

## Adaptive Infrastructure: Landscape as an Armature for Adaptation

*A conversation with Dr. Kristina Hill*

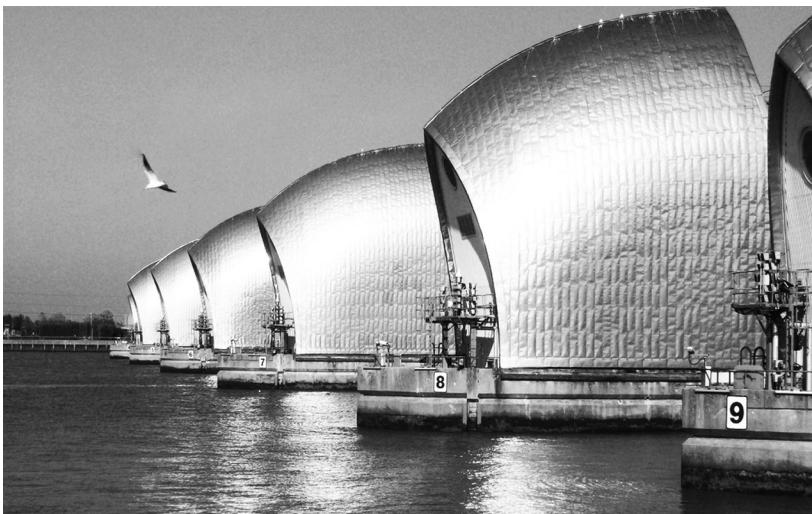
*We would like to hear about your current work—specifically, what are you working on now, what are you thinking about, and where are you seeing responses?*

I am working on the Water Management Strategy for New Orleans which evolved from a program called the Dutch Dialogues. In this program, the Dutch Embassy paid to bring Dutch engineers, landscape architects, and urban designers to New Orleans to work with American designers to think of ways the city could adapt physically and programmatically to inform the Army Corps of Engineers' decisions about the city. That has evolved into a funded, professional water management planning process which, when it's done, will be the first comprehensive water plan of any American city. The water plan will include storm water (runoff, drainage, wastewater) and flood protection from the ocean. Dutch cities like Rotterdam are already on plan 2.0 and London is developing a plan called "Drain London," dealing with similar water management issues. It is good company for New Orleans to be with—London and Rotterdam, two of the most progressive planning and design cities in the world.

What is really interesting about New Orleans is whether they will move in a direction of greater mechanization, with these big concrete and steel barriers the Dutch have already built, or whether they will move more in a direction of "soft" approaches. This means creating a capacity to store water inside the city and other approaches using sand and organic materials outside of those considered traditional for a levee in New Orleans. Basically, this can be done by adding a new armature of loose material instead of

seeing the system as fixed and strong. This could be a hybrid of the Dutch system. The Dutch have developed an approach they call *de Zandmotor*, a huge pile of sand that sticks out of the coast where they want to have a wider beach. They pile up sand over 309 acres of surface area, letting the waves and the wind distribute it across the coastline. It costs 25 percent of the traditional nourishment cost for the same length of coast (much less). It's fascinating to think that we would be building things that are intended to disappear. It's Sisyphean; we are working on a cycle that we know will have to be repeated. How much more interesting is that than just building a thicker, higher levee? To learn as human beings how to adapt to the real flows around us rather than building thicker, higher walls that we can't see over and that disconnect us from nature. I think it's translatable to many places along the United States' Atlantic Coast—from the Gulf side of Florida to Maine, and even California. On the Gulf side, there is less sand, so it's a question of using appropriate, local material (sand, silt, gravel).

You can see a divergence in strategies right now across the globe on how to approach this. In Venice, they are building a lagoon barrier that is so complicated and so expensive to maintain that it is likely to fail under its own weight and complexity. Contrast this with *de Zandmotor*, which has a very low, almost non-existent, cost of maintenance after it has been put into place and which cannot really fail. It's interesting to think of these different strategies for infrastructure. How do we pursue them in ways that recognize the potential of both and make reversible, adaptable experiments that we can learn from?







*Would an adaptable infrastructure require us to rethink the scale and/or timeline of traditional projects?*

My colleagues at Berkeley, Louise A. Mozingo and Margaret Crawford, have been thinking about everyday ways that infrastructure is adapted by people. If you look at favelas and megacities, you see many examples of people working around existing infrastructure. Sometimes they remove themselves from the system, sometimes they tap in informally, sometimes they create their own. There are a lot of examples of DIY infrastructure on a small scale. Those will continue to be popular and will probably increasingly come to North America. In North America we have an interesting mixture of the European system (which is hierarchical and fixed) and the Third World system of infrastructure (which is

decentralized and DIY). We have unequal levels of service provision which means we will see DIY projects applied in places where the service is unequal, where there is a low level of service, or in places where they won't localize tax money to fix something. In a way, the SUV is an exercise in DIY infrastructure. Why fix potholes when you can buy a four-wheel drive vehicle with good shocks? There is a danger, however, as the DIY solutions often perpetuate the problems they seek to fix.

*In your work, are you dealing with multiple scales or do you find yourself working with one particular scale?*

I work mostly with institutions. I try to persuade public entities to spend lots of money. You have to persuade private lobbyists to argue for spending that money. Whether it's for tran-

sit or a sand engine on Virginia Beach, an expanded water capacity for storm water in New Orleans, or upgrades to a highway system in New York City, you have to persuade the public by talking to the most influential shareholders. That's our system—it's a two- or three-tiered world that we live in. In Virginia Beach, it is the hotel owners who will persuade the city council. In the Bronx, it was a series of trucking groups invested in the highway we were trying to take out. The goal would be to prevent the public from spending maintenance money on the highway and to allow the community to build housing and parks where the highway once was. Convincing institutions to remove infrastructure is part of adaptation as much as building new infrastructure.

*Will adaptation require a ground-up rethinking (and rebuilding) of infrastructure, or will it be facilitated more through retrofitting and adapting current infrastructural networks to respond to future needs?*

It will be both. If you don't understand public budgets—what they are committed to, and how new commitments are made—you can't build anything big. You are left with working solely in a DIY world. There have to be things that are centralized and we've already built these systems. I talk with my students about storm water systems as a "beast," like the Minotaur under that castle at Knossos. We feed it and spend maintenance money on it every day, million of dollars in every city. How

are we going to train that beast? We cannot abandon it. It has a huge capacity; it's a legacy. We can start to shift away or we can add capacity by adding to the surface. Very few cities can afford to give it up.

*A lot of your past work deals with the intersection of ecology and design. How has ecology informed the way you think about infrastructural systems?*

When studying ecology (especially without a science background), there is a limitless descriptive potential. You can talk, observe, count—there's no end to it. You may study for weeks without finding anything to apply. I try to look for thresholds in the way systems behave. For example, you cannot get songbird populations to survive in cities if there are large populations of crows because crows eat the songbirds' young. Crow populations increase as human populations increase. This is mostly due to the density of dumpsters and sidewalk cafes. Even if you have the ecological structure to support the songbirds, you don't get the performance, because there is something invisible happening that is preventing the system from working. I try to look for relationships that are limiting. What are these thresholds in the physical/biological world? Those are the things that we need to pull from ecology into design and, in a sense, to test how to design for that criterion to see if something would perform better. *As the line between infrastructure*

*and landscape becomes increasingly blurred, how do we define what infrastructure is and what landscape is? What characteristics divide the two?*

The word “landscape” comes from the words “land” and “scap,” meaning to create land. The idea of landscape is already human-made. Oppose this to ecosystem, which implies no human interaction. To me, landscape and infrastructure are closer words than ecosystem and infrastructure. My colleague Beth Meyer, wrote about Olmstead’s Back Bay Fens (part of Boston’s Emerald Necklace) as a cyborg landscape. In the nineties, it was a hot thing in academia to talk about cyborgs. This idea of technology permeating our bodies—creating technologies that had intelligences at various times; creating organisms in a laboratory or modifying them; creating landscapes that do things for us, and which we do things for. A combination of human agency and non-human agency. The issue is that we may design something unsuited for the volumes of flows that are occurring within it. We need to think about every landscape we create, every piece of infrastructure we create, as something that is shaped for the flows that are going through and around it. We are undersizing water systems given our expectations of more intense rainstorms. We are undersizing transit systems because we haven’t thought about increasing energy costs. We need to be prepared for some of the scale changes of the flows that will interact with our infrastructure in the future.

From a landscape perspective, the

potential of dynamic landscape systems—whether it’s a river corridor, or a sandy coastline, or the edge of a forest—has to be perceived as something that is strong and thick. We tend to call everything landscape-related “soft,” but I would like to see us talking about the strength of these strategies. I am trying to persuade people to remember the potential of these big systems—these armatures—to do work as infrastructure does work. We build infrastructure to move resources from places of abundance to places of scarcity or to build barriers from a place where something is too abundant and therefore a threat, like the ocean. We can use landscape to convey all of these flows and materials, not necessarily as an aqueduct or a box, but as the actual medium and materials of landscape. People often think of landscape as something ephemeral or something at a small scale, but landscape is massive and muscular and strong. Landscape is shaping the world. It’s important to understand the limits of ecology, however. If a sea level rises faster than a marsh can rise, the marsh will collapse, even if the difference is an infinitesimal amount. Those are important feedbacks that we need to be realistic about. We have to think ahead about how we will gradually adapt to the disaster event.

In geology, there are two perspectives: incrementalism and catastrophism. If you look at the past, you can see incremental change and you can see catastrophes, such as meteors and



*Model for the Bronx River Project*

natural disasters. The future is like that too. It is incremental, but there will be catastrophic events. We tend to focus on one or the other. The sand engine we are proposing for Virginia Beach will be a way to deal with both incremental sea level rise and a hurricane. If it can’t deal with both, it is not a good strategy. It may be that we do not need to keep hotels in Virginia Beach for the next one hundred years. I would not vote to spend public money for more than a transitional phase. Hotels are not integral, they are not permanent residences. A change will be responded to as if it’s incremental for a long time, as much as twenty to thirty years, then all of the sudden you won’t be able to sustain that incremental process and we will have to relocate.

I think there will be a combination of market and policy conditions that make sudden changes happen in the way we operate. We need to understand more about those. How many students in design learn about the insurance industry? That may be the mechanism by which changes occur. Unless we take control of the mechanisms, it may be someone overseas who gains control. When that happens, it will be like our current housing crisis. Thirty percent of Americans live within thirty miles of a coast. If all of those properties lose value, that will have a huge impact on the housing market. No one is going to admit that it is going to happen, so we are going to lie to ourselves for a very long time if we are invested in property. Then finally something will



*Widespread flooding in Pakistan led to mass migrations*

change. We need to study the way that changes occur in people's minds as well as in the physical world. To figure out how to adapt incrementally and to act strategically in times when the bottom falls out, whether it's a Katrina-like event or the housing crisis.

*How can designers anticipate future change and catastrophe? Especially beyond the information we currently have?*

I think we can anticipate which flows are going to increase. We need to be rooted in some reality about

economy and resource availability. We can do this by examining trends and discussing them with economists, planners, and other industry people to get a better sense of what they think is possible. Where will the tipping points be? How have people adapted in the past to large changes and flows? For example: refugees, social flows. People have adapted to these flows by putting up barriers or setting up no-man's lands. I would not be surprised to see this as a strategy in the future. As people move from low lying to higher landscapes, will those higher landscapes build a wall or will they make refugee camps? There is going to be a diaspora of people who cannot farm where they currently live because it's going to be too wet or too dry. Where will those people go when they have no food? It is worth looking at how we have handled refugee situations in the past. If climate change destabilizes political relationships in places like the India/Pakistan border region, it becomes a global crisis, especially between places with military power.

I think we need to pay careful attention to the drying out and flooding dynamics and how they will play out in a political and military context, but also in an industrial context. There was flooding around Bangkok, Thailand, and the parts suppliers for all these electronic companies were flooded out. There were no parts available. You think of electronic companies as being lo-

cated in Japan or the United States or Europe, but the pieces they are assembling are from Thailand and Asia, in low-lying, flat places that are good for warehouses. They are vulnerable. Countries that start to adapt their infrastructure for new conditions may be the places where new investments happen on this global beast of fast-moving capital. We need to commit time and resources to study and develop technologies that can deal with these future situations.

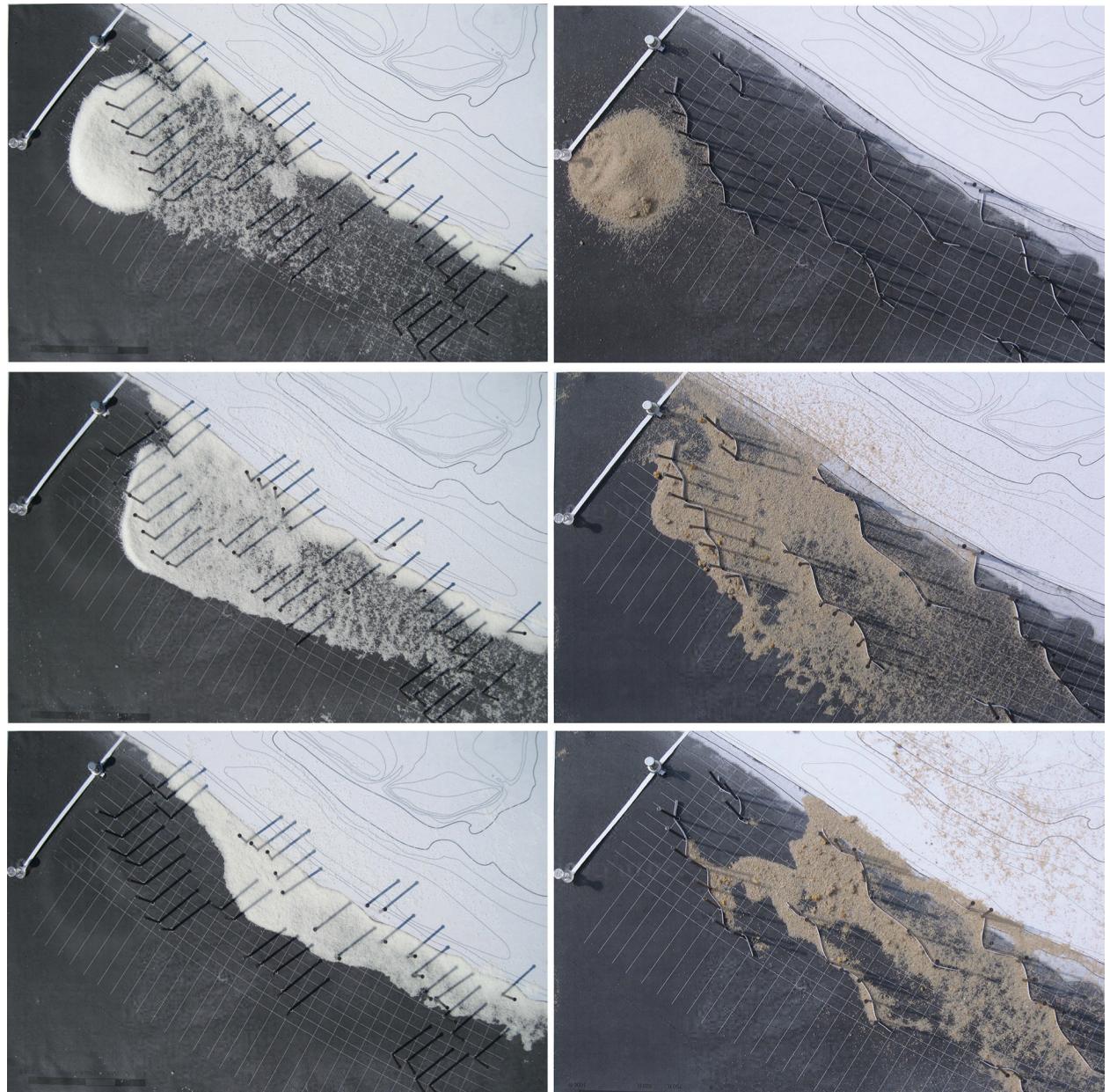
*As we make projections in the present, will that help us learn how to better project in the future?*

When science projects, it is not playing chess. Science is trying to be accurate or true in some way. They describe a range of possible outcomes, they are betting with odds. As designers, we must play the chess game. We think about the sequence—what goes first? We have to play the physical form game and make strategic choices. We need to evolve our ability to make those choices well. One concept I try to emphasize is reversibility. If you make an investment and it's reversible, it is much less risky than making an irreversible investment. How do we make more reversible experiments, in the design of planning things and engineering them? Maybe it means not building things that have to be paid for over a forty-year timeframe, because we think there are going to be big changes in twenty to thirty years.

*How has ecologically driven infrastructure affected the balance between research and design? Are the two becoming increasingly symbiotic and synonymous?*

I think so. It is important to emphasize two things: one is that research must be speculative in the sense that we are testing and that we are imagining future worlds, but it must pull on a thread that is anchored in reality. I have seen projects by intelligent people that have no relationship to a likely technological future. Why are they wasting their time? That is a great charrette for the weekend, but is it worth an entire semester of work? Is it marginalizing us as designers if we are seen on the crackpot side of speculation? I would rather see us associated with some of the practical issues we discover through research: the real thresholds, costs, and processes. Even if those change, we will have learned to track them. The people who are tracking the thresholds, costs, and political feasibility of different strategies will be the ones who succeed in having influence.

The other issue that I hear commonly discussed is indeterminacy. I talk about *nondeterminacy* in a book from 2002, *Site Matters*. Essentially, nondeterminacy means that you examine current trends, knowing that they will not necessarily be true forever. You can project twenty-five to fifty years. Looking further than that—one hundred to two hundred years—it becomes harder. What is



*Proposal for a sand motor by Nathan Burgess*

going to happen to oil, to technology? However, projecting twenty-five to fifty years is a reasonable bet. We do this in cities all the time. We build things that have a thirty- to forty-year debt allowance. Every time someone buys a house with a thirty-year mortgage, they are making a bet over that time period.

Indeterminacy implies that science cannot help us divine anything about these trends. It allows one to divorce oneself from science and engineering

because everything is seen as indeterminate. That is completely marginalizing for us; it isn't true that these trends are indeterminate. You will see a lot of prominent people in our field talking about indeterminacy and flux and then painting these pictures of fantasy landscapes made of algae ponds or super absorbent polymers. I don't think it helps. I think those materials and production systems may have a role. Let's have a dialogue with people who are actually working in the planning and industrial side of

that to see if it's even feasible. I think there are important strategic issues that we must discuss or it will marginalize our professions at the very time in which we can play a significant role.

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