BUILDINGS & CITIES

Transition to a regenerative future: a question of time

SYNTHESIS

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ABSTRACT

This paper explores the difference between the ways that nature functions and the way that the built environment is currently produced and operates, and if and how they can be realigned. While regenerative approaches can apply to a range of human enterprises, the paper focuses on their application to the production of the urban built environment. It examines if and how they may move into mainstream building practice and how long this may take given the inherent inertias in the building industry. Key issues include the recasting and interrogating of the accumulated knowledge held by design professionals within a broader living systems frame, and rethinking what constitutes a successful outcome of building design. Such efforts are set against the diminishing time available before a series of climate tipping points are crossed and further short- to mid-term constraints posed by a host of other powerful countervailing forces.

PRACTICE RELEVANCE

A critique of emerging regenerative practices is provided with an overview of both the challenges facing design professionals moving them into mainstream building practices, and the opportunities it provides them. Rather than viewing their work as solely reducing environmental impact, regenerative practices offer architects and planners a positive casting and expansion of their responsibilities. They enable design professionals to both contribute in the bringing about of systems-level change and to provide inhabitants with greater opportunities and pathways to both navigate an uncertain future and re-establish, reconnect and co-evolve with natural systems.

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1. INTRODUCTION

'Regenerative' practices have gained prominence in the literature over the past decade or so and are considered by their proponents as offering necessary ways of thinking and processes of decision-making that promote collaborative and reciprocally evolving relationships between social–cultural and ecological systems (Mang & Reed 2012). While regenerative practices can apply to a range of human enterprises, this paper explores the difference between the ways that nature functions and the way the built environment is currently produced and operates, and if and how they can be realigned.

The paper fully subscribes to both the ambitions of regenerative practices and the necessity to embrace them, but focuses on how to move them into mainstream building practices. While the positive emphasis of regenerative practices can be quickly grasped, the fundamental transformations to which they aspire will take time, and thereby raising issues of timeframes, rate of change and the forces that speed up or slow down their adoption. Given the rapidly shortening time to avoid tipping a cascade of disastrous changes in climate and other planetary systems (McKay *et al.* 2022), how quickly design professionals, construction practices, and the institutions and authorities that regulate them can change, and in turn make these changes manifest in the built environment, become important questions. To permit a focus on the adoption of regenerative practices, the paper does not revisit all the arguments to justify them, nor does it present their strategies, concepts and underlying ecological worldviews—these are covered extensively in the literature (Hes & du Plessis 2014; du Plessis & Brandon 2015; Mang & Haggard 2016; Wahl 2016; Roggema 2022). Noteworthy, much of the literature regarding regenerative practices related to the built environment draws extensively on the core ideas and concepts developed by the US Santa Fe-based Regenesis Group.

The paper is organised in three main sections. The first examines the relationship between human and natural systems and reviews several key aspects related to how they can be harmonised. Importantly, this section provides an understanding of the distinctions and similarities between the ways that nature and the built environment function. The second presents several key cultural, institutional and professional inertias that are inherent in how buildings are produced and which affect the speedy adoption of new approaches, and the challenges facing the adoption of regenerative practices. After discussing the shortening time available to act, the paper concludes by emphasising the need to remain positive and the role that regenerative practices and individual and collective human agency can play in coping with an increasingly uncertain future.

2. ALIGNING HUMAN AND NATURAL SYSTEMS

Although cast as the 'defining issue of our time' (UN n.d.), Rees (2021) stressed that climate change is *not* the root problem. Like many other pressing environmental concerns—acidification of the oceans, depletion of fish-stocks, erosion of soils, desertification, shrinking tropical forests, biodiversity loss—he contended that the climate crisis is instead one of the symptoms of ecological overshoot. The 'human enterprise is using resources and generating wastes in excess of the regenerative and assimilative capacities' of the planet (Rees 2021) and, in the case of climate change, human activity emits more carbon than the ability of 'sinks'—the atmosphere, the oceans, soil and vegetation—to absorb. The unfolding dramatic change in the global climate is therefore but one manifestation of the fact that something is seriously wrong in the way humans currently inhabit the planet. Rees connects overshoot to current 'simplistic, growth-oriented, market-based economic thinking' and the dominance of economic models that:

> make no useful reference to the dynamics of the ecosystems or social systems with which the economy interacts in the real world.
>
> (Rees 2017)

We continue to 'prosper' at the cost of a ceaseless exploitation and degeneration of ecological systems, and while global capital produced per person had doubled over the past three decades, the world's stocks of natural assets upon which human life depends have fallen precipitously by 40% (Dasgupta 2021).

Calls for fundamentally rethinking our place in the world and 'reconnecting' human activity with the timeless laws of nature are not new, but have increased in recent years (Martin *et al.* 2016; Dellinger 2018). Ives *et al.* (2018: 1189), however, contended that many of these calls have 'remained speculative and vague' and offered:

> relatively few concrete insights regarding the characteristics of a connected society or how to achieve this goal.

Surprisingly, they did not reference 'regenerative' practices or mention Indigenous practices that have endured for millennia. Although the latter are richly diverse across distinct Indigenous Peoples, they tend to share foundational principles for maintaining 'right relationships' between humans and 'more-than-human' relatives (Pollom 2010; Pidgeon 2019; Kimmerer 2022). While there are many differences between 'emerging' and 'resurging' Indigenous regenerative practices, a common ambition is to nurture rather than deplete social and natural capital/capacities. As such, regenerative and Indigenous practices thereby begin to counter the overshoot issues raised by Rees (2021) and reinvest in mutual thriving of human and ecological systems (Hes & du Plessis 2014).

2.1 DEGENERATION OF NATURAL SYSTEMS

By 'dismantling the Earth's ecosystems, eliminating genes, species and biological traits at an alarming rate' (Cardinale *et al.* 2012: 59), human activity has disrupted ecological interdependencies to a point threatening their abilities to self-sustain and maintain the numerous direct and indirect health, cultural and economic benefits that enable humans to survive and thrive (Brondizio *et al.* 2019). Such a destruction of the habitats and populations of other species not only poses significant legal (Stop Ecocide International n.d.) and moral issues (Hance 2018; Kopnina *et al.* 2018) but also is considered at least as threatening to man's welfare as climate change (Harvey 2018). Montoya *et al.* (2018) argued that while the loss of individual species may not lead directly to ecosystem collapse, *every* loss reduces the biosphere's cumulative integrity and productivity. Human activity and the consequences of climate change are shifting the distribution of species, changing the interactions between them, and transforming the structure, function and potential of their communities (Grimm *et al.* 2013). This is equally the case for human communities, which are increasingly experiencing socio-political (war, persecution), economic (unemployment, poverty) and ecological/environmental (climate change, natural disasters) disruptions (News European Parliament n.d.), which in turn are triggering cascading human migrations and escalating tensions in the regions/nations where migrants end up (UN Migration 2022; Abel *et al.* 2019).

Gladwin *et al.* (1997: 234, 238) contended that:

> [t]he major environmental problems that we face today primarily result from differences between the way nature works and the way humans think.

and

> there is probably no challenge greater than that of transforming the ways human beings think and exist in the world.

Orr (2005: xiv) likewise stressed that what is being faced is:

> nothing less than a rethinking and remaking of our role in the natural world [...] a recalibration of human intentions to coincide with the way the biophysical world works.

While natural systems intrinsically adapt to survive, human systems are 'endowed with volition and intentionality' (Cole *et al.* 2013: 239), and each system and the relationship between them will be affected differently by a dramatically changing climate. Moreover, the notion of 'co-evolutionary'—the 'reconnection of human aspirations and activities with the evolution of natural systems' (Mang & Reed 2012: 6)—emphasised in regenerative practices, speaks to a continually adapting relationship over time and thereby making it necessary to reconcile how the timeframes and rates of change of socio-cultural systems align with those of ecological systems across various scales.

The built environment represents a manifestation of society's aspirations, values, and technological capabilities and, importantly, embodies its attitude towards the natural world. A core position of advocates of 'ecological' design and regenerative practices is that the production of the built environment must follow the 'non-negotiable laws of nature' (Graham 2003: 8), that 'guidelines for effective and ethical action' need to 'cooperate' with nature and comply with its rules (du Plessis & Brandon 2015: 56), and that humans 'act as if we are part of nature' and follow its 'laws and designs' (Hes & du Plessis 2014: 21). How natural systems work has been extensively covered in the literature (Capra 1996; Bak 1996; Wilber 2000; Gunderson & Holling 2002) as has the ways that we connect to living systems. Here, discussions transcend utilitarian and functional dependencies or the 'integration of human technology into ecological processes' (du Plessis & Brandon 2015: 57), to embrace emotional, psychological and spiritual dimensions (Berry 1993; Egri 1997). The lessons nature offers as a model for human systems have been reflected through concepts such as biophilia (Wilson 1984; Kellert 2008) and biomimicry (Benyus 1997; Pawlyn 2011), and form enduring foundations of a rich tapestry of Indigenous knowledge systems across the globe. Hard-earned Indigenous knowledge gained through the exchange of different ways of knowing, upheld by strong community-level involvement and passed from generation to generation, has enabled them to identify and navigate significant challenges presented by environmental change (LaRiviere & Crawford 2013). Indeed, the local and traditional information gained by a long history of being connected to the land is increasingly recognised in supporting forest management science (LaRiviere & Crawford 2013; Schmidt *et al*. 2021).

Six characteristics of natural systems are of interest to the issues explored in this paper.

First, the natural world is comprised of an integrated system of nested, semi-autonomous 'wholes' operating at different levels simultaneously, with each cooperating and contributing to ensure its own health and the health of the overall system. Importantly, each whole depends equally on the smaller systems of which it is composed and the larger systemic context of which it is a part. Wilber (2000: 24) argued that sciences of 'web of life' and the sciences of 'wholeness and connectedness'—all critical characteristics of natural systems—speak 'unmistakably of [natural] hierarchy as the basic principle of wholeness'. The notion of 'panarchy' (Gunderson & Holling 2002) characterises the critical hierarchical relationships between 'small and fast' and 'big and slow' elements within an ecological system. Maintaining dynamic order—or 'right relationships'—is critical in both ecological and human systems. The ways and extent that the larger systems are challenged by the smaller ones are important in initiating systems change. While still retaining a high degree of autonomy, buildings can be informed by their larger socio-ecological context and act as value- (and capacity-) generating nodes within them, nurturing capacities to share and exchange resources that can serve as inputs for other systems or processes. However, although there are multiple narratives of what the built environment could or should be, the ones held by those with the power over decision-making typically prevail and having people in places of 'public visibility and power' who hold a new paradigm is therefore important in creating system change (Kuhn 1962; Meadows 2009).

Second, each species holds a unique 'niche' position and role in an ecosystem (Polechová & Storch 2019). In the production of buildings, the notions of niche and nested systems can relate to *both* the design process and the resulting project. Rojas-Gracia (2020: 101) positioned the design process as a 'pivotal period' that offers the potential:

> [to] cultivate and nurture mutually beneficial connections and interactions between the different aspects and flows that converge in the creation of a project

and to actively seek opportunities to nurture synergies between them. She further suggested that the design process can:

> stimulate dialogues and action that can potentially result in positive changes to local dynamics, having a ripple effect in larger systems

and, as such, can 'nourish' the inherent agency of people and the places they live (166). As with ecological systems, where each element relies on the others for the betterment of the whole, regenerative projects seek to add social and ecological 'value' to the communities of which they are a part, with their inhabitants benefitting reciprocally.

Third, ecological systems drive toward diversity, complexity and connectedness and thereby enjoy greater resilience. Here they move through a lengthy initial period of slow change before a 'tipping' phase when momentum builds, becoming increasingly visible as it accelerates (Rotmans *et al.* 2001). Historically, the design of buildings also evolved into rich and diverse solutions in response to widely varying climatic and cultural contexts across the globe. However, the subsequent dominance of a global 'modern' culture has homogenised human experience and expectation, as is profoundly evident in standardised building form and comfort standards. This growing uniformity of contemporary settlement patterns 'beget an attitude that they are disposable and interchangeable' (Beatley 2004: 3) and, by becoming increasingly homogeneous, simple and fragmented, also become more vulnerable to external stressors. As such Buchanan (1994: 23) suggested:

> the true role of design extends beyond problem-solving and utilitarian concerns, and beyond superficial simplification to be the creation of [higher levels] of order

that generate and enable greater diversity in type and relationships.

Fourth, the collapse of mature ecosystems is followed by a release of potential and phase of reorganisation during which innovation and new opportunities are possible as they transition into some other type of ecosystem (Gunderson & Holling 2002). Although they may retain some of the original species' characteristics of the original ecosystem, their abundance, interaction and ecological functions may change (Newton 2021). Du Plessis (2021) suggested that:

> liminal places [...] where things are no longer working and the call for something new and radically different cannot be ignored

present opportunities for new potentials to be released and for developers to create regenerative interventions, *e.g.* vacant office buildings following the COVID-19 pandemic and failing shopping centres due to increasing online purchasing.

Fifth, ecological systems are inherently embedded within unique physical settings. Regenerative practices prioritise the understanding and engaging of the unique qualities and potential of places and all life that inhabits them. Although people currently move more freely and their 'sense of place and community becomes malleable' (Williams 2013: 1), 'place' still holds considerable significance, with many important consequences. First, people typically hold a strong affinity with the places in which they live, offering a 'doorway into caring' (Mang & Haggard 2016: 38). Moreover, Weil (1952: 40) argued that to be rooted in a place is 'perhaps the most important and least recognized need of the human soul'. Second, the affection for place can 'unite people across diverse ideological spectra' and can unleash the 'personal and political will needed to make profound change' (Mang & Haggard 2016: 39). Third, while the climate crisis is driven by the aggregate of greenhouse gas emissions globally, the consequences will be experienced on a local scale as will the community capabilities to adapt to threats (Paterson & Charles 2019).

Sixth, most ecosystems possess an inherent ability to rebound from major disturbances. The time taken to recover from those caused by direct human activity (*e.g.* deforestation, oil spills, overfishing) or natural events (*e.g.* hurricanes, cyclones, fires) (Jones & Schmitz 2009) varies depending on the type and extent of the damage, the type and diversity in their constituent species, and whether the source of the damage is persistent or completely removed. By contrast, the impacts of climate change will be more enduring. Once added to the atmosphere, CO_2 remains there for between 300 and 1000 years (Buis 2019). The resulting accumulation of atmospheric CO_2 from the pre-industrial level of 275 ppm has set planet-changing forces in motion that perhaps 'cannot be stabilized for centuries' (Orr 2011: ix) but are certainly irreversible on the timescale of humans alive today (NASA n.d.). As such, increased ocean temperature, increased acidification and deoxygenation

(Goldfarb 2017) will continue to degrade marine life habitats and drive the migration of species to colder waters, and the continuing melting of icecaps and thermal expansion of the oceans will increase sea levels and flood threats on low-lying coastal regions.

2.2 WORLDVIEW AND PARADIGM SHIFTS

Western societies still largely hold a prevalent anthropocentric worldview that implicitly places human enterprise as dominant over and essentially independent of nature, and non-human beings are important only to the extent that they affect humans or can contribute to their wellbeing (Boslaugh 2016). Indeed, despite climate change having profound adverse impacts on biodiversity loss, it is largely framed in human cost—loss of lives, loss of property, disrupted food supply, *etc.* (State of Nature Partnership 2019). By contrast, a 'biocentric' worldview considers humans and other species are all interdependent members of the community of life, each living thing has inherent worth, and humans are not superior to other species (Brennan & Lo 2008). Although direct kinship and ecological connectedness are embedded within Indigenous cultures (Pollum 2010; Kramm 2020), over centuries anthropocentrism has equally become ingrained in all aspects of Western society and culture and concretised through building and planning practices. Despite the numerous benefits of 'rewilding' urban areas (Schulte to Bühne *et al.* 2022), it will 'take time to shift out of the mindset of wanting to completely manage nature in cities' (Song n.d.), to permit it sufficient agency to evolve on its own terms, and for urban dwellers to feel comfortable coexisting with a wider range of animals that constitute complex ecological systems.

Our search for, and structure of, knowledge remain largely entrapped in a mechanistic scientific paradigm. Founded on the belief that:

> human intellect and will would produce the science and technology to master and manage a chaotic nature
>
> (Egri 1997: 409)

it favours rational, analytical, reductionist, linear thinking (Capra 1996; du Plessis & Brandon 2015). Advocates of regenerative practices call for a shift to an 'ecological' worldview that embraces a 'systems view of life' and embracing of the integrative thinking that it requires (Capra & Luisi 2014). The mechanistic and instrumentalist worldview has been some 500 years in the making and remains ingrained in all aspects of Western society and culture, and is not likely to be quickly replaced. Goldsmith (1997: 4) suggested that shifting worldviews is very difficult for three reasons. First, they constitute a 'highly coherent and self-consistent whole' and thereby enjoy a:

> great credibility regardless or not [if they] reflect a society's relationship with its environment with any sort of accuracy.

Second, while knowledge and thinking remain accepted until they are challenged, individuals and societies have a:

> psychological stake in maintaining the integrity of their worldview in the face of any new knowledge that might serve to discredit it.

Third, such a shift, involves a 'profound rearrangement or recombination of the knowledge' that affects the 'very metaphysical, ethical and aesthetic foundations' of the prevailing worldview (Goldsmith 1996: 435).

Regenerative practices stress that living systems are self-organising networks whose components are all interconnected and interdependent, and that their essential properties derive from these relationships. Here, Fang & Casadeval (2011), Capra & Luisi (2014), du Plessis & Brandon (2015) and others note three key points. First, while reductive approaches are incapable of adequately explaining the behaviour of living systems, modeling and even understanding their multitude of dependencies, relationships and interactions is inherently extremely difficult. Second, although reductionism is seemingly counter to the systems thinking that underpins regenerative practices, they *each* offer valuable perspectives, insights and knowledge for building design and planning.

Third, an ecological paradigm does not negate or replace reductivism, but it is important to understand reductive approaches' limitations, their realm of validity, and the appropriate context to apply them (du Plessis & Brandon 2015).

Building design, by its nature, integrates a host of social and technical issues, and necessarily and constantly moves between reductive and holistic analysis—the investigation and resolution of details within the context of a larger design context. However, regenerative practices explicitly seek to cultivate mutually beneficial connections, interactions and synergies not only between internal building systems but also those potentially between buildings and their socio-ecological context. Here, while most of the accumulated knowledge held by design professionals regarding 'green building' strategies and technologies to reduce environmental impacts remains valid, regenerative practices require them to recast and interrogate this knowledge within a broader living systems frame.

3. INERTIAS AND CHALLENGES

3.1 INERTIAS WITHIN THE BUILT ENVIRONMENT

The built environment is a complex, multilayered, multi-actor system, operating and interacting at multiple scales—from buildings to neighbourhoods to entire metropolitan regions (Williams 2013; Cloete 2017). While it comprises buildings, transportation systems, utility infrastructures and public spaces, new *individual* buildings represent a primary policy and regulatory focus for reductions in greenhouse gas emissions and resource use. However, in 'mature' built environments changes occur at a 1–2% per year and, without the major retrofit of the building stock and associated social practices with building use, a focus on new buildings will have a minor impact over the short term.

3.1.1 A complex multi-actor process

The design and construction of buildings involves the interaction and coordination of a wide range of actors whose respective institutions and norms consider them as separate and specialist silos. The extent to which design professionals engage climate change and other environmental issues depends on their commitment and capability, and, to a large extent, the licence given by their clients and the freedoms permitted within regulatory frameworks. While stakeholders have different expectations and priorities, those holding greater power over resources and decision-making typically dictate outcomes. As such, the 'need to survive in a competitive and changing marketplace' (Janda & Parag 2013: 47) requires design professionals to pursue projects that do not always align with their professional and personal convictions. Moreover, where and how a market-based system currently assigns value assumes importance—design quality and externalities are not reflected in project valuation or in the briefs given to design teams. Construction requires the involvement and phasing of numerous skills and trades, and, like design professionals, construction managers and trades are continually confronted with accommodating new construction techniques, materials and technologies supplied by a wide range of allied industries.

3.1.2 Longevity of buildings

Design decisions have profound future social, environmental and economic consequences. Foley (1976: 503) argued that:

> the energy consumptive buildings of today are the poverty traps of tomorrow—those who are forced to live in them will be so bled of income in the struggle to stay warm that opportunities for saving and betterment will be dramatically curtailed.

The legacy of past design decisions and Foley's claim are increasingly evident in the realities of 'fuel poor' households and buildings unable to remain habitable during sustained high summer temperatures (Nicol *et al.* 2022). Since most of the current building stock will still exist way beyond 2030, without significant retrofits, many of their inhabitants will have to carry the increasing costs for the basic requirement of remaining comfortable or suffer increasing health burdens if they cannot.

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3.1.3 The pace of change

Whereas the adoption of various technologies has increased over the past 100 years (Thompson 2012), strategies to reduce building-environmental impact have been slower. The United Nations Environment Programme's (UNEP) *Global Status Report for Buildings and Construction* (2021) suggested that the 'next five years will be about widely adopting transformational approaches'. Efforts to 'transform' the building market are not new. Voluntary building environmental certification systems (*e.g.* Building Research Establishment Environmental Assessment Method (BREEAM), Leadership in Energy and Environmental Design (LEED)), issue-specific programmes (*e.g.* Passive House) and their associated training programmes, for example, continue to evolve and directly and indirectly influence client expectations and building practices. However, only approximately 6% of accredited LEED buildings have achieved the highest LEED 'Platinum' status with the greatest carbon reductions (Cad Details n.d.; Pyke 2019), and only 37,000 projects have been Passive House certified (International Passive House Association n.d.).

While Becqué *et al*. (2019) noted that there were at least 2500 'zero carbon' buildings worldwide in 2019, using their 'own unique mix of energy efficiency, renewable energy, and/or carbon offsets', two developments may accelerate more widespread adoption. First, while it took six decades to install solar power to become more 'affordable', with costs falling by a staggering 15% per year between 2010 to 2020, such technologies are rapidly becoming more widely accessible. Second, an increasing number of large architectural practices and institutions are *committing* to deliver net carbon-zero buildings, by either 2030 or 2050 (RIBA n.d.; AIA n.d.)—with architectural practices *pledging* to engage the twin crises of climate breakdown and biodiversity loss (Architects Declare n.d.) and broader multi-partner global initiatives have been launched to achieve 'massive' carbon reductions (Brownstein 2019). But commitments and pledges must be kept if transformative change is to be realised and accompanied by professional educational and training programmes.

The adoption of regenerative practices currently appears to be in the same position the emergence of green building was 25 years ago, but without the same broader organisational, educational and promotional support (as provided by green building councils). Cooper (2012: 360) argued that the transformations demanded by regenerative practices will be harder and likely longer than the 30-plus years it had taken to embed energy-efficient design in education, practice and its regulation—and that was a 'single-issue campaign'. Regenerative practice, he emphasised, is not only a multi-issue endeavour, but its successful application resides in their interconnectedness. The Living Building program (established by the International Living Building Institute in 2006), which embodies language and ambitions closest to those of regenerative practices, has to date only produced a modest number of projects. By 2022, only 24 were fully certified 'living buildings' worldwide, only 56 were partially certified and fewer than 400 projects were pursuing certification (Living Building Challenge n.d.).

3.1.4 Countereffects of regulations

Buildings must comply with numerous jurisdictional regulations and code requirements that protect the health and safety of inhabitants (*e.g.* fire and smoke protection; structural integrity; thermal and noise regulation, *etc.*), individual rights (*e.g.* accessibility, view corridors) and influence environmental performance (*e.g.* energy and water use). Considerable faith is placed on mandatory building codes that might require more stringent reductions in operational and embodied energy and carbon emissions (UNEP 2021). However, such codes and regulations are not widespread, relate to construction rather than to operation, and have little influence on the existing building stock. Moreover, those who create and administer them are influenced by a host of other factors such as 'affordability' and vested interests that typically overshadow ecological values.

Tenbrunsel *et al*. (1997: 111) identified that regulatory approaches to address environmental issues have several possible countereffects. First, standards tend to direct attention toward the regulation rather than 'focus on how to optimally deal with the underlying problem'. Second, prescriptive regulations can act as a 'force against innovation and creativity in solving environmental problems'. Third, they can 'promote self-interested rather than societally based behaviour'. A 'follow the rules' mentality may therefore diminish compulsion or perceived need to exceed them (Janda & Parag 2013) and, for architects, replace professional ethics (Bordass & Leaman 2013).

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3.1.5 An urbanising world

It is anticipated that nearly 60% of the world's population will be urban by 2030 and 70% by 2050 (Destatis n.d.), and the built environment will continue to expand with greater density to meet this increasing population. Dense urban areas pose different challenges for regenerative practices—the integrity of ecological systems has also been largely displaced or degenerated and communities have qualitatively different engagements with place. Moreover, they are not spatially homogenous in terms of the diversity in social and economic equity, demographics, proximity to services, and accessible natural amenity, and they are influenced by numerous powerful interests and agendas.

Informal, self-constructed settlements in the Global South, although 'intricately woven into the functioning of the city', for the main part 'operate outside the common legal and regulatory framework' (Oxford Martin School n.d.) and are developed without professional involvement (Hernández & Kellett 2010). By contrast, the majority of global 'overconsumption' occurs in 'formal' settlements in developed countries where buildings that have been designed by architects and regulated by planning authorities. Heinrich (2016) characterised formal cities as spatial concentrations of exchanges and evolving networks of relationships, but their scale of development was beyond the agency of inhabitants. By integrating informal opportunities within existing formal systems, he contended that the resulting differentiated scales of parts would enable more exchanges and new networks of relationships. In addition to strengthening a sense of community, this would permit its members to exercise greater individual and collective agency in the face of an increasingly uncertain future.

3.2 CHALLENGES FACING REGENERATIVE PRACTICES

Regenerative practices are seen as offering a necessary path to forge a collaborative relationship with the natural world and it is difficult to find fault in the ambitions of their proponents. Indeed, entering the internal discussions within major multinational professional service firms such as Arup (n.d.) and the US Green Building Council's (USGBC) (n.d.) 'long-term regenerative and restorative design vision for LEED', are indicative of their increasing influence. While the widespread adoption of 'green buildings' continues to face barriers (Saboo 2023), regenerative practices face a qualitatively different set of challenges.

3.2.1 Changing the design process

Regenerative practices and the changing roles of building design professionals have been covered by Mang & Haggard (2016), Plaut & Amedée (2018), Pawlyn (2019) and others. For regenerative practitioners, the design process engages and collaborates with a broader range of relevant stakeholders rather than remaining solely in the purview of design professionals and serving interests of an individual client. Faith is placed in forging a shared vision, responsibility and ownership amongst stakeholders as co-creators—blurring the boundaries of expertise, building-in the capacities and feedbacks necessary for continuous improvement, and providing greater assurance of maintaining the initial ambitions of a project. Here, Margaret Wheatley's principles on what makes a community healthy serve as important guides, specifically that 'people support what they create' and 'people act responsibly when they care' (Pfortmüller n.d.). However, design professionals hold considerable knowledge about and experience with technical and material systems and how buildings are constructed, and in regenerative practices they remain responsible for translating the input of an expanded stakeholder group into the final project. It is uncertain if they will treat co-producers' lived experience as a legitimate basis for contributing to decision-making or grant it parity of esteem with their own professional expertise. Moreover, unless architects commit to investing in gaining a deep understanding of regenerative development and design, a skilled facilitator is required to guide the design team through the complexities of living systems, instil new ways of knowing and gain the commitment of all stakeholders.

Rather than being an individual, developer or institution financing a project, Rojas-Gracia (2020: 169) suggested that the notion of 'client' be extended to include the:

> ecosystem, the place and the communities that interconnect during the design process and would be affected by the project.

Within this conception, stakeholders should not be 'exclusive to diverse *human* communities and agents' (emphasis added), but rather include 'interrelated "entities," living systems and flows' (169). Instead of a project's design focusing solely on meeting a set of programmatic needs, she emphasises that design teams need:

> [to] explore and question who design initiatives and processes serve, who would benefit from design-related outcomes, and what kind of collaborations can serve better a place. (169)

The critical point here is that regenerative practices demand design teams ask questions about themselves regarding what they value. For Hes & du Plessis (2014: 231), what is most needed is the 'courage to act'. Indeed, rather than considering this transformation an insurmountable challenge, Ichioka and Pawlyn (2021: 19) believe that:

> [n]ow is exactly the right moment to be maximising our agency in bringing about positive, systems level change.

However, for many architects, clients and developers, this would require an act of faith departure from the perceived certainty they see in the outcomes of current design practices.

While the design of a project may be delayed for several reasons, once initiated it is typically under time and cost constraints. Regenerative practices demand investing more time upfront in facilitated stakeholder meetings to discover what they value, understand different perspectives, resolve competing views and to arrive at a shared agreement of what could or should be manifested in the project. This extended time investment permits stakeholders to co-invest in a project, collectively set a direction for the work from the outset and begin nurturing a broad culture of stewardship. While the value of placing a greater emphasis at the front end of design is not currently recognised, the benefits in terms of permitting a design team's self-actualisation, developing appropriate design propositions, forging shared visions, community engagement and downstream cost savings, can be considerable.

3.2.2 Between stories

Regenerative practices depend on the openness of participants to engage and a willingness to commit time to do so. Gibbons (2020: 47) suggested that this might not be the case in situations where there is:

> pressure for developers to build quickly, inhabitants are busy with their daily lives, or power dynamics such as social justice, political conflicts, and vested interests present barriers to even considering significantly different processes and outcomes.

Moreover, regenerative practices sit within emerging living systems thinking, while the mindset of the planning, regulatory and financial institutions that govern how buildings are designed remain dominated by well-established, yet increasingly outmoded, ways of operating. As I. Cooper (personal communication, Eclipse Research, Cambridge, UK, 2020) considered:

> we have competing stories, where one is embedded in our society's power structures, economy and social mores, and the other is struggling to find interstices that it can wriggle through in an attempt to get a foothold.

3.2.3 Redefining success

Buildings are currently considered 'successful' by such measures as being delivered on-time/on budget, attaining a level of environmental performance certification, and whether they are celebrated in the media at the time of their completion or by awards thereafter. Three points are important for this paper. First, when completed, and in its preoccupied state, a building is often

considered as at its most architecturally pristine and that the subsequent life seen as a diminution from this initial ideal condition (Mostafavi & Leatherbarrow 1993). Second, the responsibility of design professionals typically concludes with the completion of a building's construction and the review, coordination and sign-off related to any remaining deficiencies. Third, a building's performance in use often differs markedly from that anticipated or predicted during design. This performance gap results not so much from the building design and technology itself, but rather from the differences between assumed and actual patterns of occupancy, the use of controls, and building operation and management. Although conducting post-occupancy evaluations have long been advocated to understand if a building successfully meets its inhabitants' functional, comfort and environmental performance as designed, if evaluations are made at all (Watson 2020) they are typically conducted within a year after of completion (HMC Architects 2020). However, 'Soft Landings' is gaining traction as a broader framework to address concerns of building owners and inhabitants and to 'feedforward' learning from the experience to future projects (Way *et al.* 2009; Agha-Hossein 2018).

With regenerative practices, a completed building is not a conclusion but the beginning of a value-adding process, and proponents place faith in the forging of a shared vision, responsibility and ownership amongst a broader range of relevant stakeholders by being co-creators. This raises four issues.

First, how is it possible to know at the outset if and to what extent a project can be acknowledged as accomplishing its ambitions given the unpredictability and uncertainties inherent in the evolutionary nature of complex systems? Moreover, how can regenerative design practitioners convey their ambitions to clients who expect a high level of certainty about what they are committing significant financial resources to? Here, regenerative practices pose challenges of demonstrating:

> robustly and clearly not just that its claimed benefits and outcomes can be delivered, but that they are worth the substantial effort clearly required.
>
> (Cooper 2012: 358)

This seems particularly important given that 'evidence-based' design has raised the expectations that decisions about the built environment are founded on credible research to achieve the best possible outcomes (Harris *et al.* 2008: 1).

Second, given the uncertainties over the life of a project regarding future possible changes and diminishing commitment of inhabitants and community members, Tainter (2012: 372) argued that a:

> system with uncertain future evolution' cannot be 'resolved by another system with uncertain future evolution.

His scepticism extended to concerns regarding what 'monitoring criteria' would indicate if the project is either succeeding or failing.

Third, an increasing number of projects such as the 'restoration' of ecologically degraded sites that provide social and ecological benefits, are often inappropriately labelled as 'regenerative' (Mang & Reed 2012). Moreover, while few built 'comprehensive' regenerative projects currently exist, Ichioka and Pawlyn (2021) presented examples that showed 'important aspects' of regenerative projects: 'green shoots'. This raises questions about what is required before a building 'project' can claim to be 'regenerative'. Moreover, if a building—in and of itself—cannot be 'regenerative' but can *only* be viewed as an agent in the continual positive evolution of its social and ecological setting, after what period do benefits start to become evident? In what ways should the benefits be measured and discussed? And, given synergistic relationships within a complex socio-ecological system, can these be confidently attributed to the building?

Fourth, the way knowledge is developed and how it is applied by design professionals are of considerable importance engaging in regenerative practices. An important issue is the difference in the processes by which knowledge about the natural world is acquired and the worldviews that

frame them. Regenerative practices and Indigenous ways of knowing and belief systems embrace the mind, spirit and emotions in engaging the world. However, given that the complexities of the current world cannot be understood only by qualitative descriptions (Smil 2022), they are open to scepticism by those wedded to science based on objectivity, evidence and validation. It would seem unnecessary to measure everything and important to differentiate between 'measuring' success in terms of technical performance, and success of the project as a change agent enabling systems evolution.

3.2.4 Regenerative case studies

It is reasonable to argue that case studies that embody new ways of thinking are perhaps as valuable in convincing designers and clients as the regenerative literature. While the descriptions of the regenerative development and design processes have been exhaustively covered in the literature, few urban case studies have been published. Regenesis's (n.d.) website, for example, only lists 14 projects and the majority of these are situated in non-urban contexts. Moreover, they are unfortunately briefly covered, only emphasise their involvement in the project and have yet to provide insight into how they unfolded through time and meet their initial ambitions. An important challenge is to consider:

> whether and to what extent it is feasible to apply the regenerative approach in an urban context, particularly at different scales.
>
> (Clegg 2012: 368)

4. DISCUSSION AND CONCLUSIONS

4.1 SHORTENING THE TIME TO ACT

The climate crisis will exempt:

> no one, no organization, no nation, and no generation from here on as far as one can imagine
>
> (Orr 2011: xvi)

and it is increasingly considered that we are at a 'defining moment' in human history (UN News 2018; Environmental Justice Foundation 2021). Scientists emphasise that deep reductions in global anthropogenic greenhouse gas emissions are required by 2030 to avoid the Earth's climate system crossing dangerous points of no return and preventing devastating societal consequences (Hansen *et al*. 2013; Mooney & Dennis 2018). Already, the likelihood of global near-surface temperature exceeding 1.5°C above preindustrial levels for at least one year between 2023 and 2027 is now 'more likely than not' (WMO 2023). The progress being made *each year* is thereby hugely important (Cole 2020). Making such reductions would be a difficult challenge even if the climate crisis were given full political attention and international cooperation, and garnered broad societal commitment. Moreover, such commitments would have to be sustained for at least two generations (Smil 2022). Responses, however, are currently compromised by the immediate and lasting human, economic and ecological costs of increasing climate catastrophes, the aftermath of the global COVID-19 pandemic, the impacts of the Ukraine war, and the continued failure of political leaders to shed their prioritisation of short-sighted national/economic interests.

4.2 SOCIETAL TRANSFORMATIONS TAKE TIME

Societal transformations have historically taken a long time—the agricultural revolution took centuries, and the Industrial Revolution took generations (Macy & Brown 2014: 4). A transition to a regenerative future will have to unfold as we navigate through increasing climate-related catastrophes, the resulting compounding ecological, social and economic consequences, and while simultaneously dealing with a host of other current and future threats. It remains uncertain if transformation can occur before a 'tipping point' is reached 'beyond which we cannot stop the unravelling of the systems supporting complex life-forms' (50). But this is now a matter of decades

or maybe even years. Although it is also uncertain what human responses might unfold as the climate crisis worsens, Hes & du Plessis (2014) suggested that the remarkable regenerative, self-healing abilities of living systems, the innate human creative and entrepreneurial spirit, and the implementing of innovative ideas collectively provide hope that concerted action can and will steer a different and positive future path. However, while embedding regenerative practices into the *production* of the built environment seems unlikely for some time, this does not diminish either their necessity or importance of its ideas and ambitions to clearly change discussions.

4.3 COPING WITH UNCERTAINTY

Rather than construing the changes in global climate systems and resulting harm presented in the paper as overly alarmist and pessimistic, the intent was to acknowledge that we will be navigating through an increasingly difficult and turbulent future, and to position regenerative practices within that context. However, humans have adapted for *certainty* wherein human perceptual systems are oriented toward 'order, maintenance, optimization, and predictable equilibrium states of adaptation to the external world' (Gladwin *et al*. 1997: 243). This paper contends that we need to prepare for the unpredictable rather than repress uncertainty and subscribes to Harari's characterisation of the future as one where we 'will increasingly have to deal with things nobody ever encountered before' and will have to 'feel at home with the unknown' (Harari 2018: 256). Here, Mang & Haggard (2016: 201) emphasised that regenerative practice does not 'settle into the comfort of having "the answers"', and accepts that the 'state of "not knowing" is necessary for true innovation'—attributes of importance in navigating climate change.

If political leaders and authorities are deemed unable to address catastrophes resulting from climate change, citizens will need to rely on their agency and improvisation to navigate through the immediate difficulties and subsequent uncertainties. Here Clay *et al*.'s (2016: 335) research reinforced how interpersonal relationships, social capital and social networks help:

> [to] reinforce the cohesion and resilience of a community and thus its ability to respond and adapt to a disruptive event, returning to the original or a more desirable state.

Regenerative practices, such as coping with the impacts of climate change, will to a large extent depend on people's day-to-day actions in the places they live, and the resolve and collaborative capabilities of community members. Human agency at the individual and particularly the collective level must thereby be understood as central issues and recognised as ones that regenerative practices are well-suited to support. Individual agency, choices and actions are enabled and/or constrained by characteristics of the context in which an individual is located. Although human agency has been increasingly substituted by automated technologies that remove the control of buildings from those who occupy them, it would be prudent for buildings and larger developments to be infused with capabilities that enable inhabitants' greater agency to collaboratively improvise and to provide them options to adapt to increasingly uncertain conditions and changing needs. Importantly, designers will need to understand how design choices permit or constrain such capacities, and themselves build the individual and collaborative capacities necessary to inspire, enable and nurture them.

4.4 ENGAGING PLANNERS

Mang & Haggard (2016: xxxiii) noted three 'agents' that provide an 'opportunity to increase a project's transformative effect in the world': the *designer* whose 'unique capabilities and outlook impress themselves' on everything they do; the *design process* which 'shapes the consciousness, capabilities, and aspirations embedded into the product'; and the *design product* which 'continues to act on the world into which it has been created'. Given its prominence in the literature, this paper has focused on building design professionals and changes in the design process. However, Tainter's concern that the scale of many commissioned projects may be too small and thereby 'a scalar contradiction between the aspirations of regenerative designers and the realities of their profession' (Tainter 2012: 371) implies that a complementary critical mass of regenerative *planners* would potentially accelerate their adoption.

4.5 REMAINING HOPEFUL

Discourses related to green building design and addressing the impacts of climate on the built environment are largely framed negatively or cast as technological challenges. Indeed, catastrophes caused by climate change directly impact people's lives and communities, evoking stress, anxiety and a host of other emotions. While remaining hopeful in such times is essential: '[a]uthentic hope comes with an imperative to act' (Orr 2005: xix), and indeed, the 'combination of optimism and personal agency' differentiates hope from 'wishful thinking' (Jensen 2022).

Shellenberger & Nordhaus (2004: 31, emphasis added) argued that offering a 'positive, transformative *vision*' creates the 'cognitive space for assumptions to be challenged and new ideas to surface'. The positive framing of regenerative practices is part of its appeal to design professionals and developers and, if and when its advocates provide a clear and accessible narrative that equally captures public and political buy in, may potentially accelerate their widespread adoption.

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The author has no competing interests to declare.

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