PAPER #3.01

AGILE ARCHITECTURE: CROSS-CULTURAL CRITICAL CONSIDERATIONS OF MUTABILITY IN DESIGN

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How to cite
Sinclair, Brian Robert. "Agile architecture: cross-cultural critical considerations of mutability in design." In *Proceedings of 3rd Valencia International Biennial of Research in Architecture. Changing priorities*. Valencia. 2022. https://doi.org/10.4995/VIBRArch2022.2022.15202

ABSTRACT

Modern architecture is, with limited exceptions, designed and constructed in ways that prove static, staid and resistant to change. Iconic design, crafted by genius architects as sole authors, considered solidity and permanence before responsivity and adaptability. In principle architects knew best what society needed spatially and provided artful designs with expectations that were beyond challenge and not subject to modification. Over the past century there were numerous efforts by designers, such as Gerrit Reitveld, Cedric Price and Kisho Kurokawa, to anticipate change in program, to consider user influence in operations, and to challenge conservative thinking around the monumentality of buildings. In most cases thinking of these innovators outpaced technology's ability to keep pace. However, in recent years and especially in Japan, technology has advanced in ways permitting greater mutability and heighted agility in architecture. Considering pre-fabrication for example, as one means to increase adaptability and customization in architecture, the Japanese market proves a clear leader, a proven innovator and a pronounced success story. North America, on the other hand, has been intensely resistant to agile design, modularized construction and open building. The present research critically considers these two realms, Japan and North America, deploying case studies to illuminate differences in approach. Included in facets considered from an agile architecture vantage point are psychological posturing around change, legal systems around construction, political attitudes around policy and societal expectations around monumentality. Japanese influences of history, spirituality and culture contribute to a willingness to have architecture that's transient, temporary and unfixed. In North America values around ownership, materiality and capital resist architecture that's mutable. This paper analyzes differences in approach and develops a conceptual frame for more appropriate, responsive and responsible architecture for the 21st century.

KEYWORDS

Agile; architecture; open building; systems thinking; innovation.

1. 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

Smart cities have become a landmark in urban Over much of the long history of architecture the products of design have been rigid, immutable, fixed and permanent. Built out of hard materials and unyielding connections, buildings were and generally still are intended to remain standing for generations, defying gravity and keeping deterioration at bay. While many structures, such as religious centers and government projects, reached for monumentality, even modest houses of the vernacular style aimed to withstand the tests of time. Architecture schools taught the importance of the iconic and celebrated the genius of the designer. This conventional posturing continues in schools across the globe, where the typical design project is a new stoic construction on a clean 'tabula rasa' site. Competition for attention is paramount and obsession with permanence is pervasive.

However, over recent decades we have come to understand the gravity of climate change and the negative impacts of global warming. We have also realized the fundamental role that the construction industry plays in this global crisis, including not only greenhouse gas production but also landfill contributions. Serious efforts have been made by the building industry to try to right the ship. Rating systems promote green building and professional associations subscribe to mitigation measures intended to render the enterprise more sustainable. That said, the push has often been restricted to actions that are low hanging and self-evident, such as reducing fossil fuel consumption, conserving water and lowering embodied energy. All of these steps are vital and commendable, yet they remain insufficient. Glaring in its omission is the ability of architecture to shift and adapt based on changing needs and altered demands. In other words, the potential of Agile Architecture within the greening equation remains largely untouched and untapped.

2. BACKGROUND

> "Considering architecture in the context of the massive changes currently taking place reveals that our profession is more reactionary and conservative than the rest of the world might suspect." M. Shamiyeh, 2007

After the Second War populations around the globe started to swell in dramatic ways and cities began to burgeon in serious fashion, including escalating demands for housing, office buildings, manufacturing plants and the accompanying infrastructure needed to support rapid development. While new technologies and emerging materials were deployed in the construction, the act of building arguably remained traditional in process and outcome. Modern design followed similar practices for production and assembly that its predecessors had advanced and perfected. Even with the initial emergence of information technologies in the 1950s and 1960s, and the promise of novel modes of making, building practices remained mostly conservative and predictable.

There were several brave pioneers who imagined a different future, one informed and inspired by major advancements in art, science and philosophy. Visionaries such as Japan's Kisho Kurokawa and Britain's Cedric Price, pondered the ability of architecture to morph and modify as a building's users and their needs changed over time – whether over a short-term diurnal cycle or across the longer span of a project's lifetime. Kisho and Cedric conceived of architecture that was dynamic and fluid, able to alter its form and function based on activities of its time – whether for innovative housing or for varying public amenity. The courage of these thinkers, who clearly ran counter to the norms of their days, was met with limited success and even less limited uptake. In part the failed vision was a result of their unbridled minds running so far in advance of technology's capacity to keep pace and meet the challenges. Simply put,

the theories underpinning the architectural aspirations were far more advanced than the construction technology available to see them realized.

3. AGILITY AND CULTURE: THE BIGGER PICTURE

> "Details, when they are successful, are not mere decoration. They do not distract or entertain. They lead to an understanding of the whole of which they are an inherent part." Peter Zumthor, 2010

> "Above all, architects should think before they create hardware." Kisho Kurokawa, 2001

Today technology has clearly advanced to levels whereby projects that are agile and adaptable are achievable. However, in many jurisdictions across the plane, the push against agile architecture, prefabricated buildings and modular construction remains profound. Despite such resistance from clients, developers, governments, and the architectural profession itself, to alternative ways of conceiving and creating buildings, there have been some remarkable advances and impressive leaps achieved, considering and constructing agility in design. Without doubt there are pockets of progress in this regard, with places like the Netherlands, Germany and Japan vastly outpacing more staid and difficult regions such as the USA and Canada. The present paper considers a comparison in context, conditions and culture, between North America and Japan, with regard to progress in the realm of Agile Architecture.

There are many demonstrable differences in the ways that Architecture and Construction is approached on either side of the Pacific Ocean. Some of the differences are driven by culture, some by legislation, some by policy and some by posturing. In many respects the success of Japan in advancing the agile and open building agenda, and the failure of North America to follow suit, can be explained in the vast separation that exists in mindset, methods and means between the two disparate worlds. The current paper, while not exhaustive in explorations and explanations endeavors to highlight some key features that act for or against the realization of Agile Architecture. Despite the progress or lack thereof, of any given jurisdiction, the author argues that all architects, clients, builders and authorities-with-jurisdiction must move aggressively towards an embrace of agile architecture, open building, prefabrication, design-for-disassembly, and modular construction if we, as a civilization, aim to tackle the existential threat of climate change. Architecture in our present times can deploy available and emerging tools, techniques and technologies that permit environments to adjust & accommodate to users, to climate, to conditions and to circumstances (Dara & Sinclair, 2018). Artificial intelligence fosters feedback and anticipates change. The author has previously written (Sinclair, Mousazadeh & Safarzadeh, 2012; Sinclair, Mousazadeh & Noori, 2014) about both physical and psychological dimensions of change, considering how environments might mutate and how people might react. The present paper critically considers progress in theory & practice of open building and agile architecture, and develops a viewpoint that can help us better understand the potential of responsive environments to heighten our quality of life. Agile Architecture must undeniably prove a fundamental ingredient of sustainability moving forward. Buildings of tomorrow must be capable of adapting, adjusting, migrating, managing and mutating. Staid design and static dwelling are no longer tenable in an ethos where species' survival is in question.

The following sections of the paper examine and explore dimensions of two cases, Japan and North America, with regard to the structures, systems, attitudes and attributes that characterize the countries. The goal is not to have a fully parallel comparison of

these different cases, but rather to portray and convey aspects of each place that contribute either an embrace or a denial of Agile Architecture. The situation in each country, and culture, is unique and highly complex. The author does not purport these analyses, and resultant characterizations, as definitive. Rather they present some initial musings that might contribute downstream to more focused research aimed at shifting perceptions, removing barriers, and opening minds/paths to more responsive and responsible architecture.

4. NORTH AMERICA

> "Architecture often ignores its role of making a place with purpose." Cedric Price, 2003

Concepts around flexible, agile, adaptable architecture have generally been met with resistance in North America. There are many reasons for a reluctance to adopt building systems that are modular, prefabricated, kit-of-parts and dynamic, some pertaining to legal barriers, some to psychological uneasiness, some to industry organization and some to financial arrangements. Historically the term modular building in North America has conjured up images of stigmatized cheaply built mobile homes. Only in recent years has modular building and prefabrication taken on more innovative design and qualitative character. Even with significant advancements in quality of design and construction, its adoption remains slow, with skepticism running high and market-share minimal. It is worth exploring some of the barriers that have been in place to limit the embrace of Agile Architecture in Canada and the United States (while distinct markets, they do enjoy many commonalities).

4.1. Urban activation scenarios

The design and construction industry in North America is highly fractured and fragmented. Unlike many other markets, including those in the European Union and across Asia, the industry in North America is plagued with intense separation of functions and responsibilities – for example the division of the trades. Each trade has its accepted roles and expected timing within the building production process. The complexities introduced by virtue of a plethora of players and processes proves daunting, and in many ways act against the kinds of streamlining and efficiencies inherent in agile architecture and open building approaches. Prefabrication, for example, pulls together numerous trades, procedures, materials and assemblies in ways that are intensely efficient, in terms of labor, time and money. Open Building, as another example, challenges the sequencing of the trades and makes post-occupancy adjustments easy and quick, in many cases reducing or eliminating the need for downstream engagement by contractors to tackle simple reconfigurations of space.

4.2. Horizontal Structure

In North America the design and construction process is extremely layered with respect to sequencing and production. The organization is horizontal, with each contributor occupying their own disciplinary, legal and administrative silo. Each player in the system is, under conventional arrangements, unique and distinct with arm's-length relationships in place to ensure autonomy. There are an increasing number of non-conventional contractual arrangements appearing in North America in recent times, perhaps acknowledging the need to find more efficient ways of moving building projects from concept to construction. That said, the system in general is arguably broken in serious ways – with unreasonable investments required to bring projects to fruition through mazes of legislation, contractual quagmires and workforce wastefulness.

4.3. Litigation and Adversarial Relationships

From a legal perspective the design and construction industry in North America is notorious for its unfathomable environment of litigation and for its ethos of deeply adversarial relationships. Lawsuits seem inevitable as means to confront differences and the courts prove prevalent as vehicles to resolve disputes. Change orders on many projects are significant in number and prove a financial burden to the system. Pressures to fast-track projects, to reduce delivery times, limit carrying costs and generate revenues sooner, all translate into a milieu where mistakes are made, modifications are required and problem-solving on the fly is normalized. In some respects, it's like jumping from an airplane with yards of fabric and a sewing machine in the hopes of fashioning a parachute before the ground arrives. Certainly, within this indisposed environment many projects do manage to get constructed and often to reasonable levels of care, however not without frustration, friction, anxiety and at times antagonism.

4.4. Quantity

North America is not well known for the quality of its buildings, at least not from a technical perspective. European nations, in general, tend to place far more emphasis on details and a high calibre of production compared to their counterparts across the Atlantic. A study of European architecture journals quickly reveals the differences in approach and outcomes – with EU publications very concerned with details and building as science while Canadian and American trade magazines focus more on images and building as object. In North America there is great attention paid to the commodification dimensions of building production, including maximizing lease-ability and obsession with speculation (i.e., 'flipping' property).

4.5. Value Engineering – Bottom Line Thinking

A hallmark of the North American construction industry is its fixation with numbers and bottom-line thinking. The budget is paramount in the equation of building production, eclipsing aspects of eminence such as detailing, right-to-light, material richness, and psychological dimensions of dwelling. The infamous exercise of 'value-engineering', pervasive in the industry, involves cutting budgets in aggressive ways that seldom consider longer-term human-centric implications. In an economic ambiance where money matters above all else, the art & human sides of the equation commonly suffer. When the exercise of cost cutting is in the hands of accountants and engineers, the architectural value of projects is too often left on the editing room floor.

4.6. To sum up...

While the situation of the design and construction industry In North America is painted as rather bleak, there are signs that things are changing. The preoccupation with fast and cheap is losing momentum in an era of climate change, global warming and an urgent call for sustainability. The demands are rising for responsibility, accountability, durability, adaptability, and quality throughout society, including of course the building industry. Given the negative impacts of the industry on the environment, professionals and governments in North America are critically questioning the viability of business as usual. As this soul searching continues, architects and contractors will need to look for other ways of designing, crafting and occupying spaces and places.

5. JAPAN

> "Those who make channels for water control the water; makers of arrows make the arrows straight; carpenters control their timber; and the wise control their own minds." Wray, 2004

In contrast to the North American case, Japan has been a world leader with regard to innovation in the design and construction industry, including pioneering open building and agile architecture. There are many reasons for such progressive posturing and trail-blazing, including aspects influenced by history, by geography, and by cultural, psychological, sociological and spiritual factors. The embrace of innovation in the industry is pervasive and profound. Prefabrication is normal. Adaptability is commonplace. Mutability is widespread. Buildings are made by many companies, including those known in the West for cars and electronics. Designs are made for disassembly. Building research is well-funded and extensive, having demonstrably positive impacts on the built environment at all scales. Robotics are omnipresent, both in manufacturing processes and on construction sites. Sustainability is an expected, versus an optional, outcome of efforts. It is insightful to consider some aspects of the industry in Japan that set it apart from other nations.

5.1.Integration of Industry

Within the design and construction industry in Japan there is remarkably high integration. As opposed to the troubling fragmentation seen in North American markets, the Japanese system works in a more cohesive and well-oiled manner. Due to radically different approaches to making, including a preponderance of prefabrication, Japan does not struggle with trades colliding and overlapping, with sequencing dilemmas and with a constant barrage of change orders. While projects are delivered in expedited ways, there are efficiencies in the modes and manner of delivery that are quite distinct from North American counterparts. For example, a family can easily order their home in a retail chain store that also provides food, clothing and stationery. Once ordered, the home is manufactured in a factory in prefabricated parts which are then brought to the residential lot and assembled without delay. The production of houses is approached in ways that parallel the assembly of cars, televisions, trains and planes. In North America, to the contrary, the production of buildings is a tedious, piecemeal, slow and arduous endeavor.

5.2. Vertical Structure

The design and construction industry in Japan is vertically organized. Deviating from the North American model which sees a spectrum of individual players, such as developers, architects, engineers, manufacturers and contractors, cobbled together on a building-by-building basis, the Japanese market has many large companies that encompass an array of disciplines under a single roof. In some instances, these mega-companies develop, design and build with professionals fully embedded in the corporation. The unique structure of the architecture profession in Japan, whereby several tiers of status & responsibility co-exist, translates into an ability to have exceptional design talent in-house. While high profile design architects (e.g., Ito-san, Kuma-san, Ando-san, etc.) do play a major role in Japan, so do the wealth of less prominent architects who in many ways do the heavy lifting. The vertical arrangement of the industry in Japan explains, in part, its high efficiency and its remarkable productivity. In an era where waste is problematic, the construction industry globally needs to push hard to develop new modes of making and different ways of working. While many aspects of Japanese society are less than ideal, it is undeniable that the design and construction industry is exemplary.

5.3. Trust + Honor

The long and colorful history of Japan celebrates rich stories of the samurai culture, of the power of Bushido and of the value of honor to a society. While much has happened since the days of the sword, memories and values in many ways remain and continue to inform,

influence and inspire the Japanese people. This impact holds true for the design and construction industry as well, where it manifests in many ways, including great attention to detail, and obsessive concern with workmanship, and a commitment to discharging duties with care. From the development office in the corporate tower to the design department in the studio to the construction worker on the site, no detail is inconsequential, however small or insignificant it may seem to outsiders. The commitment to trust and an unswerving subscription to honor translates into facilitation of relationships in the business and levels of cooperation unheard of in North American settings. In many cases, few if any change orders are issued, even on complex and challenging projects. In many cases major projects are initiated on a handshake between business partners, and problems arising downstream are solved in after-hour meetings in yakitori bars between key players.

5.4. Quality

Unlike North America's concern about the bottom line, and its industry's willingness to value-engineer the art out of buildings, the situation in Japan seems far more balanced. Like its European counterparts, the Japanese building industry is unwilling to separate art from science and poetics from pragmatics. Cost savings are found through innovations and efficiencies, versus going after the low hanging fruit (such as materials, finishes, social space, details, etc.). As a result of this mindset, quality is seldom part of the negotiations around cost control and project budgets. Art is an inseparable part of building, whether in the private or public sector. Even modest projects in Japan are commonly beautiful in design, inspiring in details and ingenious in execution.

5.5. Spiritual Dimensions – Impermanence

A final point to explore regards the spiritual underpinning of Japan, which also exerts significant effect on the culture including the conception and crafting of its spaces and places. Japan follows a complex mixture of Shintoism and Buddhism. The author has written widely on the influences of spirituality on the architecture of Japan. For the purposes of the present paper, what is most meaningful is Buddhism's position on ephemerality and impermanence. In Buddhism there is an acceptance of transience as a fundamental feature of our 'material' existence. Many shrines and temples in Japan are intentionally dismantled and then reconstructed as testament to the impermanent nature of our journey through life and our reality on earth. This sensibility also flows into the design and construction of all project types, not only religious buildings. Such acceptance of impermanence primed Japan for its role as a leader in open building and agile architecture. Structures, like life, should not be overly rigid and too fixed. To the converse they should be subject to shifts, variations and transformations. In examining the traditional Japanese home this fluidity and adaptability is seen in the movement of shoji screens and the complete dissolution of the boundaries between inside and outside.

5.6. To sum up …

Japan is quite unique in many ways, with numerous characteristics positioning the country to assume leadership in advancing an agile architecture agenda. Today our planet faces unprecedented catastrophes driven by global warming, burgeoning waste, escalating pollution, dwindling resources and the arrival of the unknown (such as pandemics, war, political turmoil and the like). The conventional ways many nations have approached the making of cities and buildings is no longer tenable. It is instructive to study, in a comparative sense, the ways in which various countries and various systems design, build and inhabit. In the present paper the author argues that there are timely lessons to be learned by the Japanese ways of seeing, thinking and acting around architecture.

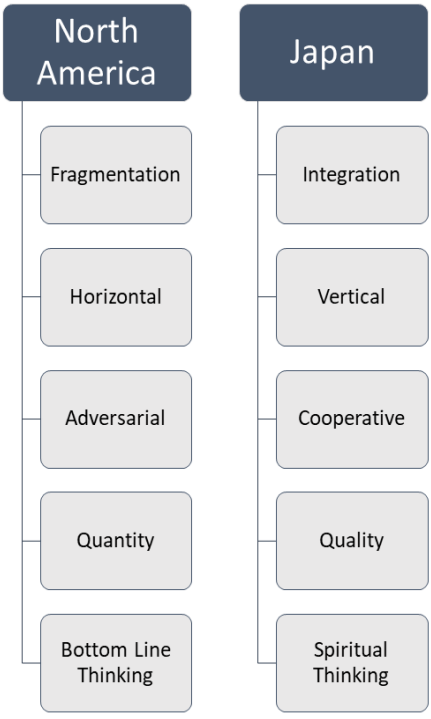

Figure 1. Case Comparison – North American versus Japan Building Industry

6. SUSTAIN: SYNTHESIZING A CONCEPTUAL FRAME

> "Architecture is the will of an epoch translated into space; living, changing, new." Richard Weston, 2011

It is apparent that building industries internationally need to urgently shift gears and change directions. In an ethos of emergency, where we all confront the existential threat of climate change, the design and construction sectors must find more innovative, efficient and effective ways of operating. To this end the pursuit of more agile architecture holds promise. Agile architecture involves adaptability, prefabrication, modularity, design for disassembly, mutability and, more demonstrably, end-user choice, control, management and empowerment. In considering a path forward, as a provocation, the author postulates a more holistic, responsive and responsible approach to design and construction. Without doubt this frame is a starting point for meaningful, and hopefully productive, reconsiderations of the manner in which we conceive and craft the built environment.

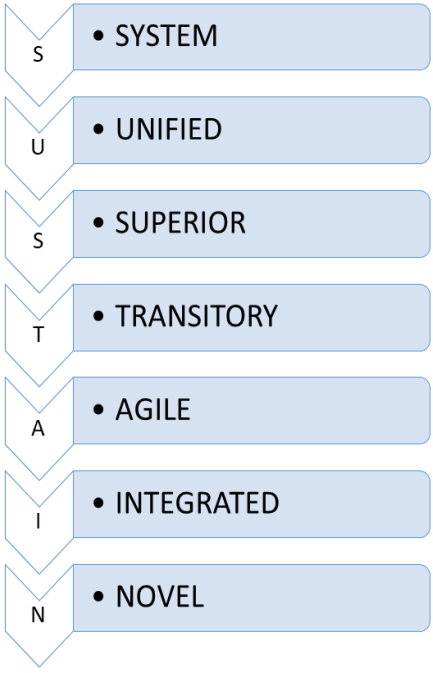

Figure 2. SUSTAIN Frame – Rethinking Design in an Ethos of Emergency

7. EXPLAINING THE FRAME

System: Understanding the process as an intensely interconnected series of activities

Unified: Viewing design and construction processes as far more seamless and far more fluid

Superior: Valuing quality well above quantity
Transitory: Seeing architecture as more impermanent and exceedingly demountable

Agile: Ensuring architecture is adaptable, mutable, responsive and responsible

Integrated: Working to connect the dots and piece together the puzzle

Novel: Seeing, thinking and acting in innovative and unconventional ways

One future scenario for architecture, considering all the current environmental, social and economic issues, would be about designing structures that are fully adaptable from inside out and across scales. Resilience ideally overarches all scales and dimensions. In order to do so, the best designs can be defined as those that spatially, functionally and aesthetically accommodate change. In this kind of architectural practice, collaboration among all the stakeholders is essential. Design, construction and building systems, in this methodology, are not distinct entities that develop independently. Rather, they are all inspired by the latest developments in art, science, technology, theory and practice that should be thought of and integrated from the beginning and throughout the process.

> "People are very open-minded about new things - as long as they're exactly like the old ones." Charles Kettering

Architecture in the 21st Century, a period already understood through its dramatic movement + intense change, must be far more responsive, resonant & resilient than designs for days long past. Rather than requiring users to shift, twist and surrender to fit into static environments, a new Architecture reacts, adjusts & accommodates. The present paper postulates a conceptual frame with which to better consider, create and construct such design. It aims to transition mindsets + methods of Architects + Architecture, in the spirit of the late Kisho Kurokawa, from an age of the machine to the age of life. In the current proposition for reconsidered and more appropriate Architecture, people must reside centrally and the dynamic, responsive & meaningful must eclipse the static, staid & stale. Ingenuity, creativity + open-mindedness proves vital.

8. CONCLUSIONS

> "Through a growing capacity to tolerate uncertainty, vagueness, lack of definition and precisions, momentary illogic and open-endedness, one gradually learns the skill of cooperating with one's work, and allowing the work to make its suggestions and take its own unexpected turns and moves." Juhani Pallasmaa, 2009

Our times are rich in complexity and replete with crises. Architecture, as a discipline and profession, as theory and practice, has proven enduring and impactful. For generations, the design and construction of buildings was about defying gravity, divining dwelling, embodying values and celebrating stability. While many of these aspirations remain significant, they can no longer be accepted as the status quo. In a period of great upheaval and uncertainty, including regrettably the challenge of the survival of our species and the viability of our planet, it is timely to question our values, our methods, our outcomes and our impacts. This critical self-examination includes the

role of architects, the purpose of design, the implications of building and the nature of dwelling. The present paper has examined two arguably different approaches to design and building, namely in North America and in Japan. While each case has its strengths and weaknesses, the author argues that the Japanese approach to construction of the built environment, with its emphasis on integration, modularity and mutability, proves especially relevant as a means to address global upheaval. A comparison of driving forces that shape each case was presented, together with the advancement of a framework for more sustainable, responsive and responsible architecture for the 21st century. It is evident that architecture can no longer advance in a business-as-usual mode – there is far too much at stake to continue on our current path.

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