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Published in:
Envisioning Architectural Scales in the Analogue and Virtual Representation of Architecture

DOI:
https://doi.org/10.60558/eaea16-2023-348

Publication date:
2023

Document Version:
Publisher's PDF, also known as Version of record

Document License:
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https://doi.org/10.60558/eaea16-2023-348

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Measurable and Immeasurable Scales: Speculative Transformations of Architectural Photography

Introduction

Architecture is always designed in response to a wide range of scales – the macro scale of site context, the micro scale of building assembly, and all the spatial, structural, and social concerns that fall in between. Architectural design at all scales must respond to measurable and immeasurable inputs and constraints. For example, the flow of solar energy toward a building is a measurable input to which design must respond in different ways at different scales – from scale of site to scale of a construction detail. The way people move toward a building, enter it, and experience it is an immeasurable input that must also be responded to in different ways at different scales. A measurable constraint such as a dimensional limit placed on a building or component of a building, and an immeasurable constraint such as the desire of a client must also be addressed in different ways at different scales. These are just a few examples of the many ways architectural design must accommodate measurable and immeasurable concerns at different scales.

Given these complexities of measurable and immeasurable scale, how should the topic of scale be introduced to beginning architecture students, particularly when digital drawing and imaging environments make it extremely challenging to grasp scale in relation to the physical world? This essay will present the framework of a visual studies exercise given to first-year architecture students that attempted to address this question.

Pedagogical Context – Time and Scale

At the beginning of the course, to initiate a discussion about the nature of drawing[1] in architecture, students were asked to consider drawing in relation to two very broad concepts – time and scale. With respect to time, drawing was discussed as an artifact representing an idea, and as an act performed in time. In his book *Architectures of Time,* Sanford Kwinter argues for an approach to architecture that engages time to bring novel things into being. Rather than thinking of architectural design as similar to making ice cubes, which are formed into already determined shapes, he suggests that architectural design could be more like the genesis of snowflakes. The

[1] In the course, students were asked to produce a series of visual works combining images, lines, and surfaces in two- and three-dimensional digital design environments. In this essay these works will be referred to as 'drawings' mainly because they are being used as drawings have been used historically in academic and professional settings – as instruments in a design process. What 'drawings' are in architecture today is certainly up for debate, but this debate is beyond the scope of this essay.

genesis of snowflakes engages time as it draws matter into a difference-producing process that does not have a determined outcome (Kwinter 2001, p. 26). Kwinter notes, however, that structures of civilization, Western civilization in particular, seek stability and generally attempt to tame the difference-producing 'wildness' of time. But rather than accepting the predictability of stability, he suggests one might be better off embracing the onslaught of difference time produces. "For the very same principle that 'corrupts,' transforms, and diminishes Forms, evolving them toward disuse, decrepitude, and disappearance, also *gives,* produces, and creates."[2] As a response to Kwinter's proposition, this course asked students to consider how they could draw something novel and possibly somewhat 'wild' out of a conventional, acceptable, or stabilized view of an already existing building. It was suggested that their drawings, dynamically produced in time, might be seen as 'transformations' or even 'corruptions' of canonical works of architecture.

With these notions of time in hand, the issue of scale was addressed. Scale is a particularly difficult concept to teach beginning architecture students because most, if not all of what we call 'drawing' in architecture school is done in digital environments where a canvas, drawing board, or model space is infinitely zoomable and therefore has no fixed or intuitively understandable scale. Scale, however, is so ingrained in how architects conceive and represent buildings, that its deep significance may be at least partly hidden from us as practitioners. Edward Robbins has observed in his anthropological study of architectural drawing that it is necessary to step outside a culture to understand it more fully. Because Robbins is interested in uncovering how the various ways drawings work remain hidden to architects, he takes a different view of drawing than most architects would by foregrounding its role as a social practice rather than a representational object (Robbins 1994, p. 5-6). Albena Yaneva takes a similar anthropological outsider's view in a study of how scale is used in a design project by the Office for Metropolitan Architecture. Yaneva embedded herself in OMA's office during design of the Whitney Museum extension, an unrealized project adjacent to Marcel Breuer's iconic building on Manhattan's Upper East Side. Yaneva describes her work as an 'ethnographic' study, which required her to 'live' in the architect's office (Yaneva 2005, p. 868). From her position as an outsider embedded in an architectural office, Yaneva makes a number of important observations regarding how a series of physical models are used to visualize and discuss design of the building at different scales. Although her study concerned the use of physical models, her observations and conclusions are seen to be applicable here in relation to this student drawing exercise. Three of Yaneva's observations will be used to frame the discussion of scale: 1) that a concept of 'fuzziness' is productive as it relates to cognition of design, 2) that circularity between scales sets up iterative development, 3) that architectural models capture heterogeneous design parameters.

[2] Kwinter, 2001, p. 7.

1) FUZZINESS

While size of a building or object is quantitative, scale is qualitative and relative. In scale, something is larger or smaller than something else, but how much larger or smaller is not specified (Morris 2009, p. 9). As a result, the scale at which a building should be represented is not definitive, though Yaneva notes there is a typical way architects use scale, which is to start designing at smaller scales and progress to larger ones. (Yaneva 2005, p. 870). Smaller scales limit the amount of information that can be contained and conveyed by a model. Architects often refer to small scale models as 'abstract,' implying that they foreground an idea (or something immeasurable) rather than representing something like the configuration and assembly of building materials (or something measurable). Starting at a small scale works well in the realm of physical models and drawings because at a small scale dimensions of the architect's body and perception constrain dimensions of their tools and materials, and thus constrain dimensions of their work. In the physical world, there is a limit to how small or closely spaced an individual part of a model or an individual line in a drawing can be. But this is not the case in the digital world where elements of a model or drawing can be constructed and inspected at indefinitely larger or smaller sizes. When dimensions of the physical world are removed, it becomes difficult to determine how small is too small, and how much information is too much information. As a result, for beginning students at the beginning of a design process, it is difficult to conceive how a model or drawing can be abstract or contain something as immeasurable as an idea. Yaneva, however, introduces another term, 'fuzziness' (Yaneva 2005, 870), which seems useful in translating abstraction that happens inherently in the physical world to the digital world. Rather than burdening representation with a need to have a positive quality (i.e., it is abstract and thus contains an idea), fuzziness implies that certain aspects of design simply do not need to be attended to presently. They can be temporarily forgotten or pushed off to the side; attention can be diverted to other aspects of the design at other scales.

2) CIRCULARITY

As a design process progresses, moving between scales is not linear; it does not simply progress from small scale to large. Yaneva observes the OMA architects moving from a smaller scale model to a larger scale model and back again, evaluating the position of an escalator in relation to how they are able to visualize it in different ways at different scales. She finds there is circularity between the two models as the architects physically move back and forth between them, and this puts an iterative design process into motion (Yaneva 2005, 883), which eventually allows the architects to determine the most desirable position for the escalator. Decisions made while working on one model require decisions made while working on the other model to be reconsidered. In the physical world, the fact that the models are two different and distinct objects forces a separation of scales. If a digital model or drawing represents all scales at once, is it still possible to create a similar circularity that encourages constant reconsideration of a design problem?

3) INCORPORATING HETEROGENEOUS DESIGN PARAMETERS

In an architectural model, such as OMA's site model for the Whitney Museum extension, heterogenous design parameters come together in a new gathering.

> For example, a small concept model with barely visible figures takes into account the adjacent buildings, the tiny slot allocated for the site, the eclectic features of New York city fabric, the dense network of local districts, the zoning fragmentation, the variety of building heights, the marks of history, the city politics, and the neighbor's relationships.[3]

Some of these parameters such as dimensions of the surrounding buildings and the site are measurable, and others such as 'marks of history' and city politics are immeasurable. These heterogeneous parameters operate at different scales, from the scale of the of the city down to the scale of the building. Yaneva describes models such as these "not projections or anticipations of the building; rather they are new compositions shaped according to multiple constraints."[4] In other words, a model works as a generator and container of knowledge rather than a facsimile of the building. She states that nothing is more convincing for showing the 'composite' character of a building than a physical model because of how it accommodates heterogeneous parameters. As with Yaneva's other observations concerning fuzziness and circularity, the potential to composite heterogeneous design parameters will be discussed in relation to the drawing exercise presented here.

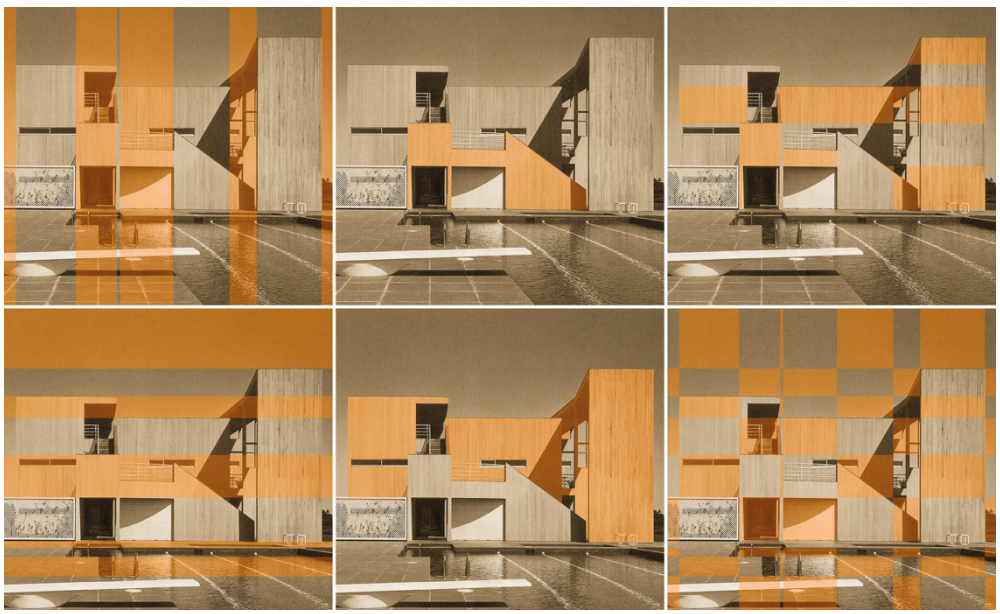

Fig. 01. Analytical images of Gwathmey Sigel Architects, de Menil Residence, East Hampton, NY (1983). Photograph by Yukio Futagawa. X-Y grids in left column, figural grids in center column, combined X-Y and figural grids in right column.
Source: image by author

[3] Yaneva, 2005, p. 872.
[4] Yaneva, 2005, p. 873

Architectural Photography

Within this pedagogical frame dealing with time and scale, students began an analysis of architectural grids found in a photograph by Yoshio Futagawa of a late 20th century American house. Futagawa was the founder and one of the principal photographers of *Global Architect (GA)*. For more than 50 years, *GA* has been a highly regarded and widely distributed publisher of contemporary international architecture. As such, *GA* could be considered a major purveyor of legitimacy or acceptable standards and practitioners in contemporary architecture. With this in mind, students were asked to select one of Futagawa's photographs that looked frontally at one exterior side or interior wall of a house, a single-point perspective view that is as much like a two-dimensional elevation drawing as a photograph can be. Architectural grids were overlaid on these photographs in two ways: 1) as horizontal and vertical (X-Y) grids which align with horizontal and vertical datums in the architecture, and 2) as figural grids highlighting prominent two-dimensional shapes in the façade [Figure 1].

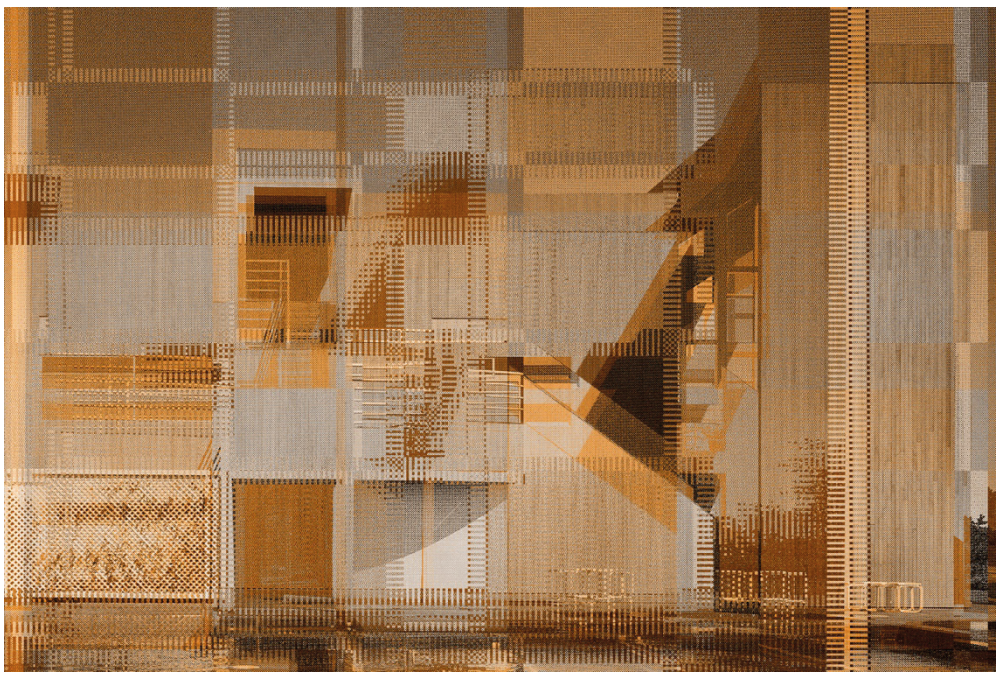

Fig. 02. Transformed image of Gwathmey Sigel Architects, de Menil Residence, East Hampton, NY (1983), based on photograph by Yukio Futagawa. Two-dimensional transformations of an analytical image (see Figure 1) introduce new grids in a different scale and register.

Source: image by author

These grids were drawn as transparent overlays so the photograph remains visible through them. The grids themselves do not apply measurable scale to the image, but the photograph does. So, whether viewed on a computer screen as the student zooms in and out of windows while working, or printed for presentation, the photograph represents recognizable architectural features such as doors, windows, and stairs. The

resulting analytical images have a measurable scale that can be perceived by the student, allowing an intuitive estimation of the size of the building, and thus the scale of the image.

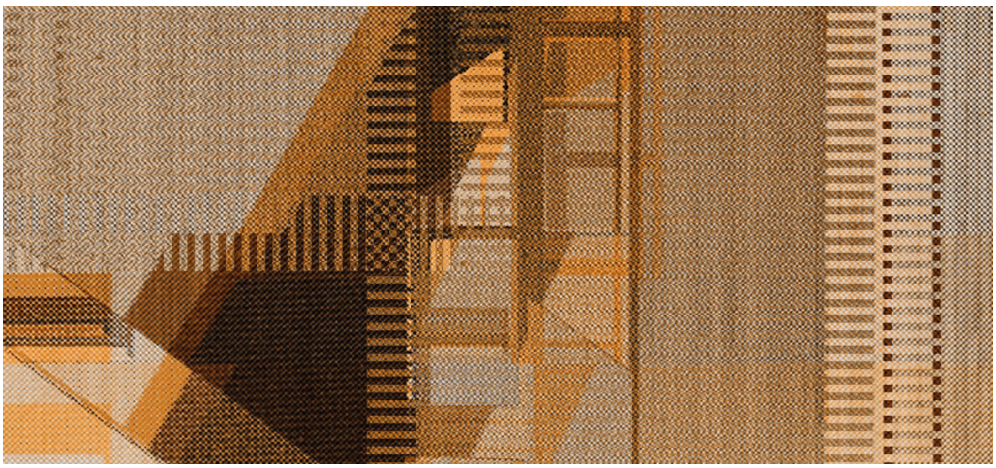

Fig. 03. Transformed image of Gwathmey Sigel Architects, de Menil Residence, East Hampton, NY (1983), based on photograph by Yukio Futagawa, detail. This detail shows an area of the image where architectural features are unrecognizable and an immeasurable scale is introduced.
Source: image by author

The Drawing Process

With this intuitively recognizable scale built into the analytical images, students were asked to transform them by engaging in a process that 'corrupted' (to use Kwinter's terminology) the original architectural photograph. Transformations introduced new grids, which were based on the architectural grids described above, but at different scales and in different registers [Figure 2]. As described by Rosalind Krauss, grids are visual structures that resist narrative or sequential readings. For Krauss, a grid is "flattened, geometricized, ordered…" "In the flatness that results from its coordinates, the grid is the means of crowding out the dimensions of the real…"[5] As new grids are introduced to the image at different scales, dimensions of the house as seen in the photograph are 'crowded out' to make way for another scale and register of visual information. This new scale is much smaller, and it is a registration of the software used to transform the image rather than of the architectural image. Particular areas of the image are transformed to an extent that the architecture is no longer recognizable [Figure 03], or there is a 'fuzziness' introduced that encouraged the students to divert their attention away from the original house. In these fuzzy areas, scale becomes immeasurable because there is no longer a visual reference to recognizable architectural features such as doors, windows, handrails, etc. Students were asked to work on this type of transformed image until the initial architectural photograph was still recognizable in some areas of the image, and unrecognizable in other areas. Or

[5] Krauss 1979, p. 50.

until it sustained a relationship between measurable scale and immeasurable scale, and it composited heterogeneous parameters including the architecture of the original house and the logic of the software.

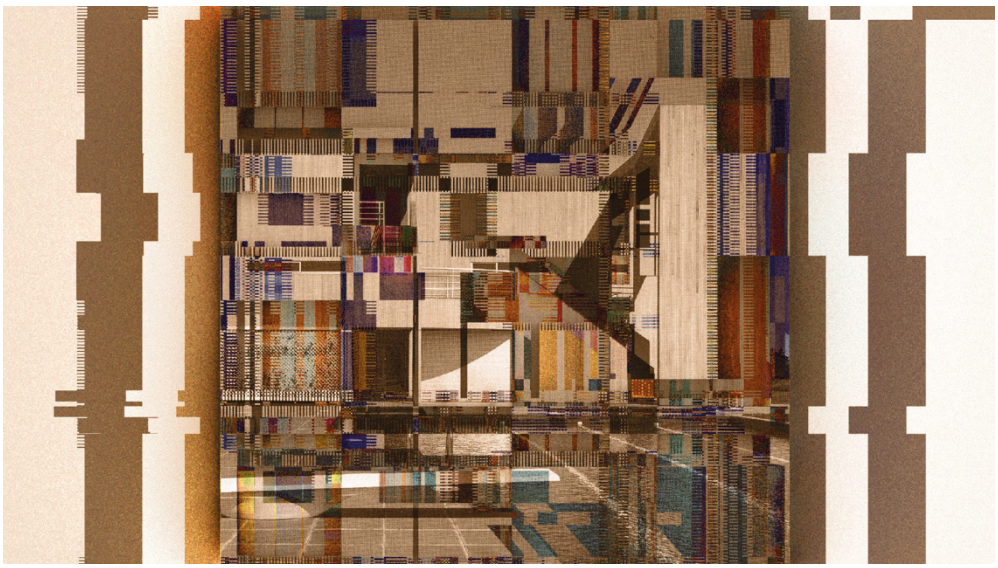

Fig. 04. Transformed image of Gwathmey Sigel Architects, de Menil Residence, East Eampton, NY (1983), based on photograph by Yukio Futagawa. This image is an orthographic view of a three-dimensionally extruded model, texture mapped with the transformed image. Z-axis scale is invisible but revealed indirectly through shadows projected by multiple lights.

Source: image by author

Krauss notes that grids tend to flatten imagery, and this is true for the transformed image. Architectural grids overlaid on the original photograph and abstract grids transforming it tend to reduce its perspectival depth. This flattening was countered by considering another type of immeasurable scale in the image, the Z-axis, or dimension perpendicular to the image plane. The Z-axis was introduced by extruding elements of the new scale and register in the transformed image. Another image was then produced from an orthographic view of a three-dimensionally extruded model, and texture mapped with the transformed image. In this image, the Z-axis scale is invisible, but revealed indirectly through shadows projected by multiple parallel beam lights shining on the three-dimensional model [Figure 4]. This sets up a type of circularity within a single drawing, which consisted of flattening through the initial introduction of grids to the architectural photograph, re-introducing depth through three-dimensional extrusions, flattening again by texture mapping the three-dimensional model with a two-dimensional image, and finally re-introducing depth through shadow projection. In a similar way to how Yaneva observes the two physical models working in OMA's office, this drawing exercise sets up a circularity that produced iterative design development. The image resulting from this iterative development contains two types of fuzziness: 1) visual coherence of the architecture from the original photograph, sometimes it is legible, sometimes it is not, and 2) two-dimensional vs. three-dimensional readings, grids tend to flatten, but perspective

and shadow add visual depth. The fuzziness produced through different types of grid-based transformations allowed students to imagine different scales into the final image. It became possible to consider that the image might represent something larger or smaller than the house in the original photograph, and it allowed the students to imagine the scale of implied depth in an orthographic image, all without completely loosing perception of measurable scale from the original photograph. As the drawings were explicitly process-oriented, students were able to see how iterative development unfolding in time evolved the form of original canonical house toward 'disuse, decrepitude, and disappearance,' as it produced something novel. In this way, the exercise took Kwinter's recommendation to embrace the 'wildness' of time.

Student Assessments

One to two years after completing the course, students were given a questionnaire regarding key outcomes of the course and were asked to describe how they understood them from the perspective of having completed a significant portion of the school's architectural curriculum in the meantime. To some extent, students were able to grasp key aims of this drawing exercise. Summary statistics and some of the most relevant responses are presented here:

1. Question: Generally speaking, how easy or difficult do you find it to perceive and understand scale of a building you are designing when you are working on it in the computer in two and/or three dimensions?

   Summarized answers (out of 11 respondents):
   Can understand scale well – 5
   Cannot understand scale well – 5
   Answer unclear – 1

   There are times when I model in 3D and draw in 2D where I don't realize how big or small the space actually is. – Dawson Chak

   I find it very difficult to perceive and understand scale when working on a computer. Both the human body and the building's surrounding context are great to refer to when understanding scale. – Haley Korwan

2. Question: How do you think your ability to perceive and understand scale while working on the computer has changed since you took this course as a first-year student?

   Summarized answers (out of 11 respondents):
   Ability to perceive and understand scale has changed for the better – 8
   Ability to perceive and understand scale has not changed for the better – 2
   Answer unclear – 1

I realized that you can work on the tiniest detail like a baseboard then zoom out to the entire building and it almost seems insignificant. Since I was a first-year student I noticed that the more effort you take in the small things, the more the larger views look complete. – Logan O'Neill

As a first-year student, I understood the logistics of scale, but I did not fully understand how it can influence a project. – Sami Detwiler

3. Question: In this class, how did you perceive scale in the transformed Photoshop drawing [Figure 2]? What features or qualities of the drawing allowed you to understand how large the building in the drawing is? Were there areas in the drawing where you found scale easier or more difficult to understand?

   Summarized answers (out of 11 respondents):
   Can describe how scale is perceived in the transformed image – 4
   Cannot describe how scale is perceived in the transformed image – 6
   Answer unclear – 1

   The railings, stairs, columns, and beams that move across the house allow the scale of the structure to be understood. – Haley Korwan

   I think I saw scale through the details such as the doors and stairs and went off of that comparing those standard dimensions to other parts of the building to imagine how big everything else was. – Alec Kim

4. Question: In this class how did you perceive scale in the composited image/model drawings [Figure 4]? What features or qualities of the drawing allowed you to understand how large the building in the drawing is? Were there areas in the drawing where you were able to perceive three dimensionality?

   Summarized answers (out of 11 respondents):
   Can describe how scale is perceived in image/model drawings – 8
   Cannot describe how scale is perceived in image/model drawings – 1
   Answer unclear – 2

   I think scale can be seen are in the big chunks or areas where aspects of the images are clear or not as glitched. These areas give some sense of scale, ignoring the original scale and creating a new scale where you can read scale of the broken-up pieces and how that might introduce a new scale to the project. – Christopher Elias

   I would say starting out and working in photoshop at least for me it registered at a smaller or even residential scale, but as we moved through the semester and began developing the final images like in question 4 [Figure 4] to my eyes the scale seemed to change to a more urban level. – Cooper Myers

5. Question: If some aspects of architecture can be considered measurable (the dimensions of a building for example), and some aspects can be considered immeasurable (the way people move toward a building, enter it, and experience it), how might you describe measurable and immeasurable scales in the composited image/model drawing(s) you did in this class?

   Summarized answers (out of 11 respondents):
   Can describe measurable and immeasurable scales – 8
   Cannot describe measurable and immeasurable scales – 1
   Answer unclear – 2

   I think scale is measurable in the identifiable regions (doors, windows, columns) and immeasurable where the transformations so obscure the drawing that nothing distinct can be drawn out (is it a wall? a shadow? a floor? etc.). – Casey Rosen

   For composite images, the immeasurable space can also be thought of as the depth and dimension that the filter [created in Photoshop] imposes on the original image and form of the building. – Haley Korwan

Fig. 05. Right: transformed image of Gwathmey Sigel Architects, de Menil Residence, East Eampton, NY, USA (1983), based on photograph by Yukio Futagawa. Left: transformed image of Robert Stern: Residence in Llewellyn Park, NJ, USA (1981)

Source: student work by Zonglin Li (R) and Clara Cruz (L)

Conclusion

As this course was for beginning students, focus was on design thinking fundamentals and work remained abstract, with the understanding that more advanced courses would explore issues of scale in less abstract, more technical ways. In this context, students acquired skills to produce a particular type of architectural drawing, and hopefully insight to understand resulting drawings not just as an artifact, but as

architectural knowledge allowing them to imagine a design for a novel building. While this building retained a memory of a canonical work of architecture, the pedagogical frame dealing with time, scale, and grids, helped guide the students through a process that did not accept the canonical work as a given, and found a contemporary image for architecture by allowing the conventional to be overwritten and at times forgotten.

It should be acknowledged that the ease with which evolving digital technologies allow new architectural imagery to be produced and multiply has the potential to call imagery's legitimacy or seriousness into question. Robin Evans made note of the fallibility of images even before computers began to be widely used in architectural design education:

> In a situation where everything is mobile, where only one thing at a time can be held down and kept still, images are the easiest items to immobilize. We should nevertheless recognize that possession of these easy captives is not a sign of victory, but a sign of fallibility. The art of composing images retains its preeminence largely because architecture has to be taught. The question is, how much more is ever brought within the scope of the architect's vision of a project than what can be drawn?[6]

For Evans, the preeminence of the image, or the drawing, in architecture is a result of it being both a result of architectural knowledge and producer of architectural knowledge – drawing has to be taught to students in order for it to teach them. So, what can be brought into a student's vision of a project beyond what can be drawn into an 'immobilized' image? The hypothesis in developing this drawing exercise was that using an architectural photograph as an underlay for an iterative drawing process that transformed or 'corrupted' the initial photograph would give the students a sense of scale as they developed a novel architectural image. Based on students' responses to the questionnaire given after the course, this appears to have worked reasonably well. In addition to using the photograph as a reference for size, many students are able to articulate a difference between measurable scale residing in recognizable architectural features of the photograph, and immeasurable scale residing in more abstract regions of the drawings. Teaching the course and reflecting on it afterward has revealed a more comprehensive reading of how these drawings work in relation to scale, which has potential to further expand the students' scope of vision. This has been articulated in terms of three observations made by Yaneva: 1) fuzziness is an important quality for architectural representation because it diverts attention away from things that do not need immediate attention, 2) circularity, either forced by multiple physical representations of a project, or built into different stages of a digital drawing process is what sets up an iterative design process, 3) architectural representations incorporate heterogenous design parameters, which is what allows a drawing or model to deal with measurable and immeasurable scales simultaneously. These are the findings from the research presented here that will be carried forward into development of subsequent visual studies courses.

[6] Evans, 1995, p. 360.

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