# Riffing on Kuma: culture-based sustainably via pattern and layering

Naomi Darling<sup>1</sup>, Ray K Mann<sup>2</sup>

<sup>1</sup>Mt. Holyoke College/University of Massachusetts Amherst <sup>2</sup>University of Massachusetts Amherst

ABSTRACT: This study is based on an architecture studio that examines culture as an integral part of architectural production, on the theory that achieving a deeper level of sustainability requires a thorough-going engagement with culture. Believing that culture encompasses and is a society's approach to all the pillars (ecological, social, economic) of sustainable development. Achieving this requires deeper insight into the myriad ways in which culture can shape architecture, which in turn shapes culture. While the link between culture and sustainability is increasingly accepted, what culture is relative to architecture needs more careful analysis. We will first review how studying artifacts beyond the confines of architectural production sparked deeper understandings of how culture is both persistent and dynamic across time and circumstance. Our focus, however, will be Kengo Kuma's theory of how pattern and layering are potent vehicles for enacting culture as sustainability--"The rediscovery of the heritage of traditional Japanese patterns and boundaries can unveil new horizons and new challenges to sustainability in world's architecture. Through layering we can protect ourselves from natural elements, without detaching us from nature" (Liotta & Belfiore, 94). We will show how our own "riff" on this through analyses and making exercises—helped students internalize qualitative and quantitative sustainability values. Students embarked on project design ready to test how culture, as embodied in things like food growing and preparation, climatic and seasonal awareness aligned with patterns of activity, and layered spatial practices, could inform sustainable approaches. This enhanced mode of design thinking will enable them to function more meaningfully, as well as pragmatically, out in the world. This is a case study based on qualitative methods of evaluation.

KEYWORDS: Culture, Kuma, Pattern, Layering, Sustainability

#### INTRODUCTION

For several years we have been teaching an architecture studio that examines culture as an integral part of architectural production through the lens of Japanese culture. Our underlying goal, in addition to broadening students' exposure to other histories and ways of thinking, is to reinforce the notion that achieving a deeper level of sustainability in architecture requires a thorough-going engagement with culture. As seen in the third diagram of a 2015, European Cooperation in Science and Technology Action IS1007 paper entitled "Culture In, For and As Sustainable Development." (Figure 1) culture encompasses and is a society's approach to all the pillars (ecological, social, economic) of sustainable development. Achieving this requires deeper insight into the myriad ways in which culture can shape architecture, which in turn shapes culture. While the link between culture and sustainability is increasingly accepted. what culture is relative to architecture needs more careful analysis. The studio is for undergraduate seniors drawn from both pre-professional and liberal arts institutions in our region. For most of them, this studio is the first where culture is introduced as a driving component in the design process for both architecture and sustainability. While these ideas have been developed in an academic milieu, we conceived this pedagogy based on its direct relevance to professional practice.



Figure 1: Diagram relating Culture to Sustainable Development. (reinterpretation by author) (Dessein at al (Eds) 2015)

#### 1.0 BACKGROUND

## 1.1 Summary of previous study

In a paper given in 2018 at the NCBDS Conference, we argued that culture is a necessary underpinning of most if not all sustainably-based actions (Darling & Mann 2018), and we put forth architecture's obligation to think more deeply about how culture is manifested and shaped by the built environment, while cautiously navigating through such issues as imitation and appropriation. We discussed Barbara Allen's notion of a "performative regionalism" that in our thinking, moves beyond the Critical Regionalism of Tzonis, Lefaiver and Frampton, and invites architecture to play a more active role in embracing the cycles of human activity as pertaining to the seasons and climate. Turning our focus to how space can support performance or "lived culture", Allen argues, leads to more culturally embedded results:

Performative regionalism provides an understanding of the interaction of people and place that allows architecture to be understood as, in part, an enabler of cultural practices. (Allen 2007, 426)

In our earlier paper, we focused on the study of baskets as artifacts—in part because a major collection was being exhibited at the time—but also because of the transparency of maker to material to user, and the inherent "structurality" and tectonic sense of detail. We described how we did several exercises during the first half of the semester, from research to analysis with drawing and making assignments that translated and required material engagement at a human scale. Through investigating non-architectural precedents as diverse as the baskets of Tanabe Chickuunsai IV or garments by Rei Kawakubo, factors such as time, materiality, layering, the body, and the relationship to nature, emerged as recurrent cultural themes as manifested in made artifacts (Figure 2).



Figure 2: Artifact analysis by students Erin Keating and Nicole De Araujo

Introducing a sense of spatial layering, interweaving and rhythmic delineation via baskets in a museum, where students could walk around them, see their scale and notice details of construction, this immediately enhanced their spatial sensibility, including a sense of structure

as an essential element of space-making. Students then created constructions using only bamboo skewers, fuel line and tissue paper, translating formal or conceptual principles from their precedent artifacts into a made object (Figure 3).





Figure 3: Bamboo construction by students Erin Keating and Anna Arscott

## 1.2 Kengo Kuma and patterns and layering

In continuing to develop the theme of how the study of the broader history and culture deepens students' understanding of the intertwining of culture and making, we will focus on ideas of pattern and layering that followed the preliminary basket exercises described in the previous paper. In the initial studio, we based the project on a site in Japan, which provided the rationale for dipping into the culture. A year has passed, furthering development and changes to the curriculum that enable us to compare results. This past fall (2018) we located the project on our U.S.-based campus. The site selection deliberately included an existing historic building that has a strong institutional (but not stylistic) connection to Japan, but nonetheless this change required a different kind of rationale for using Japanese culture as a springboard, one which hinged on the paradox of applying cultural translation in a seemingly unconnected culture and environment.

We found a possible basis for this in Kengo Kuma's ideas as put forth in *Patterns and Layering*, Liotta and Belfiore's book about research in Kuma's academic studio at Tokyo University. Its basic premise is that the long Japanese tradition of abstracting nature through sophisticated pattern and layering techniques embody a strategy towards a more performative architecture that can transcend a particular place and climate for a more performative architecture. When Kuma playfully states that "Japanese architecture is a treasure-trove of boundary techniques," (Kuma 2010, 10) he is offering up the possibility that concepts such as patterning and layering are simultaneously embedded in Japan's culture but also available for borrowing by others:

Spatial layering is a tool that can radically redefine the role of architecture and its way of interacting with context, both physical, social and cultural. The rediscovery of the heritage of traditional Japanese patterns and boundaries can unveil new horizons and new challenges to sustainability in world's architecture. Through layering we can protect ourselves from natural elements, without detaching us from nature. (Liotta & Belfiore 2012, 94)

We realized that these potent concepts might be used as techniques for transferring culturally embedded knowledge to a more universal platform in the studio. Before launching into how we applied this, however, a more in-depth discussion about layering and patterns needs to be articulated. Because of our personal connections to the culture, the instructors had an intuitive understanding of what Kuma was getting at, but we knew from experience that such concepts can be elusive to those unfamiliar with Japanese culture. The ideas needed further unpacking beyond a simple reading discussion. Most of our students have limited exposure to cultural studies much less critical theory about cultural exchange and transformation, so a lot of ground had to be covered quickly. Luckily, we could get off to a quick start via a fine example of a traditional Japanese tea room at one of our participating institutions, and Saana's Grace Farmas a premier example of a contemporary work of Japanese origin involving cultural translation-which is a field trip away (Figure 4).

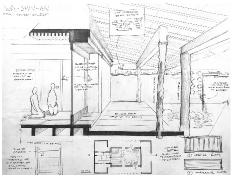




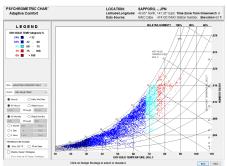
Figure 4: Wa-shin-an Analysis (student: Steve Paquette) and Spatial Layering at Grace Farm (photo: author)

### 1.3 Layering

In the tradition of Japanese architecture, one may find the concept of the multi-layered building envelope with its soft boundaries allowing for occupancy environmental control, which reveals design strategies that entail the integration of micro-local ecosystems. (Vitorino 2012, 118)

Layering as a word immediately conjures spatial conditions, so in that sense it is intuitive. However, the built environment experienced by students, particularly from the U.S. suffers from a lack (or loss) of layering. Even if it is easy on some reflection for students to ponder their love of traditional porches and mudrooms, or other appealing and useful transitions between inside and outside environments, such spatially nuanced typologies are often underutilized when actually designing, thus meriting an intentional focus on layering.

Layering in Japanese architecture occurs along horizontal and vertical axes and performs both culturally and environmentally. Vitorino has developed a table categorizing nine Minka (vernacular Japanese house) typologies that are seen in different geographical and thus climatological regions of Japan. As a long island extending from 31 deg North in southern Kyushu to 45.5 deg North in northern Hokkaido, (for reference, relative to the eastern US, Savannah Georgia is at 32 deg North and Montreal Canada is at 45.5 deg North) there is a big range in mean annual temperature and corresponding differences in rainfall versus snowfall. Using the genetic climate model developed by Gersmehl, Kammrath and Gross, Japan, similar to the Eastern US, is in a frontal climate characterized by variability with hot humid summers and cold dry winters. Further to the north, Hokkaido is colder and very snowy, while south in Kyushu, there are palm trees and typhoons. This is not unlike the difference between Vermont and Charleston, South Carolina—so although it may seem paradoxical to look to Japanese layering techniques when designing for the east coast, in terms of climate, a quick comparison of the psychrometric charts for Sapporo, Japan and our local climate, approximated by weather data from Chicopee Falls, MA shows the two to have similarities. (Figure 5)



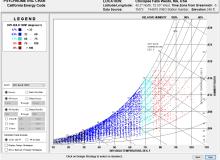


Figure 5: Psychrometric Charts of Sapporo, Japan and Chicopee MA (generated using Climate consultant)

As Rapaport states in House Form and Culture:

One need not deny the importance of climate to question its determining role in the creation of built form. Examination of the extreme difference in urban patterns and house types... shows them to be much more related to culture than to climate. (Rapaport 1969, 18)

This is definitely the case in comparing the building typologies that have evolved in the Eastern US in comparison to Japan, and also within these two countries. It is for *cultural* reasons that the patterns of building in Savannah, GA are more similar to Amherst, MA and similarly the building patterns in Kyushu are more similar to Sapporo than Amherst is to Sapporo despite the more similar shared climate between these northern locations. Despite the large temperature variations, the cultural similarities and shared building traditions have led to layering strategies, horizontally and vertically, fixed and movable, that can be found throughout Japan.

Vitorino's table categorizes vertical layers as part of the lateral envelope: Intermediate zones of habitation including verandas and porches, and fixed and movable layers including fixed walls and movable doors such as wooden Amado, and shoji-screens. Thinking along horizontal layers, there is the entry level across a threshold, and often a level for a wooden floor and a slightly raised tatami floor. In Japan, the horizontal and vertical layers have been formalized as boundaries between sites for the ritualized sequence of actions, patterns of living, and the physical surfaces themselves that have been exploited by the Japanese as surfaces for geometric pattern making.

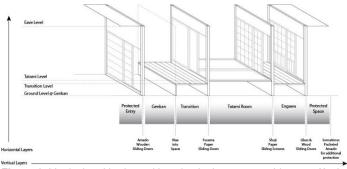


Figure 6: Vertical and horizontal layering in Japanese architecture (Author 2019)

Figure 6 is an abstracted diagram showing a hypothetical layering sequence through a space. Under a protective overhang is the first layer, traditionally, sliding wooden doors or Amado and a wooden threshold into the *genkan* entry. Culturally, this is where one removes shoes and rises vertically into the interior, home or public space. Typically, one would then rise onto a wooden floor and then across another layer of a sliding fusama door (a sliding opaque wood framed panels traditionally finished with paper on both sides) into a tatami room. The opposite side of a tatami room might have shoji screens with the ability to filter light, an *engawa* or outer veranda and a final outer sliding wall to open the engawa completely to the garden. An additional protective layer of sliding wooden doors are often stored in a box attached to the exterior wall and closed in the evenings. Within the garden and beyond are additional landscape layers that are borrowed extensions of the internal space as have been written about extensively by F.L. Wright and others. This means that the innermost tatami rooms which are the primary living spaces are layered within multiple levels both horizontally and vertically. Vernacular buildings in the eastern US, also in a frontal climate, have traditionally had layers for climate control such as the covered porch and vestibule entry but differ in the cultural role that these intermediary places have, and lack the large expanses of sliding walls and screens. While the above texts demonstrate that these ideas have been around for a while, Kuma is able to repackage them in more contemporary and universal terms.

#### 1.4 Pattern

Kuma and others such as Japan scholar Donald Richie, have articulated how pattern has a special place in Japanese culture:

...among men, the Japanese are probably the foremost pattern makers. They are a patterned people who live in a patterned country, a land where habit is exalted to rite; where the exemplar still exists; where the shape of an idea or an action may be as important as its content...where the profile of the country depends upon the shape of living--Donald Richie (Liotta & Belfiore 2012, 9)

Most often, the discussion begins with the role of *katagami*, which are stencils for bloc-printing patterns on cloth or paper that date to the 19<sup>th</sup> century, in which each pattern takes on a symbolic role as much as ornamental, often embodying an abstracted reference to nature, or alternatively represent family crests etc. Their enduring ubiquity in Japan gives them status as cultural reference points (considered among the Important Intangible Cultural Properties of Japan. The patterns are seen as both harnessing geometric regularity and repetition, while at the same time invoking the dynamic, irregular, and de-centered syncopations that together embody the natural. (unlike European stencil work the tended towards the scenographic or floral, katagami features bold graphical shapes and contrasts, and a sense that the forms have been honed to express the essential quality of the object or idea represented) Such pattern systems are said to have had a powerful influence on early Modernists, in addition to having the potential to exert influences anew. (Liotta & Belfiore 2012)

Kuma's invocation of the word "pattern" is in itself daring in the context of contemporary architecture's legacy where pattern has tended to be eschewed along with "ornament" (at least in the Amero-European context). Ornament itself has been undergoing a long, slow process of recovery via publications such as Moussavi's *Function of Ornament*—as a trajectory of digital design, where patterns emerge inherently from structural and other generative operations. Moussavi sees the potential for new cultural expression and meaning in these processes and products, declaring that "Architecture needs mechanisms that allow it to become connected to culture (Liotta & Belfiore 2012, 19) Kuma's own built work naturally exemplifies such ideas. After shedding the Western-influenced, Post-modern and symbolladen work of his early years, he has embraced deep searches into materiality and their inherent expressive potential, often through seemingly simple means such as slatting, stacking, crossing—to generate buildings that are virtually composed of "pattern" at a volumetric and tectonic scale. While the buildings' authorship is readily identifiable, the conceit is that the patterning-as-construction erases the architect as the overweening form-determiner.

Pattern is form expressed through materiality, but as a concept it also transcends form: referencing back to Ritchie, pattern is also "the shape of ideas or actions" and consequently, that which gives expression to "the shape of living." Even in *Patterns and Layering*, these multiplicities can be seen amongst the individual contributors from the Kuma studio, where some focus primarily on the formal and symbolic consequences of a pattern analysis while others on the potential environmental strategies of using "patterned" layers. Across the body of the text, we observed that pattern is discussed primarily in the following ways:

- As an abstracted visual representation of nature, acting to capture its essential characteristics
- 2) As an integral part of generative/digital processes (applicable from small- to large-scale)
- 3) As the inherent tectonic of screening or filtering layers, which tend to be built up of parts and repetition—essentially for the purpose of modulating environmental forces.
- 4) As a pattern of behavior, of both humans and non-humans, shaped by daily or seasonal cycles of living.

In other words, each of these aspects are separately available for expressing a culture-based sustainability, whether it occurs as a graphical representation of the interconnectedness between humans and the environment, or as filtering layers that actively modulate climatic conditions or otherwise delineate zones of inhabitation. Multiple aspects can happen within the same object or objects, but they are nonetheless separate mechanisms at work—the first being primarily symbolic, the latter being both active and symbolic through purpose. One could further say that objects like screens, or thick layers of woven thatch, invite human interaction and awareness of the environment through the opportunity to be adjusted or be otherwise tended to—tying readily into the notion of sustainability as lived culture. This idea treads into

the fourth manifestation of pattern as a "pattern of behavior", but this point was subject to some debate as to whether it was explicitly or implicitly addressed in the book's text, if at all. Certainly, by quoting Ritchie, the idea of pattern cutting across all aspects of Japanese culture, from technique to habit to land use, is invoked—but the point is not fully taken up elsewhere. Even the subsequent discourse on layering as an essential characteristic of Japanese spatial culture focuses primarily on the visual/perceptual realm as opposed to how layered spaces support a host of lived behaviors that are still foundational to the culture. This may seem like a fine point, but as we found, particularly in the studio context, an important lacuna.

"Pattern of behavior" naturally evokes Christopher Alexander—a connection NOT made in Patterns and Layering-but which should nonetheless be considered relevant: "...we must begin by understanding that every place is given its character by certain patterns of events that keep happening there." (Alexander 1979,4) or: "All acts of building are governed by a pattern language of some sort, and the patterns in the world are there, entirely because they are created by the pattern languages which people use." (Alexander 1979, xi) Or referring back to Barbara Allen's Performative Regionalism, when she states that in Louisiana, one designs for large extended families to gather and dance as opposed to a good view. (Canizaro 2007, 426) In a traditional setting, this might further manifest in activities such as plant tending, food drying and pickling, washing and drying, repair of household goods, retail activities out of the home, moon-viewing and other seasonal celebrations, and so on-activities that could require distinct temperature zones or degree of ventilation, wet or messy activities, protected outdoor areas, degrees of privacy or sheltering for example. The key point was that patterns are not only about a visual representation or an activated spatiality or a structuring of adjustable environmental zones—but that patterns of behavior that are more environmentally sustainable can be supported and shaped anew by aligning with the multiplicity of environmental zones that emerge from a layered architecture articulated by patterned/layered separations. In other words, that the tectonic exploration advocated by Kuma should be meshed with an Alexander/Allen sensibility about lived culture. In modern life, a new look at activities that give us more interaction with and stewardship of the environment, perhaps in different guises and new tectonics—are ripe for invention.

#### 2.0 APPLICATION IN THE STUDIO

## 2.1 Patterns and layering applied to site 'forces' analysis

Pedagogically, our challenge was to develop a sequence of design prompts to enable a translation into material expression of these concepts of layering and patterning that students were exposed to more broadly through field trips, readings, broad cultural research and more specific material culture research including architectural precedents. Our approach was to assign two more conceptual making exercises focused specifically on layering and patterns before introducing a specific building program. Project 4 was a site analysis prompt (Figure 7) and Project 5 was a landform and structure prompt (Figure 8). Although students were thinking spatially about the eventual project site, we intentionally did not assign the building program during these initial exercises.

Thinking of pattern as a means to express spatial gradients on a site, the design assignment that most directly engaged students with the ideas of layering and pattern making discussed above was the site analysis project in which students were asked to choose 3 site "forces" and develop a graphic pattern to represent these forces across the site. Examples of forces given were: the range of vehicular and pedestrian behavior, warm to cold areas of the site, wind, site hydrology, views from the site, vegetation, etc. For all of the site forces, students were to consider the gradient of these forces across the site and use their pattern making to communicate the intensity and scale of the gradient of their force across the site, i.e most sunny to least sunny. Students were challenged to develop the pattern to further represent secondary or more nuanced aspects of the information, i.e. how to represent pedestrians walking versus a bicyclist or skateboarder? Further, students were prompted to think about how the "forces" they represent might or might not be influencing each other. Ultimately, we

wanted to conjoin the derivation of pattern and the activity of layering with the capturing and conveying of real information.

After developing their site force patterns, students were to cut the analysis patterns using the laser cutter to develop patterned screens considering positive and negative space, the need for the pattern to hold together structurally as well as for communicative and aesthetic effect of how best to sequence and present their three layers. Students were encouraged to experiment with interlayering, folding, using spacers, and to create some depth between the analysis layers to show them in an interesting and meaningful way. Among the several agendas, was the goal to make physically manifest things that are less tangible though no less present, such as mechanical fan noise of a neighboring building or infrequent but loud garbage trucks, wind gusting or runoff during storms—phenomena that are often ignored even in practice, but which must truly come to the fore in a performative architecture.

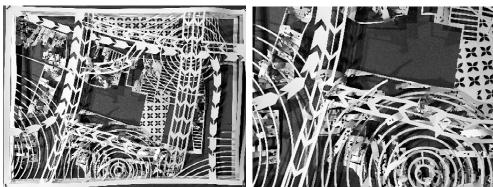


Figure 7: Project 4 - Site Forces. Student: Steven Paquette

Although in preparation, students read excerpts from "Patterns and Layering," one of the biggest challenges we found was that even with this reading, students struggled with the distinction between pattern making and diagramming and developing analytical layers that could communicate tangible site information within a graphic pattern. The most successful examples became both "diagrams of spatial organization" existing on the site as well as "generative element(s)" of the ultimate projects that were developed.

## 2.2 Site "forces" analysis segue into landform-based concept design

Perhaps the biggest break through this year was in the development of Project 5: Landform & Structure, an intermediary conceptual exercise that required student to translate directly their site analysis layers into landform topographies in direct response to the conditions that they observed and analyzed on the site. By keeping this assignment essentially program free, students had the freedom to spatially develop the site in response to and extending upon the layers and patterns within their "site forces" project. In developing their Landforms, students were again working with layered sheet material, cutting, folding, bending and lifting in response to sun, wind, light, circulation, etc. Using similar techniques and translating the layered and patterned analytical constructions of the site into shaped topographies and geometries positioned students to push, pull and adjust this second iteration into Project 6, when students were assigned the full building program. Thus the intuitions of the pattern making and layering that students explored in Project 4 were maintained as active ideas in their final projects.





Figure 8: Project 5 - Landform and Structure. Student Hannah Clark

## 2.3 Building programming for patterns and layering

By invoking William G. Clark who was foundational to the agricultural legacies of both our institution and that of Hokkaido, Japan—and the historic building bearing his name at the center of the site—we had a means to both indulge in a nod to Japanese cultural practices yet focus more universally on the importance of cultural and environmental responsiveness. We intentionally developed a multi-faceted program with spaces that would be best served with a gradient of light conditions, temperature control, privacy, accessibility-"liminal" spaces as spatial layers that service and equip the program spaces, while often mediating climatic zones between the inside and outside. These are the very spaces that are often not clearly articulated in typical "program brief" square footages, so we made sure to spell them out and describe how and when they might be used in conjunction with the more fully conditions spaces, while also encouraging further invention. This allowed students to fully consider how the daily rhythms and patterns of life and culture are enabled while making buildings that are more performative both ecologically and sociologically (Figures 9 and 10). The combination of the preparatory exercises that activated a patterning and layering sensibility in the students, and a highly descriptive program that enabled them to envision and justify functional scenarios was in our opinion highly successful for almost all students, yielding lively and convincing results that were quite unlike their previous studio work.



Figure 9: Project 6 - Student Center for Sustainability. Student: Caroline Dolan



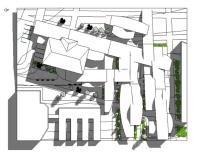


Figure 10: Project 6 - Student Center for Sustainability. Student: Courtney Jurzynski

#### CONCLUSION

This was the fourth time that we co-taught a culture and sustainability-based studio and each time we have refined the semester's sequence. This past fall, the combination of Project 4 - Site Forces with Project 5 – Landforms and Structure, enabled the most direct translation that we have seen of students being able to transfer thinking and physical making around concepts of spatial layering and patterns directly into their design proposals. The transition to a local site that students could see and visit, as well as a carefully developed program that consciously combined spaces needing gradients of light, air, temperature were also critical in this success. Moving forward, it may be helpful to have students analyze *katagami* precedents more directly for pattern-to-meaning techniques, and also to have them organize the given program into gradients more directly aligned to the three site forces each chose for their initial site investigations, enabling them to more quickly grasp and translate their layered form making exercises into the relatively large and complex building program and site.

In relationship to professional practice, we feel that utilizing "hands-on" pattern/layer-making to bridge the gap between diagrammatic analysis and building design would be effective, since professionals are often similarly challenged to visualize the multiple and often non-visual factors impacting a site and program. In addition, the technique of using a detailed program narrative where building activities are further aligned with variable thermal zones can define strategic positionings and help guide the design process to not only reduce energy bills, but to produce buildings where a more complex interaction between climate and building are envisioned and shared:

...it is possible to rethink both the meaning and the role patterns might play as diagrams of spatial organization and generative element of a project. Today there is renewed interest in elaborating an architecture that can again balance economic and social forces and connect space through different spatial devices and in the study of their application and meaning in architecture. (Liotta & Belfiore, 2012, 17)

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