of the workings by eliminating any additional decorations and/or external treatments (Harkness, 2014).

Wood, for example, was kept unpainted to emphasise and observe its inherent textures and colours, and joints were left visible to honour and acknowledge the craftsmanship.

5.2.5 Honesty of material

It can be argued that some will question the truthfulness and honesty of plastic. Roland Barthes, in his essay on “plastic”, argues that while the material is in a sense discredited with Greek shepherd names such as Polystyrene, Polyvinyl, Polyethylene, it is, at its essence, the culmination of a transformational process starting at the one end with raw chemical elements, and ending as a finished “human object” (Barthes, 1957:110).

Plastic has entered our understanding as more than a mere substance and is the personification of infinite transformation and its very existence is a sign of its omnipresence, visible in every sphere of life. It can be described as a miraculous substance, but a miracle is, in essence, invariably an abrupt transformation of nature. Plastic can be defined as “less of a thing” and more as the “trace of a movement”, where the original materials are infinitely transformed into endless converted objects, a spectacle of end products (Barthes, 1957).

The original substance is never a sign of the absoluteness of the artistry of plastic, characterised by the singularity of its origin to the bountifulness of the end effects, ranging from ordinary household items to exquisite jewellery. This ability of plastic to transform can give someone a feeling of euphoria of power and prestige (Barthes, 1957).

Barthes argues that, in reality, plastic can be viewed as a negative substance, as a disgraced material, lost between the “effusiveness of rubber and the flat hardness of metal” as it represents none of the authentic produce of the mineral world, incapacitated to accomplish the jubilant uniqueness of nature (Barthes, 1957:111). He is of the opinion that the popularity of plastic underlines the “evolution in the myth of imitation materials”, where the imitation materials is an indication of its pretension as they belong to the world of appearances without actual usefulness by aiming to cheaply replace the rarity of diamonds, silk, feathers, furs, silver, etc. – which represent the real magnificence of the world.

Barthes (1957:111) maintains that plastic is merely a household material and, while it once was a magical substance, it is now mundane. Its ordinary character is the very reason for its success and existence and its guise is aimed at what is common, not rare, with nature no longer a pure essence to be regained or imitated, but rather to be replaced by the more bountiful “artificial matter”.

Barthes theorises that plastic is primarily engulfed by its purpose and that objects will be invented solely for their usefulness and that the possibility exists that the whole world could be plasticised, even life itself, as plastic aortas are now being manufactured.

While certain views seem to degrade plastics, especially with regards to its artistic possibilities, this research will argue that there is also a case for the honestly of this material. But what is the honesty of a “dishonest” material? This honesty derives from the notion that the material can possibly become anything. Its truthfulness is exactly that: the direct relationship to its transformability.

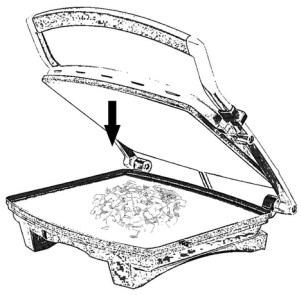
Therefore, the patterns are inchoate-mid-transformation phases to a continuously delayed completion. This delayed completion derives from the concept of colour separation along with the total colour integration of the plastic material. This ideology of plastic signifies an aesthetic phenomenon which is closely associated with its transformability.

5.3 TEXTURES AND PATTERNS

5.3.1 Achieving different patterns

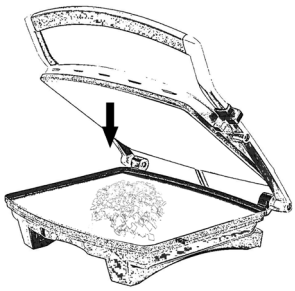
The following illustrations are techniques that were followed to achieve particular patterns. There are numerous other possible patterns to achieve, but the study only focused on five different patterns and the course of action to achieve them.

❶



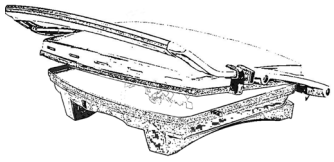
The shredded plastic particles were placed between baking sheets, then placed inside a sandwich press which was then gently closed. (A)

❷



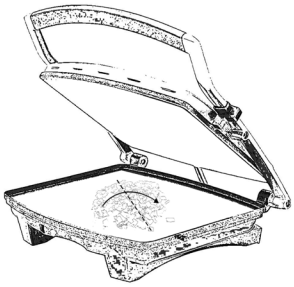
After ensuring the plastic was melted, additional shredded plastic particles were placed inside to increase the volume. (C)

❸



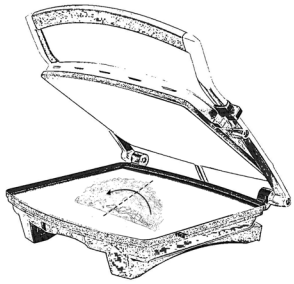
When the sandwich press was closed, gentle downward pressure was applied to ensure that the plastic was compressed while being melted.

❹



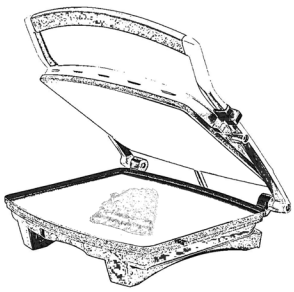
The melted plastic was then folded over to ensure effective bonding between the plastic particles and to allow the colours to blend appropriately. (E)

❺



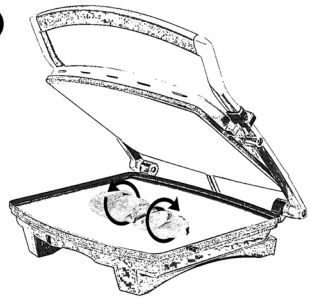
The melted plastic was then folded over a second time and the sandwich press was gently closed. (F)

❻



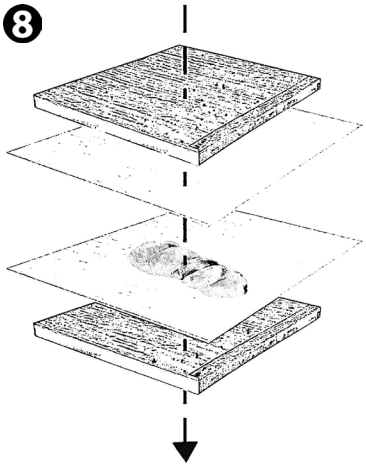
The plastic inside the press needed to be melted properly before continuing to the next step.

❼

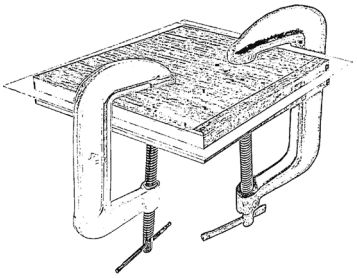


The twisting technique was applied and the plastic was then placed in the press again. (I)
This step was repeated once more. (K)

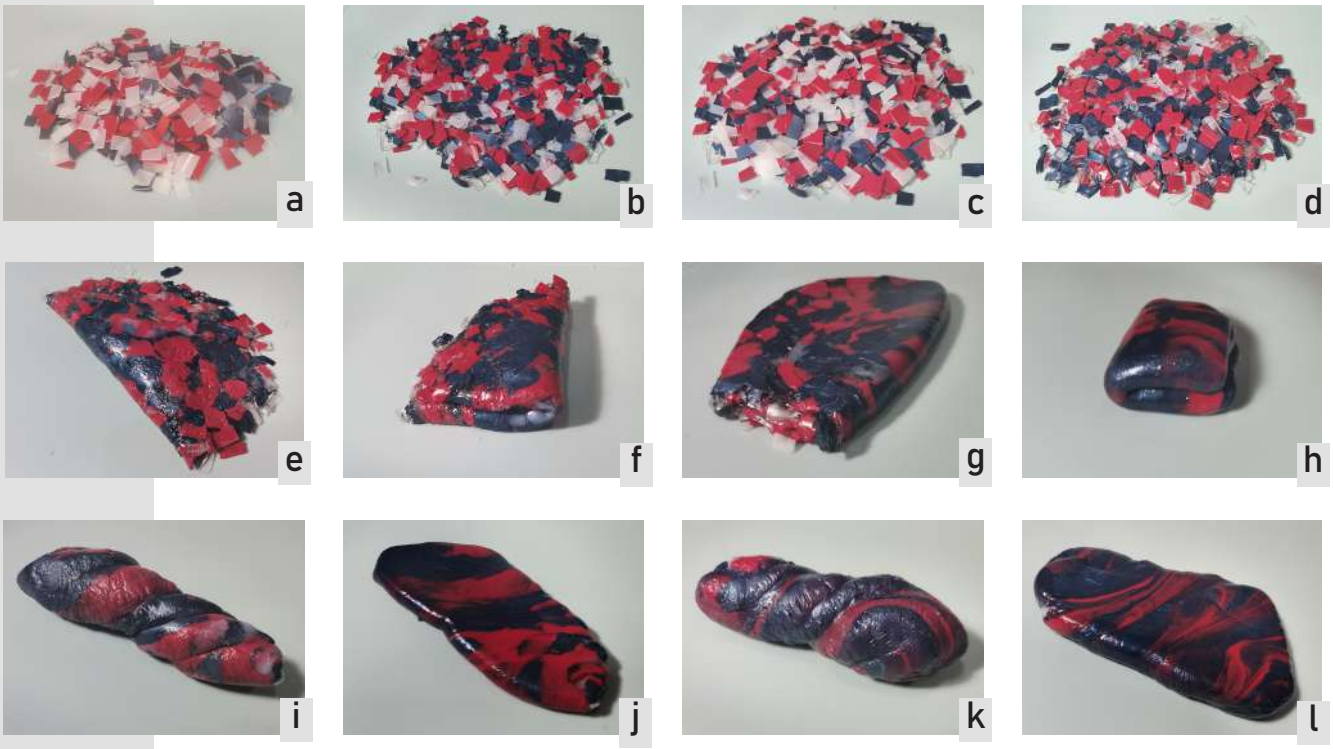
❽



The melted plastic was placed between two sheets of baking paper which were then sandwiched between two pieces of wood.



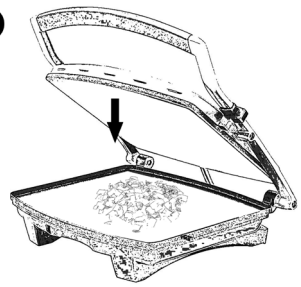
The pieces of wood were then secured with G-clamps and the plastic was then compressed as the clamps were tightened.



1.

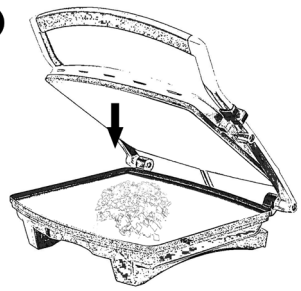
Figure 14: Marble Effect, Long Swirls (Author, 2021)

❶



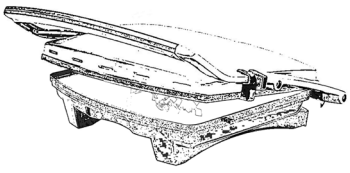
The shredded plastic particles were placed between baking sheets, then placed inside a sandwich press which was then gently closed. (A)

❷



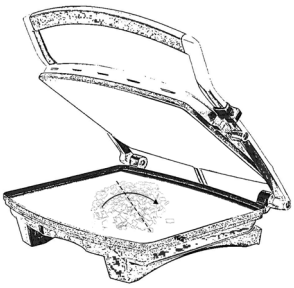
After ensuring the plastic was melted, additional shredded plastic particles were placed inside to increase the volume. (C)

❸



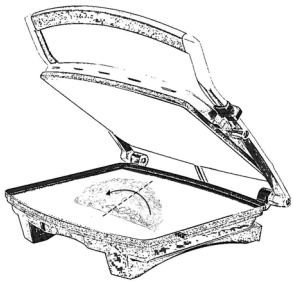
When the sandwich press was closed, gentle downward pressure was applied to ensure that the plastic was compressed while being melted.

❹



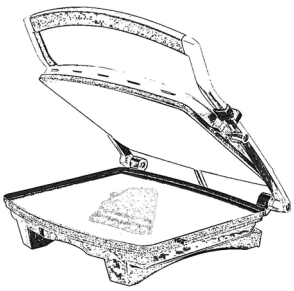
The melted plastic was then folded over to ensure effective bonding between the plastic particles and to allow the colours to blend appropriately. (E)

❺



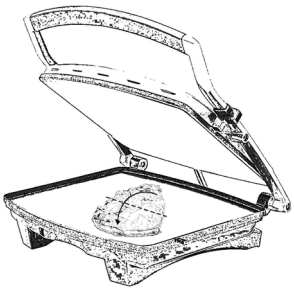
The melted plastic was then folded over a second time. (F)

❻



The sandwich press was then gently closed and downward pressure was applied. (G)

❼

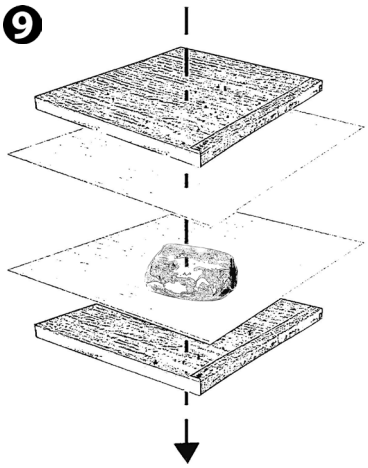


The melted plastic was folded over for a third time and the sandwich press was closed to further compress and melt the plastic.

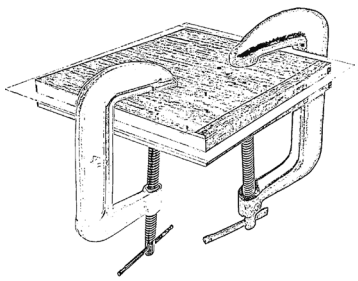
❽

The sandwich press was opened and the melted plastic was removed.

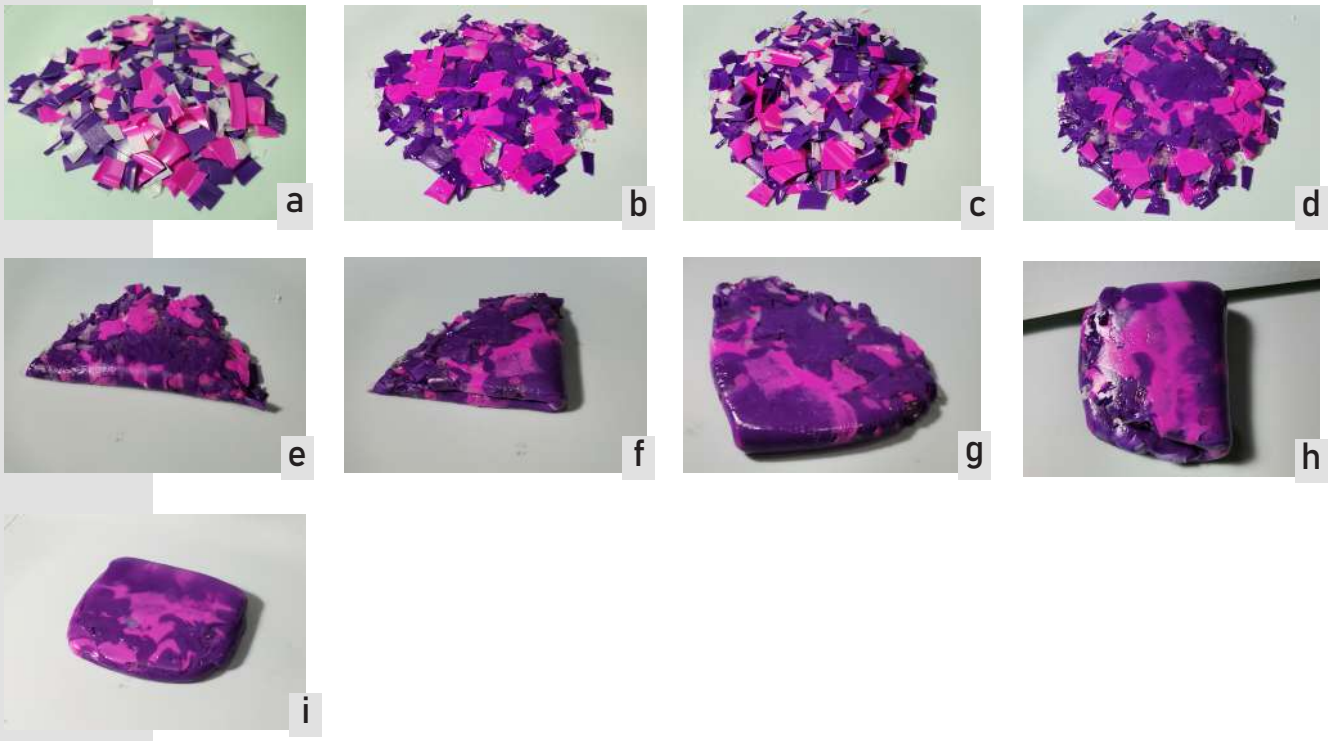
❾



The melted plastic was placed between two sheets of baking paper which were then sandwiched between two pieces of wood.



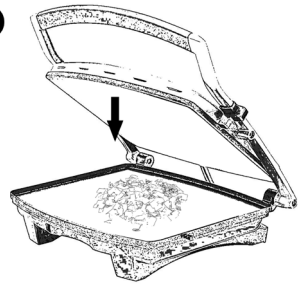
The pieces of wood were then secured with G-clamps and the plastic was then compressed as the clamps were tightened.



2.

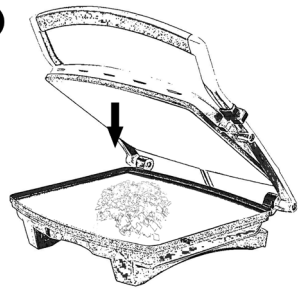
Figure 15: Abstract Watercolour Effect, Fewer Swirls (Author, 2021)

❶



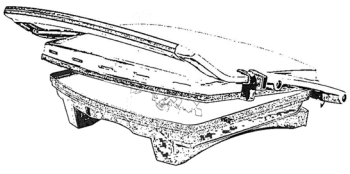
White and translucent plastic particles were placed between baking sheets, then placed inside a sandwich press, which was gently closed. (A)

❷



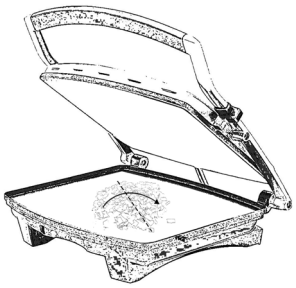
After ensuring the plastic was melted, additional shredded plastic particles were placed inside to increase the volume. (B)

❸



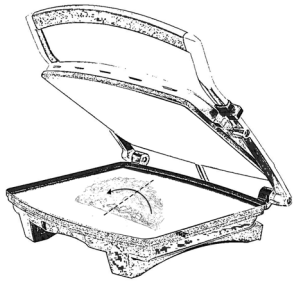
When the sandwich press was closed, gentle downward pressure was applied to ensure that the plastic was compressed while being melted.

❹



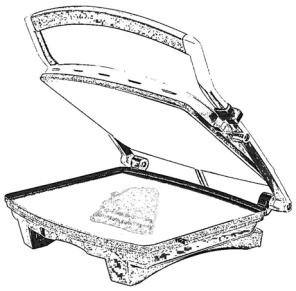
The melted plastic was then folded over to ensure effective bonding between the plastic particles and to allow the colours to blend appropriately. (C)

❺



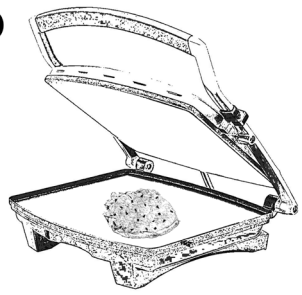
The melted plastic was then folded over a second time. (D)

❻



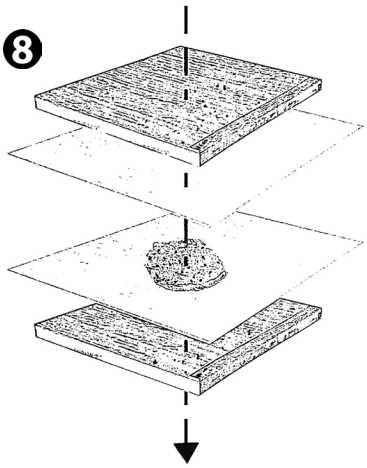
The sandwich press was then gently closed and downward pressure was applied.

❼

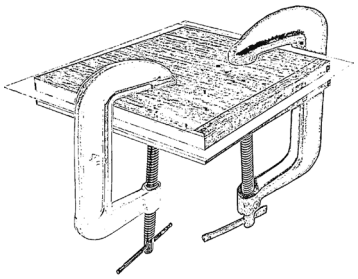


Small colourful plastic particles were placed on the melted plastic and the sandwich press was closed to further compress and melt the plastic.

❽



The melted plastic was placed between two sheets of baking paper which were then sandwiched between two pieces of wood.



The pieces of wood were then secured with G-clamps and the plastic was then compressed as the clamps were tightened.

3.

Figure 16: Coloured Splash,
Absence of Swirls (Author, 2021)

4.

Figure 17: Watercolour Effect, Different Colour Palette (Author, 2021)

5.

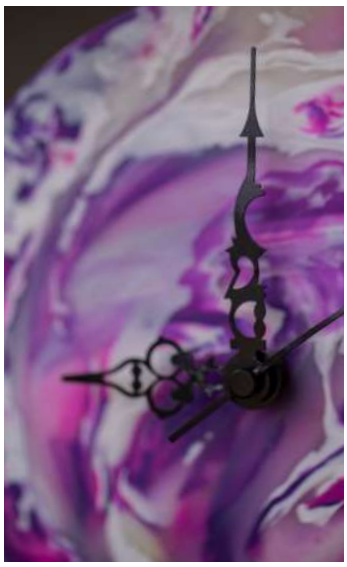
Figure 18: Long Swirl Combined With a Watercolour Effect, Bright Colour Palette (Author, 2021)

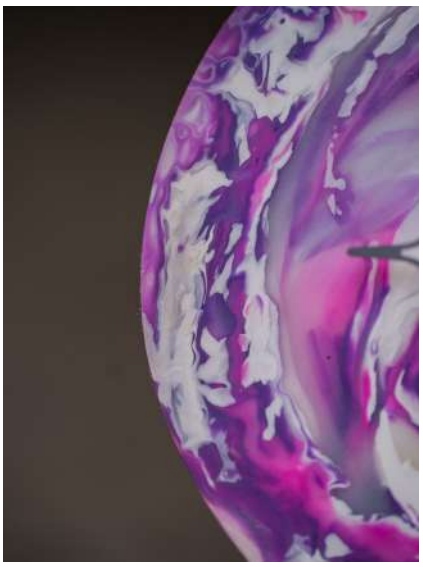
5.4 OBJECTS

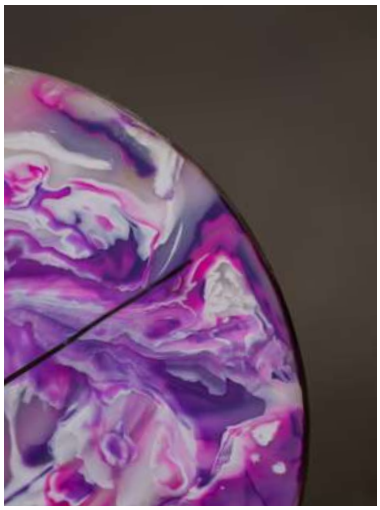
Usually, an object must have a function in order for it to be considered useful. The function must be described and sense has to be made of the object through the “lens” of function. This thought process led to the crafting of objects in view of what the function could be. It was anticipated that by adding other elements or ornaments to the material, function, and essentially more value, would be added to the object.

Ultimately, this concept of usefulness, which is directly connected to functionality, is an erroneous assumption. According to Adolf Loos (1908:21), adding ornaments to a material is a “crime” against the national economy, as it only results in a waste of labour, money and the material (Loos, 1908). The same can be said of adding elements to an object to establish its function.

The material itself holds significance and by adding elements to introduce function to the object, the value of the material and object can be covered. Function as ornament begins to obscure the making process and its value, because the significant value of making is replaced by the negligible value of function.

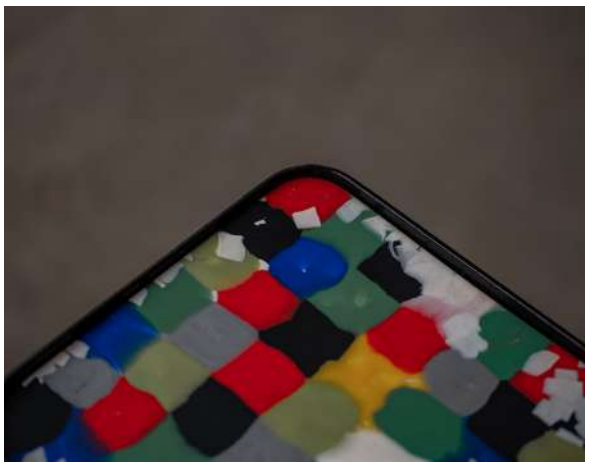




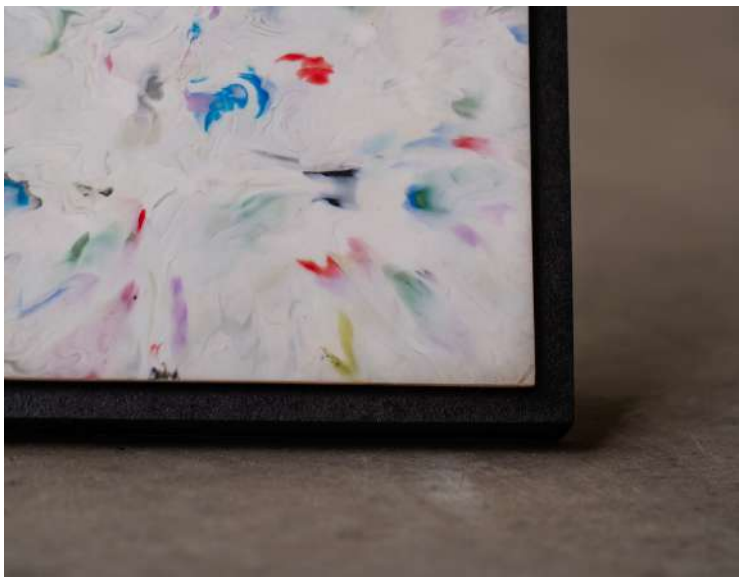


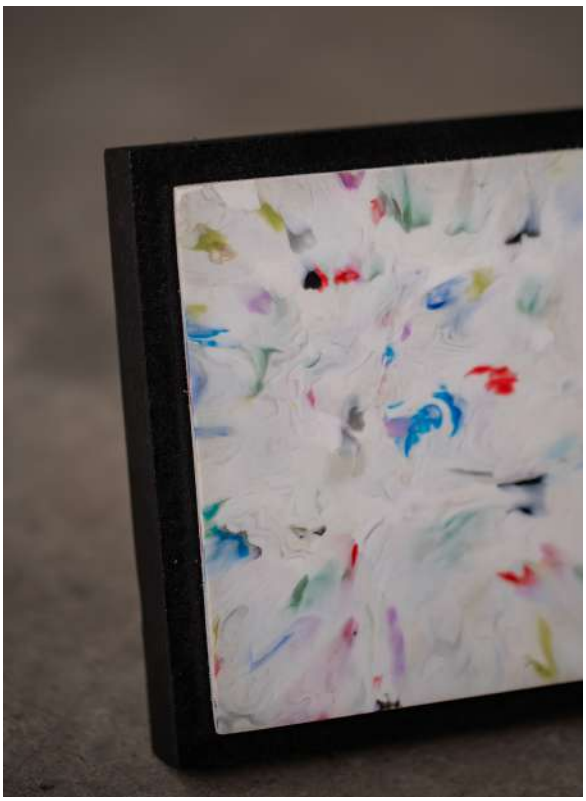
Photographs by Natasha Bouma, 2021.

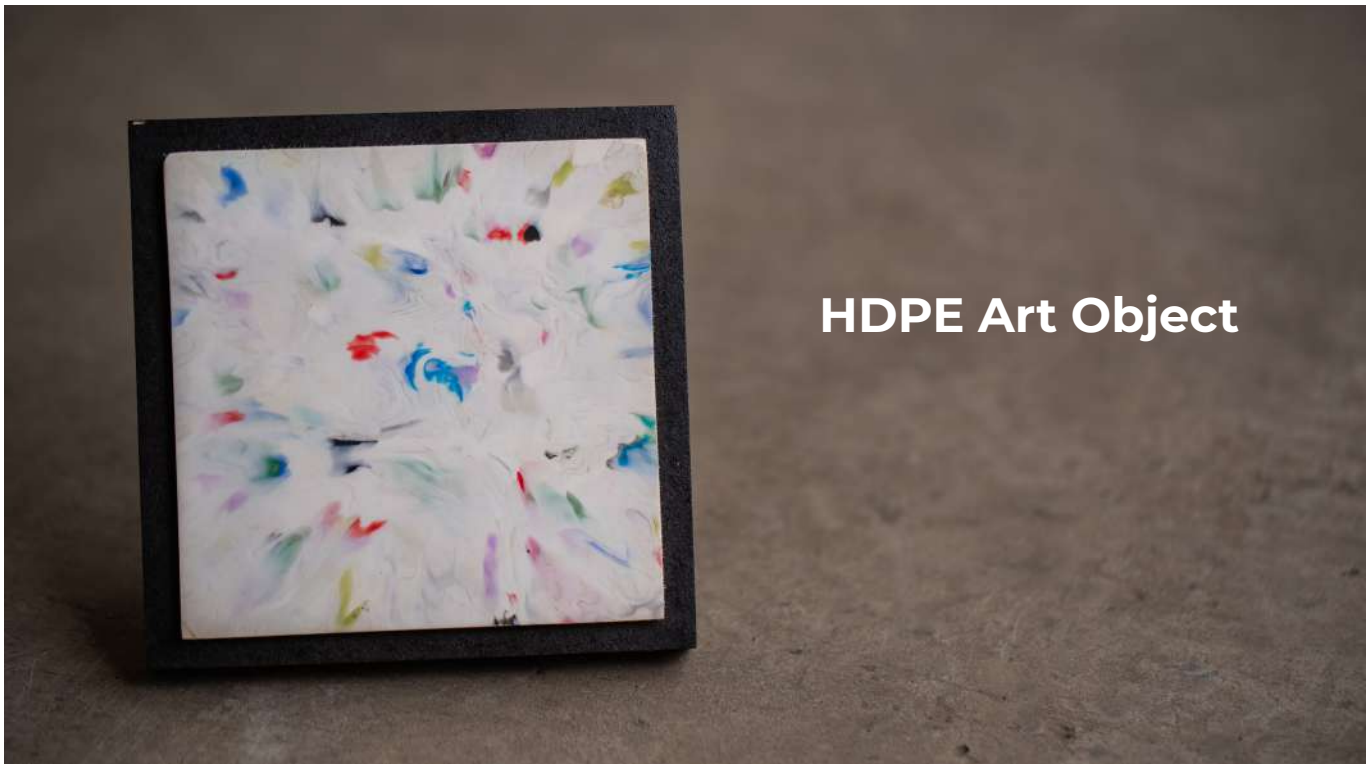
Photographs by Natasha Bouma, 2021.



Photographs by Natasha Bouma, 2021.







Photographs by Natasha Bouma, 2021.

5.4.1 CONCLUSION

A critical reflection on form, function and content

To be critical of function without abandoning it is significant. It is not inappropriate for an object to have function, but what that function is should be open to interpretation. The function is not necessarily the object itself, but the function emerged from reimagining the waste cycle and craft in the kitchen as the value exists in these procedures.

5.5 HDPE SCULPTURES

Beauty is in the eye of the beholder (Hungerford, 1878). Whether you take a piece of art, a painting, literature, a film, or a sculpture, the beholder interprets the piece from his or her own perspective and emotions. The beauty of art is subjective, and the beholder gives meaning to it according to his or her own interpretation. One such example is the blue monochrome by Yves Klein (1961), which is nothing more than blue paint on a 1,95m x 1,4m canvas, but was sold for $17,400,000 in 2008. This illustrates how the beauty and value of any work of art lies in the interpretation of the observer.

The first notion of art, presented by Greek philosophers, was that art is a mere imitation of reality. This theory, which was created by Plato, appears to have created this idea solely to declare that the value of art is questionable. According to Aristotle, art has a certain significance since art is therapeutic in the sense that it stimulates the beholder and removes harmful emotions (Sontag, 1966).

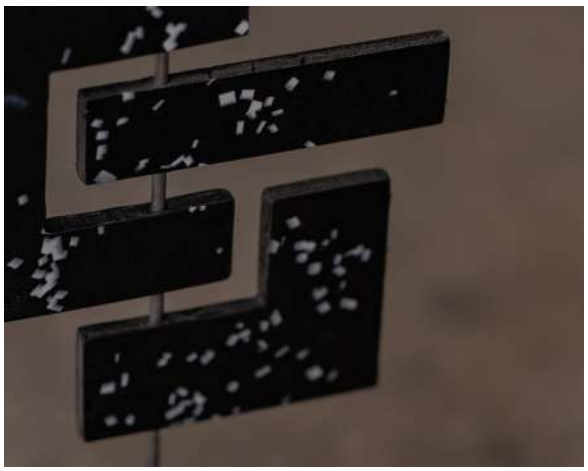
The defence of art gives rise to the strange concept of “form” being separated from “content”. Interpretating art by questioning its content amounts to the question: “What is the art saying, or trying to say?” This approach to art is a hindrance, violating art into an article for use and form, which then becomes merely an accessory. The interpretation of art must be understood in the context of translation and must be valued in view of human consciousness. Form must be understood within the context of “own experience”, the rediscovery of our senses, to see more, hear more, and feel more (Sontag, 1966:2,6,10).

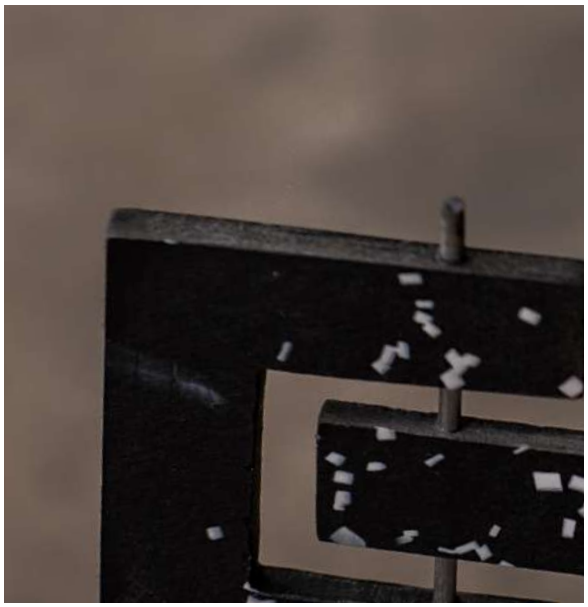
“There are no facts, only interpretations”

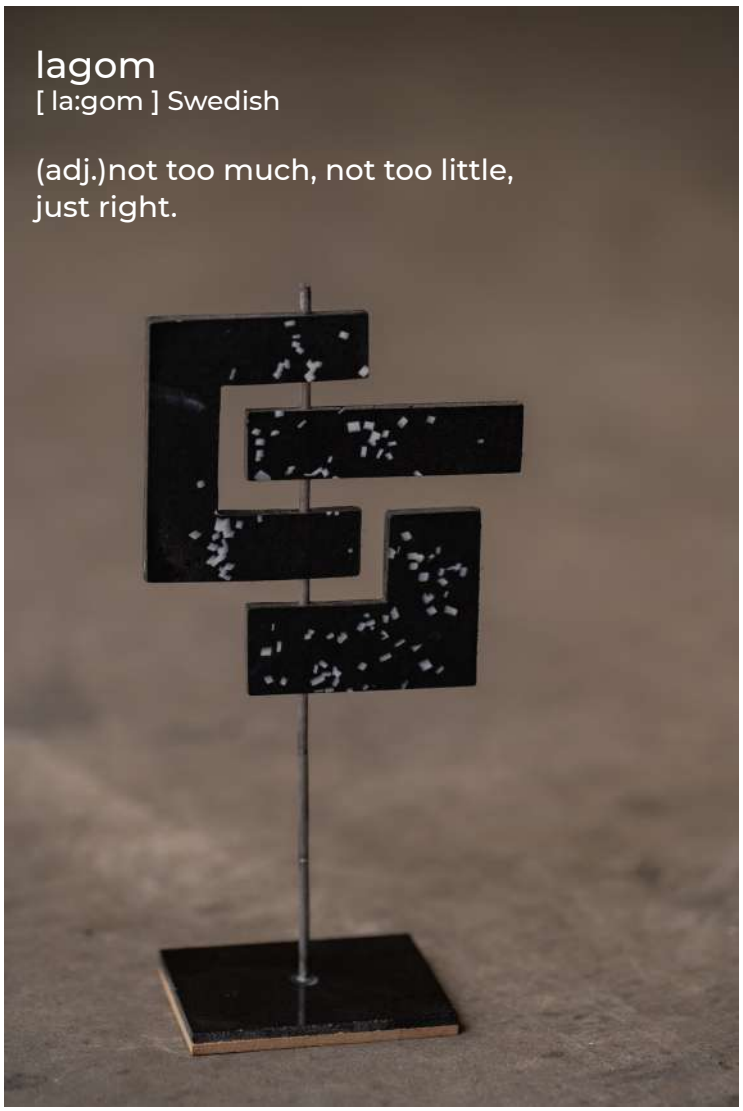
- Friedrich Nietzsche

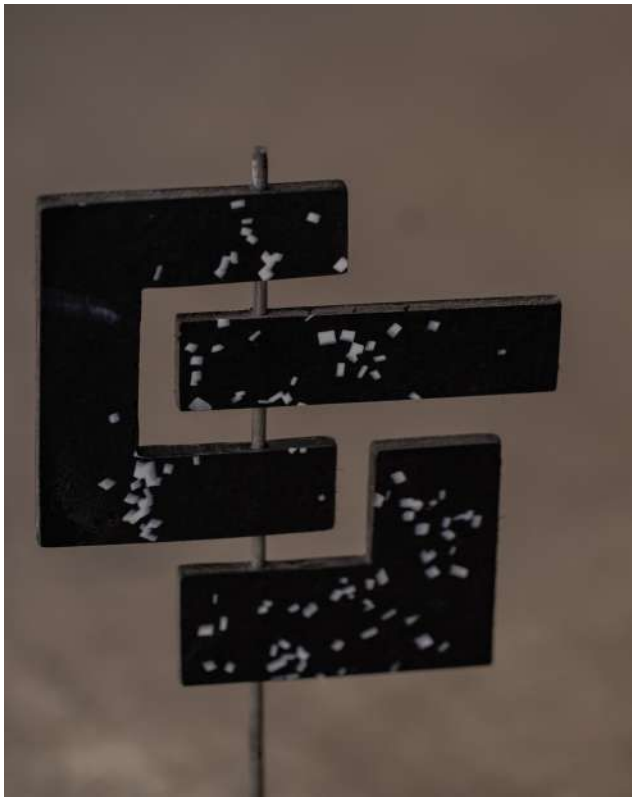
Photographs by Natasha Bouma, 2021.

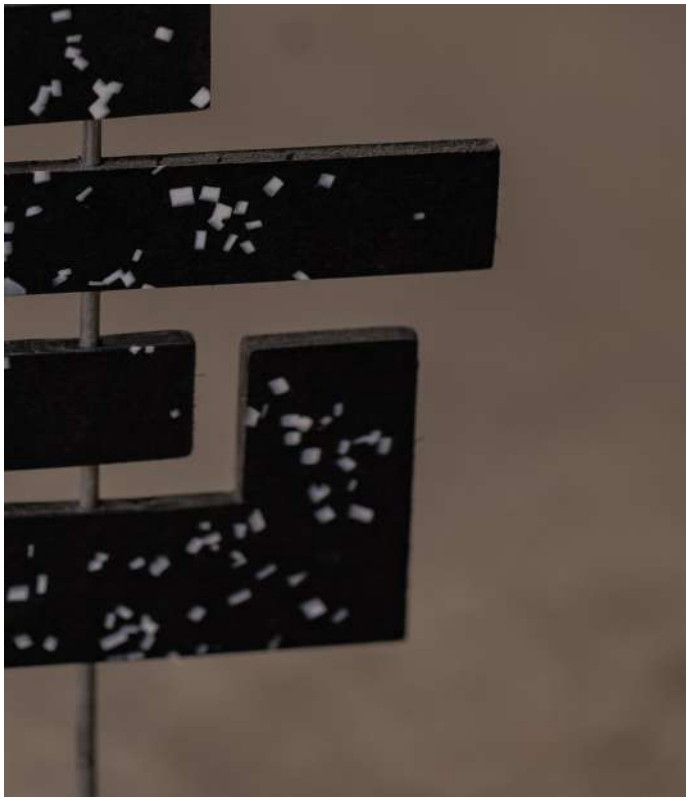
Photographs by Natasha Bouma, 2021.











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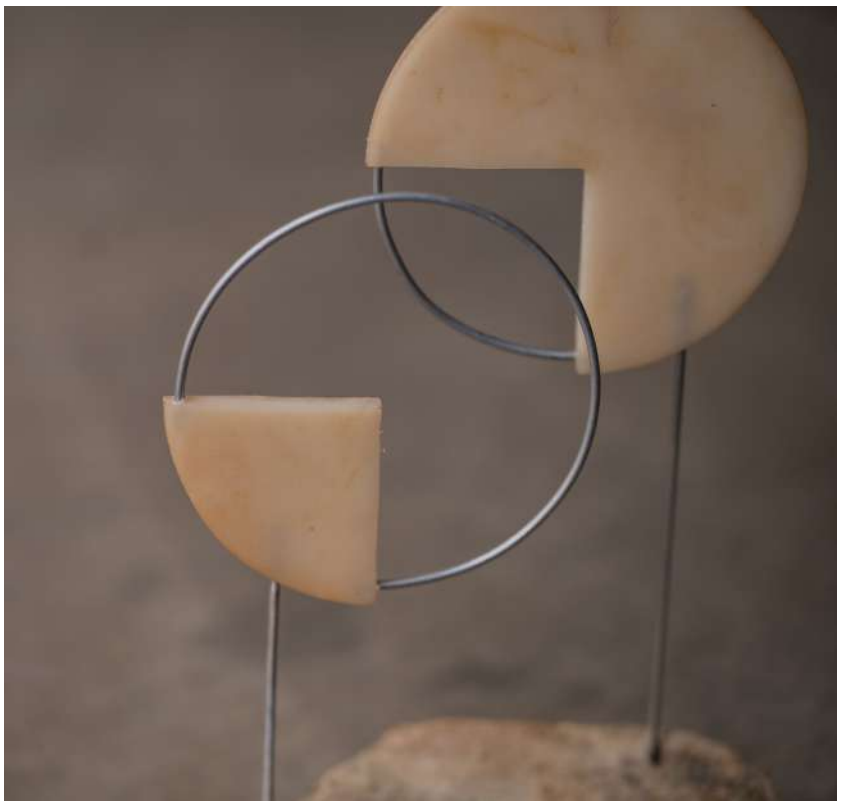
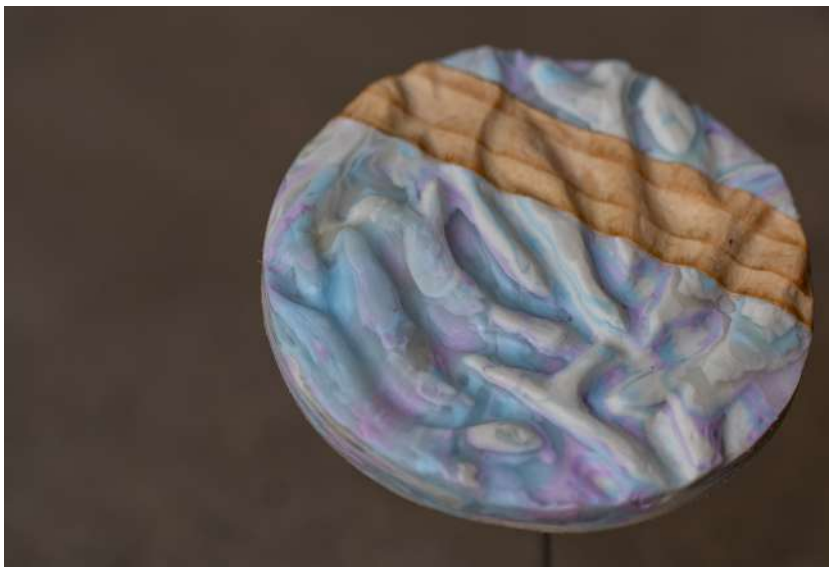
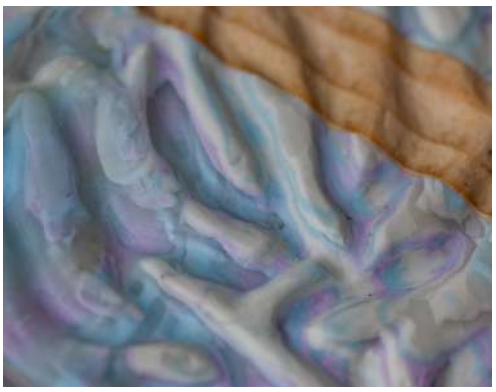
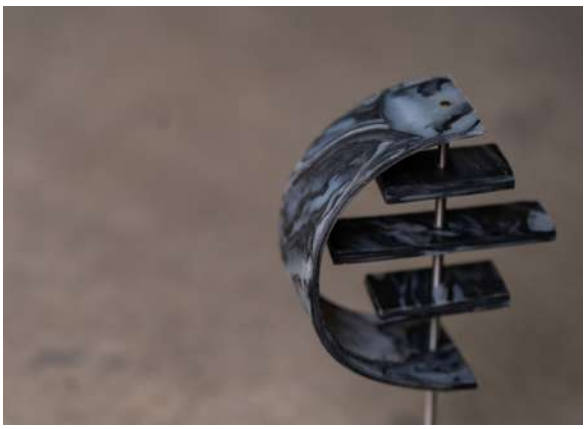


Photographs by Natasha Bouma, 2021.





Photographs by Natasha Bouma, 2021.



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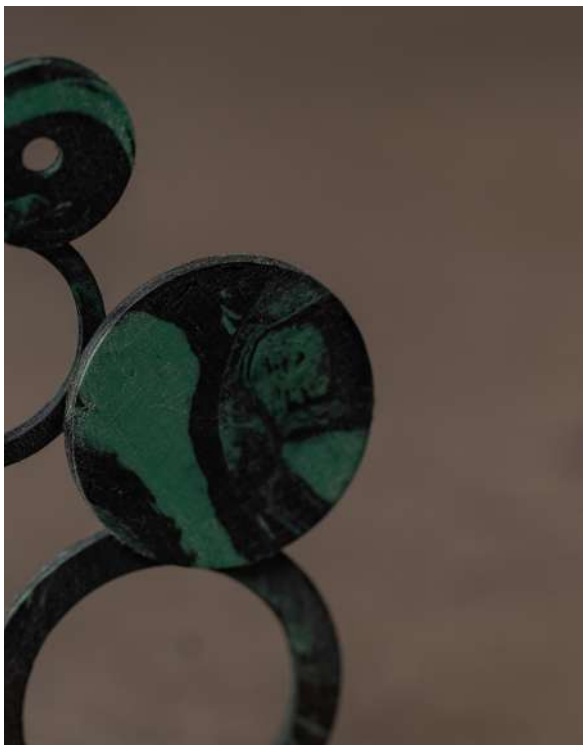

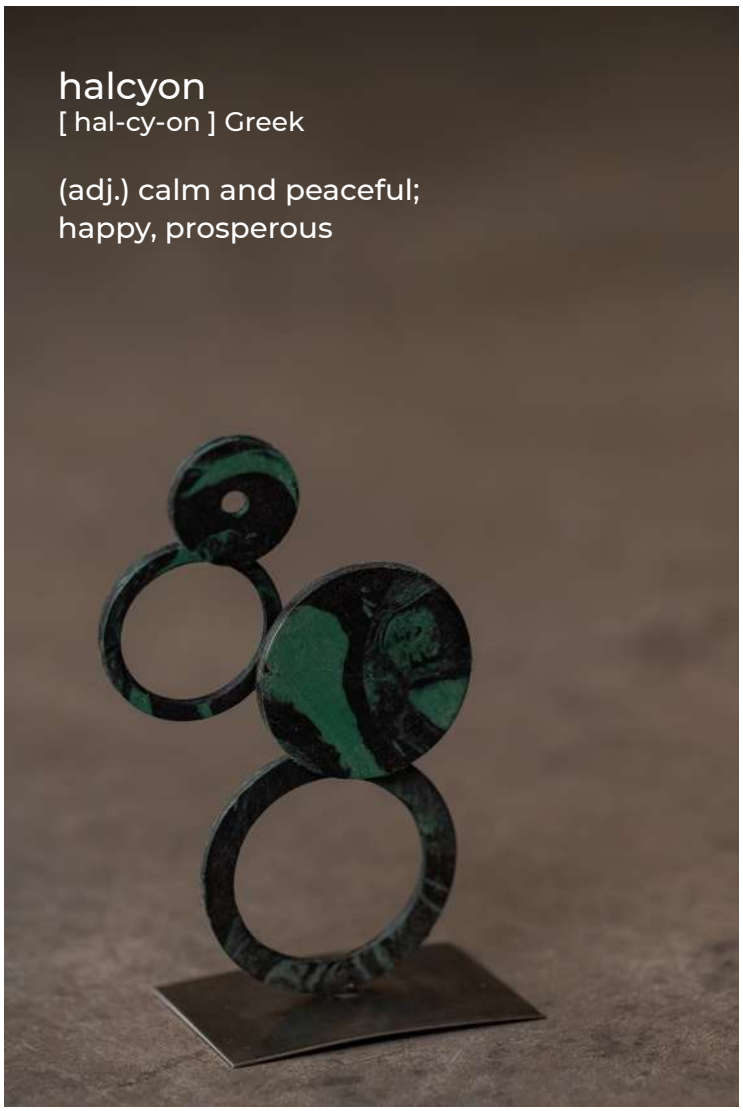

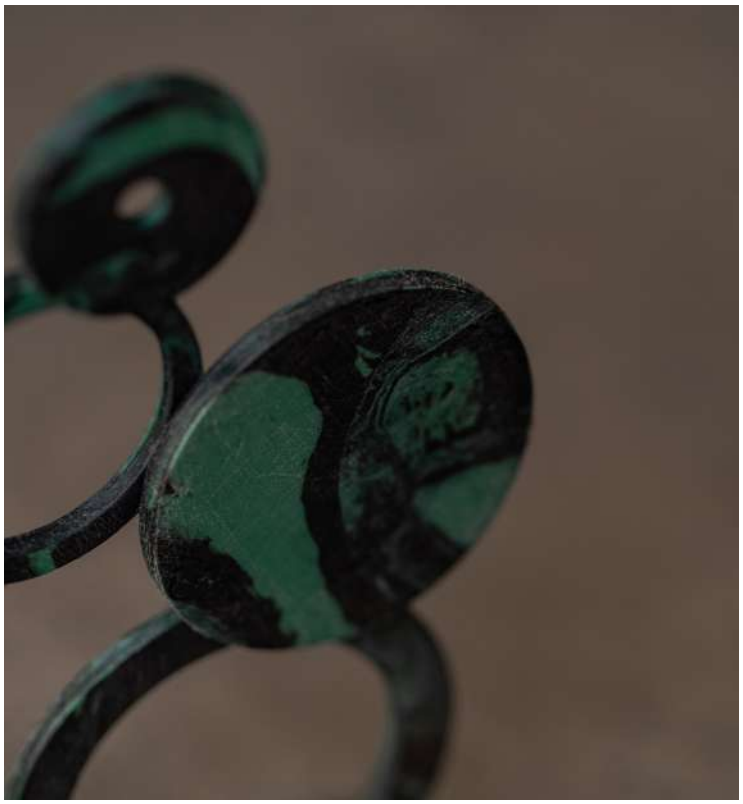

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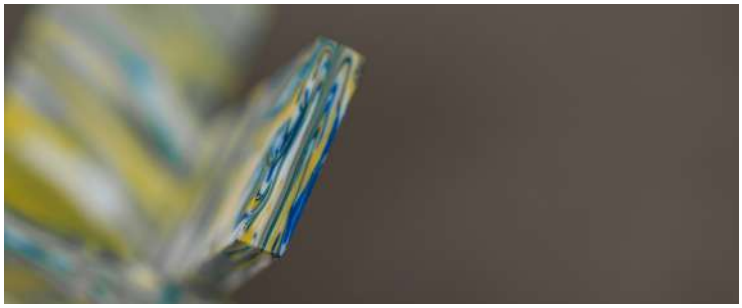
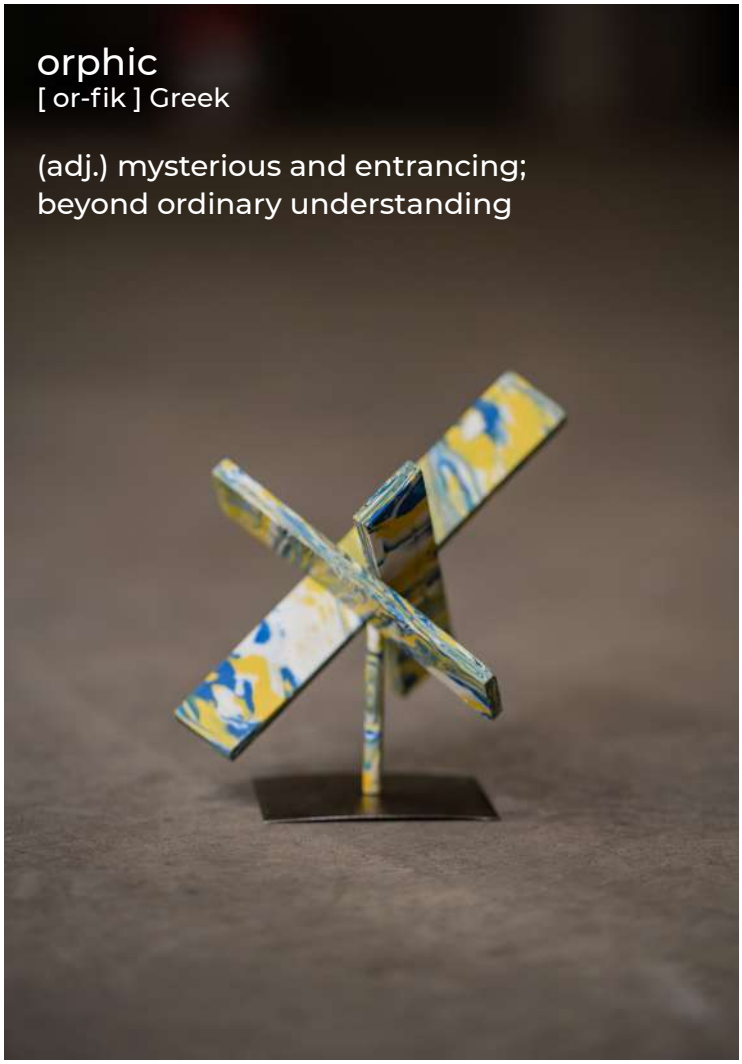




Photographs by Natasha Bouma, 2021.

5.5.1 CONCLUSION

Art has a variety of meanings and connotations which might differ from each individual, according to its psychological influence. The psychology of art is intertwined with aesthetics and perception, as well as personal experience.

Art is poetic, expressive, and beautiful, and connects people in ways that no other medium can.

5.6 DETAILING

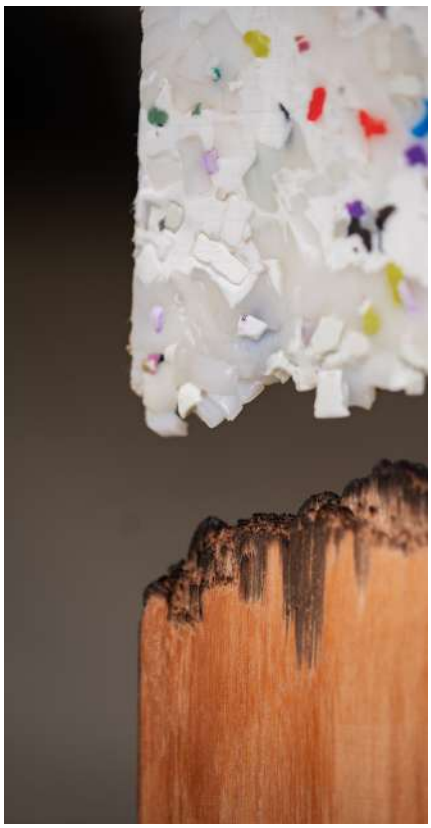
Detail is one of the fundamental aspects of architecture and is emphasised by the maxim “God lies [or is] in the detail” which is ascribed to Mies van der Rohe (Frascari, 1984). Detail evinces the process of attaching meaning and significance to an object that was created by someone and is regarded as the minimal unit of significance rather than just being a subordinate element. Labatut (as cited in Frascari, 1984:23) noted the following: “Whatever the air spaces, areas and dimensions involved, it is the precise study and good execution of detail which confirm architectural greatness. “The detail tells the tale”.

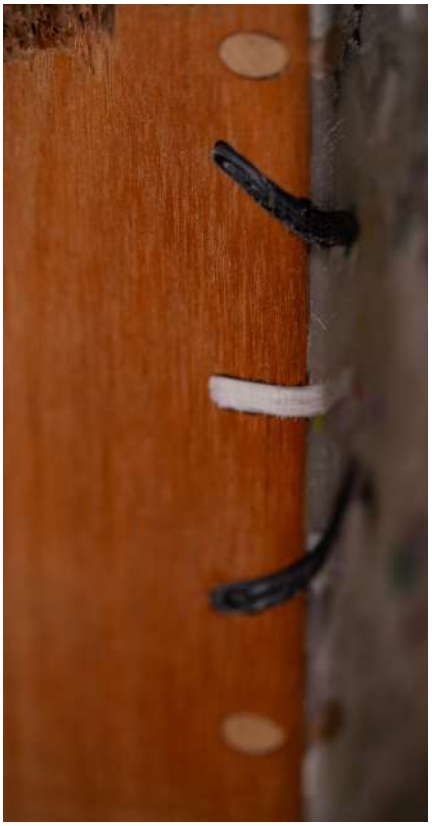
There is something to be said of the poetry of elevating the connection between objects and the immaterial dimension to the dimensions of design, of thinking, and of ideas. Rather than the practical construction of how the materials are attached together, the connection between the materials now also mean something. The link between the materials represents that of a mediator which connects two elements. There is a proper distinction that can be made between material as mediation and form as mediation.

Mediation with a literal material connection is the glue introduced as the joining medium. This was essentially the initial approach to connecting different elements. As the detailing developed, more direct formal communication was introduced by way of mediation with form. Although this concept is rather abstract, it illustrates how an object along, with the absence of objects and the shape of those occurrences, can be defined as the mediator.

Furthermore, form can be characterised as detail. Altering an object by cutting a hole into it can be considered “form making”. The form itself is the component in which the other elements are then placed. This means that the factor that connects the objects is their having complementary forms that link together.

Identifying the two different mediations that were used in detailing is not to demonstrate that one is superior and the other inferior; it is to understand that they are two different working methods.





Photographs by Natasha Bouma, 2021.

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5.6.1 CONCLUSION

The interpretation of detail within the architectural space is commonly understood in terms of the architectural structure. This research, however, argues that the same interpretation of detail also applies to this study as the exercise of detailing is, in reality, the linking of material elements and components and is interpreted within the theoretical and empirical spheres. The interpretation and implementation of detail make up the fundamental process by which practice and theory must be developed and is the result of the many different realities of function and is the mediate or immediate construct of the structure and use of space (Frascari, 1984:24).

Frascari (1984:26) points out that the Arts and Crafts Movement redefined the role of detail in that detail became "the means for the redemption of the workers" whereby "the skill and knowledge of making the detail were given back to the workers". A duality exists in that knowledge of the details and skills that are the resources that the architect requires in order to apply his or her profession. Frascari (1984:26) defines architecture as "the art of appropriate selection of detail" and cites Alberti who sees "architecture as the art of the selection of appropriate detail whose result is beauty, which is a meaningful goal".

In architecture, visual and tactile sensations and the location of such detail give rise to the patterns that tie meaning to a perception. Each detail communicates a narrative of its making, of its placing and its dimensions, and the selection of detail. This is the result of identifying its functional purposes and is facilitated by the pursuit of representation and expression brought about by the making (Frascari, 1984:29).

The purpose of detail in a design is manifested in the representation and re-use. The detail, in its structuring principle, may appear inadequate and obscure but in the re-use of the detail, integrating functionality and representation can become a creative catalyst. Detail, as a minimal component in the process of meaning, defines architecture as an art as well as a profession.

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By understanding detail as joint, architecture becomes art as it combines spaces and materials in a meaningful manner, where the joint becomes the space in which the construction and the interpreting of architecture occurs.

Joint is the space where the process of meaning may be understood, as the meaning of the original Indo-European root of the word art is “joint” (Frascari, 1984:36-37). Kahn (as cited by Frascari, 1984:37) delineates it as follows: “The joint is the beginning of ornament, and that must be distinguished from decoration which is simply applied. Ornament is the adoration of the joint.”

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6 REFERENCES

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