NEOCLASTICS
DEFINING ARCHITECTURES OF FLUX

by

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A clast is the result of breakage. A geological term, it references a grain or fragment of sediment that has detached from a larger rock\textsuperscript{1}. Clastic rocks result from the fusion of individual clasts, the reformations of the physical weathering’s detritus. Although the word’s root – *klastos* – simply means “broken into pieces” in Greek\textsuperscript{2}, the English appropriation reveals a dichotomy, referring at once to deterioration and agglomeration, the breaking apart and coming together of geological matter. As a verb, “clasting” could mean one of two things. It could either be used to explain the process of falling apart, or the process of reconfiguring and amassing of fallen material. The word recalls not only the fragility of the natural environment, but also its resilience, its ability to piece itself back together and adapt to its new place in the world on its own terms and entirely without human intervention. It also inherently refers to the chance violence of events that impact the terrestrial environment and the immensity of the physical force required to fracture the understructure of our human habitat. This implies a counterforce of equal magnitude – here generative rather than destructive – for the production of new material.

The processes of clasting and likewise their scale are beyond human control. Nonetheless, humans seem compelled to insert themselves into the process by attempting to prevent this breakage and reconfiguration from happening. Urbanism tends toward some degree of permanence in the sense that it is designed to resist outside forces of decay and destruction. It originates in a conscious effort to build resistant structures. While most of the time these urban areas function smoothly (at

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\textsuperscript{1} Oxford English Dictionary, 2\textsuperscript{nd} ed., s.v. “clastic: Designating a rock consisting of fragments of pre-existing rocks. Clast – a constituent fragment of a clastic rock.”

\textsuperscript{2} Ibid.
least on a logistical, geographical scale), they are out of sync with clastic events that are by definition cyclical. If physical shifts take place on a scale beyond human control, these urban systems are permanently damaged and scarred. Unlike clasts, they do not rejoin if left undisturbed long enough. Ruins remain ruins until the next upheaval, and humans are forced to start again from scratch, each time hoping to have prepared sufficiently for the future, yet never knowing exactly what to expect.

This is in large part the result of faulty theories of architecture. The built environment, which resides for the most part atop the earth’s surface, functions properly only in stable conditions. Buildings are meant to stand still, protecting us from the elements and providing us with shelter. Architecture partially acknowledges the turbulent and unpredictable nature of outside world (why else would we need shelter at all?), but it also stands strongly in opposition to it. Humans are seldom ready for crisis. The way we have structured our built environment for centuries ignores the basic geological facts of constant, cyclical change. As a result, when “disaster” strikes, we are generally unprepared. If we are lucky, the architecture encasing our bodies and belongings makes it through in one piece. If we are unlucky, it breaks, or collapses, or crumbles, or detaches from its groundings, putting us at high risk of death and injury.

I put “disaster” in quotes because it implies a human-centric hostility towards environmental processes. The late architect and theorist Lebbeus Woods famously argued that these geological events are not inherently catastrophic. Rather “their bad reputation comes from the destruction to human settlements that accompanies them, when buildings collapse under the stress of [natural] forces…[and they are] blamed,
as though the purpose of these sublimely unself-conscious phenomena was to damage and destroy the human.” I have to agree with him. The rigid shells that we inhabit, no matter how modern the material, are descendants of the temporary structures of ancient semi-sedentary societies. They are meant to inhabit spaces temporarily, seasonally but not indeterminately. The species *homo sapiens* is an evolutionary success because we have always learned to adapt to change. The essence of our knack for survival is variation and the ability to communicate these differences in a productive way. Species that are overspecialized become extinct in reaction to sudden environmental change.

And sudden environmental change is clearly on the horizon. This is where my idea of *neoclastics* becomes relevant. It refers to a reconsideration of our human interaction and relationship with clastic events, a rethinking of the way built structures respond to and reflect the inherent qualities of the terrestrial environment. Designers, engineers, and thinkers are on the brink of transforming this theoretical concept into a physical reality. As a result of recent independent climatic events such as Hurricanes Katrina, Irene, and Sandy, various earthquakes, tsunamis, and other geologic processes, and also the palpable imminence of rising sea levels worldwide, there is clearly a heightened awareness in the architectural community of the inevitability of ruin to our current built environment.

The process of restructuring our thinking about architecture’s interaction with landscape reveals multiple limits to the way we represent nature, structures, and the two of them together. How can we understand them as inseparable when we have

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such different visual and linguistic vocabularies for each? With different ways of disseminating information about each to a universal audience? And different modes of representation? Is there a formula for conjoining these disciplines, for visualizing neoclastics? And if so, how can we go about determining it?

To begin to answer these questions, we must revert again to the definition of a clast and the symbolic implications beyond its literal physicality. A clast also implies a sort of boundary or edge – the line along which it separates from a larger rock. This boundary defines the clast’s existence as well as its potential to regroup and form a clastic mass. The clast itself lies in a sort of geological purgatory between two limits. On the one hand, it is indistinct from its mother rock, for its material is consistent with that of the rock from which it detached. On the other, it enters a phase in which it is ever so subtly distinct from the clastic rock it will become when it fuses with other clasts. Its individuality is transient. Just as the clast exists between such boundaries, so too does the effort to introduce it as a concept within the paradigm of architecture.

To that end, my thesis will be divided into two parts. Each part will identify opposing limits in the representation of projects situated within what I will call a neoclastic perspective. Each part will be divided into subsections that identify and exemplify the extremes of each opposing limit. The two parts will come together in an attempt to determine where this new perspective might be situated within the preconceived systems/disciplines of architecture, landscape design, urban planning, and engineering.
Part I will discuss the limits of representing architecture and landscape as separate entities that respond individually to the elasticity of nature. In other words, it will focus on projects that presuppose a chronic environmental or climatic situation that threatens the built environment. The aims of these projects are to determine ways of visualizing the changing nature with the hope of devising potential architectural interventions that adapt to these conditions. Mapmaking ultimately underlies this task, for we produce maps as a system for apprehending and communicating physical reality and the work that is done to that reality. A history of attempts to map previously unmappable phenomena (which for the most part deal with representations of conflicting temporalities, or more generally, the understanding of the changing of space over time) will thus provide a conceptual anchor to two contemporary projects, each one related to a particular landscape.

The first of these projects, *The Active Layer* (2010) by Lateral Office, is founded upon understanding and discovering the dynamics of an unstable, turbulent landscape through a series of two- and three-dimensional cartographic experiments. The focus of the project revolves around revealing possible disciplinary limits in the visual representation of a territory, which only then becomes a point of departure for potential architectural projects. In this case mapping becomes an architectural project in and of itself because it determines future constructive possibilities. The next subsection, which discusses a project entitled *Retreating Village* (2005) by Smout Allen, illustrates a subtle, yet profound, conceptual shift from representing landscape to thinking first and foremost about the architecture – the built environment as opposed to the natural. The conditions of an active landscape in this project are a
given. Rather than spend time mapping the landscape, the focus is on creating and representing an architecture that responds to and interacts with the landscape’s shifting conditions. The project becomes one in determining the limits of conventional architectural drawings, seeking new forms of representing a structure that is as changeable and mutable as the landscape on which it resides, yet still manages to fulfill its primary mission as shelter.

Part II will describe and analyze new ideas about visualizing architecture and landscape as a single entity, as inseparable components of a larger acute environmental condition (i.e. earthquake, flood, etc.). In the projects discussed in this section, architecture becomes the landscape and the landscape becomes the architecture. Both projects focus on the limits of realizable potentials, how to think or render more intelligible the marriage of humans (and their things) to nature (and its unpredictability). But their results are very different. The first example, a redesign of San Francisco by Lebbeus Woods entitled Terrain (1999), deals heavily with theory and prioritizes the need for innovative methods for architectural representation. It completely rejects conventional architectural drawing models, and substitutes a mode of visualization utterly abstracted from reality. Indeed it toys with crossing into the realm of science fiction. The second example, the Sand Motor (2011-present), is anchored firmly within practicality, asking questions such as: What is the limit of negotiation between social and political systems and experiments in engineering? And how large a gap can exist between the fields of engineering and design before they are no longer in conversation about the intersection of the built and un-built environments?
Complementary to the recurring theme of limits is the notion of “research practice” in the architectural community. The phrase “research practice” refers to projects that explore ideas outside a firm’s client-based projects, ideas that might further the knowledge of architecture or landscape design within the field, or experimentations in structures that inhabit a landscape. It is a methodology that enables the search for new systems for understanding (in this particular case) shifting environmental conditions and one that encourages projects that focus less on responding to an individual’s desires and more on responding to larger unspoken needs, cultural particularities for example. A research practice is an attempt to extend the limits of acceptable architectural practice into other industries. I choose the clast as a symbol for the nebulous territory between the physical sciences, the social sciences, and what can be considered the “creative” science of design that is generally left out of architectural inquiry. As these three worlds converge, we might begin to reveal a missing link, an alternative perspective, a neoclastic “new normal”.

A dispute arises in response to unpredicted, acute phenomena. While in this thesis I deal mostly with ideas devoted to altering the course of and discourse pertaining to disaster architecture, there is an entire scholarship dedicated to “resistant” design that attempts to modify/rethink the conventional, static structure while retaining its basic form. This approach works squarely within the limits of architecture as we understand it, maintaining the perception of natural disasters as events that should not be allowed to disrupt our built environment. It implies a high degree of human control over nature, an attempt at proving our invincibility. Resistant designs are for the most part responsive, meaning that they are devised as reactions to
previous disasters. At the worst they are after-the-fact solutions, at best novel attempts to anticipate future calamities of a familiar type. This suggests initial destruction before resolution. Consistent with my terminology, resistance understands the clast as something incredibly disruptive and uncomfortable, a state of being that must be resolved and avoided at all costs. It also inherently and purposefully aims to prevent clastic reformations. As discussed previously, when our current built environment undergoes destructive violence it becomes difficult to reuse or restore the damaged material. Unlike rock or sediment, steel reinforcements when broken evolve into rubble that must eventually be cleared away to make space for a replacement structure, also made out of steel that is perhaps engineered to be sturdier, better crafted, or less fragile.

As the *New York Times* article on March 31, 2014 entitled “For Californians, 2 Quakes Put Preparedness Back on the Map” suggests, resistance preparedness is not a constant effort. After a twenty-year dry spell, these recent 5.1 and 4.1 magnitude earthquakes (on 3/28/14 and 3/29/14 respectively) came as a shock to most Californians. Except, of course, to the geologists, who understand these earthquakes to be “the predictable end of a cycle: a return to what might be an uncomfortable normal in which 5-magnitude earthquakes become routine events.” The utter lack of concern for amending the architectural approach to dealing with such disasters is brought to light in this article. “About three months ago, an ambitious program to

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5 Southern California Earthquake Data Center, “Recent Earthquakes in California and Nevada.” http://www.data.scec.org/recent/recenteqs/Quakes/quakes0.html.
6 Nagourney, “For Californians, 2 Quakes Put Preparedness Back on the Map.”
rebuild large parts of Hollywood, including the construction of tall buildings, was suspended after state geologists found that a major fault runs through the heart of the redevelopment area." There is a drastic disconnect here between nature’s clasts and the methods of constructing our own shelters. Whether or not these new massive high rises were designed to be reinforced with the strongest possible material, and whether or not they would be equipped with tuned mass dampers that would absorb shock to reduce an earthquake’s vibration amplitudes, the integrity of the structures are nonetheless still at risk for there is always the possibility of collapse.

This is where the concept of resilience not only becomes relevant but also permits us to circle back to neoclastics. “Resilience” is a vague and broad term referring to any design that is remotely adaptable to its environment and/or its users. In dealing with architecture and landscape, however, it is a concept that in the past decade or so has been theorized and overused to death, used to describe everything from new high-tech infrastructure (New Orleans’ proposed $14.5 billion civil works project of a 133-mile chain of flood walls, levees, flood gates and pumps will be designed for, according to the Army Corps of Engineers, “far greater strength and resiliency than anything that went before it”8) to “greener” more sustainable proposals (Shigeru Ban’s Paper Tube School in Sichuan after a devastating earthquake was described as “temporary but resilient”9). While the term resilience might conjure appropriate images of enduring, strong, and lasting landscapes that are

7 Ibid.
designed to sustain powerful natural forces, it can be (and has been) so variably applied as to lose the specificity of meaning it ought to have in order to define the new architectural type stemming from its intersection with architecture, landscape design and engineering. In *Pamphlet Architecture*’s issue 32 entitled *Resilience* (2012), James A. Craig and Matt Ozga-Lawn of the London-based collaborative practice, Stasus, directly address their problem with the term as it relates to architecture on an urban scale,

A surface reading of the term ‘resilience’ suggests a certain kind of immunity to trauma, a shrugging-off of the chaos of events—a bouncing back. It is a term that largely escapes rigorous inquiry and is more often used as a label establishing the positive properties of something. On closer examination, the meaning of the word (and that which it is applied to) becomes less clear. Is a resilient individual one who adjusts quickly to new circumstances or one who suppresses all memory of trauma? Is a resilient material fundamentally altered during the event, but, like elastic, not after—and what of a resilient city?10

This problematic reading of the word is what led me to consider an alternative – neoclastic– that more specifically describes the conditions of the environment and the type of research architecture that attempts to function alongside/atop nature, rather than against it.

PART I
A HISTORY OF MAPPING THE UNMAPPABLE

As a prelude to the architectural case studies that follow, this chapter aims to relate a history of the representational practice of crossing dimensional boundaries – representing both linear and non-linear temporalities as they relate to geographic space together on the same page. From Medieval attempts to visualize a Biblical Paradise on earth, ever present yet always anchored in a mythical past, to an Early Modern rationalistic ordering of the map, which eliminates anomalies to idealize the world’s territories in static relationships to one another, to more recent attempts at creating a diagramming process that sacrifices neither space nor time by representing them on the same plane, cartographers, scientists, and artists have always struggled with visualizing the world and its surfaces in an objective manner. As it turns out, to define a universally objective method of mapping is almost impossible.

To map an object, a space, or an area means to visually represent what exists with a clarity that is self-explanatory. While referential images or a key of symbolic definitions are often included to aid in the legibility of the map (when its chosen scale renders some objects or events or too small or abbreviated to fully understand them without description), there is seldom any complementary document to explain exactly what is happening in the image. Unlike the information embedded in other forms of visual media, maps are not designed to be ‘unpacked’ or ‘interpreted’ by their users— we expect that what is there is meant to be taken at face value, and what is absent must surely be absent for a reason. However, political, social, cultural, and environmental ideologies are inevitably and inextricably interwoven in all types of
maps. Abstractions are unavoidable, as is a degree of imperfection on the part of the mapmaker.

Further complicating this process of mapping is an innate human desire to conceive of the world on a scale beyond the scope of the naked eye. In other words, forms of knowledge that require analysis beyond the observational are alluring in their unattainability and therefore drive much of scientific inquiry. To map the unmappable, then, is to attempt to achieve an objectivity that exceeds the known or the obvious through the lenses of space and time. Epistemologically speaking, it is necessary to determine what is scientifically objective. This is primarily an ideological question that demands distinctions between the role of the artist versus the role of the scientist, as well as the importance of images versus that of words. To understand the subtleties of these distinctions, it is necessary to understand the evolution of landscape representation as both an art form and a science. Lucia Nuti posits that “Vision...is part of a historical culture. It provides a pattern for the interpretation and organization of perceived environmental data. As a consequence, modes of representation are not simply sets of formal qualities, but expressions of diverse visual cultures.”¹¹ How might one dissect the ideologies and representations to uncover the epistemological contexts within which these maps were produced? Furthermore, how can the language of topographic and geographic symbols be understood cross-culturally?

The goal is not to compare the merits of landscape painting and mapmaking. Early maps, however, were both informational tools as well as art objects, and

therefore resided in a similar realm as their more painterly visual analogues. Whereas landscape paintings can be viewed as products of a narrative interpretation of a natural environment, steeped with references (to history, to religion, to human emotion), mapping is a form of diagramming—simplifying something that could have many representational possibilities. This is distinct from the idea of an objective depiction of nature. Instead, a map is a reasoned image introducing a set of symbols, almost analogous to code language, that describe more than can be taken in by human sight. At once visual and textual, the diagram takes more variables into account than exist in the natural world—it is an amalgam of multiple realities.

There is a clear distinction between a symbolic representation and a symbol itself. The sign is composed of the signifier (symbol) and the signified. The signifier is often random, which explains why the viewer needs prior knowledge to penetrate the sign. The viewer must also know the set or system to which the signifier belongs, i.e. alphabetical, numerical, pictorial symbols, etc. Symbolic representation, therefore, requires both prior knowledge from the viewer, and his or her ability to understand the image in two ways at once. First, it can be understood formally, taking the symbolic and analyzing it as concrete, describing what is obviously on the canvas.

Alternatively, it can be understood in terms of its allegorical value – a representation of a series of objects in a landscape that together make up an image that is greater than the sum of its parts. This use of symbolism in art requires multiple ways of seeing on the part of the viewer. The many dimensions of the painting exist differently in the artist’s head than they do in each of the viewers, resulting in a type of ambiguity that is intriguing for art historians. Such images can be contextually
dissected in order to attempt to determine what the artist could have meant. In this sense, the identity of the artist is forever present in the image.

Maps, however, use symbols as shorthand, a way to represent something that simply could not fit on the page, something of a different scale or different dimension. In this case, the apparent and symbolic understandings of the image are one in the same. They do the work of symbolic representations in painting but leave almost no room for interpretation—they explain themselves, they are explicitly unambiguous. Rather than relying on the viewer to manipulate and juggle the multidimensionality of the map in his or her head, the job of the mapmaker, and the role of the symbol, is to make apparent and clear these many dimensions, the coming together of different types of information onto a single page. This separates the map as a scientifically reasoned representational image from a landscape painting or an interpretative image.

Because mapping, in this sense, is treated as a science rather than solely an art, the goal of this chapter is to discuss selected literature on medieval, renaissance, and more contemporary maps from a scientific, epistemological perspective. The analysis of works by Alessandro Scafi and Lucia Nuti, who are primarily historians, will work to understand how cultural (including religious) ideology and specific historical contexts shaped the evolving understanding and search for objectivity in science through such visual media as maps. While much abstract scientific theory and philosophy was contained in the written word, the understanding of nature, the environment, and the geographical world in general can be most aptly described the way it can be most readily observed—visually. With visual representations, however,
the line between science and art becomes obscured. In mapmaking in particular, one cannot exist without the other.

In medieval maps, for example, there is an attempt to unite the earthly with the spiritual. There is a dichotomy between presumed historical reality and otherworldly fiction in the Biblical text that makes little sense spatially. The temporal removal from the human-life span makes a coherent chronology of people, time, and place nearly impossible to interpret in a linear way. The Garden of Eden provides a particularly interesting example because of its dichotomy of unattainability yet everlastingness, superimposed with the notion that it is strictly a location of the past—after the expulsion of Adam and Eve it remained a regretful memory for Christian believers. With the act of re-placing it on the map, reinstating its geographical dimension, Eden could be transformed into something tangible and hopeful once again. While paintings during this period and for much of the Renaissance and beyond attempted to portray the particular Edenic environment in such detail as to decide on specific plants and animals that could have inhabited the area, maps locating Eden served more concrete goals: to serve as a spiritual aid that would complement the text of the Bible as well as to create a ‘scientific’ basis upon which to make the existence of Eden undisputable. If it can be located geographically, or adjacent to a known geographical space, this mythical place would transition into the realm of an observed location.

Ideologically, this can be seen as proof of the power of religion—that it can literally alter the way we understand the world. What underscores this complex integration of the mythical with the geographical are the interrelated concepts of
space and time. In his article on mapping Eden, Scafi explains the apparent awareness to this dialectic of medieval mapmakers, who seemed “to have been deeply aware of the fact that if mapping is to express spatial relationships, geographical space cannot exist without time—a sophisticated recognition, and one that is perfectly consistent with the most recent discoveries of modern physics which confirm that space and time are intimately and inseparably connected in a four-dimensional continuum.”

Scafi acknowledges the general contemporary consensus that maps are static representations of a particular moment frozen in time, exemplified by the medieval mappamundi as encapsulating a “many-layered fathering of historical events” that “demonstrates a strong intuition for the ‘space-time’ character of reality.” This multidimensional worldview which takes duration in time into account, however, seems to be at odds with the standard two-dimensional technique of map-making. While it is nearly an unconscious process to flatten three dimensions into two, the idea of compressing time into a static painting seems irreconcilable.

This is where the ideological basis of such a process becomes important. As Scafi argues, mapping is more than simply the drawing of lines that delineate boundaries. The act of constructing a map “no less than writing a text, is essentially a social act, one which involves the thoughts and beliefs of both mapmaker and culture.” To situate the Garden of Eden on the world map, then, becomes a mode of translating text to image. It becomes a spiritual aid, according to Scafi offering “direct experience of a space and a condition which had always been described as

indescribable.”¹⁵ He goes on to explain the epistemic value in religious cultures of direct experience and vision that trumps a “syllogistic reasoning and common sense” that are generally esteemed in the world of the real. Because believing in what is beyond human perception is fundamental to Christian faith, to be able to create a visual model of what might seem counter to worldly logic and include it in a map of the world, would be to objectify what was previously subjective in the sense of being an article of faith. As Scafì states, “After all, depiction changes the phenomenon depicted. It can make real something previously unreal.”¹⁶

Beyond Scafì’s argument is this recurring notion of the search for an objective truth. By including Eden in the world of the known, the mapmaker was asserting the validity of its existence to the point of objectivity. Eden no longer stood for particular virtues or spiritual conditions (humanity’s fall from grace, etc.) or served as a descriptor or symbolic allegory. It was a diagrammatic symbol in and of itself. Its representation became self-referential, part of a larger geographical vocabulary.

In terms of locating Eden, the time differential exists between the human realm, or time as we know it, and the Biblical. Whereas mortal time can be paused and captured to illustrate a detectable moment that can be labeled by year, time in Eden has a dual nature—it is at once constantly present and yet preserved in the past. The space occupied by Eden does not evolve, is not affected by the external forces that mutate and transform the mortal world. Therefore, its geographical positioning must exist in a separate realm from the constantly shifting layer inhabited by humans.

Scafi discusses these realms in terms of macrospace and microspace, or in other words, the cosmological and the chorographical.¹⁷

There seem to be two main approaches for medieval mapmakers in terms of representing Eden. The first is a multilayered approach, consisting of a map of the terrestrial world as the base, with the vignette of Eden superimposed, acknowledging the separation between the macrospace and the microspace of the frame [Figure 1]. This method of representation distinguishes the temporal inconsistencies between the two spheres by creating a clear divide in the space and scale. In doing so, the map projects a reiteration of the very impossibility it is proposing. Rather than attempting to transcend the two-dimensional page, Eden and the earth coexist on the same page as separate compositions.

The second technique used to represent Eden is to incorporate it directly into the map of the world [Figure 2]. This requires choosing an existing geographical location and deciding if Eden were anywhere, it would be there. In this scenario, the mapmaker is essentially playing God by taking the liberty to combine the earthly and the spiritual worlds in such a way as to meld them into one. The temporal dimensions are no longer separated by anything other than a thin borderline that is no different than the one that might delineate a country. However, what is represented within those borders is not always congruous with the rest of the map. For instance, the scale or perspective might change and with that, the level of detail. This method creates an amalgam of the layered dimensions, fusing the macrospace and microspace into one.

The mapping of Eden on earth in medieval maps is not always represented as a utopia. In other words, it does not transform what is known to exist in an idyllic

sense. Rather, it inserts itself into what was thought and known at the time to be the pre-existing order—either directly into the landforms that make up the map of a region (generally somewhere in the Middle East) or as a separate entity, floating above the map of the world as if in a cloud, seemingly unrelated to the landforms below, illustrating a third dimension on the two dimensional plane. This speaks to the ideological value of Eden at the moment when these maps were produced. Eden was unattainable to humans. Its integration into the map was an act of verifying the universal presence of God, not marking it as a location for a pilgrimage or feasible destination. Even in the examples where Eden is inserted geographically into the map, it was usually located somewhere beyond the possibility of travel in medieval Western Europe. In this way Eden was purely a Biblical symbol, representing the text as an image. Because of its integration into the geography of the world, a map of Eden became a depiction of multiple temporal dimensions at once, illustrating both the mortal and the eternal.

The grid was a way to regulate these symbols, to make them understandable and recognizable in a standardized context. The epistemological belief that fostered such logic-based thinking was a result of Renaissance humanist ideology. No longer tolerant of the idea of divine intervention, humanism existed in the mortal world and set out to create an idealized version of the earth that, in a sense, would compete with Christianity’s understanding of God’s terrestrial creation. The map itself went from being a global image made up of symbols to a symbol as an entirety—what the map strived to do was to encapsulate an idealized depiction of the whole known world within a single set of rules. This type of representation required a manipulation of the
observable spatial dimensions into a self-created logic where information could be visible at once.

The Gallery of Maps [Figures 3 and 4], located in the Belvedere Courtyard in the Vatican and completed between the years of 1580 and 1583, is a prime example of how mapmakers were able to apply this method of multi-perspective representation in a uniform manner. Based on drawings by geographer Ignazio Danti, the painted maps of Italy that ran along the walls of the long, narrow hall applied techniques of both geography and chorography as defined by the ancient geographer Ptolemy. Fiorani adds that, “Renaissance scholars and map-makers commented on Ptolemy’s definitions of geography and chorography, acknowledging that chorography, as a mode of representation, could not be defined in absolute terms but only in relation to other representational modes.”\footnote{Francesca Fiorani, \textit{The Marvel of Maps: Art, Cartography and Politics in Renaissance Italy}, (New Haven: Yale University Press, 2005), 188.} This meant that chorography (a visual study of smaller details in a map, such as particular provinces or regions or cities as opposed to geography, a depiction of the world on a larger scale) depended on a pre-determined representational system that governed the map as a whole. Rather than defining individual locations as existing in other temporal dimensions as the medieval maps had done with Biblical imagery, the Renaissance mapmaker utilized chorography to enhance a connectedness between scale changes. Fiorani describes the process whereby Danti “had to gather the best cartographic sources, compare and make them uniform in terms of scale and accuracy, and divide them according to space available in the corridor.”\footnote{Fiorani, \textit{The Marvel of Maps: Art, Cartography and Politics in Renaissance Italy}, 192.} He thus proceeded in a way that is almost analogous to a mathematical formula. However, this process of creating a uniform
representation had to do with an understanding of the map, or in this case the gallery, as a whole. Fiorani continues,

Like other Renaissance maps, the Vatican maps combined different systems of representation. The whole map was represented in orthographic projection, but other elements were painted in linear perspective or in bird’s-eye view. At the edges of each map were painted perspective and plan views of cities, buildings, or fortresses. Historical vignettes, represented in perspectival views and at a scale larger than the map itself, were placed on the topography of the maps...By including the Ptolemaic grid, the scale in passi communi, and the astronomical location of the most important places, these chorographical maps aspired to the mathematical accuracy that was usually regarded as the domain of geographical maps.20

The mathematical accuracy that Fiorani is describing here is at once multi-perspectival and limited in its dimensionality. It describes a system that deals with the whole, rather than the individual components. While each vignette, each chorographical detail of an Italian city, and each slice of topographical detail can be observed separately and from a different perspective depending on its scale, the point of the Gallery of Maps is to create a dominating experience of the whole. In that sense, we are meant to view the map as a single understanding of Italy at a single point in time contained within two walls. The layout of the gallery alone speaks to the choreographed nature of the space: Italy is split between the two walls divided by the Appenine Mountains, which is where the viewer is positioned. As one walks from one end of the hall to the other, as if along the peak of the range, he or she is experiencing a geographical and cultural history of Italy. However, this is an understanding of Italy’s history separate from the one told in linear time. It is told as a story chorography and geography, moving spatially through one time scale to another.

20 Fiorani, The Marvel of Maps: Art, Cartography and Politics in Renaissance Italy, 194-5.
The sense of temporal and iconographic uniformity that reigns in the Gallery of Maps can be seen in smaller scale maps of the world, such as Visscher’s *Nova Totius Terrarium Orbis Geographica* (1652) [Figure 5]. In this world map the grid underlays both the geographical features and the vignettes that border it. Similarly, the viewers’ eyes are drawn immediately to the colorfully and boldly delineated borders of landforms demarcating the continents. Clearly there is an emphasis on the contour. Perspective also plays a role in this map, though again, on a much smaller scale. In each of the bottom corners we are guided to a rough approximation of how the world becomes spherical with views from the North and the South poles. Again, mathematical regularity trumps reality in both the spherical renderings and the flattened out world map. While attempted to encapsulate a general ideological representation of the world (as viewed by the West) at the time through the use of multiple perspectival and scalar views, the map becomes, like the Gallery of Maps, a uniform entity, a symbol, an icon of Renaissance Europe.

The idea of a map as an icon is strikingly clear with Jacopo de’ Barbari’s map of Venice (1500) [Figure 6]. On first glance, the city appears to be laid out with an extreme chorographical precision. However, upon closer observation, it becomes apparent that perspective used to draw each individual building changes as one moves across the city in order to highlight the culturally significant monuments (such as St. Peter’s) and to produce an all-encompassing view. Here, the use of many perspectives in one depiction represents the city from an impossible vantage point, one beyond the scope of human visibility. In this way the city becomes an icon, or a symbol, of itself.
It is idealized from the point of visibility and it is completely isolated from any other land.

With the rise of humanist virtue came new conceptions of what could be perceived as the truth. In her essay “Mapping Places: Chorography and Vision in the Renaissance,” Lucia Nuti explains the fundamental shift as one where “the superiority of geography over chorography, that is the superiority of intellectual and mathematical over pictorial and sensual knowledge, was commonly and consensually acknowledged.” 21 This directly counters the ideology behind the medieval mappamundi proposed by Scafi where the perceived truth or essential knowledge resided in the visual and the experiential rather than in ‘common sense’ (which translates to ‘scientific’ in humanist terms). In this way the imposition of a rationalized order, the grid, took the place of Eden on the map. Because of the altered belief system what became important and remained important throughout the Enlightenment would be the careful articulation of a mathematically and scientifically deduced projection of the world. The objective view in these terms would determine a new truth, and “the accepted superiority of mathematical representation lay in its being absolute, abstract, and total. Chorography could offer only subjective records of ephemeral reality.” 22

The sense of totality that these mapmakers strived for required a transformed relationship between time and space. In order to allow for geography to fit neatly into a grid, the dimension of time had to be eliminated. This static environment could then be represented according to humanist principles of mathematical abstraction that

reduced known, natural phenomena to ideal geometric quantities. Nuti explains this technique of representing landscape and geography as a comparison between two of the key figures responsible for this reformation of visual representation and the map in the Renaissance: Alberti and Ptolemy. She states “Leon Battista Alberti was possibly the first to reconsider urban representation within the terms of mathematical abstraction. The relationship established in his *De re aedificatoria* between the architect and the painter is similar to that expressed by Ptolemy between the geographer and the chorographer.” In other words, the architect’s, as well as the geographer’s goal, is to appeal to the human intellect rather than the senses by creating a representation that is in harmony with an ideal order. This mathematically derived practice is, in a way, an attempt to objectify (and in turn, idealize) the map of the world. In the process of creating a static image, the mapmaker takes the averages of landforms in a so-called rationalized way, resulting in a reasoned image that reflects a mathematic purity. No longer dealing with forms to appeal to the senses, the mapmaker becomes a scientist, deeply rooted in a revival of classical epistemological beliefs that are seen in other scientific illustrations of the natural world.

**Epistemological background**

This acquisition of knowledge through abstract reasoning finds its origins in classical texts. In Book 7 of the *Republic*, Plato introduces the concept of the ideal versus the real in comparing numbers (mathematics) and forms. The “Forms of the Good” or the ideal forms, are equivalent to the universal truths, they are what nature intends in its creations. Numbers themselves are ideal forms. They can only be dealt

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with and thought about in the abstract, they do not exist physically and can only be represented in reality, not seen or heard or felt. Numbers do not require any other sense—they rely purely on thought and thought alone. Similarly, the ideal Forms of the Good are conceptions, abstract entities that cannot be detected through any of the senses. The goal of the intellectual or the knowledgeable (in Plato’s case, the philosopher or the guardian, in this case, the mapmaker) is to eliminate observation and the information perceived through the senses, to separate it from what is known to be the truth in the abstract.\(^{24}\)

For the period from the Renaissance to the mid-eighteenth century, the role of the mapmaker as scientist becomes that of a translator who takes the purely conceptual ideal forms, the Forms of the Good, and recreates them in the perceptual world. Nuti acknowledges this trend, identifying that in the science of mapmaking, “‘To appear’ and ‘to be’ are regarded as different dimensions of reality.”\(^{25}\) He adds, “The mirage of a total vision stimulated artists to work out solutions where modes of representation were stretched to the ultimate of their expressive potential and the game of illusion transgressed the bounds of truthfulness.”\(^{26}\) Representation is no longer about the coherence of multiple dimensions on a single page. Rather, the map becomes flattened and the time conveyed is an idealized, regulated moment that exists neither in the past, the present, nor the future.

This reversion to classical philosophy positions science as a way to idealize and formalize the known – to see the real world as a system of irreducible parts, as mathematically driven. The map as an entity becomes a symbol of the role of science


and mathematics in society. The mapmaker replaces the divine creator. Defining an ideal perspective becomes crucial to the linkage between art and science. In both landscape painting and in maps there is a favored point of entry into the image that highlights the grid through linear perspective where symmetry dominates the composition.

These geographical representations, however, are devoid of the dimension of time. Such mathematical ordering and a consciousness of the composition as a whole create a sense of stillness reflective of its uniformity. In this way, Renaissance maps suggest a certain permanence and immutability of the world, they decelerate or disable time. From the perspective of scientific objectivity, this is representative of a sort of empirical method of observation in which the mapmaker would absorb the natural world through the senses – through his experience – and record with a mathematical exactitude onto the paper what they were observing. However, these records were not without idealizations. Ideologically speaking, there was an emphasis on “truth-to-nature” representations implying a rationality and purity in composition and form that demonstrate an intention towards idealization.

In their book Objectivity, Daston and Galison call this virtue “trained judgment” in the absence of which objective images would only exist theoretically, lacking of substance or definition that would make them applicable comparisons to reality. “Trained judgment” evolved from a period where machines were believed to relay the most objective, and therefore, relevant information to scientists (through processes like photography). An epistemological shift occurred wherein scientists who once sought to produce strictly objective images that represented the particular—

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meaning the form in its unabridged, unedited state—now understood that without contextualization of the form, without being able to interpret the individual, the amassing of purely objective information would lead to no larger conclusion about the individual and its related forms.

The mapmaker could no longer be entrusted with the power to create a rational order. What had become precise was not the individual ability of the mapmaker but the scientific method of falsifying something that did not work, something that did not conform to reality. Rather than acting as an artist-scientist as he/she did in the past, applying the scientific method (Cartesianism), the mapmaker would become the interpreter of it, trying to put a structure on empirical reality, and using the method to fill in the blanks where previously there was no empirical data (i.e. unexplored places). What had become unmappable through the static, mathematically oriented tradition was geographical time. As Nuti states, “The relationship between the abstract and the concrete, the mathematical and the visual, the exact and the lifelike, established by the Ptolemaic distinction which lay at the basis of Renaissance geographical culture, is still both present and problematic.” 28 In other words, even after centuries of advancement in methods of scientific inquiry, the same problems of the representation of geography still exist.

This problem can be analyzed once again in terms of symbols. Idealized symbols in a map represent an idealized reality devoid of the dimension of time. Everything is static so as to adhere to the rules determined by abstracted mathematical forms. However, nature doesn’t always follow the purest of scientific reasoning. Viewing geography, or the composition of a map, as something complete,

perfect, and uniform becomes problematic in terms of the way scale and speed act upon our perceptions of the environment. In the 1970s Swedish geographer Torsten Hägerstrand identified the shortcomings of the map’s ability to represent space ‘as time goes by’. “The great adventure of my scholarly life,” he wrote, “has been to transcend the map. I see, almost literally, the opulence of the world as a moiré of processes in conversation.”29 These diagrams [Figure 7] are simplified examples of how space and time could interact on a single plane. The goal here is to identify a slice of time and space that can represent the whole without attempting to be the whole, a visual synecdoche, a way of describing that will point to the multidimensionality (meaning the inclusion of time in addition to three-dimensional space) of the earth’s environments. This problem can also easily be seen in the creation of coastlines. The coast itself, says Carter in his essay on coastal mapping, “had to be linearized, reconceptualized as a coastline” in order to fit logically into the grid.30 He goes on to say that these “linearizations of phenomena…are uniform, dimensionless, and self-repeating. They refer to a time that displays no temporal variation, to a space that, like the grid of a map projection, pretends to have no effect on the objects it contains.”31

Without the sort of selective organizing or categorizing necessarily done by humans, mechanical data would only exist in and of itself, with no goal other than to identify itself as existing in the world. Under the virtue of “trained judgment,” the scientific world functioned in a very different way than it had in years passed.

Scientists were now not only workers controlling the machines, but they were also trained experts in distinct fields. This type of focus on particular subjects, specific, narrow branches of the major fields of study, served as a way for scientists to channel more creative, subjective intuitions about natural objects in a way that didn’t jeopardize the objective information they were dealing with. In other words, scientists, rather than removing themselves from image-making processes, were involved in an interpretation that lent these images meaning outside of themselves.

Daston and Galison’s discussion of the ‘scientific self’ helps one to understand human’s evolving beliefs in terms of the attempt to mechanize the process of collecting objective data. With an understanding of the perceived degree of objectification possible by a human brain, one can begin to identify the precise points of divergence between trained human judgment and programmed computer analysis. Although the construction of programs involves trained judgment in the production of analytical categories introduced by human programmers, once data is fed into the program it is completely out of human hands. The data undergoes an analysis that is constant and unchanged over time. The output information, then, can be viewed as the product of a human-made organizational system, rather than the product of human organization.

**Time-geography**

With a focus on the physical world and its interaction with human actors and their varying behaviors and predictive capabilities, Hägerstrand’s time-geography provides an alternative, interdisciplinary approach to understanding how humans
interact with and live in a constantly shifting environment. In attempting to visualize an unstable environment, it seems to take a dynamic approach to representing the geological processes and how they have shaped landscape and society over time. To quote Lawton, “Hence two modes of explanation are employed in geography: a functional or ecological mode which examines the spatial linkages between phenomena and their interaction within particular environments; secondly, a genetic or historical mode of explanation of the origins and processes of development of geographical features, landscapes and areas.”

The premise of time-geography is to develop a method of representational mapmaking that enables visualization of data in its original spatio-temporal context. That is to say, the goal is to create a system through which geographical information can be analyzed and clearly presented without sacrificing crucial information such as how the data changes or might change over time. To describe Hägerstrand’s socio-geographic theory, Lenntorp uses the analogy of the theater with actors, their roles (activities, behaviors) and the scene. The human actors who are observable in the physical world play ‘roles’ that can be represented in time-geographic notation. The scene is the backdrop, the natural world that these human actors inhabit. The goal of time-geography is to integrate these three spheres, or conversely, to separate them as little as possible, in the processes of analysis and mapping. It was Hägerstrand in the mid 1960s who developed a system of notation for such a multidimensional mapping as a representational model for his theory, a notation which meant to provide a deeper understanding of human action in relation to spatial structures, or our environment.

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Martin Gren, a time-geographer and scholar of Hägerstrand’s theories explained that an ordinary map represents “aspects of the world as one moment frozen in time, as a static snapshot.”

It is important to make the distinction between the type of visualization that Hägerstrand strives for and the contemporary digital animations that seem to appear on the news and on online publications. While there are many cases where digital renderings are extremely useful, such as in predicting the path of an incoming storm or illustrating a distinct shift that happened over a specific period of time (as in a before-and-after shot with an animated in-between time-lapse sequence), the idea behind time-geography is one that is more widely applicable, a universal system of the representation of space over time, a methodology in and of itself, rather than a hyper-specific, situational moving-image model. Although digitally animated maps operate in time-dependent scenarios, there is a significant agency allotted to the cartographer to decide on scale, speed, and other information to simplify and edit down the message being transmitted. These maps are mainly used to transmit at most a few pieces of data that are often exaggerated in color, size, shape, etc., in order to make the data more clear. By contrast time-geography attempts to describe a complete environment as it changes over time, with the creative focus invested in the development of a system of organizing the spatial data on a two-dimensional plane so that the time variable is apparent. This eliminates the risk of misrepresentation for the sake of simplicity and appeal to a mass audience while still allowing to spatially represent temporal data that might otherwise remain non-visual.

Hägerstrand’s own ideal model, however, has many unresolved aspects. The first problem is the difficulty in representing many different objects on the same time-space grid. For example, if we were to take a square kilometer of land, the objects ranging from humans to smaller individual ecosystems and larger inanimate landforms each have different temporalities (in other words, they change at different rates). Furthermore, these changes and transformations are not always of the same type; if many corporeal phenomena undergo qualitative changes, some do not. As Gren observes, objects “may not merely remain the same in pace, or move in time over static space…the conception of both space and time used in space-time diagrams do not adequately represent the variety of different physical ontologies that exist in the corporeal world.” However, like the design projects discussed in this paper, what is important here is not the feasibility of the resulting creation (in Hägerstrand’s case, the time-space diagram), but that fact that it adopts a novel way of thinking about the relationship between humans, the surrounding environment, and how they change in relation to each other over time.

Though Hägerstrand never directly talks about architecture or the built environment, his theory implies the built environment as a subset of geography/landscape represented on a time-space grid. As a creation of humans that alters the geography of a place, both visually and in its use, architecture not only impacts the change of an environment but also reflects it. “Action in the landscape whatever the meaning is, is also matter acting on matter. Seen in this perspective actions become space-time trajectories of matter.”

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understood in terms of natural and man-made matter, as well as humans themselves. Therefore, the emphasis and importance is on the material world, the physical matter that is doing the action. In an architectural context, there is a shift from an emphasis on a historical or traditional approach to design and one that gives agency to the environment and the materials on which (and with which) a structure is to be built. The importance of natural phenomena such as the consistently augmenting landscapes of the arctic, earthquakes, and erosion by water is “not only their physical ontological status, their position or movement in timespace, but what they do.” Human impact atop these natural phenomena (such as architecture), Hägerstrand might argue, must take into account these actions above all else.

What Hägerstrand struggled with in his time-space diagrams was the representational shift between three and two dimensions. At first the diagrams were planar two-dimensional representations that resembled graphic charts more than maps. [Figure 8] In an example of a map from his essay “Survival and Arena”, he depicts a particular farm in space and time, using vertical lines to represent occupiers of the space and horizontal lines representing newcomers and goers of the farm. This map seems to have no axis or frame of reference by which it can be read, but rather remains a system of lines that perhaps only Hägerstrand and his contemporaries could fully understand. Another map of the same farm seems more familiar, including an x and y-axis (the x-axis denoting the population associated with the farm, including A-owners, B-tenants, C-lodgers, and D-farmhands and maids, and the y-axis denoting time in years) [Figure 9]. The first apparent flaw is that fact that these maps would quickly get very complex if they were to represent any larger portion of time (for

example hundreds or thousands of years rather than decades). They already require very specific insider knowledge to firmly grasp meaning and significance because there are no obvious patterns derived from such geographical analysis. Secondly, and arguably more importantly, is the fact that in both graphical setups, consideration of the agency of the land itself, the geography, the matter that is existing over time, is severely lacking. The landscape (the farm in this case) is still secondary to the action existing on it, and its own activity is relatively nonexistent. The bi-directionality of the action between land and human is sacrificed for a two-dimensional diagram that is supposedly more coherent.

In an attempt to adhere more strictly to his own theories, Hägerstrand brought his diagrams into a partial three-dimensionality. [Figure 10] Such diagrams are representative of an “aquarium type” visualization that engages three-dimensions while remaining in only two, made up of lines on a plane. It was still flawed. While the relationship between the diagram and the land to which it referred was clearer, the translation remained largely abstract and theoretical. It was as if the diagram was not representing the phenomena occurring on the land, but rather was a drawing of a model that was representing the land (except the model was missing/nonexistent). And similarly to the planar diagrams, while the aquarium was able to represent the movement of objects on the land parcel over time, it nonetheless lacked a representation of the movement of the earth on the site itself. The same interdependent action inherent in Hägerstrand’s quest was missing. Any further attempt to add it into the existing framework would have made the diagram illegibly complex. However, the shift from planar to cubic was significant. It created the
possibility for a diagram of this sort to resist the limitations of the page and to transition into something completely three-dimensional, the possibility for an actual model of the coexisting forces happening on the land.

Hägerstrand’s diagramming theories were highly criticized in the 1970s for the several years after they were published. There was too much stress placed on the setting/the physical world and the objectification of the human actor, rather than understanding the human role as one of thinking and experiencing with the ability to predict and expect. “Looking back, I would agree with some of the criticism,” says Bo Lenntorp, his colleague. “In our studies, we had overly emphasized things that were feasible to depict graphically…But it is important to note that we (and Hägerstrand) had tried to establish a world-view, an approach where time and space would not be looked upon as a composition of the two dimensional but as a frame for analysis.”38 As we shall see in the following case studies, this search for a mode of representation that might promote geographical analysis, rather than simply observation, is still a struggle for not only geographers, but also artists and architects. Breaking out of conventional models in cases such as these becomes increasingly difficult as these conventions continue to be utilized and reified.

The search for a visual language that could communicate the constant change of the tactile, morphological geographic features in a way as tangible as reality is still underway. Time-space diagrams privileged vision, only one sense necessary in detecting change in a seemingly stable surface—they lack literal tangibility and an alteration of the way a body understands its surroundings (the sense of proprioception). The eventual goal for geographers, architects, and analysts alike is

for space and time to exist in the same system in such a way that geography could
describe more completely the dynamic processes of environmental change. As a
system that relied only on the visual and an extremely informed base knowledge of
Hägerstrand’s theory, time-space diagrams were not successful in publicly
communicating and describing this phenomenon. One of the problems with this
attempt to develop the diagram as a solely visual language is the “language-reality”
distinction in representation that Gren discusses briefly. In short, language is
supposed to stand in for representation and vice versa. Therefore, it makes sense that
a first attempt at representing time and space in the same system would be one that is
analogous to being read: on a two dimensional surface made up of black lines on a
white plane. However, the multidimensionality required for a spatial representation of
the interactions between human and land invariably transcends the plane. Implicit in
the bi-directionality of these interactions is the concept of changes in the land having
an effect on human activity. In this case, the experiential is equally as important as
the objective, statistical information.

Lawton offers an example of this complexity and variation in the spatio-
temporal study of place based on particular shifts in the environment. He states,

The impact of post-glacial fluctuations in climate are reflected both in changes
in vegetation and in the response of man whose changing evaluations are in
turn an agent of environmental change which may now be traced by a growing
battery of analytical techniques in stratigraphy, pollen analysis, geomagnetic
changes, archaeological reconstructions and a rich variety of historical data
and approaches to their analysis (Baker and Billinge, 1982).

What is important to note in this example is that changes in landscape
independent of human intervention are treated separately from the human responses

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that result in additional variables of fluctuation in the environment. Maps are generally produced to visualize and spatialize these solely environmental changes. Yet the other data relating to human impact on and reaction to these changes remains non-visual for the most part. It is not integrated into these maps in order to safeguard against the problem of over-complication. Thus, as Lawton continues, the emphasis on explaining the “evolution of landforms through geologic time” is necessarily shifted to explaining “the functioning of geomorphic systems in short spaces of time”\textsuperscript{41}. In the transition from an analytical perspective of a scale too large to account for humans and one that is human scale, the prospect of creating a universally legible visual framework becomes more reasonable.

An idea of the cartographic synecdoche becomes important in discussing the following case study where maps are used to depict a territory far larger the scale of the individual. The changes that occur, however, occur on both a geologic time-scale and a human time-scale. In this case, smaller sections of the maps are used to stand in for the whole as allusions to the types of changes happening on both the large scale and the small scale.

\textsuperscript{41} Lawton, “Space, Place and Time,” 202 ; Schumm, 1979.
LATERAL OFFICE: THE ACTIVE LAYER

In 2010, the Toronto-based architecture research and design firm Lateral Office began work on a project that would greatly influence their future body of work. The self-titled “experimental design practice” founded in 2003 by Lola Sheppard and Mason White, is concerned with challenging the preconceived norms of architectural processes, particularly focusing on the interaction between space and place, built and natural environments. For them, design is a vehicle for engaging in social, ecological, and political systems as a way to affect change through the production of new typologies “made possible by an architecture that brazenly confronts today.” Both Sheppard and White have extensive teaching experience, enabling their mentality towards research and the process of discovering architecture’s new relationships to possibilities outside of the discipline. My focus in this chapter will be one of their projects that greatly shifted the historical narrative of mapmaking in its attempt to visualize and represent traditionally non-visual and non-spatial data.

The project, The Active Layer, was named for the thin, top layer of permafrost that cyclically thaws during the summer and refreezes in autumn, below which the soil remains frozen year-round. The areas of focus were the permafrost zones in the Nunavut and Northwest Territories of Canada, prime examples of thermokarst landscapes with active layers that when thawed, transformed the entire topography of

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43 Ibid.
44 Ibid.
the landscapes. In a phone interview with Sheppard, she described her firm’s growing interest in how architecture might interface with local ecologies and also amplify already disturbed ecologies by taking into account the dichotomy between the man-made and the natural. Simultaneously, the firm was interested in how architecture can begin to engage with unconventional scales, an entire territory for example, fundamentally structured by small, highly dispersed communities throughout a given, demarcated area. How does one capture the dynamic processes of such a landscape and how do these representations affect architecture reflective of this condition? What is the necessary visual language that might simply and clearly translate this information to audiences unfamiliar with the particulars of such a landscape?

*The Active Layer* was the first of many responses to these questions and became a precursor for a set of speculative projects dealing with the dispersed network of settlements in the northern arctic territories. In a lecture in November 2012 at the Taubman School of Architecture at the University of Michigan, Sheppard described the project as one that is ongoing and perhaps impossible to finish due to a complex set of issues in this two-million-square-kilometer circumpolar region. The impetus for her office’s research was, 1) their interest in the rapidly growing, young population in the far north and the lack of a regional vernacular; 2) the total lack of physical connectivity between communities; and 3) the economic, social, and ecological potential of a landscape, often mythologized as a unique geographical territory, yet sparsely populated, “fragile and sublime … one of the most dramatically changing climates on earth” with an “estimated quarter of the planet’s energy
resources.” The population, she explained, is growing because of these potential energy resources. Yet no one has begun to think about how settlement or urbanism will progress in such a politically contested territory. The firm summarizes the history of the Canadian subarctic region as having a history of “colonial enterprises, political maneuverings, and non-integrated development proposals that perpetuated sovereign control and economic development. Northern developments are intimately tied to the construction of infrastructure, though these projects are rarely conceived with a long-term, holistic vision.” The territory is not only part of a rapidly changing physical environment and a speculative boon in resource extraction, but it is also the home of an emerging First Nations indigenous culture, Nunavut. Because of its situation in a circumpolar region, a cultural or linguist mapmaker might represent the region in terms of the shared languages, cultures, political, and economic interests across many national boundaries (Siberia, Lapland, Greenland, Alaska, etc.), whereas a geologist might see it in terms of subterranean composition and an oil company in terms of its resources.

Historically speaking, subarctic urban development has relied exclusively upon the importation of southern models. And it still does, even though the thermokarst landscape covering most of the territory renders these models highly

46 About 13% of the world’s undiscovered conventional oil resources and 30% of the world’s undiscovered conventional natural gas resources, are said to exist in the Arctic, according an assessment conducted by the United States Geological Survey in 2008. (http://www.eia.gov/todayinenergy/detail.cfm?id=4650); “Northern Canadian settlements have traditionally expanded under the pressure of previous diamond and gold rushes, and along with the emerging oil and gas rushes, the federal government anticipates the creation of deep-sea ports and military bases. However, with this urgency to expand, there is little vision of development beyond economic expediency and efficiency.” http://lateraloffice.com/NEXT-NORTH-2011; Sheppard, Lola. “Post Natures.” Lecture, Fall 2012 Lecture Series (Aesthetic) from University of Michigan: Taubman College of Architecture and Urban Planning, November 12, 2012.

inefficient in the Arctic. Infrastructure as familiar to us as roadways and highways, healthcare, and education (just to name a few) does not function productively in such a topographically dynamic and culturally dispersed landscape. One of the goals of the project, then, is to ask how one might develop a kind of “hyper vernacular and very specific context” for urbanism and infrastructure. Similarly, how might infrastructural and architectural designs help to cultivate and perpetuate these local ecosystems and cultures?

The project began with a series of GIS-made maps [Figure 11] that illustrate the change from solid to liquid over the course of months. From the time the winter permafrost begins to melt, the ground cracks and reveals miniature pools of water that by mid-summer become micro-lakes thereby pock-marking the terrain and completely altering its external presentation with the added possibility of ongoing dramatic upheavals. Areas that were accessible by solid “land” are now isolated within these lakes, necessarily altering travel routes.

The first map of the series serves as a site reference, clearly denoting the portions of land to be analyzed on a large-scale, gray, outlined projection of the Arctic at a single moment in time. Without naming each territory and without reference to the exact scaling of the enlarged areas, the map is clearly more about the visuals than about transmitting information. Or rather, the information that the firm believed to be relevant could be (or should be) extrapolated from the visuals alone, from comparison of the uniform rectangular topographic slices of land, laid out in a row above and to the right of the reference map. What is apparent in each of these

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48 Ibid.
49 Ibid.
rectangular land samples is a variation in texture or morphology of each location. This suggests that these particular topographic enlargements are representations of these land samples in the summer months, due to the porosity of the land. Because each sample remains unnamed, these images seem to stand in for the whole—representative of general variation in the territory by contrasting the specificity of each area. This idea of synecdoche is one that we shall see continuously in this project and is a concept that cartographers have applied for hundreds of years.

The legibility of the first map is obscured for the sake of graphic consistency in the second series of maps [Figure 12]. While it is clear that we have now zeroed in on one particular area of land at approximately the same scale as the first map, it’s unclear which piece of land has been selected. Perhaps, in keeping with the theme of synecdoche, this new aerial illustration [“6. Aerial” subfigure in figure 12] does not belong to one of the previous land samples at all, but is a combination, a melded approximation of all the first map’s samples. To its immediate left is a purely topographic map of the area with the level gradations outlined solely in contours rather than in incremental shades of green and brown. The first four versions of this plot of land are interpretations of the surface in the months from September to December over the course of which period the average daily temperature drops 31°C as labeled. Without background knowledge or understanding of the project, these rasterized blue and white monthly maps are progressive abstractions of the original aerial image. They are also attempts at visualizations of non-spatial freeze/thaw data, representative of another theme pervasive in Lateral Office’s work as well as in my own research.
Although the *month* and *degree* labels make clear that a shift is occurring over this period of time, it is nevertheless very difficult to pinpoint what is actually going on between each map in the absence of external information. Clearly, Lateral Office was aware of this illegibility or the project would have stopped here. To this point they have effectively created maps representing the alteration of the landscape of a permafrost territory over the course of four months – from a completely thawed state in September to nearly completely frozen in December. In fact most cartographers would have stopped at this step. How much more detailed can a map get? How can one represent change in two dimensions before entering into the realm of digitized animations? Had Lateral Office wanted this project to be solely a cartographic one, their mission would have been complete. Yet from an architectural perspective, they recognized that these maps are failures at communicating to a universal audience not only the temporal alteration of the landscape but also how this change affects people – how it affects the territory as both geographical social entities.

The narrative of *The Active Layer* shifts from two dimensions to three in the next series of map diagrams. [Figure 13] In these twelve images, tens of thousands of topographic points and bathymetric depths from the freeze/thaw data maps are converted into dowel heights depending on the depth distance from the sea level of the frozen/thawed masses. While it is clear that some type of conversion is happening in these diagrams (informed for the most part by the gridded background), the graphics themselves appear to be sections of the previous series of maps completely abstracted. Colors seem to refer to particular heights, but the images become clear only upon seeing the project in its final three-dimensional, immersive form [Figures
14 and 15]. A total of about twenty-five thousand dowels demarcate points on a white base translated and rescaled directly from the previous maps, essentially replicating a piece of the Arctic landscape at once physically through the project’s interactivity and symbolically by using selective information to stand in for the whole of the terrain. Throughout the wooden replica of the deep piles of earth are other materials that represent the various surface qualities of the terrain – foam for snow, plexiglass for ice, and blue sticks to represent the thermokarst meltwater pools that shift between water and ice.

The project attempts to discover the line between a theoretical design and a realizable one, fully imbedded in the realities of the landscape and ecologies while being aware of logistics, without stepping into the bounds of science fiction. Lateral Office is interested in how architecture can engage with the landscape at the scale of a territory as opposed to dealing with the relationship between the built and natural environments on a human scale. The installation reflects these conditions in an immersive way that could not possibly be understood in a two-dimensional map of the region. The scale of the project becomes important in the representation of the Canadian landscape because its overpowering nature is something that cannot be quantified or fully measured but must be experienced.

The project attempts to depict information that rarely gets rendered spatially as a way to better understand and translate the relationship between human structures and the landscape. It is a map that works as a structuring device where the dimension of time becomes undeniably important. This requires a multidimensionality of “man/land interactions.” Resilience, in this case, has to do with architects
understanding the functioning of a territory. The land itself is mutable, it reacts physically to the climate, and only by creating a structural model that clearly shows its seasonal changes can we begin to understand how one might inhabit such an environment.

**Background, influence, and ideology**

In the same lecture at Taubman College of Architecture, Sheppard explained her understanding of the contemporary architect, not as an artist or scientist but as a detective who speculates and formulates theories, reworking them through various tests as a tool for arriving at possible truths. This approach challenges notions of problem solving that are often associated with the work of architects. Rather than redressing undesirable situations, the unstable Arctic landscape for instance, the work of the architect becomes one of tactically uncovering and understanding a network of realities, working within the present given system rather than understanding it as a deviation from some predetermined norm. This is reminiscent of the pioneering ideas of the early twentieth-century conservationist and planner Benton MacKaye, whose ideas stood in contrast to his near-contemporary Robert Moses. MacKaye believed in creating a balance between humanity’s needs and nature’s needs when intervening in a landscape, embodying a “hopeful planning alternative [to Moses’ notoriously monumentalist planning attitude]: he strove to reconcile somehow the grassroots endeavors of citizens, the integrity of small communities and natural landscapes, and the technical resources and legal authority of a benign federal

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51 Ibid.
government.”52 “Geotechnics”, a term coined by MacKaye referring to the science of making the earth more habitable53, can be applied directly to the general aims of Lateral Office’s research.

Sheppard made clear in a phone conversation that Lateral Office is a firm deeply contextualized by ecological and anthropological research as opposed to the self-referential dialogue among architects and theorists.54 She sees their written and visual work as more predictive than retrospective, like an almanac for imagining future issues relevant to the architectural community but not necessarily originating from previous architectural problems. The Active Layer as an attempt to produce a new visual translation of this subarctic territory is one of such projects. With the help of Archeworks, a 501(c)3 non-profit organization focused on promoting socially conscious and ecological designs funded by foundation and corporation grants, tuition fees, and individual donations55, the design team was able to conduct this research for the sake of interdisciplinary research – to allow architecture and design to enter into a dialogue with social and ecological activism.

For example, Lateral Office’s perspective on what they call “Post-Natures” functions within a realm of disability studies and animal studies to situate their role as architects within a larger context. To revert back to the discussion of Eden for a moment, we can understand the entire concept of nature wrapped up in a mythical realm, untouched and uninfluenced by humanity. By identifying and charting these spaces or places, the mapmaker is in a way apprehending them as a prelude to

53 Ibid, 1.
54 Lola Sheppard, Personal Phone Interview. February 14, 2014.
working on them. Pierre Bourdieu and David Harvey, for example, would say that as soon as the mapmaker lays his compass and draws lines to demarcate a territory, he is committing an act of symbolic violence on that “nature”.\footnote{Pierre Bourdieu, \textit{Pascalian Meditations}, (Palo Alto: Stanford University Press, 2000), 186; David Harvey, \textit{The Condition of Postmodernity}, (Oxford: Basil Blackwell, 1989), 234-7.} In this case, mapping is an officially recognized power to construct or rationalize space (i.e. the state makes maps according to zip codes and thereby constructs a bounded space that confines its residents to a mapped order).\footnote{Ibid.} These spaces that are created as a result of the mapmaker are what we can define as “Post-Natures”.

The roles of species and their surrounding ecologies challenge an anthropocentric view of the built environment that is too often taken for granted in the world of architecture. How can an environment such as that of the Canadian North be structured in such a way so that it is attuned to not only the needs of humans but also to the various migratory species who pass through this expansive terrain, and the ecosystems that nourish them? Sheppard mentioned Donna Haraway and her discussions on the cyborg as existing in a mutant state between the previously conceived boundaries between nature and culture, human and animal, organic and inorganic, and the human and technological in order to more deeply understand the effects and results of continual change in landscape. For Sheppard, the cyborg as the human undergoing constant and continual transmutations, a constant work in progress, serves as an analogy for a Post-Nature in which environments are constantly “being re-scripted, re-imagined, and the idea that these mutant landscapes are not something to regret but offer opportunities for asking what is the role of architecture and
infrastructure in this environment?” 58 She articulates the difference between architecture that uses nature metaphorically (architecture that formally or functionally references nature but is distinctly separate from it) and architecture that views environments as place inhabited both by humans and other species and attempts to either adapt to it or function within it – a post-human nature, or simply diverse natures. In this sense, in projects like The Active Layer and those that stemmed from it, Lateral Office seeks to question the role of architecture on a territorial scale. Can design work at a scale beyond the human community to encompass a host of other variables (ecology, species, migration, climate, etc.) in order to enhance to productivity and usability of their environments? Can it do so through “insertions or tweaks rather than massive recalibrations of systems,” the way that most infrastructures are approached? Their work is not wholly descriptive; as I shall explained below, a series of projects, Next North derives from this interactive mapping.

According to Sheppard “all the elements over which the designer has no control… affect a system or its inputs and outputs.” And she maintains that architecture itself, either purposefully or unintentionally, helps in the production of these mutant environments on a scale that is greater than the building itself. The environment becomes an active design agent in and for itself, instrumental and performative rather than a mere platform for its users to create experience. She differentiates the idea of “surroundings” versus that of “environment,” explaining that the surroundings of a built structure are non-discriminatory objects, conditions, or beings that exist around the architecture, whereas environments are only those things

58 Lola Sheppard, Personal Phone Interview. February 14, 2014.
that are useful or important in relation to the architecture, conditions that are attuned to the needs of the users of the interior and exterior spaces defined by the architecture. It is possible, then, for architecture to begin to be more aware of these environments and aid in their production and/or mutation.\textsuperscript{59}

There is clearly a discrepancy between the actual and perceived effects of architecture on its surrounding environment. When talking about the transition of Lateral Office’s focus from site to territory, Sheppard discusses the recent trend in architectural discourse and practice that seeks to align architecture with urbanism, infrastructure, and ecological studies in an attempt to broaden the terms of each of the fields for a more interdisciplinary approach.\textsuperscript{60} Yet the scales of each of these disciplines are drastically different. If architecture is generally conceived as structure and its immediate site, then urbanism covers a slightly or much larger area, and infrastructure and ecology an even larger one. Were these disciplines truly to engage with one another, Sheppard argues, they would all need to function at a scale that acknowledges a common denominator. This means, they would all function at the scale of a territory. Once architects are dealing with such a large and unfamiliar scale, however, the information and data bigger than a two-acre plot become impossible to ignore. Transportation, for example, becomes crucial to the design of individual structures and across vast tracts of land. Accessibility and information about the users become problems that exist on a much larger scale that must be dealt with in and around the architecture. As Sheppard reiterates, “Territory is expanded and thickened with environmental data, competing claims of economic forces,

\textsuperscript{59} Ibid.  
\textsuperscript{60} Ibid.
systems of mobility, ecological systems and so on. Therefore, the architecture atop this territory will have to address multiple layers of data relating to its environment thus requiring the ability to visualize, predict, and interpret the environment with all of its data concerning these disciplines is the necessary first step. This is where an in-depth understanding of mapping and GIS data processing is imperative.

**Structures and social data – layering**

In order to begin thinking on the scale of a territory, we turn back to Lateral Office’s initial challenge: the mapping or spatialization of the information describing the landscape. Each ecological and infrastructural system has a different boundary that exists within a single territory. Roads have separate boundaries from rivers, which have separate boundaries from animal migration paths, which have separate boundaries from ecosystems, and so on and so forth. Each of these boundaries is apt to change at any moment depending on numerous chance happenings. For example, a snowstorm can cause roads to close and force a rerouting of travel networks. A drought or erosion can condense or expand the boundaries of a river. A windstorm can displace a flock of migrating birds, and an invasive species can wipe out an entire ecosystem. To begin layering the data of not only these systems on the scale of a territory, but also data on their innate possibility to be altered, is to achieve what I referred to in the previous chapter as a multidimensional representation of space. In his essay “Form, Substance, and Difference”, anthropologist Gregory Bateson posed

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61 Ibid.
this question of a territory: “What is it in the territory that gets onto the map?” His answer is that it is *difference*,

be it a difference in altitude, a difference in vegetation, a difference in population structure, a difference in surface, or whatever. Differences are the things that get onto a map. But what is a difference? A difference is a very peculiar and obscure concept. It is certainly not a thing or an event. This piece of paper is different from the wood of this lectern. There are many difference between them—of color, texture, shape, etc. But if we start to ask about the localization of those differences, we get in trouble. Obviously the difference between the paper and the wood is not in the paper; it is obviously not in the wood; it is obviously not in the space between them, and it is obviously not in the time between them. (Difference which occurs across time is what we call “change.”) A difference, then, is an abstract matter.

To restate the first paragraph of this section in Bateson’s terms, the changing of boundaries within a territory is the result of a difference in each of the systems occurring over time. The role of cartography, Bateson would have argued, is not to encapsulate this dimension of time, but rather to apprehend the complex fluctuations by providing before and after images, by representing the differences between the many phases of the alteration of systemic boundaries. These differences form the lines and planes and scales and colorations of maps. The mapmaker must legibly distill these differences in order to translate them simply and universally. By allowing these differences to take a visual form, one can begin to understand the inherent interaction and interrelation of the changes taking place in the environment.

In the Taubman lecture, Sheppard interpreted Bateson’s ideas as the impossibility to truly know a territory by means of a map. The further one zooms out on a map, the more one confronts an “infinite regress” and an “infinite series of

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63 Ibid.
The value of a map, therefore, is not in the map as a literal object or as an objective translation of geographical information but in the layering of components that comprise a map – the map contains a physical structure isomorphic with that of the territory it describes. The map, therefore, serves as a series of symbols that allows one to understand the elements that work together in a territory.\textsuperscript{65}

\textbf{Next: Next North}

Beyond its unique apprehension of the permafrost landscape and its suggestion for alternative forms of mapmaking, \textit{The Active Layer} is a study of the surface conditions that attempts to reveal possible future uses of the landscape. In the Taubman lecture, Sheppard described how after its completion as an interactive mapping project, \textit{The Active Layer} became only the first component of a larger series of architectural and infrastructural proposals entitled \textit{Next North} (2011) that took the symbiotic set of relationships in the subarctic landscape as sites for proposing structural questions. What the firm had proven through their cartographic research was that the seemingly barren Canadian north is in fact an incredibly ecologically rich territory, one that could become the foundation for a new vernacular type of urbanism.

The Lateral Office team developed six projects not intended as solutions, rather a series of “what if?” questions. What might happen to a certain type of infrastructure in this subarctic context? Sheppard described them as follows:

\textit{Liquid Commons} looked at mobile schools that would take advantage of ice-breaking routes and could network a set of seven communities that individually couldn’t afford to have a cultural hub, but if you started to

\textsuperscript{64} Lola Sheppard, “Post Natures,” lecture, 2012.
\textsuperscript{65} Ibid.
imagine the cultural hubs as sort of mobile, floating elements in the summer they could go to each town and rotate. And in the winter they would freeze into place along the ice-breaking routes and become a kind of hub – infrastructure would come to you in the summer and you would go to the infrastructure in the winter.

*Health Hangars* looked at healthcare in the north and rethinking it. Currently it is all about medevac\(^6\) flying everywhere and sending everyone south thousands of kilometers. Could one think of a sort of distributed network of hospitals that would stay much more regionally and given the kind of reliance of health on airplanes, look at the intersection between hospitals and airports as a new programmatic type? [Sheppard also noted that the Faculty of Medicine at the University of Toronto has shown great interest in this project].

*Caribou Pivot Stations* looked at the relationship of migration species and research stations. It was an observation that there are research stations that are in a way independent from the environment in which they sit, and then there are caribou that are no longer able to migrate in the way that they used to because they can’t get access to the lichen that stands beneath the snow because of certain environmental changes. The idea was that the research stations could be strategically located along caribou migration paths and have mechanized arms that would scrape the snow away so the caribou would have access to the food resources that lay beneath the snow. The building would become a soft modifier of the environment.

*Ice Road Truck Stops* looked at ice roads and ice road truck stops in the Northwest Territories and the intersection of tourism and ice roads that currently only service the truckers. Could this double-duty in the summer and winter?

*Arctic Food Network*, situated in Baffin Island, looked at the intersection of food, mobility, and culture, the reality of settlements that are very isolated and stark. Simply accessing food in the north is an ongoing challenge, and as people have settled there have been programs to send food from south. However, it is really expensive and not really healthy (now there are a whole host of health issues like diabetes because produce is insanely expensive). How could one start to think about resources such as hunting and fishing, traditions that are being lost to younger generation as a consequence of a changing climate that makes them more difficult to practice? Or the snowmobile, which is the only way to move about? There is an increasing

\(^6\) Medevac: “emergency removal of sick or injured people from an area especially by helicopter.” (Merriam-Webster Dictionary).
reliance on technology being able to assess environmental conditions whereas previously it was done by human instinct.\(^6^7\)

Iceberg Rigging proposes a central rig system that mediates between touristic, industry, and military presence in the Iceberg Alley coastal waters. The rig offers an overnight facility, monitoring scientific facilities, and an iceberg harvesting deck. Simultaneously a series of small deployable augmentation devices are employed that allow for a range of interactions with icebergs: from harvesting to sports to monitoring to simply balancing or wrangling.\(^6^8\)

What is unique about Lateral Office’s approach to these proposals is the detail with which they sought to understand the precise needs of the inhabitants of this environment. Each projects is designed as a kit of parts (stacks, sheds, meshes, poles, vaults) that would be easily transportable and could be assembled to create a variety of architectural types: stacks could be used as cabins, small community kitchens, or greenhouses, vaults could function as underground freezers or root vegetable storage points, meshes would be implemented to grow mussels or harvest kelp, and poles were envisioned as lighting for way-finding or telecommunications.\(^6^9\)

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\(^6^7\) Sheppard continues to describe this project: “We are working with an anthropologist who had been tracking the routes that the Inuit take (and northerners not only Inuit) in Baffin Island and he’s been looking at GPS as system for tracking traditional trails. Also looked at existing infrastructure that supports food, so they have these modern community freezers that are generally all failing now that cost millions of dollars to maintain, there are a few examples of arctic greenhouses. Role of telecommunications (WiFi is sparse) and tradition of underground freezer taking advantage of the ground as a naturally cold condition and then also looking at systems of mobility as agents within project. It became a network for food sharing and food exchange as well as way to maintain certain cultural practices idea that they could also spawn sorts of micro-economies or micro-trade, a town that had access to certain resources could share or trade with another town. We started charting where various species were, where access to food resources where, and despite the image one has of the north (barren) there is actually a wide range of food (meat, sea mammals, shell fish, berries, flowers) mapped where they were present because idea was to imagine these hubs at intersection of where people were and where access to food was. We looked at calendar of when these things naturally grow – used this to speculate where architecture could extend the growing season or extend access to it because one could now trade or grow in greenhouse or so forth. Color codings are transcribed to a regional map so you can see which towns have access to what (some have access to a lot, some only a few resources). There was the idea that trading would augment their access to food; Lola Sheppard, “Post Natures,” lecture, 2012.


individual components of the kits would begin to aggregate and evolve into communal hubs or small towns depending on resources and needs or a certain area. Sheppard speculates the development of different village “types” that might begin to form – resource-rich settlement areas might contain larger kitchens and communal centers (type A), on the perimeters of which hunting cabins and places to harvest mussels or kelp might lie (type B). Even further away from population centers would be shelters that would house overnight fishing expeditions (type C).

The proposals are fundamentally based in the idea of merging tradition with contemporary technologies at both a cultural level and a geographical/tectonic one. This applies not only to the types of structures and infrastructures that the firm proposes but also to the systems of construction. Sheppard explains that the kits would combine conventional subarctic building techniques and materials (such as standard lumber tied using traditional tying systems, snow pack walls) with high-tech materials (such as copper building skins that respond to the extreme temperature differentials). She imagined these kits as prefabricated and compact, easily transported to site by sleds and constructed by only a few people.

Conversation about these proposals is not limited to an isolated architectural community. Lateral Office is now in the process of developing what they call “community consultation kits” that allow communities to specify what exactly they need. Sheppard explains the idea of the project that

On the one hand asks what the role of architecture in this kind of extreme environment might be, and [on the other] how the context and environment becomes a provocation back to us – how does one conceive of a project? How does one conceive of implementing it? How does one engage a territory without necessarily building extensively? We’re interested in the fact that networks of small things strategically deployed across the territory could
work at a territorial scale without necessarily having a very large footprint. They could be incremental and adaptable.\textsuperscript{70}

\textsuperscript{70} Ibid.
“The coastal village of Happisburgh in North Norfolk is falling into the sea,” say Mark Smout and Laura Allen, co-founders of the English architecture firm Smout Allen [Figures 16 and 17]. This is not an exaggeration. As a result of coastal erosion, the village, with the small population of around 1,400 people (in about 600 houses) is not so slowly slipping into the Atlantic Ocean. The village has a history of shrinking landmass, as it once was not so noticeably a coastal town. Historic record indicates that between the years 1600 and 1850 over 250 square meters of land was lost due to erosion. In more recent history, based on a photograph taken in 1992, the village had retreated by another 105 meters only twelve years later in 2004 [Figure 18]. Forms of hard infrastructure, such as concrete sea walls, wooden revetments, and groynes (small jetties extending from the shore to protect the beach against erosion or to trap shifting sands) have temporarily slowed down the rate of erosion. Yet despite these efforts, the British Geological Survey reported that large portions of the coastal land remain in disrepair and erosion will only intensify in the face of climate change and sea-level rise. Smout and Allen offered their own analysis about this fifteen-mile stretch of land on the Norfolk coastline stating, “there is evidence that hard sea defenses…although providing protection for the immediate beach and cliff, magnify problems elsewhere.” If allowed to erode naturally, they conclude, the loosened sediment would actually help to strengthen beaches that protect towns and villages further along the coast in either direction.

71 Oxford English Dictionary, 2nd ed. s.v. “groyne”.
72 British Geological Survey, “Coastal Erosion at Happisburgh.”
https://www.bgs.ac.uk/landslides/happisburgh.html, 1.
One might expect that most architects have little interest in land that is rapidly disappearing, especially given their opinion that saving the land is neither financially nor ecologically viable. Smout and Allen, however, found this to be a perfect site, in all its hopelessness, for their work and research. This chapter focuses on their project called *Retreating Village* (2005) that deals with the village of Happisburgh and their plan to rethink coastal urbanism. Theirs is primarily a research project. There is no client, nor is there any funding to enable its realization. In fact, the tract of land upon which this village resides is fated to disappear completely, to literally fall into the sea. As outlined in their proposal, the British governmental policies regarding managed retreat, such as the Shoreline Management Plan, have come together in agreement that Happisburgh is at this point irreclaimable.\textsuperscript{74}

In this sense, Smout Allen’s project is a study of a vulnerable landscape and the physicality of managed retreat. “Managed retreat”, the technical term used by urban planners to describe the necessary abandonment of coastal land due to excessive erosion, describes a scenario wherein both the built environment and the natural landscape are allowed to succumb to the pressures induced by incoming water. Any and every aspect of the constructed and intervened landscape is vulnerable to distortion, inevitable swollen with unwelcomed salt water. It is only a matter of time until most traditional building materials will erode, rot, disintegrate, rust, or dissolve completely, leaving behind unrecognizable ruin. This is Happisburgh’s fate.

In analyzing this project as an expression of their design ideology, itself clearly rooted in the work of their mentor Peter Cook and the 1960s collective

\textsuperscript{74}Laura Allen and Mark Smout, “Research Output 2: The Retreating Village (2005),” (The Bartlett School of Architecture, UCL, 2008), 1.
Archigram, it will become clear that Smout Allen is pushing the boundaries of architectural representation – that of the fluidity between structure and user. Their design reinterprets the way shelter performs in a landscape affected by the climate, an augmented landscape. How can architecture as shelter be defined in its interaction with the surrounding environment? How can these designs be represented in such a way as to translate the instability of the land onto the structures?

In contrast to Lateral Office’s projects that deal with a rapidly developing yet environmentally unstable region, Smout Allen’s work examines a territory in an apparently irreversible economic decline and faced with the problem of housing a population that no longer fits on its shrinking landmass. Still, both firms reflect a similar approach to understanding the organic nature of settlements in their responses to changing physical conditions. Quoting T. Rowley and J. Wood from their publication _Deserted Villages_ (1985) Smout and Allen state, “Villages have prospered, declined and migrated to new sites for a wide variety of social, cultural and economic reasons as they have responded to changing conditions.”

Accordingly, their project adopts this language of transience, “of permeable screens, loose-fit structures, and cheap materials that complement and contribute to the nature of the restless landscape.”

In short, they propose to redesign the village on a series of mechanical levers, pulleys, winches, rails and counterweights, “mimicking techniques for hauling boats from the waves,” so that its inhabitants can literally react to the predictive retreat of

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75 Ibid.
77 Ibid.
the land by continually shifting their village onto more stable land. While the design itself, although unusual, is based on old technologies, the translation of the project from words to images (to what they hope would become an eventual full-scale architecture) relies on a system of representation that resists the traditional in its very nature. When we think of architectural drawings, what first comes to mind is planometric, sectional, and elevational diagrams of the prospective structure that come together in a way that is fully descriptive of the shape, structure, interior versus exterior space, paths of movement in, out, and through the space, and function of the building. This system works perfectly well for static buildings in static environments, for what is drawn is meant to exist as is, from the time the structure is built until it falls into disuse, disrepair, or is replaced, added onto, or completely demolished. These are the types of drawings that were most likely made in preparation for the construction of the houses that currently exist in Happisburgh, the same ones that are slipping into the sea. Yet how might one represent an architecture that is designed to change over time? That doesn’t remain stable or static, nor does the land on which it is built? How can a plan be predictive of the movement of the earth beneath the structures in so exact a way? Smout Allen has dedicated as much time, if not more, to creating a system of visualization and representation that deals directly with this motion as they have to the concepts of the house designs themselves. Their work reflects their preoccupation with the fact that neither their structures nor the landscape will remain in a single place at any moment.

The project exists in a series of drawings, diagrams, and models that at first glance appear more sculptural than architectural. Each individual mechanical unit that
makes up the complete landscape is very technically drawn [Figure 19]. There is text accompanying each unit describing its function alone and in the system. They read as follows:

**Hulk:** Each house occupies the silhouette of a lost property. The new house takes the form of a “hulk” or solid enclosure inside which most of the house’s normal functions are placed. Revetment shutters appear to protect the hulk and its occupants from the weather. However, access ramps and ladder staircases puncture between the skins. The houses literally fold up or stretch out in their changing hinterland.

**Faggots:** Bioengineering approaches for coastal defense are low-impact retaining techniques that retard erosion. Coir rolls, or “soft” revetments of planted nets simultaneously control erosion and provide a natural habitat. In areas of more aggressive erosion they can be combined with faggots and fascines, made from live cuttings of hazel, chestnut, or willow bundles that provide the support for the coir rolls. The cuttings sprout and, as roots secure the soil, they become a living and sustainable revetment.

**Beams and Arcs:** The village is slipped, dragged, and rotated by a mechanism of anchors, ground beams, and concreted arcs.

**Skids:** The village is mounted on steel and concrete skids that allow each house to be dragged across the landscape. They are manipulated by no fewer than three pulleys that are anchored in the landscape and attached to the frame mounted above the skids and below the floor of the house.

**Props:** Temporary timber props strengthen the cliff in critical areas until they are eventually engulfed by the landscape.

**Gardens:** Each house travels with a “garden” of rope that reinforces the surrounding soil. These three-dimensionally woven geotextile bags are connected to frames and fed out through “windows” in the revetments. For some villagers the baskets and rope gardens are used as allotments for prize-winning vegetables; for others they provide a personal space for sunbathing.

**Frame:** The rope gardens are fed out on a counterbalanced ratchet whose equilibrium is interrupted by the movement of the village and the cliff edge.

**Buoys:** The sea is populated by a swarm of floats that are flexible and dynamic to allow them to be reconfigured by the waves. The buoys act as beacons for the village to warn of inclement weather.\(^\text{78}\) [Figures 20 and 21]

These drawings, however, are physically isolated from each other on the page suggesting parts of a system that merge to create some greater whole. The plan becomes clear in the later representations of the entire structural system. These more general drawings of the entire architectural landscape reflect the chaos and movement of the environment.

In one drawing that appears to be some combination of birds-eye-view and plan, the hard-lined forms of the new mechanical features superimpose wispy, possibly partially erased lines that delineate the ground surface. The beams and arcs clearly dominate the landscape. They look as though they were collaged onto the drawing, and therefore collaged onto the landscape. These incredibly solid structures now inhabit a landscape of instability and unintelligibility. The abstractedness of the pencil marks on the page represent an abstractedness of form in the natural environment. The possibility of change is not only imminent, but also unpredictable. It can occur at any moment, disabling its own representation through continuous and confident lines. The note that accompanies this drawing, “Remnants remain of footings and paths that evoke the past life of the village,” recall another moment in time, further obscuring permanence temporality of the landscape and its forthcoming change.

Smout Allen’s description of one drawing states, “The village is shown, suspended in a twitchy altitude, in its inevitable withdrawal from the edge. The architecture and the landscape are marked by this continual performance.”

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80 Ibid, 60.
also in the representations of the two interacting entities themselves. Smout and Allen seem to be producing an infinite series of drawings depicting this project. And it makes sense because there are unlimited ways to imagine these structures, unlimited positions to take in relation to one another, unlimited orientations to make in relation to the retreating coastline, and an unlimited distance the village might travel in its lifetime. One might wonder why possible variations were not explored in a series of digital images? As mentioned in the previous discussion of Hägerstrand’s time-geography theories, an animation generally conceives of a specific path of movement, one that is assumed to happen. In these drawings, Smout Allen are trying to depict the site as it undergoes a more ambiguous fluctuation between stillness and agitation.

What is striking in many of the drawings are the blocks of color that at times transect the page at diagonals [Figure 23] or follow particular curves of the structures. [Figure 24]. They seem to accentuate the movement that would be taking place in the architecture, symbolizing the dynamic force upon the built structures that allows the separate pieces to be moved, or to be activated by their users. In the same way, their drawings have a strong graphic quality reminiscent of Italian Futurist painting that historically used lines forming sharp angles and bold colors to represent contemporary ideas of speed, motion, and dynamism. However, it is important not to conflate the ideologies of the two periods. While the theme of movement is apparent in both, Futurism was notoriously anti-environmental in the sense that this newfound speed and technology was destined to overshadow nature in an act of violence fronted by men.81 Smout Allen’s work, on the other hand, originates in the dynamism of

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81 Filippo Tommaso Marinetti, Italian poet and founder of the Futurist movement, famously stated in his Futurist Manifesto of 1909 that “We are on the extreme promontory of the centuries! What is the
nature itself, the constant shifting that occurs on land (and at the edge between land and water). The built environment, according to their ideology, is meant to follow these permutations of the landscape, moving and changing along with it so as to cause minimal disturbance to the natural world.

However different their supporting ideology the Futurists present an interesting counterpoint here. They were among the first artists, architects, and writers to attempt a visual representation of motion – the motion of buildings, the motion of humans, the motion of machinery, and the motion of the three together as one. Paintings such as Umberto Boccioni’s The City Rises (1910-11) [Figure 25] or Marcel Duchamp’s famous Nude, Descending a Staircase, No. 2, (1912) [Figure 26] demonstrate this transcendental motion in space and time, of landscapes and of humans in space, in such a way that translates this non-static phenomenon onto a two-dimensional plane. The Italian artists do it by creating multiple outlines as if illustrating each moment in time separately yet on a single canvas, giving the effect of a flipbook, or a vibration (in the case of Boccioni’s landscape). While Smout Allen never alludes to early twentieth century art in their writings, there is an undeniable connection between these works in terms of representational goals.

In terms of this visual depiction of movement and energy, there are technical problems in both Futurist painting and Futurist architecture. If many of the paintings, such as the ones cited above, become exercises in the representation of motion that exists in the living (and industrial) world, Futurist architectural design only suggests

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use of looking behind at the moment when we must open the mysterious shutters of the impossible? Time and Space died yesterday. We are already living in the absolute, since we have already created eternal, omnipresent speed.”; F.T. Marinetti, “The Futurist Manifesto,” In Three Intellectuals in Politics, by James Joll, (New York: Pantheon Books, 1960).
http://vserver1.cscs.lsa.umich.edu/~crshalizi/T4PM/futurist-manifesto.html
the existence of such motion symbolically, through “oblique and elliptic lines” that “by their very nature posses an emotive power a thousand times stronger than perpendicualrs and horizontals, and that no integral, dynamic architecture can exist that does not include these.”⁸² The Manifesto of Futurist Architecture combats the historical, the traditional, and the decorative in favor of the simple, violent, and impermanent.⁸³ Smout Allen’s designs and drawings for Retreating Village in some ways bring together these two visions of Futurism without implying the negativity that generally goes hand in hand with the declaration of “violence.” Whereas the Futurists believed that in order to embody the speed of their new industrial technology, war was the necessary violence (in order to destroy the old and defunct style of living), the drawings produced by Smout Allen suggest that the speed representative of their world – the speed of nature and the changing climate, the velocity of the natural elements, such as water, and the power of erosive forces – is itself a type of violence that, rather than yield to human counterforce, insists on receptivity. To accept the natural turbulence that destroys land and homes is to work within the constraints defined by nature, or to create alongside the violence – an approach that never would have occurred to the Futurists, who were focused on their own active destruction of the past.

In 2007, Princeton Architectural Press’ publication dedicated to forward-thinking, unconventional architects, Pamphlet Architecture, dedicated an issue to Smout Allen’s recent work entitled, Augmented Landscapes (2007) where they describe the Retreating Village project as follows:

⁸³ Allen and Smout, Pamphlet Architecture 28: Augmented Landscapes, 60.
The architecture responds to its position, sited on a shifting and elevated horizon. The main inhabitable spaces are concealed behind large slatted revetments that provide secondary protection from the elements. The slats are reflective on one side and are tilted and placed eccentrically to achieve a disruptive pattern. The pattern, which aims to disguise the village on the cliff and to make its elevation and location less tangible, adds to the sense of the site and the architecture losing ground to the sea. The proposal is examined and designed through an ongoing series of working drawings, existing between the territories of sketch diagrams and architectural orthographic representations. They contain multiple viewpoints and simultaneous dynamic shifts of position.84

What is clear from this description is that Smout and Allen are not afraid of the impending erosion. They are, in fact, highlighting and accentuating the violent quality of the destructive forces of water through their redesign of the village. Most villages, towns, and even cities that face such erosive dangers react with fear – fear of the unpredictable chaos of their surrounding environment and the uncontrollability of nature itself. So often the response is to envisage a war between humans and these forces, and thus conceive architecture and infrastructure as exclusively defenses. Smout Allen, Lateral Office, and as we shall see below, Lebbeus Woods are working in shifting the paradigm to one where design becomes active in the environment, accepts the state of nature and the dynamism of its forces, and attempts to create an architecture that works alongside this violence. In such a way, the Retreating Village does not solely rest atop a cliff, it becomes a part of the Happisburgh landscape.

Thinking through drawing

Very little of Smout Allen’s architectural work is realized full scale. This is not a problem for them. As educators at the Bartlett School of Architecture in London

84 Ibid, 57.
as well as practicing architects, Smout and Allen believe there is an attainable goal in their design work that does not necessarily require the physical architecture, but instead remains in the drawing of a potential. Potential is a key word in their practice, as Smout says in an interview with Peter Cook and Will Hunter, “In every problem there is a potential rather than a particular solution, and that’s the way we teach and talk about projects.”85 The making of representations, then, becomes a source for ideas, a source for potential responses to a problem. In the same interview, Allen suggests that these representations of their concepts, which lead to more in-depth design work, help them understand more clearly the interior and exterior environments that they are creating. Later on, in the design process or in response to a completely different prompt, these drawings may light a spark for a different potentiality, sourcing a new design idea.86

Most of the drawings produced for Retreating Village are not so-called “production drawings” that illustrate the physical construction of the project. Rather, they are unconventional, “indulgent or poetic” ideas relating to design potentials.87 They are the source of the production of ideas. The representations of this project begin to produce novel ideas about landscape that are not necessarily apparent at first. Smout Allen arrives at these ideas by thinking through drawing – something fundamental to their practice, an idea and research method that stems directly from the Modernist tradition. In Creation is a Patient Search, Le Corbusier describes his drawing process declaring that “If you have a pencil in your hand, look at [these

86 Ibid.
87 Ibid.
objects] and you will understand; you will then have a storehouse of inspiration to
draw upon, the lesson taught by natural phenomena.”88 Drawing is a tool for
understanding nature and is something that is active in the process of discovering
dynamic phenomena. Through the utilization of drawing in planning, the urban
environment becomes “‘evidence of the activity of a civilization’ or… ‘evidence of
the activity of a society’. And this is a machine civilization and a machine society.”89
It is the job of the architect not only to translate creative potentials into realities, but
also to translate ideas from the mind, onto paper, and then into words describing the
projects that eventually become these realities.

Smout explains to Cook during the interview that their investigation of site
goes beyond what is visible, beyond the architectural into historical or ecological
information that its environment might hold. Similar to Lateral Office, as Laura Allen
notes, “The making of the representation is important to us. Since we never really get
a building from what we do, a lot of the process and ideas are simply embedded in
just a couple of drawings. They’re not to build anything from; they’re there to help us
imagine all these environments and all the life that this thing has. And maybe all of
those little manoeuvres are where you lay a see for later on – for further development
of those ideas as and when.”90 These visual representations are somewhat foreign to
the world of architecture—they address the concepts of temporariness, instability, and,
in the words of Geoff Manaugh, a “terrestrial dynamism”\footnote{Geoff Manaugh, Landscape Futures: Instruments, Devices and Architectural Inventions, (Actar, 2013), 128.} that exists in living nature but not in conventional plans or sections.

**Archigram and social theory**

Peter Cook once said that “people draw a big distinction between projects and buildings but I don’t.”\footnote{Simon Sadler, Archigram: Architecture Without Architecture, (Cambridge, MA: The MIT Press, 2005), 4.} This idea that in a certain way came to frame Archigram’s presence in architecture can be traced directly to Smout Allen’s practice. As mentioned earlier in this chapter, Smout and Allen studied under Peter Cook, one of the founding members of Archigram, and it is clear that they have internalized many of Archigram’s ideals. Archigram was born in 1961 as “a single sheet filled with poems and sketches”, its name derived from the combination of the words “architecture” and “telegram”.\footnote{Gili Merin,”AD Classics: The Plug-In City / Peter Cook, Archigram” (10 Jul 2013. ArchDaily. Accessed 06 Apr 2014). http://www.archdaily.com/?p=399329.} As a response to Modernism in the 1960s and 1970s, Archigram embraced a perspective that opposed the Post-Modernists. While Post-Modernism began as a rejection of Modernist philosophy, a rejection of architectural form for the sake of function (the quintessential Modernist phrase is “form follows function”\footnote{Louis Sullivan} through the reclamation of traditional architectural typologies (such as the Classical order) and a reinstitution of the acknowledgement of the historical, Archigram can be viewed as an exaggeration of Modernist ideals to an extreme, dabbling in the realms of fantasy and fiction. Archigram was comprised of a group of young English architects obsessed with a type of futurism that was anti-heroic and
pro-consumerist (very much distinct from the early twentieth-century Italian Futurist who was very much pro-hero, pro-violence), inspired by science and technology as a means towards creating a new reality.

The designs produced by Peter Cook and his fellow Archigram members were inherently modular, ‘high-tech’, and importantly, interactive. They asked their audience what they wanted from architecture in an attempt to create environments for people and not solely for the sake of architecture and structure. It was in this way an extension or literalization of Modernism’s “machine for living” – simultaneously outrageous and realistic, imaginative and optimistic. They sought to provide the equipment for living and being as opposed to participating in the repeated production of fixed volume that is expected to be “mutely inhabited”. In his history of Archigram, Sadler states, “Archigram’s designs destabilized the fundamental assumption that architecture is a static art: Archigram was unconvinced that a building’s firmitas (solidity) was the necessary pre-condition of its utilitas and venustas (utility and beauty), as Vitruvius’s foundational equation of the Western architectural tradition had ordained.”

There is a direct allusion to Futurism in Archigram’s understanding of cities as “life-supporting machinery of a culture in perpetual change” that can also be applied to Smout Allen’s *Retreating Village* (the production of an active, mechanical environment). However, in the cases of Archigram and Smout Allen, this machinery works to protect the consumers rather than to destroy them. Peter Cook’s project entitled *Plug-In City* [Figure 27], for example, consists of many modular architectural

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96 Ibid.
97 Ibid, 8.
units that literally plug into an “infrastructural mega machine” to create a system that is constantly evolving and completely alterable (by giant cranes). The concept of the design suggests a flexibility of the use of space inciting a more nomadic way of life in response to Modernism’s suburbia. Similarly, *Retreating Village* attempts to translate this plasticity onto an environment in such a way as to both liberate and protect its inhabitants in the face of a changing climate.

Architecture theorist Robert Kronenberg discusses the notion of flexible architecture enabling human physiological and psychological development. One of the key points in the evolutionary success of human beings lies in their adaptability – beginning as nomads, creating places out of spaces upon which they could survive, bound to change (the change of seasons, movement of animals, local and distant availability of necessary nutrients and foods, flow of abundant and clean water, temperature change, etc.). Even when societies began farming and settled in areas for longer periods of time, “their existence was still dependent on a significant group of specialist travelers who maintained a nomadic lifestyle…The traditional purpose of a nomadic way of life was to make the best use of scant resources; however these new forms of travelling lifestyles emerged in response to both increased agriculture and technological skills and to new demands for services and products.” A flexible building, in this case, has the potential to inhabit an environment lightly, to allow the natural environment to flourish around it rather than to impose its foreign structure on

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98 Merin,"AD Classics: The Plug-In City / Peter Cook, Archigram."
local ecologies. “[I]t could be a house that interacts with the surrounding landscape in a less formal sense and becomes an event rather than an object.”

The temporal dimension of a flexible land use complicates perceptions of space and place and representations of the built environment. As the geographer Richard Lawton explains,

A valuable means of bringing together our use of time is to see time, like space, as a resource permitting an ecological approach to the study of human activities within time-space regions… these various temporal dimensions of activity have the effect of taking people into a wide territory and shaping their perceptions of space.

This reflects central questions in the study of time-geography as discussed earlier, such as concepts of location, spatial relationships between phenomena, and the interaction of people and places and the change over time of those relationships.

As much as they could, both Archigram and Smout Allen sought to develop and represent a new type of architecture that would translate the complications of continual change occurring among nature, buildings, and humans. The resulting structures (or visualizations of potential structures) embody an alternative approach to the Modernist mantra “form follows function”. While early twentieth-century Modernist architects believed that the form a building should do only as much as its function required (a rule that comes across quite clearly in Peter Cook and Smout Allen’s designs), there was a sense of timelessness, an inability for further growth inherent in the ideology. Modernists fundamentally rejected the historicity of architectural forms and motifs. It would be contradictory to their philosophy, then, to imagine these forms as undergoing change, becoming eventually historical objects.

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100 Ibid. 11.
102 Louis Sullivan.
themselves. In other words, while the function of the structures would inevitably change over time, the form itself would remain a static reference to the original function intended by the architect – form only follows the primary function, the function intended when the building was designed.\(^{103}\)

On the other hand, *Retreating Village* (and *Plug-in City*) maintain a logic of form continually following function, form equaling function – as the function changes, the form changes along with it. Similarly, as the form changes as a result of uncontrollable exterior events, the function of the space is meant to necessarily adapt. Physical activity is not only anticipated, it is implied.

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\(^{103}\) Le Corbusier’s *Villa Savoye* (built in 1928 in Poissy, France) is a good example of the formally static structures produced by Modernist architects. It is a quintessential Modern house, commissioned by a couple as a country home just outside of Paris. Both its interior and exterior are glorifications of the most advanced construction technologies of the time very clearly addressing Corbusier’s emblematic “Five Points” of his Modernist aesthetic:

1. **Pilotis** (reinforced concrete columns that bear the load of the structure replacing supporting walls.)
2. **Roof gardens** (so that no space would be wasted. Necessitated a flat roof.)
3. **“Free” floor plan** (made possible by the absence of internal supporting walls. This made it possible to have large open interior spaces.)
4. **“Free” façade** (the façade no longer had a structural function because of the pilotis, so the exterior of the building could be separated from the core.)
5. **Long, horizontal windows** (to let in even light throughout the house. This was also made possible by the free façade.)

This allowed Corbusier to open up the bottom floor of the house to allow for the newest invention: the automobile. Rather than having the bulk of the living space on the ground floor, it was moved up a storey and replaced by a driveway that circled directly underneath the perimeter of the house. In fact, its turning radius was designed to perfectly accommodate a 1927 Citroën. Today, the house is a museum. It is a relic of the Modern period. It is furnished close to how it would have been in the 1930s. Its driveway is no longer used. It has undergone numerous major renovations to keep it looking pristine and as it did when it was built, despite major damage that has occurred due to weathering over time. Walking into it is like stepping back almost one hundred years. It is a piece of history [FIGURE 28]; Le Corbusier (1986), *Towards a New Architecture*, (Mineola, NY: Dover Publications, Inc.).
PART II
"Response, recovery, mitigation, risk reduction, prevention, and preparedness” – the disaster lifecycle according to the Federal Emergency Management Agency (FEMA)

It is commonly believed that architecture should be utilized as a “preventive” measure when it comes to disasters. Its solidity and permanence is meant to protect us from external forces, from human-produced or natural clastic events. In many cases, however, a built structure does more harm than good, negating its value in the face of whatever disaster it might prevent by creating new dangers through its physical presence and faults inherent in the very concept and execution of its structure. The use of modern materials such as steel and concrete has allowed for sturdier, taller structures by replacing load-bearing walls with load-bearing steel reinforcing rods that reduce the quantity of material necessary for a structurally sound building and anchor it to a foundation with reassuring durability. Yet to the extent that such buildings are subject to unimaginable natural or human forces, their potential dangers to their inhabitants and neighbors can increase exponentially.

This paradox of modern building techniques cannot be ignored. Technology is never neutral and always carries a host of conflicting implications, be they beneficial or destructive. Thus there is an ethical responsibility that goes along with the invention of new infrastructural technologies, and in the face of an obviously dangerous or unstable structure, we have an obligation to ask why it was built to begin with.

A major obstacle in planning for emergencies is the expectation of the quick fix, symbolic of the expected rhythm of development in the Internet age where information is made available to anybody and everybody at the tap of a finger. We are
programmed to believe that safety technology should also be developed and implemented at a comparable speed. Forms of “hard” infrastructure such as reinforcements, bracings, and barriers, satisfy both the need for speed and the innate desire for physical evidence of safety. They can be built quickly and are visually representative of their function.

In Part I, I discussed the difficulty of bringing new forms of dynamic mapping and architectural renderings into existence in terms of universal legibility and clarity. In Part II, I will argue that the problematic of bringing new forms into existence is just as difficult. In short, the issue is (again) with the inability to communicate effectively across disciplines. There is cognitive dissonance between architects and engineers that ultimately has to do with the fact that they do not have a common form of representation. Architects rely heavily on a very conventional type of drawing that has a tendency to ignore utilities and structural necessities, while engineers use geological surveys, maps, and technical diagrams (e.g. HVAC systems). Therefore, in the extraordinary circumstances of natural disaster, they are in large part reacting not only to the disaster itself but also to each other’s plans regarding the disaster. This recursive reaction becomes a nearly unbreakable cycle resulting in compromise – rebuilding, redesigning, reinforcing, and amplifying structures that already exists. It stands to reason that in the absence of an ability to understand each other’s parameters, the designs that both architects and engineers will agree upon all have to do with what they have previously agreed upon.

The following case studies lie on opposite ends of this spectrum. The first, which deals with San Francisco and the city’s constant threat of earthquakes, is very
much an artistic endeavor. The architect, Lebbeus Woods, envisions an
unrecognizable architecture through a series of unrecognizable drawings. There is
nothing conventionally “technical” about the way he goes about composing these
sketches or imagining these alternative cultural scenarios. The second, which deals
with the potential dangers to the Dutch coastline posed by sea-level rise, is very much
a feat of engineering. Though no less a design project than Woods’, it relies
completely on advanced technical knowledge and digital diagramming of geological
data. What the two projects share is their attempt at breaking this self-perpetuating
cycle of resistant designs, fixes that shy away from disaster. Although they each go
about it in a very different way, there is clearly a shared belief that innovative
thinking and design can shift our perspective away from fear of clastic events and
towards an attitude of embracing the neoclastic.
In the last quarter of the nineteenth century, a new “earthquake-proof” architecture for San Francisco seemed attainable. At this point, most new constructions were at least fireproof, made primarily out of brick or stone, rather than wood. The sense of stability and permanence was reassuring to locals who considered it an “advanced technology”. However as the earthquakes of 1865 and 1868 revealed, it turned out that wood-frame constructions absorbed the seismic shock better than heavier and denser materials such as stone and brick. In fact, they were less likely to fall, less likely to produce serious casualties. Tobriner mentions the common saying, “Earthquakes don’t kill people, buildings do,” that became a source of controversy among architects seeking to build in places like San Francisco. There were two possible methods of remedying the problem. The first was to revert to wood-framed building that would protect San Franciscans from the trembling of earthquakes but simultaneously jeopardize them and their homes to the dangers of fire. The second was to attempt to adapt masonry structures to withstand the forces of an earthquake. Clearly, development and utilization of a new technology was preferable, especially if the outcome would be a fireproof and earthquake-proof building.

One attempt at reinforced masonry constructions was to use bond iron along with brick, a method inspired by its nineteenth century use by the English engineer Isambard Kingdom Brunel to increase the strength of the brickwork of the Thames

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105 Ibid, 60.
106 Ibid, 61.
River Tunnel.\textsuperscript{107} A further reinforced method was to incorporate iron bracing into the structure as well, equipping the building with both internal and external support.\textsuperscript{108} Alternatively, some architects experimented with combining wood and stone by building timber-framed brick structures – amalgams of materials suitable for the separate disasters. When the ‘earthquake-proof’ City Hall of 1871 proved a failure, designers agreed that an earthquake-proof architecture was nearly impossible, both physically and fiscally.\textsuperscript{109} The experience led them to direct their creative energy more aptly towards producing earthquake-resistant structures.

Alfred Mullet was appointed the supervising architect for the Treasury Department in 1866 and brought to his office new knowledge about constructing under earthquake conditions. After having studied the most recent earthquakes in the San Francisco area, he understood that different surface conditions had different impacts on structures in disaster conditions – landfill offered almost no support for the building, and rock offered the best (sand was somewhere in between).

The use of piles in soil subject to lateral movement is injudicious in the last degree, and must as in this case split the building…It has always appeared to me that the only chance of success lay in the construction of a timber foundation well framed and bolted together forming in fact a raft of sufficient strength to sustain the foundation, when the building would probably have moved as a unit, if at all.\textsuperscript{110}

By the early twentieth century the steel frame had taken over as the most resistant building method. However, with the implementation of steel came a giant schism between architects and engineers. As buildings got taller and risk of collapse

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\textsuperscript{107} Ibid, 65.  \\
\textsuperscript{108} Ibid.  \\
\textsuperscript{109} “The construction of the new City Hall was plagued from the beginning by change orders, cost overruns, discontinuities in design, and disputes…” Ibid, 75.  \\
\textsuperscript{110} Ibid, 77.  \\
\end{flushleft}
increased, architects could not longer be responsible for both the design and the construction logistics.\(^{111}\) It became a requirement for architects to consult engineers for steel-framed building plans, complicating both the decision-making and building processes. In fact, a significant rift developed between the architects and the engineers. In general, the architect focused on the aesthetic design, the function, the shape, and the materiality of the building, while the engineer’s principal concern was the safety of the building’s potential inhabitants. Over the next several decades as technologies continued to advance, the engineer became ostensibly silenced in the process, widening the communication gap between the two fields and growing tensions. Tobriner describes the architect has having “very little concern” for earthquake-resistance.\(^ {112}\)

**The project**

The work of Lebbeus Woods directly responds to the saying “Earthquakes don’t kill people, buildings do”. In fact, he took the idea that buildings are violent quite literally. Beginning in the early 1990s, during the Croatian War of Independence, Woods began to interpret the formal nature of the built environment as producing inherently hierarchical spaces that reinforced the social antagonisms. Divisions such as ‘public’ vs. ‘private’ that result in the demarcation of boundaries that allow a certain type of person to pass and another to be prohibited, monumental architecture of official state power (“the large and expansive buildings that demonstrate the wealth of private corporations, arts institutions, and stable

\(^{111}\) Ibid, 85.
\(^{112}\) Ibid, 93.
governments”¹¹³), architecture sponsored by banks and mortgage companies – Woods would say that such constructions reek of elitism. In Zagreb, Woods proposed spaces that he called “free-zones” that would challenge users to rethink their actions in and around the war-torn streets, “empowering those who have been disempowered by prevailing institutions.”¹¹⁴ These spaces would be inserted into the city fabric adjacent to, around, suspended above, and between pre-existing buildings. They were unrecognizable architectural forms, jagged and asymmetrical, contrasting with the surrounding environment as an invitation to reconceive the relationship between interior and exterior spaces and the human role within and among them. [Figure 29]. Woods hoped they would become “active instruments – machines – of change,”¹¹⁵ only inhabitable by those who were willing to explore new modes of inhabiting the city.¹¹⁶ This project, like most designed by Woods, existed solely in drawings and models. It was never realized full-scale.

In 1999 Woods shifted his focus from human to natural violence, applying similar theories about free space to areas devastated by terrestrial rather than political forces. The main project Terrain dealt with earthquake architecture in San Francisco. Woods imagined an alternative role that buildings might play during at earthquake. He described the project in EARTHQUAKE: a Post-Biblical View and referred to the surpassing or transcending of human’s alienation from nature through the medium of

¹¹⁴ Ibid.
¹¹⁵ Ibid.
While we generally blame natural phenomena for the “disaster”, he repeated Tobriner’s aphorism, “earthquakes don’t kill people, [falling] buildings do.”

Regardless of the epistemological shifts towards observing the world through an increasingly objective lens, freeing science and technology from the “grip of religion per se,” there remains what Woods describes as an “adversarial Biblical relationship between to domain of the human and the realm of ‘Divine’ nature.”

Nowhere is its fragility in this regard more clearly demonstrated than in earthquake regions. There, not only has the idea of the Cartesian ‘grid’ as a symbol of rational efficiency and stability been overturned (literally) by the nature of earthquake forces, but the civilizational cornerstone of human independence from Nature (a conceit, however transparent, that has propelled the notion of human progress) has been broken to bits. In light of the consistent failure of leading societies such as the United States and Japan to build effectively against earthquake, it is reasonable to reconsider the dominant philosophies, techniques and goals of building and urban design in earthquake regions.

As he argues in the case of Zagreb, humans repeatedly ignore the violence that the architecture inflicts on society. It is the literal form of the built environment and our preconceived understandings of how architecture must fit into nature that is hindering the evolution of an architecture (and in turn, a culture) that is more immune to natural phenomena. Despite our advanced technologies and knowledge of the earth’s processes, we are stuck trying to fix a system – an entire approach – that is broken. Terrain is Woods’ attempt to shift the ways in which humans approach to relating to the intersection of landscape and architecture in a way that resists demonizing natural events.

118 Ibid.
119 Ibid.
The concept of resilience comes into play in his view of the built environment as terrain, as landscape, rather than as a collection of objects inhabiting the natural world. His drawings of notably fragmented structures are an attempt to imagine a built landscape undergoing continuous transformation, inhabiting the earthquake rather than being disturbed by it. [Figures 30 and 31] In this way, he maps movement through a fantastical scenario, using drawings and models to theorize possibilities outside of the realm of normative architecture. Movement is inescapable and fundamental and therefore must exist in mapping and diagrams referring to spaces and places and the structures on and within them. While such projects are generally referred to as theoretical architecture one could also excavate his ideas in the attempts by mid-twentieth century geographers to describe the interactions between humans and their environments in terms of time vs. space graphs.

While not entirely practical, the idea is that in order to get to the root of the problem (natural or man-made disaster), more than a surface understanding and cultivation of a relationship between the building and its environment is necessary in order to bring about a change. While his drawings may seem anything but soft, this idea is precisely in line with and even an extension of the ideology of many of ‘soft’ architecture’s pioneers such as Archigram. Instead of mimicking nature in order to understand it, as his many contemporaries concerned with resilience were (and still are) doing, Woods’ approach is to learn through contrast and opposition, and to bring about change by exaggerating the outcome of violence.
**The process: diagramming theories**

In an interview in 2008 published in the Canadian journal *Azure*, Woods described his motivation in creating a “free-space” architecture that counters traditional opinions of what the built environment can and should be. Like Peter Cook and Archigram, Woods was attempting to reapply and extend Modernism’s ethics as a way of repositioning the human in relation to his/her surroundings.

Modernism pretended – or actually hoped – that architecture would be the instrument for making a better world for most people. The idea has melted away in architectural discourse. It will take someone wiser than me to explain why. Maybe it is because many became disillusioned with ideals. Maybe it is because everyone-for-themselves capitalism has become so successful, materially. Architecture, regardless of successes or not, can still be radical in its hopes for making a better world for many. It’s up to the architects to set the agenda. 

In a certain sense what Woods is describing as the atrophy of Modernism is a lack of communication between architects and the public. The ideals became too far abstracted from reality and were transmitted through a visual language that grew increasingly disconnected from technological possibilities.

Traditionally, architecture’s visual language follows rules similar to linguistic grammar in the sense that we are meant to ‘read’ the diagrams and plans/sections of a not-yet-constructed building. Certain symbols denote physical features, such as doors, windows, walls, empty space, stairs, etc., which are standardized such that they can be universally understood. According to Kari Jormakka’s reading of the architect and theorist Christopher Alexander’s *Notes on the Synthesis of Form*, one of architectural design’s major problems is its reliance on words in articulating questions having to do

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120 Lebbeus Woods, Interview with Leo Gullbring.
121 For example, Corbusier’s *Plan Voisin* for Paris.
with form and function. In fact, I would expand this argument to say that it is a problem that architectural representation itself relies so heavily on language, on a type of legibility equivalent to that of the written word. While it may seem nonsensical to propose a visual language so far removed from the known and comprehensible standard that exists today (and has for hundreds of years), it seems as though the representational method limits the possibilities of design as well as the converse (standards and generalities of “architecture” and “structure” and “built environment” limit what is possible to conceptualize through drawing and modeling).

It is a known fact that “Architects tend to draw what they can build and to build what they can draw”. However, the possibilities of visuals far surpass those of words. How does one verbally describe a form that has yet to exist? Or a form with undefined boundaries whose contours are designed to evolve? Or something existing without a geometrical, Cartesian grid? These are the types of conundrums Woods addressed in Terrain.

Alexander’s response to this dilemma was to develop a pattern language that proposed formal questions and their solutions to these representational problems. It functions much like any other spoken language, consisting of vocabulary, syntax, and grammar, but it applies to activity beyond verbal communication. The vocabulary is made up of known solutions to design problems (i.e. the division between interior and exterior = wall). Each of these solutions includes a syntax that describes how the particular solution might fit into the larger, more comprehensive or more abstract design (for example, a room must have a way to let people in and out, as well as a

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system of ventilation). The grammar describes the way in which the given solution benefits the larger design. Therefore, if there is no benefit, or if the benefit is expendable, that particular solution is not used in the final design. Design “patterns” are made up of a web of vocabulary, syntax, and grammar. They are analogues to coherent paragraphs, or full essays. In short, Alexander proposes a complete system. It does not specify what the final outcome of the design should or could be but allows instead for infinite permutations. Furthermore, it applies legibility to designs that might otherwise confuse a universal audience, engineers, or other architects for that matter. It is an attempt to simplify not only the design process but also the way in which it is presented and represented.

Jormakka writes, “While the method of de- and re-composition and the notion of universally valid patterns are highly suspect and the pattern language is rather conservative, Alexander’s original notion of a constructive diagram and distrust of language anticipates the concerns of the contemporary Dutch avant-garde.” Beyond Dutch avant-garde architects, such as Caroline Bos and Ben van Berkel (who founded the firm UNStudio based in Amsterdam) who form the point of departure for Jormakka’s philosophical discussion on diagramming and constructing a dynamical and time-space sensitive architecture, Alexander’s stress on diagramming anticipates the twenty-first-century trend of “resilient” design. He makes an important distinction between form diagrams of architectural projects not yet built that, as is clear by their

125 Ibid.
126 Ibid.
127 Jormakka, Flying Dutchmen: Motion in Architecture, 28-9.
name, are representations of formal aspects of the building, a plan or a section for example, and requirement (or function) diagrams. To Alexander these diagrams are only useful if the functional consequences of such formal qualities are predictable. In other words, drawings help if the use of and movement through the structure are apparent through its formal visualization. Requirement diagrams, on the other hand, are non-iconic notations denoting important properties and constraints of the design that have implications affecting the form.\footnote{Jormakka, \textit{Flying Dutchmen: Motion in Architecture}, 30.} This type of diagramming is abstracted from a direct representation of planimetric or sectional imaginings of the architecture because it is a depiction of non-physical, time-dependent spatial organization. The ideal method of diagramming is a constructive one, where form and requirement are superimposed and act together – where form and function are one in the same.\footnote{There are precedents for this diagramming method that go back to the 1930s, when Frank Lloyd Wright argued in favor of “form and function are one,” which superseded Louis Sullivan’s “form follows function”; Joe Siry: ARHA 254, Lecture 9, in Media Database.}

With the ability to articulate in visual terms a constructive idea wherein form and function are inseparable without limiting the representational technique to the conventions and vocabulary of the contemporary design world, the diagram can work as the foundation of a new method of conceptualizing an integrative and dynamic architecture. Jormakka cites Bos and van Berkel in his discussion of diagrams and the connection they have made in their own research between visual representational methods and the notion of a type, of a new classification of forms. Jormakka writes that “They claim that ‘a representational technique implies that we converge on reality from a conceptual position and in that way fix the relationship between idea and form, between content and structure. When form and content are superimposed in
this way, a type emerges. This is the problem with an architecture that is based on a representational concept: it cannot escape existing typologies.’”

**Deleuze’s “smooth space”**

The philosopher Gilles Deleuze identifies a concept that illustrates Woods’ frustration with the current “violent” architecture (such as that which exists in contemporary San Francisco, resisting earthquakes). Deleuze defines “smooth space” as part of a “nomad” or “minor science”. “Smooth space” refers to space where matter is fluid (such as the sea), an open space “throughout which things-flows are distributed, rather than plotting out a closed space for linear and solid things [which refers to the opposite – “striated space”].”

“Nomad science” is defined by the modeling of smooth space in a way that produces “a movement that holds space and simultaneously affects all of its points, instead of being held by space in a local movement from one specified point to another [which refers to the opposite – “royal science”].”

“Nomad science” could be applied to Woods’ experiments to articulate a built environment that acts and reacts along with the natural. His imagined environment, his Terrain, is so-called “smooth space” – it acts like a body of water.

Deleuze explains the opposition between the two types of sciences, “nomad” and “royal”, in terms of the Gothic cathedral. Not only was the advent of the Gothic cathedral an attempt to quantitatively obscure Romanesque churches (by

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133 Ibid, 363.
134 Ibid, 364.
creating taller, longer, and overall larger churches), but, as Deleuze argues, it also marks a qualitative change: “the static relation, form-matter, tends to fade into the background in favor of a dynamic relation, material-forces.”\textsuperscript{135} He describes the new method of cutting stone used in the construction of Gothic cathedrals that enables the “holding and coordinating [of] forces of thrust, and of constructing ever higher and longer vaults,”\textsuperscript{136} as a method that relies on an active rather than static relationship between the solid parts of the building. “It is as if Gothic conquered a smooth space, while Romanesque remained partially within a striated space (in which the vault depends on the juxtaposition of parallel pillars).”\textsuperscript{137} Therefore, the “nomad science” is one characterized by the generation of “forces of thrust”, whereas the “royal science” is one that simply organizes matter.\textsuperscript{138}

The problem remains that “royal science” (sometimes referred to as “state science”) is the normative method of analyzing and building spaces. It is representative of a Euclidean geometry, which Deleuze describes as a “theorematic science… [in which] mathematical figures and equations were thought to be the intelligible form capable of organizing surfaces and volumes.”\textsuperscript{139} However, such an organization is useless for the construction of a dynamic architecture like the Gothic cathedral. Instead, Archimedean geometry, “a projective and descriptive geometry,”\textsuperscript{140} which is characterized “less by the absence of equations than by the very different role they play: instead of being good forms absolutely that organize

\textsuperscript{135} Ibid.
\textsuperscript{136} Ibid.
\textsuperscript{137} Ibid.
\textsuperscript{138} Ibid.
\textsuperscript{139} Ibid.
\textsuperscript{140} Ibid.
matter, they are ‘generated’ as ‘forces of thrust’ (*poussées*) by the material, in a qualitative calculus of the optimum.”\(^{141}\) Because of the authority given to Euclid’s mathematics in all scientific fields, it is not surprising that the products of the resulting technologies would fit the capabilities of Euclidean geometry. In other words, they would be organizations of surfaces and volumes, which in the most basic way describes most architecture.

Woods’ struggle is with the representation of a Deleuzian non-Euclidean geometry. The forces of this “royal science” create the illusion that his projects are unrealizable, abstracted from contemporary architectural discourse. His creations oppose authoritative (architectural and scientific) conventions. *Terrain* imagines an architecture that not only inhabits a “smooth space,” but is integral to its smoothness – it doesn’t attempt to halt the functioning of tectonic forces, but encourages it, accepts the natural state as the norm.

In the following chapter, I examine a project that works at the border of two “smooth spaces”: sand and sea, testing the limits, examining the boundaries, of maintaining the smoothness in the modeling of a “nomad science”. The creators of the project are not trained as architects – their work resides completely within the realm of engineering – they are working towards a Deleuzian design from within the scientific community.

\(^{141}\) Ibid, 364-5.
THE SAND MOTOR

The history

The birthplace of coastline engineering, the Netherlands, has had extensive experience with flood mitigation. For years they preserved the reclaimed land that makes up nearly fifty percent of the Netherlands and the entire region of Holland. Without flood barriers of any sort, the entire western half of the country would be completely submerged in water. Since 500 B.C.E. they have constructed terps, or man-made hills, throughout the coastal countryside, and from the 1600s on they have created polders, or reclaimed land, turning “swampy, peaty, warm, humid places into land that can be farmed out.”

In the twentieth century, modern inventions enabled technologies that could protect coastal cities from sinking as a result of seasonal storms and floods. One such example resulted from the North Sea flood of 1953. Followed by a serious hurricane only a month later, this flood demonstrated the damage possible in a worst-case scenario for a low-lying country. Not only did flooding and severe weather conditions weaken the already poorly constructed levees, but the storm also coincided with the spring tide, when the sea level rises much higher than it does at any other point in the year. In total, eighty-nine levees were completely destroyed. As a result, the flooding throughout Holland destroyed houses that had survived the initial storm. It became startlingly clear to the Dutch Department of Waterways and Public Works that more drastic measures had to be taken in order to prevent the reoccurrence of such a

catastrophe. As a response, the Delta Works project began, wherein a series of dams, dikes, levees, storm surge barriers and caissons were built in the Rhine-Meuse-Scheldt delta. This would shorten the Dutch coastline, reducing the risk and damage to the land from future floods and storms.

These solutions, like much hard infrastructure, were temporarily successful. More recently, however, it has become clear that the country’s geography demands a system that can handle climate change on a larger scale, rather than a system that is weakened by it. In an interview published by the American Society of Landscape Architects (ASLA), Dutch landscape architect Jerry Van Eyck speaks of the problem of the Netherlands’ coastline,

We discovered we can’t put more dikes, or ‘hard’ infrastructure in place to control against sea level rise – water seeps through the weak spots. Instead, we need to use ‘soft coastal protection.’ These soft coastal-engineered systems, or ‘sprayland,’ consist of mud that has been sprayed under water for years, creating strips of coastal land. Airplanes then throw Buckthorn bush seeds out in order to vegetate these strips. Bulldozers then come in to create fire escape lines through the vegetation.

The resulting landscape looks overgrown and wild despite it being very decidedly constructed.

Beginning in the late 1970s and early 1980s, research was conducted to measure the effect of storm surges on coastal sand dunes (which line the Netherland’s shore). Eventually it led to the development of techniques involving sand replenishment to maintain the shoreline. Jan Van de Graaff, Professor Emeritus at the Delft University of Technology, Department of Civil Engineering (Coastal

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145 Green, “The Netherlands’ Evolving Relationship with Water.”
Engineering Group), was one of the first engineers to undertake this alternative study on floods and storm surges and their effect on the Netherland’s natural coastline. In 1977 he published a paper entitled “Dune Erosion During a Storm Surge” for which he conducted a series of model tests designed to determine the amount and severity of erosion created by rising water levels and currents. Using an average profile along the Dutch coast, he then induced “ordinary” and “storm surge” conditions, taking into account coarseness of sand, and then comparing his results to profiles in nature. To set up his project, he states,

A great part of the primary sea defense in the Netherlands is made up of unprotected dunes. It is a well-known phenomenon that during rather severe storm surges erosion of the dunes takes place. Normally this erosion does not cause trouble since in most cases the width of the dunes is sufficient and mostly during the summer accretion occurs. A rough inquiry into the phenomenon of dune erosion shows the erosion to increase sharply when the maximum water lever of the storm surge increases. Naturally, the wave conditions are important as well.  

He then discusses the Dutch ‘Deltaplan,’ implemented in 1953 (as previously discussed) and its fairly low probability of failure (1:10,000). His experiment aims to determine whether the dune row is safe, or whether it is in danger of being completely eroded, despite the Deltaplan, which created a series of blocks in three estuary mouths to reduce the length of the newly strengthened dikes that was exposed to the sea [Figure 32]. Though the results of this study were promising (that the erosion caused by a fixed amount of water and storm surge was 25%-50% less than had been thought before the tests), de Graaff made it clear that this made it even more “meaningful to continue with tests of the kind to increase the certainty of the applied scale relationships and the final erosion in nature. Since at the moment no facilities

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are available in The Netherlands in which high waves can be generated, a direct extension of the scale area is impossible.”¹⁴⁷ The modeling technology was not yet developed enough to account for the possibility of the type of extreme, weather we experience today, nearly forty after this initial study.

In 1985 de Graaff followed through with his project to continue research on dune erosion on the Dutch coast. From what is written in “Probabilistic Design of Dunes: An Example from The Netherlands”, it is clear that whatever “promising” results obtained from the 1977 study were already being reconsidered. De Graaff explains in some regions (what he calls the “Dutch” situation), dunes have the same function as sea dikes – to prevent flooding and protect coastal communities. In other regions (what he calls the “Florida” situation), however, dunes are solely a “transition zone between sea and land and are sometimes part of important holiday resorts. In those cases high investment costs have been made frequently in building houses and hotels close to the edge of the sea.” He continues, “Under storm (surge) conditions, however, dunes can be damaged by the sea. Knowing the amount of retreat of the dune’s toe is in both cases important.”¹⁴⁸ De Graaff explains that although both cases are relatively safe under ‘normal’ conditions (dictated by a calculated mean sea level), during storm surge this water level rises, resulting in much higher waves near the shoreline. This redistributes material from the dunes, carrying it towards deeper water, leaving the overall slope of the beach profile decreased [Figure 33].

In his discussion, de Graaff declares,

¹⁴⁷ de Graaff, “Dune Erosion During A Storm Surge”, 133.
Since 1972 [the year of the development of the Dutch Guideline to design safe dunes], the knowledge of risk analysis has increased considerably. At the moment, a chance of failure of $10^{-5}$ per year has been accepted as a reliable chance. A dune is assumed to be safe nowadays if it is wide enough to withstand the amount of erosion with that small chance of exceedence... For beach house owners, coastal managers and insurance underwriters an appropriate dune erosion calculation model, based on moderate chances of exceedence, will e very useful in determining the risks.\textsuperscript{149}

What is implied in the study is the desirability of coastal development for human use, and the ability for functional and efficient infrastructure to preserve this visual, cultural, and recreational performance of the shoreline, rather than sacrifice the beauty of nature by constructing an imposing piece of hard infrastructure, such as a sea wall, that may or may not function effectively.

With the 1990s came a series of governmentally imposed beach nourishment/sand replenishment policies in the Netherlands in order to preserve these integral strips of land. It was determined, as stipulated by another project by de Graaff, “Beach Nourishment, Philosophy and Coastal Protection Policy” (1991), that “like many other structures (e.g. bridges, buildings), some coasts need maintenance. Regular maintenance of structures is never considered to be a waste of money, but rather as conservation of valuable investments.”\textsuperscript{150} This statement implies that the coastline is not only an environment but also a piece of infrastructure, not unlike a bridge or a building, or a dike for that matter. National authorities, like the Ministry of Transport Public Works, and Water Management, and the Directorate General for Public Works and Water Management, together with sub-national authorities, such as water boards, provincial and municipal authorities, and Provincial Consultative

\textsuperscript{149} de Graaff, “Probabilistic Design of Dunes; An Example from The Netherlands”, 498-99.
Bodies for the Coast, are responsible for the Netherlands’ evolving relationship with soft infrastructure and coastline management.

The first national policy set in place was Dynamic Preservation designed to counteract the structural recession of the dunes that was noticeable in the late 1980s.\textsuperscript{151} Dictated by the reference terms “rest strength”, “basal coast line”, and “coastal foundation”, this policy worked on multiple scales, dealing not only with the effect of erosion on the dunes, but on the immediate shoreline (the beach), and the shore face (the sea floor) [Figure 34]. The working of the Dynamic Preservation policy could be seen on the pre-2008 Delfland coast near Ter Heijde, a location that would soon be the site of a new, more sustainable, sand replenishment project. This particular strip of coastline had been protected by groynes constructed two centuries ago. The projected plan was to instigate a series of sand replenishments by extracting sand from nearby waters off the coast and transplanting it onto this five-kilometer section of shoreline. In 2005, a total of one million square meters of sand was dredged out of the North Sea, outside of the coastal foundation, to be dumped on a five-kilometer square area of shoreline.

This method, however, was not considered sustainable for a time period greater than ten years – taking into account a variety of scenarios resulting in sea-level rise, early studies showed that the coastal system as a whole “was losing more sediment (~12 Mm\textsuperscript{3} year) than was put in by Dynamic Preservation (~6 Mm\textsuperscript{3} year).\textsuperscript{152} The Dutch government proposed additional dredging and replenishment at deeper


\textsuperscript{152} Koningsveld et al., “Dunes”, 171.
water to compensate, however, at the expense of the local ocean ecology and environment. The system was not perfect by any means, but it was a necessary step in the progression towards a more ecological variation on the same theme.

In the early 2000s, as more information became available on the dangers of climate change for coastal regions, new data suggested that “design conditions for dunes and dikes were more severe than previously suspected. In particular, the wave periods for extreme conditions were found to be longer. This was expected to result in more energy reaching the coast under design conditions, causing sea defenses to suffer more during extreme events.”\textsuperscript{153} The Flood Defense Act of 1996 intended to make sure the strength of Holland’s dunes satisfied the legal safety limits. Coastal safety became a major focus in the vulnerable sections of Holland’s coastline, namely the Delfland Coast (near Ter Heijde) [Figure 35].

Aside from safety, the “spatial quality of the coastal zone and nature values are taken into account also,” amplifying the pre-existing duality between emergency infrastructure and nature to a national level.\textsuperscript{154} In response, three strengthening alternatives for the dunes were devised: raised dunes, seaward broadening, and extended seaward broadening [Figure 36]. They were evaluated not only for their functionality and sustainability, but also for their impacts on the surrounding natural environment. The seaward broadening technique was eventually chosen for its smooth transition from land to sea and its affordability. It would reduce the amount of replenishments necessary by a considerable amount, while maintaining the sanctity of the built environment. It was thought to increase “the safety level of the Delfland

\textsuperscript{153} Koningsveld et al., “Dunes”, 178.
\textsuperscript{154} Koningsveld et al., “Dunes”, 178.
coast while at the same time providing increased space for nature and more opportunities for recreation

The project

Holland’s Sand Motor, conceptualized in 2008 and implemented in 2011, achieved this previously elusive integration. It combined the most recent engineering technologies with a sense of environmental sustainability and spatial sensibility. In order to work towards a permanent solution to the ongoing problem of flooding and dune erosion, a wide range of technical and scientific expertise must be combined with a spatial form and planning logic. In addition to hydraulic engineering, extensive knowledge about specific ecosystems (fresh and salt water marine ecology), spatial planning, and “green” technology are necessary for an environmentally and economically sustainable response. In the past few decades the immediacy of climate change has additionally affected the area with dire projections of ever-rising sea levels and changing rainfall patterns. Furthermore, population growth has made the issue more pressing than ever. Evacuating dangerous flood zones is no longer an option. This simply dislocates or spreads the problems (necessary transportation leads to an increased carbon footprint, etc.) What is required is a solution, or series of solutions, that work together with urban planning to improve the living conditions along the coastline in an environmentally and fiscally sustainable way.

Though sand replenishment techniques are temporarily effective, they are a drain on financial resources as well as damaging to marine and coastal ecosystems.

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156 Ibid.
Sand must be dredged up from local offshore sites every five years then dumped onto the coastline to reinforce the barrier between the land and the sea. The operation consists of pumping sand from the ocean bed and depositing, pumping or rainbowing (spraying outward on location) the sand onto the site. For the most part, this system works to keep the seawater from flooding coastal land and neighborhoods. However, sand mining is notoriously damaging to its surrounding marine ecosystems as well as extremely costly because of the elaborate equipment required.

In response, the Rijkswaterstaat (or RWS, the Dutch Ministry of Infrastructure and the Environment, focusing on public works and water management and responsible for flood protection and prevention) together with the provincial authority of Zuid-Holland (South-Holland), local municipalities and water boards, NGOs and businesses developed a project in which “building with nature” was the guiding motto. Working with two local dredging companies, Van Oord and Boskalis, they built an experimental peninsula out of sand, or a sand motor (also referred to as the sand engine), on the coast near Ter Heijde. The idea was that by engineering a man-made peninsula that extends 1 km into the sea and is 2 km wide, nature would do the work of moving the sand across a longer stretch of shore, and the constant replenishment of sand would no longer be necessary. Instead, this sand motor would evolve over the following twenty years, eventually creating a sturdy dune barrier between Ter Heijde and the sea.

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Several possible designs for the sand engine were created and compared using morphodynamic modeling in order to approximate the morphological effects of each plan over a twenty- to fifty-year period [Figure 37]. This included estimates of the dune’s development and the impact of changing currents and weather on erosion and accretion of the coast. Many possible shapes for the sand motor were modeled, including detached islands, peninsulas, shore-attached bars, bells and hooks. The hook-shaped design was finally chosen based on its cost, safety, and ecological and recreational benefits. In the computer simulation of the hook-shaped peninsula after five, ten, and fifteen years, the top of the hook is elongated in the northerly direction, “pushed onshore, creating a shallow, sheltered area that is filled and emptied through a small channel. In time the elongated sand body is breached and a shallow plain is formed, ultimately leading to wide beaches. Sand is spread in both northern and southern directions.”\(^{159}\) In fact, the estimates conclude that approximately twice as much dune area as the reference situation (the replenishments without the sand motor) will be created over the next twenty years. Since the strength of a dune is directly proportional to its size, this projected model indicates that the sand engine will be significantly more effective than sand replenishment every five years in protecting the coastal area from flooding.\(^{160}\) [Figure 38]

After a two-year planning period, the project began in March 2011 and was fully implemented the following November. Using a trailing suction hopper dredger, sand was mined ten kilometers off the coast and deposited in place.\(^{161}\) To lessen the

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damage done by such large-scale mining, eco-dynamic processes were utilized in place of traditional methods. Traditionally, the sand mining pit is a flat seabed. This design hinders, if not completely halts, the redevelopment of marine habitats and biodiversity. The alternative approach, piloted in South Holland, creates a morphological gradient, or a “trough, slope and crest” texture in the seabed rather than a completely flat one, resulting in a bed similar to one that would be created naturally. This allows for greater biodiversity and regeneration of marine wildlife on the mining sites.\textsuperscript{162}

The initial deposit of sand was considerably greater than the every-five-year replenishments, but the overall amount would be less than what would normally be added over the next twenty years. Furthermore, by limiting the mining and depositing to only one deposit for the first twenty years, they could avoid disrupting the ocean beds and their ecosystems.\textsuperscript{163} Ecologist Dr. Martin Baptist from Imares Wageningen UR, an institute or research in strategic and applied marine ecology, believes that the sand engine, if it is successful, is a step in the right direction in terms of preserving marine ecology,

\begin{quote}
Although a sand engine has a major effect locally, the advantage is that it leaves the natural world in the wider environment undisturbed for 20 years. If on the other hand, you regularly replenish sand at numerous points along the coast, marine life doesn’t have time to recover. It takes between four to six years for the soil community to recover in places where sand is disrupted. Another disadvantage of sand replenishment done in the traditional way is that it makes the coast steeper. This reduces that habitat for marine life in shallow waters”\textsuperscript{164}
\end{quote}

Baptist further explains that if the sand moves at the slow and steady rate at which it is expected, the marine animals could adapt to the flow of sand originating at the sand engine and spreading along the shore.

Similarly, hydraulic engineers Timon Pekkeriet and Arjen Luijendijk of Deltares, the South-Holland institute for applied research in water, subsurface and infrastructure, posit that extreme weather should not affect the functioning of the sand motor: “The combined effect of small storms is much more important than that of a single heavy storm,” Pekkeriet says, followed by Luijendijk’s statement that “If you look at things over the longer term, the effects of all the storms average out.” In other words, the effect that acute extreme events have evens out over time. What is most crucial to the project is what these average conditions are.

There are, however, engineers who doubt the effectiveness of the sand motor. Dr. Ronald Waterman, a hydraulic engineer who has worked with the Provincial Council of Zuid-Holland argues that the goal of reinforcing the Dutch coastline should be to recreate a 17th century coastline (“by way of approximation”). This means a “flexible, dynamic, and hollow coastline that is in balance… In the long run, sand engines will achieve that, but it’s not what they’re designed for. They do not have the ideal shape for that purpose.” He does agree that the implementation of the sand motor will boost the ecological habitats as well as create a safer environment for humans, but he is undecided whether the mass production of sand motors along

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the Netherlands’ shoreline should completely replace the practice of frequent sand replenishment.

Over the next twenty years, engineers from Deltares and Imares will monitor this pilot sand motor. They will routinely maintain the base coastline and observe whether the sand is spreading across the coast as predicted. Since a side-effect of the sand motor in its first years could be a rise in the level of the groundwater, affecting the vegetation, the amount of extractable drinking water, and the quality of the water in the dune lake, the water will be sampled frequently using monitoring pipes. Similarly, ecological developments under water, on the beach, and in the shadow of the hook between the shoreline and the sand motor, will be carefully observed and documented. The hypothesis is that the sand motor will not only work efficiently as a flood barrier, but that it will also preserve local flora and fauna in a way that was impossible with sand replenishment [Figure 39].

The sand motor’s planned life-cycle distinguishes it from past implementations of soft infrastructure in Holland. While it serves the same purpose – to protect coastal areas from flooding and erosion – it becomes somewhat of a separate entity, a space with a built-in evolutionary process distinguished from the typical coastline. Similarly, its recreational role, something between a beach and a park, sets it aside from typical, recognizable leisure spaces. It, therefore, creates its own category as a technology responding to disasters. Though it does indeed (or is at least supposed to) protect the coastal environment, the sand motor’s function and method is not necessarily obvious, and years from now, when it is no longer brand new, it will become just another

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location, another destination, that provides for a designated range of activities. It will have a spatial identity unrelated to its function as a piece of infrastructure.

On the other hand, it is only projected to last for twenty years, not even a single generation, putting a definite cap on its lifespan. In some ways, it is simply a more robust temporary plan, only different from more frequent methods of sand replenishment by about a decade. As a longer-term solution, the sand motor is still a collection of temporary solutions framed by a series of overlapping processes with life cycles of their own: sand mining, dispersal, the rejuvenation of local marine and coastline ecologies, and finally the re-creation of a recreational space. In this respect, the sand motor exists in a purgatory between a culture obsessed with speed and its antithesis – a culture concerned with endurance. It neither serves as a quick fix nor a “forever” solution to the problem, but instead lies somewhere in the middle. How, then, can this planned, structured, and designed space be reconciled with today’s world?
AFTERWORD

Despite their enormous formal and conditional differences, I classify each of the preceding case studies as an example of neoclastic design. Taken at face value, my selections are nonsensical. To make a formal comparison would be a kind of “surreal experiment!” (Comparing a peninsula made of sand to jagged steel sheets bolted together between buildings to pod houses on tracks to a wooden dowel gallery installation?) That is, however, not my intention. What is relevant in the four projects discussed is the method of representation as it relates to the goal of the design. There are two reasons for this. The first is to provide a visual translation of the implications of unstable landscape conditions for the built environment. The second is to identify the limitations of conventional architectural practices and to devise a system by which future architects can amend them. The trouble is comprehension. How can these ideas be relayed clearly and directly? And is it possible to alter a system of thought that has been in place for centuries?

The answer is yes, but only if everyone can agree. Architects must agree with engineers and vice versa. Political authorities must agree with scientific authorities and vice versa. Societies must collectively agree that the natural environment is in fact undergoing drastic upheavals that have significant effects on our architectures. To resolve these disagreements is beyond the scope of my thesis. The individual architects and engineers that I have selected, however, each provide a framework that proposes an interdisciplinary approach to resolve some of these problems. Considered

169 Elijah Huge.
together they might provide the basis for a hybrid architecture-landscape-engineering-social practice, in other words an experiment in neoclastic practice.

Lateral Office does so through the use of geographical/geological and sociological information. The firm’s territorial research raises questions about developing urbanisms and social networks in chronically unstable landscapes. Their mode of visualizing and representing these conditions is contextualized by cartography – the redefining of information transmittable through maps. In such a way, they are able to communicate not only with other architects, but also with other sciences, gathering and applying information generally excluded from purely design practices. Clastic events are no longer disturbances – they become integral to the architecture.

Smout Allen’s practice takes a more historically situated approach to neoclastic design. With a similar-to-Lateral Office’s chronically mutating landscape as the precondition, their research attempts to extend the ideology introduced in early twentieth-century Modernism, a discourse steeped in the modality of equating the form of a structure to its function. The extension lies in the actually functioning of Smout Allen’s designs, both as drawings and as models. The architecture responds to the unpredictable coastline, it reacts and acts to environmental change. The breakage of land is not feared.

Lebbeus Woods reimagines a landscape and its architecture completely. Architecture is the earthquake, the earthquake is the architecture – the two are inseparable, one in the same. “Willful destruction exposes for all to see the nature and effects of these forces in a way that peace often disguises, or attempts to disguise
through its maintenance of the appearance of normalcy, which architects are trained to exalt.” The illusory stability of the natural and built environment is a result of our Cartesian (and Euclidean) legacy – that of the organization of solid static geometries on a rationalized grid. This illusion is our default, much to Woods’ chagrin. His designs, then, articulate a neoclastic order separate from traditional design legacies, one that deals with a dynamic geometry of constant ebb and flow.

The Sand Motor accomplishes the restructuring of a piece of infrastructure as a process rather than object or a product. There is no completed state, there is no single form it takes. It is functional and functioning, and its form reacts to these processes accordingly. This is possible primarily because its designers, the engineers, are not chained to a legacy of the production of shelters, of exoskeletons for humanity, that retain a proper shape in order for us to maintain our conventional relationships to spaces and places. Perhaps we must revise our expectations of architectures in the form of clastics.

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Lebbeus Woods. [http://lebbeuswoods.wordpress.com/],
Oxford English Dictionary, 2nd ed. s.v. “clastic
Sant'Elia, Antonio. “Manifesto of Futurist Architecture.”


http://www.lebbeuswoods.net/EARTHQUAKEtext.pdf.

http://lebbeuswoods.wordpress.com/2010/01/13/earthquake-again/


Figure 1. Fra Mauro, *Map of the World*, 1459.

Figure 2. Richard (of Haldingham or of Sleaford), *Hereford Cathedral Map*, c. 1285. http://gnomeonline.tumblr.com/page/2.


Figure 7. Torsten Hägerstrand, *Time-space diagram representing a human body in space through time*


Figure 16. Smout Allen, *Slab footings of demolished properties at Beach Road* from “Retreating Village” *Research Output 2*, 2005.

Figure 21. Smout Allen, Retreating Village—lexicon of architectural devices (2). Taken from “Research Output 2: The Retreating Village”, 2005.
Figure 22. Smout Allen, *Retreating Village*. Taken from “Research Output 2: The Retreating Village”, 2005.

Figure 23. Smout Allen, *Retreating Village*. 
Figure 24. Smout Allen, *Retreating Village.*

Figure 26. Marcel Duchamp, *Nude, Descending a Staircase, No. 2*, 1912. Philadelphia Museum of Art.  
Figure 27. Peter Cook, *Plug-In City*, 1964.
Figure 28. Le Corbusier, *Villa Savoye*, 1928.  
http://www.bc.edu/bc_org/avp/cas/fnart/Corbu.html

Figure 30. Lebbeus Woods, *Terrain*, 1999. MoMA.  
http://www.moma.org/collection/browse_results.php?criteria=O%3AAD%3AE%3A26299&page_number=5&template_id=1&sort_order=1

Figure 31. Lebbeus Woods, *Terrain*, 1999. MoMA.  
http://www.moma.org/collection/browse_results.php?criteria=O%3AAD%3AE%3A26299&page_number=5&template_id=1&sort_order=1
Figure 32. 1952 Flood/ Delta Works. 
[https://www.uwec.edu/jolhm/EH4/Coastal%20Erosion/Netherlands.html](https://www.uwec.edu/jolhm/EH4/Coastal%20Erosion/Netherlands.html)

Figure 33. Jan van de Graaf. Taken from “Probabilistic Design of Dunes; An Example from The Netherlands”. *Coastal Engineering*, 9 (1986) 479-500.
Figure 3. Schematic representation of the spatial scales associated with the coastal management concepts for dune strength (1 year), coastline preservation (5–10 years) and preservation of the Coastal Foundation (50–200 years) (Mulder et al., 2006).

Figure 34. M. van Koningsveld et al. Taken from “Dunes: The Netherlands Soft but Secure Sea Defences,” In Western Dredging Association, Session 2B: Beneficial Uses of Dredging, Proceedings and Presentations (2008).

Figure 10. Overview of identified weak links in the Dutch coastal flood defence system. The box indicates the location of the weak link of Delfland near Ter Heijde.

Figure 35. M. van Koningsveld et al. Taken from “Dunes: The Netherlands Soft but Secure Sea Defences,” In Western Dredging Association, Session 2B: Beneficial Uses of Dredging, Proceedings and Presentations (2008).

Figure 37. Mudler and Tonnon, “Sand Engine”, 2010.
Figure 38. Mudler and Tonnon, “Sand Engine”, 2010.

Figure 39. Rijkswaterstaat and the province of South Holland, Zandmotor: Delflandse Kust, “Photo of the sand motor taken September 4th, 2012.