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WHEN THE FUTURE BECOMES NO LONGER A THREAT BUT, MORE, AN OPPORTUNITY

CUANDO EL FUTURO YA NO ES UNA AMENAZA SINO, MÁS BIEN, UNA OPORTUNIDAD

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Abstract

The City of London is entering new and relatively unexplored territory with its intention of making "Culture and Commerce stronger together". An opportunity to demonstrate this ambition exists at London Wall West, a site in the cultural heart of the Square Mile, but plans drawn up so far have attracted considerable opposition as they involve the demolition of existing buildings. Even though the City stands firm in its conviction that new buildings are required, justifying this approach in a world where construction accounts for 39% of the planet's global greenhouse emissions is challenging. The proposed answer, "Building Less is More", will require the City to develop a degree of confidence in the idea that, in part, London Wall West can become virtual. We can anticipate that to design and construct a new virtual world, where people can spend time that is as good as in the outside physical world, London Wall West must become a test bed for experimentation on how to turn "conjecture" into reality. As in the physical world, the creation of a virtual realm depends on defining and understanding the determinants of people's behavior. Architects are already involved in creating virtual flights of fancy but holding the reins of all those who are unleashing the power of generative artificial intelligence will be the "metaverse curator"–a completely new role to match the task of building "a new and better world".

Keywords: Sustainability; Metaverse; Virtual Reality; Conjecture; Artificial Intelligence; Art.

Resumen

La City de Londres se adentra en un territorio nuevo y relativamente inexplorado con su intención de fortalecer al mismo tiempo la cultura y el comercio. En London Wall West, un lugar en el corazón cultural de la Square Mile, existe una posibilidad para demostrar que esta ambición es posible, pero los planes elaborados hasta ahora han suscitado una oposición considerable, ya que implican la demolición de edificios existentes. Aunque la City se mantiene firme en su convicción de que nuevos edificios son necesarios, justificar este enfoque en un mundo en el que la construcción produce el 39% de las emisiones globales de gases de efecto invernadero del planeta es un desafío. La respuesta propuesta, "Construir menos es más", requerirá que la City aumente su confianza en la idea de que, en parte, London Wall West puede volverse virtual. Podemos anticipar que, para diseñar y construir un nuevo mundo virtual, donde la gente la pueda pasarla tan bien como en el mundo físico exterior, London Wall West debe convertirse en un banco de experimentación de cómo convertir la "conjetura" en realidad. Al igual que en el mundo físico, la creación de un ámbito virtual depende de definir y comprender el comportamiento de las personas. Aunque ya hay arquitectos creando vuelos virtuales de la imaginación, los encargados de llevar las riendas de todos aquellos que están desatando el poder de la inteligencia artificial generativa serán los "curadores del metaverso", un rol completamente nuevo que coincidirá con la tarea de construir "un mundo nuevo y mejor".

Palabras clave: Sostenibilidad; Metaverso; Realidad Virtual; Conjetura: Inteligencia Artificial; arte.

Introduction

Located in the heart of the City of London, two buildings have now become vacant. First, the Museum of London, which is moving to new premises located in nearby Smithfield Market and secondly, Bastian House, an office tower built in the airspace above the museum (Figure 1). I know these buildings well: I live next to them in the Barbican, an architectural masterpiece containing over 2000 flats with an adjacent world-renowned arts center. As an architect myself, I have taken a keen interest in what will happen at London Wall West (as the museum site is now called). For the City of London, the vacated buildings raise the following questions: must the post-pandemic dreams of a fast-changing city be met by repurposing existing structures? or can those structures be demolished to facilitate rebuilding? These are not unusual questions but, in the case of London Wall West, they have a significance that is not only local, but extends throughout the Square Mile to London, generally, and further, to other cities, worldwide, that are facing similar dilemmas.

As a model for my research into the making of a partially virtual future, I regard London Wall West as a test bed for experimentation on how to plan for the on-coming metaverse and how to construct it.[i] The lessons that my findings, suppositions, and ideas hold for tackling the climate crisis are potentially life-changing and, if adopted by the City, they will add considerable credence to the City's declared ambition to lead the way in creating a more sustainable future.

Figure 1. Museum of London with Bastion House built in airspace above the Museum. Buildings located in the City of London.

PART ONE: A Tale of Two Realities

Culture and Commerce Stronger Together

Known as the Square Mile, the City of London's reputation for commercial and financial expertise remained undented after the Covid-19 pandemic, but the outward signs of activity changed, probably forever. No longer are the pavements thronged and the restaurants and pubs full

to bursting. The memory of a deathly quiet Covid-struck urban desert may now be banished, hopefully for good, and in its place remains a City still recovering from an event that impacted on its future to the extent of the Second World War and, even, the Great Fire (Figure 2). Always the City has bounced back and, this time, facing up to a post-pandemic future, the task of overcoming misfortune and turning it to advantage is no less challenging.

Figure 2. London 1666, 350th anniversary of the Great Fire of London, burning model by David Best in collaboration with Artichoke, 2016. (Image courtesy of Artichoke.)

Early in 2021, the City's Culture and Commerce Taskforce (C&CT) dedicated to Fuelling the City's Creative Renewal declared its intention to

"….reanimate the City of London's spaces in unique ways that attract people back […] and build the connections required internationally for the City to remain a global hub of commerce and become a center for culture."[ii]

In arriving at its conclusions, the Taskforce recognized that the Cultural Sector can potentially play a crucial role in the City's recovery. In London, as in many other metropolises round the world, it can be anticipated that in such a post-pandemic context, up to two fifths of the current office space will become surplus to requirements and, thus, become available for repurposing. Of course, changes to physical space as now demanded by a depleted city cannot themselves generate new types of collaboration between people from different spheres of activity. It will take the "software" of digital transformation working in close harmony with reconfigured operational environments, both physical and virtual, to ensure the success of the City's bold plan for renewal.

The City is fortunate in having, in the North West corner of the Square Mile, a place already established as a center for culture, which can be expected to play an increasingly important role in furthering the City's long-term cultural ambitions. Already, it embraces world class institutions such as the Barbican Centre's performance and exhibition spaces, the Guildhall School of Music and Drama, the Museum of London, and the London Symphony Orchestra (Figure 3). Now, at a time when the City is entering new and relatively unexplored territory, with its intention to join commerce, culture and the arts together in a spirit of partnership and sociability, I am focusing on one particular site in the City's cultural center: London Wall West. The site has the opportunity to

become a test bed for experimentation on how to turn blue sky thinking into reality–a reality that will be part virtual and part physical.

Figure 3. The City of London's cultural center with London Wall West located at a midpoint.

Opportunities to create environments designed to host culture alongside commerce do not arise very often. That is why the development of the London Wall West can be expected to become the subject of close scrutiny. The eyes of the world will be watching. Will London Wall West succeed in acting as a cultural beacon in bringing people back to the City? Can it effectively demonstrate the City's new-found destiny as a global center of culture?

Architects Diller Scofidio + Renfro (DS+R), in a briefing of their scheme for London Wall West, stated that the City was aiming to

"develop the City of London's bold new cultural district stretching from Farringdon to Moorgate, the vision for which seeks to amplify the creativity embedded in the area and use it to create lasting change long into the future."

At a first glance, the resulting scheme reveals two massive office buildings which have done little to endear the scheme to local communities, who remain largely opposed to the development.[iii] But, on closer inspection, the offending buildings contain floorplates of sufficient depth and flexibility to accommodate cultural and commercial organizations working alongside one another. They should be regarded, therefore, as mixed use buildings where many and various members of the cultural sector can be expected to come together with their counterparts in the commercial sector in a spirit of sociability and partnership (Figure 4).

Figure 4. The main feature of the proposed development at London Wall West by Diller Scofidio & Renfro is a pair of deep-space office towers surrounding a public suspended "meadow" with public meeting space under.

DS+R's proposals are exemplary in providing spaces both within and outside the buildings to encourage cross-sector interactivity. Further, the wealth and quality of new landscaped, open and accessible spaces to be provided will ensure that London Wall West becomes a magnet for visitors. The comprehensive greening of the proposed buildings will serve to markedly improve the environment not only for visitors but also for workers and residents.

London Wall West as a Microcosm of Change

Once implemented as a prototype for the future, London Wall West's influence will spread to every corner of the Square Mile. In my opinion, once built, it will be seen as a model of thoughtful development which looks beyond the environmental dimension by addressing how people from different backgrounds both mix and connect. And quite apart from meeting functional requirements, the architects have given close and expert attention to the importance that "feel," and atmosphere can play in generating a sense of place. Existing green spaces will become part of a connected oasis of glades, which promise making the area a sought-after destination as well as a microcosm of biodiversity (Figure 5).

Figure 5. A suspended meadow is the center piece of Diller Scofidio & Renfro's scheme.

It is true, of course, that the proposed built environment at London Wall West is carbon hungry, but so is every other development, new building or conversion of existing ones that involve major demolition and construction processes. In a world where construction and the wider built environment currently account for 39% of the planet's global greenhouse gas emissions, we need to find some way of reducing, radically, the amount of carbon embedded in construction processes. For this reason, the City's aim at London Wall West must be to ensure that the development plays some small part in preventing global heating rising above 1.5C by the year 2050. Faced with this challenge, the following question remains: What steps can be taken at London Wall West–just one site amongst many worldwide–to help stem our seemingly unstoppable dash to climate disaster?

The omens appear to be good because Chris Hayward, Policy Chairman of the City of London's Corporation, returned from his attendance at COP 27 to declare

"Although each annual climate summit is tasked with the gravest challenge–protecting the only home we have ever known–we should feel confident that the City can continue to be leaders in creating a more sustainable future."

But, to date, the only concession made by the City towards a more sustainable future at London Wall West is a decision to "reduce the width of the building proposed to replace the Museum of London by three meters, while the building proposed to replace Bastion House will be reduced by two meters". These reductions will not go far in reducing the amount of greenhouse gases emitted by either building. In fact, by reducing the size of available floorplates, they will serve only to make the buildings less able to perform their function to accommodate a multiplicity of cultural and commercial organizations working together.

To cut a long story short, the scheme has now become becalmed in a sea of conflict, which is partly of the City's own making but, also, caused by external factors that are impacting every city

worldwide seeking to find a way into a post-pandemic future. Will it be possible for the City to find the seeds of resolution that will enable it to resolve this *impasse*?

Before answering this question, we need to look, more generally, at how the construction industry, worldwide, is advancing net-zero carbon buildings, both now and in the future.[iv]

The Impact of the Built Environment on Climate Change

The conclusion of the United Nations Environment Programme, 2022, Global Status Report for Buildings makes for a depressing reading:

"What is clear from these past two years is that the structural changes needed in the buildings and construction sector are not yet happening. While the increase in investment in energy efficiency in existing buildings and a greater number of new buildings being constructed to higher energy performance standards are welcome trends, the impact on energy use and energy intensity is not yet showing, nor is there any sign of emissions from the buildings sector being decoupled from energy use or construction activities .The war in Ukraine and the ensuing energy crisis being felt in some regions underline the urgency of such a structural change."

"To achieve the emissions targets needed for all buildings to be aligned to the Paris Agreement goal of the global economy being net zero carbon emissions by 2050, emissions from the buildings sector will need to halve by 2030. This will require an annual emission reduction rate of -8 per year, equivalent to the impact of the pandemic each year."[v]

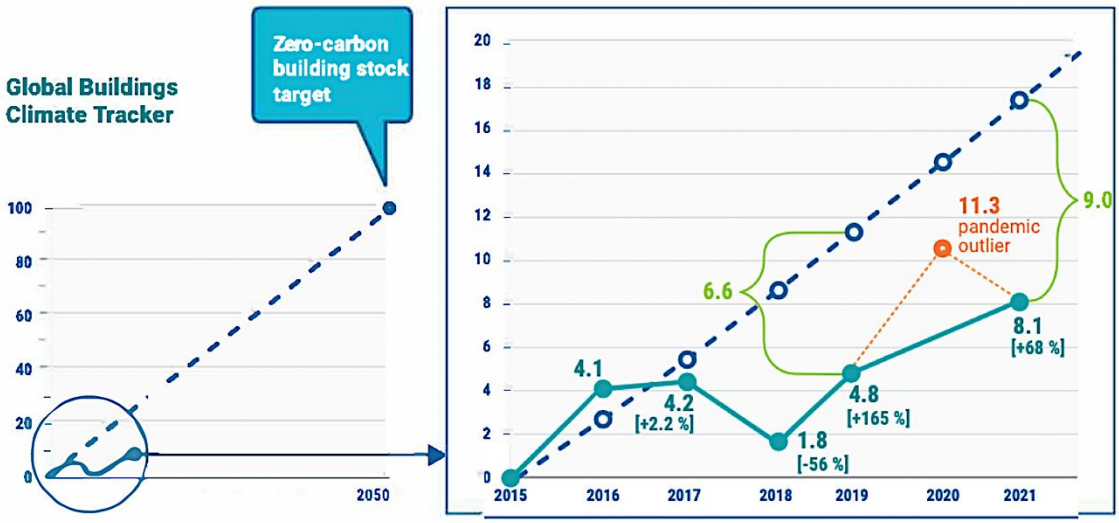

Figure 6. Direct reference path to a zero-carbon building stock target in 2050 (left).
Zoom into the period between 2015 and 2021, comparing the observed Global Buildings Climate Tracker to the reference path (right)
Global Buildings Climate Tracker extracted from United Nations Environment Programme, 2022, Global Status Report for Buildings with permission.

The Report contains a Global Buildings Climate Tracker (GBCT), which explains the construction industry's dismal record (Figure 6). In zooming in to the period from 2015 to 2021, the dotted dark blue line serves as a benchmark. To be on track, the lighter blue line must be on or above the dotted blue line. In 2020, the GBCT index moved closer to the reference path, as indicated by the grey dashed line that approaches the blue line. This is due to the exceptional slowdown of large parts of the economy, including the construction sector, and the limited use of non-residential buildings such as offices during the Covid-19 pandemic. As this would give a false positive message of decarbonization moving towards being "on track" the 2020 observation is treated as an outlier. In fact, buildings' decarbonization progress is slowing down and the decarbonization gap is increasing. Despite the 68 per cent improvement shown in the GBCT index between 2019 and 2021, the index has fallen further away from the path to a zero-carbon.

From this dire result, it is clear that the decarbonization of the worldwide building stock is not "on track" to reach the goals of the Paris agreement. In 2021, the building decarbonization index was only 8.1 points out of 100, while it should have been over 17.1 points out of 100. This shows that the sector is achieving about half of the necessary decarbonization. The gap between the actual decarbonization performance and the desired pathway has been widening since 2018. Post-2021, a significant rebound in building sector emissions confirms that the boost in decarbonization during the pandemic was temporary. A structural, systemic, improvement was not achieved.

Figure 7. A bio-based structure (timber) was proposed for a social housing project in Milan (architects Diller Scofidio + Renfro and Stefano Boeri Architetti)

Carbon emissions from buildings' operations combined with the materials used in construction are estimated to account for around 39% of global energy and process-related emissions. The selection of construction materials plays a critical role in creating a high-performance building with low operation carbon over time. For example, when designing materials for both new and retrofit construction sites, swapping a concrete based exterior wall system for a bio-based structure (e.g. timber or bamboo) can greatly reduce the amount of up-front embodied carbon (as well as the ongoing emission caused by maintaining cooling systems in hot countries).

Many ingenious examples of this approach can be found worldwide, but a change of materials in itself will never make up for the overall poor performance of the construction industry in reaching Paris agreement targets (Figure 7). Another, more radical, approach has to be found.

Building Less is More

At this point, to look at other ways that cities can tackle change and expansion, without incurring in unacceptable levels of carbonization, I am turning to the mega-cities of the Far East.

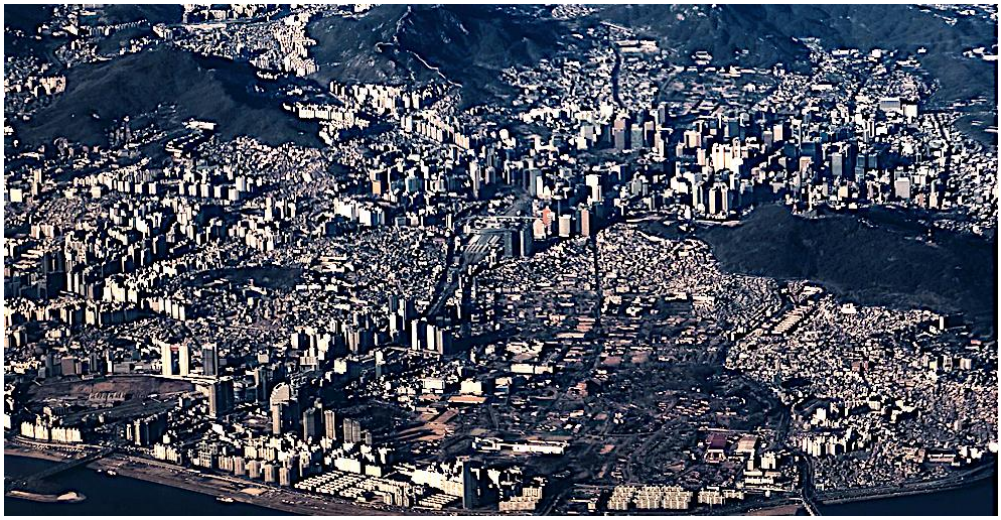

Figure 8. View of Seoul, South Korea, where the ever-increasing difficulties of physical communication in a congested city have led to workers spending time in a virtual world.

In South Korea and China, to alleviate the difficulties of physical communication in ever-growing urban centers, local governments have been motivated to embrace Virtual Reality (Figure 8). The result is an "all or nothing" approach to digital transformation which demands that South Korean workers spend all their working time in a virtual world. For instance, employees of Zingbag, a financial company, no longer need to travel to the center of Seoul. They work virtually in a 30 storey building, Metropolis, that can accommodate up to 300 people, at any one time, on each floor. Employees working in the same virtual space can immediately communicate with colleagues whenever they want by moving their avatars. They have no need to use phones or e-mail. Instead, they communicate by word of mouth. We are told that Zingbag's virtual environment has generated a more motivated workforce with a lower cost of living and a better quality of life. Certainly, in the Far East the idea has caught on.[vi]

By contrast, in the West, I can foresee that individual choice will remain a matter of paramount importance. Here, our adoption of a new post-pandemic work/life balance requires that we are given the option of deciding, for ourselves, how much time we want to spend in a virtual world. I will call this the "50/50" approach to digital transformation. It heralds the "Dawn of a New Everything." In this new dawn, which is already with us in a nascent form, we can anticipate metaverse curators, new media artists and digital architects taking delight in creating "a different place, perhaps fantastical, perhaps where we assume bodies that are far from human."[vii] David Hockney (Figure 9) gives us a foretaste of just such a world. In a recent London exhibition, he

provided scenes of work and play projected in three dimensions (3D). Although not yet fully immersive, they give some indication of a future virtual world taking shape alongside our normal physical world.

Figure 9. In Lightroom's Bigger and Closer (not smaller and further away) exhibition, London, 2023, David Hockney provides first signs of a world where you are in a different place, perhaps fantastical, perhaps with a body that is far from human.

For the future, we will see this type of virtual world replacing, at least in part, our constructed physical world, where architects and builders are responsible for more and more buildings producing bigger and bigger cities. I think you can see where I am heading: the construction industry can play a significant part in averting the climate crisis only by building less–a paradox, if ever there was one. By encompassing a "Building Less is More" policy, the City can lay claim to becoming a leader in creating a more sustainable future at London Wall West and, thereby, resolving its current *impasse*. And the same policy, if adopted by other cities facing similar difficulties, will assist in significantly reducing the heavy carbon footprint of construction worldwide. Time, then, to look at the full implications of taking such a fundamental step towards tackling climate change.

A Symbiosis of Virtual and Physical Space

The making of the virtual world (or metaverse, as I will now call it) is dependent on the development of Virtual Reality (VR) as a tool for social interaction. As with most technologies, whether VR is good or bad depends entirely on how it is used. In full-dive VR, users should be able to build their own lives as they choose, genuinely interacting with others around them and leading a meaningful and valuable life. This is a future that David Chalmers foresaw when he suggested that in the not-too-distant future, as our planet becomes increasingly ravaged and overcrowded, people will migrate more and more towards the virtual realm. As he described in his book Reality+:

- "Virtual worlds are not illusions or fictions or, at least, they need not be. What happens in VR really happens. The objects we interact with in VR are real."
- "Life in virtual worlds can be as good, in principle, as life outside virtual worlds. You can lead a fully meaningful life in a virtual world."
- "The world we are living in could be a virtual world. (Chalmers does not say it is, but it is a possibility he does not rule out.)"[viii]

So, from Chalmers' description we can infer that VR can be much more than escapism; it can be a full blooded environment for living a genuine life in a first class virtual reality. The metaverse can be envisaged as a virtual world where no one spends an entire lifetime; people will be able to enter or exit it as they choose. It promises a world that users will apprehend with all their senses, as if they were physically inhabiting an environment where no trace of the ordinary physical environment remained. To sum up, the metaverse can be described as a virtual world (or system of virtual worlds) in which everyone can spend time living day-to-day lives with many forms of social interaction.

In its current primitive form, although the signs of an ecosystem of metaverses are beginning to take shape, it has not yet come close to realizing Chalmers' forecast of virtual worlds becoming first class realities. However, by 2026, it can be anticipated that 25% of people will spent at least an hour per day in the metaverse. Whether for work, shopping, education or entertainment, a nascent metaverse is set to take our experiences online to the next level. Capgemini, one of a number of multinational firms advising companies on digital transformation, forecasts that the metaverse will give rise to a new era of collaboration where

"by replicating an office environment, people can come together in a shared virtual space that can be both informal and formal. Whether to relax in a breakout space or to present at meetings, employees can use their digital avatar to immerse themselves in a new virtual environment with colleagues."[ix]

In the City of London, for instance, where the Covid-19 pandemic reshaped the working world, employers are beginning to think about the metaverse's capability to promote not only collaboration but, also, creativity and increased productivity. Often, advised by experts in the field of digital transformation, managements are investigating the benefits of "digital twins" as a means of transforming ways of working.[x]. A digital twin is a virtual copy of a company's operations enabling it to insert any potential changes into a virtual version of the business, which then helps the company to identify more efficient ways of working. Approaching a digital twin in this way is valuable as a means of finding out what works and what does not without putting the business at risk. The point I am making here is that the metaverse should not be viewed as something unknown, happening sometime in the future. The beginnings of a symbiosis of virtual and physical space have already become a reality–a new way of everything that will enable the City to grasp the future now.

Seizing the Opportunity

Nowadays, real estate business is being reimagined in the metaverse. It now offers a fast emerging but viable investment opportunity in an entirely new way. Digital architects are engaged in designing an entire parallel universe that seamlessly connects with our existing one (Figure 10).[xi] It is a new world that enables investors and owners to create interactive spaces that facilitate virtual

contact between users anywhere. To date, such virtual real estate investments have taken place primarily on established metaverse platforms, e.g., [Sandbox] and [Decentraland][xii], but options also exist for investors to create their own metaverse platforms (i.e., the route I would expect the City to take). In either case, the skills required to make these early forays into the metaverse involve virtual real estate management, digital architects, metaverse curators, technologists (i.e., specialists in virtualization) and, significantly, new media artists to create the look and feel of customized virtual space.

Figure 10. A virtual self-governed City in the Free Republic of Liberland, a "micro-nation" squeezed between Serbia and Croatia. No one lives there but according to Patrik Schumacher of Zaha Hadid Architects, *"The time is ripe, technologically, economically and socially, for shifting more and more of our productive lives into the metaverse"*.

There appears to be much to gain by making an early investment in the metaverse: those who take the plunge, while having to navigate a number of associated risks, could well find themselves in a position to reap substantial financial rewards as the metaverse gains mainstream adoption in the next five years or so. Time, then, is on the City's side because by the time the London Wall West becomes a physical reality the market in virtual real estate will have become fully established. For the City, facing an uncertain future, I believe it is this hybrid form of development that may offer the best of both worlds: it will enable the City to demolish existing buildings at London Wall West without compromising the construction of a fully sustainable development. The vacated London Museum structure is overtly idiosyncratic, fit only for the purpose for which it was designed, and Bastion House, to achieve status as a Grade A office, will require the replacement of every element of its fabric and services. A myopic stance towards climate change should never become a reason to retain existing buildings that are no longer fit for purpose. At London Wall West, demolition, not retention, is the way forward with a watchful eye kept on the City's declared role as a champion of sustainability.

Fortunately, the DS+R scheme already contains the seeds of its own transformation into a 50/50 world. A glance at the proposed office buildings (Figure 4) reveals that each is almost a mirror image of the other–a somewhat exceptional circumstance that enables them to be reconfigured as digital twins–one physical, the other virtual–as we have seen happening in companies undergoing digital transformation. At London Wall West, the virtual twin can be

expected to contain vital information on the structure, context and behaviors of the physical twin. It will be dynamically updated with data from its physical counterpart throughout the lifetime of the project. Further, the virtual twin will enable owners, designers, contractors and trades to speak the same language and share a common understanding of the project's requirements, constructs and needs. For the City, a virtual twin's potential to provide a "what if" analysis and simulations of the future will be of particular value–a key management tool for assessing risks and assessing outcomes. Also, as I explain in 3.7, the London Wall West virtual twin will take on a life of its own as part of a [London Wall] metaverse platform where, as owners of virtual space, the City will establish a valuable asset for letting space, as in the more familiar physical world.

Figure 11: Left: view looking South showing current proposals for London Wall West with the replaced Bastion House and new Rotunda building. Right: the replaced Bastion House retained as a physical building. Rotunda becomes a digital twin (shown in yellow outline). As a result, the extent of the suspended meadow is increased, and views South are opened up. With acknowledgement to Diller Scofidio + Renfro, New York.

To illustrate the environmental impact of this transformation, I have adjusted one of DS+R's presentation drawings to show how the physical "removal" of one of the twin towers opens up vistas from a substantially enlarged meadow (Figure 11). The potential gains are significant: more open green space is acquired and the considerably reduced carbon footprint of a partially virtualized scheme, achieved by building less, will set new standards of sustainability not only for the City but, also, demonstrate a viable way forward to the rest of the world.

Of course, before plunging into a virtual world, the City will need to be confident that the carbon footprint of constructing non-real estate will represent a significant improvement over the carbon cost of physical construction. This is a subject surrounded by confusion, which is not helped by the arcane language used to describe the processes involved.

The Carbon Footprint of Virtualization

The high quantities of energy involved in "minting" NFTs (Non Fungible Tokens) has sent up alarm signals regarding the unsustainability of virtualization. Only a few years ago NFTs were notoriously expensive to produce in terms of energy because the mechanisms used to create them relied on a computationally costly system called "minting", in which blockchain technology, essential to the creation of metaverses, produce unique pieces of data associated with photos, videos, audio, and other types of media. NFTs come in the form of avatars, artwork, music, digital creatures, and HTML code, as well as plots of land in virtual worlds like [Decentraland]. Further, most NFT minters opt for the Ethereum blockchain, which requires computers–"miners"–to take turns guessing answers to increasingly challenging mathematical problems. The key point here is that the Ethereum blockchain, representing an industry worth $195 billion, recently has made a 99.95% cut in its absolute energy use. Overnight, the sustainability movement, which previously had ignored or deplored the virtual world, recognized that it now represents a "pixelated escape route from fragile earthly reality". More than that, it might offer the only feasible escape route to a future sustainable planet.[xiii]

The metaverse will continue to need very high resolution pictures, which will boost energy use even further. But now, these increases can be achieved without compromising sustainability targets. Etherium has led the way and now other data centers are planning improvements in energy use that will enable them to become more environmentally friendly. Meta has committed to achieving net zero emissions by 2030. Microsoft has pledged to run its Azure cloud platform entirely on renewable energy by 2025. For the future [Decentraland], a virtual platform based on Ethereum, will be able to rely on green, clean and renewable energy. Such radical, immediate impacts on energy use can be made in the virtual world because the data on which these reductions depend are concentrated in a relatively few centers; their carbon footprints are readily identifiable. Whereas, in the construction industry the opposite applies: sources of high carbon emissions are located in millions of separate sites, worldwide, which explains, in part, the construction industry's dismal record in meeting sustainability targets.

A Green Light for the City

As with all property development, the location of non-real estate reigns will have no better location than in the heart of the City of London. Companies and institutions, worldwide, will be encouraged to establish a City outpost which will provide both virtual and physical access to a global hub of commerce and an emerging center for culture. Either way, the opportunities for attracting people back and appealing to new users are almost endless. This is why I am urging the City to take a long hard look at a way ahead that appears, at first glance, to be "blue sky thinking" but, on closer examination, offers a creative resolution to a seemingly intractable problem. The City's new virtual possibilities woven into existing physical proposals for London Wall West will send out a signal to the world that the City is determined to lead the way in creating a sustainable future.

The fact that the physical presence of buildings at London Wall West will be dramatically reduced should do much to staunch objections to the proposed scheme. Further, the scheme could substantially reduce carbon footprint through virtualization and might set new standards for cities worldwide to follow when embarking on processes of digital transformation. Replicated many times over throughout the world, a policy of "Building Less is More" might succeed in redirecting our current course towards climate disaster.

PART TWO: Constructing a Virtual World

Can my "Tale of Two Realities" take us to the Future?

My story has not ended but it has reached the point where the City has an opportunity to lead the way forward to a sustainable future. The London Wall West scheme can act not only as a cultural beacon but, also, establish the City as a world leader in digital transformation. My own part in this process, as an architect and resident in the City, is to prompt new thinking on the future relationship between a fast changing City and emerging technology–with an emphasis on processes of virtualization. It is my belief that eventual success will depend on the skill and imagination demonstrated by digital architects and new media artists in creating virtual environments at London Wall West, which are as good as their physical counterparts.

Many people are making predictions about what the metaverse will be and what it should be. For my money, the thoughts of Nick Clegg (Vice President of Global Affairs and Communications at Meta) on "Making the metaverse: What is it, how it will be built, and why it matters" possess a clarity of purpose, which is lacking in most published information on the subject.[xiv]. Moreover, "Building Less is More" is an idea that he finds intriguing, as do others who have described it, variously, as revolutionary, compelling and not least, totally convincing. It is an idea that depends on first, defining what we should expect from the metaverse and then, pursuing the difficult path of making it happen. That is what I am aiming to do in this article.

So far, I have told a "Tale of Two Realities" which is far removed from dystopian science fiction. Rather the opposite, I am painting a picture of a life enhancing fact. But, if London Wall West is to enter this new world, it must become a crucial test bed for experimentation on how to turn "conjecture" into reality–a reality that embraces a symbiosis of virtual and physical space.

Defining the Quality of a Metaverse

Nick Clegg suggests that the quality of a metaverse will be the feeling of presence. That is, you will be right there with another person in another place. He knows, too, that our interactions in the metaverse must replicate those we experience in our daily lives:

- Currently our communication with one another involves emails, text messages, and written posts on social media. Face-to-face conversations and speech based communication continue to happen but less frequently as a result of the enforced periods of isolation we all experienced during the pandemic–a pattern of communication that has remained persistent after the pandemic receded. The metaverse will constitute a shift back towards ephemerality, making speech in a shared virtual environment the first option for communication.
- In our familiar physical world, we have the ability to pick up on emotional cues or influence audiences by modulating our voice, moving around and using body language. To create this level of embodiment in the virtual world, avatars will reflect our bodily movements just as it might occur in a physical reality. They will enable us to communicate expressively, to use our hands to create and manipulate digital objects and to interact within a virtual 3D environment (Figure 12).
- In the not-too-distant future, we will be able to communicate virtually in ways that make us feel as if we are actually in a specific space with other people–an outcome that

> can be regarded as the next generation of the Internet, a 3D experience which prioritizes a sense of immersion encompassing not only VR but, also, augmented reality (AR) and a mix between these and other forms of reality (XR).

The technological challenges of meeting the attributes of ephemerality, embodiment and immersion are formidable but, once overcome, they will ensure that people can experience the metaverse in a way that is as good as life outside in the physical world.

Figure 12. Users can already gain a strong sense of embodiment in a virtual world when they control "humanoid" avatars with their hands. (Tsinghua and Carnegie Mellon Universities).

It is not a one-size-fits-all metaverse that lies ahead, as I think Mark Zuckerberg might have anticipated when he launched his concept of Meta. Instead, it is a series of separate virtual worlds all dedicated to meeting individual aspirations where you can be in a different place, perhaps fantastical, perhaps where you can assume a body that is far from human. There is nothing mundane about an environment where the relationship between mass and gravity (flying), the principle of locality (teleportation), entropy (making the arrow of time go backwards), and causality (there is no physical damage despite the intensity of the blow) all turn our expectations of normal human behavior upside down. All these experiences lie in wait for users who, accessing or interacting with a virtual world for the first time, will begin a process of "re-worlding".

"Re-worlding in VR depends on the possibilities that the virtual world allows you to experience, both a feeling of social presence (the sensation of interacting and sharing the same experiences with another avatar) as well as a perception of control (degree of synchronization between user – avatar - virtual environment), both conditions mediated by the code and computing capability of the VR device with which you are accessing the virtual environment."[xv].

It is through the re-worlding process that the user interprets and finds meaning in the virtual world. The consequences of this process can then extend into how people navigate and sustain their lives in the more familiar real world.

The term "user" can be defined as being the actual person immersed subjectively in a virtual world. As I mentioned in 2.3, I am anticipating that, in the West, a 50/50 ratio is likely to be adopted by users who, potentially, might spend half their time in a virtual world and half in the physical world. It is a ratio that should be regarded as being variable depending on users' own inclinations and the extent to which their working life demands contact with others who may be remote physically but easily accessible virtually. Always, organizations undertaking processes of digital transformation should ensure that a seamless transition can be made between both worlds–a transition that can be made by each and every person in the organization via their VR device.

Users will be personified in the virtual world through their own avatars, which can be defined as the digital interfaces that allow users to interact intentionally and purposefully in a metaverse. The design of a personal avatar can have implications for other users; avatars with human characteristics tend to create more positive social interactions than fantasy avatars (Figure 13). Further, people's emotional states can influence how their avatars behave in the virtual world thus indicating that there is a fine line between the real and the virtual experience; in VR, it is impossible to completely detach ourselves from what we are feeling in real life.

Figure 13. Fantasy Avatars: Universal Everything explore digital life in motion with Lifeforms at 180 Strand, London, 2022.

In the not-too-distant-future, when organizations, both large and small, can be expected to create their own metaverses, the behavior of users will be influenced by the same factors that have served to generate an organization's unique "pattern of activity" in the physical world.

Defining People's Needs in a Metaverse

Not all will be new and unfamiliar in a metaverse created as a virtual expression of a presence in the physical world. As techniques are developed which are capable of extending processes of digital transformation into a virtual world, success will depend, as it does in the physical world, on paying close attention to the well-being of people–whose needs are ever changing rather than a fixed set of requirements–at all levels within an organization. Maslow, in his *Hierarchy of Needs* includes, at the lower level, physiological needs (to sustain life and health), safety (the avoidance of physical danger and need for protection) and belonging (social needs involving the desire for affection and friendship). Higher level needs include self-esteem (a desire to

be treated with deference and respect) and self-actualization (the need of a person to strive for his or her fullest potential as a human being). People do not move from one level to another in any precise fashion, but it is safe to assume that, unless lower order needs are satisfied, the others will not come into play in any major way (Figure 14).

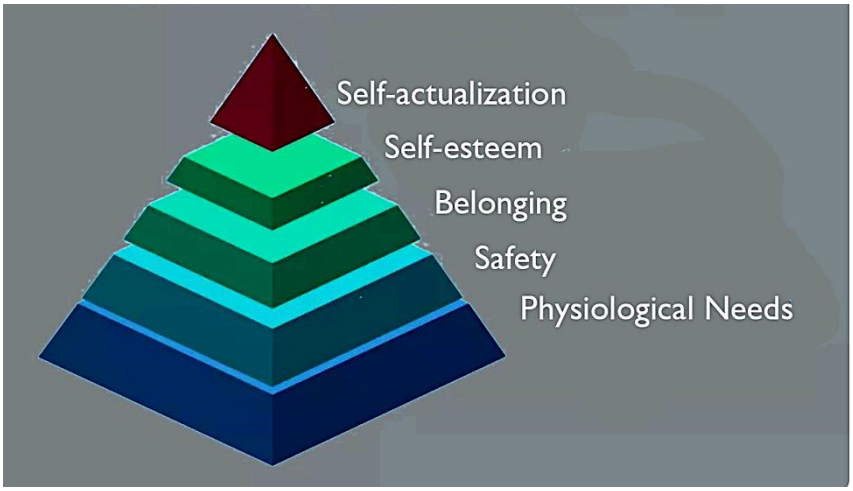

Figure 14. Maslow's hierarchy of needs

In creating a metaverse, it can be anticipated that people's needs, both at a lower and a higher level, must be kept firmly in mind by the metaverse curators and new media artists involved. Indeed, they can play at being gods but only as long as a tendency for willfulness (a common trait among deities) is replaced by respect–respect for people's freedom of action and their ability to carry out their tasks effectively. Further, they must remain constantly aware of people's differences and the multiplicity of their needs to ensure that:

- The adoption of a 50/50 approach to digital transformation enables people to feel as *comfortable* in the virtual world as in their more familiar physical environment. (It is through paying close attention to ergonomic factors that life in a virtual world can become as fulfilling as the physical world.)
- A sense of order emerges from the expression of *diversity* in the virtual world, where many new opportunities for the expression of differences will exist (i.e., in the choice of avatars and metaverse settings).
- Freedom of expression is available in the virtual world. Such freedom *compensates* for the time spent away from a more familiar physical world. (Experiences of flying, teleportation, entropy, and causality can add excitement and a sense of everyday adventure, which far exceeds anything available in the physical world.)
- *Communication* via speech is the first option in the virtual world with less reliance on emails, text messages, and written posts on social media than in the physical world.
- A seamless transition between the virtual and physical worlds enables effective *collaboration* with colleagues not only locally but, also, throughout the world. (Control of entering and exiting the virtual world is in the hands of all personnel via a range of VR devices.)

- The organization's extension into the virtual world is seen as a way of contributing to people's *self-esteem* as they make their own way into a new virtual world, which offers extraordinary opportunities for self-actualization and advancement.

London Wall West: a Test ed for Experimentation

All the components that constitute a metaverse are almost already in place. Finding the glue that can hold them together will be the key to creating a future where an ecosystem of metaverses is set to become a 3D elevation of our online world–an outcome that includes a more intuitive and productive way of communicating information and ideas. (Remember, humans did not evolve to touch 2D interfaces.) By adding new virtual challenges to the already acknowledged physical ones that I have outlined in 2.1, the full range of challenges to be met at London Wall West can be summarized as:

- creating an environment which demonstrates how the City can remain a global hub of commerce and become a center for culture. (The DS+R scheme meets the physical requirements of members of the Cultural Sector coming together with their counterparts in the Commercial Sector in a spirit of sociability and partnership but provides no indications on how the virtual world will play its part in this bonding process.)
- adjusting to a new post-pandemic work/life balance by giving close attention to the creation of a virtual world, which people will be able to enter or exit as they choose. (By embracing the metaverse, the City will be able to adopt a "Building Less is More" policy, which will substantiate its decision to demolish existing buildings at London Wall West.)
- reducing the physical construction of new multi-purpose buildings. (This will send out a clear signal to the world: the City is determined to lead the way in creating a sustainable future.)
- giving full consideration to the social, behavioral and psychological aspects of people's needs (on the assumption that virtualization technology will enable intuitive and productive communication to take place in an ecosystem of metaverses).
- developing the City of London's bold new cultural district stretching from Farringdon to Moorgate, with a vision that seeks to amplify the creativity embedded in the area and use it to generate lasting change long into the future (This is the City's initial aim in developing London Wall West. By adopting a 50/50 approach, all these aims can be achieved with the additional benefit that, as the metaverse becomes established, non-real estate in the form of virtual platforms will become an ever-increasing asset.).

I recognize that the above extended list of challenges represents a huge step up from the original brief issued to DS+R. No architectural firm, however advanced it may be in tackling technological issues, can be expected to accomplish a result spanning two realities. For this reason, the team currently at work on London Wall West will need to be supplemented with a further range of skills garnered from backgrounds not normally associated with the word "construction". Who are they and what do they do?

New Problems, New Skills

The skills of emerging media artists and digital architects will need to be brought to bear on the construction of the "extremely complex system" of a metaverse. The nature of artistic practice has changed radically over the last 50 - 60 years to the extent that new media artists can apply to their work an ability to use computation as a blank canvas for exploring art as a process and to use the remarkable attributes of artificial intelligence (AI) to produce options that learn from experience. As an aide to creativity, there is now a Pandora's box of opportunities available for producing and presenting ideas for the virtual world. But, to prevent "capriciousness", all of these must be rigorously controlled to ensure that users' multifaceted and changeable needs are given proper consideration. For this purpose, the new and relatively untried role of "metaverse curator" will come into its own–a role that will extend the word curating to cover not only the content of a virtual world but, also, its impact on people from a behavioral and psychological point of view (as I have described in 3.4). Only then can life in a virtual world cease to be an illusion; VR combined with our life in physical reality will help in establishing "a better 50/50 world".

Figure 15. A Pandora's box of opportunities is available for producing ideas in the virtual world. Here, a metaverse hub inspired by the Silk Road is proposed by Grimshaw, WKN, Farshad Moussavi.

Already, just a few new media artists and digital architects, who are fluent technologically, have demonstrated their ability to explore the virtual world to find forms which astound in their scope and imagination. But, within the next few years, the oncoming metaverse will require that many more become similarly equipped. Fortunately, it is a need that already has been recognized in the realm of art education. In the UK, to name just one, at the University of the Arts London (UAL), the Creative Computing Institute (CCI) offers training and diplomas in creative technology to students, across UAL, providing opportunities for textile, illustration and film students alike to gain fluency in emerging technologies.[xvi] Stress is laid on the way AI generative platforms enable the production of high definition virtual environments. At an equivalent institute in New York, the School of Visual Arts (SVA), students gain experience in the programming of special effects for the film industry as well as the skills needed to step inside and explore virtual buildings. These centers of "arts technologies" are continuing a tradition developed over many centuries (since the Renaissance, in fact) for artists to bring disruptive mechanical and electronic tools to bear on radical and revolutionary artforms. It is in the metaverse that new media artists will find their métier.

To make the future, advanced technology in itself will never be enough. It will require art and technology to be woven seamlessly together to make the virtual world the place we want it to be.[xvii] Then, we can anticipate that all our lives will be altered forever by a mix of electromyographic sensors, volumetric holographic displays, immersive headsets and projection, and tracking cameras that collectively will provide support, stimulation, and simulations never before possible.[xviii]

Constructing the Future

"For better or worse, the pandemic forced us to sink or swim. Somehow, we swam. We learned new skills, increased our emotional flexibility, and learned optimism and the capacity to rebound. If we take all that into context, it sounds like we are learning to build a future rich with possibility."[xix]

Already, the City of London has glimpsed such a future with its vision to build the connections required internationally for the city to remain a global hub of commerce and become a center for culture. But this vision has not yet been translated into a practical reality affecting every part of the Square Mile. London Wall West, taken as a beacon of change, might indeed lead the way forward. The lessons learned there will act as a model for developments further afield but, before physical construction takes place, is it possible, I wonder, to foresee the wider implications of taking this crucial first step?

By planning for culture in a 50/50 environment at London Wall West, the City stands to reap rich rewards from letting prime physical space as well as gaining handsome returns from its ownership of a [London Wall] metaverse platform. Owners of virtual land can transact, develop, lease or otherwise use their entitlement to virtual construction, in any manner they see fit. As yet, there are very few restrictions in place affecting virtual space. For instance:

- Everyrealm (formerly Republic Realm) purchased a plot of land in [Decentraland] and converted this into a shopping district called Metajuka (inspired by Tokyo's Harajuka shopping district.
- Sotheby's has created a digital replica of its London headquarters, in [Decentraland], to showcase digital art for sale.
- Samsung has launched virtual retail space, again in [Decentraland], for engaging customers in its own products.

As owners of a [London Wall] platform, the City will be able to provide opportunities for real estate managements to gain valuable experience in letting a portfolio of virtual space. We can anticipate that the aim, in offering preferential rates to those tenants who also have a physical presence at London Wall West, will be to encourage a pattern of dual tenancy that can be extended, over time, to another City owned metaverses in the Square Mile. Although, in theory, such a plethora of metaverses will enable people, activities, and businesses to disperse geographically, the City will remain crucial–perhaps even more than today–to serve as a person-to-person hub of collaboration and innovation. In the City of London, organizations will continue to gain access to a deep talent pool because people want to be there (e.g., those who have moved within the last 10 years or so to Canary Wharf, a docklands outpost of the City, are now returning). For the future, we

can expect to see this trend continuing as leading "superstar" cities become more and more important as places for workforces to come together and interact in the physical world.

If London Wall West can be given the go-ahead as a 50/50 test bed of experimentation, a lot will depend on it becoming recognized as a model for success in establishing the City's future. Already, we know that, by adopting a "Building Less is More" policy, the City will be able to rest on its laurels as an exemplar of sustainability but, also, success at London Wall West, and its virtual complement [London Wall], could give the City sufficient confidence to create its own [Decentraland]–i.e., a [Square Mile] platform for virtualization. To some, this idea will appear as a "fantasy beyond belief," although, in fact, the construction of a virtual [Square Mile] (to complement the existing physical reality) represents the only feasible way for the City to build the connections required internationally for the City to remain a global hub of commerce and become a center for culture. It heralds a future rich in possibility. The infrastructure of a virtual [Square Mile], created and managed by the City, will generate a platform where new media art's engagement with advanced technology can be expected to act as a magnet for visitors and create a fulfilling wonderland for the City's inhabitants and workers.

Figure 16. A [Square Mile] platform for virtualization (i.e., the City's own Decentraland) will enable the City, and many commercial and financial organizations already located in the physical Square Mile, to become "hosts to culture". Sketch by the author shows the hub of the City's [Square Mile]

I can foresee the City becoming a "world first" in demonstrating Culture and Commerce coming together as a powerful motivator of change and renewal. But final success will depend on culture and commerce joining forces as equals: a token influx of culture will never be enough.

Currently, in the physical Square Mile, a pattern of events is emerging which indicates that surplus space for existing owners, tenants and users is becoming evident, over time, as the City adjusts to a new office / homeworking balance established during the Covid-19 pandemic. (City companies that I have approached on this subject confirm that they need, at most, three fifths of their existing space.) The release of this surplus space onto the market will occur as current leases expire or come up for renegotiation, with significant amounts becoming available over the next 5 - 10 years. It is during this same period that lessons to be learned from the physical construction of London Wall West and its virtual counterpart as a digital [London Wall] twin will become apparent. Has it worked as a beacon of change?

Given a positive response to this question, it will be safe to assume that the same idea can be applied to the much bigger canvas of the [Square Mile] platform (Figure 16). The many commercial and financial organizations, already gathered together in the City from all corners of the earth, can then become, if they wish, hosts to culture. To take one hypothetical example, I can imagine, for instance, that Deutsche Bank, with a large physical presence in the City and potentially an equivalent virtual presence in the [Square Mile] platform, inviting the Staatliche Museen zu Berlin to curate an out-reach virtual presentation, where a City-based international audience can engage with German art and artefacts. The Staatliche Museen, as one of the most digitally advanced museums in Europe, will be well equipped to take on this challenge.[xx]

This type of cultural brokerage, applied many times over, will quickly establish the City as a global center for culture. Moreover, as has proved to be the case in [Decentraland] and other platforms, real estate prices in the metaverse are rising exponentially. Bloomberg estimates that the metaverse market could reach US$800 billion by 2024, up from about US$500 billion in 2020. The creation of a [Square Mile] virtual platform promises to become a winning venture for the City, firmly establishing its reputation as a global hub of innovation and sustainability.

Conclusion: The Value of Conjecture

It was the City of London's ambitious intent to make "Culture and Commerce Stronger Together" that ignited my inquiry into how, potentially, a solution to the City's own dilemma, caused by plans to build London Wall West as a beacon of change, might be resolved by adopting a policy of "Building Less is More". But no organization, however bold and determined, can be expected to embrace the unknown without establishing a blueprint, which will provide at least some assurance that the journey ahead can lead to salvation. In saying this, I am working on the premise that it will take the construction of new virtual environments, working in close harmony with existing and reconfigured physical environments, to ensure the success of the City's bold plan for renewal. In this article I have shown how it can work. Moreover, the time is now.

The software of digital transformation requires blending human potential with technology to enable creativity. Machines are not taking over the world; they rely on a process of machine learning whereby they must first be trained by humans. This idea of technology and people working symbiotically lies at the very heart of the digital transformation–a fact that is firmly established in the cultural sector. For this reason, the City's plans for becoming a center for culture (whilst remaining a global hub of commerce), far from being blue sky, are set to move ahead at a time when many cultural institutions will be only too willing to merge with the life of City streets–a move that jells with their own plans for change and digital transformation.[xxi]

My suggestion that the metaverse offers a solution to the City's apparently intractable problems must be regarded as a conjecture[xxii]–a conjecture where London Wall West, in highlighting all the salient factors that are set to impact on the construction of an ecosystem of metaverses, can help to stem our seemingly unstoppable dash to climate disaster. The current dire performance of the global construction industry in reducing greenhouse gas emissions pinpoints the need for action, and the opportunity to satisfy that need by building less is effectively illustrated by the proposed reduction in London Wall West's carbon footprint.

I am not suggesting that the task that lies ahead will be easy. Far from it. Initially, we might not be completely successful in tackling each and every aspect of a process which, inevitably, must change our lives forever. However, I regard the attributes of a metaverse as a way of solving problems, not making them. Taken as a model for embracing a future that can resolve the problems of the past, London Wall West offers an ideal opportunity for the City to undertake an ideas-led process of renewal. The City may or may not decide to take the plunge into a problem solving virtual world. But if it does, City policy makers will take credit for facing up to a challenge that central government is failing to fully address (i.e., tackling climate change). Whatever happens, I am grateful that at London Wall West I have found the complexity and components of a challenge that extends far beyond the City's Square Mile. By embracing the virtual world ahead of time, the future becomes no longer a threat but, more, an opportunity.

References

Ball, Matthew. *The Metaverse And How It Will Revolutionize Everything*. New York: Liveright Publishing Corporation, 2022: 255.

Capgemini. "Is the metaverse inching closer to reality?" (2022). https://www.capgemini.com/insights/expert-perspectives/is-the-metaverse-inching-closer-to-reality

Capgemini. "Want Digital Transformation Success? Then preparation is key" (2021). https://www.capgemini.com/insights/expert-perspectives/want-digital-transformation-success-then-preparation-is-key/

Chalmers, David. *Reality+ Virtual Worlds and the Problems of Philosophy*. London: Allen Lane, XVII.

Cherner, Jessica. "Zaha Hadid Architects is Building a Virtual City for the Metaverse." (2023). https://www.architecturaldigest.com/story/zaha-hadid-architects-building-virtual-city-metaverse

Clegg Nick. "Making the Metaverse: What is it, how it will be built and why it matters." (2022). https://tech.facebook.com/ideas/2022/05/making-the-metaverse/

City of London. “Culture and Commerce Fuelling Creative Renewal.” (2021). https://www.cityoflondon.gov.uk/assets/Things-to-do/full-report-culture-and-commerce-fuelling-creative-renewal.pdf

City of London. “London Wall West.” (2022). https://londonwallwest.co.uk/wp-content/uploads/2022/06/CoL.LWW_.A0.Boards.WEB_.21.06.17.pdf

Hyoung-Yong, Chai. “Working in the metaverse: Does Telework in a Metaverse Office Have the Potential to Reduce Population Pressure in Megacities? Evidence from Young Adults in Seoul South Korea.” (2022).” https://doi.org/10.3390/su14063629

Lanier, Janier. *Dawn of the New Everything*. *A Journey through Virtual Reality*. London: Penguin Random House, 2017: 1

León-Dominguez, Umberto. *Mastering Virtual Reality*. London: Amazon, UK, 2022, 25

Moss, Jennifer. “The Pandemic Changed Us. Now Companies Have to Change Too.” (2022). https://hbr.org/2022/07/the-pandemic-changed-us-now-companies-have-to-change-too

Townsend, Solitaire. “Could The Metaverse & Web3 Save Sustainability?” (2022). https://www.forbes.com/sites/solitairetownsend/2022/09/29/could-the-metaverse--web3-save-sustainability/?sh=1690767b6463

Trickett, Terry. “New Media Art as a Vehicle for Research and Innovation”, (8. Conjectural coincidence). (2021). https://doi.org/10.14236/ewic/EVA2021.41

Trickett, Terry. “Through the Looking Glass to a Post-pandemic World with New Media Artists as Our Guide. (3. Museums and Galleries at the Crossroads), (4. Art & Technology acting together to create Virtual Worlds). (2022). https://doi.org/10.14236/ewic/EVA2022.40

University of the Arts London (UAL). *Creative Computing Institute,* 2023. https://www.arts.ac.uk/creative-computing-institute

United Nations Environment Programme. *Global Status Report for Buildings and Construction 2022*. Open English edition. https://wedocs.unep.org/handle/20.500.11822/41133

[i] Throughout this article, the word ‘construct’ is used with two different meanings: to erect a building (physical reality) or to form an idea bringing together various conceptual elements (virtual reality).
[ii] City of London, “Culture and Commerce Fuelling Creative Renewal,” (2021). https://www.cityoflondon.gov.uk/assets/Things-to-do/full-report-culture-and-commerce-fuelling-creative-renewal.pdf
[iii] City of London, “London Wall West,” (2022). https://londonwallwest.co.uk/wp-content/uploads/2022/06/CoL.LWW_.A0.Boards.WEB_.21.06.17.pdf
[iv] Net zero means no longer adding to the total amount of greenhouse gases in the atmosphere. Greenhouse gases include carbon dioxide (CO_2) and methane. Under the 2015 Paris climate agreement,

197 countries agreed to try to limit global temperature rises to 1.5C by 2100. To achieve this, scientists said that net zero CO_2 emissions should be reached by 2050. However, the UN now wants countries to bring forward their net zero targets by a decade. Not all emissions can be reduced to zero, so those that remain need to be matched by actively removing greenhouse gases from the atmosphere. This is known as "offsetting."

[v] United Nations Environment Programme, *Global Status Report for Buildings and Construction, (2022),* Open English edition. https://wedocs.unep.org/handle/20.500.11822/41133

[vi] Chai Hyoung-Yong, "Working in the metaverse: Does Telework in a Metaverse Office Have the Potential to Reduce Population Pressure in Megacities? Evidence from Young Adults in Seoul South Korea," (2022)," https://www.mdpi.com/2071-1050/14/6/3629/htm

[vii] Janier Lanier, *Dawn of the New Everything. A Journey through Virtual Reality*, London: Penguin Random House, 2017, 1.

[viii] David Chalmers, *Reality+ Virtual Worlds and the Problems of Philosophy,* London: Allen Lane, xvii.

[ix] Capgemini, "Is the metaverse inching closer to reality?," (2022) https://www.capgemini.com/insights/expert-perspectives/is-the-metaverse-inching-closer-to-reality

[x] Capgemini, "Want Digital Transformation Success? Then preparation is key," (2021) https://www.capgemini.com/insights/expert-perspectives/want-digital-transformation-success-then-preparation-is-key/

[xi] Cherner, "Zaha Hadid Architects is Building a Virtual City for the Metaverse," (2023) https://www.architecturaldigest.com/story/zaha-hadid-architects-building-virtual-city-metaverse

[xii] Whenever a reference is made to a virtual platform, e.g., Decentraland, the name is placed inside square brackets: [Decentraland].

[xiii] Solitaire Townsend, "Could The Metaverse & Web3 Save Sustainability?," (2022) https://www.forbes.com/sites/solitairetownsend/2022/09/29/could-the-metaverse--web3-save-sustainability/?sh=1690767b6463

[xiv] Nick Clegg, "Making the Metaverse: What is it, how it will be built and why it matters," (2022). https://tech.facebook.com/ideas/2022/05/making-the-metaverse/

[xv] Umberto León-Dominguez, *Mastering Virtual Reality*, London: Amazon, UK, 2022, 25

[xvi] University of the Arts London (UAL), *Creative Computing Institute,* 2023 https://www.arts.ac.uk/creative-computing-institute

[xvii] Terry Trickett, "Through the Looking Glass to a Post-pandemic World with New Media Artists as Our Guide. (3. Museums and Galleries at the Crossroads), (4. Art & Technology acting together to create Virtual Worlds), (2022) https://www.scienceopen.com/hosted-document?doi=10.14236/ewic/EVA2022.40

[xviii] Matthew Ball, *The Metaverse And How It Will Revolutionize Everything,* New York: Liveright Publishing Corporation, 2022: 255.

[xix] Jennifer Moss, "The Pandemic Changed Us. Now Companies Have to Change Too," (2022). https://hbr.org/2022/07/the-pandemic-changed-us-now-companies-have-to-change-too

[xx] Many other museums, including the Imperial War Museum and the Science Museum Group in London, are now transgressing their physical boundaries by engaging with emerging technologies (e.g., volumetric displays, ray tracing, holograms and Desktop AR) as a way of sharing 3D exhibits in remote locations. Such lessons, learned during the pandemic, are proving to be vital in establishing new audiences for arts and culture.

[xxi] Trickett, "Through the Looking Glass."

[xxii] Terry Trickett, "New Media Art as a Vehicle for Research and Innovation", (8. Conjectural coincidence). (2021). https://www.scienceopen.com/hosted-document?doi=10.14236/ewic/EVA2021.41