FROM THE WOMB TO FAKE TITS

How plastic lives with, through and in-between us

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Bachelor Thesis

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Defining Change: What is Plastic?

> *The hierarchy of substances is abolished: a single one replaces them all: the whole world can be plasticized, and even life itself since, we are told, they are beginning to make plastic aortas.*
>
> -*Roland Barthes, Mythologies* (Barthes, 1957, p. 117)

Figure 1 My own bioplastics, 2019, Stedelijk Museum Amsterdam, 2019, Photo LNDWStudio

To Mould: An Introduction

> *Origin: mid 17th century (in the sense 'characteristic of moulding'): from French plastique or Latin plasticus, from Greek plastikos, from plassein 'to mould'.*

(Oxford English Dictionary, 2020)

The best place to start is to define what plastic is; what does this word mean? In my own work, I followed the linguistic routes of the word 'plastic' back to their original Greek definition: the word Plassein 'to mould'.

All plastic materials can be *moulded*, but not all materials that are mouldable are plastics. For example, wax can be melted and moulded like plastic, clay can be moulded into different forms, but neither are plastic. Wax and clay can be plasticized, that is made plastic, they can be changed, shaped and moulded, but this does not make them plastics.

I refer to 'plastics' - not just 'plastic' - as when we speak of 'plastic' as a material we can be referring to a huge number of different materials which in turn create a huge number of different objects (See figure 2).

Polyamides (PA) or (nylons):	fibres, toothbrush bristles, tubing, fishing line and low-strength machine parts such as engine parts or gun frames
Polycarbonate (PC):	Compact discs, eyeglasses, riot shields, security windows, traffic lights and lenses
Polyester (PES):	fibres and textiles
Polyethylene (PE):	a wide range of inexpensive uses including supermarket bags and plastic bottles
-High-density polyethylene (HDPE):	detergent bottles, milk jugs and moulded plastic cases
-Low-density polyethylene (LDPE):	outdoor furniture, siding, floor tiles, shower curtains and clamshell packaging
-Polyethylene terephthalate (PET):	carbonated drinks bottles, peanut butter jars, plastic film and microwavable packaging
Polypropylene (PP):	bottle caps, drinking straws, yogurt containers, appliances, car fenders (bumpers) and plastic pressure pipe systems
Polystyrene (PS):	foam peanuts, food containers, plastic tableware, disposable cups, plates, cutlery, compact-disc (CD) and cassette boxes
-High impact polystyrene (HIPS):	refrigerator liners, food packaging and vending cups
Polyurethanes (PU):	cushioning foams, thermal insulation foams, surface coatings and printing rollers: currently the sixth or seventh most commonly used plastic, for instance the most commonly used plastic in cars
Polyvinyl chloride (PVC):	plumbing pipes and guttering, electrical wire/cable insulation, shower curtains, window frames and flooring
Polyvinylidene chloride (PVDC):	food packaging, such as: saran wrap
Acrylonitrile butadiene styrene (ABS):	electronic equipment cases (computer monitors, printers, keyboards) and drainage pipe

Figure 2 A list from Wikipedia on some of the different synthetic plastic types and their applications. ***(Wikipedia the free Encyclopedia, 2021)***

I began looking for the definition of plastic as I was working with bioplastics. Bioplastics are considered 'bio' as they come from renewable resources and can biodegrade, but why are they considered plastic? I also work with kombucha leather – a plastic alternative to leather which is grown in liquid using bacteria. Can these materials be described as plastic? Should they be?

To answer these questions, we first need a working definition for the complicated term plastic. Etymologically, plastic is a noun (something made of plastic) but can also be an adjective. Plasticity refers to *'the quality or state of being plastic, the capacity for being moulded or altered.'* (Merriam-Webster.com, 2021) A material can exhibit plasticity without being plastic, if it can undergo a permanent change when strained or stretched from its original shape. Conversely, some plastics do not exhibit plasticity, as when they are strained beyond their original shape they will break before they deform.

Plastic and plasticity do not only exist in reference to materials. Plastic can also refer to something fake, something unreal, and can be used to describe people. An example I have come across many times is the 'Plastic Paddy'- used to refer to someone who claims to be Irish usually because they have Irish ancestors, yet was not born in Ireland, or has never been to Ireland – a 'fake' Irish person. Neuroplasticity refers to the brain's ability to learn and be changed, altered and adapted in response to different experiences. Your brain is plastic, it is always changing as you learn new things. The plasticity of the brain is at its highest when you are young and your brain is developing, but the brain continues to exhibit plasticity even through adulthood. Neo-plasticism is an art term which refers to 'new art' created in response to the 'plastic arts' which refers broadly to visual art as opposed to music and literature.

Therefore, plastic and plasticity have multiple definitions. They are similar in their meaning to the words changing, stretching, and moulding. In reference to a person, plastic can be understood as still involving change in that you are changing how you present yourself, moulding your personality, body or both to your surroundings.

I will explore these definitions of plastic while continually referring back to the material of plastics. I will interrogate our relationship to plastic, can it ever be positive? What is plastic and how does plastic as a substance relate to plastic as a concept? I will talk about the different topics such as definitions of plastics, the ways in which we interact with plastics, how plastic goes beyond materialism and how plastics can be used for good.

We are all familiar with plastics as material, yet unfamiliar with their history, or their production process. Why would we be? This knowledge is not required in the use of plastics. We are more concerned with how to deal with plastic waste. I will argue that becoming aware of the materiality of plastics, their history, and their journey is required to deal effectively with plastic waste. I will also go further to argue that an understanding of how plastics function and act as materials, can allow us to learn to think of the world 'through plastic', to think 'plastically'.

In what remains of this chapter I will consider how plastics evolved and entered our lives. In Chapter two, I will examine the ways in which plastic is seen as a bad or toxic and even dangerous substance and point to the possibilities of bio-plastics. In Chapter three I will consider the ways in which working with bioplastics is a form of human-nonhuman collaboration, and consider the ethical dimensions that ensue. In Chapter four, I will consider and reveal the hidden gender-dimensions of plastic. In Chapter five, I will use these ideas to argue that plastic offers neither a Utopia or Dystopia, but that engaging I a speculative approach to its future, we can in fact move away from a crude binary approach

to plastic in our lives. In conclusion, I return to how I have attempted to do this in my own art practice, and where I hope it can take our understanding of plastic.

A Changing History

To understand literally what plastics are as a material it is best to approach them through chemistry. *'From a chemist's perspective plastics are made of the same class of materials: Polymers. And the distinction between which ones we happen to call "plastics" and which ones we don't is fairly arbitrary.'* (Knight, 2014) Polymers are *'very large molecules formed by the joining of many small molecules called monomers. The name of the polymer comes from the name of the monomer used to make it.'* (Bitesize, 2021)

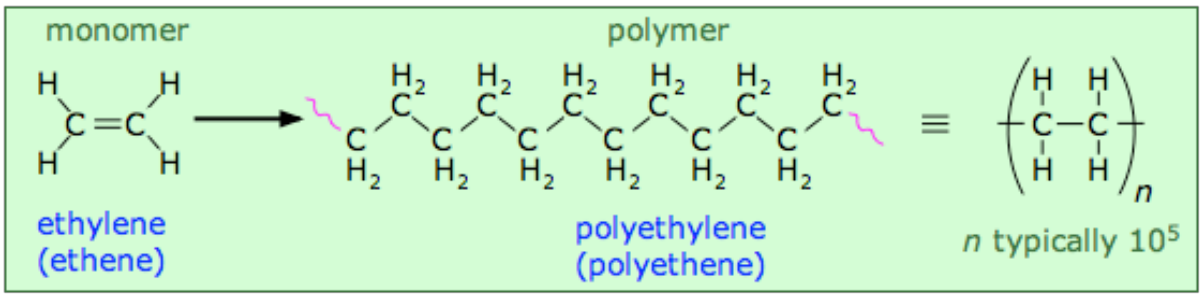

Figure 3 Polymer Chains of Polyethylene, (LibreTexts, 2020)

For example, the monomer ethene can be used to create the polymer poly(ethene), the monomer styrene can be used to create the polymer poly(styrene), and so on. Polymers are not only created by scientists but are also *'synthesised in nature and even in our bodies. The most common natural polymers are carbohydrates like starch and proteins.'* (Bitesize, 2021) My own favourite recipes for creating bio-plastics use starch as a polymer. I bring emphasise the existence of natural polymers, not only because they relate to bioplastics but also because the history of plastics begins with them.

> Humans have benefited from the use of polymers since approximately 1600 BC when the ancient Mesoamericans first processed natural rubber into balls, figurines and bands (Hosler, et al., 1999). In the intervening years, man has relied increasingly on plastics and rubber, first experimenting with natural polymers, horn, waxes, natural rubber and resins, until the nineteenth century, when the development of modern thermoplastics began. (Andrady & Neal, 2009)

'Thermoplastics' refers to plastics which will melt when heated and harden when cooled meaning they can be reheated, reshaped and remoulded multiple times. 'Thermosetting' plastic is a polymer which can only be melted and shaped once. This means that most recycled plastics are thermoplastics as thermosets are almost impossible to recycle.

Additives or plasticizers are usually added to polymers when making plastics as they help improve the polymer's plasticity, flexibility, elasticity.[1] 'Plasticizers are not chemically bound to the polymer chains, and thus can leave their hosts relatively easily.' Plasticizers are also used in bioplastics, an example being glycerine which is what I always use in my bioplastics.

[1] A plasticizer can be one or more of a possible 80,000 chemicals

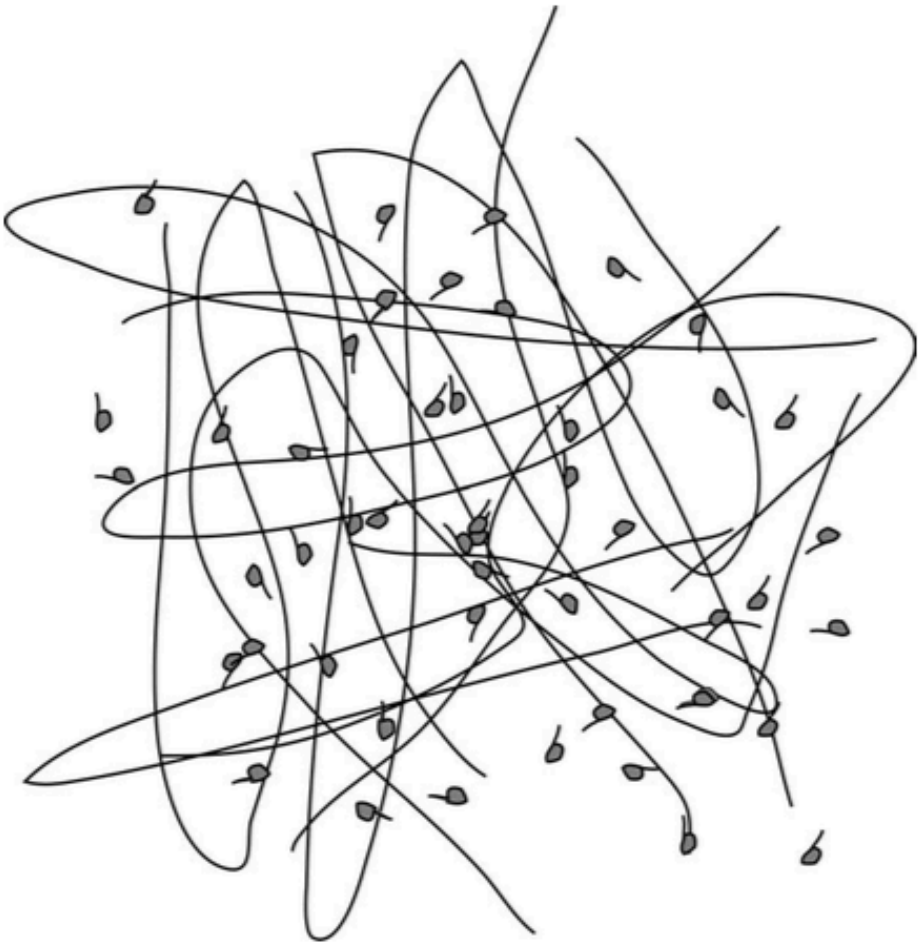

Figure 4 'Long polymer strands make up plastics, while plasticizers nestle amond the polymer strands, unbound, and can leave teir host through off-gassing or leaching (Liboiron, 2013, p. 140)

Throwaway Living

DISPOSABLE ITEMS CUT DOWN HOUSEHOLD CHORES

The objects flying through the air in this picture would take 40 hours to clean—except that no housewife need bother. They are all meant to be thrown away after use. Many are new; others, such as paper plates and towels, have been around a long time but are now being made more attractive.

At the bottom of the picture, to the left of a New York City Department of Sanitation trash can, are some throwaway vases and flowers, popcorn that pops in its own pan. Moving clockwise around the photograph come assorted frozen food containers, a checkered paper napkin, a disposable diaper (seriously suggested as one *reason* for a rise in the U.S. birth rate) and, behind it, a baby's bib. At top are throwaway water wings, foil pans, paper tablecloth, guest towels and a sectional plate. At right is an all-purpose bucket and, scattered throughout the picture, paper cups for beer and highballs. In the basket are throwaway draperies, ash trays, garbage bags, hot pads, mats and a feeding dish for dogs. At the base of the basket are two items for hunters to throw away: disposable goose and duck decoys.

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Figure 5 'Throwaway Living' by Peter Stackpole, Life Magazine, August 1955 (Liboiron, 2014)

Here Today, Still Here Tomorrow

The history of modern plastics is usually considered to have begun in 1907 when Leo Baekeland created the first synthetic polymer named Bakelite[2]. This was the first polymer derived from fossil fuels which paved the way for the creation of other synthetic plastics.[3] Bakelite could be moulded into any form and was used to replace rare and expensive materials such as ivory, silk, diamonds and fur. These objects, once only available to the bourgeoisie, were now available to everyone.

Figure 6 'They are all BAKELITE Plastics – but all are Different, 1941, Science History Institute

[2] Bakelite, sometimes spelled Baekelit or polyoxybenzylmethylenglycolanhydride

[3] 'It was the first synthetic plastic - the first to be derived not from plants or animals, but from fossil fuels. Baekeland used phenol; an acid derived from coal tar. His work opened the floodgates to a torrent of now-familiar synthetic plastics - polystyrene in 1929, polyester in 1930, polyvinylchloride (PVC) and polythene in 1933, nylon in 1935.'

Figure 7 Bakelite Advert, Radio Magazine, October 1927

The Bakelite corporation used the symbol for infinity in their logo, a foreshadowing of how plastics were here to stay. Their tagline was *'The Material of a Thousand Uses'*, with marketing emphasising their versatility and durability, the path was moulded for this material to insert itself into everyday life. Plastics were further embedded into society by the second world war, with plastics used in *'everything from military vehicles to radar insulation'*. This meant many petrochemical companies built plastic manufacturing plants to create these plastics. When the war ended, these plastic manufacturers needed to find a new way to bring plastic products to a wider consumer market.

Figure 8 Thanks to plastic, thedieline.com

In her article Life and Death in the Anthropocene: A Short History of Plastic Heather Davies suggests that 'the invention and proliferation' of plastics was mostly driven by a need to 'simply replace the objects we already had – but at a price and in a quantity that helped to instantiate a middle class defined by consumption.' (Davies, 2015, p. 349) In her paper 'The Persistence of Utopia' Wagener-Lawler explains that with plastics becoming more 'commonplace' and being increasingly regarded as 'cheap', plastic manufacturers began to emphasize the material's 'convenience'. She writes 'The return of women from war-time factory jobs to the home suggested strategic capture of the "women's market" with the seemingly irresistible triple-convenience of promise of labour-saving, time-saving, and cost-savings.' (Wagner-Lawlor, 2017, p. 70) Cellophane/Cling-film allowed you to wrap your food to keep it clean and fresh for longer. Advertisers emphasised Plastic's disposability suggesting that instead of spending time washing your dishes, you could just throw them away instead.

Figure 9 A 1971 advert for Evenflo Baby Bottles convenient disposable baby bottles (HuffPost, 2019)

Figure 10 A 1960s magazine advert for disposable cups tries to edge out similar products made of paper, emphasising plastic's affordable "toss-away prices." (HuffPost, 2019)

Figure 11 You see So Many Good Things in DuPont, E.I. du Pont de Nemours & Company, Advertisement for DuPont Cellophane, 1955 (HAGLEY DIGITAL ARCHIVES, n.d.)

Figure 12 Cellophane Keeps Things Clean: Shows What It Protects! Protects What It Shows! E.I. du Pont de Nemours & Company, Advertisement for DuPont Cellophane from The Saturday Evening Post, 1947 (HAGLEY DIGITAL ARCHIVES, n.d.)

Figure 13 Everything's at Its Best in Cellophane, E.I. du Pont de Nemours & Company, Advertisement for DuPont Cellophane, 1956 (HAGLEY DIGITAL ARCHIVES, n.d.)

Davies also writes that 'Plastic created the conditions for global trade and consumerism, while these systems themselves became increasingly reliant upon carious forms of plastic.' A self-perpetuating system was created. Think of the stackable boxes that glass bottles are transported in, think of plastic bags, shrink-wrap.[4] As Davies says, 'the infrastructure and the speed of advanced capitalism, and the fantasy of unending economic growth fuelled by extractivist policies and mass consumerism depend upon plastic.' Many companies now rely on plastic packaging to deliver their goods to the world. Think of the last time you ordered takeaway food, or a product off the internet. It's packaging most like contained some sort of plastic. It is the same case for many products from supermarkets, especially food items.

[4] Also known as cellophane or cling-film

Figure 4 Plastic replacing nature, Photograph by Nathalie Gordon, 2016 (Boredpanda.com, 2019)

Figure 15 Peeled avocados protected in plastic (Boredpanda.com, 2019)

Figure 16 Stackable Plastic boxes, Kimberly Gordon, 2015

The creation of synthetic plastics is dependent upon petrochemicals and Davies suggests that this relationship is *'intimate'*, considering the ways in which we use plastics in our everyday lives. She gives the examples of how *'we use plastics to eat, clothe ourselves, as*

sex toys, as soothers for babies.', also giving the example of how the internet can only exist due to the *'thousands of underwater and underground cables sealed from the elements with plastic coating'.*

You can probably observe similar *'intimate'* relationships with plastics in your life, just look around you. For example, I am writing this on a plastic keyboard and the keyboard is only functioning because of multiple plastic parts in its hardware. I have been taking notes with a plastic pen, drinking water from a plastic bottle, I packaged my lunch in plastic Tupperware. In some cases, you may not even be aware that something contains plastic such as the clothing you wear, or the bed you sleep on. Davies suggests that since plastic is so *'ubiquitous'*, so much a part of our *'daily lives'*, it is hard for us to understand just how intertwined we are with plastics, meaning *'their presence in our lives can be easily taken for granted'.* Davies says, *'it also implicates us: there is no way to extract one's life in the twentieth century from plastic.'*

This reliance on plastic materials means the production of plastics increases almost every year and since 2015 the world has produced over 380 million tonnes of plastic yearly (Ritchie & Roser, 2018). To visualise this number let us compare this waste to the biggest animal on earth: blue whales. Blue whales weigh on average 100-150 tonnes (Dimery, 2019), so in this example let us say that all blue whales weigh exactly 100 million tonnes. 380 million tonnes is the equivalent to 3.8 million blue whales. In 2019 368 metric tonnes of plastics were produced in the world. This is projected to increase 33 billion tonnes by 2050 if current consumption rates continue. (Rochman, et al., 2013) This is equivalent to 330 million blue whales.

In this first chapter I have explored different definitions of the word plastic and the history of plastics as a material. I feel these are important subjects to explore as when we are talking about plastics, we need to know exactly what we are referring to. As you have seen there are many materials which fall under the umbrella term of 'plastic', and this word can even be used beyond materials, to describe people, art and change.

Remains to be Seen: Plastic Destruction and Repair

> *Plastics ... A way to a better more carefree life.*
>
> — (House Beautiful, 1947)

I find it interesting to think back to how I understood waste as a child. When I was young, I was very conscious of never using too many pieces of A4 paper when drawing. I knew that a forest somewhere had been cut down to supply my paper and so I felt guilty in using any. The Amazon Rainforest, a place so vast and far away that I found it hard to conceive of, was particularly emphasized by adults as a place that needed to be protected.

I can now imagine children growing up today are even more aware than I ever was of the effects that their actions and the materials they use have on the environment. The pressure to 'save the planet' and be more environmentally aware increases every year, and we now find ourselves being constantly reminded of our destruction of the environment. Newspapers shock us with headlines like '12 Years left to Save the Planet' (Watts, 2018) and 'Brazil's Amazon Rainforest suffers worst fires in a decade' (Reuters in Brasîlia, 2020). I can assume that with the increased awareness of impending environmental disasters, comes increased anxiety.

Necklaces for All of Us!

A large aspect of environmental concern is our plastic waste. Amongst the reminders of Global Warming and Planet Ending we are also reminded of our plastic waste polluting the environment. Marine animals trapped in plastic bags, turtles with straws up their noses, dead seagulls with their stomachs opened to show all of the plastics they have eaten. I would say that the guilt I felt when using paper as a child has now been replaced for me, and in society, with a guilt over using plastics.

In 2006 the children's film 'Happy Feet' portrayed a penguin with plastic beer can packaging around its neck, which it believed to be a necklace gifted by the 'mystic beings' (humans). When the penguin is almost choked to death by the plastic, he accompanies other penguins on a journey to find humans to help remove it. They find a lot more plastic waste and exclaim 'there's enough necklaces for all of us!' (Happy Feet, 2006). This scene could act as a metaphor for humans' relationship with plastic as when it was first invented, we found it to be a magical material, but now we are choking on it. We are aware that our plastics pollute faraway lands and oceans, disrupting and hurting something, or someone else. We are also aware of the plastic pollution all around us, right in front of our eyes.

Figure 17 Necklace gifted by the 'magic beings, Happy Feet, 2006' (greenecoservices, 2018)

While researching plastic I have become increasingly aware and observant of the plastic waste around me. When I leave my house, I can always guarantee that I will see a plastic bag floating in the wind, a plastic bottle, takeaway packaging. Plastic pollution is so much a part of our scenery that it blends in. Microplastics have been found from near the top of Mount Everest (the highest point on Earth) as well as in the Mariana Trench (the deepest point on Earth) and so it is safe to say: Plastics are everywhere.

The pervasiveness of plastic waste is due to the fact it takes hundreds, if not thousands of years to break down. All the plastic ever created is still on the planet. Although plastics cannot ever break down entirely, they do break up into continually smaller pieces called 'microplastics'.[5] Microplastics are mostly invisible to the human eye, but they are in our oceans, they are in our food and they are in our bodies. The fact that microplastics cannot be seen means their danger and pervasiveness is not as obvious and so not taken as seriously, despite them being the most common form of plastic pollution.

Plastic Bags and Plastiphobes

> *"Do you ever feel like a plastic bag, drifting through the wind, wanting to start again?"*
>
> *– Katy Perry*

[5] When a piece of plastic is less than 5.0mm in length is considered to be a 'microplastic'.

Figure 18 Bag, Hendrik Kestens, 2007

All of this makes it sound like plastics are a terrible material, polluting everything and everywhere and poisoning us at the same time. This understanding of plastic pollution, namely that it is all bad, that plastics are a terrible material, is an approach taken by many people today. Cutting down on one's plastic waste has become an essential approach to life for many. People are celebrated for living a 'plastic free life'. A world without plastics is a goal for many. I believe this is a flawed, unachievable, and unnecessary approach to plastic waste. I believe plastics as a material are misunderstood and that their benefit to society goes underappreciated, and that their benefit may be equal to, or even out-weigh their negative effects. We do not want plastic waste; but we need plastics.

The plastic bag is the perfect example of society's misunderstanding and misuse of plastics as a material. Plastic bags were developed to replace paper bags which required forests to be cut down and so were considered bad for the environment. Plastic bags are stronger, more durable and waterproof than paper bags and so they can be used multiple times. The creator of the plastic bag, Sten Gustaf Thulin, *'always carried [a plastic bag] in his pocket folded up'* (Weston, 2019). Plastics were not designed to be single use, but they became single use and are now thought of as a representation of disposable plastics, the worst of plastic waste. So, instead of plastic should you use a paper bag which will biodegrade faster, or a cotton bag which you can reuse? These seem like common sense solutions and yet they are worse for the environment.

According to the UK Environment Agency, a paper bag needs to be used at least 3 times, and a cotton bag at least 131 times *'to ensure that they have lower global warming potential*

than conventional HDPE carrier bags that are not reused.' (Edwards & Fry, 2011, p. 7) The production process of paper and cotton bags requires a lot more energy and water and generates more waste than that of plastic bags. They are also heavier and so, depending on where they are made, there is a higher environmental impact from their transportation.

This example of the plastic bag shows the main issue with plastic waste. We are using a material which can exist for a thousand years to design a product intended to be used once and then thrown away. Plastic as a material is not the problem, the design process is.

I would also encourage those who believe we should do away with plastic altogether to consider what plastics provide for them in life. One place in which many people do not acknowledge their benefits is in the medical field. In 'Childbirth in the Age of Plastics' Michel Odent, a childbirth specialist and practicing physician specialising in obstetrics suggests 'The history of medicine during the past fifty years cannot be dissociated from the history of the use of plastic material.' Odent writes of how the continual development of intravenous drips made of different plastics meant that their use 'became so widespread in modern hospitals that the procedure of intravenous cannulation became gradually the business of nurses and midwives, while it was originally the business of doctors.' This is an example of how Odent believes plastics 'transformed most medical disciplines', he gives another example of anaesthesiologists who went from being 'experts in the administration of inhaled drugs' to become 'experts in the use of intravenous and epidural routes.' (Odent, 2017, p. 2)

Not only were medical disciplines transformed by plastics, they:

> also made possible the emergence of new specialties, such as neonatology[6]. In the middle of the twentieth century, paediatricians were occasionally asked to take care of newborn babies. Today, neonatologists share the activities of departments of obstetrics and there are intensive care units for newborn babies. In such units most babies are in a plastic incubator, with plastic catheters introduced in big veins and in natural orifices. In general, the very concept of intensive care is a consequence of the medical use of plastic material. (Odent, 2017, p. 3)

[6] A branch of medicine concerned with the care, development, and diseases of new-born infants (Merriam-Webster.com, 2021)

Figure 3 Four-year-old David Vetter in a sterilized Environment, 1975, Baylor College of Medicine Archives (PBS, n.d.)

What Odent and others have suggested is that plastic made possible, simplified, and made more hygienic many medical treatments. Plastic also made treatments less painful and can be found throughout the medical world. If you need to be scanned you will be put inside a plastic MRI scanner, if you need to be administered fluids plastic tubing will be put into your arm. Most knee or hip replacements contain plastics and if you need a hearing aid it will mostly be made of plastics. The medical industry also relies on plastics to keep many things sterile; equipment, IV tubes, blood bags, protective clothing such as gloves and gowns.

Figure 4 A nurse in Spain wears a bin bag and a protective plastic mask due to shortages of personal protective equipment during the Covid-19 Pandemic (BBC News, 2020)

This idea is developed in the article by scientist Jody Roberts in 'Reflections of an Unrepentant Plastiphobe: Plasticity and the STS Life' where he confronts his disdain and knowledge of the toxicity of plastics with his real-life experience of plastics being used in the treatment of his daughter post-birth in the NICU ward, to the accommodation of his daughter's cerebral palsy:

> The plastics that populate my everyday life and that fill me with such anxiety also help to make Helena's life possible. But we resist the simply dichotomies imposed on us. The plastics are not simply life saving or a threat. They are both. (Roberts, 2010, p. 117)

Figure 5 Jody Robert's daughter Helena, A 'Future Plastiphobe' Photograph by Jody Roberts (Roberts, 2010, p. 102)

We may all now relate to this sentiment more than ever. We need only look at the recent global Covid-19 pandemic to see how the use of plastics and their ability to protect is so necessary in our lives. Plastic materials were the most widely used material for shielding and protection from contracting and spreading the Covid-19 virus. We have been using plastic in abundance; masks, gloves, screens to separate us. This pandemic really highlighted the necessity of plastics in our lives and slightly 'paused' the pushback against the use of plastics for the time being. Yes, now we are dealing with the plastic pollution of masks, gloves etc in the environment, but plastic has also potentially saved lives. We have had to balance short-term safety with long-term pollution.

Figure 6 The Tunel do Abraco (Hug Tunnel) at the Geriatric Cline Tres Figueiras Amidst the Coronavirus (COVID-19) Pandemic (Lucas Uebel, Getty Images, 2020)

Figure 7 People wearing makeshift protective clothing during the Covid-19 Pandemic (South China Morning Post, 2020)

Figure 8 Makeshift Corona protection, Leeroy New, 2020 (ANCX, 2020)


Figure 9 Photographs by Diana Giannopoulos of discarded gloves during the Covid-19 Pandemic (BBC News, 2020)

Figure 10 Gary Stokes holding facemasks collected from the Ocean (OceansAsia, 2020)

If not for plastics, we would not have as many forms of birth control which would increase issues of overpopulation and unwanted pregnancies. The most positive action you can take to help the environment is to not have a child (Carrinton, 2017) and so plastic's assistance towards this cause and the plastic waste that comes with it, makes it the lesser of two evils. For example, a condom is a single use plastic, but using a condom as birth control and throwing it out is better than creating a baby which will use on average 5,000 (plastic) single-use nappies[7] in its lifetime. I can think of many other situations where I have used one form of plastic to replace using single waste plastics; a silicone menstrual cup to replace single use menstrual pads, using a strong reusable plastic bottle instead of buying multiple disposable bottles, a Tupperware plastic box instead of cling-film.

These examples show that a fixed position cannot be used to approach plastic use and waste. There are many different types of plastics, for many different uses. There are varying levels of toxicities in these plastics. Plastic lives in between dichotomies such as 'good and bad', 'harmful and life-saving', 'clean and dirty'.

You're Toxic, I'm Slipping Under

"I'm addicted to you; don't you know that you're toxic"

-Britney Spears

Petrochemical Plastics are toxic. They leech toxic chemicals, whether they are ocean or environmental waste, or if they are burned. Plastic's toxicity is not something visible and yet it should be a motivation for us to use, produce and discard less plastics.

[7] Producing a mountain of waste equivalent to 130 black bin-bags (Mamabamboo, 2019)

> ‘Plastics aren’t toxic’, says our chemist.
> ‘Of course, they are’, I reply.
> Our chemist clarifies: ‘Plastic polymer chains by themselves aren’t toxic, but the small molecules that are added or attracted to them are toxic.’ (Liboiron, 2015, p. 3)

The quote above is taken from Max Liboiron’s article ‘Redefining pollution and action: The matter of plastics’ where she is speaking to a chemist about the toxicity of plastics. The chemist distinguishes *‘between the polymer part of plastics – the plastic itself – and the added chemicals, called plasticizers or monomers, which are routinely added to plastics.’* It is the plasticizers, not the polymers which are toxic. Liboiron also notes that various plasticizers have been *‘correlated with infertility, recurrent miscarriages, feminization of male foetuses, early-onset puberty, early-onset menopause, obesity, diabetes, reduced brain development, cancer and neurological disorders*.’[8]

Phthalates are plasticizers, added to plastics such as polyvinyl chloride (PVC). Again, in *Childbirth in the Age of Plastics* Odent writes about how phthalates came under scrutiny *‘following a discovery that blood stored in PVC plastic bags for transfusions contained significant concentrations of phthalates.’* (Odent, 2017, p. 28) This is one of many examples in the medical world of how plastics are so prevalent that, while facilitating our treatment, at the same time their potentially toxic chemicals are also entering our bodies.

Nancy Tuana emphasizes the mixing of toxins and bodies in her writing ‘Viscous Porosity: Witnessing Katrina’:

> The viscous porosity of our bodies and that of PVC allow for an exchange of molecules, where PVC and phthalates pass through the porosity of skin and flesh, particularly the mucosal linings of our intestines and our lungs. Plastic becomes flesh. The molecules that mix with our flesh are endocrine disrupters that mimic, enhance, or inhibit a hormonal action. They function as chemical messengers, traveling through our blood until they hit an appropriate target—a lung, our liver. When such a molecule hits such an organ, it interacts with a receptor, which “recognizes” the molecule as a hormonal component. It then either passes through the membrane into the cell to interact with the DNA or RNA of the cell to either turn on or turn off a genetic process, or it releases a molecule that is part of the receptor that does the same thing. That interaction can lead to cancer. (Tuana, 2008)

Plastic is literally becoming us and in using plastics we are mixing with it, absorbing it, coming together in a toxic bond. Tuana argues that this makes it difficult to divide nature/culture as we think of ourselves as *‘natural beings’* and plastics as *‘cultural artefacts’*, made by technology and yet plastics are made from *‘naturally occurring materials’* constructed and changed (and made toxic) by humans, with the plastics in turn changing our bodies from their natural states.

[8] Such as early-onset senility in adults and reduced brain development in children. As Heather Davies notes in ‘Life and Death in the Anthropocene: A Short History of Plastics “This is only the list of possible effects on the human body, without even beginning to account for all the *other bodies* affected by plastic and their associated chemicals’ (Davies, 2015, p. 351)

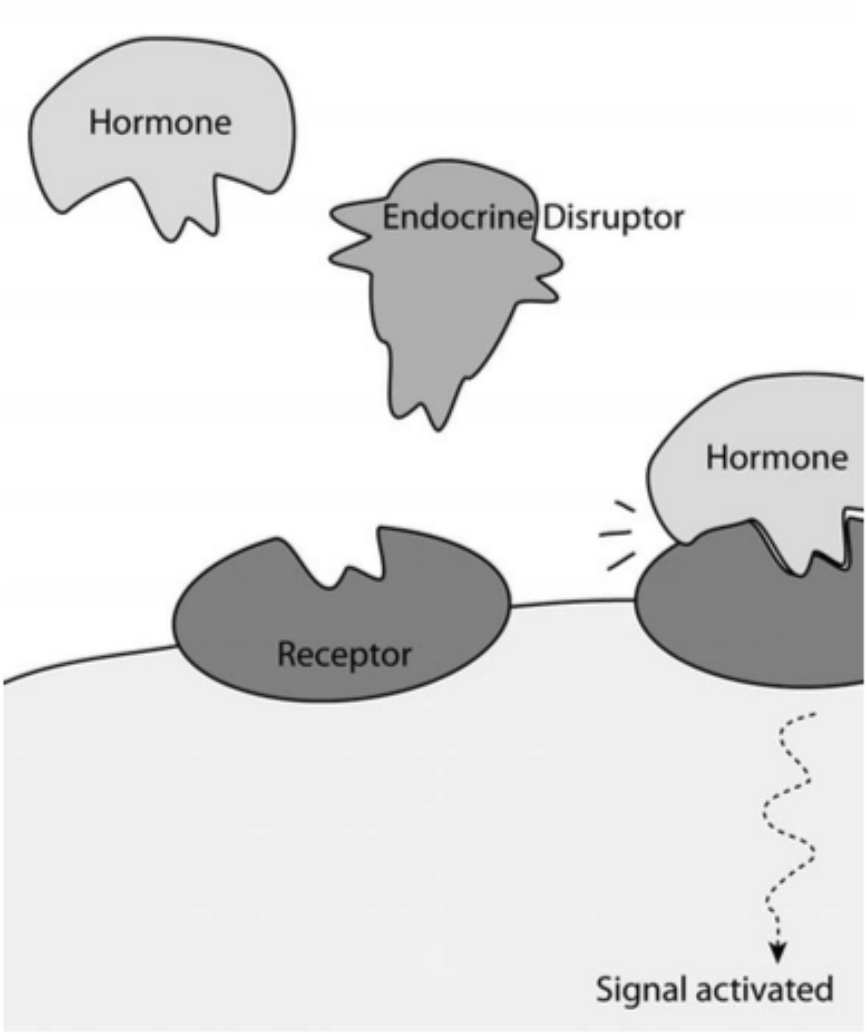

Figure 11 Illustration of a Receptor 'recognising' a endocrine disruptor as a hormone (Liboiron, 2013, p. 141)

In this chapter I have explored further how plastics as a material exist in our environment. I have explored how this is a complex material which affects our lives in beneficial and detrimental ways at the same time. I have also emphasised how plastics and cannot be viewed as completely 'synthetic', or separate from the natural – they come from nature, exist in nature and even permeate all aspects of life on earth.

Growing Plastic: The Non-Human and Plastics

"Problems cannot be solved by the same level of thinking that created them."

-Albert Einstein

Figure 12 Touching the SCOBY (Studio ThinkingHand, 2019)

Plastic Mothers

You may have heard of kombucha before; a fermented tea drink gaining popularity around the world because of its perceived health benefits. A mythical history (claims were made that it could cure cancer) made kombucha popular around the world and this drink could be relatively easily brewed at home. Kombucha is considered to be beneficial to health as it contains living bacteria considered to be probiotic which aids/improves gut flora and digestion. The drink is created by mixing tea[9] and sugar and adding to it some already fermented kombucha liquid and a symbiotic culture of bacteria and yeast – SCOBY for short. What drew me to kombucha was not the fermented drink, but the SCOBY which would float on top of it. A SCOBY looks like a slimy mushroom, with a wet, smooth surface. It can often appear to look like human skin and its thickness depends on how long it has fermented. The Kombucha SCOBY is known as the 'mother' and when fermented it will grow and create other SCOBYs.

[9] I myself use Oolong and Green tea, but you can brew kombucha with many different teas.

Figure 13 Kombucha brewing instructions, Illustrated by Lila Volkas, 2013

Figure 14 Kombucha drink, Maly Kalexa/Getty Images (Women's Health, 2019)

So how does kombucha relate to plastics? When sharing my work with bioplastics, I was often asked if I had heard of kombucha. I knew of the kombucha drink, but not of the use of SCOBYs as a biomaterial. If you dried out the kombucha SCOBY it can function as a plastic or leather (dubbed 'vegan leather or pleather) replacement. This material continues to gain popularity as a renewable material and source of inspiration for bio-artists and designers. The project which really cemented and publicized the possibilities of SCOBYs being used as a material is Suzanne Lee's 'Bio couture' – Clothes made from dried SCOBYS.[10] Kombucha SCOBYs have also acted as an inspiration to artists, the SCOBY Mother provoking artists to respond to it and to use it in their art, myself included. Two Alumni of the ArtScience Interfaculty where I study, have based their graduation projects around the kombucha

[10] (Lee, 2014)

SCOBY materials: “the Tale of the non-human” by Naja Ryde Ankarfeldt (2015)[11] and ‘The Pages of my Research’ by Lianne van Roekel (2020)[12]

Figure 15 Naja Ryde Ankarfeldt’s graduation project ‘Tale of the non-human” (Stichting ArtScience, 2015)

[11] “The graduation project “the Tale of the non-human” by Naja Ryde Ankarfeldt explores the artists ongoing research into the correspondence between material and agency. Working between art and science Ankarfeldt investigates the ecology of repetitive and dynamic patterns with the purpose of creating aesthetic tactile experiences.” (Stichting ArtScience, 2015)

[12] “One year ago, I was confronted with a material I had never seen and smelled before. The gorgeous brownish translucency of the material, the undefinable smell, the asymmetrical texture and patterns, the incredible strength yet flexibility it had, provoked strong ambivalent sensibilities. Since this cross-modal encounter, the mighty material of cellulose grown by microorganisms has been the focus of the research for my Master degree of the ArtScience Interfaculty” (Van Roekel, 2020)

Figure 16 Lianne van Roekel's graduation work 'The Pages of my Research' (Van Roekel, 2020)

Can SCOBYs be considered plastic? I will argue yes, drawing on my earlier arguments as to the plasticity of the definition of plastic. I have grown many Kombucha SCOBYs for my research and, although the material is more often compared to leather, it often functions in the same way as plastics do. I have grown thin kombucha SCOBYs which function exactly like shrink-wrap, sticking to itself. Dried SCOBYs are waterproof and so can function as a material seal around objects just as plastic does. What I also love about this material is its self-adhesive properties; if you wrap an object in a wet SCOBY and let it dry, it will self-seal to itself- like natural glue. Although the SCOBY material functions in many of the same ways as plastics it differs in that it is compostable. If thrown away it will eventually biodegrade and disappear. These benefits mean that SCOBY packaging is being researched and even used as a plastic and leather replacement around the world, by companies such as 'MakeGrowLab' who create SCOBY packaging and encourage its use as an environmentally friendly plastic replacement.

Figure 17 MakeGrowLab's Scoby packaging (MakeGrowLab, 2019)

Entangled Right/s

> *'The attempts to re-situate our relationship with nonhumans require strenuous efforts on the part of artists and thinkers to envision an intricate language that conveys the multiply-emergent relations that rightly (re)surface. The allure of art as ecocritique lies in its ability to navigate around militant environmentalism and instead engage a discursive practice that allows oneiric, speculative intersections while prompting previously inaudible voices to the frontline.'* (Ciao, 2018, p. 22)

Figure 18 Patchwork of Scobies, Artwork and photograph by Adrienn Újházi, Biophilia, 2019

Could the kombucha SCOBY could potentially be used as a plastic replacement? Could it be the answer to all our problems? Should it be the answer? I bring attention to the SCOBY material because of its similarity to plastic, but I also want to show the link between what I might term non-humans (live beings that are not human) and plastics. The contamination and entanglement of plastics and non-humans is clear in situations with animals and plastics where we can physically see it happening. It is less obvious when it comes to other non-human life forms which we cannot see such as bacteria. 'Plastisphere is a term used to refer to ecosystems that have evolved to live in human-made plastic environments.' (Wikipedia, The Free Encyclopedia, 2021) Some of the organisms in these ecosystems have the ability to break down plastics, but 'scientists also fear that creatures in the plastisphere break down chunks of polyethylene and polypropylene so completely that dangerous chemicals are leached into the environment.' (Sahagun, 2013)

In 2016 a bacterium[13] was discovered which was able to break down and consume PET[14] plastic as a sole carbon and energy source. It was found in a plastic waste recycling facility having naturally evolved the ability to eat plastic. Since its discovery scientists have genetically modified this organism to break down plastic faster. These bacteria have been lauded in many articles as the solution to our plastic problem. These non-human assisted 'solutions' are interesting to consider but can also be problematic in many ways. First that they assume that we 'own' these bacteria and thus have a right to use them for our needs. Secondly, they allow us to continue to produce the same amounts of plastics as before, without consequence. But plastic pollution is a human-made problem and so in using non-humans as a fix-all solution we would never learn from our mistakes and it would not directly combat the root of the problem. We would continue to produce, use and dispose of harmful plastics without feeling guilty about it.

This argument is supported by Heather Davies in interview with Rosa Menkman for Sonic Acts:

> Plastics have been around for 110 years, and bacteria have evolved to deal with these new environments. There is, for instance, a type of plastic eating waxworm that has two different kinds of bacteria inside its gut that allow it to digest polyethylene. Specific communities of bacteria have developed on the tiny pieces of plastics in the ocean. This is called the plastisphere. The waxworm and the plastisphere can be understood as a kind of non-filial human progeny, as I have suggested, and we should ask ourselves what kind of responsibility we have towards them. There has to be an ethics of acknowledgement and maybe even an ethics of care towards these particular kinds of bacterial communities, because of the fact that we inadvertently created them. This is not to suggest a godlike capacity and I certainly don't mean that we should produce more plastic to accommodate these bacteria, but we do need to rethink the scales on which humans act and create. We are responsible for the life and deaths of so many creatures, regardless of our intentions. (Davies, 2016)

This argument does not mean that these human and non-human collaborations should not exist. There is room for interspecies collaborations and an exploration of how they would function. The question, I suggest, is rather how to collaborate ethically with non-humans has been and continues to be explored extensively. There is no obvious answer, but a method I find effective is engagement with non-humans through 'acts of care'. A personal example of this is my SCOBY growing process where I try to take care of the bacteria (feed them, set the right temperature for them) to the best of my abilities- that they can grow and thrive. In caring for them I learn through practice how to improve this care so that they can flourish. Fermentation and the ingestion of a fermented drinks can also be understood as an interspecies collaboration as the bacteria in the drink mix with my microbiome. There is a risk here of slipping into anthropomorphism and seeing the non-humans as 'pets' you are looking after instead of as active collaborators. We must continue to ask ourselves 'How can we affectively listen to non-humans?' And try our best to listen.

[13] Ideonella sakaiensis

[14] polyethylene terephthalate

When it comes to environmental destruction (and plastic waste) humans are accountable for other humans but do not feel as responsible for the non-human. Although we often only start caring about a problem when it affects us (such as only caring about marine plastic pollution when it enters our food chain), it would do us good in the long term to consider how non-human life forms are affected by our actions. This could potentially stop the problem from even affecting humans. I am also imagining a future world where everyone grows their own plastic. Imagine if you continually fermented your own kombucha. You could drink the excess kombucha tea (if you wanted) and produce all the plastics you need in the process. When you are done with your plastic packaging you could either compost it or put it back into a tea and sugar mix and continue making kombucha. If we created and cared for our plastic, watching it grow over time, would we feel more of a connection to it? Would this make us more likely to dispose of it ethically or avoid disposing of it at all? These questions and many more arise for me in response to the speculative SCOBY-inspired future I have just suggested. Whether or not this is a future which could or should exist, one thing that is for certain is that we should always be aware of the non-human entanglements which make up The Plastisphere and our world.

I have brought attention to the idea of non-humans as we must be aware of the many changes that plastic initiates on the natural world and living beings. Plastic is not only affecting the environment and its inhabitants but also creating new life. When thinking about plastics we must not only think in terms of our relationships with them, but the also the relationships of all living things to this material.

Figure 19 Satin Bowerbirds often collect blue plastic to attract partners, Photograph by Joseph C Boone, 2016

Figure 20 A black kite bird decorates its nest with plastic, Photograph F.Sergio, 2011

Figure 21 Bird breaking through plastic to reach bread, Photograph by David Clode

Figure 22 Fish inside their plastic homes, Photograph by Alison Cornford-Matheson, 2013

Life in Plastic, it's Fantastic: Gender, The Body and Plastic

I'm a Barbie girl, in the Barbie world
Life in plastic, it's fantastic
You can brush my hair, undress me everywhere
Imagination, life is your creation'

- *Aqua, Barbie Girl* (1997)

Figure 23 Synchrodogs' plastic human (Paper Mag, 2016)

Plastic is a gendered word. Plastic is not only a material but can be used to describe a person.[15] Can a person also be plastic?

The Plastics

> *Cady: You know I couldn't invite you. I had to pretend to be plastic.*
> *Janis: Hey, buddy, you're not pretending anymore. You're plastic. Cold, shiny, hard plastic.*

(Mean Girls, 2004)

Figure 24 The Plastics, from Mean Girls 2004

[15] (***figuratively***, *informal*, *of a person*) fake; insincere. (Wiktionary, The Free Dictionary, 2020)

One of the main ways that you can find plastic relating to gender is as an adjective to describe women. If you have seen the film 'Mean Girls' (2004) you may remember the most popular girls, whom the protagonist is warned to avoid, are called 'The Plastics'. This is a not a name they have given to themselves but how others refer to them. They have vapid personalities; they care more for how they look than who they are as people: they are fake.

Plastic as an adjective to describe women appears throughout society. Scroll through the comments of an article on the Kardashians and you will undoubtedly find a comment deeming them 'plastic'. It is an insult thrown at any woman who appears to care too much about her appearance, in particular women who have had, or appeared to have had plastic surgery. Women, in particular celebrity women are often attacked and belittled online for having received plastic surgery, meaning many women never admit to it. Of course, people of all genders get plastic surgery, but women make up the majority of patients.[16]

Figure 25 Meme about the Kardashians being plastic, (ifunny.com, 2020)

[16] Interesting to note is that the majority of plastic surgeons are men (Wolpow, 2017)

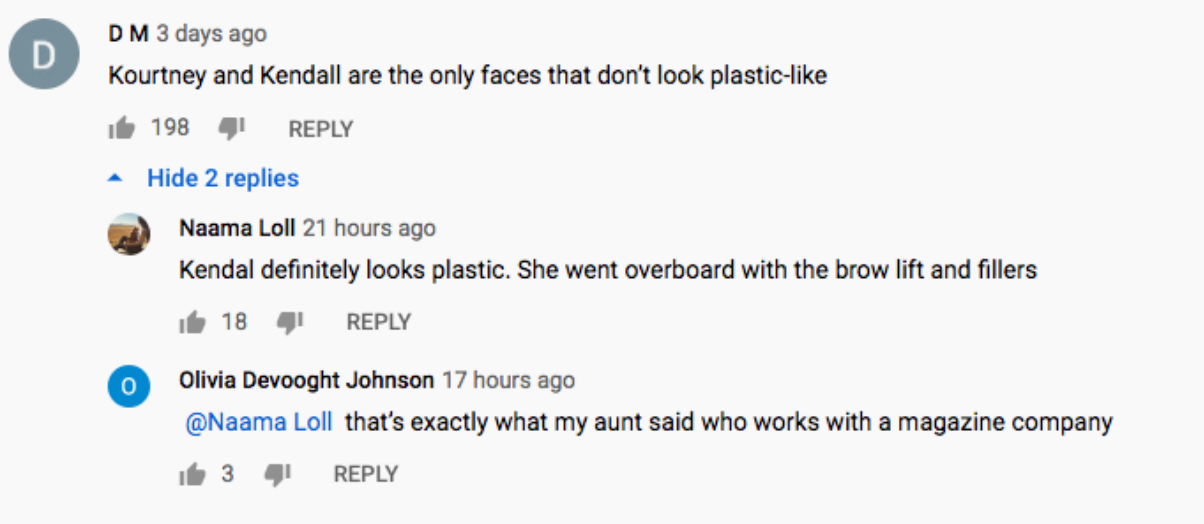

Figure 26 Screenshot of comments under a video of The Kardashians

By contrast in Ru Paul's drag race, a TV show where people (mostly gay men) dress up in drag to compete to be crowned the winner of each season, a break is presented from this idea that it is mostly women getting plastic surgery (although drag, in terms of drag queens is understood to be a 'performance of femininity' (Wikipedia, 2021)). There is also an alternative perception from the idea of plastic surgery being such a negative thing. Although on the show drag queens often bring up other queen's plastic surgery when reading[17] them, the queens with plastic surgery are usually proud and less ashamed of their enhancements, openly admitting to having had plastic surgery. It is not something to be hidden like it is for women. The drag queens are moulding their bodies. They can create the perfect ass, sculpt their face and body in whatever way they want. They do not need to have breast surgery as they can strap on fake breasts of any size or have no breasts at all. Women on the other hand are admired more for having 'natural'[18] beauty which has not been enhanced.

[17] To mock someone in a humorous way (Urban Dictionary, 2009)
[18] Not cosmetically enhanced

Figure 27 Monique Heart walking the runway on RuPaul's Drag Race with a uniquely contoured body

> *'My shape is plastic, it's so nice*
> *I'll be your flotation device*
>
> *I'm black-market beauty*
> *I'm not a girl, you should have known (oooh)*
> *I'm just pumped with silicone (we're just pumped with silicone)'*
>
> *-Silicone by Willam (Featuring Detox and Vicky Vox)*[19] (Willam, 2013)

I am not only bringing attention to drag queens to compare society's reception to plastic surgery in men and women. I also want to suggest that the art of drag is the perfect example of the plasticity of the human body and the plasticity of gender presentation. Drag queens can mould their bodies into different shapes and different characters, literally using plastic to create their desired body and facial prosthetics[20] to mould their face. By changing your outward appearance, you also change how people view and perceive you.

> Drag challenges the status quo. It's always challenged the matrix – the matrix being 'choose an identity and stick with it the rest of your life because that's how we want to sell products to you, so we'll know who you are and can put you in a box and then sell you beer and shampoo. Well, drag says 'I'm a shapeshifter, I do whatever the hell I want at any given time.' And that is very, very political. RuPaul (Nichols & Delbyck, 2017)

Even if people perceive you differently this does not mean that you are a different person. You can mess with the plasticity of your appearance and keep the essence of what makes you. This is also true of getting plastic surgery. I could get a boob job tomorrow and remain the same person I was today. Of course, others could perceive me differently from before[21]

[19] Contestants on Ru Paul's Drag Race
[20] Most facial prosthetics are made from plastics
[21] Most likely in the sexist perceptions as I mentioned before. A woman who cares about her appearance is often considered to be less intelligent by society despite appearance and intelligence having no connection

but I would not **be any different** unless I myself chose to be. This is because I can change, to become a different person, physically and internally. I am plastic, not fixed. This idea both comforts and excites me. No matter what happens to me I can remain the same, yet if I wanted to, I could wake up tomorrow a completely different person.

Figure 28 Lamb in it's Plastic Womb, Partidge, E. A. ET AL. / Nature Communications

Plastic Surrogate

You may have seen articles or photographs in 2017 of a baby lamb (Roberts, 2017), seemingly growing inside a plastic bag with tubes coming from it. This 'plastic bag' was an artificial womb designed to allow premature foetuses to continue to grow and mature. Although only tested on animals so far, this plastic womb was created to give premature human babies a chance to survive. I became extremely interested in the possibility of growing a foetus outside the womb, as I would like to have children of my own, but I do not feel any desire or need to ever be pregnant or go through childbirth. I love the potential thought of avoiding pregnancy and childbirth and the risks involved in that, and instead watching my baby grow outside me in a plastic womb, taking it out when it is ready.

Although here I present the polyethylene womb as a substitution for pregnancy, a Utopian possibility for me, it could also be interpreted as a Dystopia by someone else as many women do want to carry and enjoy carrying a child themselves. Historically pregnancy and childbirth have been the role of biological women. There are obviously many positives to having a baby but there have also been political, social and health downsides to pregnancy and childbirth. A key factor in the Gender Pay gap is the fact that women have children and go on maternity leave, setting them back in their careers. Pregnancy and childbirth can be dangerous for women. There is a pressure on women to have children and a stigma around infertility. The possibility of pregnancy to exist outside the human body, would free the human from these negative effects of pregnancy and childbirth. It would allow groups of people for whom having a child was difficult or impossible to have progeny. It would mean that women's bodies would no longer need to be used for surrogacy. The baby's health

could be monitored as it grew. You could literally watch your baby grow inside its polyethylene home.

Figure 29 Surrogate Mother by Thema R.Newman, 1961, Made out of plastic

Toxic Friends: From Womb to Grave

Plastics may make obsolete this Utopian/Dystopian future I have just presented even before it begins, as plastic may take away our ability to biologically reproduce altogether. Heather Davies explores this in her essay *Toxic Progeny: The Plastisphere and Other Queer Futures*, where she writes *"the chemicals that we are adding to our environment, of which plastics play a central role, are directly interfering with our reproductive systems, and over time, our ability to reproduce."* (Davies, 2015, p. 237) She suggests that plastics *'contribute to queerness'* as queer reproduction is often non-biological.

The chemicals she references are the plasticizers I spoke of before, but also bisphenol A (BPA) which is not considered an additive as it is the basic building block of polycarbonate.[22] When these plastics are *'repeatedly washed, exposed to heat, and other stresses'* in any way

[22] BPA is a weak synthetic oestrogen found in many rigid plastic products, food and formula can linings, dental sealants, and on the shiny side of paper cashier receipts (to stabilize the ink). Its oestrogen-like activity makes it a hormone disruptor, like many other chemicals in plastics. Hormone disruptors can affect how oestrogen and other hormones act in the body, by blocking them or mimicking them, which throws off the body's hormonal balance. Because oestrogen can make hormone-receptor-positive breast cancer develop and grow, many women choose to limit their exposure to these chemicals that can act like oestrogen. (Breastcancer.org, 2020)

toxic chemicals are released meaning *'we all have BPA in our blood.'* BPA has also *'been detected in maternal and foetal plasma, placenta, amniotic fluid, and follicular fluid.'* (Odent, 2017, p. 30) So the BPA could be in our blood before we are born.

Plasticizers are endocrine disruptors and so they can mimic hormones. These endocrine disruptors can interfere with foetal development and it has been suggested they can 'feminize' male foetuses. What is most commonly meant by 'feminization' is that the chemicals leeched from plastics are physically changing bodies. In the case of biological male bodies, they can interfere with the *'development of the testis at the very beginning of intrauterine life'* causing *'penis abnormalities, undescended testicles, lower sperm counts and more testicular cancer'.* (Odent, 2017, p. 30) They also cause breast cancer to develop in women. There is also one small study which suggested that exposure to plastic in the womb could affect the behaviours of boys, making them less likely to play with 'masculine' toys such guns.

In Max Liboiron's post-doctorate dissertation entitled 'Redefining Pollution: Plastics in the Wild' she emphasises the difficulty in researching the correlations between plastics and their effects on our bodies. She gives the example of smoking which technically does not cause cancer, but smokers do *'have a higher risk of developing cancer compared to non-smokers.'* (Liboiron, 2012, p. 98) The same system applies to plastics: it is not guaranteed that exposure to synthetic plastics will cause cancer to develop, but it increases the probability that it will. Liboiron also emphasizes that '*even in cases where epidemiologists have correlated the presence of an endocrine disruptor with an effect in the body*', there is also the complexity of 'categorizing' the levels of 'harm' they cause. (Liboiron, 2012, p. 99)

Liboiron gives the examples of *'cancer, delayed brain development, and early onset senility'* as effects which can be easily categorized as harmful, but gives the examples of *'obesity, the feminization of male foetuses and sexual differentiation'* as being *'less simple to categorize'*. She explains that this is because we cannot definitively categorize what is *'normal and abnormal'* when it comes to the differentiation in human bodies such as birth defects, obesity, cancer, which may be caused by the effects of plastic toxins. She does though give the example of how *'our culture has traditionally'* looked to *'nature'*, to *'what occurs "naturally" to categorize what is 'normal and abnormal'*. Liboiron gives the example of *'British freshwater fish'* which have increasingly developed *'intersex characteristics, due to many of the same chemicals altering human bodies'.* (Liboiron, 2012, p. 100)

Heather Davies calls the *'effects of reproductive toxicity that arise due to the prevalence of plastic in the environment enact a queering of the body'*, emphasising how plastics *'may be contributing to a future where there is less sexual difference'* (Davies, 2015, p. 237) which we can see in Liboiron's example of the British freshwater fish and the similar effects of toxins from plastics on the human body. So, issues such as infertility and mutations which currently could be perceived as 'abnormal' could in the future, because of plastics, be 'normal'. Considering the difficulty in observing, categorizing and defining the effects of plastic chemicals on the body, most of us will only observe these effects as they happen to our bodies over time. As Liboiron argued, it is also hard to define if these effects are always bad, take the example of the plastics suggested potential to affect the behaviours of boys. Is it really 'abnormal' or un-masculine for boys to not want to play with traditionally masculine

toys? I would argue that it is not, and if in fact plastics were blurring this boundary between gendered behaviours, that would be a good thing.

In her dissertation Max Liboiron also explains that *'there is no control group of bodies that have no plasticizers in them'* (Liboiron, 2012, p. 97) which makes it exceedingly difficult to observe the effects of plasticizers on the body, there are no plastic-less bodies to compare the plasticized bodies to. The fact that all living things on earth have become so plasticized means we will have to, whether we want to or not' learn to live with the (potentially toxic) effects of these interactions. After all, many of us already are.

The use of plastics to define humans shows that the definition of plastic goes beyond material. Plastic can be a beautiful way to think about things: the body as plastic, gender presentation, our personalities. The idea that change is always possible. What this chapter also shows is that the human body, in absorbing chemicals leached from plastic, is being changed by plastics. It is impossible to separate the body and plastics.

Figure 30 Baby in Bag, Photograph by Attila Manek, 1987

The Plasticene: The Future of Plastics

> *I wrenched the nylon curtains back as far as they would go*
> *And peered through perspex window panes at the acrylic road*
>
> (Poly Styrene, 1978)

We have explored plastics past and plastics present, but what is the future of this material? Can our understanding of plastics thus far help us shape the future of plastics? And how can we use the concept of plasticity as an approach towards understanding and navigating life?

Reheat/Reshape/Remould/ Reduce/Reuse/Recycle/Repeat/Regenerate

> *"The weird thing about all the plastic is that people don't actually like it, but in order to cope with it they develop a perverse kind of fondness for it, which is what I did. I said, 'Oh, aren't they beautiful because they're so horrible."*
>
> (Poly Styrene, 1978)

My exploration of my relationship with plastics was first facilitated by the creation of my own bioplastics. The use of the word 'plastic' in the name put me off trying to make them at first, as I assumed the process would be overly complicated. Out of interest I checked the ingredients and to my surprise there were only four. This first recipe I tried consisted of gelatine, water, glycerine and vinegar. As my work developed, I gathered more and more recipes for different bioplastics. Many natural polymers have been found and continue to be found and used to create bioplastics. For example: algae, fruit such as mangos, bananas, mangos, cow dung. My favourite recipe uses potato starch (very cheap to buy or can be created at home from potato skins), glycerine as a plasticizer and water. What made me fall in love with bioplastics as a material is that they exhibit what I have now come to understand as the ultimate characteristics of plasticity/of being plastic. They are a viscous, sticky material. They can be moulded in real time with your hands, onto any surface or object you choose. They can be melted and remoulded into something new. When creating bioplastics at home there is always an aspect of unpredictability and uncontrollability. You will never really know exactly what colour, texture or size the bioplastic will be when it dries. What I also loved about creating bioplastics was their creation process. You mix the ingredients together as liquids and then cook them in a pot like food, and they will slowly become a viscous jelly-like substance. Patience is required while you stir the plastic and wait for it to cook, but this also allows you to enter a meditative space. You need to spread the bioplastic on a mould or surface to dry, which can also be a meditative and relaxing experience. As Tara Ribeaux, one of my first bioplastic cooking inspirations says in the section 'Rituals and Tactics' in her 'Bioplastic Cookbook for Ritual Healing from Petrochemical Landscapes':

> Creating bioplastics is a long and slow process, it is a place of participatory and integrative making outside of our predominant instant gratification/ready-to-consume culture. It's a fluid and trans mutative process. You get your hands sticky, slime like solutions can seep between cracks and onto different surfaces of your home or workspace, spreading like a plasmodial body. (Ribeaux, 2019)

Ribeaux emphasises the accessibility of bioplastic ingredients, that they encourage their creator to literally get their hands dirty. She appreciates their constantly changing

materiality in that they often change shape and size or break. She argues that in the process of making bioplastics that we in turn form a kinship with. She considers her bioplastics precious as she created them herself, unlike the petrochemical packaging which is often created out of sight in a factory - designed for and used one time and then thrown out. This introduces an interesting idea in that if plastic were separated from the traditional infrastructures which created it, and instead was created by people outside these infrastructures,[23] would we form a deeper understanding and thus relationship with this material? Of course, in Ribeaux's situation she is using bioplastics, but this same idea could be applied to other plastics as well, especially thermoplastics which can be melted down and reshaped.

Figure 31 Tara Ribeaux teaching others how to create bioplastics (Ribeaux, 2019)

[23] In Communities, in kitchens, by artists, in schools etc.

Figure 32 Some of Tara Ribeaux's Agar Agar Bioplastic (Ribeaux, 2019)

One example of how this could work in action is in the work of Precious Plastic- an open source plastic recycling platform which mainly shows methods of turning plastic waste into

usable products. The project was started to reduce plastic waste through different means[24] and focuses on people having the possibility to bring about change and being the solution to the plastic problem. There are now over 80,000 people in the Precious Plastic community working together, sharing ideas and ways of recycling plastics in their communities. What I like about the Precious Plastic project is that they have a YouTube channel and PDFs on their website where they show you exactly how to create the machinery you need to recycle plastic. They educate you on the different types of plastics there are and whether they can be reused. They work with biodegradable plastics while all the time questioning if they are the solution to the plastic problem.[25] Precious Plastic shows that there is not one fix-all solution to the plastics problem. They present a combination of different ways to tackle it, yet they emphasise that through working together with others through DIY and community-based open-source approaches we can begin to tackle our plastic waste problem and have fun while doing it. What I like most about the Precious Plastic creations is that the objects they create from plastic waste are very beautiful. They are a blend of beautiful colours, a kind of marbled plastic.

Figure 33 Some Precious Plastic plastic recycling machines and the objects they have created

[24] Recycling, biodegradable materials, zero waste lifestyles

[25] In one YouTube video they bury some biodegradable plastic in soil and see how long it takes to decompose. (One Army, 2020)

Figure 34 Plastic created by Precious Plastic machines out of recycled plastics

I see a link between Precious Plastics 'do it yourself' approach to melting and remoulding of recycled plastics and the creation of 'do it yourself' bioplastics by creators such Tiara Ribeaux, where experimentation and unpredictability is always part of the creation process. These approaches take the power of plastic-creation and recycling/composting away from traditional infrastructures and puts it into the hands of ordinary people. It allows people to engage with plastic on a creative level instead of only through consumerism.

These projects also emphasise the materiality of plastics: their plasticity is that they can (mostly) be reheated and reshaped, stretched and changed. Although we see plastic waste as problematic because there is so much of it and it does not disappear, its potential is that it can be used again and again and again. In a sense it is the ultimate recyclable material. This is also an important characterization of bioplastics as materials, as many bioplastics, especially those used in industry, need to be composted correctly for them to disappear from the earth completely. Even when composted correctly, depending on the materials used to create them, they could still leech harmful chemicals, or they could fail to break down entirely, creating more microplastics. A positive side to bioplastics, at least in my experience, is that they can be reheated and reshaped easily and are often less toxic. Bioplastics are not a solution to plastic pollution as that problem exists because of plastics permanence. As a material they must be approached in the same way we approach petrochemical plastics: with the knowledge that they can exist for a long time, treating, creating and using them as if they will be here forever.

Utopia, Dystopia or Both?

Plastic as it exists now would seem to lend itself more to the idea of a Dystopia - a world where our plastic waste is everywhere, destroying oceans and habitats, killing animals,

poisoning humans. This future is in stark contrast to the future alluded to when plastics were first introduced.

> The new plastics offer "fluidity, a grace, a technological beauty of line and purpose that is sure to become the hallmark of a new way of life."
>
> —The Society of the Plastics Industry, New York Times, 1968

What I would argue is that plastic sits in between Utopia and Dystopia and has the potential to create both. It does not take much imagination to see the dystopic aspects of plastics. A plastic Utopia on the other hand requires speculation. We must imagine a new world and think of the ways it would be possible to bring it about before we can begin to try to live in it.

Wagner-Lawlor begins her essay 'The Persistence of Utopia' with a quote from Toni Morrison *"Utopias are designed to keep people out",* an understanding of Utopias *'as exclusionary and often reactionary'*. This was not the case for the post-war presentation of plastics as in their creation of a consumer utopia that everyone could afford. In this same essay Wagner-Lawlor argues *'that utopia is plastic'*, that the utopia being envisioned depends on the who is envisioning it. (Wagner-Lawlor, 2017, p. 67)

Synthetic Speculation

The exploration of renewable materials, in particular bioplastics and Utopian ideas have always been strongly linked in my work and research. Utopia gives us an opportunity to imagine a radically new way of life, a new way of being and living. I always found it most interesting to use bioplastics to explore Utopian narratives, instead of the more traditional and scientific way of exploring bioplastics in terms of design and function in modern society. I believe what unites the idea of Utopia and biomaterials is artistic and creative practice. Of course, we can research how we *should* tackle plastic pollution, but artists can make us *want* to. Artists are particularly good at speculating and, in this speculation, they can ask and pose questions that other research methods may not even think of or try to ask. With speculative design the artist/designer asks us to consider their idea as if it already exists and functions in society. This makes us think about the effects and possibilities of their ideas as if they did in fact exist. Speculative projects are a way to present potentially complicated scientific research in an accessible, fun and interesting way. Speculation is used in many of the projects I will now talk about. One thing to note is that, although I emphasised the link between bioplastics and Utopia in my own work, in the examples I will now give, many of the artists are responding to Future Dystopias.

Some of the artistic research I came across when working with bioplastics presented me with new and interesting ways of thinking about this material. When I first started creating bioplastics, I was very inspired by researcher and designer Miriam Ribul's open-source publication 'Material Activism' which provides different recipes and techniques for making and working with bioplastics/renewable materials. *'Recipes for Material Activism does not require specialized skills and replaces collaborative consumption with collaborative production… [i*t aims to] *'re-place traditional manufacturing processes'*, it sometimes requires you to *'hack common tools'* and all of the recipes use *'non-toxic and easily sourced materials.'* (Ribul, 2014) I loved the ideas presented in this book: the possibility to create my

own plastic; to create collaboratively with others; The idea of just cooking and designing plastic with easily accessible tools; the idea of open source bioplastic recipes bringing people closer to the textiles you use.

A project which visualizes well this gap between the everyday products we use, and their production process is designer Thomas Thwaites 'The Toaster Project'. He tried to build a functioning toaster[26] from scratch through collecting and assembling all the materials himself. In the end he discovered this was exceedingly difficult, but he did manage to make the toaster, although it did not look quite like conventional toasters sold in shops, and he admitted it would have been easier just to toast some bread on a fire.

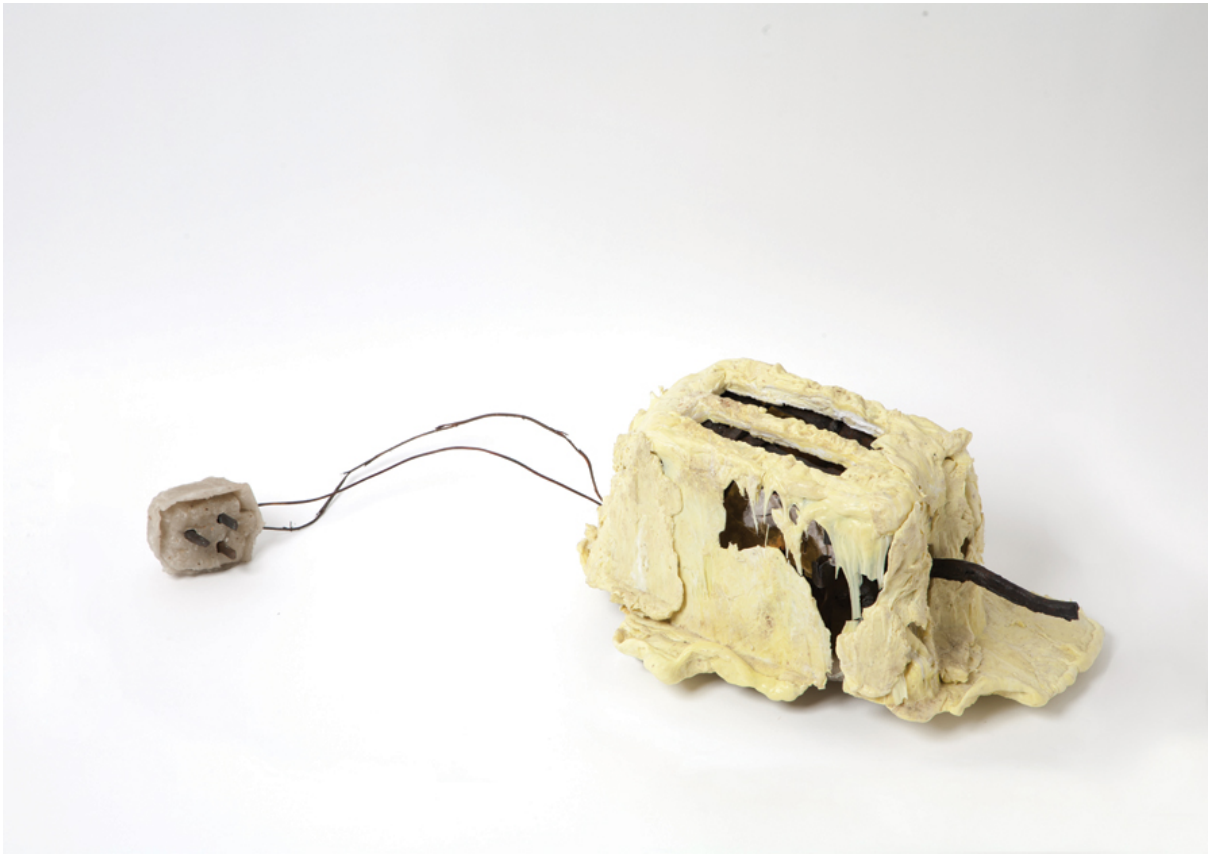

Figure 35 Thomas Thwaite's finished toaster

Another project which I found very inspiring is Architect Maria Vergopoulou's proposal for a way of living in a speculative future in response to a future homes design competition for the magazine Dezeen.[27] Entitled 'Cocoon BioFloss', Vergopoulou's proposal was situated in an *'"economically and politically uncertain" future in which resources are scarce. Traditional building materials such as brick and concrete would be replaced by bioplastic, a renewable material derived from agricultural bi- products. The material's ingredients would be harvested from organic matter such as sunflowers, potatoes and apples, which would be grown on site by the buildings' occupants. The kitchen of each residence, situated at the*

[26] beginning by mining the raw materials and ending with a product that Argos sells for only £3.99: A toaster.

[27] The concept was submitted by Vergopoulou in response to the Dezeen x MINI Living Future Urban Home Competition brief, which asked Dezeen readers to design a home that would address the challenges cities could face in 100 years time.

heart of the unit's floor plan, would double as a laboratory where bioplastic production would take place.' (Adey, 2019)

"It is the most important part of the house," - Maria Vergopoulou

Figure 36 Maria Vergopoulou's Cocoon BioFloss houses

Figure 37 The kitchen where the bioplastic is made

A project which introduced me to the idea of wearable bioplastics is designer Cathrine Disney's project 'Synthetic Protection: Bio intelligent Membranes' (2016) which responds to a speculative Dystopian future after the disastrous effects of global warming. *'Conventional clothing'* is no longer appropriate due to weather extremes and so materials need to be *'environmentally responsive'*. She designs bioplastic clothing which *'contains genetically modified organisms that can respond to our environment'* meaning the clothing would protect the wearer in extreme weather conditions. She says *"The functions and aesthetics of the bio intelligent membrane were inspired by nature. For example, in extreme cold conditions, I have taken inspiration from polar bears, and in extreme heat, reptiles."* (Disney, 2016) I found this project remarkably interesting as it presents the idea of bioplastic as a material which could potentially *'sustain an environmentally responsive organism'.* What if the bioplastic itself was actually living? What if the bioplastic could regrow and regenerate itself, react to our bodies and the environment?

Figure 38 Cathrine Disney's Biointelligent Membrane clothing

Another project which was also pivotal in my bioplastics research was 'Bioplastic Fantastic' by Johanna Schmeer in which she designed seven 'products' which produce all the nutrients and energy needed for humans to live[28] by being exposed to artificial synthesis. These products were made from enzyme-enhanced bioplastics and *'the concept is based on a recent scientific breakthrough in the synthesis of functioning "biological" cells made from polymers and enzymes.'*

'All of the device designs are based on bacteria which have similar functions in nature. They use the functional part of the biological circuit (enzymes) and combine this with non-living matter (bioplastic).' (Schmeer, 2014)
As with Disney's bioplastic clothes, Schmeer combines living material with bioplastics to create her idea. What I found the most interesting about this project was the idea of eating bioplastics.

[28] They produce water, vitamins, fibre, sugar, fat, protein and minerals through biological processes, allowing for a more self-sufficient lifestyle.

Figure 39 Joanna Schmeer's Bioplastic Fantastic food

Figure 40 Joanna Schmeer's Bioplastic Fantastic food

Figure 41 Joanna Schmeer's Bioplastic Fantastic food

The consumption of plastics is something humans have been trying to (and have had to) avoid for years now. We do not want to be poisoned by our own waste. Bioplastics are technically edible (although not very tasty), but much less toxic than eating petrochemical plastics (As we are increasingly doing), and so there is a lot of potential to explore the consumption of bioplastics. What would an all-plastic diet look like? What if we designed disposable plastic plates and cutlery but they themselves were also the meal?
I would also like to bring attention to the winning project of the 2020 Bio Art Design (BAD) Awards[29] entitled 'Becoming a Sentinel Species', a research project, and a collaboration between Heather Leslie, Juan Garcia Vallejo and Sissel Marie Tonn. The project responds to the plastic pollution and the idea of marine species acting as 'sentinels' for this environmental pollution. The project imagines a speculative future where humans explore and reflect on the role of the sentinel.

As Tonn writes, 'The film follows two researchers who experimentally introduce microplastics collected from the sea into their own bodies. In order to "become sentinels" they isolate macrophages from blood and contaminate them with microplastics in a laboratory setting.' (Tonn, 2020)

This project is interesting as it is similar to the previous projects discussed, but instead of introducing living bacteria to the plastic, the plastic is introduced to the living: that is, human bodies. This project also links back to the ideas presented in my previous chapters such as understanding the non-human and humans becoming plastic.

The long lifespans of plastics allow and encourage us to think long-term, to imagine what world we want to exist in the future and how to bring that world about. Instead of thinking in short term profits and gains, we should think in deep time, imagining how we want our

[29] Bio Art and Design Award

kin to exist hundreds of years in the future. If we do not want them to inherit a world not drowning in plastics, then we need to start moulding that world now.

I have shown you different speculative plastic projects in this chapter as I want to show how, in thinking through plastics, we can explore different scenarios and futures for plastics to exist in, in the future. We can think not only, how do I interact with plastics, but how would I like to interact with them? Again, plastics give us an interesting way to approach the world.

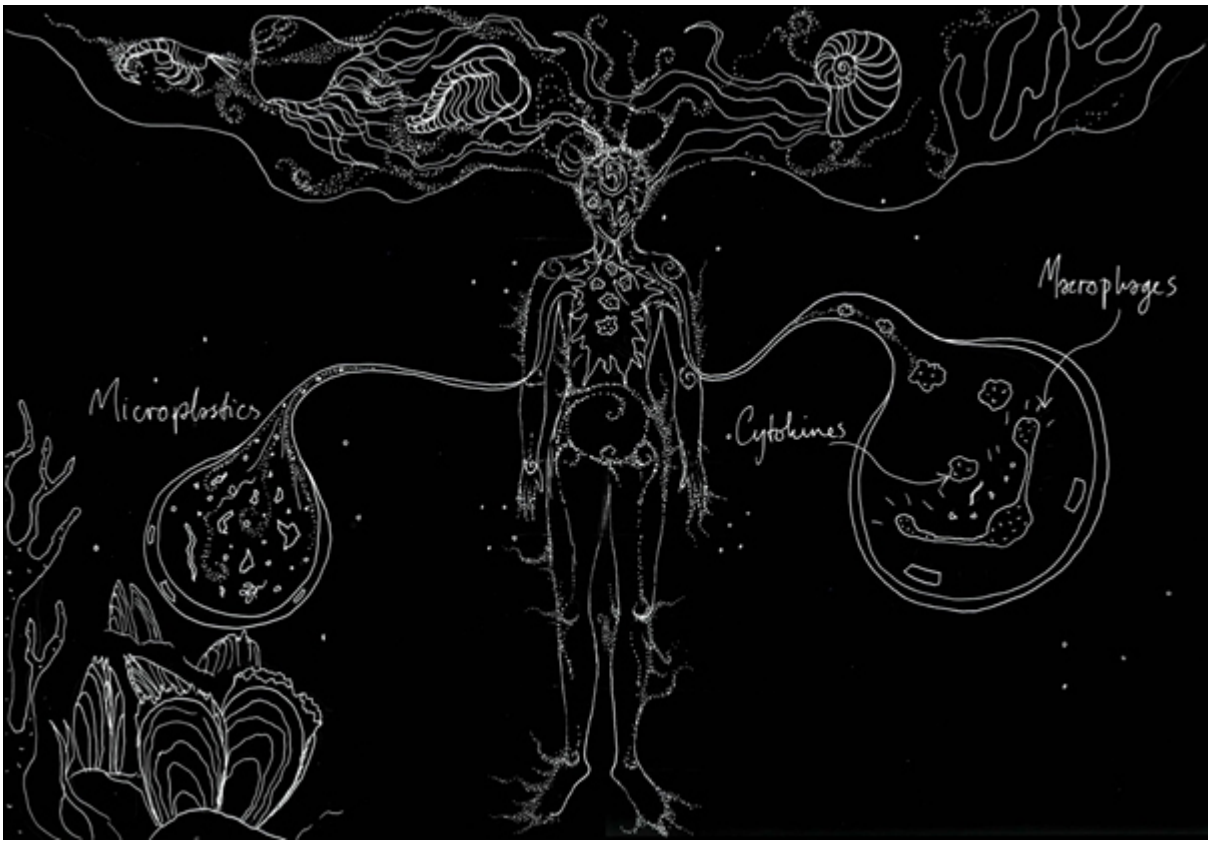

Figure 42 Human Sentinel Concept Sketch, 2020, Sissel Marie Tonn

Conclusions: Potentialities materialized

Businessman: I just want to say one word to you, just one word.
Benjamin: Yes, sir.
Businessman: Are you listening?
Benjamin: Yes, I am.
Businessman: Plastics.
Benjamin (after a long pause): Exactly how do you mean?
Businessman: There's a great future in plastics. Think about it. Will you think about it?
Benjamin: Yes, I will.
Businessman: 'Nuff said. That's a deal.

- (The Graduate, 1967)

In summary, this thesis has explored the different ways in which we understand both plastics and the concept of 'plastic', to understand better our relationship with it. We need to be aware of the different definitions, the different concepts, and meanings of the word plastic to fully understand what we should do with plastics as a material. I hope, through exploring the meaning of plastic in this text, I have helped you understand the word and the material in a better or different way than you did before.

Throughout I have built an argument that rather than a binary choice between living with plastics or living without plastics, we need to understand the full complexity of how we are already entangled with it. I have suggested that rather than a choice between Utopia or Dystopia, plastic offers us elements of both, and so we must find a way to continually navigate our relationship with it. I have referenced many different ways of tackling plastic pollution as it will take a combination of different approaches to effectively tackle this problem. Luckily, we can look to this material as inspiration for how to approach moulding this future. If we behave like plastics, with the ability to change and adapt, we can continually form the possibilities for this material. We must all remember that we are plastic. It is inside of use and all around us, even when we cannot see it.

We must look at the world through plastic and think 'plastically'. Think "this is the world we have now, but what kind of world can we have in the future?" Like the various definitions for the word 'plastic', everything is changing all the time, the world will not be the same in a year, a decade or a century. The way we act now will decide what that change is, what it creates. The many ways I have explored of thinking about plastics, the speculative realities, the many possibilities, also give us an interesting way of thinking about the world. Thinking and acting like plastic should not be too difficult if we continue to remember we are already plastic.

I conclude with my own speculative future, inspired by the projects I have just shared and my work with bioplastics. This scenario is situated within 'The Plasticene', the next geological era after the Anthropocene, a world dominated not by humans but by plastic. I loved the name 'The Plasticene' because for me it not only represented a new era, but also sounded like a 'plastic scene' or the plastic/Play-Doh like material 'plasticine' which connotes a world containing play and creativity.

I imagine a world a hundred or more years into the future where instead of avoiding plastics, we would use them for everything we need to survive. We would live with and off a combination of recycled plastics and bioplastics. Our lives would revolve around the ability of plastics to be melted and re-shaped. We would build our shelter from plastics. You want to tear down a wall in your house? Melt it and turn it into a table. Tired of the bioplastic jacket you made? Melt it down and serve it for dinner. We would be melting and remoulding the bioplastics forever, keeping them, to quote Roland Barthes, in *'infinite transformation.'* (Barthes, 1957, p. 119)

There would be no room for consumerism or single use plastics in this world. There would also be no need to create any new petrochemical plastics. We would only use what is already on earth. Instead of money we could exchange plastic designing ideas, plastic products, creations, knowledge. For me this situation sounded like a utopia. When I told others, some thought it sounded like a Dystopia. Whether it is Dystopia, Utopia, neither or both, the thing you should at least take from it is that we now have the opportunity to mould the future and the world we want. Our journey forward is not set in stone, we still have a chance to change it. The future is plastic.

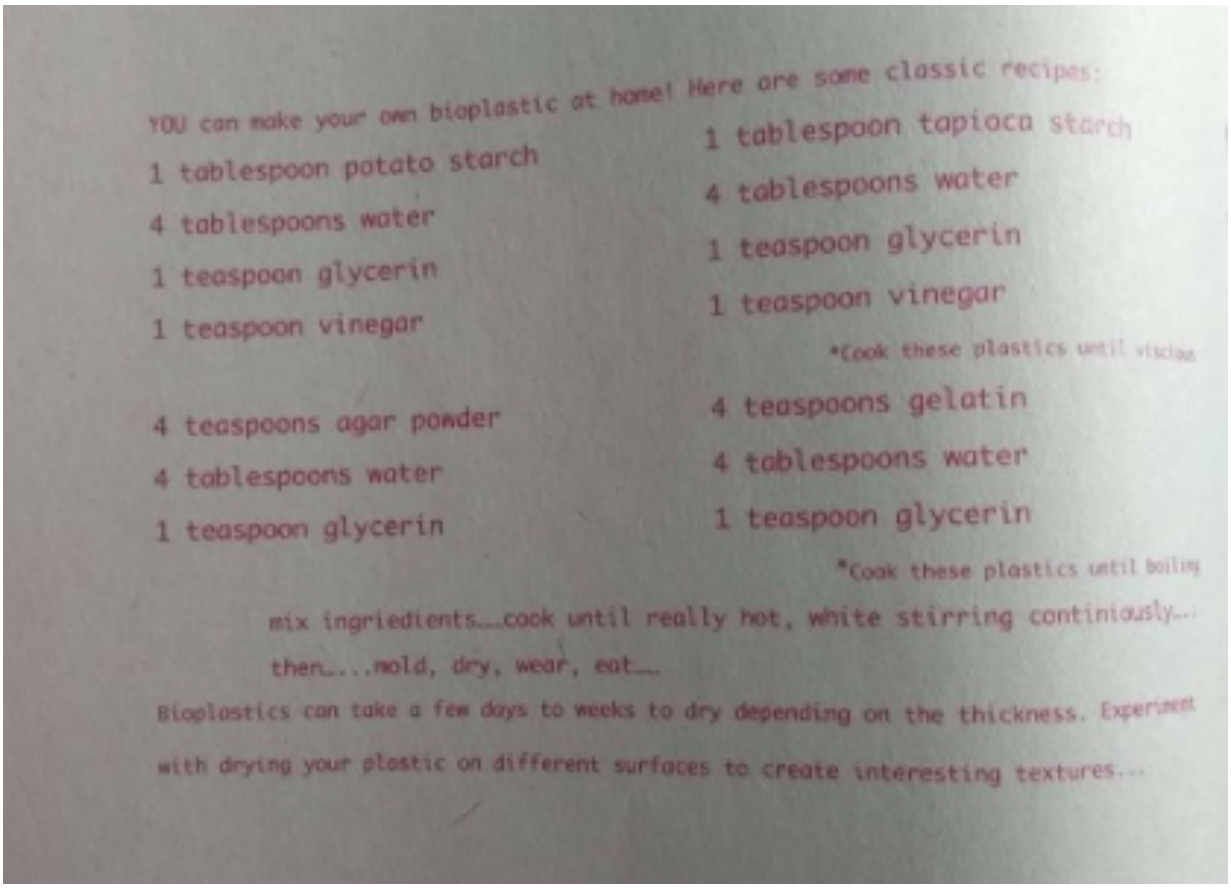

Figure 43 My own Bioplastics recipes, Photo by me

Figure 44 A photograph of me teaching others to cook Bioplastic, Stedelijk Museum Amsterdam, 2019, Photo Maarten Nauw

Figure 45 Someone colouring and flavouring their own Bioplastic plate – the plate is also the meal! Stedelijk Museum Amsterdam, 2019, Photo Maarten Nauw

Figure 46 Feeling the Bioplastic at my Bioplastic workshop, photography by Maarten Nauw, 2019

Figure 47 I like to teach others how to make their own bioplastic 'disposable' plate. Throw it away and it away and it will decompose…or eat it to get rid of it. The plates are coloured with food spices, Stedelijk Museum Amsterdam, 2019, Photo LNDWStudio

Figure 48 My own interpretation of a Bioplastic dinner, Stedelijk Museum Amsterdam, 2019, Photo LNDWStudio

Figure 49 The Bioplastic table and my bioplastic curtain, Stedelijk Museum Amsterdam, 2019, Photo LNDWStudio

Figure 50 My bioplastic curtain up close, Stedelijk Museum Amsterdam, 2019, Photo LNDWStudio

Figure 51 My dried SCOBY, coloured with beetroot juice, Stedelijk Museum Amsterdam, 2019, Photo LNDWStudio

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