Rebellion, Robotics, and a Radical Reboot: Emergent Processes in Turbulent Times

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ABSTRACT: Over past decades we've witnessed dramatic, often unsettling, upheaval within structures and systems that shape how we live, understand, discover, and design. Paramount in equations are catastrophic implications of global warming, whereby climate disasters increase, resources deplete, and quality of life is in jeopardy. Recent crises, including the global pandemic, widening economic gaps, shifting migration, and escalating political disarray, call for intense rethinking, and potential redesign, of modus operandi. Contained fundamentally in the calculations are architecture + building. The building industry is a major contributor to the predicament, including but not limited to heightened greenhouse gas emissions, burgeoning landfills, and escalating energy consumption. While historically architecture must assume liability, on a positive note design offers remarkable opportunities to right-the-ship and proffer hope. The present research acutely considers the potential of advanced technology to strengthen design, streamline production, foster wellness, and improve quality of life. Aiming centrally at novel yet ubiquitous technologies, including robotics, artificial intelligence, prefabrication and smart buildings, the research critically interrogates divides between ways we design + make and the manners in which we operate + occupy built environments. Methodologically the research comprises manifold strategies: interdisciplinary literature review, analysis of leading precedents, interviews with design + manufacturing experts, focus group sessions, and critical consideration of pioneering case studies (building industry plus technology, scientific, humanities, political sectors). It is a speculative, perhaps provocative, first step out on a broader & deeper research path, intended to raise issues, prompt questions, and set a trajectory. The internationally oriented research, creatively bridging academia & professional practice (researchers are embedded in both realms), presents a picture of a quickly moving field and argues for a radical reboot of ways we as architects and environmental designers see, think + act. The paper concludes with a conceptual framework illustrating how a reboot can be structured, promoting active uptake of evolving means to address climate change, heighten efficiency, assume accountability, promote health, and improve quality of life for consumers of architecture and the city.

KEYWORDS: architecture, catastrophe, systems, technology, quality-of-life (QoL)

PAPER SESSION TRACK: Materials and Advanced Digital Fabrication.

INTRODUCTION

> "Design is a multifaceted subject. It ranges from the smallest manufactured objects to the planning of cities, regions and entire countries. In today's world it is not only local but inevitably global." Cairns, 2014[i]

Without question societies globally confront a changing milieu whereby the ways we conceive, construct, and occupy the built environment are in dramatic flux. Notions of solidity and stability are under question while certainties, expectations and impacts alter in unforeseen ways. From routine daily activities, such as driving, dining, or dwelling, to existential assaults on species and the planet, civilization is encountering unprecedented pressures. Growing awareness concerning the gravity of previous actions, such as resource depletion and greenhouse gas generation connected to advancing the industrial complex, now places many industries and professions in a position where 'business as usual' is untenable. The architectural profession, and the construction industry writ-large, cannot escape culpability in said scenarios. In fact, the construction and occupation of buildings and the built environment, from embodied energy to operational implications, proves a major player in such existential crises. However bleak the outcomes of previous actions may seem, the architectural enterprise, and design in a much broader way, hold critical keys to tackling many modern dilemmas and to charting paths forward that endeavor to right some wrongs and repair some damage. In many ways, at the present juncture, inaction is neither a viable nor responsible option.

When we begin to understand the nature of many contemporary problems it becomes clear that design, as a problem-solving vehicle, affords society many ways of seeing, thinking, and acting that could lessen or even reverse the implications of a difficult trajectory. When we consider the potency of design, and its ability to transcend conventional boundaries, it provides both cause to pause and encouragement that we do have real choices and grounds for optimism. Many problems over recent decades have been amplified through the arrival and deployment of advanced technologies -- from the pervasive deployment of the combustion engine to the

omnipresent power of the silicon chip our lives have been changed in remarkable yet now, in hindsight, concerning ways. Without question the quality of life in many parts of the world has been exceptionally elevated. Cities have developed as major cultural, social, and economic engines, with rich fabric and unparalleled amenity. Buildings have grown in sophistication, size, and service, whereby they often house comprehensive communities and serve as vertical cities. However, as has been made abundantly clear in recent times, this tsunami of progress and privilege has come with severe consequences.

The present research accepts this troubling environment as a starting point for a major examination of forces and factors at play, and a dramatic reset -- what we call a radical reboot -- of our raison d'être and our modus operandi. In other words, as architects we must crucially reconsider and redesign both our purpose and our means.

2.0 DELINEATING THE APPROACH

> *"Typically theory is understood as an overarching philosophy governing certain aspects of practice.*
> *The objective of theory is to establish something fundamental about how we act in the world,*
> *a result of considerable analysis and rationale." Lucas, 2016[ii]*

The present paper, as a window into a larger and longer-term research agenda, introduces the work of the team considering new ways of approaching, engaging and executing architecture. As such the content is on one hand descriptive and delimiting, while on the other hand speculative and provocative. Embedded within the broader agenda are discrete yet inter-related investigative steps, including a Prix de Rome program, a Venice Biennale installation, and ongoing local, regional, national, and international projects (e.g., scholarly, professional, public, private, etc.) aimed at design education and design practice. Taken together these studies and initiatives form a body of research that informs, inspires, and influences the 'radical reboot'. This paper examines this range of engagement, delineates key aspirations, reveals preliminary findings, and synthesizes a new way of organizing ways of seeing problems and seeking solutions.

2.1. Goals

Given the dire consequences of inaction, the present research critically considers how our ways of educating and practicing can shift to better respond to mounting challenges within society. In particular, we are aiming to reimagine how our design and build processes can morph in ways that address concerns, harness technology, improve efficacy and, broadly, usher in higher-quality solutions. The ways in which quality is defined and delivered is, of course, at the heart of our studies, our aspirations, and our actions. Arguably there are many ways of viewing and assessing quality in buildings and of the built environment. There are significant cultural and contextual ways of understanding quality in design and the quality of life in built environments. The researchers accept that diversity is fundamental to the work at hand, and that definitions of quality will see regional nuance and contextual adaptations. That said, we believe there is common ground that architects, and agents of design, should operate within when chasing innovation and structural realignments.

The goals of the present research are:
- To conduct environmental scans (via literature reviews and system networking) to better understand the nature of contemporary architectural problems;
- To examine architectural education as a preparatory vehicle to better match professional competencies with desired outcomes;
- To investigate modes of architectural practice that realize better traction and more positive impacts in raising quality of buildings and the built environment;
- To consider the potential and power of emerging technologies, both computational and constructional, to render more impactful and positive changes in our communities and in our cities;
- To envision and craft a conceptual framework that can both advance and propel further research while concurrently offering some inspiration and guidance to educators, practitioners, clients, and authorities charged with creating and managing buildings and the built environment.

2.2. Research Methods

> *"It was incredibly important for us to induce a sense of freedom of movement, a milieu for strolling,*
> *a mood that has less to do with directing people than seducing them. Hospital corridors are all*
> *about directing people, for example, but there is also the gentler art of seduction, of getting people*
> *to let go, to saunter, and that lies within the powers of an architect." Zumthor, 2010[iii]*

The present research deploys several tactics in addressing the larger aforesaid goals of the agenda, and most notably through intertwined interdisciplinary (mixed qualitative and quantitative) methods. Methodologically the research comprises manifold strategies: interdisciplinary literature review, analysis of historical and contemporary precedents, interviews with design + manufacturing experts, focus group sessions, and critical consideration of pioneering case studies (building industry plus technology, scientific, humanities, political sectors). It is important to underscore that the present paper outlines both the philosophic underpinning of the broader (albeit initial) investigatory agenda and the initial research steps conducted to date. In other words, the paper is concerned

about delineating a longer-term roadmap that guides research thinking into reform of education and practice, while depicting a shorter-term series of steps and projects that contribute to our (the research teams) understanding of the cultural, contextual, and circumstantial facets that shape buildings and the built environment. Such immediate efforts are illustrated through, most notably, the illumination of contemporary conditions of practice (e.g., shaped via emergent technologies) and the architectural projects included in the paper (e.g., shaped via shifting societal expectations). The present paper reveals several windows into this larger, longer-term, complex, comprehensive, and demanding research agenda.

Three dimensions of the research, both in the longer-term agenda and in the shorter-term activities, warrant further delineation. They are vital qualities of the investigatory approach and serve to shape thinking and sharpen lenses.

Design as Research: While many aspects of the research approach are arguably conventional (i.e., typically strategies deployed in major research institutions), one prong of the current research that is both robust and critical is 'design as research'. All members of the research team are immersed in both education and practice. On the practice side, projects are viewed as vital vehicles to explore innovation and to move theory into practice (i.e., the ethos of praxis). Included in the present paper are two actual design projects that serve to advance thinking and test theories, of note as pertains to the idea of a 'radical reboot'. Design, in this sense, is a living laboratory whereby concepts are examined for impact and efficacy, in particular as they address the many pressures on modern life and as they hold promise to lessen the impacts of looming crises.

Embedded Research/ers: A key feature of the present research, and longer-term agenda, is that all members of the research team are embedded agents in the ethos at question and are engaged players in the design pursuits underway. In this way the research benefits from on-the-ground testing and direct feedback. Advancing thinking in an academic setting, while important on many counts, is disadvantaged in terms of real-life applications. Practice, on the other hand, affords researchers a critical opportunity to test concepts, to gauge market acceptance, to construct architecture, and to solicit immediate and tangible feedback. Being embedded is, of course, a double-edged sword. To this end, the research team accepts some limitations around bias while also inviting the benefits that accrue when 'tires can be kicked' in-situ.

Systems Thinking: Moving ideas from a lab situation (in-vitro) into a field situation (in-situ) carries many implications. Without question the task of moving a building project from concept through construction comprises a messy, complex, and demanding journey. Design has often been cast as being capable of coping with 'wicked problems' and of managing wildly complicated processes of implementing ideas in environments characterized as 'messy vitality'. While a lab situation proffers capacity of variable control and management, things get less clear in the rough and tumble reality of 'real life'. The present research is clearly resident in the world of the everyday -- in the market where architectural services are procured and buildings are constructed. As such, the researchers are intensely committed to understanding the systems in effect and the interrelationships at play.

2.3. Structure and Anticipated Outcomes

The present paper, proffering several windows into the manifold research agenda underway, is structured to provide two key deliverables: namely, an understanding of major forces and factors at play and under consideration for a 'radical reboot' of the profession, and an exploration of significant architectural projects that provide inspiration and information to assist us in reshaping both the education of architects and the conduct of architectural practice. The anticipated outcomes at this, preliminary, phase of the greater research agenda include a delineation of parameters that will shape subsequent research as well as a conceptual framework that will guide seeing, thinking, and acting moving ahead.

3.0 DEPICTING THE PROBLEM

"There are no rules of architecture for a castle in the clouds."[iv] *Chesterton, 1925*

Based on the literature review for the research agenda, focused on key subjects such as design, architecture, the built environment, quality of life and city building, the researchers gave shape to the landscapes where design transpires, and the 'radical reboot' will happen. The forces + factors at play are many and consequential -- in essence comprising the intense pressures for change that impinge on us locally, regionally, nationally, and internationally. The following sections of the paper endeavor to paint a picture of components of the milieu of practice that prove especially germane to a rethink of ways and means (to produce buildings, spaces, and places).

3.1 Society

Undeniably our modern world has transformed, and is transforming, in ways inconceivable even a few decades back. From economic upheaval and climate change to political instability and public health assaults, societies around the globe confront intense and unprecedented challenges to quality of life, and even to life itself. While some crises have been anticipated and managed to some degree, others have been unexpected and debilitating. In part a result of rapid population growth and increased global mobility, and in part a consequence of endemic fragmentation and an unbridled appetite for progress, today's world is replete with problems that seem to rise in numbers and increase in consequences. Architects, while historically cast as serving narrow markets and offering

luxury services, can no longer reside on the sidelines and shelter in the shadows. In fact, to the contrary, architects and design stand as remarkable agents for positive change. The present research, and researchers, accept that architects and a quest for buildings have been major contributors to current crises, and assume that architects and the provision of buildings, moving forward, can be major contributors to healing, restoration and regeneration.

3.2. Technology

At the core of many equations around crisis and opportunity, in our current times, is technology. Viewed by the researchers as both blessing and bane, technology (both computational and constructional) comes to us as a powerful tool and as an unmitigated risk. Plato referred to the Pharmakon -- that is, a medicine that can be rendered as poison or remedy contingent upon application, politicization and so forth. History provides us with countless examples of pharmakons that cut both ways -- for example, the combustion engine, nuclear technology, and the internet. In all three of these cases, we see both positive impacts and devastating consequences. The present research accepts that technology can get us into greater trouble or can lift us out of existing quagmires. In many ways the path chosen must be based on evidence in decision making and risk acceptance in pursuing innovation. In this paper, and in its associated research agenda, technology must be deployed with an open mind, a courageous outlook, and some solid grounding (based on facts, findings, clarity, and creativity).

3.3. Sustainability

Over recent decades, and certainly since the Brundtland Commission, the notion of a more sustainable world has stood large in our minds and weighed heavy on our souls. The pursuit of a more viable and responsible society, where future generations hold more sway than current consumers, is both noble and essential. In the realm of architecture and design, ideas around sustainability and environmentally conscious action have been in the foreground. Programs that assess and rate the 'greenness' of buildings, and of communities, have fortunately proliferated - with widescale subscription by clients and broad policy adoption by governments. The design professions have willingly embraced sustainability as key to a better future - both for the professions but more importantly for the users of buildings and the occupants of cities. Within the current research agenda, the gravity of sustainability is undeniable. That said, the researchers see sustainability in ways that differ from the status quo. The idea of Agile Architecture is paramount in this approach, whereby flexibility and mutability stand central in any definitions of sustainability. The days of static buildings and stoic construction need to be behind us, replaced with projects that respect circularity, buildings that are primed for disassembly, and facilities that can morph based on user needs (as opposed to users contorting into intractable spaces and places).

3.3. Trajectory

In considering research, practice, problems, and projects from the literature work of this study, it is clear that a new trajectory is essential. Many challenges facing our contemporary world are building in scale and escalating in impacts. It is no longer reasonable to wait for others to act. Architects need to understand the milieu, assess the options available, then take steps to reconsider and redesign the ways we see, think and act. The present research, developing a 'radical reboot', aims to alter our trajectory - both as design professions and as a larger construction industry. While such aspirations are grand, the research aims to manage the change beginning at the level of architectural education and practice, and most notably through an aggressive realignment of processes based on societal expectations, technological empowerment, and reconceived lenses on sustainability.

3.0 EXPLORING THE CASES

3.1. Precedents

To create tomorrow it is valuable to learn from yesterday. The research examined three historical projects that serve to influence and inform further study and consideration of a 'radical reboot' of design and practice. These three projects, the Nakagin Capsule Tower, New Babylon, and the Fun Palace, are located in different geographies and respond to diverse forces (societal, technological, cultural, social, economic, and so forth). Despite such difference, all projects were visionary, bold, and willing to challenge prevailing conventions of their time and place. The current research drew great inspiration from the architects and designers that pioneered these historical cases. The following are brief descriptions of the projects and, crucially, lessons learned as we advance the research agenda and associated design work.

3.1.1 Nakagin Capsule Tower: This project, by noted Japanese Metabolist Kisho Kurokawa, aimed to alter the ways we inhabit the city and the way occupation transpired. Onto several rigid service cores were affixed dwelling modules, or capsules, that efficiently and flexibly allowed residents to live, work and play. The concept for the tower, located in the Ginza district of Tokyo, was that highly rationalized and efficient residential pods would plug into the cores -- with an ability to swap out modules as needs shifted and circumstances warranted. Despite this brave model, since the project's opening in 1972 not a single module or capsule has moved. While the reality of agility did not materialize, the remarkably progressive design for this project provides great motivation for the present research. Kurokawa's vision for this ingenious project was far ahead of the prevailing technology's ability

to keep pace. The lag in technology in no way diminished the power of the concept -- to have architecture shifting to meet changing needs versus forcing users to change to accommodate rigid buildings. Concept + Inspiration = Building Modularity

3.1.2 New Babylon: A brilliant and progressive urban proposition, conceived of by the forward-thinking visual artist Constant Nieuwenhays in the 1950s, New Babylon considered the ability of urban conurbations to accommodate diverse 'situations'. With the provision of unimagined freedoms, in space, time, function and activity, dwellers had the ability to exercise desires in profound ways. The facilitation and satisfaction of wants and needs through the iterative and responsive nature of architecture and urban design was exceptionally advanced for its time. Concept + Inspiration = Urban Resiliency

3.1.3 Fun Palace: British Architect Cedric Price conceived of the Fun Palace as a realm of flexibility, where change of function and configuration was readily fostered by a kit-of-parts approach. Spaces could morph over the course of a day or through a week, with a neutral shell transformed readily to meet shifting requirements of a diverse user base. While unconstructed, Price's vision for an architecture quickly disassembled then reassembled was far ahead of its time. Concept + Inspiration = Architectural Flexibility

3.2. Contemporary Design Cases

"The creation of place, buildings, cities and landscapes has traditionally been conceived as a monumental art, as the creation of lasting artifacts that embody the achievements and ideals of a civilization. However, despite the current volatility of economics, climate, war, politics, technology and culture, the places in which we live, work and recreate are becoming increasingly predisposed to obsolescence, impermanence and transience."
Yona Friedman

A vital component of the present research is the study and testing of ideas in practice -- that is, moving from the realm of theory into action. The researchers have extensive experience, in academia and practice, operating across realms and between concepts and constructions. Drawing from the historical precedents, and gaining insights from the literature reviews, the present paper delineates three projects that each aim to showcase a different pursuit or ethos: Building Modularity, Urban Resilience, and Architectural Flexibility. As noted previously, the present paper is a window into several essential aspects of the broader and longer-term research agenda. The following projects are explored briefly to showcase approaches and build understanding. Future research is anticipated to heighten understanding of our (societal and professional) responses to intense forces, factors, problems, and crises at hand.

3.2.1 Winnipeg Warming Huts (2020) | Building Modularity: This project was the winning entry/project for the intriguing and high-profile Winnipeg Warming Hut Competition. Conceived as a small shelter or hovel, S(Hovel) reimagines an everyday, off-the-shelf article of winter – the snow shovel – into a swirling vortex of mystery and intrigue that only reveals its true identity upon closer inspection and inhabitation. Built from 214 aluminum shovels and conventional ring-lock scaffolding, we challenged ourselves to design a warming hut that could be built and subsequently disassembled using unspecialized labour furnished with only a hammer and a hand drill! Designed for disassembly, S(Hovel) is destined for a philanthropic afterlife in which, following its stint as a Warming Hut, the 214 shovels will be donated to Snow Angel Programs, non-profit charities that assist seniors and the infirm with snow removal each winter season. This circular life cycle enables S(Hovel) to infiltrate the larger community of Winnipeg, enticing the multiple narratives of winter's spectacle to unfold.

Figure1. Winnipeg Warming Huts Project (MODA, 2022)   **Figure2.** Holistic Framework for Design + Planning (Sinclair, 2022)

3.2.2 Holistic Model for Design + Planning | Urban Resiliency: Traditionally design and planning function in quite fragmented and isolated ways, with narrow scope setting the direction for design, approvals, funding, development, implementation, and so forth. The Holistic Model for Design + Planning runs counter to this reality, embracing systems theory and systems thinking to bring ideas, player, politics, financing, and other parameters into the same sphere -- basically bringing other disparate actors and activities into a common and ethical space. The model calls for equitable attention afforded to multiple dimensions of a project -- bringing concepts, consultants, clients, government, users, and other stake + rightsholders into conversation. The notion is not to define quantitative and finite solutions to a design or planning challenge, but rather to cultivate discussion aimed at finding paths that are effective and appropriate. The model finds application and relevance across scales, from single building projects to large mixed-use developments.

3.2.3 FARM (2020) | Architectural Flexibility: This project, a World Architecture Finalist, explores the potential of architecture to accommodate growth and change in simple, clear and affordable ways. Here today, gone tomorrow… This sentiment resonated with the client – a developer in Edmonton, Alberta, Canada – who, in their brief for a new 1100 sm commercial project challenged the architects to conceive a building more as an event than object as a means of temporarily developing and occupying one of their inner-city sites. Even though privileging the temporary and the ephemeral provides a bridge to the immediate, this not only implicates long-standing traditions of the architectural profession, but also challenges sustainable rhetoric which cites new construction as contributing approximately 40% of the worlds carbon emissions. This line of thinking favours permanence over impermanence as the "more responsible" design approach. In response, design began by researching the principles of circular design, which advocate for a cradle-to-cradle ethos towards construction, engendering a novel life-cycle approach to design that is less preoccupied with permanence than it is with designing for circularity, disassembly, and impermanence. Circular design is ushering in newfound freedoms and sensibilities towards sustainability that are prompting architects to question the notions of monumentality, fixity and stasis within our physical environment. With FARM, design began by producing a taxonomy of agricultural vernacular typologies of the Canadian prairies. The architects became enamoured with the bucolic beauty of Quonset huts and their modular, prefabricated assembly logistics. Responding to our client's desire for a project with a 'shelf life', we challenged ourselves to design a building in which all components could easily be disassembled. Every major component – from the screw-pile foundation system to the modular, structural steel rib envelope, to the insulative 'pillows' that are mechanically fastened back to the structure, to the panelized interior finishing, to the interior concrete block walls that are mortared together using dissolvable, cementitious grout, and to the modular glazing units – can be efficiently taken apart and up-cycled. Ninety percent of the components used in the building will be indexed using material passports that will produce a database kit of parts to aid in the future reuse or re-purposing of the building, either wholly or in part. The building is comprised of several Quonset huts ganged together, providing an inherent spatial flexibility whereby a tenant can occupy one, several or all the bays. The modular approach to construction enabled by Quonset hut technology allows each bay of the building to recede at points of public interface, and tear apart in unexpected instances, producing secret gardens and courtyards that not only provide spectacle but also allow daylight to penetrate the building's interiors, providing an ethereal light that accentuates the building's barrel-vaulted form from within.

Figure 3. FARM Project, Edmonton Canada (MODA, 2022)

4.0 CONCEIVING THE FRAMEWORK

> *"At some point architecture lost its mission to change society. It is largely because architecture has become a tool of capital. But I believe that, limited as it may be, architecture still has a power to propose something to society, or has some role to play in society."* Ito, 2012[v]

Complexity has always been inherent to the tasks of designing buildings and building cities. In the present research there is an overarching concern to find better ways to tackle problem-solving in the

built environment. To such ends, the researchers argue that traditional processes are dated and increasingly ineffective. As we have noted, societal problems are daunting in complexity and consequences. Technology is rapidly appearing and yet often reluctantly and conservatively deployed. Fragmentation of approaches to design and planning often proves limiting and impotent. All of this said, and considering the aforesaid literature work, precedent studies and contemporary projects, the researchers have shaped a framework that will guide future work (both research projects and key national and international initiatives such as the Prix de Rome and Venice Biennale). Our framework embraces five components that are both intertwined and symbiotic -- leveraging emerging technology and subscribing to systems theory, they intentionally relate to our previously underscored aspects of Building Modularity, Urban Resilience and Architectural Flexibility.

4.1. The Framework for a Radical Reboot of Architecture

"In all Open Building projects, design decisions are made on two levels: the lower level of interior fit-out is to accommodate the user, while the higher level contains all that the users have in common: the load bearing structure, the main utility systems, and the public spaces."[vi] Habraken, 2005
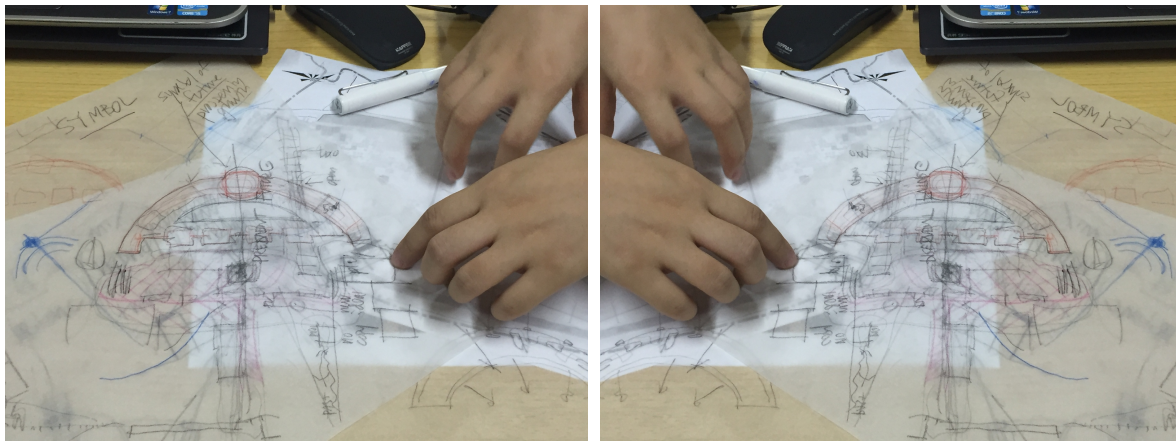

Figure 4. The Potency of Design and the Power of the Studio (Sinclair, 2022)

Our framework presents the following five aspects as key to innovatively deploying emerging technologies to the betterment of environments and their users. No one aspect is paramount -- rather all need to be addressed in concert as we seek to discover more powerful ways of realizing buildings and communities with humanity front of mind.

In-Situ Fabrication: If robots are to be employed in large-scale construction, logistics and ways of making need to be entirely rethought. In-situ fabrication allows for the continuous projection and erection of large format or even complex construction systems.

Digital Materiality: Digital Materiality suggests that instead of copying long-established construction methodologies, we should fundamentally re-think the very act of 'making' through inventing novel fabrication processes (e.g., Mesh Mold, Smart Slab, Spatial Timber Assemblies, etc.) derived directly from the logic of the given materials.

Mass Customization: Efficiencies in time, cost, speed, efficiency, quality, and environmental sustainability (as they pertain to robotic fabrication) are enabling mass customization at the scale of architecture. In addition, the ability to mass customize the 'parts' that comprise architecture is enabling a wide range of outdated architectural topics, such as ornamentation or detail, craft or craftsmanship, cultural vernacular, and architectural history, to re-enter current architectural debate.

Artificial Intelligence: Recent advancements being made in both A.I. and Machine Learning have paved the way for 'sensing robots' that are capable of troubleshooting, recalibrating, and responding in real time to the myriad of complexities that arise on a construction site, facilitating an open-ended feedback loop that is critical to constructing at full architectural scale.

Robotic Entrepreneurship: Lastly, an emerging trend towards 'entrepreneurship' in which architects are diversifying the services they provide through folding robotic fabrication technologies and architectural practice into a single milieu. Not only does this reinvest in our profession's diminishing agency towards the making of our physical environment in a more socially, culturally, and environmentally sustainable way, it also opens the door with respect to operating in tangential industries.
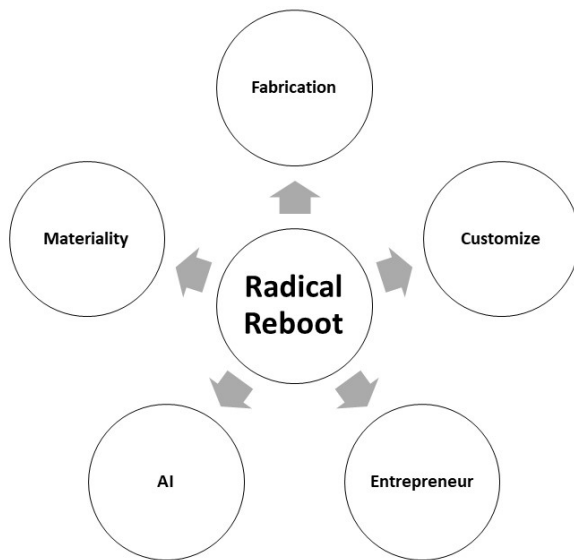
Figure 5. Conceptual Framework for Radical Reboot (Couzens, Sinclair + Klumper, 2022)

5.0 ANTICIPATING THE IMPACTS

It seems clear that architectural design -- including architectural education and practice -- need reconsideration, reform, and reboot. Societies around the planet are shifting in outstanding, if not worrying, ways. In order to positively impact the processes, policies, and principles of architectural creation, it is insufficient to tinker around the edges and tweak current approaches. As we have argued in the present paper, a dramatic turn in perspective and practice is urgently in order. While the research agenda is in its early stages, the anticipated impacts are manifold. As educators and practitioners, the research team stands intent on serious curricular revisions to education and bold tactical changes to practice. Of course, issues around policies and the viewpoints of authorities with jurisdiction loom large, and as such stand as objectives to address as the research advances.

CONCLUSION + NEXT STEPS

"Interweaving of humanist principles and architectural design appears to be a fruitful and optimistic path for designers."[vii]
Lyon (2017)

The present paper has aimed to describe the early stages, and foundational principles, shaping both near and far term goals for a broader research agenda targeting a radical reboot of architecture. Quality in the built environment, including building design, is an issue front and center in cities around the globe. As our planet sees growing urban settlement and increasing pressures on development, the need to get design 'right' increases exponentially. We know that the ways we design has implications on the ways we behave and feel (physically, socially, psychologically, etc.). The recent global pandemic has put a serious spotlight on architects and design, illuminating the implications of poor design while highlighting the benefits of good design. Of course, how we define good design, or quality in design, is core to any arguments for a radical reboot. The present research, incorporating literature reviews, examination of historical precedents, and consideration of current projects (from theory and practice), concluded with the development of a 5-part framework that seeks to harness technology, embrace humanity and, in the end, generate more appropriate, effective, and sustainable design. The ability of design to better respond to and accommodate user needs, and societal expectations, is fundamental. Following from this initial 'step out', or introduction of the research principles, the research team has a series of subsequent programs -- both academic explorations and design projects - geared to generate insights and evidence important to further shaping the conceptual framework and to advancing a radical reboot of architectural education and practice.

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