# Climates: Architecture and the Planetary Imaginary

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# Next-Century Collaboration between Design and Climate Science

Kate Orff and Adam Sobel
in conversation

KATE ORFF

I'm happy to sit down with you today to talk about the changing relationships between climate science and design. There are so many questions about how scientists and designers can work together differently in the coming decades to address severe heat, heavy rainfall, storm surge, and flooding, and their ramifications for social life and public space, as these phenomena intensify and affect cities and landscapes across the globe. But working together often involves starting with a very clear understanding of how different disciplines operate, which we designers often don't have. What are our methodologies? Our tools? At what scales do we work? And how do we define the questions and act based on determinations of value? Scientists are trained to put a number on uncertainty in terms of probability (e.g., 1 in 10 versus 1 in 100), but this way of communicating risk is often abstract to the typical person on the street. Designers—with our multiple approaches—can handle it differently. What other ways of communicating climate scenarios do you see, and how do you think designers can help visualize and communicate scientists' assessments and translate their findings for decision-making contexts?

ADAM SOBEL

Before answering this, let me say that I believe communicating the full reality of the oncoming climate change is the most profound and difficult obstacle to dealing effectively with it. I don't think the problem is unique to climate science; it's human nature. Constitutionally, we're not good at visualizing a future that is fundamentally different from the present or past—or at least we aren't able to visualize that future in a way that will motivate us to take action. This is the case even when we know, intellectually, that this future is possible or even probable.

In his book *Thinking Fast and Slow*, psychologist Daniel Kahneman discusses how people think and act in qualitatively different ways depending on whether they're facing something within or without their recent experience. His experiments showed that we think fast and instinctively when dealing with familiar challenges—which is effective most of the time. Whatever we did before will usually work again if we're facing something routine. But when we have to manage future risks that are far outside our experience, we can't rely on instinct—we have to use our conscious intellects to assess the risks and decide what to do. That's thinking slow, and when we do that we don't make such good decisions, even when we have good information.

Kahneman also writes about "availability bias"—our tendency to behave as if the likelihood of something that's recently happened to us happening again is greater than it really is, while if something has not happened recently, or ever, we tend to behave as though its likelihood is smaller than it really is. This tendency holds true even when we actually know what the likelihood is, quantitatively.

KO

Do you see Superstorm Sandy as a wake-up call? That was certainly an extreme event that was deeply felt and had tragic

KO
consequences, with so many lives and livelihoods affected here in the New York City region.

AS
Yes, definitely. If you look at the history of substantive, preemptive actions taken to reduce risks of future disasters, they were virtually always carried out in places where similar disasters had recently happened. New York City is a great example—we're seeing tremendous activity here post-Sandy, including your own Living Breakwaters project. Scientific understanding of the risk of a Sandy-type event clearly existed well before the fall of 2012 and was known to government decision-makers. It had been studied, quantified, and understood, but virtually nothing like the investments that are being made now in "resilience" were made pre-Sandy. It took the event to make it real.

Climate change is just about the worst kind of problem in this sense. It is coming on gradually, so even though there is good scientific evidence that it is well under way, most people do not feel it viscerally. And the future global environment is going to be outside the experience of everyone on the planet. So the problem feels remote and far away, it's difficult to visualize, and it's very difficult for people to prioritize it as a political issue among other issues that are ultimately less dire but whose impacts are easier to see in the short term. This holds even for people who understand and accept the scientific predictions. I'm not talking about denial. I'm talking about the difficulty of acting rationally on the basis of information that we believe intellectually to be true but that tells us about a future that's foreign to us.

KO
Can collaborations between scientists and designers, then, advance a new understanding of the issue and forge a different mode of working through it?

AS
This is an important question, not just for designers but for the broader purpose of communicating the reality of climate change. I don't think scientists can solve this problem on their own, because it's not primarily a scientific problem. It is, in part, a scientific communication problem, but on such a large scale that we need talent from outside the scientific community to help us. We need professional communicators. We need more movies, books, and other kinds of storytelling about climate change. There is a growing body of "cli-fi" literature—books that envision futures in which global warming has further advanced. The great fiction writer Amitav Ghosh recently delivered a lecture series at the University of Chicago in which he considers why climate change hasn't been written about much in "serious" fiction.[1] It's important that people like him are starting to recognize this gap in our cultural imaginations. Designers should be part of this project, too—the built environment also has stories to tell, and some of them can be about climate change.

KO
I love hearing that—in urban design we've been working to advance our technical and narrative storytelling skills in order to help people imagine possible futures in ways that go beyond static plans or proposals. I feel, for example, that the climate

maps that only show potential urban flooding relative to contour lines—with entire cities underwater, rendered in blue—are actually quite unproductive for any sort of action-oriented discussions. I wonder what other forms of communication we can engage—video, interview, interactive scenario building? The Ghosh reference is a great one. I've also been reading Naomi Oreskes and Erik Conway's book, *The Collapse of Western Civilization*, which pulls in political and social ideology as a backdrop to future conflict.[2] Inspiring and sobering. Along those lines, can you please talk a bit about your Extreme Weather and Climate initiative? To start, I'm particularly interested in how you landed on its name—haven't scientists been desperately trying to shift the conversation away from weather?

AS

Studying extreme weather events is critical for a number of reasons—most obviously because they do a lot of damage. In many cases, we can't anticipate the risks of the most extreme events precisely. For example—what is the probability of a Category 4 tropical cyclone hitting Manhattan or Mumbai, two places where this hasn't happened in known human history? How is climate change affecting that risk? And what kind of damage would the storms inflict if they did happen? As you know, a lot of us at Columbia—in many different parts of the university—are working on questions like this in relation to many types of extreme weather events. The Columbia Initiative on Extreme Weather and Climate aims to make connections between all of these different efforts, stimulate new work in this area, and build relationships with outside partners also interested in extreme events.

Beyond their physical consequences, extreme events also make profound psychological impacts. This makes them very important to the climate change conversation. They generate "teachable moments."

This is part of the justification, I think, for the science of extreme event attribution, in which scientists explicitly calculate the role that human-induced climate change has played in specific weather events. We used to say we couldn't do this, but today it's a rapidly growing field. It's not easy to justify this work on a purely rational basis—if we want to understand climate-related risks, the best way is to study large-scale patterns rather than individual events. But events that have just happened get people's attention like nothing else. And for some purposes it doesn't even matter if attribution studies are conclusive. The mere act of asking the question after an event occurs prompts people to visualize what climate change *could* mean, which may be the more difficult challenge we're facing—more difficult than the science—at this point in history.

I first got the idea for the Extremes initiative, in fact, when Mayor Bloomberg endorsed Barack Obama for president. This was in the immediate wake of Sandy, and Bloomberg stated that whether or not the storm had been affected by climate change, its destruction demonstrated the seriousness of the problem. While he didn't really like either candidate, he felt Obama was better on climate, and experiencing Sandy spurred him off the fence and into making an endorsement. He knew that strong statements about climate change's role in the storm couldn't yet be justified, but he rightly saw Sandy as a signpost to the future of New York City, especially because of its vulnerability to rising sea levels.

Along those lines, I wonder if projects like your Living Breakwaters can play a similar role to extreme weather events—as powerful physical experiences that compel us to visualize different futures. That is, can projects that are being designed and built to address the effects of climate change also enable people to understand its realities in a more visceral way? Do you see Living Breakwaters playing an educational role in this or any other sense?

KO
Absolutely. It was conceived as a physical project—a chain of rock breakwaters, seeded with oysters—that would initiate a new set of behaviors and a new way of perceiving the landscape of the harbor. High school students seed and monitor the oysters as part of their science curriculum, and Staten Island fishermen and kayakers will steward the structure as it grows—it's designed to foster finfish habitat and recruit additional shellfish to attach themselves to its surfaces. I think we have to begin to integrate social and physical adaptation. We are not adapted to the climate we have now. My goal is that *Living Breakwaters* will help us prepare for the climate of the future—not only by restructuring our physical environment but by reorganizing our ways of intervening, perceiving, and coming together, so that we can build up a more protective landscape over time and channel work in a productive way. What's especially great is that because the project is federally funded and is being implemented by the New York State Governor's Office, we can pilot and test this new way of thinking resilience—as a physical *and* social practice—knowing that it can have an impact at multiple scales. Living Breakwaters is really trying to chart a path of an empowering view of climate response—not only asking how we can reduce and manage risk but also how we can begin to work together in a solution space that's interesting and fun.

AS
How do you account for sea-level rise—or any other aspect of climate change—in the design of Living Breakwaters? Does the project self-adapt, fail gracefully, etc.?

KO
The project is built of rock, and that rock can be added to as water levels rise. There is also a low onshore dune that can be replenished. We're seeding the in-water structure using five different oyster techniques, with the idea that because the oysters are living organisms, they can accrete and grow and gain complexity over time, further reducing the force of incoming waves and cleaning the water. My point is that extreme weather happens, but rather than being catastrophic, we can modify the built environment to make these events less catastrophic—"failing better," so to speak. In every case, we need to avoid failing catastrophically. We need to learn from the errors of the

past hundred fifty years of levee building, occupying wetlands, and creating single-purpose infrastructure that doesn't provide any other community or ecological benefits, and which actually obscures public perception of environmental risk.

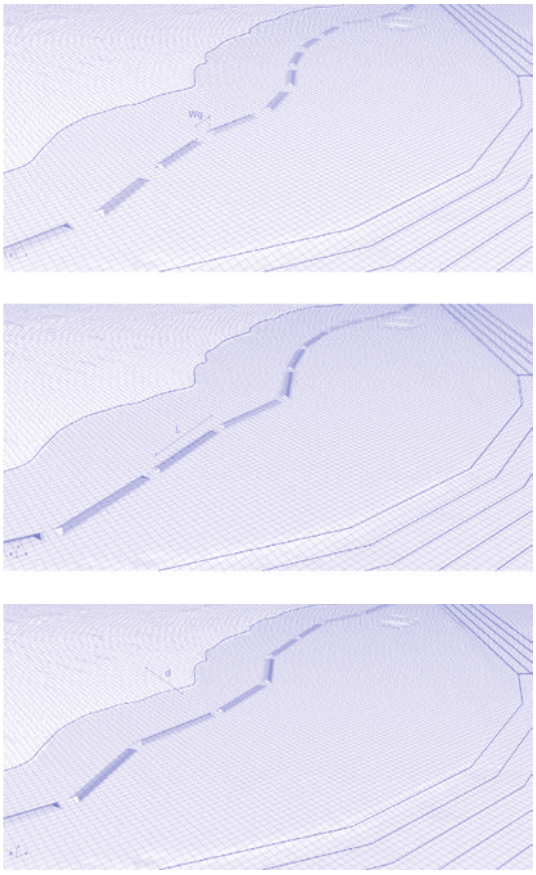
AS
Those are all important points, but let's pursue that last one about perception a little further. How does that play out in Living Breakwaters? What is the interplay in such a project between function and public education, whether it's aimed at climate change or any other environmental issue? Is part of their purpose to make people think, and if so, how?

KO
Well, as the project is growing over time as physical infrastructure, it's also growing a sort of social infrastructure and larger-scale educational project about ecology, water quality, and the vulnerability of our harbor. New York City public school teachers and students participating in the Billion Oyster Project, funded through our HUD grant, will become connected to the shoreline. The big-picture idea is not to "protect people from" water or to keep water out of our city but to bring people closer to it—on an everyday basis, so the risks posed by rising sea levels are better perceived and understood. Although this project was conceived for the New York region, which is facing extreme hurricanes and flooding events, it could be applied to a range of places with different climate risks. I think this is one of the most captivating and challenging climate-related questions we're facing—how climate shocks interact with social systems, and how they will play out relative to the very real constraints of time, budget, and permitting, local planning approvals, serious trade-offs, approvals, and all the other gritty realities of construction. We need some kind of brave new world, or brave new mode of practice, where sociologists, climate scientists, urban designers, and politicians all sit down and try to have the same conversation. We are actually well equipped at Columbia to be the conveners of this conversation.

AS
Yes, we are. We're starting to convene it right here! But going beyond conversation, what about the practical dimension of this kind of collaboration? If tomorrow you could have a climate scientist on your staff as you designed a landscape project, what would you have them do?

KO
Well, I would ask them to first help us define the goals of the project, and the scale of its efficacy and impact, and then to work as an integral member of our design team, modeling and iterating different change scenarios at different scales. One

exciting thing we currently have on the boards at SCAPE is a computer modeling tool. We've developed a complex 3-D topographic model that spans land and water, in which we can actively iterate different physical characteristics of different offshore breakwater and onshore dune scenarios in terms of height, length, spacing, location, etc., using the modeling program Grasshopper. We then nest these scenarios into a detailed refraction/diffraction hydrodynamic model—which is used to simulate surface wave propagation—to test its efficacy along the coastline. This is an exciting development that melds a design process with active testing and modification.



Screenshots from the hydrodynamic model of the Living Breakwaters project. The breakwaters' distance between segments (Wg), single segment length (L), and distance from shore (d) are among a set of parameters that are being calibrated and tested throughout the design process. Courtesy of SCAPE.

I get the sense that scientists and engineers feel that they're expected to provide only the "design-to" criteria: X for earthquakes, Y for the hundred-year flood, Z for sea-level rise, and so on—but that has got to change. We've got to begin working together in an iterative and activist way, and our models have to work as shared design tools as we explore more

complex and imaginative futures. How would reforestation of a project's region impact rainfall, for example? Or how would nourishing our bays with sediment, or strategically reducing dredge channels in New York Harbor, reduce flooding, and to what extent? This is a question we worked through for Living Breakwaters with oceanographer Dr. Philip Orton.

Ultimately, the major collaborative challenge we face is that climate science is presented as massive, abstract global data relative to open systems, whereas design and construction require the definition of clear boundaries. At SCAPE we've aimed to advance projects at a landscape scale in order to bridge this difference, but I believe we need to both scale up and scale down as we move forward. When building and constructing resilient landscapes, a project's impetus is so often rooted in what is possible from a regulatory standpoint, or from a capital or funding standpoint. So when we begin to look at "climate" and at "natural systems," many of the values and assumptions and information required for a project are often driven not by design intent but by what can be done—what it will take to implement the project, particularly from a regulatory standpoint. I'd like to continue working with climate scientists to help determine what *should* be done, to expand the perspectives through which climate change adaptation and mitigation projects are viewed and the criteria by which they are evaluated. It's important to highlight new methods for developing projects as well as areas where policy and regulatory change may be required in order to anticipate the next hundred years of adaptation. We need to not only work backwards from what is currently possible but clearly map out the larger systemic changes needed to transform the urban landscape, and to test our hypotheses through a joint science- and design-driven process.

1

Amitav Ghosh, "The Great Derangement: Fiction, History, and Politics in the Age of Global Warming," 2015 Berlin Family Lectures, The University of Chicago, 2015. Videos of all four lectures are available at https://berlinfamilylectures.uchicago.edu/2015-amitav-ghosh. A book that collects them is set to be published by Penguin Random House in 2016.

2

Naomi Oreskes and Erik M. Conway, *The Collapse of Western Civilization: A View from the Future* (New York: Columbia University Press, 2014).

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