Geologic Time is No Longer Slow Time: Rapid Climate Change and the Architectural Site

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In this era of rapid global climate change, landscape changes that once occurred in geologic time scales are now occurring within the lifecycles of buildings. Global surface temperatures, weather patterns, and lake and ocean levels are changing quickly and unpredictably. This new architectural context raises questions about existing practices in site-responsive architectural design: What are new ways of thinking about design that can account for both the geological history and the geological future of a given site? What is site-responsive design for sites with uncertain ground or climate? What are new theoretical frameworks for design thinking that offer insights into relationships between the built environment and the history and future of the global atmosphere?

Since the Mendenhall Glacier Visitors Center was completed in 1962, the Mendenhall Glacier has retreated nearly 1.75 miles, leaving a large lake between the visitors center and the glacier terminus. Glaciologists predict that within 100 years the Mendenhall Glacier will be gone. In this paper, we use the design of a new visitors center for the Mendenhall Valley that curates the recent past and that anticipates enormous change in the near future, as a practical case study in the role of geologic time in architectural design.

HISTORY AND THE ATMOSPHERE

*We are intrigued by what is arguably a growing recognition that the geologic, both as a material dynamic and as a cultural preoccupation, shapes the "now" in ever more direct and urgent ways. (*Ellsworth and Kruse, 2013)[1]

As we begin an era of rapid global climate change, the temporal frameworks that define architectural site are no longer reliable. While cultural mores have long impacted the built environment in decadal waves, the physical environment of buildings has been mostly static. While it has never been possible to design for future tastes, it has been possible to depend on climates and it has been possible to rely on the physical form and existence of a given site.

At the same time, it is notable that in August this year, the Alaskan village of Shishmaref voted to move its ancestral home out of the way of melting sea ice and permafrost.[2] That single village is representative of the millions of people in the Pacific region who will likely be displaced or forced to migrate in the next decades because of climate change and rising sea levels.[3] As described in his now-famous article for *Rolling Stone* magazine "Good Bye Miami," (2013) Jeff Goodell describes a three-foot rise in sea level submerging more than a third of southern Florida and leaving an archipelago of abandoned buildings and crumbling overpasses.[4] With the design of their 2015 Perez Art Museum in Miami, and in contrast to alternatives available to the village of Shishmaref, architects Herzog and de Meuron and landscape architects ArquitectonicaGEO have responded to the future submersion of their design site with a thoroughly elevated building.[5]

As a temporal framework for measuring large-scale change, geologic time has always out-scaled the life cycles of buildings. Sudden landslides and earthquakes aside, if geology has acted on buildings, it has been in the weathering (stone, metal, wood) of the buildings themselves. Unfortunately now, geologic time is no longer slow time and Aldo Rossi's tempo (time and the elements), with architecture "made possible by the confrontation of a precise form with time and the elements, a confrontation which lasted until the form was destroyed in the process of this combat"[6] is inverted. Now, the building may last longer than the weather. It might even be fair to say that the modern built environment—as it unfurled the means and the demand for this catastrophic combustion of fossil fuels—has derailed the weather.

Site-responsive design in architecture, as described in a canon of guidebooks such as *Design With Nature* (McHarg, 1969), *Sun Wind and Light* (Brown and Mackay, 2001) and *Green Studio Handbook* (Kwok, 2007) and as demonstrated by architects such as Glenn Murcutt and Behnisch Architeckten, demands careful response to regional climate data and sometimes sensitivity to regional and cultural history.[7] These pedagogues and practitioners have offered detailed ways to engage temporal frameworks of climate and region. Now, what is the tool kit that will arm designers as geological shifts in climate and terrain enter the lifecycles of buildings? What tools will future designers use that will disentangle them

Figure 1. Kiesler, Grof, Chua.

from the gas-guzzling legacy of the contemporary built environment and to take on the present and the future of climate and terrain? How will these buildings respond to the uncertainty of climate and the uncertainty of the site itself?

CLIMATE CHANGE AND THE MENDENHALL GLACIER

The Mendenhall Glacier Visitors Center near Juneau, Alaska was completed in 1962. At the time of its construction, the glacial ice of the Mendenhall Glacier filled the Mendenhall Valley to the foot of the visitors center. Because of human-caused climate change, since then the Mendenhall Glacier has retreated nearly 1.75 miles, leaving a large lake between the visitors center and the glacier terminus. Now, most visitors use the existing visitors center as trailhead facilities for a longer trek to the edge of the lake at the base of the receding glacier. Last summer, more than a half a million visitors came to glimpse the shrinking glacier.

Glaciologists forecast that the glacier will be completely gone within the century. But, the future shape of the glacier is dependent on future earth surface temperatures and those temperatures are directly dependent on future levels of greenhouse gases in the atmosphere. The design site is, materially and empirically, the past site (ice), the future site (lake) and the atmosphere (greenhouse gases) as the determinant of the rate and degree to which these transformations will occur.

This view of the Mendenhall Valley as an artifact of millennia of geologic forces acted upon in a century or so of rapid climate shift, fits well into the framework of the "geologic" that is described by Elizabeth Ellsworth and Jamie Kruse in their introduction to *Making the Geologic Now: Responses to Material Conditions of Contemporary Life* who write that they "are intrigued by what is arguably a growing recognition that the geologic, both as a material dynamic and as a cultural preoccupation, shapes the "now" in ever more direct and urgent ways." [8]

While Ellsworth and Kruse reference the abruptly shaped landscapes and atmosphere of the Anthropocene, their work is most relevant to the "fast time" view of the Mendenhall Valley in their suggestions that understanding "of earth processes can offer inspiration for how we might think about the qualitatively different ways that humans are now living on planet earth. . . . Daily experiences of what has preoccupied philosophers for generations: space, time, matter, and change, are being dramatically altered by new predicaments of speed, scale, flow, and density."[9] According to Ellsworth and Kruse who reference Jane Bennett's key text in New Materialism *Vibrant Matter: A Political Ecology of Things*, "Earth and atmosphere are not inert, but are key actants that require purposeful interaction."[10] Bennett's view of New Materialism offers an even more specific way of understanding the past and future ground and past and future weather of a given site—and inseparably—as a way of understanding the atmosphere as part of a temporally and physical expanded site.[10]

In this view, the subjectivity of human experience is subsumed by the overall agency of nonhuman forces—transformations of matter and energy—in the shaping of space and phenomena. This perspective, in which the shape and nature of the architectural site over time is inseparable from the make up of the global atmosphere over time and in which geologic time is no longer slow time, will require new ways of thinking about the history and future of architectural site. In particular, how can people and buildings engage geological processes? What does New Materialism, or more simply the physical sciences, offer architects as a way to view the past, present, and expanded site of architectural design?

In this paper, we contextualize work that took place in an architectural design studio at the University of Oregon in 2016 that uses the studio model to explore notions of geologic time and to develop architectural responses to change in site and climate. In this case, the architectural site includes the physical form of the site over time as well as the physical makeup of the global atmosphere as a critical agent in the shaping of the future site.

As a vehicle to begin to engage some of these questions, we asked small teams of students to propose new visitors centers for the Mendenhall Valley that would reframe the glacier physically and culturally for the next 100 years as the glacier fully recedes. This critical design work was structured by the following prompts.

SITE

I suggest a twofold consideration of the site in architecture: in terms of theory of knowledge (what we think site it), and in terms of the impact of theory on action (what we make of a site, or how it informs constructions and is formed through them). (Burns, 2005)[11]

For two weeks, students researched and re-represented the Mendenhall Valley with a focus on the dynamic geomorphology at the intersection of the valley, glacier, and lake. Students re-worked the site in drawings and models to develop a body of works that represent the scale and nature of the site over time. The resulting body of work included: 1) at least one full and usable model of the site that combines physical data with some other data layers, 2) additional site models that abstract the site in other useful ways, and 3) drawings, maps, and diagrams that are all original work derived from available data for the site. Students were encouraged to think critically about the temporal assumptions in their site models and drawings. Most site drawings and models incorporated multiple time scales.

Students' approaches to site analysis drew from parallel work such as that of MAP Office's (Hong Kong) design approach to "recompose, redraw or reexamine the territory," and of David Gissen's analysis of

territory as an urban "webworks" (stitching together nature and people).[12, 13] Students were also influenced by the recent work of Weiss/Manfredi (New York) and their projects that blur divisions between nature and building in crafting the public realm.[14]

The site-specific approach in design examines architecture as a work in the present, but also accounts for the memory and future of the place. In the research presented in this paper the site-specific approach is more oriented to geomorphology, the shapes and processes of topographical change. In *Landform Building: Architecture's New Terrain*, Stan Allen considers this turn to the geological a desire to create a new forms and terrains through the folding and creasing of surfaces.[15] The new geologically oriented approach brings new vocabulary to design practice: "peak," "rock," "mountain," and "crust" and offers new strategies such as simulation or imitation of geological and natural processes.

The process of site analysis, or of using new tools to redraw the terrain over time, reshaped students' views of the Mendenhall Valley. For example, the student group DRAPIRUVANNYA (R. Kiesler, E. Grof, M. Chua) created a series of collages (Figure 1) that illustrate a progression of space and information as tourists enter Juneau, Alaska. The collages represent the human life, tourist life and natural life in sequential time.

The student group NOT ENOUGH TIME (K. Zanger, J. McCarthy, M. Olney) analyzed social media from the human perspective. They asked: what do tourists write and what do they post about their trips to the glacier (as one of the most popular tourist destinations in Juneau)? By collecting quotes, photos (Figure 2) and advertisements from social networks such as Facebook, Twitter, and Instagram they concluded that there is not enough time for people who visit the site. This shortage of time could refer to the short visit most tourists are allowed by tour companies or to the short time remaining in the lifespan of the glacier.

The student group MOUNTAIN (H. Rodriguez, M. Moore, L. Jacobson) did a photomontage, a timelapse video that shows the history of the glacier, the way it is changing and the glacier projected for the next 100 years (not shown).

BUILDING

There was never a time when human agency was anything other than an interfolding network of humanity and nonhumanity; today this mingling has become harder to ignore. (Bennett, 2010)[14]

Following the study of the geomorphology of the valley in concert with a study of the building program, students developed a morphology for a visitor center building to accommodate 500,000-1,000,000 tourists per year, primarily during the summer months and that would be relevant for current and future topographies. This would be the hub for visitor services and interpretation of the glacier. The resulting body of work included the development of three morphological and programmatic strategies for the visitor center: 1) final models that describe the morphology and program strategies of the building, 2) perspective sections that connect the building massing with the building functions.

In *Groundwork: Between Landscape and Architecture*, Diana Balmori uses the idea of the "thick line" to explain the interface between architecture and landscape and the connection between a building and its surrounding.[16] The consideration of the site and the building as a continuum that can be modified by others illustrates the dependence of architecture on landscape. In architectural practice, the erasing or the thickening of the separation between architecture and landscape will be key in design for geological time, materialism, and the atmosphere.

The student group GROUND+SKY+WATER (M. Faul, R. Brown, C. Neal) designed their building as a series of built ledges that imitate natural forms of the stones from the site (Figure 3). The experience they wanted to create for visitors was of exploration of ground, sky, and water. To do this, they created a path that connects three different destinations in a back/forward movement of time.

As a glacier is moving, it leaves the raw surfaces of the mountain behind the glacier or it seems that the land is moving out from beneath the glacier. The group LAND (S. Lim, M. O'Brien, J. Frost) envisioned a new visitors center as a curvilinear movement of the building on the ground surface. The building is a part of a path from the main entry and main access to the site through the viewpoint to a glacier, using acoustic land sculptures to connect the movement of the glacier across time and space (Figure 4). The speakers are located in the main lobby so the visitors will have a chance to hear the glacier before they see it, or long after it has melted. The folding body of the building moves visitors spatially and temporally.

Recognition of geologic time in design may come from architectural materials and their usage over time. The student group MELT (G. Hevey, A. Kopetzky, C. Speck) designed a building that changes over time along with the glacier (Figure 5). The building proposal consists of three parts of different materials that are permanent/semi-permanent/least permanent. The building at the time of complete construction in 2018 will consist of cross-laminated timber, steel and concrete. Each of these parts has functional and experiential meaning as well as its own lifespan. By 2060 when the glacier has fully melted, the timber sections can be removed, and in 2100 only concrete blocks will remain. The remaining concrete block will shape viewpoints to mark the historic termini of the glacier.

CONCLUSION

Landform building sets out to examine the many manifestations of landscape and ecology in contemporary architectural practice: not as a cross-disciplinary phenomenon (architects working in the landscape) but as new design techniques, new formal strategies and technical problems within architecture. (Allen 2011)[18]

While traditional analysis of the territory in architecture is widely used in architectural practice, in this design research we present a non-traditional response to site history as a guide for designing for uncertain sites in uncertain weather for an uncertain atmosphere. The work depended on interdisciplinary knowledge and colleagues in glaciology, environmental science, and environmental history.

Students' proposals for new visitors center designs responded to analytical study and historical research of the Mendenhall Valley and has been effective in uncovering the nature of the site through the lenses of time in an era of rapid global climate change. In the design research, we found

Figure 2. Zanger, McCarthy, Olney

a hints of ways that history might frame the site and how it might engage issues of global climate change, geology and architectural form.

Buildings approaching the forms of mountains and caverns; structures that appear as rivers and clouds: the contemporary architects producing these conditions advance an agenda that we can provisionally term the "architectural reconstruction of nature". In addition to representing relationships to nature, the processes or shapes of nature, this architecture also appears to bring nature back into the view and experience of the city. (Gissen 2011)[19]

ENDNOTES

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Figure 3. Site development: ground+sky+water by Faul, Brown, Neal.

Figure 4. S. Lim, M. O'Brien, J. Frost.

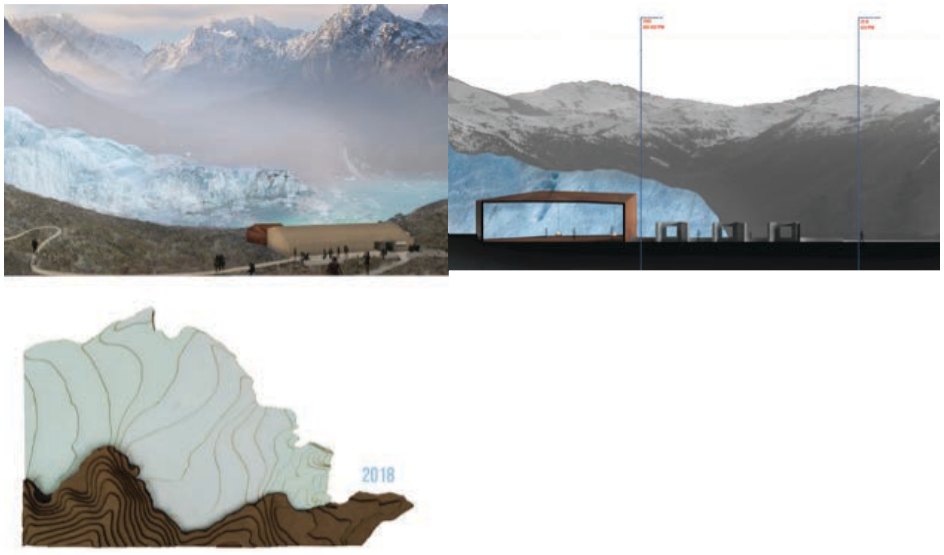

Figure 5. Hevey, Kopetzky, Speck.