FLUX
CREATING DYNAMIC SYSTEMS WITHIN THE BUILT ENVIRONMENT

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LANDSCAPE ARCHITECTURE

Flux: Creating Dynamic Systems Within the Built Environment

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ABSTRACT:

Flux: Creating Dynamic Systems Within the Built Environment

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In order to create landscapes able to adapt to the constantly shifting demands placed upon it by human and ecological processes, there is a need to incorporate the flux of these human and ecological processes into a physical and dynamic share of the built environment. This will require a perceptual shift in understanding this human/ecological relationship (on the part of both the designer and the user) as well as a change in the design/implementation/ management strategies currently employed by designers and planners. Instead of designing landscapes expected to be maintained to look and act in a static manner, the built environment needs to be designed with flux in mind.

This thesis' methodology begins with a position paper narrating the current body of knowledge regarding human experience and treatment of dynamic systems within the built environment, focusing specifically on the Outer Banks, a series of barrier islands located off the northern coast of North Carolina. It looks at this relationship through three languages: scientific (or geomorphologic), legislative and design. Next is a sampling of case studies aimed at emphasizing this dynamic relationship between humans and their surroundings. Finally, the design project incorporates the viewpoint developed in the position paper and applies it to a hypothetical site design located in Kitty Hawk, North Carolina. The site is currently slated for a Hilton hotel that will be finished by Spring 2006; however, the spirit of the design has the potential to be incorporated into many sites along the coast.

For those who carry salt air in their souls

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"For the artist communication with nature remains the most essential condition. The artist is human; himself nature; part of nature within natural space." – Paul Klee

"Architecture is the simplest means of articulating time and space, of modulating reality, of engendering dreams..."
– Ivan Chtchegov

"Speed and time have replaced the traditional idea of space. Movement connects the fragments in space in constantly changing configurations." – Adriaan Geuze

"The environment exists for the purpose of movement." – Lawrence Halprin

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Flux: 1) Constant or frequent change; fluctuation. 2) A flow or flowing.

Motion: 1) The act or process of changing position or place. 2) A meaningful or expressive change in the position of the body or a part of the body; a gesture.

Fig. 2.1: A nautilus shell cut in half to expose the inner chambers. (Source: Wikimedia Free Commons)

PART TWO:

Introduction

The complimentary/contradictory relationship between human and ecological change has been tumultuous and ever-shifting, creating a constant state of flux in our world. Accepting the fact that both human and ecological processes are different yet equally important, design should incorporate constantly shifting human and ecological processes into a dynamic manifestation within the built environment. This mindset requires a critical understanding of the human/ecological systems relationship: while humans certainly create their own flux (in both a psychological – or internal – sense as well as a sociological – or collective – sense), they are still an integral part of and dynamically connected to the environment, or "nature." We are not an opposing force to nature, but rather a subset in the universe, just as birds or fish are. Of course, we currently make a much larger impact on our environment than birds or fish, but are nonetheless just

another element in the complex, dynamic ecological systems surrounding, enveloping and directly interacting with us (Spirn 1998). Our path with nature converges and diverges depending upon our intentions and their outcomes, especially within the discipline of landscape architecture. While most landscape architects believe we have a call to be stewards of the environment (ASLA 2003), sometimes our designs can have negative consequences on both the environment as well as the users of the space. For example, groins, or jetties, were often constructed to help prevent beach erosion. Unfortunately, the outcome of the use of these man-made structures has been worse erosion further down the beach. The good intention was there, but since we did not fully understand the ecological processes at the time, there was a negative outcome (Pilkey 1998). We now have the ability to re-approach the situation of erosion along the shoreline with a more dynamic understanding of ecological flux as well as how we are intrinsically connected to it.

Over time, this theory of a seamless connection between ourselves and the environment has been investigated and explained in multiple disciplines, including philosophy (with authors like Gilles Deleuze and Paul Virilio), economics (such as Herman Daly's steady state economic theory), ecology (with Arne Naess' deep ecology movement), mathematics (through the work of Mandelbrot, Julia and Fibonacci, among others), and the hard sciences (especially quantum physics, the home of Chaos Theory). The results have been overwhelming, confusing and oftentimes frustrating, and leave many begging the question: where is my place in the universe? While design does not directly answer that question (then again, no discipline has yet to answer that question), design is grounded in the idea of creating a sense of place for people based on existing elements as well as ones we create.

This dynamic sense of place is often manifested in a static landscape design that is unable to respond to these changes in place either caused by human use or ecological systems. At times, human and ecological flux has been divergent, specifically when our intent is to destroy the environment. At other times, they converge (for example, during large disasters, such as December 2004's tsunami in the Indian Ocean). My goal is to get the flux of both human motion and ecological systems to mimic or respond to each other within the realm of design. They are still separate, but feed off of each other, almost dancing as a pair. Our built environment will always have a human signature; however, we can use lessons learned to create a syncopation of human and environmental flux in the landscape.

One way to find that syncopation is within the Fibonacci sequence or the Golden Ratio, both mathematical equations whose implications are ubiquitous in our environment, including our own bodies. Mirror images of each other, they are both equations that allow us to use a language we developed (that of mathematics) and apply it to a situation in order to better understand it (in this case, the world around us).

While the inside of a nautilus follows this sequence, the outside is much different and subject to a different set of forces not explained by the Fibonacci sequence. Beaten up by the tides, broken from the waves, deformed by malnutrition of the animal dwelling inside, a nautilus shell rarely exists in a state of near perfection. Just like us, it is subject

Fig. 2.2: The author's first attempt at a diagram of interaction between human and ecological motion. (source: S. Ridgely)

to the natural forces working upon it, forces which are constantly in flux. Because these ecological systems do not behave in a linear manner, humans have had a difficult time relating to it. We try to be rational animals, constantly attempting to relate to the world around us in a logical way. Unfortunately, it is becoming clearer and clearer that we cannot rely on a worldview of stability and linearity when dealing with our environment (France 2003).

A precursor of the Chaos Theory, known as the Butterfly Effect, explains in greater detail how our environment affects everything. Edward Lorenz published his paper on the effect in 1963. Originally tested within the realm of meteorology, the flapping of a butterfly's wings in Brazil affects tornadic weather patterns in Texas. His finds helped the scientific community explain how systems "such as the weather or the stock market are difficult to predict over any useful time range" (Wikipedia 2005). This is an important concept further developed in Chaos Theory, which, simply put, states that everything is connected to everything else, and therefore, each movement of an object has an effect on everything (Kellert 1993).

There are three dynamic ways to understand this human/ecological relationship of flux in the landscape: one involves looking at a moving human through a seemingly "fixed" (or at least maintained as such) built environment; second is looking at a "fixed" or "settled" human within the context of a dynamic environment, one that is constantly in flux; finally, there is the situation of the moving human experiencing an environment in flux. The final instance is not only the most commonly found in the landscape (Kronenburg 1995), but also the most often ignored (Johnson et. al. 2002).

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Fig. 2.3: A watercolor exploring the author's understanding of flux. The result of the exploration of flux via watercolor has yielded a greater understanding of a designer's ability to create while lacking complete control over the outcome. (source: S. Ridgely)

This incorporation of flux will allow for smarter development strategies that are able to accommodate the constantly shifting needs of both users and ecological systems. This investigation of flux is understood as the ever-changing impact of cycles from ecological systems and humans' reaction to these cycles. These two experiences are fundamentally different from each other and need to be respected in the landscape in their own ways, yet still come to a mutual understanding of each other. How can we mesh this understanding of flux (both on the part of nature as well as humans) to create a symbiotic relationship within the built environment? It is time for the built environment to support the ever-changing landscape of which we are a critical part, both as teacher and student.

This need to incorporate this kind of flux into the built environment has developed from the degradation of our environment thanks to our development patterns. We create stability as it is the easiest way to manage a system. If there is no change, there are fewer variables to worry about. However, if there is no change, there is no way for the built environment to adapt to the ecological processes present in the landscape. This is clearly evident in shoreline development, especially along a barrier island (which is the location of the design component of this thesis). In the event of a hurricane, the built environment is currently unable to adapt to those changes in the dynamic barrier island ecology. This includes shoreline migration, estuarine shifts, and the creation of inlets. Future shoreline development demands that we need to work with the ecological cycles, not against them, in order to create places that are able to accommodate a harmonious human/environmental relationship.

The increasing pressures of a society revolving around Information Technology (IT) has forced us to rethink our relationships between coworkers, friends, family, even within the greater framework of a global community. We now synthesize information into knowledge, which then affects our activities and endeavors, potentially in a more efficient manner. While efficiency is a valuable goal, these efficiencies have distilled many beautiful aspects of our lives, promoting streamlined experiences that lack user inputs and insights. The shortest path from home to work is the most common way to travel, and transportation patterns have developed around that concept. We should revel in our choices, offer alternatives within the network of paths to allow for varied and exploratory experiences (ones that we as designers may not even be aware of), encourage situations that will "revolutionize everyday life and release the ordinary citizen into a world of experiment, anarchy, and play" (Sadler 1998, p.69). We need to create landscapes that engage users and the surrounding ecological systems to reconnect the two seemingly disparate parts. This reconnection will yield not only a healthier, more ecologically sustainable landscape, but also recognition that users are as much a necessary activator of the built environment as the trees, pavers and paths. This will have a dramatic impact on the idea of a journey or sequence through a space. The journey can be individual, collective, and/or revelatory, and its sequence can be manipulated depending upon entrance, exit and path choices. This journey creates a motion sequence that will be informed by such authors/designers/artists as Lawrence Halprin, Bernard Tschumi, Bernard Lassus and James Corner.

We must use the flux of a site to incorporate those two seemingly disparate cycles and in a broader sense, redefine the accepted methods of designing the built environment. Instead of creating a program, how can designers activate a space through a "field of potential" (Schafer 2002)? Today, we have technology and knowledge that can help us create places able to adapt to our needs and wants as well as to the ecological cycles present in the area. Just as a Transformer toy is able to change and shift with the wants of a user, the built environment should incorporate enough flexibility to accommodate the flux of both humans and ecological processes over time.

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Site Design

A design project situated in Kitty Hawk, North Carolina, is used to demonstrate how to apply this new understanding of flux to the design process. It will deal with the creation of a hybrid public space with rental dwellings able to accommodate the constantly changing uses of both locals and visitors throughout the year while still supporting a dynamic coastal environment.

Elements include:

- Construction of a second set or layer of barrier islands along the coastline near the old pier site that is constructed using both human and ecological flux. Using littoral flow and longshore currents, this second layer of islands will eventually "renourish" the beachfront

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Fig. 2.4: Erosion along the Outer Banks, 1999 (*top*) and 2004 (*bottom*). (source: © Gary Braasch)

and become a part of Bodie Island's shoreline. However, the structural pilings placed to capture sand will remain as a testament to the narrative quality of the design.
- The original site (including new buildings, structures and infrastructure) will show how to adapt to a constantly shifting coastline by keeping the site reflexive to the dynamics of the ecological systems that shape the island. This flux present in both the transience of the human experience on the island as well as the flux of barrier island dynamics and will help shape the essence of the site over time.
- Connecting the existing site to the new islands through a structure that also acts as an historical marker and way to measure the changes occurring on both sides of the shoreline.

The purpose of the site design includes:

- Fulfill the need for more truly "public" beach space for both residents and visitors. Currently, there are access areas dotting the coastline where people are able to cross the dunes to the beach. However, there is often little (if any) parking, and many communities show disdain for beach visitors who are not dwelling in the adjacent oceanfront homes, condos and hotels that line the coast. There is a clear social hierarchy present along the more private areas of the beach that is likely to be broken down in a truly public space.
- Temporarily replenish the existing shoreline using an alternative method. While beach renourishment is the commonly accepted process to fight erosion issues along the coastline, it is currently used in a way that damages the environment (Pilkey 2004, Frankenberg 1995). Negatively impacting offshore fish habitats as well as shoreline feeding sites of birds, the pumped-in sand can have an off-putting odor often found offensive by some visitors to the beach. The new sand also has different physical characteristics than the existing sand, impacting the overall equilibrium of the site. Instead of pumping in sand from offshore, or even transporting it from other beaches, this site design will show how we can capture existing shifting sand from offshore currents and deposit them in a way that will benefit the shoreline. It is possible to use human and ecological flux in a way that benefits the environment as well as economic and personal interests. It also raises awareness of the constantly shifting shoreline and inevitable erosion issues we must accept if we are to use the land.
- Positively affect public perception of flux occurring all around us and bring our constantly shifting relationship with the environment to the forefront. This is a demonstration site for the potential of using flux as a design tool and guiding principle that affects all scales present within the site, from how buildings relate to their changing surroundings all the way down to infrastructure issues such as fresh water and electricity use in a changing landscape. Australian landscape architect Richard Weller notes:

> "Postmodern landscape architecture has done a boom trade in cleaning up after modern infrastructure as societies – in the first world at least – shift from primary industry to post-industrial, information societies. In common landscape practice, work is more often than not conducted in the infrastructural object, which is given priority over the field into which it is to be inserted. However, as any landscape architect knows, the landscape itself is a medium through which all ecological transactions must pass; it is the infrastructure of the future." (Waldheim 2002, p.12)

This thesis is, at its heart, an infrastructure project (albeit an ecological one). It is an attempt to resolve beach dynamics with development issues that are constantly plaguing our coastlines. Since engineers and planners have continued to use new infrastructure technologies in a way that is addressing the issue of shoreline erosion in the short-term but ignoring long-term effects (either due to cost, lack of manpower or otherwise), it is the role of our discipline to show how development and natural processes can interact in a symbiotic way. We have the capacity to understand ecological and societal issues and resolve them through both technical and creative means. What better discipline to approach ecological infrastructure issues than landscape architecture?

I believe our shoreline is something that everyone should have the opportunity to enjoy. Humans are part of the environment and should have access to places of beauty, whether it is "natural," man-made, or something in between. We should revel in the fresh ocean air, respect the constantly fluctuating shoreline and protect the habitat of flora and fauna. But we must do that with an understanding of how to minimize our development impacts and accept the ecological flux present on these very fussy strips of sand.

While the damage to the environment might not be as readily apparent as a coal mine site, the detrimental impacts can clearly be seen through the constant need to replenish the shoreline through a practice the US Army Corps of Engineers has deemed "beach renourishment." This is occurring at an even faster rate partly because of our development demands as well as channel dredging for navigational needs in water bodies. The other major cause of beach erosion is due to rising sea levels. While there is still no conclusion on why global warming is occurring and who/what is to blame (the environment or humans), the fact is that it is happening and is having a major effect on barrier islands. The rise in sea level is forcing North Carolina's northernmost barrier islands (known as the Outer Banks) to migrate landward in a counter-attempt to stay above water (Frankenberg 1995). This is an inevitable process; instead of trying to counter the dynamic processes, we must begin to accept this flux and incorporate its inevitability into our understanding of barrier islands. At times, this may be an exciting opportunity to understand how dynamic our environment is; at other times, it is a sad thought that future generations might not be able to experience the same joy the Outer

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Banks brings me because of its foreseeable dissipation. Regardless of my personal attachment to this place, I understand that the narrative of this place involves – and revolves around – flux.

PART THREE:

Literature Review

Literature Review Question

What is currently being done to accommodate the flux of human and environmental systems within the built environment?

Defining the problem: static landscapes vs. nomadic landscapes

"A foolish consistency is the hobgoblin of little minds." – Ralph Waldo Emerson

Currently, most built landscapes are designed to be and viewed as a static entity that exists within a given time period (Caquelin 2004). The average lifespan of an urban landscape is usually around 25 years, oftentimes due to poor design details (Kirkwood 1999). While designers, planners, government officials and others involved in the

construction process benefit from this, the users as well as the environment are hurt. A static monoculture leads us to believe that there is only one right answer to a problem, design or otherwise. To continue this mindset, it would therefore be logical to believe that there is one store that will supply you with all the commodities you will ever need. There is one species of tree that will minimize the maintenance required on the site.

This attitude is defining how those with a traditional development approach projects such as subdivisions and shopping centers. The implied life cycle is static and homogeneous in these situations, but there are still signs that change over time does occur: the subdivisions trees grow and change through the seasons; families move into and out of the neighborhood; stores in shopping centers move in and out; empty strip malls can be converted into other uses.

The ultimate underlying principles (or metaphysics) of society embraces an understanding that humans are part of the ever-changing natural cycle (Spirn 1998). This life cycle can be broken down into many different pieces: vegetation, water, air, light, geological conditions, etc. Because there are so many cycles occurring at different amplitudes and wavelengths, it is critical that our built environments take this into consideration when developing a site. If this consideration does not occur, we are unable to fully participate in the dialogue of the experience of a place.

As the population continues to grow and develop exponentially, there is a price being paid by our environmental and social structures (Daly 1993). The built environment has the opportunity to alleviate that by creating dynamic, flexible spaces that are able to adapt to the needs of the present as well as the future.

Three concepts define the framework of this thesis: they are narrative, mobility and reflexivity. These three points are here to emphasize the fact that design is an ongoing collaboration between humans and the environment of which we are an integral piece.

PART THREE – Literature Review

Narrative

Over time, a landscape accumulates a sequence of events. This ongoing plot creates a series of collective and individual interactions between humans and the environment. Narrative is present in the geomorphology of a landscape, the materials selected for the built environment, the flora and fauna that have lived on the land over time and the humans who have interacted with the site. Although narrative can be read, it can also be experienced as a revelation in the built environment. The most critical component of narrative is time. As landscape architects Matthew Potteiger and Jamie Purinton note in their 1998 book, Landscape Narratives:

> "[Narratives] intersect with sites, accumulate as layers of history, organize sequences, and inhere in the materials and processes of the landscape. Landscape not only locates or serves as background setting for stories, but is itself a changing, eventful figure and process that engenders stories. In turn, every narrative, even the most abstract, allegorical, or personal, plays a critical role in making places." (p.5-6)

Mobility

Movement within space is a critical component in understanding and creating a framework for narrative. A well-designed space allows for both planned and unplanned maneuverability in order to better understand the site itself. Better yet, the elements creating the framework should be mobile (North, South, East, West, Up, Down…) to accommodate changes in the environment. As Halprin notes:

> "Environments change their qualities with the variation of speeds they generate. As we move through them, they move around us. On our freeways and rapid-transit systems, the variation in environmental speed becomes clearer when we observe the contrast in the high-speed foreground and the low-speed background. Sitting at the window of a train, for instance, one gets a certain feeling from passing a series of verticals, a feeling very much determined by their number and the distance between them. Passing piers that are quite close to each other, surprise the passenger again and again with a sense of their nearness. The change of speed is made more apparent in this way, so that, on a route, a pattern of acceleration is soon established. We have all observed telephone poles and track markers alongside a railroad track rush by at great apparent speed while objects on the horizon seem to move hardly at all. As another example, an automobile can be defined as an instrument for moving you to the city, but it can also be defined as a means of moving the city to you. In terms of the individual whose only true continuity is his own awareness, it can be said, with all psychological justice, that the environment moves. This is an essential basis for motation." (p.71)

Reflexivity

This deals with the ability of the built environment to adjust over time according to the needs/wants of both users and the environment. This involves the temporality of space and its shifting edges. It is clearly evident on a barrier island; that is, if we were designing sites, buildings and master plans with the ability to absorb and react to a constantly shifting island, we could put more money into designing reflexive spaces and less into beach renourishment. Architect Neil Spiller (an architecture professor at The Bartlett School of the Built Environment at The University College of London (UCL) who is at the forefront of a reflexive architecture that exists more in cyberspace than in our current understanding of the built environment) has spearheaded the movement towards a more reflexive architecture, and notes in his 2002 book Reflexive Architecture that:

> "Reflexive architectures can link all matter of phenomena. This notion creates a new contexturalism as any reflexive architecture's imperavive is solidly integrated into a 'site' of ecologies, whether natural or artificial or a hybrid of the two (it's getting more and more difficult to tell them apart nowadays). A 'site' might be a set of sites – feeding off each other. The potential of such spatial tapestries has impact on the ecology, the sustainability, the fun and the ontology of architecture. There is an infinite lexicon of spatial triggers, ratchets, siphons and filters that can be used to make architecture more reactive." (Spiller 2002, p. 5)

Narrative, mobility and reflexivity can be combined and understood as flux. Recently, the concept of flux has been seen extensively in advertising. Hewlett-Packard and Lowe's currently have ads on television encouraging consumers to adapt to change, remain flexible and continue to purchase new products. In fact, the field of product design thrives on the fact that our needs and wants are constantly changing – and that is precisely why we need to purchase a brand new widget every year.

The built environment, on the other hand, is something humans see as reliably fixed in place (Spirn 1998, Lippard 1997, Caquelin 2004). We create monuments to remember the past, visit the same vacation spot year after year for family reunions, and head to New York City to see the Flatiron Building on 5th and Broadway that has been there since the 1902. Some works of architecture and landscape architecture are timeless and a critical part of our cultural vernacular, such as Olmsted's Central Park. However, there are other opportunities within the built environment that can respond to the dynamic societal and environmental flux. Neighborhoods change, trends change, residents change, paths change, the global climate changes. Instead of designing for obsolescence in 30 years, why not create a design that is able to adapt to both short-term and long-term flux, potentially for a longer period of time?

While our legislation has stated that a static shoreline is in the best economic interests of coastal towns (Dare County CAMA 2003), they have somewhat ignored the social impacts of the legislation. Titus et. al. (1991) noted in their article "The Cost of Holding Back the Sea" that:

> "The fact that it may be cost-effective to protect property does not necessarily imply that it would be in the interest of society to do so. We must also consider the loss of natural shorelines and coastal wetlands that would result. Our results suggest that up to a point, the objectives of protecting wetlands and coastal property may be compatible. Clearly, abandoning densely developed areas goes beyond that point; it would increase the areas of surviving wetlands by only 5 to 10%, but at great cost. By contrast, limiting coastal protection to areas that are already densely developed (and allowing currently undeveloped areas to flood) would increase the area of surviving coastal [property and] wetlands by 40 to 100%, depending on how much the sea rises." (p. 197)

A static stability is not sustainable. What is constant is the idea that everything is always changing…this idea of a "constant," static state is actually an illusion. The reality is that nothing is constant, perhaps not even our current understanding of reality (DeCerteau 1984). That which is constant is in flux, but flux is inherently inconsistent. In A Sense of Place, A Sense of Time, J.B. Jackson (1994) explained that those who were living closer to the land were able to sense these climatic shifts and adjusted their dwelling habits accordingly:

> "This freedom to move from place to place and use space as you saw fit, determined – and still determines – much of the planning and architectural design throughout the West…even the dwelling was thought of in temporary terms." (p.155)

Jackson hits upon a critical point. Those cultures that tend to be nomadic have found a way to shift in a somewhat harmonious way with their surroundings, while those who settle in-place tend to perceive the landscape in a more static manner and treat it as such. This can be seen in a scale as small as a plant's reaction to the shifting light source of the sun (known as phototropism) all the way up to human societies still found on our planet today.

The Bedouin tribes, mainly located in the desert areas of the Middle East, have survived by embracing a nomadic lifestyle for thousands of years – although this lifestyle is quickly being threatened by the Saudi government who is offering affordable housing, free schooling and access to health clinics in return for the Bedu settling in government-run towns (Webster 2005). Before they were placed on reservations by the U.S. government, Native Americans used a more nomadic lifestyle as well as a respect for the carrying capacity of the land to sustain their families (McDonald 1996). The concept of personal property or land ownership was born outside of these cultures and took hold in Europe. It eventually was brought to the United States, and its basic tenets clashed with the values of the Native Americans who had no concept of land ownership; in their mind, the land belonged equally to everyone, and everyone had an obligation to protect it (McDonald 1996). A 2003-04 traveling design exhibit sponsored by Vitra focused on these issues of cultural mobility as well as Western culture's disdain of flux. The exhibit eloquently notes:

> "As biology teaches us, in the final analysis, mobility, change and adaptability are amongst the prerequisites of life itself. Consequently, the fact that this exhibition focuses our attention on the kind of cultures that have a different relationship with nature from our own is particularly exciting. But a smooth transition from static to moving elements is not only in the nature of life and forms part of the life of close-to-nature peoples, it is also in the nature of the housing "familiar" to us. Windows and doors as zones of movement between indoors and outdoors and between individual rooms testify to this. And after all, our movements within the house and out of it are mirrored when we use our cars as the latter's satellites. All forms of nomadic existence have their settled moments just as all settled existence has its nomadic elements and of course living somewhere also includes arriving and being there, a protective and preserving function, just as a house and its furnishings are themselves something to protect and preserve. This is why (in the case of fleeing or homelessness) a mobile, itinerant way of living can indeed be the result of endangerment. In our society, however, the values that defined property on the one hand and free space, the freedom for personal experience on the other, have now changed. It is probably for this reason that the most promising way we can make the places we live more flexible is to develop the range of experiences they offer us. Extended data transmission functions can make just as much of a contribution to this as flexible room division and furnishing items." (Vitra 2005)

In the age of globalization, there is a need to make sure that all of this change, adaptability and reflexivity is place-specific and still breathes the same air as the site it is a part of. Just as in nomadic cultures, these changes are triggered by the environment of which we are an integral part. Influenced by regionalism, the cultural, geographical and climactic aspects of place should be revealed throughout the built environment (Jackson 1994).

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There has been a great desire to reconnect the relationship between humans and their ecological surroundings through design (Spirn 1998, France 2003). This symbiosis is at the heart of the Deep Ecology movement and is bolstered by many theories of sustainable design (Naess 1989). Deep Ecology, a theory first initiated in the early 1970's by Norwegian philosopher Arne Naess, explains that humans must use the carrying capacity of the planet to determine how to live their lives, not economic situations (Naess 1993). Naess goes on further to explain that the human population is subject to the same restrictions as any other species population; even though we have technology that allows us to genetically modify crops to make them produce a higher yield, or helps us create infrastructure able to treat higher quantities of waste, we must respect the limitations of our environment. This long-term approach involves the analysis and eventual shift of human systems to incorporate the preservation of diversity within complex natural systems, not just superficially touting technology as the answer to our environmental woes (Drengson 1995). Architect William McDonough's Hannover Principles (1992, p.10-11) are at the heart of both the Deep Ecology and sustainability movements. It outlines nine values to incorporate into design and planning:

1) Insist on the right of humanity and nature to co-exist in a healthy, supportive, diverse and sustainable condition.
2) Recognize interdependence. The elements of human design interact with and depend upon the natural world, with broad and diverse implications at every scale. Expand design considerations to recognize even distant effects.
3) Respect relationships between spirit and matter. Consider all aspects of human settlement, including community, dwelling, industry and trade, in terms of existing and evolving connections between spiritual and material consciousness.
4) Accept responsibility for the consequences of design decisions upon human well-being, the viability of natural systems and their right to co-exist.
5) Create safe objects of long-term value. Do not burden future generations with requirements for maintenance or vigilant administration of potential dangers due to the careless creation of products, processes or standards.
6) Eliminate the concept of waste. Evaluate and optimize the full life cycle of products and processes to approach the state of natural systems, in which there is no waste.
7) Rely on natural energy flows. Human designs should, like the living world, derive their creative force from perpetual solar income. Incorporate this energy efficiently and safely for responsible use.
8) Understand the limitations of design. No human creation lasts forever, and design does not solve all problems. Those who create and plan should practice humility in the face of nature. Treat nature as a model and mentor, not as an inconvenience to be evaded or controlled.
9) Seek constant improvement by the sharing of knowledge. Encourage direct and open communication between colleagues, patrons, manufacturers and users to link long-term sustainable considerations with ethical responsibility and to reestablish the integral relationship between natural processes and human activity.

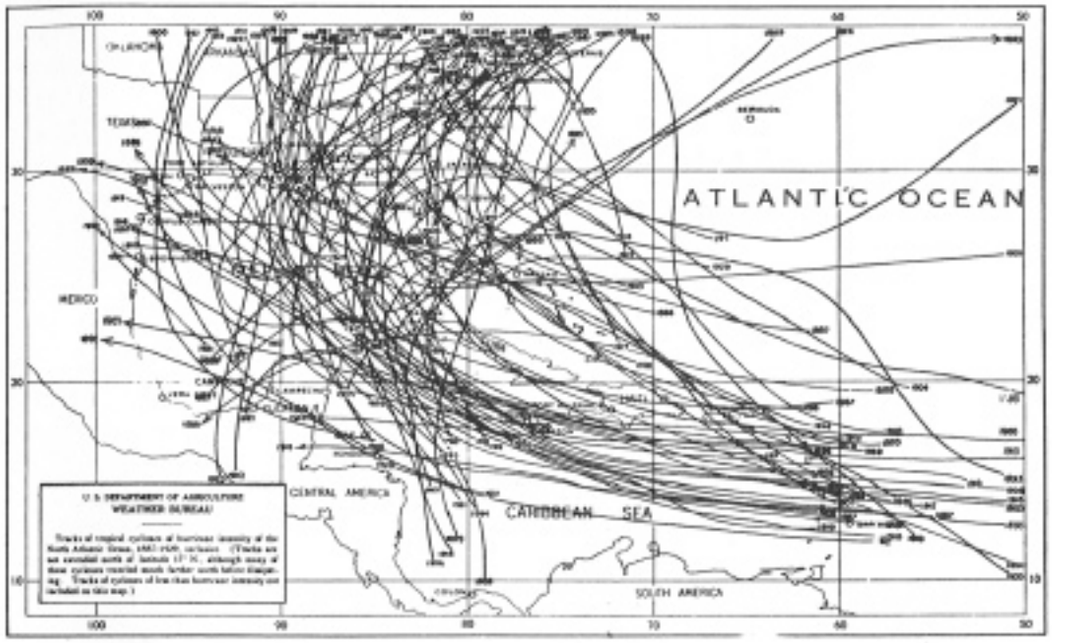

Fig. 3.1: Score of tropical hurricanes in the North Atlantic during the period of 1887-1929 – a record of ecological occurrences over time. The patterns of the score can be a guide for the future. (source: RSVP Cycles, by Lawrence Halprin. New York: George Braziller, Inc.)

Overall, McDonough encourages designing with an understanding of the dynamic relationship between ourselves and the environment with his Hannover Principles (these principles are further elaborated in McDonough's (2002) Cradle to Cradle). The idea of sustainability as described by McDonough does not have much of a history within the confines of the Western built environment, but is more of a mindset understood by those native peoples who occupied the land prior to the colonialization of America. For example, in an area such as the Outer Banks, Native Americans did not build on the oceanfront because it was too dangerous. Instead, the more wooded sound side is where small settlements occurred (Kaufman 1983).

Barrier islands are a clear example of a struggle for power between humans and the environment. The constantly shifting island dynamics along with the desire to maximize the amount of development for economic gain act as opposing forces. The idea of a carrying capacity is largely ignored by developers as well as those who have regulatory power, such as the US Army Corps of Engineers (Kaufman 1983). On the other hand, there are experts such as Dr. Orrin Pilkey (a professor of geology at Duke University) who believe that absolutely no development should be allowed on any of the islands. While taking these two opposing, extreme viewpoints into consideration, there is room for a middle ground that encompasses a fundamental shift in our relationship with the environment. But this relationship requires our input to be made in a way that respects the dynamic flux present within the ecological systems we are a part of. There is room for development, but it will require a different mindset – one that must acknowledge that naturally-occurring shifts in the landscape are a reality as well as a design tool we can work with and include in our planning and design of the built environment. We all

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deserve to have access to these whimsical strips of sand, but must do so with a great respect for the environmental flux occurring around and with us for three reasons:

1) While we can control smaller coastline movement in the short-term (with somewhat mixed success), no one has been able to solve the issue of long-term drift towards the mainland. The money being spent on keeping the island in a somewhat static state could instead be invested in research to find out the carrying capacity of the island and how to sustainably coexist with the existing dynamic ecological flux.

2) If landscape architects want to uphold the principles of sustainability, we must allow the dynamic processes of the barrier island to flow. Our current development habits on barrier islands break almost all of the Hannover Principles. As chaos theory suggests, one decision, one movement, one action has an impact on countless other parts of the system. If we want to recreate and reside on barrier islands, it is in our best interest to allow the dynamic equilibrium of the island to determine its own shape and movement and build around it.

3) Prolonging the inevitable will only create a false sense of security. If there is a large economic investment made due to this false sense of security, and the island eventually disintegrates to the point where it is no longer habitable, there could potentially be a huge economic and (even worse) human loss.

This project may be thought of as an equation with two variables: ecological dynamics and human processes (that are oftentimes a reaction to the ecological dynamics). I will set one of the variables (barrier island ecology) in order to explore the other. This other side – that of human processes, or flux – is composed of multiple influences: technology, perception of reality, personal habits, history, relationships…it is life on a day-to-day basis (de Certeau 2002). In the case of a barrier island, we choose to interact with the ecological flux on multiple levels: personal, familial, community, region, state, federal, international, galactic, etc. Because this thesis explores how we relate through development habits, it is evident to see the human/ecological relationship by looking at the issue of human processes as dictated and directed by our state and federal legislation. Constantly amended, our laws dictate how we relate to each other and to the environment (both built and "natural").

This is in no way saying that ecological processes are "fixed"; rather, it is logical to base this ecological variable on historical data of both the geomorphology of North Carolina's barrier islands and the devastating effects of hurricanes and nor'easters of all different sizes, paths and occurring at all times of the year.

At the same time, though, I openly believe ecology to be a system full of flux and create my design (and its implications) around the idea of ecological processes being dynamic, certainly not fixed or static. As noted in landscape architecture professor James Corner and photographer Alex MacLean's Taking Measures Across the American Landscape (1996):

> "[Thomas] Jefferson [found] that it is the quantitative and analytical aspects of measure that enable 'the most wholesome part of comfortable living'…with neither waste or excess, a harmonious relationship among a man [and] the world…might be said to have been structured through the rigors of modern measure." (p. 30)

Instead of using historical data and geological research to paint a fixed, static future, use the information to create an understanding of ecological processes upon which one can plan a dynamic future, one that is reflexive to the changing dynamics of the environment we are an integral part of. This knowledge of ecological flux can then influence our relationship with the environment and be disseminated through our laws, down through regional and county planning and finally to our site designs. First, though, we must understand the ecological processes we are dealing with.

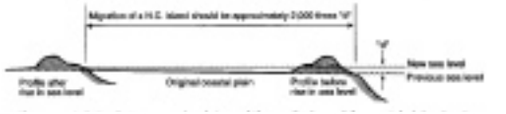

Fig 3.2: Relation between sea-level rise and the gentle slope of the coastal plain, showing why a rise of one to one-and-a-half feet per century (the rate in North Carolina) is very significant. The average slope of the lower coastal plain here is 1':2000', which means that, in theory at least, for every one foot of sea-level rise there should be two thousand feet of shoreline retreat. (source: Pilkey, Rice and Neal's How to Read a North Carolina Beach. UNC Press)

Ecological processes: the geomorphology of a barrier island

North Carolina is home to a unique chain of barrier islands. The upper portion, known as the Outer Banks, acts as a protective barrier between the ocean and the estuaries of the Currituck, Albemarle and Pamlico Sounds. Over thousands of years, the islands have morphed from the edge of the mainland to a separate entity, assuming unique ecological characteristics. There are constant changes along the island shore; an ebb and flow dominates the short-term perception of time. But looking at the island from the aspect of geological time (of which we are currently in the late Holocene period), there is a slow migration of the island back towards the present-day mainland.

This perception of change (or flux) over time has led many to believe that these brief changes usually right themselves back towards a stasis, or status quo. In actuality, though, this couldn't be further from the truth. Each small disruption is part of a greater flux, impacting not only the oceanfront of the islands, but the estuaries behind as well. The cause of these changes (minute and greater) can be broken down into 5 categories: water/currents/tidal, wind/Aeolian, soils/sand, vegetation, and human development. It is critical to understand these processes both individually and as an interdependent system. These five elements help create a sort of dynamic, or equilibrium, along the shoreline.

Fig. 3.4: Shifting sands reveal a shipwreck in Kill Devil Hills. (source: S. Ridgely)

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Fig. 3.5: The constantly shifting dynamics of Jockey's Ridge. (source: Ray Matthews, courtesy of The Friends of Jockey's Ridge State Park)

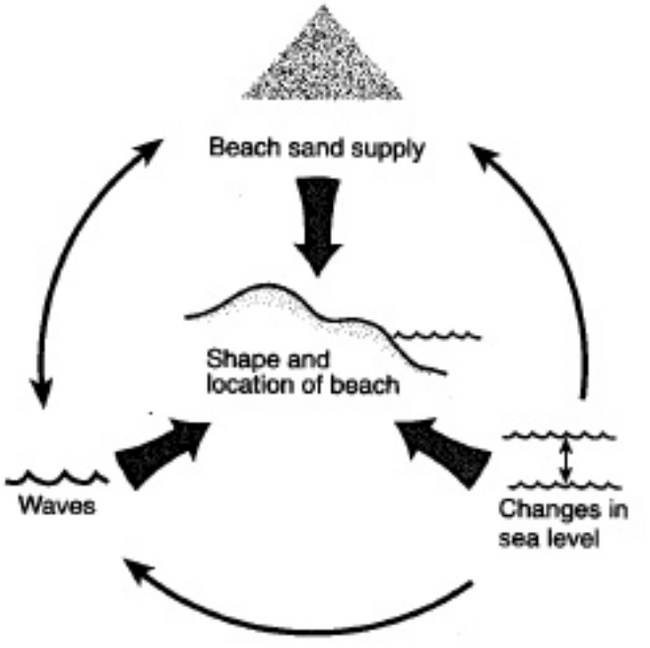


Fig. 3.3: The dynamic equilibrium of beaches: when one factor changes, the others adjust accordingly. This is why beaches, if left to their own resources, are very durable. (source: Orrin Pilkey's How to Read a North Carolina Beach. UNC Press)

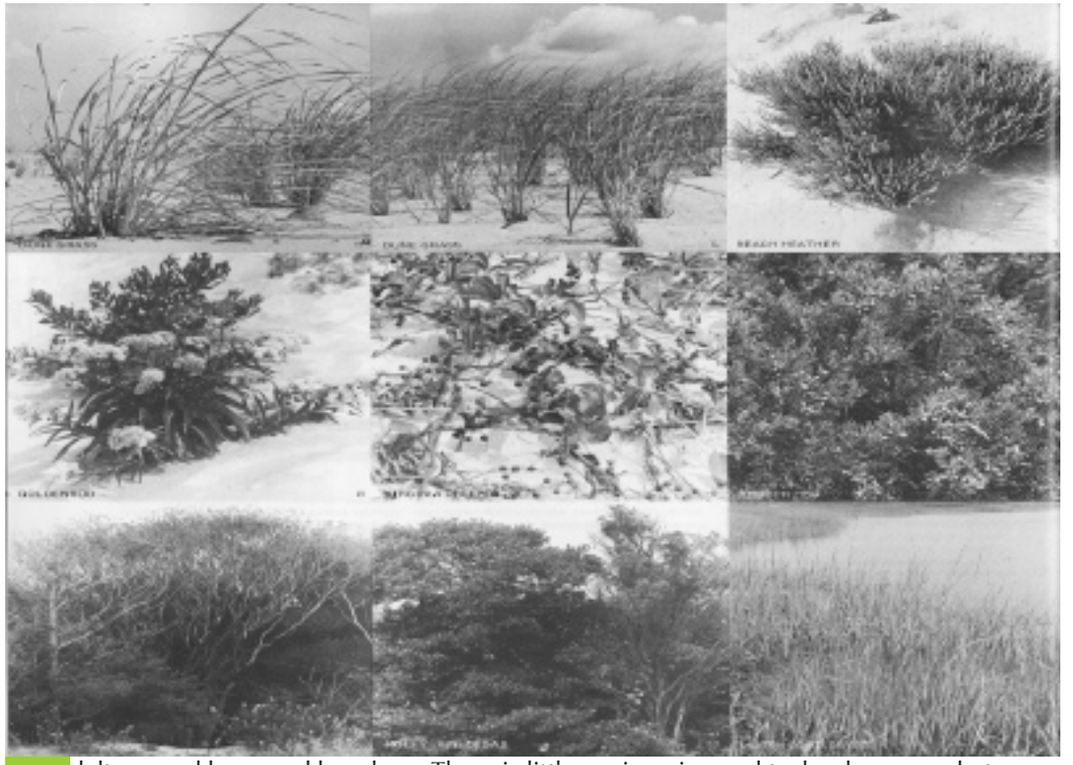
A United States Geological Survey's (USGS) report entitled "Coasts in Crisis" describes the importance of understanding coastal processes:

> "Taken individually, each natural process of coastal transport is complex; taken collectively, they create an extraordinarily intricate system that attempts to achieve a dynamic balance." (Williams 1997, p.15)

We must understand that barrier islands are created by a complex, dynamic system of elements interacting with each other. By altering one of these elements, there will be a reaction on the part of the other elements that in turn alters the relationship. While the beach is constantly trying to achieve some sort of equilibrium, the process of trying to achieve that equilibrium is extremely dynamic. At the same time, we are putting serious pressure on these areas that makes it even more difficult for this equilibrium to occur. With half of the United States population living within 75 kilometers of a coast, and more people continually moving to these areas (Williams 1997), it is critical for us to understand the elements that make up the system so that we may be able to understand how our habits can remain neutral – or even help, and not harm – that dynamic.

Water/Currents/Tidal

Along the North Carolina coast, littoral flow and longshore currents are responsible for the flow of both water and sand (which head from north to south) (Frankenberg 1995). The currents deposit sand as well as take it away, creating shoals, inlets, tidal



(opposite) Fig. 3.6: Examples of some dune stabilizing vegetation. (source: Ian McHarg's Design with Nature. John Wiley and Sons)

deltas, sand bars, and beaches. There is little engineering and technology can do to prevent currents from occurring, but we are able to manipulate the "damage" they do by dredging sand to create constant channels for water navigation and renourishing beaches (Williams 1997). Water currents as well as overall water height are critical factors in determining the shape of a barrier island (McHarg 1992).

Soils/Sand

The other main determining factor in the creation and shape of an island is the soil structure. In North Carolina, all of the beaches are made of sand, although each beach has a particulate size due to the typical wave height present as well as the size of the material (usually quartz) available (Pilkey 2004). Those islands with a plentiful supply of sand as well as material to make sand offshore (including along the continental shelf) are able to replenish much easier than islands with a shallow sand supply (Frankenberg 1995). As sea levels rise, the ability of the island to stay above the water level determines its continued existence or ultimate demise. Islands with a smaller particulate tend to be flatter (because of the sand's porosity, or the amount of space that can be occupied by water) while those with larger grains tend to have a steeper slope (Pilkey 2004).

Wind/Aeolian

Wind (or aeolian movement) is responsible for the creation of dunes on an island (McHarg 1992). As is clearly evident during large storms, dunes help to protect island interiors. Because wind tends to pick up lighter particles of sand, the composition of dunes is made up of much smaller particulate matter as well as things easily carried by the wind like twigs and detritus (Frankenberg 1995). Dunes can also be shifted slowly by either onshore or coastal winds. Much to the chagrin of local planners and engineers, the dunes will swallow up anything in their way, from putt-putt courses to roads. Jockey's Ridge, the tallest active dunes on the east coast, are located in Kill Devil Hills and have rolled through much of the development built adjacent to them. These dunes are shifting at such a fast rate because there is no vegetation present to prevent the winds from picking up the particles of sand (The Friends of Jockey's Ridge State Park 2004).

Vegetation

As quickly as wind can create dunes, it can also take them away if not properly stabilized by vegetation. Plants such as American beach grass (Ammophila breviligulata) are most common along the oceanfront dunes in the Outer Banks, with sea oats (Uniola paniculata) commonly found further south of Cape Hatteras (Pilkey 2004). Vegetation further inland on the island also helps to absorb the energy created from storms and stabilize the island. As development strips away more of the natural island vegetation (such as wax myrtle, Myrica cerifera, live oak, Quercus virginiana and Yaupon holly, Ilex vomitoria), the island's dynamic equilibrium is negatively affected (Frankenberg 1995).

Over time, these five elements have helped create a unique environment off the coast of North Carolina. Although they have existed separate from the mainland for thousands of years, the islands are shifting back towards the mainland to combat the rising sea levels (Frankenberg 1995). There are also irregular erosion problems due to our manipulation of the beach equilibrium. If we begin to change too many of the variables without allowing the others to shift accordingly, we throw the island's ability to replenish itself (Pilkey 1998).

Although there is considerable dispute over how to predict exactly what will occur along a barrier island, Dirk Frankenberg, a professor of marine sciences and former director of the Marine Sciences Program at the University of North Carolina, believes there is only consensus in his field (as well as other professions dealing with barrier island issues) about three things:

- "beach sands will move;

- beach erosion will be more common than beach accretion when sea level is rising;
- sand will be transported along the shore in a direction controlled in the long term (weeks to years) by prevailing winds and in the short term (hours to weeks) by the wind and waves occurring at the time." (Frankenberg 1995, p. 15)

Beyond that, no one can agree. Frankenberg goes on to explain that there are two main arguments present within the subject of barrier island migration: one is that they generally move in a predictable manner and that we can use modeling strategies and development techniques to preserve stability (as seen in much of the work done by the Army Corps of Engineers); the other extreme is that barrier islands, the Outer Banks in particular, are fluctuating so much that we can not use modeling to predict movement and should not even inhabit them, as represented by much of the work of Orrin Pilkey. He notes:

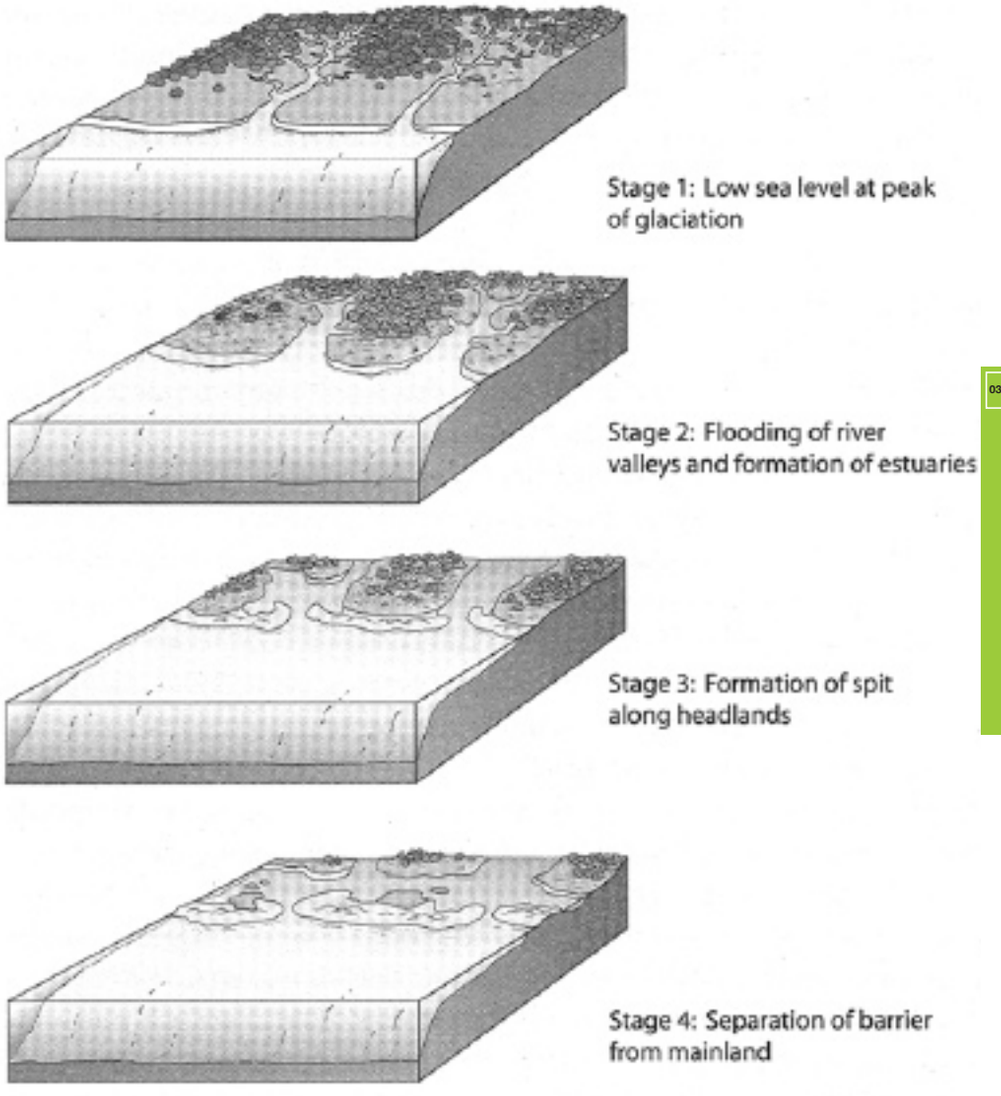
"As at numerous other artificially maintained Atlantic Coast inlets, once a navigable, maintained channel has been established, there begins a progression of ever increasing engineering stabilization that entails widening and deepening and, eventually, jettying. Channel deepening and jettying leads to erosion of adjacent shorelines, leading in turn to seawall construction or continual and costly replenishment." (Pilkey and Dixon 1996, p. 194)

While prohibiting the habitation of the islands and coastal lowlands is an extreme idea, other scientists, engineers, ecologists and activists agree with Pilkey. A 1991 journal article published by environmental scientist James Titus and others within the fields of geography, geology, civil engineering, economics and planning in Coastal Management Magazine concurs with this strategy:

> "Although the most common engineering solution for protecting the ocean coast (pumping sand) would allow us to keep our beaches, levees and bulkheads along sheltered waters would gradually eliminate most of the nation's wetland shorelines. To ensure the long-term survival of coastal wetlands, federal and state environmental agencies should begin to lay the groundwork for a gradual abandonment of coastal lowlands as sea level rises." (Titus et. al. 1991, p.174)

However, many people have already invested time, money and memories into living in these places. People are now part of the ongoing narrative of the site, and many of the properties now destroyed by the climactic fluctuations and redeveloped serve as a palimpsest for the future narrative. Most who permanently dwell or vacation on the Outer Banks do so even though they know it is a risk. Despite Dr. Pilkey's call to abandon the coastlines, there is a way for humans to live in these areas while shifting their development, consumption and waste habits in order to tread more lightly upon the land, and it begins with a development and design strategy rooted in McDonough's Hannover Principles. Synthesized, these nine principles encourage us to have a direct relationship with the land, not one that only allows us to experience the area from a distance (if at all). However, this direct relationship comes with a great responsibility, one that we are currently not fulfilling. Our responsibility is to "treat nature as a model

Fig. 3.7: The sequence of barrier island formation. Barrier islands are products of rising sea levels. (source: Orrin Pilkey's How to Read a North Carolina Beach. UNC Press)



PART THREE – Literature Review

and mentor, not as an inconvenience to be evaded or controlled" (McDonough 1992, p.11). If we were to follow Dr. Pilkey's wishes, this responsible, symbiotic relationship would not even exist. While it is certainly a good idea to heed Pilkey's warnings regarding the "restless ribbons of sand" (the subtitle of his 1998 book), we should use all of the information he has collected to update laws, amend personal property rights, restructure zoning ordinances, and create master plans and site designs that develop a direct, responsible relationship that reflexively reacts to this dynamic ecotone.

In order to better understand the effects of our present relationship with the shoreline, it is important to review current legislation and procedures in effect at the Federal, and state levels of government. As landscape architects, we are bending nature to conform to our desires and needs within the context of the built environment – but it is done so in both a public and political interest (Balfour 1999). We need to understand this legislation because these documents shape the way we are currently able to approach ecological systems through our built environment. Our shift in perspective over time regarding our relationship with the environment is manifest in the laws we create.

Federal CZMA and North Carolina CAMA Policies

The Coastal Zone Management Act of 1972 (CZMA) was the first statute set out by the federal government (under the jurisdiction of the National Oceanic and Atmospheric Agency (NOAA)) to protect our coastal environments. In reaction to the public outcry regarding our treatment of environmental issues during the 1960's, the CZMA outlined expectations placed upon coastal states with regard to environmental, aesthetic, industrial, social and recreational impacts. It was a first attempt at balancing the needs and wants of those that use the shoreline for their economic and recreational livelihood (such as fishermen, hotel owners and homeowners) with the protection of the dynamic coastal environment (including mainland shorelines, estuaries and barrier islands). The act, reauthorized in 1990, grants the power to create coastal management programs at the state level. States bordering large bodies of water (including the Great Lakes) are required to create their own coastal protection acts, which should include:

- Section 306A: Coastal Resource Improvement Program (including shoreline stabilization, public land acquisition, preservation/restoration projects, and pier creation/management)
- Section 6217: Coastal Water Protection (including non-point source pollution control, critical coastal area identification, revised land-use management)
- Section 307: Coordination and cooperation between the public, local government, State and Federal agencies

CZMA provided support to the states through the Coastal Zone Management Fund (Section 308), Coastal Zone Enhancement Grants (Section 309), and Technical Assistance (Section 310). Also established was the National Estuarine Research Reserve System, where states can exchange information regarding academic research and planning issues. Those that exhibit success in the research and development of coastal management acts are awarded the Walter B. Jones Excellence in Coastal Management Award. (The award is named after Congressman Jones, Sr., who represented North Carolina's 3rd District until his death in 1992. His son, Walter Jones, Jr., now represents the same district, located in the eastern part of the state.) Awards are given to students, professors, states, local governments, "coastal stewards," volunteers, NGO's, and others. They are selected in different categories ranging from federal to local levels according to the significance of their impact on the field of coastal management. Monetary awards are either given in the form of cash or grant money, and often are used to further develop research to continue monitoring and improving the current ecological situation.

In 1974, North Carolina passed their first Coastal Area Management Act (CAMA). It was designed to protect shorelines and estuarine areas by providing guidelines to direct development and mitigation strategies for erosion issues within coastal and estuarine zones. The most recent version, approved in 2004, also includes guidelines for land-use planning, special use permitting, public beach access, cultural and historical preservation and coastal reserve creation/management. This comprehensive legislation provides greater detail into what North Carolina wants to accomplish under the CZMA, a federal program that allocates grants to coastal projects dealing with mitigation and development. North Carolina's stance is to provide a way to sustain local coastal communities, both ecologically and economically.

CAMA was a huge step forward for North Carolina. It was the first act that delineated where the legislature stood on the environmental/human relationship along the shoreline, acknowledging that this area of the state is subject to very volatile shifts in the land over time. It recognized that the barrier islands and the estuaries behind them act as the "sponge" that absorbs all of the energy of the ocean and sounds, and as such, need careful attention. While CAMA does not explicitly say the environment is the most important element in the equation that we must protect at all costs, it instead takes a stance that the environment exists for humans to benefit from it both economically and emotionally. If we want to receive these economic and emotional benefits, we must intervene from time to time to amend our negative impacts on the land. It is unclear in the document that some of these interventions may do more harm than good, but the intention is to improve the situation in order to economically benefit from it.

This stance of benefiting from the environment is pervasive throughout the local level of government, where beach renourishment projects are commonly undertaken to preserve the new livelihood of many coastal areas: tourism. While CAMA does not completely discourage coastal development within dangerous overwash zones, it does require new buildings to be sited behind the 100-year storm surge line. There is some consideration for building movement, although that is offered up as a last resort when no other beach stabilization methods are able to solve the problem. While fishing still remains as an important component of the culture of the North Carolina coastline, overall the industry has been in an economic downturn due to lower yields and increased regulations over the past twenty years, and has been economically outpaced by tourism (State of the Coast 2003). For this reason, renourishment projects often get the green light even though fish habitats and in turn, bird habitats, are often damaged from this procedure (Titus 1991).

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Between 1998 and 2001, NOAA developed a government-funded research group, State of the Coast, which published a series of research and informational essays under this moniker. Originally pushed by then-senator Al Gore (D-TN), and passed by Congress, the State of the Coast was part of a greater "environmental report card" to help the federal government monitor our diverse ecosystems, educate the public and determine if new legislation to protect and improve the environment was necessary (State of the Coast 2004). Their publications included work that targeted the effects of pollution and climate change on the environment as well as the plants and animals that inhabit it – including ourselves. Documents included "Oxygen Depletion in Coastal Waters," "Population at Risk from Natural Hazards," and "Chemical Contaminants in Oysters and Mussels," (State of the Coast 2004). After the dissolution of the federal State of the Coast program due to lack of federal funding (State of the Coast 2004), North Carolina took it upon itself to create its own State of the Coast, sponsored by the North Carolina Coastal Federation, North Carolina Sea Grant, and the NC Department of Environment and Natural Resources (North Carolina Coastal Federation 2004). The state believed that the information produced by the research group was a critical component of raising environmental awareness of both lawmakers and residents of North Carolina. Although this public/private collaboration does not produce as many research documents as the now-defunct federal program that shared the same name, the research group does include a public outreach component as well as providing a state-level "environmental report card" Gore believed was critical in improving our responsible relationship with the environment. This document (also entitled "State of the Coast") annually outlines the successes and failures faced by the state regarding the interaction of humans and the environment along the barrier islands. Mainly targeted at large scale planning projects as well as public policy, it also highlights smaller projects and people that act as stewards of the ribbons of sand along the North Carolina coast.

North Carolina's State of the Coast is a great example of the power of public/private collaboration to help raise awareness of environmental processes we affect (both positively and negatively) with our development habits. Efforts like State of the Coast go hand in hand with design by raising public awareness of what the government is doing to change our relationship with the environment. Our goal is to then take that understanding, that knowledge, that learning process, and adapt it to the site to continue the process of changing our relationship with the environment. This part of the process involves a physical manifestation of the relationship, an intersection of how we relate to the direct contact between ourselves and the prevalent ecological systems via the built environment (Spirn 1998, Corner 1999).

Those involved with this relationship have a huge influence over how landscape architects are able to sculpt the built environment. We collaborate with many groups of professionals that include engineers, planners, artists, citizens/advocacy groups, ecologists, historians, anthropologists, lawyers, lawmakers and contractors. In this sense, landscape architects can be seen as orchestrators of collaborative efforts (Halprin 1970). If this is one of the profession's strong suits, then it is critical that the language we engage in (whether verbal or otherwise) is able to cross disciplines (Spirn 1998).

As landscape architecture professor and author Anne Whiston Spirn suggests in her 1998 book, The Language of Landscape, language consists of much more than using words to convey meaning. As Spirn eloquently notes:

> "The language of landscape can be spoken, written, read and imagined. Speaking and reading landscape are by-products of living – of moving, mating, eating – and strategies of survival – creating refuge, providing prospect, growing food. To read and write landscape is to learn and teach: to know the world, to express ideas and to influence others. Landscape, as language, makes thought tangible and imagination possible. Through it humans share experience with future generations, just as ancestors inscribed their values and beliefs in the landscapes they left as a legacy, 'a treasure deposited by the practice of speech,' a rich lode of literature: natural and cultural histories, landscapes of purpose, poetry, power and prayer." (p. 15)

The built environment has so much to offer! We can go beyond the legal and law-making understanding of language to enrich language with a deeper way of communicating our thoughts and feelings about the relationship between human and environmental flux. Currently, the language we use to explain this relationship is very much ground in explaining things during one fixed point in time, as a way of placing or framing a scene, much as a classical landscape painting from the 19th century Hudson River School might suggest. While this is a critical aspect of explaining our ideas of a site design to others, "the tendency of many contemporary landscape architects to assume that this prioritizes visual and formal qualities alone significantly limits the full eidetic scope of landscape creativity" (Corner 1999, p.153). James Corner, a professor of landscape architecture at The University of Pennsylvania, goes on to explain that:

> "Far from the assumed inertia of passive and objective representations, the paper surfaces and computer screens of design imaging are highly efficacious operational fields on which the theories and practices of landscape are produced. Any recovery of landscape in contemporary culture is ultimately dependant on the development of new images and techniques of conceptualization." (p. 153-54)

According to Corner, this development must include the investigation of multiple means to explain a landscape. These could include "the graphic (as in the picture), the optical (as in the mirror), the perceptual (as in cognitive sense), the mental (as in dreams, memories and ideas), and the verbal (as in description and metaphor)" (p. 161). In order to fully understand the use of flux and motion in design process and implementation, it is helpful to look to other disciplines dealing with the expression of flux as a methodological basis from which to further develop the concept in the built environment. In addition to the design discipline, the disciplines of dance and music have that notation present and can be used to help understand both my own design process as well as the sequential understanding of a site. Many architects and landscape architects, including Bernard Tschumi, Lawrence Halprin, Rem Koolhaas, Bernard Lassus and James Corner have taken these notational cues from other disciplines and adapted them in their own ways to design. They are inspirations I draw from in order to understand the adaptation of notational systems from art to design. By taking their understanding of design and tweaking the way they explain their representation of place, they are able to convey their thoughts in a way that is rooted in the traditional

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design experience (of plan and section), yet speaks to the idea of flux in the landscape. Their understanding of how people move through a site as well as how the ecology of a site changes over time is conveyed in the drawings, collages, models and multimedia presentations they create.

That is not to say, though, that these new notational methods employed by the likes of Corner, Halprin, Tschumi, Koolhaas, and Lassus are lacking any sort of roots. Their foundations are very solidly set within the history of our discipline and fertilized by outside fields' investigation of notational devices revolving around motion and flux.

Notation

With regards to the built environment, designers are very concerned with how people are able to comfortably move through a space (Whyte 2001). But the way many convey that motion or flux has lost its currency. Case in point: the ubiquitous arrow. As landscape architects, we use it on our plans to represent motion, path, or direction. Sometimes it is there to emphasize a critical point on the site. In some instances, designers consider circulation flow through their project – but we can go beyond that concept and design places around the changing flux of the environment itself. This includes not only our understanding of how elements in the landscape change over time, but also how we can graphically represent this change in our design process. Currently, many site plans are drawn without respect to any sort of change over time (with the exception of a few designers). But there was a time when the designed landscape was intended to engage the experience of motion, and not simply to be viewed as aesthetically pleasing scenery. This concept of flow and motion shifted towards emphasizing the static, picturesque landscape beginning in the 18th century (Bann 2000).

This idealistic interpretation of nature in the landscape was mainly promoted by the English Landscape School (e.g. Lancelot Capability Brown), which attempted to show the landscape in a state of harmonious nature as opposed to the more formal Dutch, French and Italian landscapes of centuries prior (Bann 2000). While studying the history of landscape architecture (mainly using Norman Newton's 1971 text, Design on the Land), it occurred to me that ironically, these "natural" landscapes isolated people from nature even more so than the structural gardens found on the European continent as they required much more space and upkeep, leaving them as a commodity accessible only to the wealthiest of families. The picturesque was always to be maintained in a state of unchanging perfection, with perfect follies mimicking the ruins of ancient Greece for the hermits to inhabit. In a way, it was the antithesis of the public gardens of Frederick Law Olmsted; although they shared similar aesthetics, Olmsted created landscapes for every class with his public park designs, intended to intermingle different social classes by offering multiple paths and pockets for relaxation. This attention to designing for different purposes and groups of people required an understanding of the life cycle of the landscape as well as the needs and wants of those using the place.

Our designs, created within the confines of traditional plans and sections, have been limited by the tools we use, in turn lacking the ability to convey a sense of flux or change in the landscape (Corner 1999). Few designs have responded to the desire of humans to have multiple, unique options through which to move about a place. It is not a simple task, though, to use our current setup of plan and section to truly realize the complexity of human and ecological flux. We need additional tools to further our conceptual understanding of motion. Luckily, we live in a time when access to computers and other digital media can make this leap a little easier. However, there is also the potential to put a pencil to paper to grasp motion. Ideally, we should use both hand-drawn and digital media to synthesize our design concepts as this gives us the opportunity to further explain our connection to the site as well as the flux present in both the human and ecological narratives. While the more traditional techniques of plan and section have the ability to ground us in a physical understanding of what we want the site to be at a certain point in time, multimedia applications can help to explain the site in a more temporal, fluctuating language, able to deal with time and flow in a continuous manner. It can engage people with the site in a more tactile way in order to enhance the plan and section drawings (Corner 1999).

Our designs, created within the confines of traditional plans and sections, have been limited by the tools we use, in turn lacking the ability to convey a sense of flux or change in the landscape

– James Corner (1999)

In 2000, the Department of Studies in Landscape Architecture at Dumbarton Oaks held a symposium dealing with "Landscape Design and the Experience of Motion" (Brown 2001). The topic of the space-time relationship included not only "the experience of people moving, but moving landscape phenomena, the movement of thoughts and feelings, and correspondences between these three aspects of motion were also discussed" (Brown 2001, p.112). The announcement of the symposium as well as the call for papers set up the main goal and begged the question:

> "This symposium will address a largely ignored aspect of the practice of landscape design that cuts across cultures and centuries: how did garden or landscape designers anticipate experiences of motion in their works? Motion is a central feature of all garden experiences and yet it is almost never discussed. Instead, gardens are treated as repositories of objects and of views or, at best, as records of picturesque tours. Any account of a garden seems to strive for a way of subsuming all garden experiences under a few particular images: photographs, impressions or emotions, associations, or plans seem to be most common. Strikingly enough, each of them constitutes a denial of the unity of a garden that can be discovered when moving through it or when the seasons, or the hours of the day, change it. Even photography, offering a sight of fleetingness by showing

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Fig. 3.8: The ubiquitous arrow: Louis Kahn's Traffic Study of downtown Philadelphia, 1964 (source: Envisioning Architecture, MoMA Press)

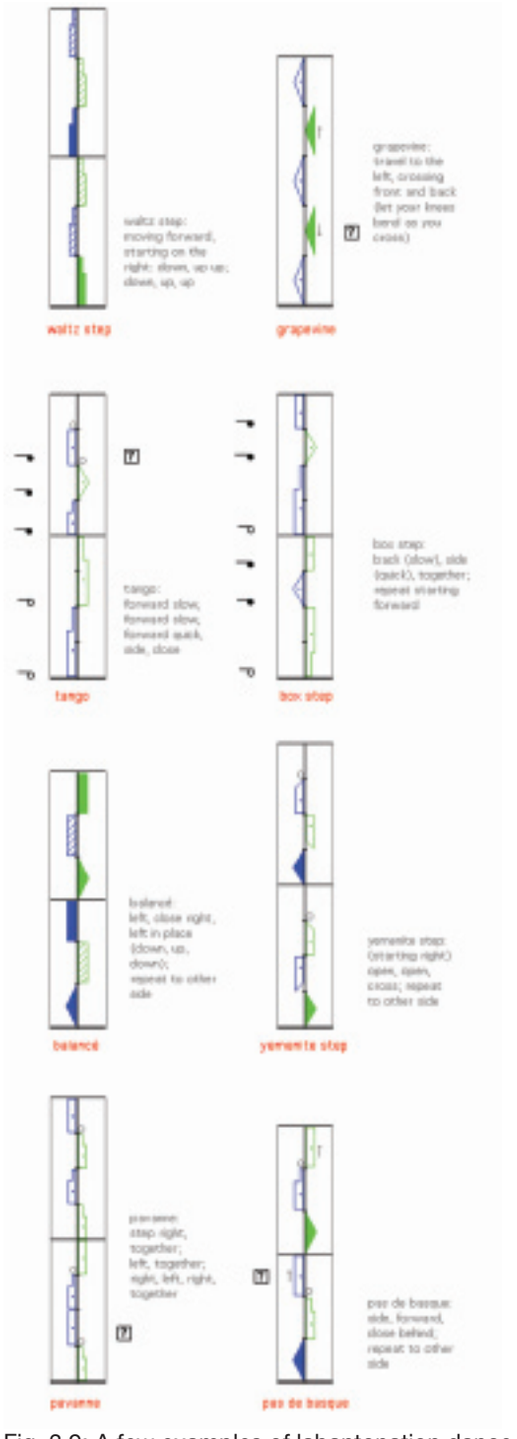

Fig. 3.9: A few examples of labantonation dance notation. (source: LabanLab at The Ohio State University)

a flickering sun through the leaves or a rare moment of bloom, remains as foreign to lively experience as a still-life painting. And since garden studies tend to rely heavily on these kinds of accounts in judgments about past gardens they tend to overlook a fundamental aspect of gardens as places by overemphasizing gardens as repositories of fixed features. A theoretical and methodological effort seems to be necessary in order to reach a clearer grasp of the kinds of motion that accrue to the specific experience of a garden as a unique place." (Dumbarton Oaks 2000)

With the exception of this symposium and the works of some (including Corner, Tschumi, Koolhaas, Lassus and Halprin) in the fields of architecture and landscape architecture, there is little literature regarding the respresentation of motion (either of users or within the landscape itself), although this subject matter seems to be gaining more recognition as of recently. However, while investigating the fields of photography, drawing/painting, film, prose, music, poetry and dance, it is clear that they have all grappled with the concept of documenting motion over time throughout the lifespans of their disciplines. Music and dance have even created notational languages based on the motion of their mediums (musical scores, labantonation, etc.). They use these notations not only to document a sound or a move, but also for theoretical analysis. This milieu of motion can be better understood by breaking down the relationships of the parts to the whole through the use of notational devices. These notational devices can give landscape architects inspiration for opportunities to create their own tools for explaining flux in the built environment. Notation within the fields of dance, music and painting are further explained to help draw inspiration for a design intervention. These three fields are often borrowed from by landscape architects and architects such as Halprin and Lassus to gain insight into the process and implementation of design to help express the flux of both the human and ecological situations.

Dance

Today, choreographers use three notational methods currently used to create the choreography of the motion of the dancers: Labantonation, Benesch (mostly used in ballet), and the Eschkol-Wachman Movement Notation (Faulkes 1998, Griesbeck 1996). All of these notational forms are concerned with using a graphical pattern to allow anyone who "speaks" the language to understand and set a body in motion.

Eshkol-Wachman Movement Notation (or EW) is a system of movement notation that was first introduced by Professor Noa Eshkol (now a Professor Emeritus of Dance at Tel-Aviv Univeristy) and her student, Professor Avraham Wachman (now a Professor Emeritus of Architecture and Town Planning at Haifa Technical Institute), in 1958 (Faulkes 1998). It focuses more on the spatial aspects of form, but is missing the more temporal aspect of motion (Faulkes 1998). The focus on this method is an overall recording of motion – it does not deal with velocity, acceleration, etc. However, the notation is hierarchical and time-sensitive. It separates the skeletal system into heavier limbs and lighter limbs. For example, the shoulder is the "heaviest" limb or is able to express the most change in motion, so its motion is noted first; since the forearm is influenced by the shoulder, it is noted next; finally, the hand is influenced by the forearm, so it is noted last. The notation also separates motion into vertical and horizontal elements, the former noted above the latter. The numbers refer to a position around the body being noted, as if a clock's numerical positions surround the skeleton parallel to the ground. Finally, the motions are separated into measures of time (marked with the vertical lines separating the numbers and symbols).

There is potential to use this method for things besides humans. Although it would not be possible to use the notation directly for elements in the landscape (plants, buildings, etc.), the vertical and horizontal motion component can be adapted to aid landscape architects in diagramming potential sequences through a space. For example, when experiencing a streetscape, isolating the elements within the container of the street and designating their relationship to each other while the user is walking (or driving) at a certain speed may be possible. While EW is rather simple to understand, it lacks any way of incorporating emotion or feeling within the motion itself.

Another form of dance notation known as Labanotation, although slightly more complicated, is better able to express a feeling through notation than the Eshkol-Wachman method. It was developed by Austro-Hungarian Rudolf von Laban, a European choreographer, in the early 20th Century (Griesbeck 1996). The basic notation diagrams nearly every relationship between the appendages and the core of the body, and puts those relationships into a replicable notation that relates the body motion to the ground plane. Like EW, Labanotation is time-sensitive and is diagrammed much like a musical score, using a staff of 3 lines to delineate between the left, center and right side of the body. This is written vertically on the page, with the motion beginning at the

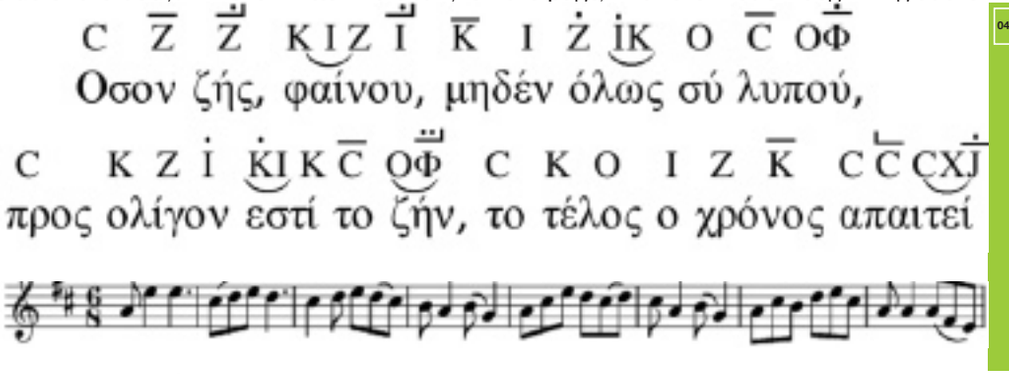

Fig. 3.10: The Seikilos epitaph, translated into modern notation. (source: Wikimedia Free Commons)

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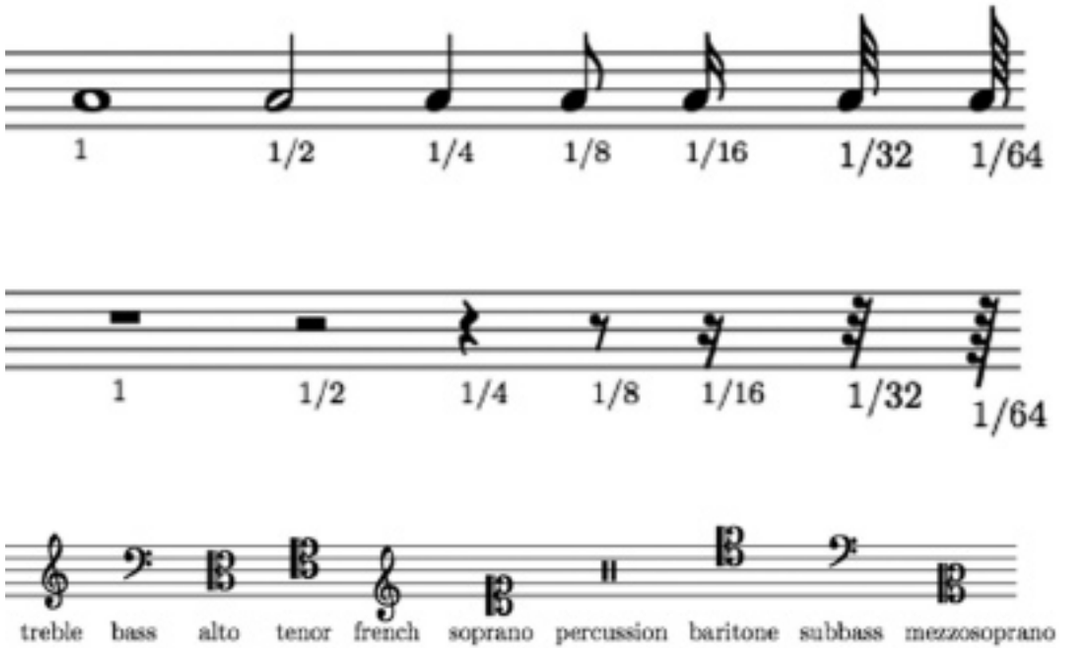

Fig. 3.11: (top) Depending upon how a note is drawn, it is played for a certain amount of time. The time signature at the beginning of the piece determines how long each note is played. (source: Wikimedia Free Commons)

Fig. 3.12: (center) Rests are also played for a certain amount of time, depending upon the time signature. (source: Wikipedia Free Commons)

Fig. 3.13: (bottom) Clefs give musicians the information to know how high or low to play the notes on the sheet music. (source: Wikipedia Free Commons)

bottom of the page.

Landscape architects can use a notation similar to dance by associating ever-changing positions of moving objects in the landscape (e.g. traffic, metro, people, bikes, park benches, mowed paths through grass, etc.) to the motion of the body studied in the dance notation. In essence, the designer is going beyond the traditional design of a space and creating a their own choreography of interaction between humans and the built landscape. The notations from the field of dance have had a significant influence on landscape architect Lawrence Halprin, discussed later in the paper.

Music

Musical notation has a rich history whose origin dates "back to the 3rd millennium BC and by others in the Orient during ancient times" (Wikipedia 2005). While there are only references to the notation from that time

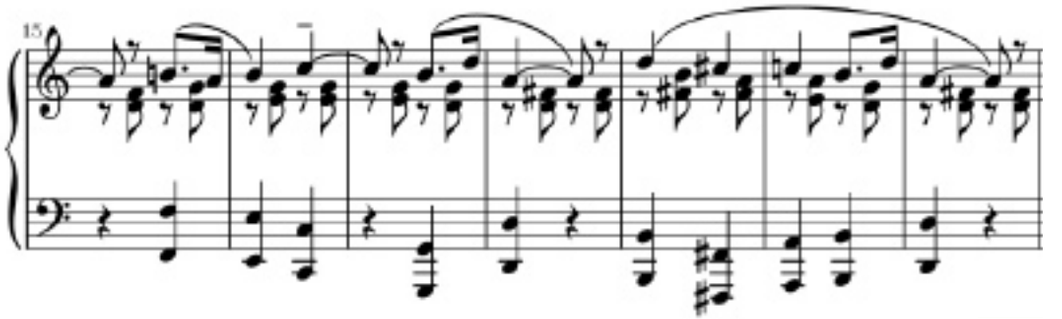

Fig. 3.14: Several measures of musical notation. The top half is known as the treble clef, which plays higher octave notes. The lower, or bass clef, plays notes of lower octaves. (source: Wikimedia Free Commons)

period, the oldest piece of notation, known as the Seikilos epitaph, is from Greece during the second century BC. Unfortunately, this is the only piece of notation known to have survived this period, and the knowledge of musical notation was lost by the time of the Roman Empire (Wikipedia 2005).

The musical notation we are familiar with developed around the 8th century AD. Monks performing Gregorian chants and other sacred songs created a way to document the songs they sang as a part of their devotion to Jesus Christ (Wikipedia 2005). The iteration of the five-staff notation as we know it was not finalized until the seventeenth century AD by French musicians.

While musical notation is similar to labantonation, it is not concerned with motion of a body, but with the motion of sound – more specifically, the blending of melody and harmony. Musical notation breaks the sounds into higher and lower notes (that reside in a certain octave), then assigns a measure of time to split up the notes which in turn gives each measure a beat. The notation is read horizontally across the page, from left to right.

While landscapes have been used as inspiration for songs (such as Johann Strauss' "The Blue Danube"), and musical genres have commonly inspired an overall design concept (such as Walter Hood's use of the blues and jazz as inspirational muses), there are few documented landscapes that have been motivated by individual songs (although the concept was extensively explored in my fall 2002 studio).

One of the clearest designed examples can be found in Toronto. The Toronto Music Garden, designed by landscape designer Julie Moir Messervy and cellist Yo Yo Ma, uses Bach's Suite Number One for Unaccompanied Cello as the main inspirational source for the design. Using the six movements of the piece, Messervy and Ma guide visitors through the built environment. As the piece moves from the Prelude, through the Courante, and eventually to the Gigue, visitors experience the music through curving riverscapes, arced conifer groves, formal parterres and grass steps (City of Toronto 2005).

Like organizing sounds to create a replicable song, landscape architects could use flows of rhythms to create a landscape that responds to the existing narrative of the place. Paths through the landscape could begin to take on certain rhythmic characteristics that shift throughout the experiential sequence of place.

Painting

In 2000, Stephen Bann wrote an extensive history comparing the pre-Claudian collection of paintings by Dutch School artists such as Paul Bril and Geoffrodo Wals before the 18th century to the perception of garden design. Bann then compared the concept exemplified in these paintings to Bernard Lassus's work, especially "The Garden of Returns." Bann argued that the Dutch school paintings evolved from a series of visually-triggered spatial movements to the more static, picturesque style, so did the development of garden design. For example, Bann compared Bernard Lassus's Garden of Returns along the Charente River in Rochefurt-sur-Mer, France, to the pre-Claudian painters of the 1500's and 1600's. The simple idea of reconnecting the cultural and historical aspects of a town to its river has been attempted in many cities – yet Lassus's approach is unique in its careful consideration of taking the horizontal and vertical spatial qualities of walking through different situations (streambeds, forest, etc.) and transposing them into the built landscape.

> "On a theoretical and pedagogical level, it is a demonstration of the way in which experience of a particular physical environment can serve as a paradigm for the experience of landscape in general, contributing to the design of new landscapes that will be responsive to such experiential criteria." (Bann 2000, p.58)

While there is no evidence that Lassus's use of motion was directly influenced by his contemporaries in other artistic disciplines, the similar aesthetic perspectives between Lassus and the art world suggest that by looking to other artistic disciplines landscape architects can be guided in how to approach the concept of path and motion of users in the landscape (Bann 2000). We do not experience a landscape on the periphery; it is only when we explore within that we can fully comprehend the ramifications of built works (Halprin 1970, Potteiger and Purinton 1998).

Beyond Bernard Lassus, there are other designers that have been interested in directly pursuing the design and representation of motion or flux in the landscape. Inspired by existing notational languages within the artform of dance, landscape architect Lawrence Halprin (husband of a dancer) created his own notational device for choreographing the landscape in the 1960's that he referred to as "motation" (Halprin 1965). Halprin's motation takes a series of symbols and arranges them vertically and horizontally to choreograph a path through a landscape over time. The symbols are categorized into general (e.g. vertical and horizontal elements), structural (e.g. high building, low building), landscape (e.g. hill, valley), moving things (e.g. human, train), and direction (e.g. below eye level right, above eye level left).

Halprin then arranged the symbols into a series of "frames" attached in a sequential order. "The frames [are] read vertically from bottom to top," replicating our visual habits when moving through a city (Halprin 1965, p.130). Halprin understood that we tend to focus on what is ahead in a vertical manner and set his frames to emphasize that factor. A second set of frames is read horizontally, like a written passage, that maps the physical path.

> "Since movement and the complex interrelations which it generates are an essential part of the life of the city, urban design should have the choice of starting from movement as the core – the essential element of the plan" (Halprin 1965, p.131).

Although Halprin's office used motation extensively, it was never really adopted by other practitioners, possibly because Halprin was ahead of his time. Little was published on the subject between the 1960's and today, but the gauntlet of studying and notationally documenting motion or flux in the built environment through a similar representational strategy has been picked up more recently by those architects and landscape architects interested in emphasizing the fluctuations of the ever-changing landscape. This method of motation (or at least one that has roots in Halprin's motation) has tremendous

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Fig. 3.15: A sheet from Halprin's Motational system of documenting and explaining the motion or flux of the landscape and the users through a choreographed sequence. (Source: Progressive Architecture Magazine)

Fig. 3.16: Tschumi's Manhattan Transcripts depicting the perceptual understanding of a continually shifting landscape. In this situation, the user is in motion and is reacting to a static landscape. (source: Envirsioning Architecture. MoMA Press)

potential when analyzing current uses of the land, changing relationships between the site and the surrounding areas, changing relationships between the site and the users, and for the overall development of new design within a site. Threads of inspiration from Halprin's work with motation can be seen more often in the work of landscape architects like James Corner and architects like Bernard Tschumi and Neil Spiller (an architecture professor at The Bartlett School of the Built Environment at The University College of London (UCL) who is at the forefront of a reflexive architecture that exists more in cyberspace than in our current understanding of the built environment). Due to the lack of projects focusing directly on this subject, this slow and steady reinvestment in the study of motion and flux in the landscape has mostly been expressed theoretically.

After Halprin's work on motation, the subject of motion or flux in the built environment was again addressed in the 1980's, but in a much different context. Practitioners, arguably spurred on by the digital age, became more interested in tracking environmental and spatial trends over time. With the development of GIS and more powerful computers, it became possible to identify a finite landscape and track its changes throughout its life cycle, which according to landscape architecture professor Niall Kirkwood is quite limited due to the lack of quality details incorporated into the design, causing it to fail at an immature age (Kirkwood 1999). Architecture professor Bernard Tschumi, currently Dean of Columbia University's School of Architecture, was a designer who picked up where Halprin left off, bringing the theory of poststructuralism to architectural theory along with his desire to understand flux and

where it fits into the discipline of designing the built environment.

Bernard Tschumi investigated ways to understand how flux is manifest in the built environment, most notably displayed graphically in The Manhattan Transcripts (1981), and rhetorically in Architecture and Disjunction (1996). Tschumi's interest in and understanding of motion developed from spending his entire life as a city dweller (mainly in Paris, New York, London, and his birthplace of Lausanne, Switzerland), constantly dealing with the ebb and flow of trends, cultures and built works that blend together to form a city's fabric (Futagawa 1997). By understanding basic human behavior, Tschumi has arguably been able to create landscapes conscious of the user in motion. His core principle of no space existing without an event, and these two elements lacking any sort of fixed relationship (Tschumi 1994) is at the heart of flux. He emphasized this relationship by using the art of montage to express this changing relationship between site and event, human and ecology.

Tschumi's drawings attempt to create a sense of flow and seamlessness that many traditional architectural drawings simply are unable to perform. The form of the building or landscape itself is what keeps people moving throughout the experience (Futagawa 1997), and his work recognizes this by incorporating elements of film, notation and painting to create a better understanding of the flux present in the design (Tschumi 1994).

Thus, methods for incorporating motion into the graphical notation used to create landscapes has already been established by practitioners like Tschumi and Halprin, By changing the medium through which we convey the meaning of design, we can in turn add another layer of metaphor to our current language. Adding to this language helps us more accurately and eloquently convey our design goals to ourselves as well as other members of the design community and beyond. Hand drawing or digitally (or a hybrid of both) creating drawings, collages, montages, etc. in a non-traditional way reveals or precipitates a different understanding of flux by taking us closer to the idea of a seamless flux – not one that is stuck in a moment or only able to convey one point in time, but one that shows the changes over time. Landscape architects have the opportunity to become more fully aware and respectful of this flux necessary to understand a built environment and incorporate this flux or motion over time into their plans (acknowledging that a "change over time" can refer to many different quantities of time; it could refer to a quick change for an evening to accommodate a party; a specific use during weekdays; a seasonal change to evoke a feeling among users; a change in uses over years, once that current activity has moved to another part of town, etc. It is unlikely that we can plan the exact time that these changes will occur, but we can design the landscape to accommodate the changes when they come about.

It is frustrating that there are only a few published texts that begin to hint at how we can integrate these various methods of engaging motion of the environment into the motion of the design process. It is a very important aspect of our designs that should be more carefully considered. But it is also difficult to comprehend in a visual way that is applicable to architecture. This subject is of great interest to artists, literary figures and others associated with human perception. We have the opportunity to use this information from other fields and manipulate it. We also have the opportunity to use computers to help us graphically represent the space/time relationship. Perhaps as more built projects deal directly with this issue, we can see the implications of designing with motion in the landscape. If successful, the site can absorb this human and ecological flux in a way that fundamentally affects our perspective on how we relate to the land – and with each other.

PART THREE – Literature Review

PART FOUR:

Case Studies

Now that this relationship between human and ecological flux has been investigated through scientific (or geomorphologic) language, legislative language and notational/design language, it is critical to consider how the built manifestation of this relationship can occur. What site designs by landscape architects are currently contributing to the language of the field that accommodate the flux of human and environmental systems within the built environment? The following five case studies are used to represent a graphical, physical and emotional understanding this complex and dynamic relationship between humans and the environment they are an intrinsic part of.

The first three designs, entitled “Lifescapes,” “Theatre Square” and “Blur,” respectively, are a more abstract understanding of this relationship. They are representative of a landscape architecture very much in tune with the temporality of the built environment and use the ephemeral characteristics of a temporal space as a critical tool to help convey the

(above and previous page) Fig. 4.1: Views of Fresh Kills in transition from landfill to park. (source: Praxis Magazine)

shifting or flux present in both human and/or ecological form. These pieces are artistic artifacts of a landscape architecture very much in tune with the changing characteristics of their sites, as well as the areas surrounding the sites. These three case studies add an opportunity to focus specifically on creative ways in which architects and landscape architects are able to pull the flux of humans and ecological processes out of the site and use them as a clever tool to invigorate a place that recapitulates our relationship with the environment.

The second two projects, Oregon Inlet and the Cape Hatteras Lighthouse, depict sites along the Outer Banks that have had to deal directly with the constant flux of a barrier island shoreline and have seen a much more public course of action during the decision-making process. These sites are critical components in the main economic force in the area: tourism. These projects have not been completed by a landscape architecture firm, although they may have acted as consultants in the process. Instead, they have been designed by engineers, and influenced by ecologists, homeowners, business-owners, planners, concerned citizens, historians, and fisherman that either recreationally use or make a livelihood via the ocean and sounds that surround the Outer Banks. These two case studies add an opportunity to specifically look at the issues surrounding barrier island development, and how it can work (or fail) within the confines of environmental flux.

This selection of five sites is shown in the spirit of understanding this issue of incorporating human and ecological flux at multiple scales and with multiple constituents and collaborators.

Lifescape by Field Operations (Fresh Kills, Staten Island, New York)

In 2001, the NYC department of city planning announced a competition to convert the Fresh Kills landfill on Staten Island into a recreational space. The successful site design had to address land issues, landfill operations, natural ecologies, and the necessity for a flexible and phased proposal. As noted in the project brief, the proposal asked teams to explore the dynamic processes of landfill decomposition and changing community needs.

"Lifescape," the winning design submitted by Field Operations (headed up by James Corner and Stan Allen) took those dynamic environmental processes and celebrated them throughout the design process, implementation and site details. While this site has had a more tumultuous history than most – it has been a repository of our wasteful habits, an undesirable effect of a society obsessed with consumption, with trash brought from as far away as Virginia – Corner and Allen are trying to simultaneously "heal" the site while making a social comment on our consumptive habits.

> "Visible from the moon, with waste mounds the size of mountains, Fresh Kills remains the most complex land mass human beings have attempted to manipulate. Starkly elegant, the artificial topography offers a unique landscape experience. As such, the site presents an opportunity to develop a new form of public-ecological landscape, an alternative paradigm of human creativity, biologically informed, guided more by time and process than by space and form." (Field Operations 2002, p.20)

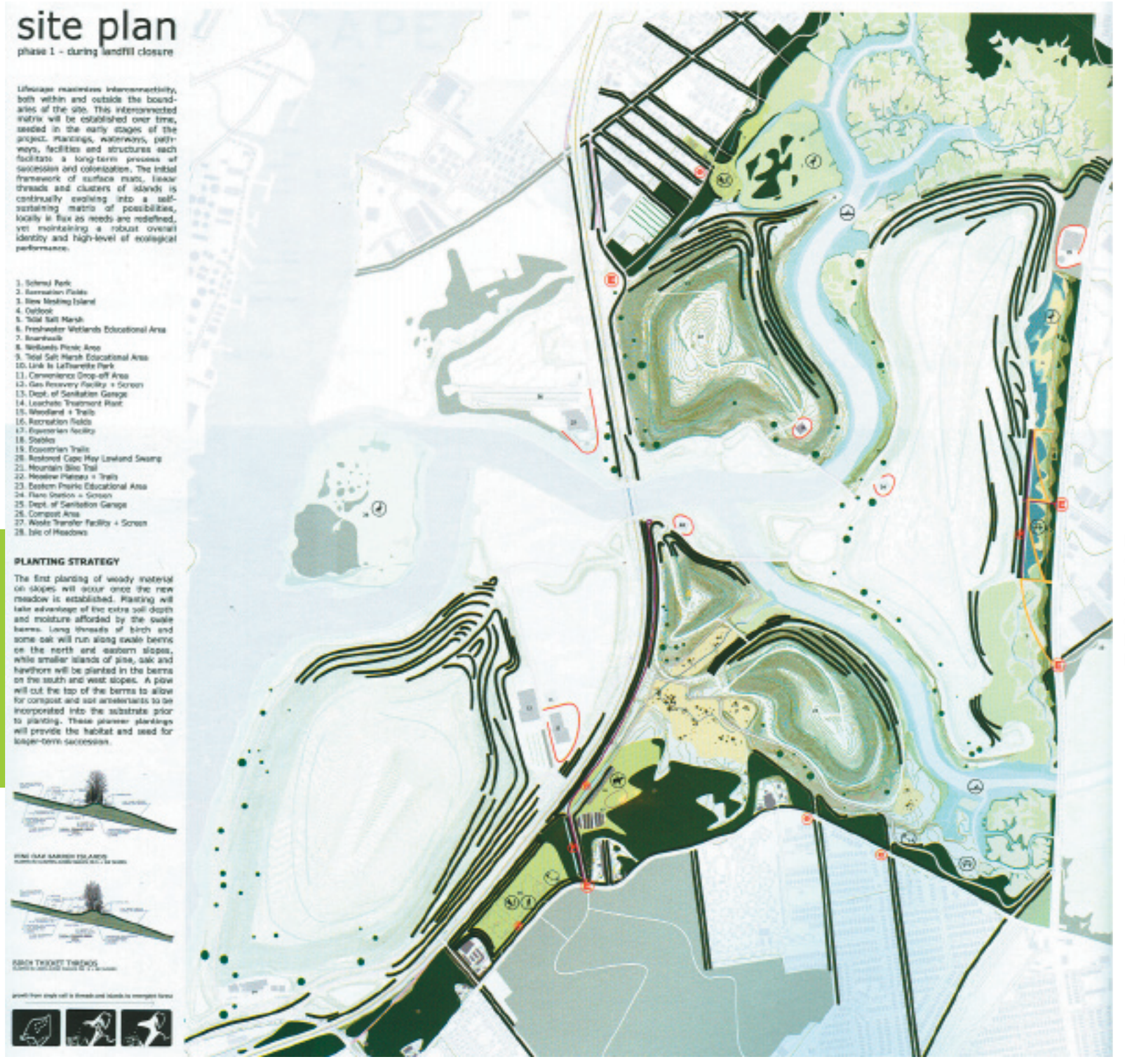

Fig. 4.2: Fresh Kills is a good example of the hybridization of adaptive management with site design to create a park that is able to dynamically change over time. The picture depicts Phase 1 of the design process. (source: Praxis Magazine)

Fig. 4.3: Phase 2 will occur once the landfill is completely closed and capped. (source: Praxis Magazine)

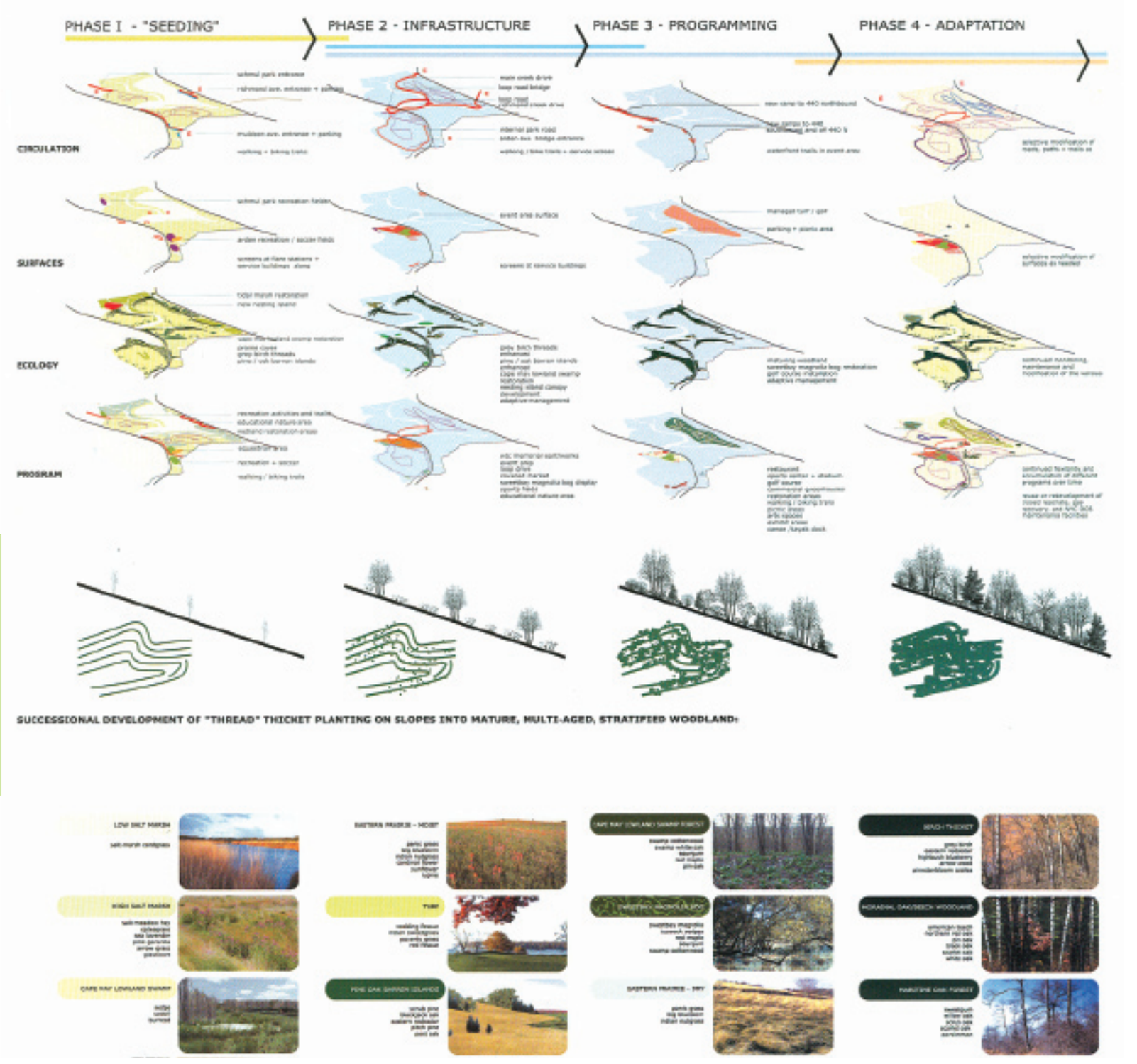

Fig. 4.4: This image depicts how all four phases integrate into each other. Note that phase four goes on indefinitely and oftentimes without the full planning by the designer – nature becomes the primary architect. (source: Praxis Magazine)

While it is uncertain as to the success of the project since it has not yet been built, the essence, or purpose, remains a novel and critical component to the future of landscape architecture: the built environment needs to become more adaptive. The design response suggests an adaptability that allows for the changing needs of both humans and their surroundings to occur over time. It also allows for reproduction, evolution, and the shifting of importance placed upon certain areas.

It is also important to look at Fresh Kills as a positive way of graphically showing change in the landscape over time. Below are some highlights of the plans, showing how different materials, site programming (of which there is little), natural processes and physical infrastructure paths will change over time.

When looked at individually as well as a complete whole, these graphics are a solid example of how to convey the idea of an adaptive, flexible response to the flux not only present in the current landscape, but how that flux (as well as human intervention) will affect the site over time.

While Field Operations did answer the original request to explore the dynamic processes of landfill decomposition and changing community needs, their design missed an opportunity to show people how we directly affect this flux that is occurring in the landscape. By locating this project on top of a landfill, the team could have addressed American consumption habits that led to the need to create a landfill in the first place, but instead decided to keep that hidden while exposing less controversial aspects of flux.

The idea of exposing some elements of the site, yet hiding others, is an issue with many different projects. As landscape architects, we have the ability to highlight narratives that can be convenient to one's understanding of the site, or challenge the status quo, or even ignore the harsh realities of living in a chaotic world. We get to choose. Our ability to tell a story – or even better – reveal an existing and ongoing narrative present within the site is very much wrapped up in how we see.

Blur by Diller and Scofidio (Neuchatel, Switzerland)

Designed landscapes are not only created with an existing landform, but they can also be created out of nothing. Such is the case of Diller + Scofidio's 2002 project, "Blur." Their concept was to blur the lines between what is built and what is existing; what we can see and what we cannot; what is inside and what is outside; what is natural and what is artificial. The intention was to create a situation that whites out or disorients any preconceived notions of landscape. This lack of control is felt not only on the part of the user, but on the landscape itself.

At its essence, Blur is a constructed island in the middle of a lake. In order to reach it, a footbridge was constructed that at times is shrouded in man-made fog. This blurring of man-made versus natural begs the question: how do we as landscape architects create our own version of man-made "nature?" This whole notion of constructing that which is a natural occurrence can be a perplexing design intervention. Diller + Scofidio's is intended to be constructed, used and removed (its life after leaving Lake Neuchatel is never discussed). The only reference to natural processes is through a human construction, notion or interpretation of the natural process itself. This is a different way of looking at a similar issue on my site dealing with the development of an island. In my own design, my intention is to place pilings and riprap to collect sand and have it constantly shift southwest towards the shoreline of the barrier island. This is yet another way to understand the human/ecology relationship, where instead of simply mimicking a natural shape or occurrence, I am harnessing natural processes to help construct the place as well as destroy it.

Fig. 4.5: Experiencing the trip out to the island. (source: Praxis Magazine)

PART FOUR – Case Studies

This notion of things strictly created by “humans” and things strictly created by “nature” is puzzling. Many people who visit Olmsted’s parks have little to no idea that this is not truly “natural,” but rather a blurring of the two. Technology can be used to disguise our work as “natural,” or can be brought to the surface and emphasized, showing users that what they are experiencing is truly artificial. Of course, most work lies somewhere in between the two extremes, but Diller + Scofidio’s work somehow lies at both ends simultaneously. That is, in their interpretation of a truly natural occurrence (islands, fog) in a truly artificial and blatantly mechanistic way, they are able to convey to visitors an understanding that in our own way, we are nature. However, the way we value our creations (as well as ecology) is not natural – it is economic. In an interview with Praxis Magazine, Diller asks “can technology be generative without conventions of productivity and efficiency?” (Reeser 2002, p. 104)

The site was designed only as a temporal landscape for a World’s Fair, and there is no longer any physical evidence of its existence. Photography is the only way it is visually accessible. In this case, the secondary evidence acts as the filter through which people experience the site. This temporality and ephemerality is an exciting way to see and understand the landscape in general, as well as my design in particular. The shoreline is but a fleeting moment in time.

Theatre Square by West 8 (Rotterdam, The Netherlands)

PART FOUR – Case Studies

One of the simplest ways to manipulate a user’s experience is to offer multiple alternatives to viewing a site. This can often be done through the creation of different programmatic paths through the place. Predetermined and oftentimes lacking flexibility, these paths are different visions of what the designer wants the user to see.

By allowing the elements within the space itself to exhibit their own type of flux, change with time and/or with the needs or wants of the users, a designer is incorporating another facet to their conceptual understanding of the space they are creating. Another force – dynamic flux – is now a part of the design realization. This landscape can be temporary and fleeting, or permanent and reflexive to the needs and wants of those using it. The motion could be in the seasonal change of the planting, or the physical manipulation of forms in the landscape by users. A great example of this is found within West 8’s design of Theatre Square in Rotterdam, The Netherlands. This is the synthesis of the motion of the user interacting with the flux of the landscape itself.

Theatre Square acts as a variety of urban spaces throughout the year, ranging from the low-key plaza to relax in before or after a play in the theatre across the way to a host of the annual skateboarding exhibition. Because the square acts as a platform (the surface hovers 35 cm above the ground), the user is elevated to a prominent element within the landscape (Molinari 2000). More importantly, the user is able to manipulate the landscape as he or she sees fit by controlling the lighting elements; their position, height and brightness are able to change at the user’s whim, thereby allowing the site to

Fig. 4.6: A view of the square during a skateboarding festival, 2000. (source: NAI)

adapt to how the space wants to be used by visitors. In this built environment, the users have the overall power to determine how the place will adapt (as long as the weather cooperates).

The rich mosaic of materials used also creates a certain flow through the space. The various woods, epoxy and steel changes the feel underneath the feet of the users, manipulating textures to engage both visual and tactile senses. The success of the square is due to the synthesis of the users into the landscape; by allowing the people that inhabit the space to become a part of it instead of one that simply observes it, the designers are able to inextricably link human to landscape. The flux, in this case initiated by users, is what more landscapes should engage. Although not mentioned in any text regarding this site, it is clear that this work is in the same vein as Halprin's motation. The consideration of multiple paths for the user as well as multiple elements that are in flux in the landscape was something Halprin's motation carefully choreographed. West 8's Theatre Square takes that idea of motation one step further, and concedes that while all of this motion or flux is occurring, there are countless ways to experience it. It is not motation in a controlling way, but rather as a liberating opportunity for the user to gain authority within the site.

PART FOUR – Case Studies

PART FOUR – Case Studies

Cape Hatteras Lighthouse: Moving a National Treasure

In 1937, Congress established the Cape Hatteras National Seashore, protecting a 50-mile swath of the southernmost Outer Banks from development. The authorization also established a National Park at the very tip of Hatteras Island that included the Cape Hatteras lighthouse, built in 1870 (NPS 2005). For years, this lighthouse had protected seafaring ships and allowed them to safely navigate the dynamic waters of the area. In the end, the one place that signaled stability had to be moved.

How ironic is it that a project whose original intention was to protect humans from the dangers of ecological processes was eventually overwhelmed by them. The ecological processes (in this case the tumultuous waves and shifting sand of Cape Hatteras) won out and forced us to make a difficult decision: either part with an historic treasure or try to move it away from the breakers. While it is not uncommon to move buildings, the sheer height of the lighthouse made this a risky gamble. In the end, it took 115 hydraulic lifts and nearly six months of preparation and implementation to gently move the 4800-ton lighthouse 2900 feet inland in 1999 (NPS 2005).

The discussion that went on prior to the decision to move the lighthouse was heated and took place over many months, but most locals (as well as the National Park Service) knew this issue must be dealt with since the 1930's. Some believed that by leaving the lighthouse where it was and allowing the natural processes to overtake the solid piece of architecture, it would show humans how fallible our development decisions really are. Others wanted to see the destruction in order to show that we are not as powerful

as the ecological processes we try to stabilize. Many people clung to the idea that technological advances in erosion control could protect the lighthouse in its current location from the Atlantic. However, the historic character of the lighthouse proved to be too much of a precious artifact to sacrifice to the ocean, and the lighthouse was relocated.

What can we learn from the moving of the Cape Hatteras Lighthouse? If economically feasible technology is available, and there is an opportunity to save a national treasure, then by all means attempt it. However, in considering future development, perhaps it is safer to build further away from a dynamically shifting shoreline. Unless we are able to part with our home, store, or hotel, building further away from the shoreline remains the most economically and environmentally viable option.

Fig. 4.7: Cape Hatteras Lighthouse before the move (below); the lighthouse during relocation (left). (source: copyright 1999 Gary Braasch)

The debate revolving around the moving of Cape Hatteras Lighthouse also taught us an important lesson about change, stability, people and design. People crave stability in a world of flux – it is one of the reasons we switched from a nomadic lifestyle to an in-place lifestyle (Kronenburg 1995). After switching these lifestyles, though, we in turn lost the ability to understand or see how much flux is occurring around us. This turning of a blind eye to the chaos present in our lives and in ecological systems is at the heart of our problem of misunderstanding our relationship with the environment. While we are currently able to see time pass in an orderly fashion, we are ignoring the rest of the time spectrum (de Certeau 2002). That is, there is another aspect of time, that of flux, that is also present. Our Western eyes and brains have a difficult time accepting the fact that things are not orderly and predictable (de Certeau 2002). But it is situations like the moving of Cape Hatteras Lighthouse that are able to push us away from the orderly end of the spectrum and pull us towards a more complete understanding of time somewhere in between orderliness and chaos. It is this middle ground that will allow us to create a deeper understanding of where we (as well as the built environment we design, dwell within and create a relationship with ecological systems) fit into our dynamic planet.

PART FOUR – Case Studies

PART FOUR – Case Studies

Oregon Inlet: Shifting Ribbons of Sand

Originally created during a nor'easter in 1846, Oregon Inlet is the northernmost inlet in North Carolina (Pilkey and Dixon 1996). While it moves between 75 and 150 feet annually, there has been an attempt to harness its power and stabilize it to behave more like its counterparts to the south, Hatteras Inlet and Ocracoke Inlet. The U.S. Army Corps of Engineers began bridge construction in 1962, just prior to the catastrophic Ash Wednesday nor'easter. Since then, both the North Carolina DOT (who maintains the bridge spanning from Bodie Island to Pea Island) and the Corps have had to deal with increasingly invasive procedures to stabilize the area.

> "As at numerous other artificially maintained Atlantic Coast inlets, once a navigable, maintained channel has been established, there begins a progression of ever increasing engineering stabilization that entails widening and deepening and, eventually, jettying. Channel deepening and jettying leads to erosion of adjacent shorelines, leading in turn to seawall construction or continual and costly replenishment." (Pilkey and Dixon 1996, p. 194)

This is a clear attempt of humans to create stability in a place where chaos is the dominating force. While it is convenient to have a bridge as well as a safe, navigable channel, it is unclear as to the potential harm this project may be causing. Since inlets are a barrier island's way of coping with the movement of excessive amounts of water during a storm, there is a need for them to be able to shift according to what the current

needs of the area may be. If the water is unable to wash from the ocean into the sound and back to the ocean during a severe storm, the water will take the path of least resistance elsewhere, whether it is through someone's home or a shopping center full of merchandise. This occurred in September 2003, during Hurricane Isabel. Nearly 40 miles south of Oregon Inlet, on Hatteras Island, the barrier island created a new inlet to allow for the ebb and flow of water through the Pamlico Sound and back into the Atlantic during the hurricane. North Carolina spent $4 million filling in the 1,700 foot gap created during the storm and repaired NC-12, the road that skirts the ocean's edge of the Outer Banks (Galuszka and Martin 2003).

With a deteriorating bridge spanning the constantly shifting inlet (dredged at a cost of $4 million annually), something must be done soon to make sure the dynamic environment does not interfere with the economic boon of the Outer Banks vis a vis the tourism and fishing industries. Few alternatives have been offered up to the community from various sources. One option would be to replace Bonner Bridge with an almost exact replica just to the west and continuing to dredge as usual (Kozak 2004). Another option offered up involves the creation of a 17-mile bridge that completely bypasses the Oregon Inlet area (as well as Pea Island National Wildlife Refuge) by heading south through the Pamlico Sound and eventually making land down near Rodanthe, a small village on Hatteras Island. In a 2003 letter to citizens of the Outer Banks, Refuge Manager Mike Bryant urged the residents to consider this 17-mile bridge as a viable alternative that would allow for natural processes and the economic interests of the area to coexist.

Fig. 4.8: Oregon Inlet in 1975 (source: The United States Army - army.mil)

Bryant notes:

> "The refuge's mission is to conserve, manage, and restore fish, wildlife, plants and their habitats, but people, too, benefit. Though its primary purpose is to be a refuge and breeding ground for migratory birds and other wildlife, Pea Island National Wildlife Refuge has been providing wildlife-dependent recreational opportunities for more than 65 years. It is a favorite destination for locals and visitors for fishing, birding, photography and environmental education."

Although a final decision has yet to be made, an urgent consensus is needed as the pilings for Bonner Bridge are becoming less stable due to shifting shoals. The 17-mile bridge option is an example of the shifting perception of our understanding of the dynamic flux of the environment.

Although this is the most current public issue to hit the Outer Banks, it is nothing new. This is yet another example of our currently flawed relationship with the environment of which we are an integral part. As with the Cape Hatteras Lighthouse, it is clear that engineering a way to try and dominate nature is usually not a long-term solution, and often has negative consequences (Pilkey 1996). We need to accept the fact that Oregon Inlet annually shifts and design with that in mind. That is not to say that people should not be able to cross the inlet over to Pea Island, but we need to cross in a way that does not interfere with the flux of the inlet. There is a middle ground of accepting the fact that ecological systems are in flux and oftentimes unpredictable. We must learn to not only design with this flux, but revel within it by creating places that offer an opportunity to teach visitors what a dynamic environment we are a part of, but how we can responsibly relate with the ecological systems present. Landscapes that are in flux can create a deeper understanding of what really is going on around – and within – ourselves.

Fig. 4.9: Oregon Inlet in 2001 (source: Southern Division American Fisheries Society (SDAFS).

PART FIVE:

Summary

As Bernard Lassus said in The Obligation of Invention (2002):

> "The fact that a place exists before one proposes to do something to it has repercussions on the nature of the intervention and poses, in a radical way, the question of knowing whether or not one has to intervene…the minimal intervention is to bring other tangible dimensions to what is already there." (p. 68)

As synthesized through the literature review and case studies, flux is already present on a site. Using the existing flux of a site as a design tool for the built environment allows us the flexibility to intervene and create relationships through what currently exists on a site. These existing systems are constantly shifting; by designing the site as a register of this change, we are able to redefine our currently disconnected relationship with the ecological systems present around us through this flux.

But the design intervention is more than just a register; it is a way for us to use flux that activates our senses, "to bring other tangible dimensions" that reconnect us and our own flux to the changing ecological systems. Although we all have the capacity to use our senses to understand our environment, we are bombarded with more images, smells and feelings than we can possibly synthesize. Therefore, we edit the information being collected through our senses. Some people choose to edit down that information into a thought-ful synthesis of understanding and connection. Others, overwhelmed by the information, choose to synthesize an incomplete and disconnected understanding. This may be occurring in part because of our culture of instant gratification, where we feel too rushed to take the time to understand what is happening around us. Design, therefore, gives landscape architects the opportunity to poetically reenergize people and make them more aware of what is going on around (and within) them through the built environment.

And what is going on around them is certainly not static. Design can act as a trigger for people to synthesize the information gathered from their senses into a knowledge that accepts the flux within themselves and their surroundings. This change is not always a safe, happy element, though; sometimes flux works to the benefit of designers, users and the site – but at other times, it works to the detriment of all of those involved. For example, flux can oftentimes mean total destruction (as is often the case with homes along the coast during a powerful hurricane); yet at other times, it can usher in creation, collection and dissipation in a way that emphasizes and revels in a process most do not normally consider.

Whatever the result, the process of using flux is time-sensitive and approaches time on multiple levels: the day-to-day, seasonal, annual, generational, and geological. Some of these have a recurring, cyclical character; yet others continue to change, never looking back. Whether the site's flux has a foot in the past, one in the future, or both firmly in the present, developing the use of flux in the built environment presents an opportunity for us to fundamentally change our relationship with the environment of which we are an intrinsic part.

Of course, this new, shifting relationship will require a significant change within the current context of public policy decisions. Can we use legislation and public policy to create places that are able to work with the ebbs and flows of the ecological and social processes? According to McDonough's Hannover Principles, we will have to make these changes in order to live in a way that embraces shifting ecological, economic and socially equitable practices in the built environment (McDonough 1992, p.10-11):

PART FIVE – Summary

1) Insist on the right of humanity and nature to co-exist in a healthy, supportive, diverse and sustainable condition.
2) Recognize interdependence. The elements of human design interact with and depend upon the natural world, with broad and diverse implications at every scale. Expand design considerations to recognize even distant effects.
3) Respect relationships between spirit and matter. Consider all aspects of human settlement, including community, dwelling, industry and trade, in terms of existing and evolving connections between spiritual and material consciousness.
4) Accept responsibility for the consequences of design decisions upon human well-being, the viability of natural systems and their right to co-exist.
5) Create safe objects of long-term value. Do not burden future generations with requirements for maintenance or vigilant administration of potential dangers due to the careless creation of products, processes or standards.
6) Eliminate the concept of waste. Evaluate and optimize the full life cycle of products and processes to approach the state of natural systems, in which there is no waste.
7) Rely on natural energy flows. Human designs should, like the living world, derive their creative force from perpetual solar income. Incorporate this energy efficiently and safely for responsible use.
8) Understand the limitations of design. No human creation lasts forever, and design does not solve all problems. Those who create and plan should practice humility in the face of nature. Treat nature as a model and mentor, not as an inconvenience to be evaded or controlled.
9) Seek constant improvement by the sharing of knowledge. Encourage direct and open communication between colleagues, patrons, manufacturers and users to link long-term sustainable considerations with ethical responsibility and to reestablish the integral relationship between natural processes and human activity.

It is important to become more aware of this flux within ourselves and ecological systems, or these processes in flux, to fundamentally change the way we design and dwell within the built environment. Instead of trying to make our landscapes static by working against the inherent flux present to create permanence, we can utilize flux because our built environment is able embrace and adapt to the human and ecological changes. We can now invest in allowing the fluctuations of human and ecological systems to occur, and value the benefits, which include:

- Narratives of different time scales brought to the surface that further enrich the understanding of the site;
- Mobility present in the site elements and paths that allow more people to enjoy and connect with the place on their own terms;
- Reflexivity that would allow the site to dynamically adapt over time to ecological and social changes.

The literature review and case studies have set the groundwork for this dynamic and reconnected relationship between humans and the environment of which we are an intrinsic part. The next step in this process is the site design. It explores how this relationship, free of flux-inhibiting engineered barriers, can take a conceptual form.

PART FIVE – Summary

PART SIX:

Design

Fig. 6.1: Watercolor study: flux in the landscape. (source: S. Ridgely)

I have always been fascinated with the idea of change in the landscape, whether it was due to my motion within it (as when driving in a car, walking through a garden, or taking the Metro over the Potomac River), or when it moves about me (as with a snowstorm, changing tides, phototropism or hurricanes). I view the landscape with a dynamic eye. So I found it peculiar, once I was accepted into landscape architecture school, that we tended to underemphasize this idea of motion (or flux, which tends not to follow as much a pattern) in our designs. Stability creates a safe framework for us to design within. As time has passed, though, the design discipline has begun to embrace this idea of flux as a design tool we can use – even revel in.

From there, I came up with the thesis question: how can we use flux to create dynamic systems within the built environment? I wanted the opportunity to test this question in an area where human flux and ecological flux overlapped in a way that was not currently

symbiotic or dynamic in order to see if I could make these two seemingly disparate kinds of flux respond to each other in a mutually beneficial way.

I began to think about places I can go and constantly "revel" in this flux, and the clearest example happened to occur in/on/with a place I have had a deep connection with since I was a baby: the coast. With Professor Ben Johnson's encouragement, I decided to take a five-day trip along the North Carolina coast to learn more about both human and ecological flux. It helped me to better understand the importance of beach equilibrium, as well as peoples' connection to living in such a volatile environment. While this was not a physically cyclical trip, I found that the things I absorbed brought me right back to the issues I would deal with on my site. Many people have asked, 'should people even be allowed to live on the coast?' I certainly think so, although it is going to take a fundamental shift in the way we relate to the environment we are an integral part of.

I believe our shoreline is something that everyone should have the opportunity to enjoy, even people who are not able to afford the rent or mortgage on an oceanfront home. Humans are a part of the environment and should have access to places of beauty, whether it is "natural," man-made, or something in between. We should be able to revel in the fresh ocean air, respect the constantly fluctuating shoreline and protect the habitat of flora and fauna. But we must do so with an understanding of how to minimize our development impacts and embrace the ecological flux present on these very fuzzy strips of sand.
And these fuzzy strips of sand are full of opposing forces. In the realm of human flux, there are the locals who dwell there year-round, and visitors who mainly visit between May and September. There are also two kinds of ecological flux present: a cyclical flux, like the changing of tides and seasons, and the non-linear kind, such as shoreline migration and sudden storms (such as hurricanes and nor' easters).

To quote Anne Spirn:

> "The greatest challenge of landscape expression is the complexity of the medium and the fact of its abiding change." (1998, p. 64)

With this complexity came a desire to explain these forces, or this flux, at work – so I began to experiment with watercolor to explore the dynamic forces wrestling each other. I also used the watercolors to look at how there are opportunities within our current static, linear understanding of design to let this flux bleed into our built environment. This is a time of transition from the static to a dynamic built landscape.

From there, this understanding of flux informed the shape and interactions within the site. The line of flux, or strongest force representing ecological systems was located along the beach ridge, running north-south along the oceanfront dune line. The force of human flux was dominated on the site in an east-west direction, mimicking the old Kitty Hawk Pier inland along US 158. These two forces helped define the rest of the design intervention.

While the site thrives as a unified system able to adapt to the flux of the ecological and human systems, there are also great opportunities to truly understand the flux of the site within the smaller places and elements that dot the landscape.

Fig. 6.2: Our current relationship with the shoreline. (source: Friends of the Earth)

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Fig. 6.3: Contextual map of the site and surrounding area. Kitty Hawk is south of the site, and Southern Shores is just to the north. US-158 aims directly towards the pier, but veers south just prior to the site. (source: Dare County GIS)

Fig. 6.4: A closer image of the site. Note how the site is cradled by US-11, which used to cross right through the site before it was relocated. (source: Dare County GIS)

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Island
Pier
Dune Crossing
Pavilion (Cistern Located Underneath)
Portable Housing
Wind Turbines
Parking
Portable Housing
Parking
Movable Walkways
Portable Housing
shoreline (re)creation: kitty hawk pier
kitty hawk, north carolina
spring 2005 thesis
s. ridgely
1
north

The Island

The offshore island is constructed using a buildup of riprap and pilings to collect littoral flow of sand offshore. There is a continual pattern of creation, collection and dissipation occurring along the coast, and the intention is to use human intervention to capture a better understanding of these ecological processes.

(previous page) Fig. 6.5: Site plan for Kitty Hawk Pier. (source: S. Ridgely)

Figure 6.6: Watercolor study of sandbars and littoral flow along the shoreline. (source: S. Ridgely)

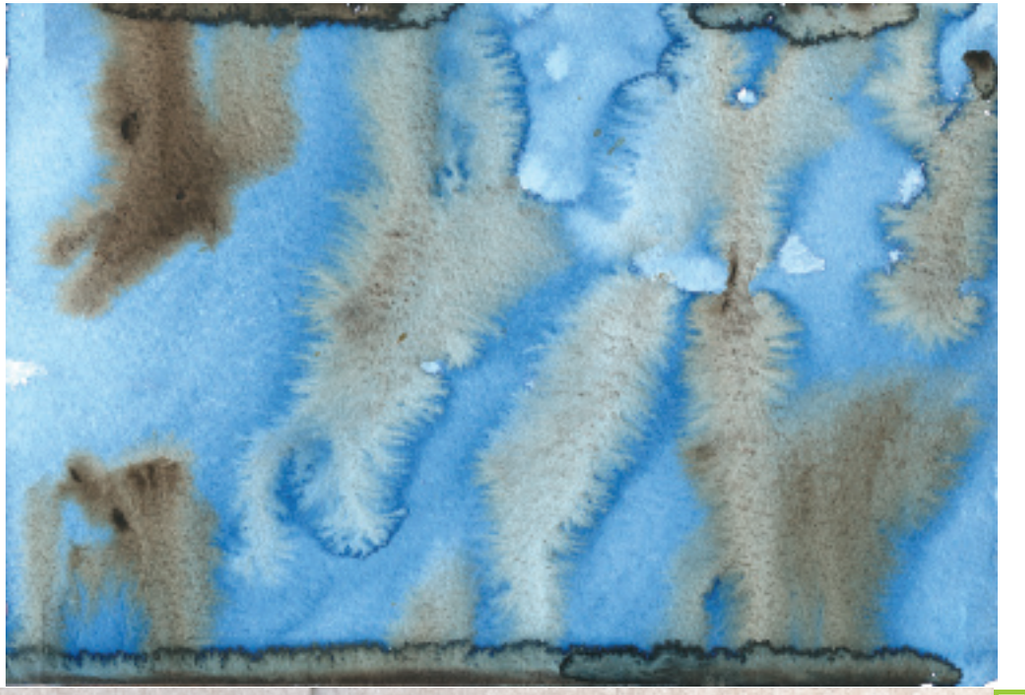

Figure 6.7: Section of the human intervention aspect of island development. Similar to a shipwreck, both riprap and pilings are used to allow the sand to create, collect and dissipate over time along the shoreline. It also acts as an ideal marine habitat. (source: S. Ridgely)

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Fig. 6.8: (near right) Watercolor investigating extension of pier creating a re-established relationship with the Atlantic Ocean. (source: S. Ridgely)

Fig. 6.9: (below) Watercolor study of the transitional manner of a dune crossing. (source: S. Ridgely)

Fig. 6.10: (far right) Watercolor exploring the harnessing of wind power by turbines. (source: S. Ridgely)

Pier

This human intervention is also present in a new, concrete pier to be constructed as a series of curves through the old pilings. While the old pier's pilings remain, the new pier is shaped in the form of a curve, a reference to the Fibonacci sequence. The pier acts as an historic and cultural marker for the dynamic, often unpredictable change of the constructed island and the Atlantic Ocean.

Dune Crossing

The pier connects to a dune crossing that is moved annually to accommodate beach dune shifts by using screw pilings, which are able to easily be planted into the sand or quickly removed. Constructed from both recycled plastic and wood, this dune crossing ties into the first of five wind turbines, generating power for the site's infrastructure.

Wind Turbines

The wind turbines, one of the few "fixed" features of the design (although they must spin to capture the energy of the wind) also acts as a register of the flux present on site. We need energy, the ecological system produces wind, so we can safely harness it and create a symbiotic relationship.

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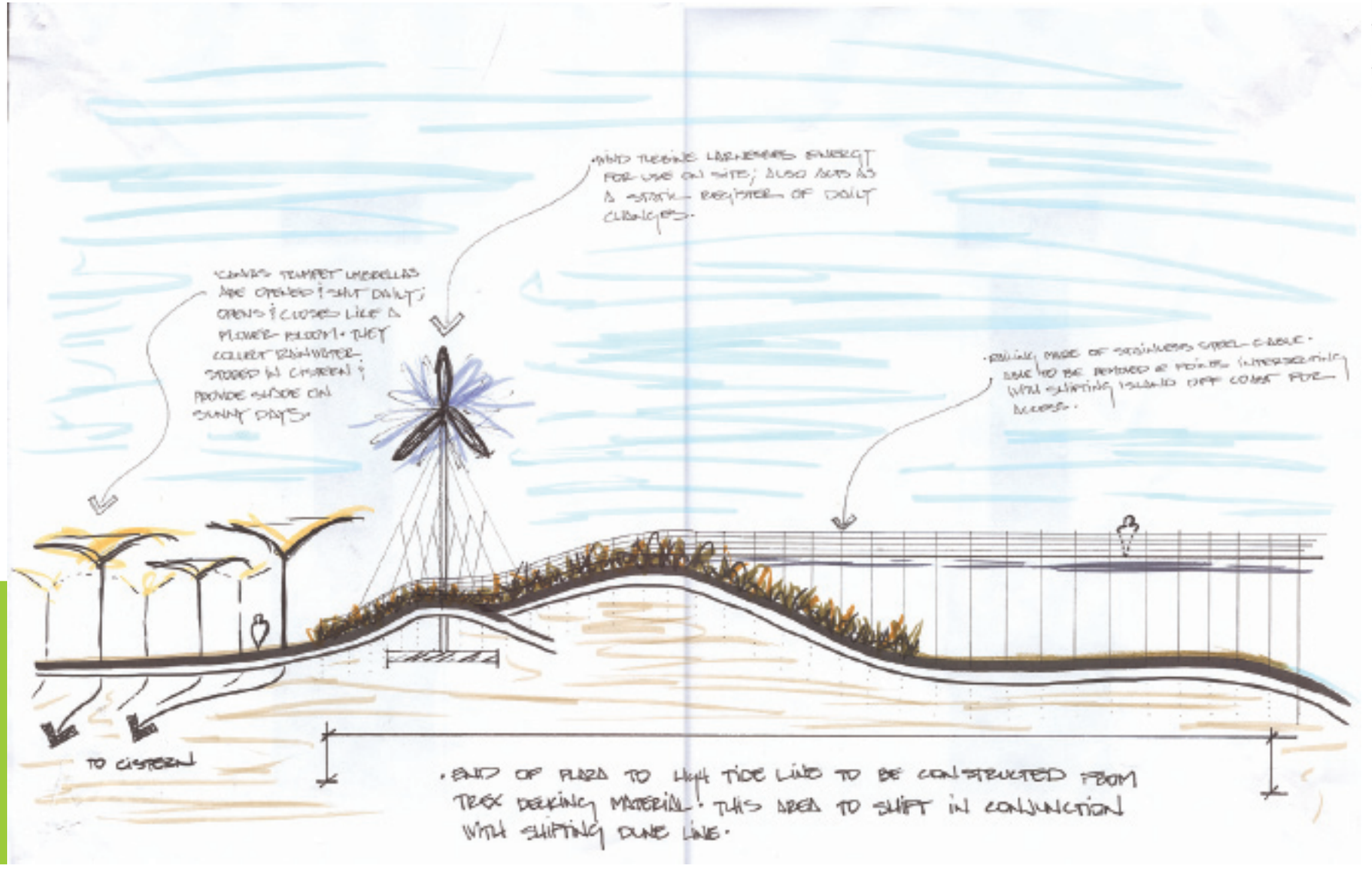

Fig. 6.11: Section through site looking north from shoreline to the pavilion. (source: S. Ridgely)

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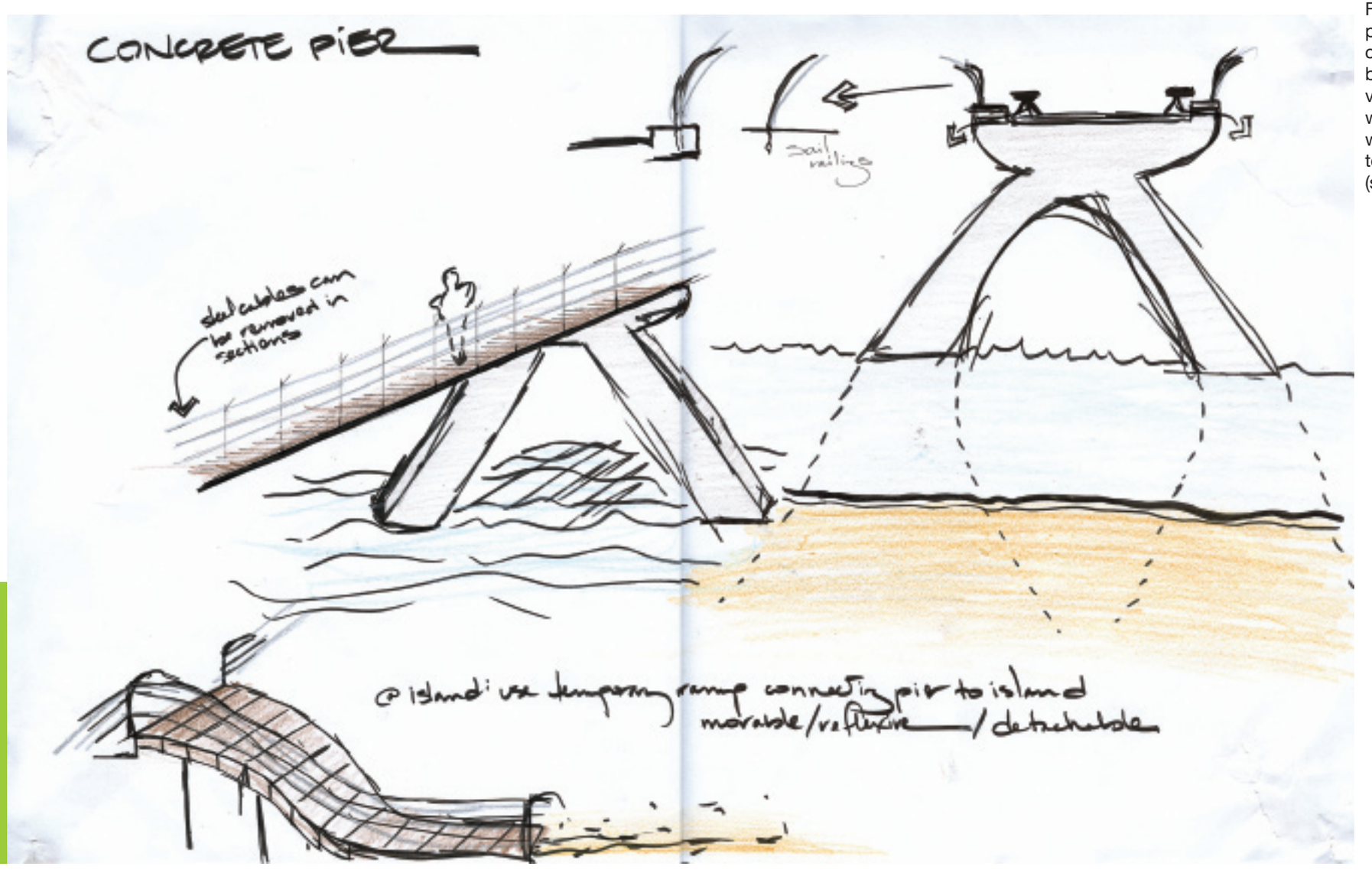

Fig. 6.12: Concrete pier and railing concept. The pier must be able to allow for visitors to interface with the island if or when the sand shifts towards the pier. (source: S. Ridgely)

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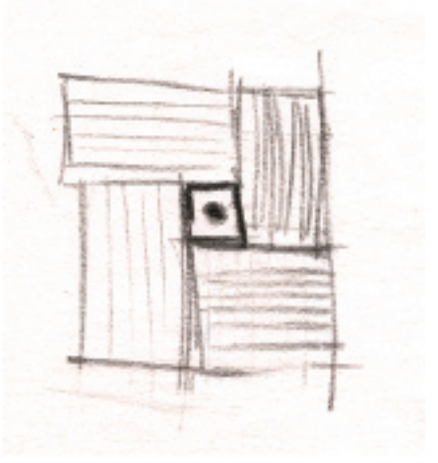
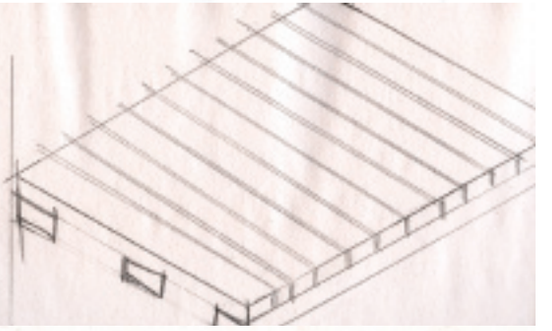
Pavilion

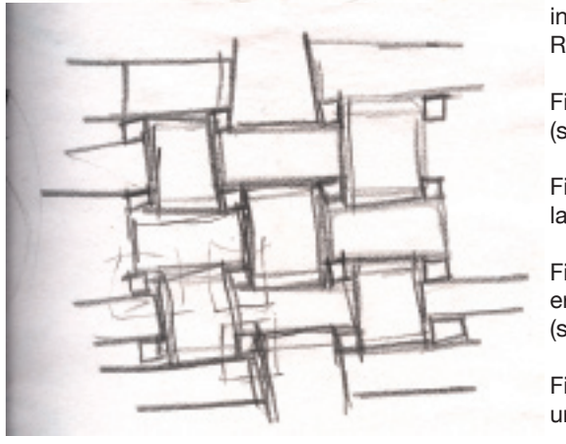
One of the places using the energy harnessed through wind power is the pavilion. The pavilion is a place to relax, pick up a drink or rent a beach chair, take a shower, or just get out of the sun. Visitors are protected by canvas trumpet umbrellas that also collect rainwater through the umbrella, down the clear acrylic tube, through the plastic, sand-filled pedestals, and through flexible pipes under the flooring into an underground plastic cistern. These umbrellas bloom in the morning and are battened down at night to expose an opportunity to view the evening sky.

A critical aspect of the pavilion (and the site as a whole) is the portability of the place. While its activities are certainly place-specific, and the materials speak to the vernacular of the Outer Banks, the actual elements that make up the built environment are able to be moved with the seasons – or more quickly, as when a potentially damaging storm is approaching the area. The modular flooring panels of the pavilion are set on plastic pedestals that are lightweight enough to be moved around, yet sturdy enough when filled with sand to act as a support system for the flooring, raising the floor panels up off of the sand. This not only allows sand to be swept underneath of the flooring, but also gives the umbrellas a place to screw into and connect to the flexible cistern pipes located below the flooring.

The large plastic cistern is located underneath the initial placement of the pavilion, towards the northwestern part of the site, safe from the potential harm of the oceanfront in flux. It is dug into the ground, with the top just under the surface of the sand. Each of the umbrellas has a flexible pipe that connects through the plastic pedestal into the top of the cistern. As the site migrates west, however, the pipes can be lengthened to still connect to the cistern. If the cistern is threatened by shoreline migration, it can be moved further back towards the west to remain out of harm's way.







(clockwise from top left)

Fig. 6.13: Plastic cistern has individual pipe connections to allow for individual relationships between itself and the trumpet umbrellas. (source: S. Ridgely)

Fig. 6.14: Mounding sand at the edge of the pavilion allows for a gradual elevation change to reach the floor from the movable walkways. (source: S. Ridgely)

Fig. 6.15: Flooring units allow for sand to be swept underneath as well as leaving room for cistern pipes. (source: S. Ridgely)

Fig. 6.16: Cistern pipe conceptual layout. (source: S. Ridgely)

Fig. 6.17: An option for the flooring unit layout. (source: S. Ridgely)

Fig. 6.18: Watercolor study of the layers and portability of the pavilion area. (source: S. Ridgely)

Fig. 6.19: Another option for the flooring unit layout. (source: S. Ridgely)

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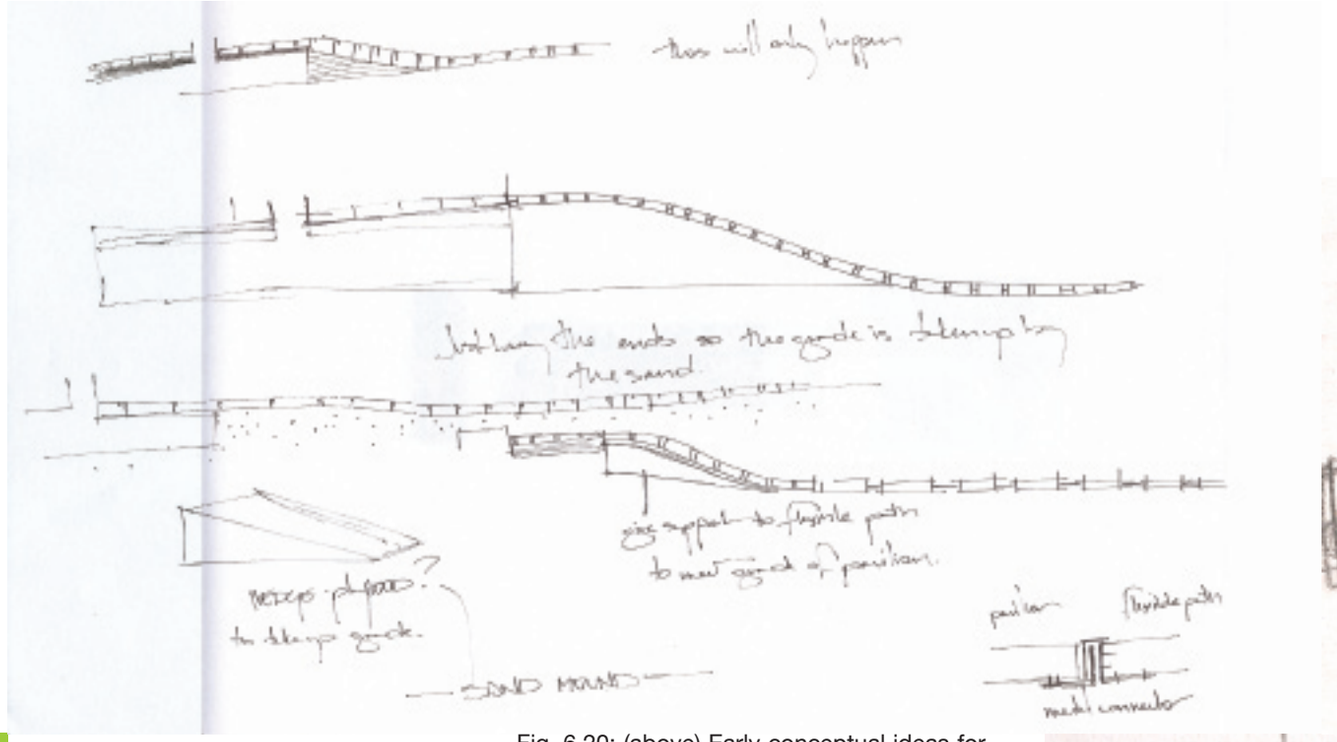


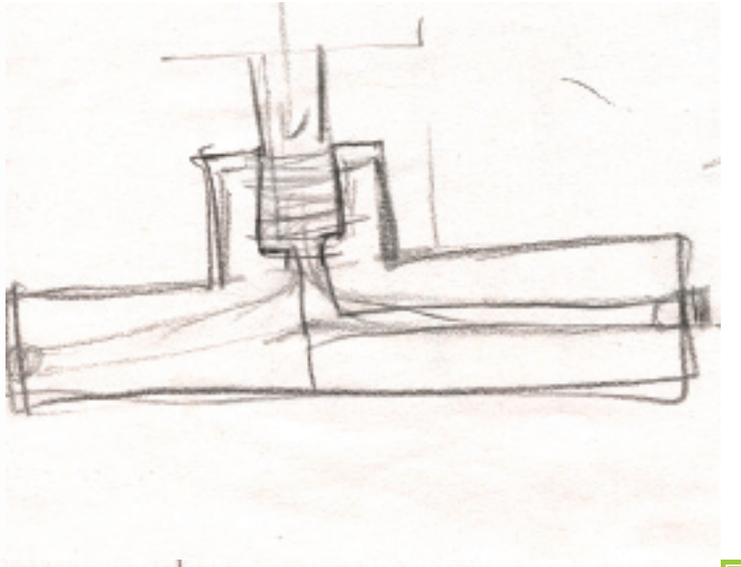
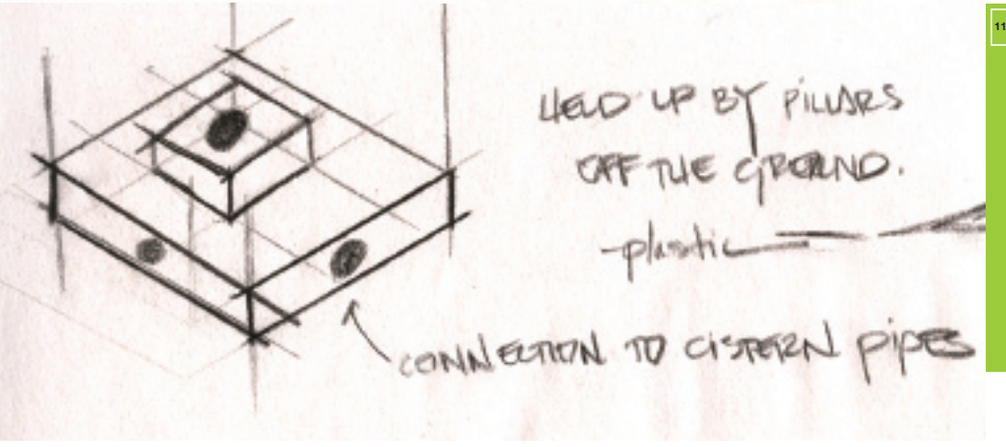


Fig. 6.20: (above) Early conceptual ideas for bringing the walkway up to grade with the pavilion. (source: S. Ridgely)

Fig. 6.21: (right) Plastic pedestal holds a trumpet umbrella in place, allows the water to pass through to connect with the cistern pipes, and acts as a footer to raise the pavilion flooring units off of the ground to leave space for pipes and sand that has been swept from floor surface. (source: S. Ridgely)



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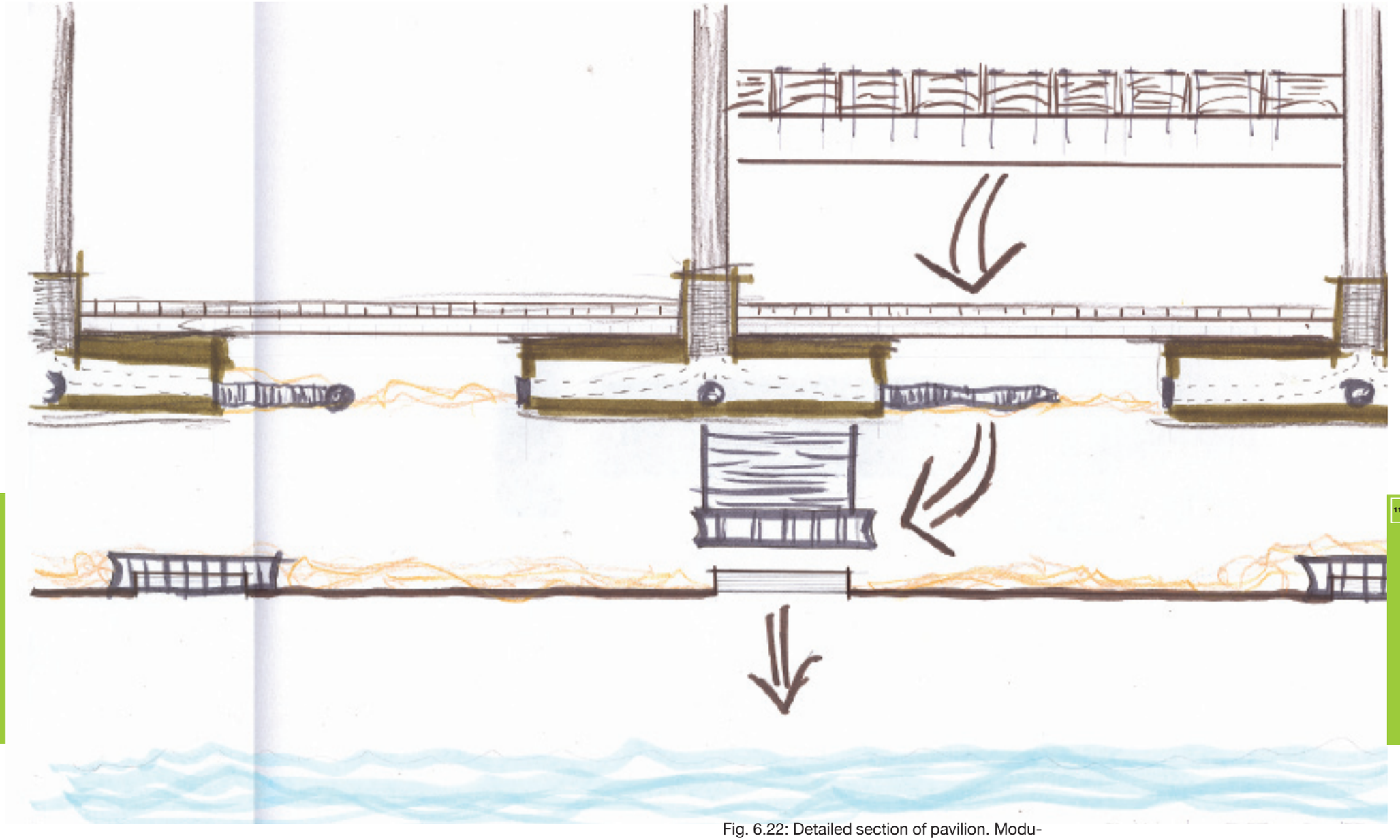

Fig. 6.22: Detailed section of pavilion. Modular flooring units rest on plastic pedestals filled with sand. The trumpet umbrellas collect water through acrylic tubes that run through the pedestal, into the flexible cistern pipes, and is stored in the plastic cistern below. (source: S. Ridgely)

Fig. 6.23: The daily blooming of the trumpet umbrellas. (source: S. Ridgely)

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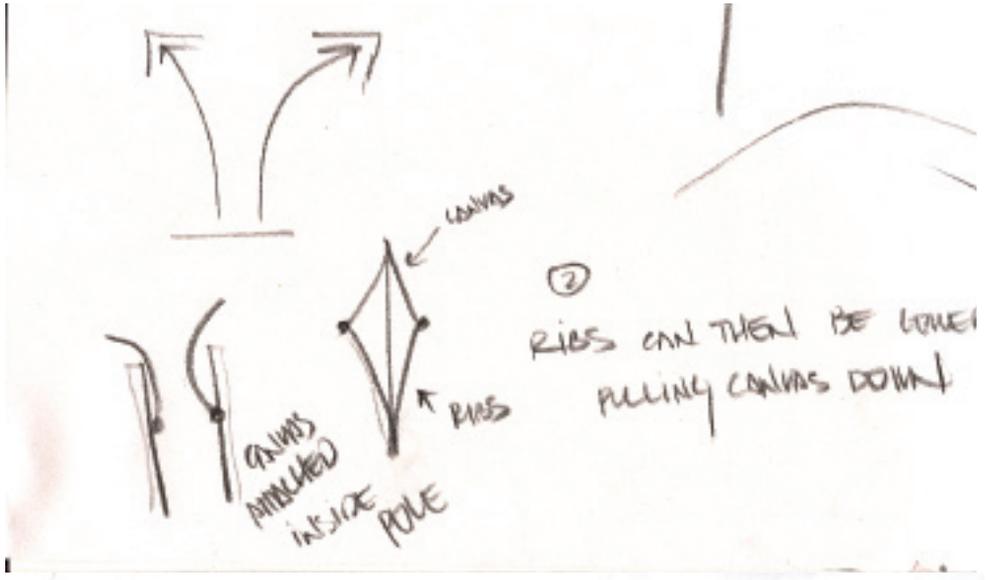

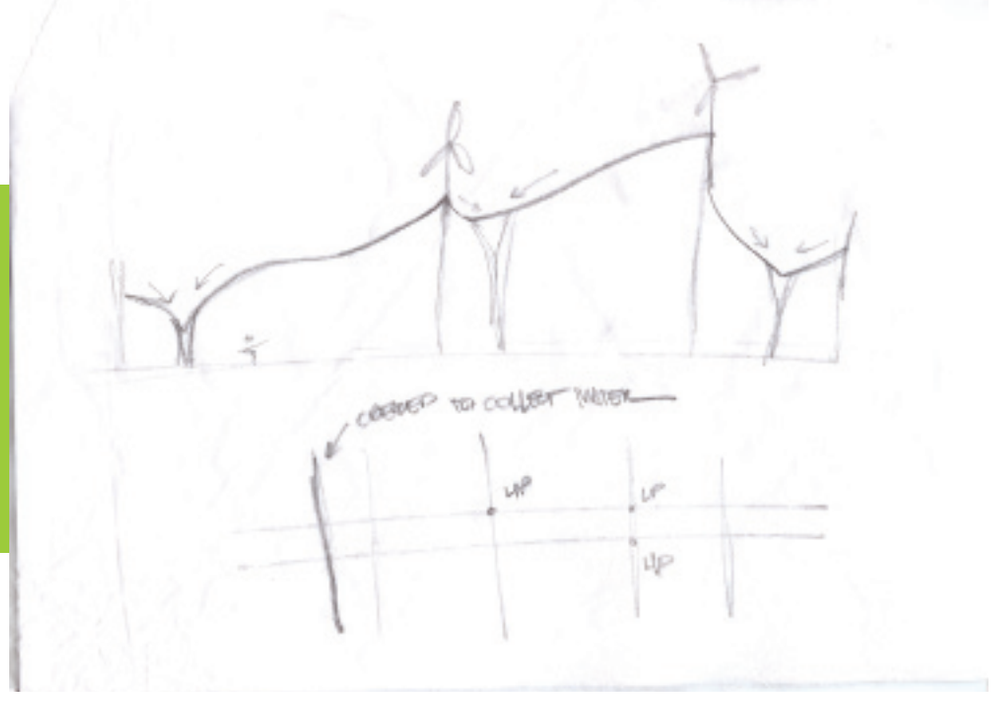

(clockwise, from top left)

Fig. 6.24: The canvas of the trumpet umbrella connects to the top of the acrylic pipe through the inside, providing a seamless connection for the water to run through. Four structural ribs run along outside channels cut into the acrylic in order to raise and lower the umbrella on a daily basis. (source: S. Ridgely)

Fig. 6.25: Pedestal and flooring layout concepts. (source: S. Ridgely)

Fig. 6.26: An early sketch of the pavlion using one large tensile structure instead of individual umbrellas. This proved to be too cumbersome for a portable design. (source: S. Ridgely)

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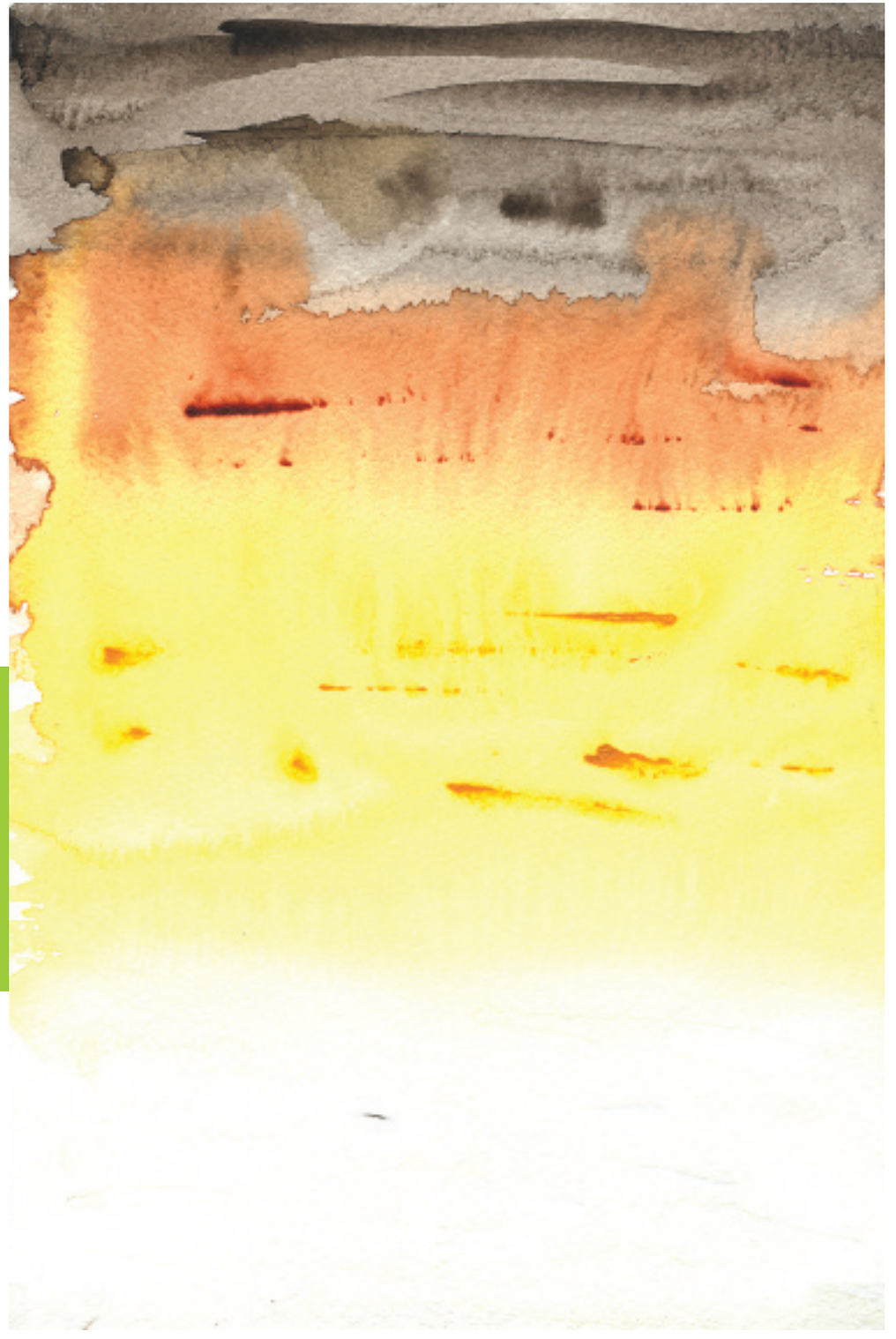

Fig. 6.27: Watercolor study of the flexibility of the walkways on site. The walkways are able to be moved in response to the flux of the ecological and human systems of the site. (source: S. Ridgely)

Walkways

From the pavilion, movable wooden walkways held together with rope take people through the dunes, wind turbines and contemplative spaces to the parking lot (paved with loose oyster shells). The walkways are fifteen feet long by five feet wide, and are able to be rolled up, unrolled, and easily moved throughout the site. If there is a situation in which a cistern pipe must cross with a path, sand can be mounded to cover over the pipe while running the moveable walkway over top of the mound.

The wooden walkways are a conscientious attempt at reusing materials that have existed on the island in another iteration. While it is simple to find 2x6's at most hardware stores, the intent is to use wood from old houses that have been previously damaged from storms and are no longer considered habitable by the town. This helps to incorporate the flux experienced by other sites along the coast into this site.

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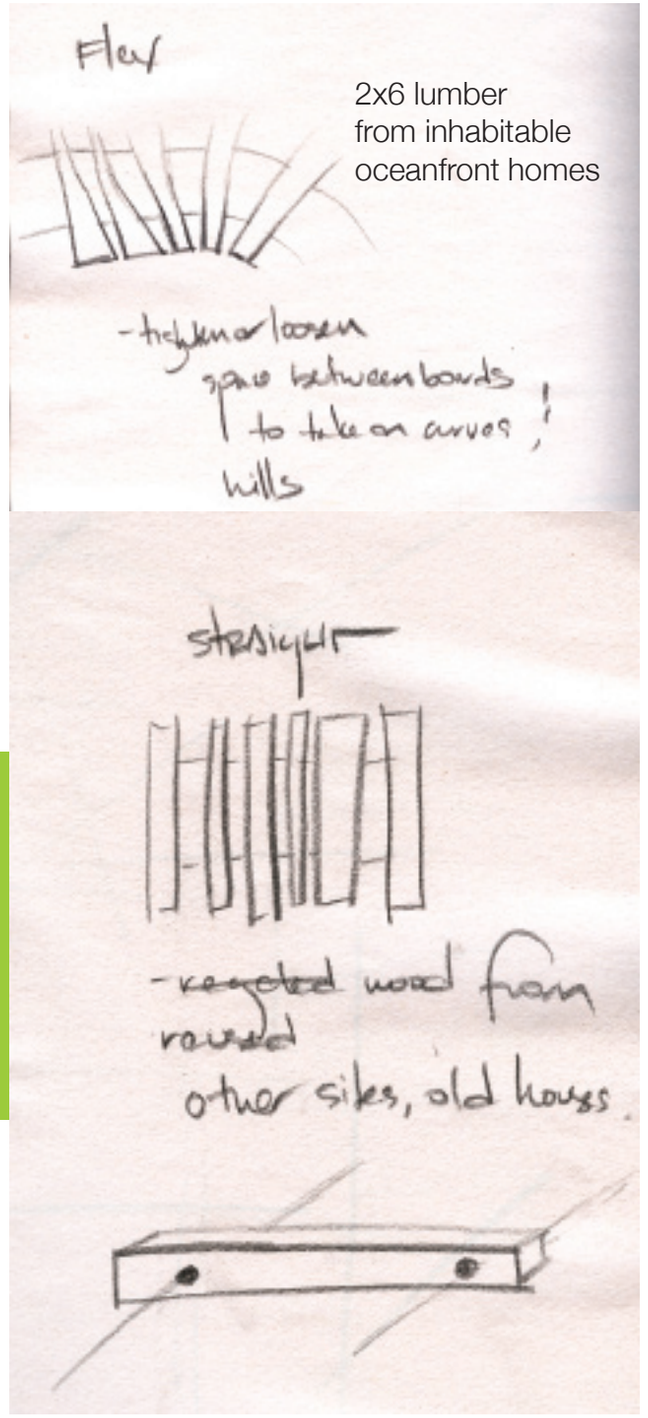

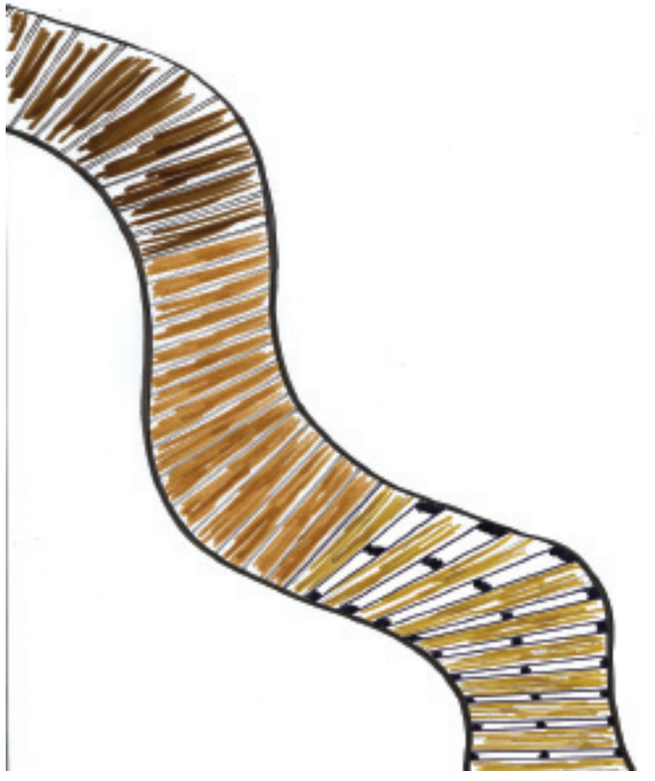

Fig. 6.28: (opposite page) Sketches exploring all of the flexible possibilities for the walkways. (source: S. Ridgely)

Fig. 6.29: (top right) The walkways have the ability to deal with changing topography on the site by using ropes to connect the reused wooden 2x6's together. Increasing or decreasing the amount of space between boards allows for more flexibility. (source: S. Ridgely)

Fig. 6.30: (center) Photograph of flexible walkway found at Topsail Beach, North Carolina. (source: S. Ridgely)

Fig. 6.31: (below left) Sketch of flexible walkway's different shapes and forms it can take. (source: S. Ridgely)

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Fig. 6.32: Watercolor exploring our current understanding of static housing within the ecological flux of the shoreline. (source: S. Ridgely)

Portable Housing

Unlike the existing, static housing, the portable housing is able to easily accommodate the flux of the environment along the shoreline and is able to show visitors how the siting of the house has changed over time. This portability prevents any need for the town to pay the environmentally and economically high bill for beach renourishment, since the housing is able to move enough to give the beach enough space to "breathe."

This housing is an attempt to join a more nomadic relationship with the land to our current static understanding of dwelling. Of course, it is always possible to go camping further south at the Hatteras National Seashore, but there is a middle ground on this site that offers the convenience and vernacular material choices of a static house combined with a more flexible relationship with the landscape found in nomadic housing.

The portable rental housing units are not only a way of generating money for the upkeep of the site, but also as a way to allow the site to adapt to the landscape over time. Just as the island has a short-term flux and a long-term flux, the dwellings are modular, and can add or reduce size depending upon how many people the place needs to accommodate on a short-term basis. Annually, however, the portable housing exhibits a more long-term flux where the pilings for the dwellings are sited for the season, and after five years, the old pilings are removed. The pilings are there for three purposes:

- to show how the placement of the dwelling has changed over time

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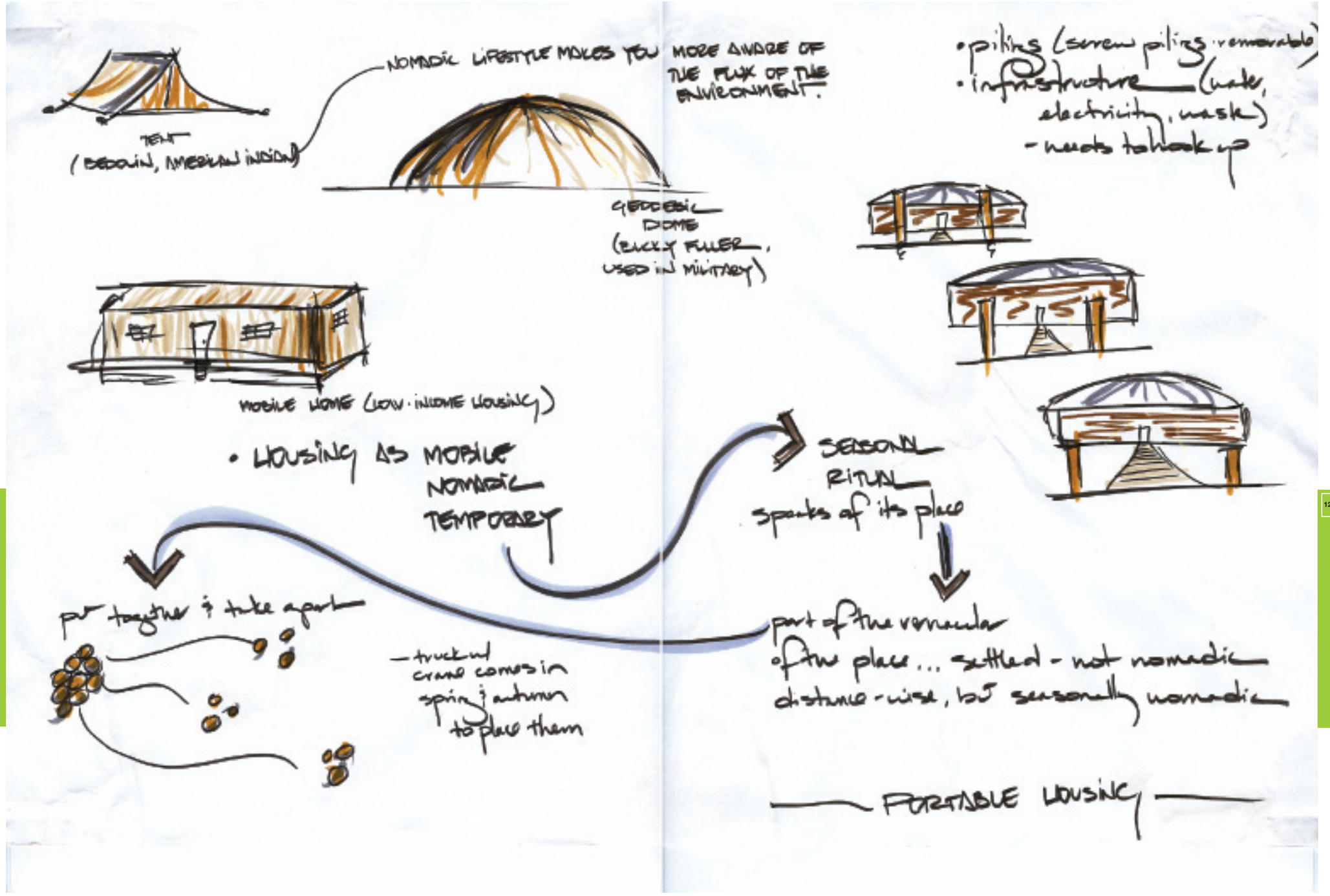

Fig. 6.33: Typological investigation of portable housing over time. The goal is to create a hybridization that is able to join nomadic and static housing. (source: S. Ridgely)

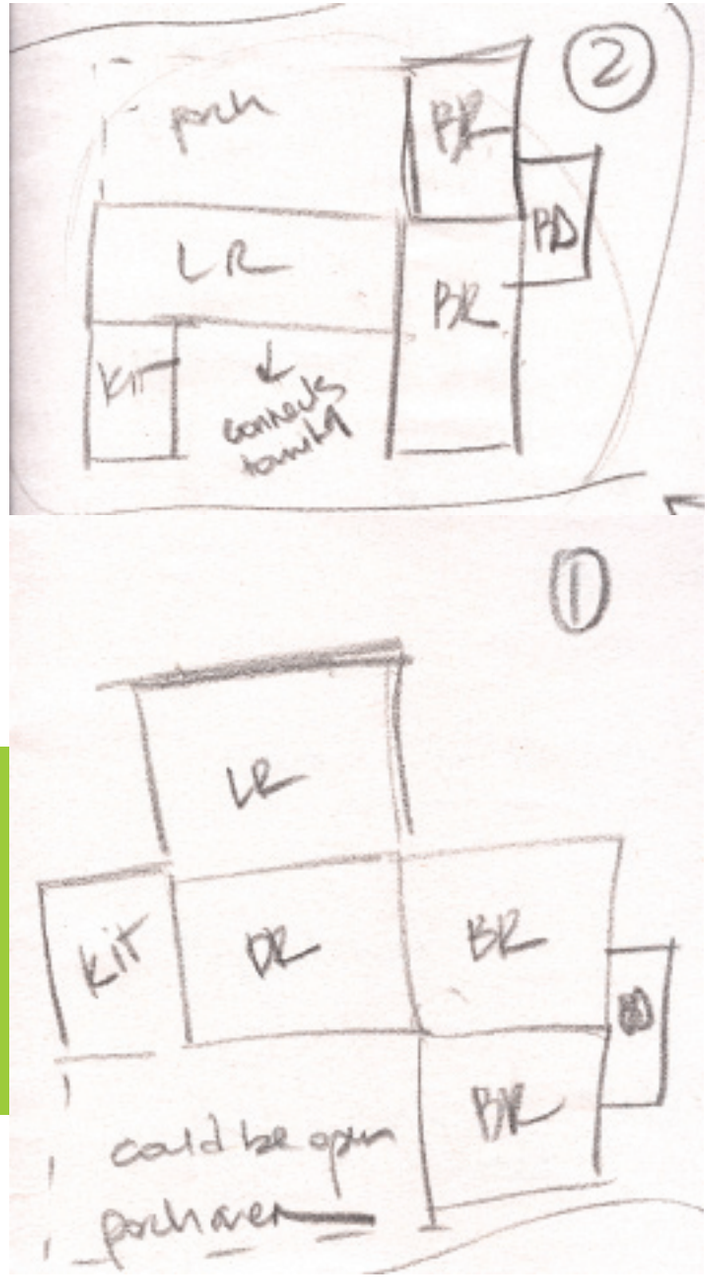

Fig. 6.34: (left) Two dwelling unit options; the units can then be physically connected to each other through the communal living/dining space, and a porch can be attached outside to unify the individual units. (source: S. Ridgely)

- to raise the dwelling to provide ocean views
- to allow for parking under the dwelling

The movable walkways connect to the portable, modular rental dwellings. These places are able to house a family of four (for example, a unit consists of 2 bedrooms, a living room, a kitchen, a bathroom and a dining room). These units could then be attached to each other to create larger units able to house more people (again, 1 unit = 4 people, 2 units = 8 people, 3 units = 12 people, etc.). When families make their reservations, they can mark down how many units they will need. The company can then deliver the units, set them up, and attach them to create enough space for the family. Building off of a two-bedroom, one bath unit, the company in charge of storing the infrastructure can drop by in between visiting families to either add or remove units, housing up to eight bedrooms/four bathrooms. The units can then be connected through the central commons area of a living room and dining room. The kitchen units are contained within modular cabinets on casters that can simply be plugged in within the central commons area.

If need be, these portable units can be easily broken down within a day. This gives families and the company enough time to safely evacuate the people and the units off of the island to prevent any damage. This also reduces the amount of cleanup after the storm, since the houses are not there to be ripped apart from the storm surge, damaging winds and possible tornadic episodes. The units are also removed from the island during the off-season to provide an opportunity for the land to rest and rejuvenate.

Both the site as a whole and the individual element of portable housing creates an opportunity to allow for more flexibility within the built environment while doing so in a sustainable way. While we create landscapes that are (hopefully) unique and somehow respond to the existing site conditions, the products we choose to populate our designs with are oftentimes not. We should create artifacts for our sites as unique as the site design, but still keep it affordable (and easily replicable, if we need it to be). This juxtaposition of personalized and mass-produced is a fascinating line to walk, and implications on one side often have relevance on the other.

As the fixed housing is being destroyed along the shoreline, this concept of replacing the condemned housing with portable housing will help to re-populate the oceanfront, but in a reflexive, sustainable manner. Portable housing is a hybrid between a nomadic way of life that makes things easy to put together and take apart, and that of a fixed, or in-place lifestyle most of us currently use.

There are many benefits to converting the housing stock along the oceanfront from static to portable:

- Housing units would be able to accommodate families of different sizes due to the modularity of the units.
- Housing units are portable enough to be quickly taken apart to prevent damage from hurricanes and nor'easters, but sturdy enough to withstand smaller storms.

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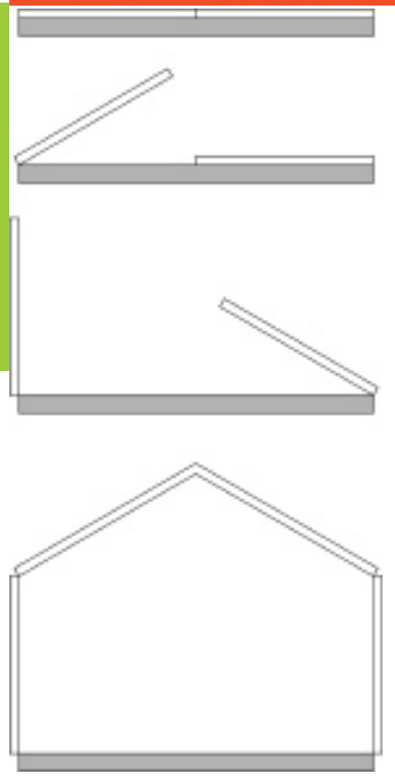

Fig. 6.35: (above) An R. Buckminster Fuller geodesic dome near Montreal, circa 1950. Fuller's investigation of affordable, lightweight, portable units was an inspiration for the portable housing of the project. (source: Your Private Sky, Lars Muller Publishers)

Fig. 6.36: (left) Conceptual study of the portable housing units. The walls would be hinged to the floor so that they could fold neatly flat on the moving truck. The units can function individually or attach to other units, and would be placed on a screw piling foundation once at the site. (source: S. Ridgely)

- Housing units are able to adapt to the landscape on a long-term basis, preventing the perceived need for beach renourishment.

Through an adaptive system of portable housing, there exists a great opportunity to provide for the greater good of the people and the environment of Kitty Hawk. These units are easy to reproduce en masse, yet are customizable, use materials that speak to the vernacular of the Outer Banks, and safe enough to provide for the comfort of visitors. They are also able to accommodate the flux of the unique environment of Kitty Hawk's oceanfront via their portability. This unique design solution is a way to respect and take care of the changing shoreline, yet still allow visitors to enjoy their vacation along the oceanfront.

The dwellings, moving paths, and pavilion infrastructure are "brought out" and "put away" in the spring with fall with two annual community projects that seasonally place, move, repair and remove site elements:

- Checkin' In: In the **spring**, locals are happy to get guests back on the island and bring out the infrastructure to use for the season:
    - o portable housing units are moved into place and hooked up to infrastructure
    - o pavilion trumpet umbrellas, pedestals, and modular flooring units are placed
    - o trumpet umbrellas are hooked up to underground cistern via flexible pipes
    - o rolls of reused wood paths are placed around dunes and vegetation, connecting houses and parking to pavilion
    - o recycled wood/plastic decking between pavilion and high tide line is shifted to safely allow passage over dunes and a connection to the concrete pier

- In the **summer**, there are also programmatic elements for visitors:
    - o outdoor showers and toilets located in the pavilion are turned on
    - o vendors are available at the pavilion to sell food, beach products, fishing tackle and bait, lounge and umbrella rentals
    - o the Town of Kitty Hawk has an official 4th of July celebration at the site
    - o tourists are able to rent one of nine portable homes on the site; profits go towards the upkeep of the entire site
    - o residents and tourists are able to enjoy one of the few areas on the island with a truly public beach

- Checkin' Out: By **autumn**, locals are tired of visitors and the long work hours. They want their island back and put away all of the infrastructure to let the site rest for the off-season. During this time, the elements are stored off the island (this may also occur when a hurricane is approaching during the late summer months, but elements will be returned to the island once the storm has passed):

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- portable housing units are repaired, unhooked from the infrastructure and stored away
- canvas trumpet umbrellas are repaired unhooked from cistern and stored away
- rolls of reused wood walkways are repaired and stored away
- any other necessary repairs are made to infrastructure, vegetation and pier

- **Winter** offers locals and the few visitors on the island an opportunity to see the site in its bare, resting form. It is the solitude of the site that is brought out to enjoy.

This engagement of humans to the flux of the landscape is at the heart of this project. This is more than a site as "register." It is a way for us to use flux that activates our senses, to bring other tangible dimensions that reconnect us and our own flux to the flux of ecological systems. There is a thought-ful-ness in the way we can edit what goes on around us through our senses. Design gives us the opportunity to poetically reenergize people and make them more aware of what is going on around and within themselves through the built environment.

PART SEVEN:

REFLECTION

Unfortunately, this site will not be constructed in the manner I have described in this thesis. Kitty Hawk recently approved the construction of a 120,000 square-foot Hilton Garden Inn resort to be completed around June 2006. It will offer 180 rooms located in two five-story towers and employ approximately 90 to 125 people. However, there is a hope that the intention of the site can continue to change the way we build all along the coast. As more oceanfront homes are destroyed by hurricanes and threatened by landward migration, as well as pressure in less-developed areas to build along the oceanfront, there is an opportunity for the critically-informed exploration of the site at Kitty Hawk Pier to bleed out and inspire other vacant sites to adopt a site design that incorporates flux.

Perhaps towns along the coast can work with land trusts to buy the land and create more enclaves similar to the suggestion of this thesis design. As the existing, static homes become

too close to the ocean to rebuild, a land trust could buy back the land from existing private landowners, and use that land as a catalyst in the area for change. More portable housing could then be placed on the site, as well as the moveable dune walkways present at the thesis site, to accommodate the flux of the visitors and the ecological systems present.

While McDonough's Hannover Principles have been used as a pillar upon which this thesis stands, perhaps it is time to reinvestigate our current understanding of sustainability that these principles provide. While McDonough has provided an eloquent basis from which to develop, this understanding of designing in an open, growing, changing system constantly in flux (as opposed to a closed, simplified system) requires another iteration inspired by the Hannover Principles.

Because of the research I have completed, the following principles have a life outside of the Hannover Principles. I have come to different conclusions about the development of the built environment because of the need to recognize that the landscape is a completely open system. We should not (and truly cannot) create an edge or boundary to make a system closed. The H.P.'s are a basis from which I developed a different ethical design stance, and has become a new iteration borne from his principles. Here, then, are six new principles to consider:

1) Use the natural processes of an area to give design a context from which to work. Without context, we are simply placing things on a site.
2) Understand the interconnectedness of a site to the surrounding area, and use that understanding to positively affect the adjacent sites. The processes on one site can bleed into other areas, creating a catalyst for change.
3) Revel within the lifecycle of a site. Nothing lasts forever. Things change. Becauase we cannot even begin to imagine all of the infinite possibilities of processes that occur (or will occur) on a site, we need to create a built environment flexible enough to adapt to these different processes that change over time. These are design tools that we can use to our benefit, not our detriment.
4) Begin to look at the landscape as something we are a part of, not a separate entity. We are able to exude a whole lot of power to destroy it. We are a part of it, just as the insects, fish and trees are. Let us use our prowess to work in the same direction as the landscape, not as an opposing force.
5) Landscapes are only successful if the people experiencing them realize how we are intrinsically connected to the land.
6) Flux in the built environment is the key to a sustainable future. By allowing the site to adapt over time, we can allow for both planned and unplanned activities that will not obligate a redesign. This requires careful studies of what is currently missing in the site, such as ecological processes that are currently being ignored or hidden, or uses by humans that are not part of the programmatic aspect of the site.

It is clear to see that there is a problem with the way we currently build along the Atlantic coast. Millions of dollars are dumped annually into beach renourishment projects, insurance claims on damaged homes, and rebuilding beach roads (such as NC-11). In order to fix this problem, it will be critical to limit development to where it currently exists. Within the confines of these areas, we can use a more flexible, adaptive system by spending less money on temporarily fixing the problem and more on smart design that looks generations ahead, anticipates flux and uses it as a design tool within the built environment.

On a global scale, the December 2004 tsunami showed us how quickly the ocean can change the built environment along the shoreline. Indonesia, Sri Lanka, Thailand, and many other countries around the Indian Ocean experienced one of the most powerful forces Mother Nature has thrown at humans in years. The speed at which the tsunami was able to rip out houses, hotels and vegetation was astonishing. While there was no warning in place for humans, animals were able to foretell the approaching wave and move inland. This is arguably because animals are not as detached from ecological systems as we currently are. This design does not address the ability of the built environment to be reflexive enough to accommodate a 20-minute tsunami warning, but the questions asked and results found speak to the need for architects and planners to not only create a built environment along the shoreline that is able to safely accommodate this unpredictable flux for both visitors and those that permanently dwell near the shoreline, but one that reconnects humans to the ecological systems and greater environment of which they are an intrinsic part.

This flux is not only necessary to acknowledge along our shorelines, but within any built environment. The new principles inspired by McDonough's Hannover Principles can guide sustainable development in our built environment into the next phase of sustainability. Sustainability is more than minimizing pollution and increasing green space in our built environment; it is an opportunity for us to reconnect to our environment and remove the concept of waste from our built environment. By creating elements in our landscapes able to be used in multiple ways, yet providing a context for a sense of place, we can come closer to achieving the goal of no net waste, for waste is not just about creating trash that ends up in a landfill or incinerator. It is about not wasting precious ecosystems, precious space, and precious time. Perhaps it can even go beyond waste and move towards creation: it is about creating adaptive, thoughtful opportunities and places for people of all socio-economic backgrounds to revel in.

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