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"IN THE PERIOD IN WHICH WE DESIGNED THE MODERN CITY, WE USED MATERIALS AND ENERGY WITHOUT REALLY THINKING ABOUT THEM, OR HOW WE WOULD COPE WITHOUT ENOUGH TO CREATE A NEW FUTURE."[1] (FRANKLIN & TILL, 2018)

"TODAY'S WASTE CAN BE MADE AS DESIRABLE AS THE VIRGIN MATERIALS OF THE PAST."[2] (FRANKLIN & TILL, 2018)

[1] Anders Lendagder in Franklin, K. and Till, C., 2018. *Radical Matter*. London: Thames & Hudson. Pg 18
[2] Franklin, K. and Till, C., 2018. *Radical Matter*. London: Thames & Hudson. Pg 19

AVOIDING TOMORROW?

CONTENTS

ABSTRACT

Environmental awareness is growing worldwide, however we are still not doing enough despite there being underused strategies available which allow for us to lead carbon neutral lives. Building from scratch is an unhealthy approach, when there are over 24,000 abandoned commercial properties in London, why are we constantly constructing new? Materials used for modern day construction add extremely high amounts of pollution to the atmosphere, one of the worst materials for this is concrete, there are alternative materials which are a lot less harmful, but due to the cost concrete is still chosen. Is it not worth to spend a little more to help save the environment and relieve our conscience? In this writing, the idea of using the unwanted and rethinking the known is explored, in a way to limit the construction of new when there are plenty of existing sites available. The three topics which highlight this are Rethinking (how we can re-purpose existing and old materials), Disappearing (the possibility of allowing buildings to decay and leave no trace) and Living (exploring the use of living materials in buildings).

INTRODUCTION

"We are running out of raw materials and creating enormous quantities of waste. We cannot continue to race through our planet's finite resources; indeed all the evidence suggests that if we continue at our current rate, we'll soon need a second planet"[1](Franklin & Till, 2018).

In a time where climate change is a global crisis, we need to become more aware of what we can do and what is already available for us to use today to help reduce our negative global impact. The vast usage of fossil fuels for energy and chemical industries is resulting in a massive pollution of plastics and greenhouse gases.
Environmental awareness has significantly increased over the past few years, with the help of important figures such as David Attenborough, Al Gore and Greta Thunberg reaching out to all generations. Despite the awareness increasing, we are still not progressing at a fast-enough pace to prevent planet Earth from being damaged to a point of no return. *I personally have been aware of the environmental impact I make on a daily basis for quite some time, I recycle what I can, reuse scraps of material, limit the amount of water and energy I use, however, it is almost impossible to maintain a life which is carbon neutral. Almost everything is made from unsustainable materials, such as single-use plastic, which is found on almost every toy and food packaging. One of my first environmental awareness awakenings was in a science lesson at secondary school when we watched An Inconvenient Truth by Al Gore; this highlighted the extent of current human impact on the environment and how every action we make has an impact, whether it is positive, or negative is up to us. The scene which stuck the most with all of us was an animation of a polar bear. The polar bear was swimming for miles feeling panicked whilst searching for ice to rest on, it eventually drowned due to exhaustion.* Due to our actions, the rate of global warming is dramatically rising. This is causing the polar ice caps to rapidly melt. It used to be very rare to find a polar bear which had drowned however, the number is rising as polar bears often have to swim for more than 60 miles to find ice [2].

1 Franklin, K. and Till, C. 2018 *Radical Matter*. Page 9

2 *An Inconvenient Truth*. 2006. Directed by D. Guggenheim.

Due to Earth's climate changing faster than any other time within the last 100,000 years, some scientists and geologists are claiming we are living within a new geological era known as the Anthropocene. The term Anthropocene originates from a Greek word meaning human, hence why the Anthropocene means an age where humans have a large influence on the biosphere. The new unofficial geological era comes after a lot of change has occurred over the past century. The Anthropocene is split into three phases: the cognitive revolution, where the population first began to significantly rise, and the first mass extinctions of megafauna (large animals, such as mammoths) began. The second phase being the agricultural revolution, where humans began to settle in communities and build hamlets, villages, towns and cities. The final phase is the industrial revolution, this is when a massive increase in the use of fossil fuels and natural materials began, which led to the increase of carbon dioxide and the start of global warming; this is the phase we are all most familiar with. The Anthropocene is a time period where humans are changing the climate, each phase has led to an increasing impact on the biosphere. Up until today we have been and continue to destroy the planet through causing a negative change to the environment and climate. Going forward we need to make the most of our opportunity to turn the Anthropocene into a positive era. Due to our increased awareness and development in technology, we are able to create ways to help save the planet and control our vast emissions.

Many scientists and designers have solutions available now which could have a huge impact towards lowering our carbon emissions, amounts of waste and our rate of global warming. In the UK alone, the built environment accounts for 40% of the total carbon footprint[3]. This percentage could be considerably lower if we considered all the materials and technology we currently have available, which allow for low-emission living.

Materiality plays a key part within lowering emissions for the built environment. Through the processes of reusing, rethinking, growing and allowing decay, it is possible to leave no trace. Materials which we commonly use in construction are 'unhealthy'. They are rarely biodegradable, recyclable or reclaimed. We have been using these single-purpose materials in construction for thousands of years. One of the worst materials for producing carbon emissions is concrete, which we have been using in construction every day since it was developed by the Egyptians and Romans. The Guardian has

3 Climate change - UKGBC - UK Green Building Council, 2020

described it as being 'the most destructive material on Earth'[4]. The production of concrete alone accounts for 4-8% of the worlds carbon dioxide levels. The only materials that are higher are coal, oil and gas (all three of these originate from fossil fuels, unlike concrete which is mainly made from cement, sand and water). Concrete and other clay-based materials (brick and tile) make up the majority of construction materials in Europe[5]. There are plenty of alternatives available which we should be using, but concrete is still mainly chosen. This may be because concrete is cheaper, quick to construct and widely available. However, do you not believe that it is worth taking extra time and money to source help towards the creation of a sustainable planet?

As we should be designing buildings in a way which causes minimal impact to the environment, we should be looking to nature for ways of going about doing this. In nature there are continuous cycles of reuse. For example, in the water cycle, masses of water evaporate, which then condensate to form clouds, these clouds then precipitate onto the ground, and that water eventually makes its way back into the original water store, after being used by vegetation and living organisms. A similar approach of reuse could be used in buildings. This could be done through reusing materials and buildings with architectural processes such as adaptive reuse and architectural recycling, or by using biodegradable materials which will return to the earth after decay.

4 Watts, J. 2019 *Concrete: The Most Destructive Material On Earth*
5 Gagg, R. 2012 Texture + Materials

In this essay I will explore three topics which all revolve around the use of sustainable materials. The first being **Rethinking Materials**. Within this chapter I will be exploring the reuse of the existing, particularly rethinking our waste. In 2016 the UK produced 222.9 million tonnes of waste, construction and demolition produced the majority of this at 136 million tonnes[6]. When there are over 24,000 abandoned commercial properties in London alone[7], this amount of waste could be significantly lower. We should be reusing and recycling buildings, just as we do for regular household waste.

As explored in the book *Buildings must Die*, buildings are considered to 'have life' however they are often preserved rather than allowing natural ageing or decay, which typically occur in living organisms. The concept of **Disappearing Materials** revolves around allowing buildings and materials to decay and leave no trace. Typically, buildings are prevented from decaying, but what would happen if they were deliberately created to die? By being biodegradable, nature is allowed to claim a building or object when unused and allows for it decompose fully into the ground. By allowing the natural process of decay, the object eventually merges into the ground as if it was never there.

The final topic is **Living Materials**. By incorporating living elements, such as plants and fungi, into buildings not only do we reduce the carbon emission rates but we have the possibility of the living absorbing carbon dioxide on an everyday basis. By allowing materials to grow within a space, there is a reoccurring change, as the living element grows, the space also grows. The term living not only refers to the growing but also how materials age and how they can hold memories of life.

6 *Where does recycling and rubbish from the UK go?* BBC, 2019
7 *Thousands Of Empty London Properties Could Be Used, Think Tank Says.* BBC News 2018

Fig 1. Image showing the deterioration of plastic wrap. Photographed by Dixon, K. 2020

RETHINKING MATERIALS

"Today's waste can be made as desirable as the virgin materials of the past."[1] (Franklin & Till, 2018).

In a time where raw materials are running out, we need to look for other resources which do not deplete. Our waste is currently one of the biggest man-made resources; by finding innovative ways to reuse the unwanted, waste can become tomorrow's raw materials.

Waste does not just refer to our regular household rubbish, it includes industrial, commercial, technological waste as well as unused and abandoned buildings. As previously stated, there are thousands of deserted buildings in London alone, and due to the coronavirus pandemic, this number is rising as many once thriving commercial retailers are being put out of business, leaving empty spaces waiting to be given a new life. Instead of constructing new contemporary high-rise buildings, we should be following the strategies of architectural recycling and adaptive reuse. Adaptive reuse is the process of remodelling a building whilst maintaining elements of its past. Often this is through keeping damage and decay, making it obvious that the building had a previous life. By carefully planning and considering where new aspects should go and how they correlate with the past, designers go through the process of "thinking to focus on what currently exists and how it can be incorporated thoughtfully into the goals and ideas of the future"[9] (Schmidt Associates, 2018). Maintaining damage allows viewers to see all experiences which have occurred to the building as well as allowing the change in use or occupation to be visible. By not completely hiding the past, the need for constructing new aspects is limited, therefore reducing the impact the build has on the environment.

8 Franklin, K. and Till, C. 2018 *Radical Matter.* Page 19

9 Schmidt Associates. 2018. *Why Is Adaptive Reuse Important In Today's World?.* [online] Available at: https://schmidt-arch.com/why-adaptive-reuse-important-todays-world/

"Global challenges, uncertainty about the future and the need to ensure a sustainable and productive future means that the adaptation of the existing building is seen to make a positive contribution to society and to the individual"[10] (Brooker & Stone 2018).

The rethinking of the use of the unwanted can create something desirable which fits into modern day society. By using the process of adaptive reuse, we can take all of the unwanted, deserted buildings across the world, and turn them into structures that are needed and given new lives.

The Bankside power station had not been in use since 1981. In 1994, the site was chosen to be converted into a gallery[11] (History of Tate Modern | Tate, n.d.), which we know today as the Tate Modern. The power station had been part of Bankside since 1947 and had become an iconic part of Southwark's skyline. The appointed architects Herzog & De Meuron planned to keep the original character of the power station. Due to the station being derelict for 13 years, some of the structural elements needed to be replaced due to being out of date or no longer in line with health and safety guidelines, for example asbestos was present in parts of the building. Construction for the gallery started in 1995, and was completed in January 2000, ready for the opening in the following May. The transformation of Bankside power station to Tate modern is a design to last hundreds of years; the site drastically changed from being an abandoned run-down site to the UK's third most popular tourist attraction. This is a prime example of taking something unwanted and creating one of the most popular tourists places in the country. *Personally, Tate modern is my favourite place to visit in London. Since I first visited the museum in 2016, just after the opening of the Switch House, I have noticed that it has always been filled with people from every demographic. As well as hosting a variety of public events, it is hard for me to imagine Tate Modern ever being an empty derelict building. Even over the past few months where the gallery has been closed, there has still been a community supporting the gallery and attending its online exhibitions and events.*

The design for Tate Modern did involve the use of a large amount of concrete however, due to it being an iconic building which is designed to last for

10 Brooker, G. and Stone, S. 2018 *Re readings 2*. Page 1

11 Tate. n.d. *History Of Tate Modern | Tate*. [online] Available at: https://www.tate.org.uk/about-us/history-tate/history-tate-modern

hundreds of years, is it considered acceptable to use damaging materials if they are in-keeping with the original architecture style or occupation, or if a building is designed to last? As explored later in the chapter Living Materials, concrete absorbs CO_2 as it ages. This further adds to the question whether or not it is acceptable to use materials which damage the environment during their production.

Fig 2. Herzog & De Meuron, Tate Modern, 2000. Photographed by Acabashi. 2018

RETHINKING MATERIALS

Fig 3: Herzog & De Meuron, The Tanks, 2012. Photographed by Dixon K, 2019

By redefining our renewable resources, to be something more than alternative energy generation or biomass, such as timber or plants, which still take years to renew themselves through growth, we should be looking to the existing. Our food waste often includes materials which we are able to turn into biopolymers or other natural materials. Biopolymers have the potential to replace anything made from plastic today.

MIT (Massachusetts Institute of Technology) Media Lab are rethinking the relationship between nature and matter on a daily basis. Their project Aguahoja, which was overseen by Neri Oxman, used a variety of new biopolymers, which were designed and created through their research into natural materials. The project explored how materials which we usually consider as waste, could be turned into environmentally friendly alternatives to the damaging materials which we currently use in construction and manufacturing. For Aguahoja, MIT Media Lab used natural components to create a compound which could be 3D printed to create a structure which would showcase the potential of biopolymers. The four most common compounds they used were chitosan, which can be found in shrimp shells, pectin, which is located in lemons and the skin of apples, casein, which is a dairy protein commonly found in milk, and cellulose, the main substance within the walls of plant cells[12]. The invention of using casein as a biopolymer showed great potential as becoming an alternative to concrete, this is because it shows good durable properties as well as being stronger than concrete. The Aguahoja pavilion stands five metres tall and consists of panels made from these biopolymers, which are 3D printed with a similar structure and appearance to human skin. MIT designed the entire structure to be water-soluble, therefore Aguahoja can decompose when exposed to water. The project was designed to decay, as I explore in disappearing materials, the potential of having buildings which decay result in putting something back into Earth's ecosystem, and results in the carbon footprint of buildings being low.

12 Oxman, N., n.d. *Aguahoja.* [online] Oxman. Available at: https://oxman.com/projects/aguahoja

RETHINKING MATERIALS

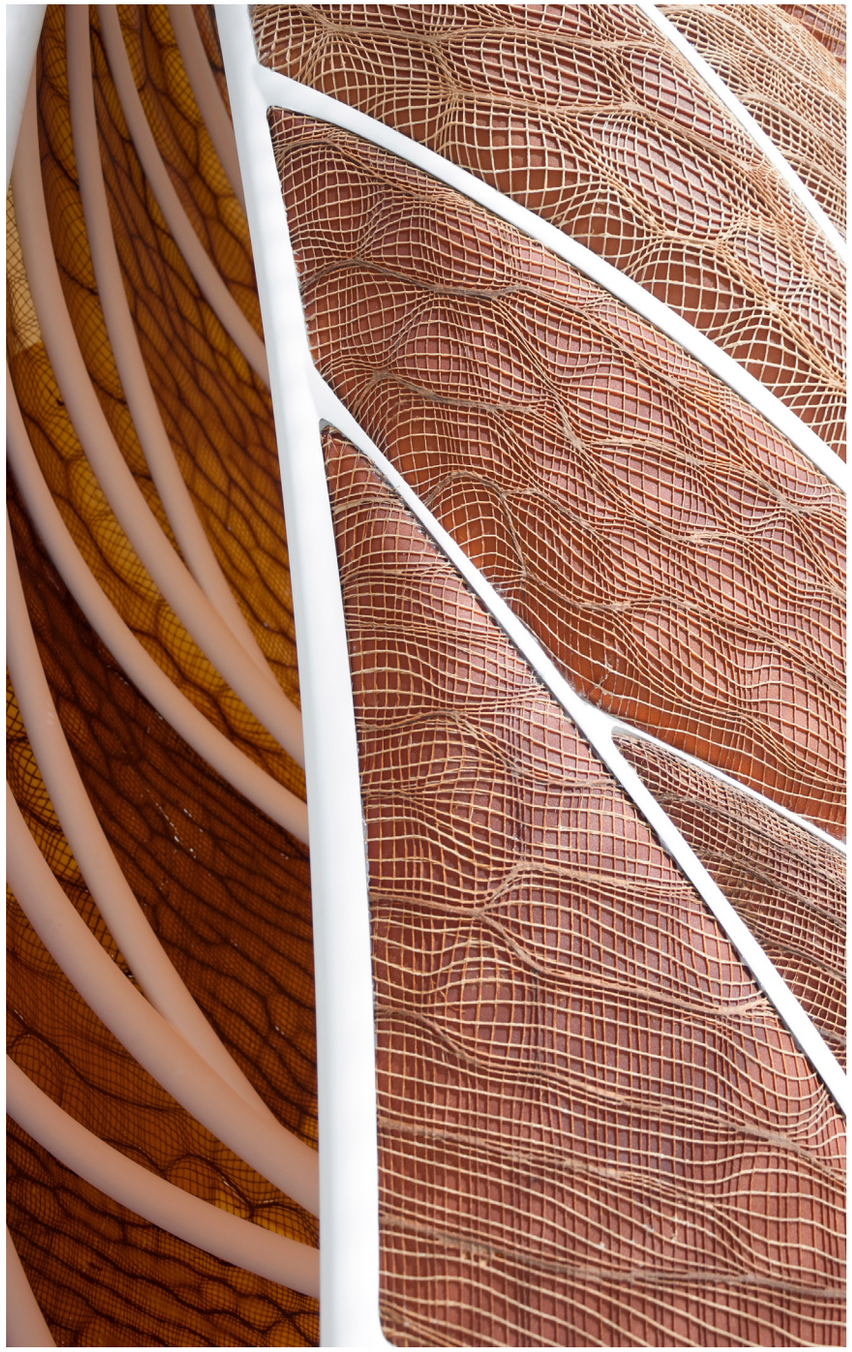

Fig 4: MIT Media Lab, Aguahoja, 2019. Avaliable at: https://www.dezeen.com/2019/10/17/aguahoja-i-mediated-matter-group-design/

DISAPPEARING MATERIALS

"From the hand of man we expect complete works as symbols of necessary and lawful production; from nature working overtime, on the other hand, we expect the dissolution of completeness as a symbol of an equally necessary and lawful decay."[13] (Riegl 1903, cited in Cairns & Jacobs, 2014)

The idea of allowing a building to disappear emphasises the view of buildings having a life. This can be done through multiple routes; such as recycling and turning materials into something new which is far from its original form; or alternatively allowing materials and buildings to naturally age and deteriorate, until they eventually breakdown and completely disappear into earth. Buildings are often considered as having a life, however, they do not usually die. Normally when we think of life, we know there would be an end. By allowing buildings to fully embrace having a life, would result in them dying. After death an object decays, there are many ways in which we can allow buildings to naturally decay once considered unusable, or 'dead'.

The usage of naturally decomposing or recyclable materials would allow for buildings to vanish once they reach a point of being unwanted.

13 Cairns, S. and M. Jacobs, J., 2014. *Buildings Must Die.* Page 71

Studio Bark explored the use of cork in structures, and how by using the many properties of cork, a structure can eventually appear to have never been built. These properties include being strong, durable, providing thermal and acoustic insulation, and being resistant to fire, water and rotting. Cork is a highly sustainable material, due to the cork oak tree's ability to replace its bark every 9 years[14], this allows for cork to be harvested without damaging a tree. Named the Cork Studio, Studio Bark designed a small outdoor cabin designed entirely from cork. After collecting unwanted cork granules from wine factories, Studio Bark underwent a series of trials to discover a way of turning the cork into useable solid brick-like blocks. To achieve the final product, the granules went through a heating process, which caused the granules to expand and release a resin which bound them together. The cork blocks were then cut to size to create a brick-like appearance. The brick-like blocks were placed on top of one another to form the cabin structure. The cork blocks were laid directly onto the ground, no foundations were required, as cork is naturally resistant to rotting. The density of the cork can be controlled during the manufacturing of the blocks. Low-density cork was chosen to be used on the floor and roof due to the insulation properties and level of waterproofing, whereas high-density cork was used on the walls as it can withhold stronger vertical loads, including natural forces such as the wind. To add further support to the cork structure, locally sourced timber was incorporated into the studio. Cork is a widely recyclable material, therefore when the Cork Studio is no longer wanted it can easily be taken apart and disposed of in a non-damaging way. This would result in the land it was on returning to the state it was previous to the built structure.

This process of using cork is very easy to replicate, and the cork blocks have potential to be manufactured in the home, meaning that we are able to produce and construct our very own sustainable structures from the comfort of our own home. These could be similar to the Cork Studio, and take on a shed or cabin-like structure or potentially the cork bricks could be used to build home extensions. There is a possibility of cork also being used as internal walls, due to the properties of cork it would provide great acoustic and thermal insulation as well as becoming a unique feature of the home due to its aesthetics. By finding low-cost environmentally friendly solutions to construction, the opportunity of building infrastructure is opened up to

14 Studio Bark. 2018. *Buildings Can Be Made Of Solid Cork: We Built This To Prove It.* [online] Available at: https://studiobark.co.uk/buildings-can-be-made-of-solid-cork-we-built-this-to-prove-it/

DISAPPEARING MATERIALS

a large demographic, who may usually turn to damaging low-cost materials such as concrete. Although the process of creating cork bricks within the home may be time consuming, the sense of achievement may bring greater enjoyment and encourage care towards structures built from the homemade brick. Also, the overall cost would be reduced as no extra labour cost would be required. The innovation of cork bricks opens up the opportunity of leading an environmentally sustainable lifestyle to everyone.

Fig 5: Studio Bark, Cork Studio, 2018. Avaliable at: https://studiobark.co.uk/buildings-can-be-made-of-solid-cork-we-built-this-to-prove-it/

DISAPPEARING MATERIALS

Fig 6: Studio Bark, Cork Studio, 2018. Avaliable at: https://studiobark.co.uk/projects/cork-studio/

As well as making objects which disappear through the process of reuse and recycling, it is also possible to create a structure which would completely biodegrade.

WASP, a 3D-printing technology developer company, produced a 3D printed house which used locally sourced natural materials. Named Gaia, meaning land, earth and mother nature, the structure is economically sustainable due to its use of natural waste materials originating from rice production. In order to create the 3D-printable compound, WASP used soil from the site, chopped rice straw, rice husk and hydraulic lime[15], all of which are natural materials and therefore completely biodegradable. Gaia has an extremely low environmental impact. Due to its design, no energy is required for heating or cooling; the structure maintains a comfortable level of heat all year round. By incorporating state of the art technology with new natural materials, environmentally sustainable buildings are easier to produce than ever before. Gaia used a crane-like 3D printer to construct the walls of the house in just 10 days.

The first ever built houses were constructed using hair, mud and manure. The methods humans used to construct were not damaging to the environment. The materials used were sourced on or near the site and were natural. The structures would naturally deteriorate if not maintained and would leave no marks on the environment. Going back to these former ways of building could have a significant impact on humans taking a step in the right direction in terms of being environmentally sustainable. However, not everyone will appreciate their homes having an unpleasant smell and having to touch manure and mud in order to maintain a home. As shown in the case studies, there are ways in which we can be inspired by how construction used to be; by looking at nature and using what is naturally provided to us combined with modern processes such as using technology to assist design, construction would be a lot less damaging.

15 WASP. 2018. *The First 3D Printed House With Earth.* [online] Available at: https://www.3dwasp.com/en/3d-printed-house-gaia/

Whilst allowing buildings to fully decay is a satisfying thought, it would not be practical in the modern world to wait for a building to disintegrate before it is replaced. With the human population continuing to grow and increasing demand, we are quickly running out of space. Rather than waiting a long period of time for buildings to fully breakdown and decompose, we could take forward some elements of these case studies by creating parts out of natural materials (which can easily and quickly degrade), and apply them to current industrial processes. The use of biodegradable materials, combined with reusing parts, or recycling the materials through the application of advanced technology such as 3D printing, would dramatically reduce the environmental impact of a building at the end of its life.

This rapid reuse of parts and materials would allow the rate of building to keep pace with housing demand. This way, space would not be blocked by unwanted buildings and construction would have less of a negative impact on the environment.

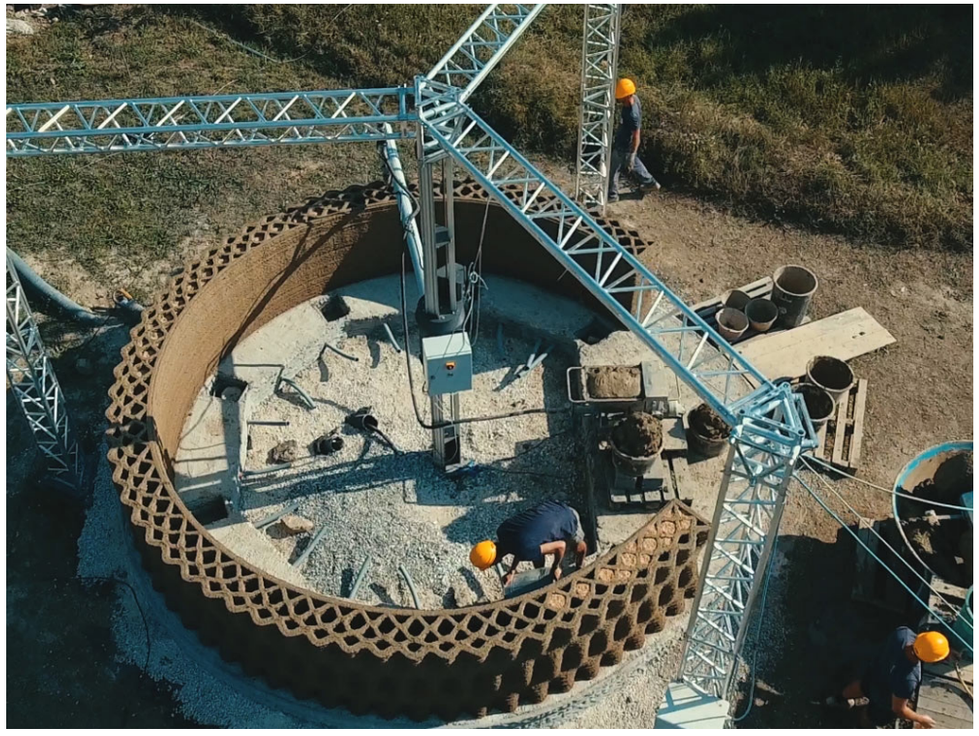

Fig 7: WASP, Gaia, 2018. Avaliable at: https://www.3dwasp.com/en/3d-printed-house-gaia/

LIVING MATERIALS

"One person's dirt is another's patina" [16] (Cairns & Jacobs, 2014).

Often viewed as an unwanted piece of dirt, the patina is a by-product of ageing and weathered materials. Through the eye of a designer, a patina is often a valued attribute of buildings which adds significant age value. The patina develops over time and expresses the beauty of aging and decay. The ageing of materials adds a further dimension of interest, and often tells a story of time.

The aging of materials provides unique colourations and textures. By allowing materials to age a space is given life as it will slowly change over time. Alexandra Palace, located in North London, recently undertook a big restoration of their Victorian theatre. The theatre was built to bring performances to the Victorian audience. Up to 3000 people could be in the auditorium at one time and some of the most popular shows were pantomimes. Over the past 80 years the theatre was not accessible to the public and fell into disrepair. Alexandra Palace wanted to bring the hidden theatre space back into the public eye. The construction began in 2016 to restore the theatre and bring it back into use. A key focus of the project was to retain the beauty of the decay, which showed the original Victorian occupation as well as providing a shabby style which fits in with the rest of the palace. When working on the theatre floor, each floorboard was numbered when lifted, so each floorboard could go back into the exact same place once the work for flattening the floor was complete. The walls were left in their state of disrepair. Brick was left exposed and the Victorian plasterwork left worn. The only change made was that a translucent seal was coated onto the plaster work to prevent it from further decaying.

16 Cairns, S. and M. Jacobs, J., 2014. *Buildings Must Die.* Page 70

Fig 8: Feilden Clegg Bradley Studios, Alexandra Palace Theatre, North London, 2018
Avaliable at: https://www.dezeen.com/2019/08/11/alexandra-palace-theatre-east-wing-restoration-renovation-feilden-clegg-bradley-studios-uk/

The term decay does not always refer to a physical deterioration; the loss of memory is also a type of decay which naturally occurs during life[17]. Buildings often hold memories of previous occupation and use, through the process of adaptive reuse, these memories can be preserved. Within the walls of many ageing buildings, elements of history can be found. From bullet holes to markings, the existing walls can tell a story of the life of previous occupants. For thousands of years, we have been looking at surfaces to discover more about human occupation and environmental history, for example looking at drawings in caves to discover how we lived before any urban developments were made.

A good example of history being preserved within a building is The Neues Museum. Originally completed in 1849, The Neues Museum is a key heritage site in Berlin. During the second World War, the Neues Museum became a target and suffered substantial bombing, resulting in 70% of the building being destroyed. The museum was unusable and was left to decay, until architect David Chipperfield and restoration specialist Julian Harrap undertook a large renovation project which took a decade to complete. It was important to both Chipperfield and Harrap to highlight the damage caused by the second world war bombing rather than doing a full restoration, as this was a key part of the Neues Museum's history.
As a result of the bombing, the Victorian columns were blackened, also there were bullet holes visible in the brick walls. The columns and walls were kept in their state of disrepair in order to display the extent of damage and decay the building had suffered. The most iconic part of Chipperfield's design is the central staircase. The original staircase was completely destroyed, however, photographs of the original staircase existed. Chipperfield decided to create a new staircase which mimicked the design of the original, which was in-keeping with the history telling design proposal.

17 Cairns, S. and M. Jacobs, J., 2014. *Buildings Must Die.*

Fig 9: David Chipperfield, Neues Museum, Berlin, 2009 Avaliable at: https://davidchipperfield.com/project/neues_museum

As well as allowing buildings to live, it is possible to include physically living elements which help to neutralise the carbon emissions rate of the site. By having carbon absorbing materials, the CO_2 rate can be mitigated.

Living walls and green roofs are becoming more and more popular within architectural design. As well as providing a pleasing aesthetic, the living wall and green roof help to reduce energy use and carbon emissions. As plants absorb carbon dioxide through the process of photosynthesis, they are a good addition to help offset carbon emissions produced within the manufacturing and construction stage. They also create unique habitats for wildlife to explore and create a home.

Vertical living walls require a complex supporting structure, as well as an irrigation system and a lot of maintenance to keep the plants alive. Scientific researchers at Universitat Politècnica de Catalunya (a university in Barcelona) have developed a biological concrete where moss, fungi, lichens and microalgae thrive[18]. The concrete consists of multiple layers. A biological layer absorbs and stores rainwater, this creates the optimum location for the moss, fungi, lichens and microalgae to grow and colonise. A waterproof layer is behind the biological layer to protect the inner structure. The cement used for the biological concrete consisted of two types: standard Portland cement and magnesium phosphate cement, which is slightly more acidic, therefore allowing the biological growth[19]. There are added benefits of allowing lichens to grow on a building; they are natural indicators of pollution. Depending on the colour of the lichen, you are able to determine the level of air pollution within your area. This then has the potential to increase awareness of air pollution within the surrounding environment.

Materials do not have to be physically living to absorb CO_2. When exposed to air, concrete undergoes a process of carbonation. Carbon dioxide is slowly absorbed, this reacts with the calcium hydroxide to form calcium carbonate, this ensures that the carbon stays locked within the concrete[20]. As mentioned in Rethinking Materials, concrete is considered a destructive material due to

18 Chalcraft, E., 2013. *Researchers Develop "Biological Concrete" For Moss-Covered Walls.* [online] Dezeen. Available at: https://www.dezeen.com/2013/01/03/spanish-researchers-develop-biological-concrete-for-moss-covered-walls/

19 Transmaterial. 2017. *Biological Concrete.* [online] Available at: http://transmaterial.net/biological-concrete/

20 CEMBUREAU. n.d. *The Cement That Absorbs Carbon Dioxide.* [online] Available at: http://useofcement.cembureau.eu/2018/04/09/the-cement-that-absorbs-carbon-dioxide/

its manufacturing process. Despite this, it has the ability of offset its carbon emissions when left exposed to air, the offset of emissions is typically not considered when determining the carbon emissions of concrete.

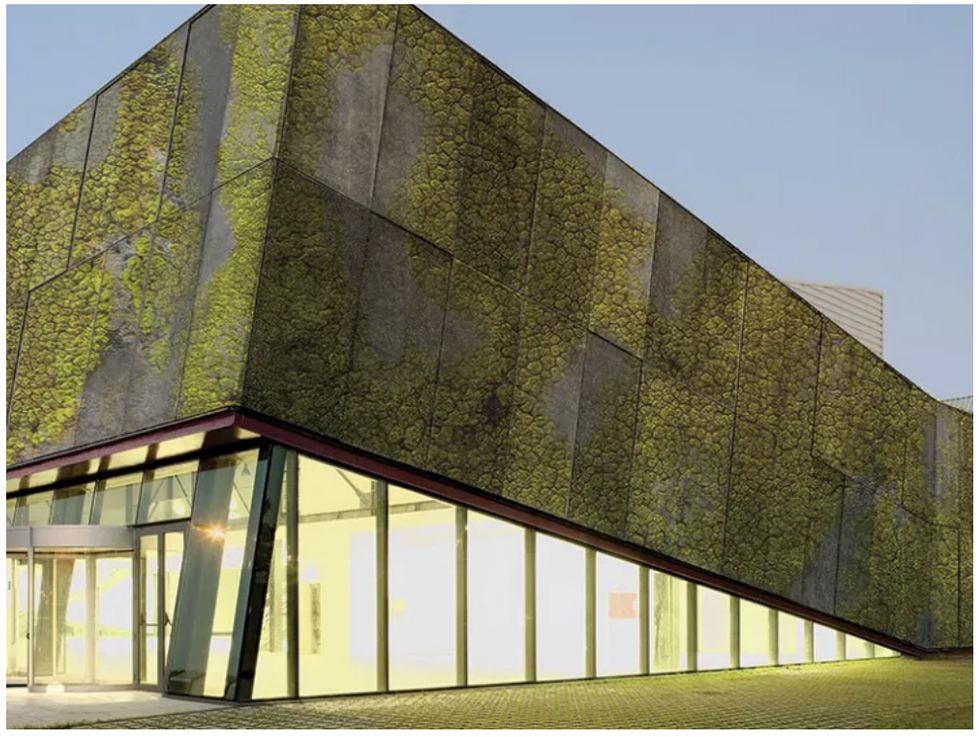

Fig 10: Universitat Politècnica de Catalunya, Biological Concrete, 2013 Available at: http://transmaterial.net/biological-concrete/

CONCLUSION

"it is our responsibility to mother the natural world"[21] (Oxman, 2019).

By exploring and considering how we change our modern ways of construction, can have a drastic impact on our global greenhouse gas emissions, and rate of climate change. Through the re-thinking of the existing where we have the potential to use our waste for the better; rather than letting it build up and pollute the ground, we can turn it into tomorrow's raw material. This would save the exploitation of our depleting resources of current raw materials (oil, gas, coal etc.), and therefore limit the impact we have on the environment. Allowing materials to decay and disappear put a life cycle on our infrastructure, this allows for the entire structure to return back to ground, eventually making it appear as if it had never been there. This process results in little environmental impact as it leaves no trace, and the natural environment is returned to its former state. By embracing the natural decay of materials, we eliminate the need for replacing them with new components.

These three alternatives to the modern-day construction industry have the potential to significantly reduce global carbon emissions, which help towards reducing the current pace of climate change. Most of these are currently available and usable for construction and manufacturing today, so why are we still avoiding tomorrow and carrying on using damaging materials and construction methods?

21 *Abstract* (2019) *Neri Oxman: Bio-Architecture*. Directed by Neville, M.

Despite this writing portfolio having a focus on the impact of construction methods and materials on the environment, it is our personal choices and habits which also have an influence on trends, including those on how we want to create or use our buildings. By making reuse more popular within our daily lifestyles, whether this is through recycling, choosing products which are manufactured using renewable resources, or turning our unwanted goods into something desirable to yourself or someone else, the current trends which are currently considered as damaging to the environment would be replaced with new ones which further promote environmental awareness and help care for our environment.

Without human interference nature thrives. This can be seen in abandoned towns and cities, including Chernobyl. Since the nuclear disaster in 1986, Chernobyl has been vacant. Due to there being no human occupation, the environment has been left to go wild[22]. All the buildings have trees and shrubs growing through them, foxes and other wildlife creatures made the houses their homes. Chernobyl is considered by many to be the worst man-made disaster, however, this is not the case. As stated in *A Life on Our Planet*, we are currently living in the worst disaster of the making of humankind[23]. Climate change is something which will impact everyone. It is only down to human interference as to why nature and the climate are currently deteriorating.

The only solution is to all come together and make the most out of all the resources available to us, and begin to embrace different building methods, so that we can sustain the lives of one another as well as the lives of wildlife and nature. If we do not make small changes to our individual choices, we will be relying on finding a second planet to live on sooner than expected, as much of Planet Earth will become uninhabitable to all living organisms!

22 Barras, C., 2016. *The Chernobyl Exclusion Zone Is Arguably A Nature Reserve*. [online] BBC. Available at: http://www.bbc.co.uk/earth/story/20160421-the-chernobyl-exclusion-zone-is-arguably-a-nature-reserve

23 Attenborough, D., 2020. *A Life On Our Planet*.

CONCLUSION

Fig 11: Chernobyl, Pripyat. Photographed by: Pendleton, J. Available at: https://www.obsidianurbexphotography.com/leisure/pripyat-palace-of-culture-energetik-music-school/

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