ARCHITECTURE VALUE CHANGE IN RESPONSE TO THE ANTHROPOCENE: THE CONTRIBUTION OF DIGITAL INNOVATION

DERMOTT MCMEEL[1] and EMINA K. PETROVIĆ[2]
[1] *AUT University, Auckland, New Zealand*
[2] *Victoria University of Wellington, New Zealand*
[1]*dermott.mcmeel@aut.ac.nz, 0000-0002-3790-3444*
[2]*emina.petrovic@vuw.ac.nz, 0000-0003-3446-093X*

Abstract. The confluence of different interests—the Anthropocene, productivity, sustainability, economics—calls for a need to re-think how the professions evaluate the built environment. There is a myriad of different strands of work under this umbrella which—broadly—point to a shift in the value framework for those people and professions who have agency in, and are responsible for, the creation of the built environment. This paper has two objectives. First, by drawing from the writing of architectural theorist Juhani Pallasmaa it teases out themes useful to conceptualise the value change. The goal is to delineate particular views around the creation of and our relation to the built environment. Second, it presents three projects: (1) tracking chemical composition of construction materials, (2) an app that encourages e-commerce in building multi-species environments, and (3) a concept for an economy in construction waste leveraging possibilities presented by blockchain technology. The aim is to shed light on how the emerging blockchain technology might alter values and organisational systems of the built environment in response to the Anthropocene and climate crisis.

Keywords. Design; Anthropocene; Value Change; Blockchain; System Design; SDG 9; SDG 11; SDG 12.

1. Introduction

In 1992 at a symposium in Trondheim the architectural theorist Juhani Pallasmaa was arguing that architecture was becoming a highly self-referential and over-intellectualised pursuit. Architects were losing sight of the inhabitant, those that 'dwell' in their creations (Pallasmaa, 1992). He cites the court case of Mies van der Rohe versus Farnsworth, who was claiming the famous Farnsworth House was unsuitable as a home. Conversely, the house—architecturally speaking—is recognised as one of the most important buildings of the century. The court, incidentally, agreed that the contribution the house made to architecture trumped its deficiencies as a home.

This example brings into sharp relief the tension between different value frameworks for valuing architect and the built environment. Viewed one way, the

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Farnsworth House has questionable value to the client and the dweller. Viewed another, it is valued highly to the professional disciple of architecture. This tension is central to the challenges of the discipline of architecture for much of the 20th century and into the 21st century. Since Pallasmaa's presentation in 1992, we have been through the age of the Starchitects (Fajardo, 2010; Klimek, 2013), where, possibly, both the architect and the architecture were celebrated over and above the environments they create. Arguably more recently this has progressed further with a current shift to architecture being valued for its 'instagrammability' and a presence on the video focused social media platform TikTok (Wainwright, 2018, 2021).

However, this tension between the architect and the client/dwellers is further complicated when faced with the Anthropocene, climate change, and the need to consider the planet as a third interested party. While the client/dwellers, as people, have always been able to express their interests, the planet needs the others to speak on its behalf. Yet, sustainable and passive buildings seem to continue as specific categorical sub-sets of architecture rather than core of the mainstream. Further to that, much of the existing work in this space is limited to carbon considerations and the well-recognised need to optimise existing practices; which are important, but that is not all that is needed. The built environment contributes to the devastation of the planet through significant material extraction, landfill disposal, and toxicity of construction materials.

This is the tension—the value shift—being explored in this paper. It asks: How do we support better inclusion—and valuing—of complex considerations of planetary needs in architecture? How can digital technologies accelerate these needed changes? But most importantly, what sort of value framing is needed for a shift away from self-referential Starchitects criticised by Pallasmaa to architects proactively re-shaping human engagement with the planet for the betterment of all.

The paper links with a range of United Nations Sustainable Development Goals (SDGs): most directly with SDG11: sustainable cities and communities; SDG9: industry, innovation and infrastructure; and SDG12: responsible consumption and production, because it is proposing a different way of thinking about sustainable architecture through innovative reshaping of industry and consumption. The examples presented in Section 4 aspire to contribute to improved health of people, and life on land and below water (SDG3; SDG14; SDG15).

1.1. PAPER OUTLINE

Section 2 looks at the material extraction and other planetary costs associated with designing and constructing built environment. Section 3 delineates and unpacks two conceptual themes, which serve as a way to organise particular changes in this shift away from Pallasmaa's concern for the 'self-referential.' These themes point to a shift from an *assertoric* gaze to an *alethic* gaze; also drawn from Pallasmaa's writings they provide a language to explore the implications for architecture. Finally, Section 4 discusses three projects that shed light on social and organisational systems that are reorienting around these values.

2. On Material Extraction

In the developed world it is estimated that construction contributes to almost half of all

planetary material extraction and one to two thirds of all municipal landfill waste (Behrens et al., 2007; Bossink & Brouwers, 1996; Purushothaman & Seadon, 2020; Schandl et al., 2018; Schandl & Eisenmenger, 2006). For example, despite currently not being recognised as an issue, aggregate extraction of sand and gravel, primarily for use in construction, is by volume the largest extraction of any solid material on the planet, with extraction rate exceeding natural replenishment rates and already causing costal erosion and ecosystem destruction (UNEP, 2019). On the other side, in recent years some real progress with recycling rates of construction waste has been noted in the European Union due to regulations requiring a high level of recycling (EEA, 2021). The issue remains that much of such recycling is downcycling of masonry waste into backfill, and possibly excessive backfill (EEA, 2021). Further issue is that such practices are not an international norm, with other countries, like the United States reporting that as much as 90% of construction and demolition waste is actually demolition waste (EPA, 2021), due to buildings not being built to easily dismantle.

There are several reasons for this high level of extraction and subsequent waste from construction. First, in many parts of the world overconsumption and waste are built into the business of construction. It is a percentage that is presumed lost and thus tendered against the total cost of a project. Suppliers may provide extra material to a contractor at no additional cost. Typically, this is an informal social contract intended to increase the likelihood of the contractor returning to the supplier for future orders. Second, there are cultural factors. Anecdotal evidence points to contractors in the small to medium enterprise category (SME) using surplus to increase resilience. For example, moving it between projects, offsetting a deficit on one site by moving surplus from another. Third, building materials in many cases are complex composites not designed decomposition and recycling. Finally, the built environment is still not designed for deconstruction, when a building is no longer fit for purpose, most of it will end up in landfill.

Further to that, there is insufficient information on how many—up to 95%—of the chemicals used in construction products impact health (Pacheco-Torgal, 2012). Inadequate recognition of health risks associated with construction materials is a complex problem (Petrovic et al., 2017), amplified by the limitations of the existing scientific knowledge (Binetti et al., 2008). This limits accuracy of the reports such as Environmental Product Declarations which are based on the available knowledge (EPD Australasia, 2021). Chemicals harmful for humans tend to also present issues for natural ecosystems, and improvements in this area are much needed for less adverse impacts of built environment on the planet.

In order to develop more sustainable solutions, a shift out of these patterns is needed, which is why it is important to question the values and agency that underpins the creation of the built environment. If we bring into the consideration the voice of the planet, it is clear that such patterns cannot continue because architecture has to find the way for effective inclusion of planetary interests. That means developing systems to help articulate this relationship, which needs to include carbon reductions, material extraction, toxicity, waste and carefully evaluating other impacts on the ecosystem.

3. Themes for the Anthropocene

In order to develop a better understanding of the dynamics which might be at play

behind the values discussed here, this section unpacks the two themes as defined by Pallasmaa: the assertoric gaze and the alethic gaze. They present two possibilities for different ways to see and value the built environment, either as designer or as inhabitant.

3.1. THE ASSERTORIC GAZE

Assertoric is an Aristotelian proposition, Pallasmaa's appropriation puts forward the 'assertoric gaze' as one of two modes of vision.

> "The assertoric gaze is narrow, dogmatic, intolerant, rigid, fixed, inflexible, exclusionary and unmoved." (Pallasmaa, 2012, p. 34)

It could be argued that the celebrated architecture of the 20th century is based on this type of 'gaze'. Projects and people that have been elevated in importance often have the characteristics of dogmatic in personality; or a process or vision that—under pressures—remained focused, fixed and unmoved.

Our opening example of Mies van der Rohe's Farnsworth House illustrates the limitation of this view; a thing highly valued from one perspective be profoundly flawed from others. So, while this gaze has been useful for inspiring and communicating by simplifying architecture and its ideologies, this paper suggests it is increasingly inadequate for engaging with the complexity of the needs to frame, value and articulate 'architecture' within the context of the Anthropocene. Concerns over material toxicity, waste and carbon footprints are continuing to increase. The discourse finds itself wanting a more pluralistic multi-standpoint lens through which to view express the built environment - what Pallasmaa refers to as an 'alethic' gaze.

3.2. THE ALETHIC GAZE

Pallasmaa discusses his appropriation of the 'alethic' gaze.

> "The alethic gaze, associated with the hermeneutic theory of truth, tends to see from a multiplicity of standpoints and perspectives, and is multiple, pluralistic, democratic, contextual, inclusionary, horizontal and caring." (Pallasmaa, 2012, p. 34)

An alethic gaze shifts away from narrow dogma, whether that is aesthetics or ideology or geometry. It moves instead towards a multiplicity of values (material toxicity, energy efficiency, waste), this is an important fundamental shift in the way society sees and values the built environment, from assertoric to alethic. The value of a building or collection of buildings is fundamentally changed. While their aesthetic value or architectural ideology is not necessarily overlooked, the alethic gaze is asking for more context and data to evaluate the architecture. A useful analogy may be the difference between data (information) and metadata (data about the information) (Duval et al., 2002). To evaluate a piece of data or information, its metadata is interrogated. We use: author; date of publication; publisher; who is citing—or dismissing—the information and where. To extend this analogy to our current topic, the alethic gaze suggests a shift away from looking at a single piece of architecture and instead is searching for what we might term 'meta-architecture,' richer datasets to help

evaluate the architecture.

3.3. THE IMPLICATIONS FOR ARCHITECTURE

Metadata's emergence is closely linked to the increase in volume of information available on digital systems (Duval et al., 2002). This increased volume required a step change in the sophistication of techniques needed to evaluate data. The Anthropocene causes us to reconsider the built environment; to consider not just the built object, but its material supply chain, its waste and carbon/greenhouse gas emission, lifecycle energy use and multi-generation material recovery and reuse. Existing data structures IFC (Industry Foundation Class), BIM (Building Information Models) and COBie (Construction Operations Building Information Exchange) are inadequate to articulate this information in relation to the environment. The current value shift appears to need additional data, tools and systems to express this new meta-architecture.

This section has contextualised a value shift in terms of two different frameworks, that of the assertoric and alethic gaze. We suggest these are two fundamentally different ways for viewing our relationship with the built environment and its relationship to wider planetary systems. We suggest moving forward into the Anthropocene that it is the alethic view of the environment that can accommodate shifting pluralistic value systems because it offers the possibility of engaging with the multiplicity of factors—the meta-architecture—of the built environment that is increasingly being demanded.

4. Organisational and Value shifts

This section discusses three approaches or projects which embody the change, and reorient the organisational systems through new opportunities presented by emerging digital technologies. We start first with an expansion upon the more traditional data-base approaches through the application of the blockchain technology. Second, an app that encourages e-commerce in building multi-species environments. Third, a concept for an economy in construction waste leveraging possibilities presented by blockchain technology.

4.1. TRACKING CHEMICAL COMPOSITION OF THE CONSTRUCTION MATERIALS

We open with a collaborative project within the Victoria University of Wellington, New Zealand which explores application of the blockchain technology for tracking of toxic and other components in building materials. Many composite construction materials are comprised of a number of components. These are manufactured in various facilities by different companies, which presents challenges when trying to obtain full value chain information. Blockchain technology offers opportunities for applications in law, especially in tracking of contractual succession of relevant information, for example for ownership of a property. The ability to lock-in specific providence information into the blockchain as impossible to change, gives certainty needed for such tracking. Applying the same logic, if all components of building materials were tracked using blockchain, the final purchaser of the material would be able to have easy access to the total composition of the material. This can be tracked in the blockchain by lodging the contractual transactions between different manufacturers

when the material components change hands.

The advantages of this approach are that it improves upon the existing systems where documents such as Environmental Product Declarations are used based on periodical reviews, and often present average or estimated summaries of the particular material (EPD Australasia , 2021). It also provides the full accuracy required by the more progressive labelling systems such as the Living Building Challenge (Int. Living Futur. Inst., 2021). The disadvantages are that for this approach to work, all companies in the particular manufacturing chain would have be agree to participate, and at the current level of development of blockchain platforms.

Returning to the value shift, this approach enables easier access to the information required for alethic gaze at construction materials, and shows that we have technologies capable of providing far more complex information needed for alethic gaze. However, this approach is not especially agile or easy to implement because: it requires agreements from a range of companies, and data storage for each batch of manufactured materials. Tracking of the composition is easier than interpretation of impacts those present, which would be more useful.

4.2. CO DE|GT: AN APP FOR MULTI-SPECIES CO-LIVING

A more agile approach which can stimulate change is the Co DE|GT mobile application is being developed at the Welsh School of Architecture's Synergetic Landscape Unit (Davidová, 2020). The unit has collaborated with Computer Science at Cardiff University as well as the School of Architecture and Planning Bhopal, India and the School of Future Environments at Auckland University of Technology, New Zealand.

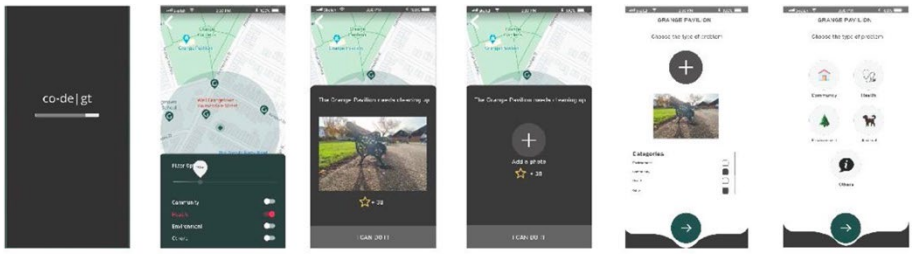

Figure 1. Co DE|GT Application.

The application illustrated in Figure 1, builds on the burgeoning research into, and potential for, crypto-currency and smart contracts for social good (WEF, 2018). It seeks to challenge the dominant 20th century view that the natural world and its flora and fauna are to be colonized for capitalisation. The app aims to grow commerce that supports diverse flora and fauna. For example, one user provides a design for a 'bug hotel' and another user who builds the hotel earns tokens. In this the app tries to redress the economic imbalance where non-human species rarely have agency within financial markets. While in this prototype the community is trading on behalf insects, future versions may speculate on future scenarios where 'things' have wallets and buying power (Pschetz et al., 2017).

By way of reflection this project embodies three shifts in relation to the shift from an assertoric to an alethic perspective. First, it challenges the dogma of economic supply and demand and the material extraction from the natural world that drives it. Second, it expands beyond the narrow view economics and into a concept of multi-species economics. Finally, whereas economic growth is generally seen as problematic in regards to climate change and emissions. The app speculates on an economy that attempts to sustain rather than deplete the natural environment.

4.3. WASTING TIME: A CRYPTO-ECONOMY FOR WASTE

In section 1.1 we outlined in some depth the problem of waste in the construction sector as a combination of economics and culture; and the provision of surplus is part of the system. 'Wasting Time' is a research collaboration between several New Zealand Universities: Auckland University of Technology, Victoria University, The University of Auckland and Unitec. It is tasked with investigating ways to reduce waste from the construction process. One of the strands of research within this programme is exploring opportunities that emerging technology might offer to address the economic problem of waste and surplus in construction.

Trash to Things Coin (TTTCoin) is a crypto-trading concept being developed by the group in collaboration with industry stakeholders. It is a concept complementary currency which can only be traded on a limited network for products and services that are verified as reusing and reusing construction surplus. In this scenario—explained in an short presentation (McMeel, 2020)—specific products can be verified as reducing or reusing construction surplus materials, and can only be purchased with TTTCoin. The manufactures of these products can pool TTTCoin to purchase waste from contractors in that currency. Contractors can use that currency to buy verified products for their projects or they can be approved to 'cash-out' converting TTTCoin to government currency and increasing cash profits. Thus, incentivising greater care of surplus material for resale to this network.

Unique currency ecosystems are not new, they have existed in the gaming world for some time, where a specific ‘currency’ can be purchased within a game. In the last decade unique crypto-currencies have emerged to circulate in the real world (Nakamoto, 2008). Bitcoin is the most famous but there are others such as Ethereum and Dogecoin. Complementary currencies that function in parallel to national currency are not a new phenomenon, although they are usually local in nature and only circulated within a specific geographic area (Amato & Fantacci, 2020). With both bitcoin and traditional complementary currencies goods or services can be bought and sold, but only within a specific limited network.

Returning to our point, the shift from assertoric to alethic gaze. This project offers two shifts. First, it is speculating on organisational systems that are focused not on the material that goes into building but the material that is left out. Second, such a scenario prompts us to ask if the systems and processes—the meta-architecture—is in place to adequately quantify what and where surplus materials are available in the supply chain and on sites and to trade efficiently with them.

5. Conclusion

To conclude, the paper has introduced two perspectives from which to evaluate the built environment, the assertoric and the alethic. Specifically, it foregrounds how history has privileged the assertoric, whereas the future requires the alethic. The alethic being particularly suited to embracing a multitude of standpoints; a necessary future requirement for society to evaluate if the built environment is fit for purpose during the Anthropocene. The introduction of the term 'meta-architecture' helps to ground this emerging departure from historic consideration of the building as 'object;' instead favouring a multiplicity of factors that need to be wholistically considered for evaluation of the built environment within the context of the Anthropocene.

Presented works show that there is scope for much innovation, and we should consider is how much particular approaches are endorsing or facilitating the improvements of the existing, or offer potential to be a dramatic 'game changer' innovation. Within this context, the first project can be seen as facilitating needed improvements within the existing: although helpful, it would not lead to a dramatic change. The other two examples show greater potential to make systemic change, and they ground how this complexity is beginning to emerge. CoDE|GT in trying to embrace a multi-species economy and TTTCoin unpacking the granular information, systems and process that might be required for evaluating and reducing waste in the construction process.

Finally, the paper, and the research projects bring to centre stage the inadequacy of existing information exchange (BIM, IFC, COBie etc.) to respond to the informational needs of the Anthropocene. Where there is a need to track material toxicity; more explicitly quantify the relationship between the built and natural environment; as well as track materials for reuse and redirection from demolition and landfill. It is an exhortation for developing new tools, systems and schema to enable an entirely different type of quantification and evaluation of the built environment.

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