

How might Biophilic Design and Technology coproduce our interior spaces in the future?

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Course: Surface Pattern and Textiles
Word count: 5283
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This Independent Inquiry report will explore the changes brought to our lives through a post-lockdown point of view as well as how this could change our interior design endeavours for the future. Taking on current events and sources, this dissertation will journey through topics such as the effects of lockdown on our psyche and how we have healed through nature and Biophilic design, along with the adaptability our spaces have had to succumb to and the rising awareness of sustainable circularity. This written piece will also dive into hypothetical and cutting-edge research and innovation projects of technology and synthetic biology that will have the power to re-design our spaces to be healthier and more sustainable places to live and for wildlife to flourish.

During our time in and out of lockdown, we have had to adapt our living spaces to our new lifestyle requirements, working or studying from home. Government issued guidelines made it compulsory for everyone to isolate, significantly decreasing the usual daily human interactions and travel from one place to another, to protect ourselves and others from this very contagious virus. This has been quite a big change from our fast-paced lives as we have had to drastically switch overnight from one very busy way of life to another; limited access to the outside world, and where our work or studying desks were only a few feet away from our sleeping arrangements.

The loss of structure and separation between productivity, creativity and resting meant facing a time of uninspired and unproductive work ethic as our workplace or learning institutions merged into our personal space. The boundaries between the two became blurred. It has really been apparent over the course of the pandemic that adapting to working from home hasn't been easy, as 'psychologically that lack of separation has resulted in a number of issues, with many struggling to work and others finding it hard to switch off' (ELLE, 2021). This confusion comes from the expectation set by ourselves to be just as productive even though these are unprecedented times, New York Times newsletter states. During lockdown we were constantly reminded that these feelings are normal as this event is completely unexpected and the only way to adapt is to let ourselves be unproductive or less productive as we build the boundaries between work and home back up again (Herrera, 2020).

In addition to feeling unproductive and uninspired, there was a deep psychological impact during the time we had to spent in isolation. Studies show that there was a serious decline in mental health especially in younger people aged 13 to 25 years old. YoungMinds, a charity

fighting for children and young people's mental health, state in their Summer 2020 report, '83% of respondents reported that their mental health had become worse' (YoungMinds, 2020) in lockdown, which grew since the previous survey in March 2020 from 32% to 41% (YoungMinds, 2020). In response, Erica Poyser, New Designer class of 2021, created *Catharsis*, in direct response to the YoungMinds charity survey as shown in Fig. 1. The work, made from sand blasted blown glass, represents 'the overwhelming emotions many have tackled alone over the past year' (New Designers, 2021), bringing relief through structureless and slumpy shapes as well as using grey tones to emphasize the general loss of structure and negative emotions that weighed on most of us at this time.



Fig.1. Erica Poyser, *Catharsis*, (New Designers, 2021)

This exceptional moment in time has mandated us to completely stop our momentum of life and take time to reflect, recentre and reassess every aspect of our existence on a global scale.

The conditions of the pandemic, the loss of many lives and the rapid decline of mental health, have allowed for a sense of rebirth, in ourselves and in nature. Throughout this year, we have been encouraged to go on daily walks, take advantage of the fresh air which became a big part of our lives and has reconnected us to nature and the world around us as this was the time of day where we would be away from our screens. These daily walks became a need for everyone to be in nature and caused a shift in interior design where health and well-being became a big part of our homes (ELLE, 2021). Many of us needed to bring back this sense of

freedom, relief and rejuvenation nature carries, indoors. This phenomenon is noticeable through “lockdown’s houseplant trend” that London photographer, Akiko Dupont was able to capture during her venture in the streets of South London and reported by BBC News as seen in Fig. 2.



Fig.2. Akiko Dupont (Lee, 2021)

Many of the subjects photographed by Akiko say that plants have had an impact on their psyche especially over lockdown. ‘Plants have such an amazing way to heal and bring us renewed hope’, says Joy, Akiko’s first subject (Lee, 2021). Akiko’s subjects collected house plants during the pandemic for therapeutic reasons stating that ‘it brightens up the mood’ and ‘looking after plants is like looking after yourself’ (Lee, 2021) (Browning, et al., 2014). This houseplant trend is evidencing that we are more emotionally involved in the things we bring into our spaces in order to take care of our minds and souls. This is the start of letting nature back into our urban world through Biophilic design.

Biophilia or Biophilic design is the practice of bringing nature back into our constructed environments and endorses the enjoyment of nature into our urbanised spaces where we work and live (Browning, et al., 2014). There are three fundamental principles to the practice of Biophilic design: Nature in the Space, Nature Analogues and Nature of the space. Nature in the Space is the direct presence and interaction of nature in the space. Nature Analogues is the non-presence of nature while still sensing a feeling of rejuvenation through an imprint or connotation to nature. And nature of the Space, where the constructed environment around us fascinates our curiosity and creates a feeling of interest and enthusiasm towards the unknown and the dangerous (Browning, et al., 2014). Biophilic design has shown to reduce stress, anxiety and fatigue and promotes creativity and productivity.

A ‘Quantitative improvement in workplace performance through biophilic design’ case study by Julia Ayuso Sanchez, Toshiharu Ikaga and Sergio Vega Sanchez, demonstrates that by introducing small items of biophilia to a place of work, employees or students are more likely to respond positively, influencing their mood and therefore being more productive and creative during work hours. This study is an experiment measuring the effect of biophilic design and its impact psychologically and physiologically. This study puts to the test the positive impacts of greenery and daylight, against numerous feelings one might have on the daily such as stress, fatigue and activity. ‘Participants in biophilic space have 4,92 points more in creative task scores, better environmental perceptions, and fewer symptoms than those in the control space’ (Quantative Improvement in workplace performanche through biophilic design: A pilot experiment case study, 2018) demonstrating that combining different aspects of biophilia such as greenery and light make the biggest difference on the statistical values.

Companies such as Interface are working hard to raise more awareness about the benefits of Biophilic design in work and learning spaces. Interface, a global company specialising in the design of flooring with the goal of being carbon neutral, work in great detail with architects, designers and clients to create human-centred spaces, where the space responds to users’ needs (Heath, et al., 2021). Their philosophy is centred around creating “+Positive Spaces”, where impact is the key word. They challenge themselves to produce a positive impact on spaces, people and the planet, where biophilic design is their main source of inspiration by

using sustainably sourced materials as well recreating the feeling of walking through nature through their material and patterns (Heath, et al., 2021).



Fig.3. Interface Flooring, (Heath, et al., 2021)

Poor spatial design can be detrimental to our mental health with corporate offices suffering from a huge loss of work time, estimated £29 billion per year, due to work related stress and unproductivity (Interface, s.d.). Interface believe it is because there is a lack of connection between humans and their surroundings. ‘In an urban world of technology and industrial architecture, this fundamental connection [with nature] can sometimes feel all but lost’ (Interface, s.d.), which is most likely one of the reasons why we have unconsciously looked towards nature for a sense of revival and inspiration during lockdown. This company also has a blog page collecting numerous case studies and articles related to positive, human spaces such as ATXK’s new office space using some of Interface’s flooring that is contributing to their design endeavours.

ATXK, leading interior construction company in Mexico and Colombia, saw an opportunity to innovate in their office space after many years of practice and fully incorporates Biophilic design in the most explicit way.



Fig.4. Communal Workspace, (Interface, 2021)

By designing the abstract shape of a tree in its communal workspace as shown in Fig.4, this suggests the importance of unity within the company's divisions and the importance of employees being able to report comfortably to their co-workers, their projects, as 'this is the area where no one has an assigned seat' says Adrian Ruano, CEO of ATXK. ATXK have specifically chosen Interface as their flooring company as they share two important and recurring issues in this project, Biophilic Design and sustainability. The choice of carpet in this workspace was made to complete the vision of the abstract, oval tree, as it represents the mossy, grassy landscape of the forest ground (Interface, 2021).

We are no longer in lockdown but still in the midst of a global pandemic which is why we are embracing a hybrid approach to our workplace connectivity; in-person and online. We might consider this to be the future and smarter way of working as lockdown has meant more time spent well reconnecting with ourselves and loved ones through technology. Pre-pandemic, open plan design spaces have been the most popular as they bring everyone together. Nowadays, as we are spending more time indoors in our own homes, there is a 'push for privacy' (Kitchen & Bath Business, 2020). Having a space dedicated to a specific activity means reaching a state of flow and staying focused can be achieved for longer.

Orangebox are a UK office furniture company who have branded themselves a “smart working company”. As an organisation they celebrate and promote working in healthy conditions, physically and mentally, in symbiosis with the blended work life we will continue to embrace post-pandemic (Orangebox, 2021). Prior to the pandemic Orangebox commissioned a case study reporting the designs of Scott Brownrigg exploring ‘the workplace of the near future’ (Dreams Unboxed, 2021) at SmartWorking London. This case study provided a considered solution to the duty of companies to make the workplace of their employees and collaborators not only a place of production, but a place of wellness and wellbeing, where all are comfortable sharing their ideas and aspirations for the company. The space designed by Scott Brownrigg was an experiment project, free of any commercial value, but necessary for marketing the workplace of tomorrow through Orangebox’ office furniture collection. Each microenvironment is catered to an experience, rejuvenation, immersion, tranquillity and interaction, translated through materials, design and biophilia.

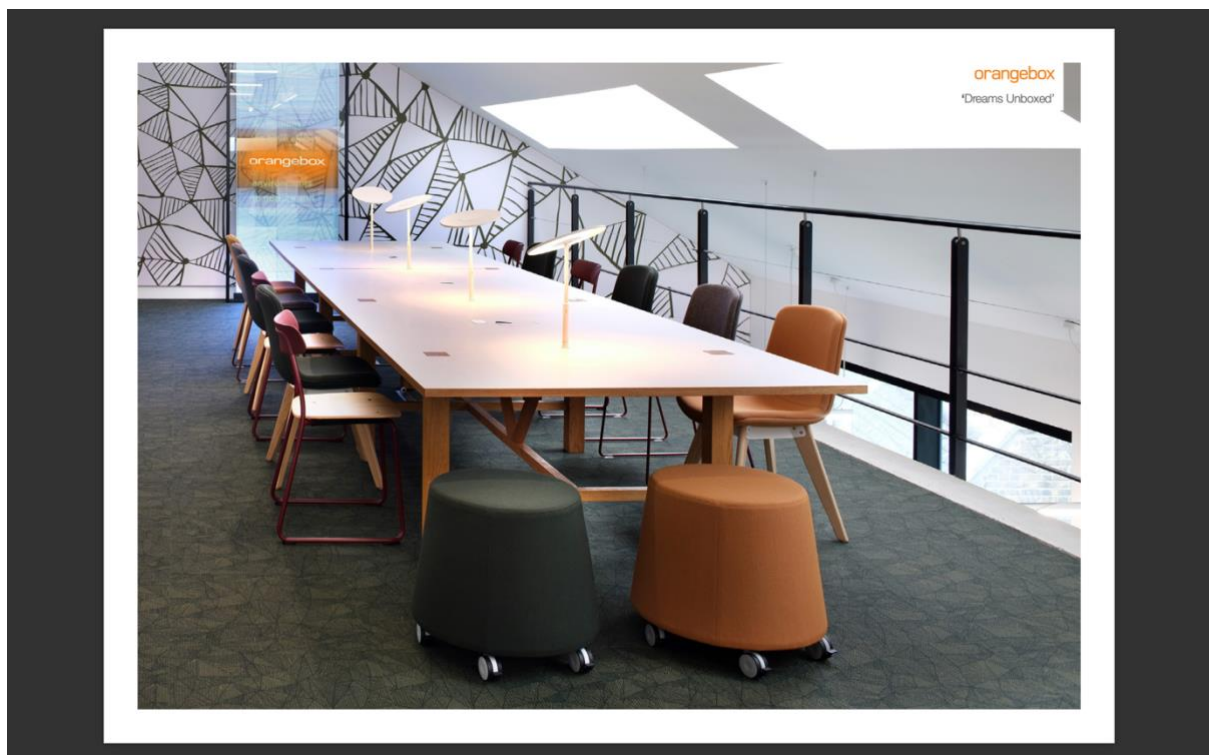


Fig.5. Group Focus, (Dreams Unboxed, 2021)

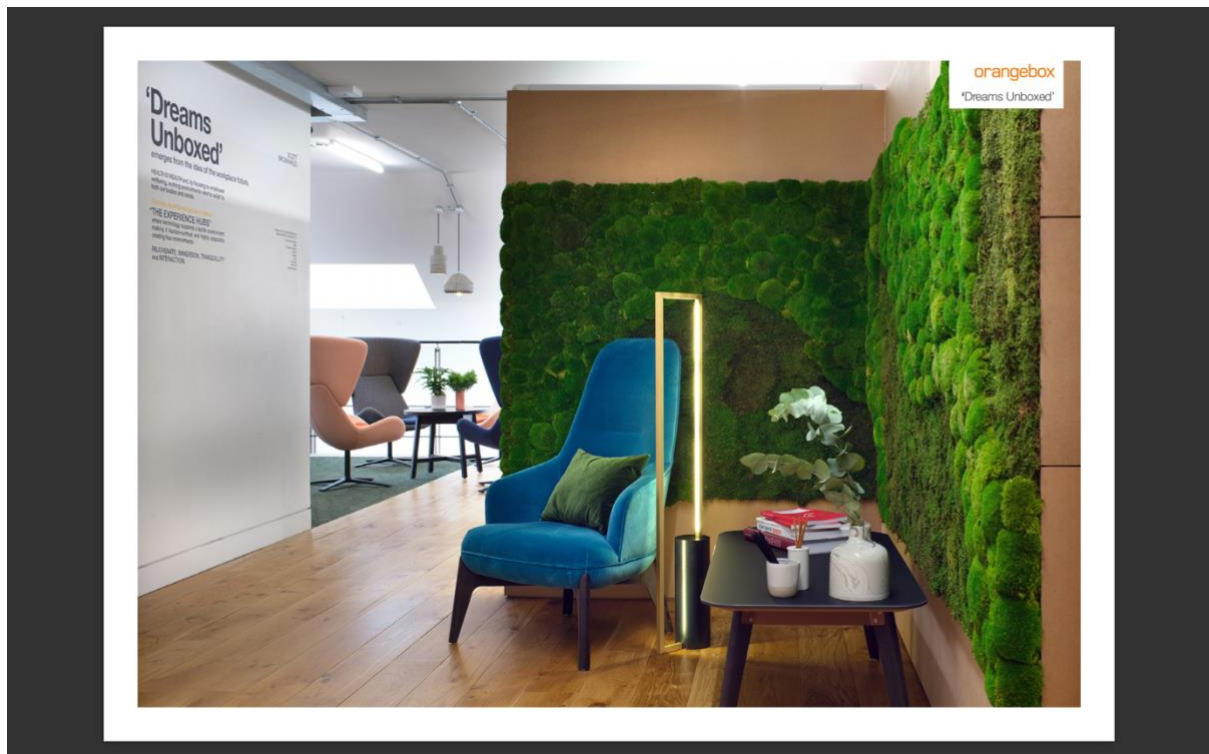


Fig.6. Microenvironment, (Dreams Unboxed, 2021)

Inspired by the workplace of the near future and Biophilic design, Orangebox create spaces specific to the needs of users, producing microenvironments within a space to maximise time spent being productive and focused. Microenvironments have been essential to us during lockdown in order to build the boundaries between work, studying and resting in our living spaces. Having the adaptability of different microenvironments to choose from, facilitating to each individual's needs, contributes to a successful working day.

Scott Brownrigg is also responsible for the design of Google offices, 123 Buckingham Palace road in London, in 2011 (Scott Brownrigg, 2019). This office space is a fully functional workspace with a dynamic and playful style but also contains all the facilities necessary for wellness and wellbeing such as a yoga and pilates studio, gym, spa and restaurants.



Fig.7. Google Offices, (Warmann, 2011)

The workspace has a London/Brighton theme that is celebrated through novelty pieces like Daleks, as well as microenvironments shaped as beach huts or red telephone booths. All these amenities are to promote a dynamic and a strong collaborative work ethic. This is an open plan space where each of the 300 employees can choose where to work for the day, there are no designated desks. Small meeting booths, conference rooms and individual workspaces are built into the space to support group or individual focus, but very few traditional offices. Google also adds their personal touch by creating doorways in its giant logo O's (Warmann, 2011).



Fig.8. Logo doorway, (Warmann, 2011)

This project completed in 2011, shows that already big companies such as Google, Apple and Adobe, for example, have the means to design spaces that can promote wellness just as much as they can for work. As blended working or studying is here to stay, more spaces such as the Google offices will surely rise in the next decade and we will be able to switch our “office” space every day for a new location.

Considering how much the pandemic has paved the way for new interior design trends such as Biophilia and microenvironments as well as pushed through the stigmatism of working from home since we are now offered this blend and flexibility of working, we can now question what place technology has in these new aspects of life. Since the dawn of time, the human race has constantly innovated in tools and practices and today we face the consequences good and bad that these innovations are having on our existence and our environment. In this 21st century, we are confronted with our biggest innovation of all that has already changed the course of history, Technology. We are already witnessing the power and influence technology is having on our everyday lives, personal and professional, though our daily use of smart phones, laptop, smart houses, alongside the advances and the opportunities it affords us as a race going to the moon, the power of the internet.

As interior design and lifestyle are evolving post-lockdown, The Facebook company recently rebranded to The Meta company, are pushing the boundaries of connectivity, working, learning, entertainment and design through their new innovative virtual and augmented reality worlds called the Metaverse (Meta, 2021). The Metaverse, believed to be the future of the internet, is the blending of our physical world to the virtual one in order to better organise our time around the things that matter. Thanks to the Metaverse we will be able to experience the world differently as we will no longer rely on a series of different physical devices such as smartphones or laptops to work, study, connect and play. For the moment, the Metaverse requires a virtual reality headset or augmented reality glasses that in time will look like normal, wearable, stylish glasses (Keynote, 2021). The Metaverse’s number one priority is connectivity, so each individual will be able to experience things with other people just as they would be in the physical world, no matter the location of each person (Keynote, 2021). In developing the Metaverse, Meta has understood the changes brought by the pandemic and is innovating to build a virtual workspace completely customisable to our own preferences and needs. This workspace will not be constrained to the screen size of our laptop, tablet or

phone and we will be able to take on as many tasks as we can manage through holograms. Meta is also on the way to perfecting different types of virtual avatars especially a most realistic virtual version of ourselves to attend work meetings online, for example. This will be done through holograms that project a life size avatar of yourself as to create this sense of a physical meeting no matter where you are (Keynote, 2021).

The Metaverse's augmented reality holograms can help us not only design a space and trial different products such as wall coverings, decorative objects and furniture, but it can also support a blended physical and virtual design (Keynote, 2021). This means that we will have the choice whether to purchase physical products or the virtual image of said product. Fast fashion brand, ZARA is exploring this virtual and physical blend through their commission from designer Shane Fu for their New York store (Hahn, 2021). This is an online window display that is so realistic that it is fooling people to come see it physically. Shane Fu uses 3D software to create “the illusion of a three-dimensional room unfurling behind the windows, inhabited by a swarm of rainbow-coloured spheres” (Hahn, 2021). This non-existent installation paves the way for further exploration and potential of the virtual meets physical spaces in retail.

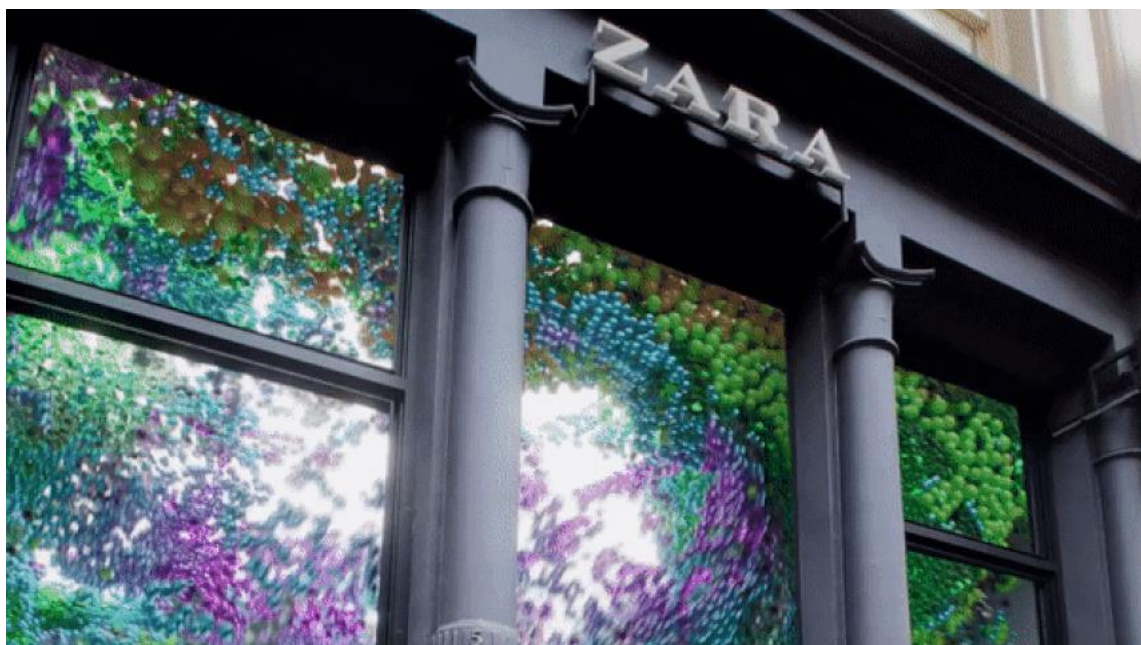


Fig.9. Shane Fu commission for ZARA, (Hahn, 2021)

In addition to curating our interior spaces virtually, we can also integrate our own fantastical worlds into our homes. As suggested in the Metaverse keynote, we could choose to have a

virtual forest in our own homes, as in Mark Zuckerberg's living room (Keynote, 2021). Just like the ZARA store front we could create non-existent spaces that are only composed of data allowing us to be as creative as we possibly can, consuming data as opposed to physical product. The possibility of this technology encourages us to all become creators and artists, to come together in building virtual worlds, creating one big community of Metaverse users. Being able to create virtual extensions of our spaces opens the limitless possibilities of the Metaverse's potential for interchangeability and digital surfacing.

Much like these incredible innovations of the virtual world of the Metaverse, we have experienced simpler, less immersive, physical meets virtual spaces during the pandemic. Museums, exhibitions, fashion shows and showrooms were all adapted to be viewed online, as well as nature and wildlife through live stream webcams. Greenpeace and the BBC are helping us to stay connected with nature and the world by providing 24/7 live stream feeds (BBC News, 2020), (Young, 2020). Watching or projecting live stream webcam feeds of the world to a wall while reminiscing our time spent outdoors became the new way of traveling and exploring. Virtual travelling could be something that we keep experiencing post-pandemic, as augmented reality is improving and soon to be in our grasp, relieving the stress put on nature by avoiding physically traveling as much as we do.

This virtual life we have led during lockdown has witnessed a small shift in the environment. As the strain and oppression on nature's resources relaxed from lesser vehicles on the roads, no traveling, no tourism, and overall, less consumerism, some parts of the world have witnessed a resurgence of nature in the urban world. Pink dolphins in Hong Kong, flamingos in Mumbai and pelicans in central London (Walker-Arnott, 2020), all these "abnormal" events show that as soon as the hustle and bustle of human life is quiet, nature is quick to act. Supported by the innovations within technology it has highlighted the need to be more conscious about the things that we truly need in our lives such as health and the connection to our loved ones. Rather than continuing to practice over consumption of material goods we are learning the importance and impact of the circularity of our possessions.

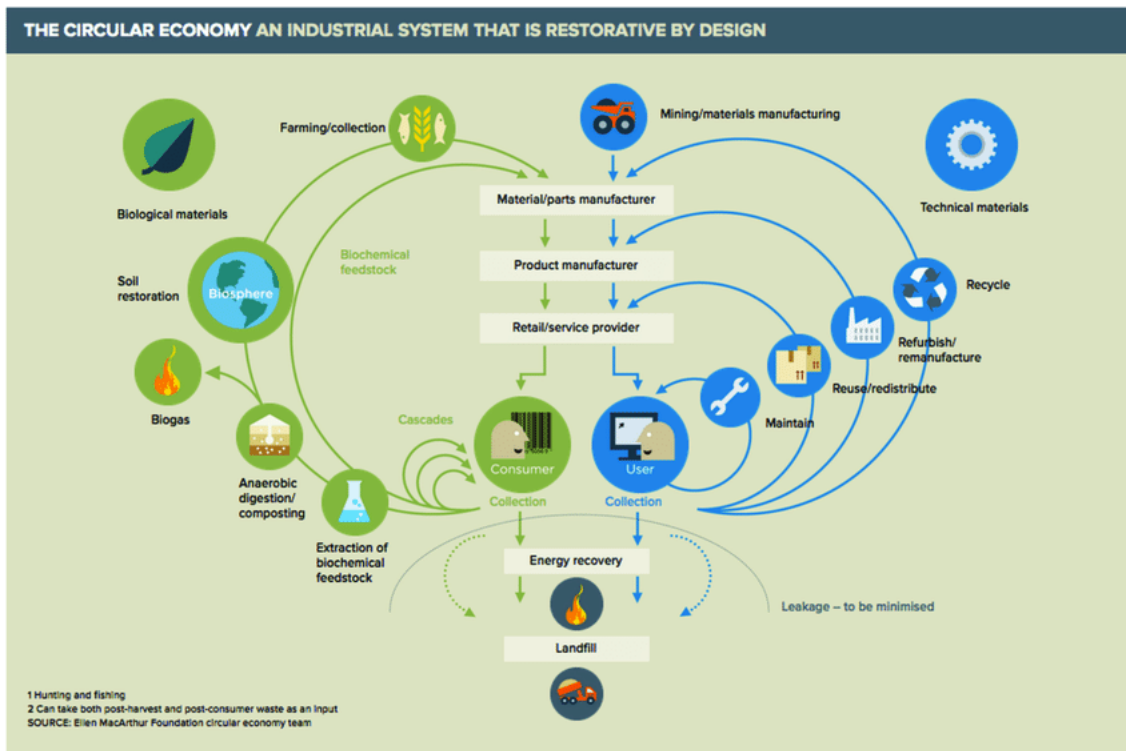


Fig.10. Circular Economy Diagram, (Beaulieu & Van Durme , 2015)

A circular economy is optimising our products lifespan by creating better quality items that are renewable through repairing, reusing and recycling and consciously using materials that are sustainable for the environment (Jain, et al., 2020). This circular model became more interesting over lockdown as we were relying on the durability and quality of our current products in order to get us through a time where it was not possible to go out and purchase new clothes, appliances, devices. Consumption of non-essential goods was deemed less important as we faced the global realities of the pandemic, heightened by the continued discussion of the global climate crisis.

Today, more than ever, it is important to be connected, however our technology continues to come at a cost to the natural world. While data innovations are future forward thinking our physical devices continue to require mined materials for production. This is why the innovation of environmental technologies is so important to progress towards cutting edge innovations such as the Metaverse. By developing technologies that are smarter, supported by the renewable resourcing of data, could this be a hypothetical design solution that better supports the circular economy?

Smart technology is the technology present for example, in smart homes, where devices are internet connected, monitoring, analysing and collecting data in accordance to the user's behaviours and needs (Proudfoot & Kelley, 2017). This technology will in time learn and regulate our energy consumption by turning on and off lights, or regulating the heating depending on our whereabouts, in order to make our lives easier and less costly to our bills and natural environment (Proudfoot & Kelley, 2017). This technology is expanding outside our homes into our build environment, soon to be "smart cities". Today we find free internet spots in almost every building of our cities, this is necessary to support our interconnectivity and upcoming technological advances such as the Metaverse.

Unfortunately, it is quite clear, and more so after the COP26 event, that time has become a luxury we can no longer afford in order to "fix" our broken environment. "Living organically" is no longer a solution capable of reversing the effects of our modern lifestyles, as it will take time for the changes to occur naturally. Which is why WWF is launching Panda Labs, "a multi-year innovation program to accelerate and amplify emerging technology" (Proudfoot & Kelley, 2017) that'll be crucial to the conservation of our environment and ecosystem. The purpose of this program is to connect us all on a global scale in order to effectively innovate in solutions for the environmental cause by bringing together unlikely allies in a joint effort.

As there is more movement and action taken to help the environmental cause and as we move towards a fourth industrial revolution, more designers are thinking virtual. The Valentino Autumn Winter 2020, born from the constraints of a global lockdown was a completely reimagined fashion show when the pandemic came to us, exploring 'the idea of rebirth, placing human values in conjunction with the digital' (Show Studio, 2020). This show consists of beautifully designed and over proportioned white garments that are the canvas for Nick Knight's fashion film '*Of Grace and Light*'.



Fig.11. (Show Studio, 2020)

As the second biggest polluter on our planet, the fashion industry is our main source of over consumption. Replacing the physical collection of trend setting garments of the season with a digitised pattern projected onto blank textiles, this show opened the discussion for change needing to happen within the industry as a step towards becoming more sustainable. This show perfectly illustrates the place technology can have in the future of our fashion industry by digitising patterns that can be projected on a few durable garments instead of constantly changing out our wardrobe.

Naturally progressing towards a virtual world and hopefully a more sustainable one, linear economies highlighted by the cheap clothing created by fast fashion will have to reinvent themselves in order to stay in business. However, this might take some time as there is a certain reluctance, especially in the fast fashion industry to take the steps necessary to instruct on the many environmental and ethical injustices and to restore a healthy balance to consumerism. This can be the approach of the ZARA commissioned virtual window display. This virtual installation poses the question of whether this is the fast fashion industry changing its ways or just a stunt to attract people to the physical place, where the installation does not exist, for business. While this is an obstacle we face as a community, we have to educate ourselves and others on the many discrepancies of industries such as fast fashion that

expect to be more sustainable while following the same faulty and incompatible business model of the linear economy.

Looking forward to the evolution of cutting-edge technology such as the Metaverse, where less product and more data will be the new way of life, we need to think about the future relationship between technology, biophilic design and nature that needs to become. Being the cause of the collapse of the ecosystem we must work hard to preserve what is left as well as using innovative technologies to revive the natural environment and species that are extinct under our rule. The preserving and revival of the natural world are both very costly which is why organisations such as the Panda labs are so important in order to collaborate in a joint effort to solve the massive environmental issues of today and educate on the importance of our ecosystems. As we have looked at the benefits of biophilic design, we have to imagine a world where our built environments are compatible with the natural world and that can support a thriving ecosystem. We can do this by designing spaces that are built for the needs of nature as well as our needs for example creating live walls and indoor gardens that will give a home to species that need to be protected while their numbers grow again. Designing spaces that embrace biophilic design to an extent where ecosystems and species can rebuild themselves uninterrupted, as well as taking care of our general well-being and wellness is the path to a healthier, better and more sustainable lifestyle, for all life.

Experimental artist, Alexandra Daisy Ginsberg has explored for many years, the unlikely relationship between nature and technology through synthetic biology and artificial intelligence (Alexandra Daisy Ginsberg, s.d.). Her goal is to explore ways in which we can innovate in the preservation and regeneration of our natural world. She also encourages the general public to take part as rebuilding our compromised green environments is a work of collaboration. Ginsberg is redefining the role of designer and artist by reconstructing and redesigning our natural environment through technology. She explores the notions of synthetic biology and design in *Synthetic Aesthetic*, an experimental research project of which she is the leading author along with a group of scientists, artists and designers (Ginsberg, et al., 2014). 'Synthetic biology manipulates the stuff of life' (Ginsberg, et al., 2014) and at its core, is the design and programmable data of the natural world. This project explores how we can collaborate in a joint effort to redesign the living world in response to sustainability issues. By engaging with synthetic biology, hypothetical and speculative ideas, it is only a question of our technology being advanced enough to perform. This can determine

the potential for technological innovations to achieve sustainability standards. However, this controversial subject poses controversial questions such as, can the technology of synthetic biology recreate nature as it should be? A synthetically designed natural world is questioning whether this is nature at all, as we are recreating organic matter that hasn't been through millions of years of evolution. Some would suggest that synthetic biology is a step too far from our idealistic and authentic organic world.

Synthetic biology, often confused with genetic engineering, is about seeing the living world and matter as machines, data and codes that are programmable materials (Ginsberg, et al., 2014). Ginsberg's most recent work commissioned by the Eden Project, *Pollinator Pathmaker*, is about using technology to determine what would be the best design layout of plants in gardens to attract and repopulate as many different species of pollinators possible (Ginsberg, 2021). They would be purposefully planted to maximise the time, use and need for pollinators to flourish our gardens and wildlife.

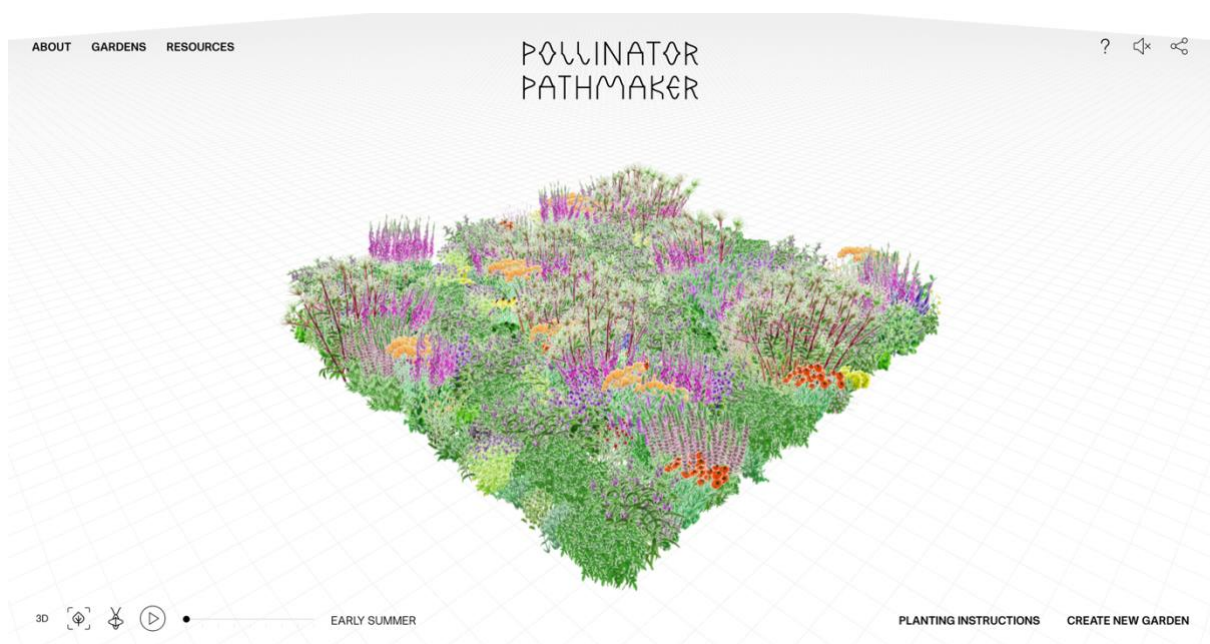


Fig.12. (Ginsberg, 2021)

The technology used to design this permanent art installation is accessible to all through the pollinator path maker website where an algorithm created by Ginsberg and her fellow computer engineers, determines what plants are best suited for the characteristics of the soil and light exposure. Once this information is uploaded to the website, the next step is called “empathy”, meaning that whatever choice we make, the algorithm will always design a space

that is suited to both plants and pollinators to thrive. Finally, we can digitally view what the garden will look like thanks to Daisy Ginsberg's 450 digital plant paintings (Ginsberg, 2021). From there, we have a 3D view of the garden that can be seen and explored through the eyes of pollinators, as well as instruction and shopping list to physically plant and create this space. By designing and planting these gardens for pollinators and other wildlife, 'it uses art to give us empathy and agency to care for them' (Ginsberg, 2021). More and more of these wildlife clusters can really make a difference in the reconstruction and population of our 'human-made ecological damage' (Ginsberg, 2021) of the ecosystem. Using technology to create algorithms to design ecosystems that can support life and become part of a biophilic designed space, can heighten our awareness of nature as well as our wellness and wellbeing. This is the definition of the ideal circular model of life.

Throughout this written piece, we have discussed the ripple effects of the radical changes occurring since the first mandated lockdown of 2020, and the opportunities these changes could do for our future and the future of our planet. The start of this dissertation journey has explored our lifestyle changes from a fast to much slower pace of life and the effect this has had on our mental health. We have dealt with these troubles through a reconnection to nature by being encouraged to do light exercise outdoors. This reconnection to nature has made us more mindful about what we surround ourselves with, such as biophilia and engaging with biophilic design. As the world was put on standby, technology has enabled us to keep some kind of normality as work, school, events, exhibitions were all adapted to an online delivery. It has also been possible to stay connected or even has reconnected us to loved ones as the rise of the health crisis became more severe.

Spending more time adapting and caring for ourselves and others has brought on a conversion about our consumption habits and how to be more sustainable in our daily lives. By making conscious and better decisions such as the circularity of our possessions, especially for our technological devices made from precious rare materials, we are choosing to have less polluting non-recyclable products in our landfills. Looking towards the future innovations of our technology such as artificial intelligence and virtual and augmented reality, we are hopefully shifting towards less devices, more data. This technology will also ensure that we can spend more time enjoying life outside of work or studying, through virtual meetings or taught lessons, for example, that could offer the same experience as if our presence in the space was physical. Nowadays, our technological advances can already help in the

repopulation of wildlife in our built environments as we have seen through the work of Alexandra Daisy Ginsberg, a collaboration between design, innovation and science. Combining Biophilic design, technology and synthetic biology through the engagement of more designers, scientist and artists, can help repair the damage done to our natural environment as well as create better spaces for our wellness and wellbeing. In doing so, can be born, designed as much for humans than it is for nature, the new era of interior design.

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Images:

Figure.1. (New Designers, 2021)

Figure.2. (Lee, 2021)

Figure.3. (Heath, et al., 2021)

Figure.4. (Interface, 2021)

Figure.5. (Dreams Unboxed, 2021)

Figure.6. (Dreams Unboxed, 2021)

Figure.7. (Warmann, 2011)

Figure.8. (Warmann, 2011)

Figure.9. (Hahn, 2021)

Figure.10. (Beaulieu & Van Durme , 2015)

Figure.11. (Show Studio, 2020)

Figure.12. (Ginsberg, 2021)