Programming the Sublime

A Conversation with **Leo Villareal**

Multiverse, 2008. White LEDs, custom software, and electrical hardware, 200 ft. long. View of site-specific installation at the National Gallery of Art, Washington, DC.

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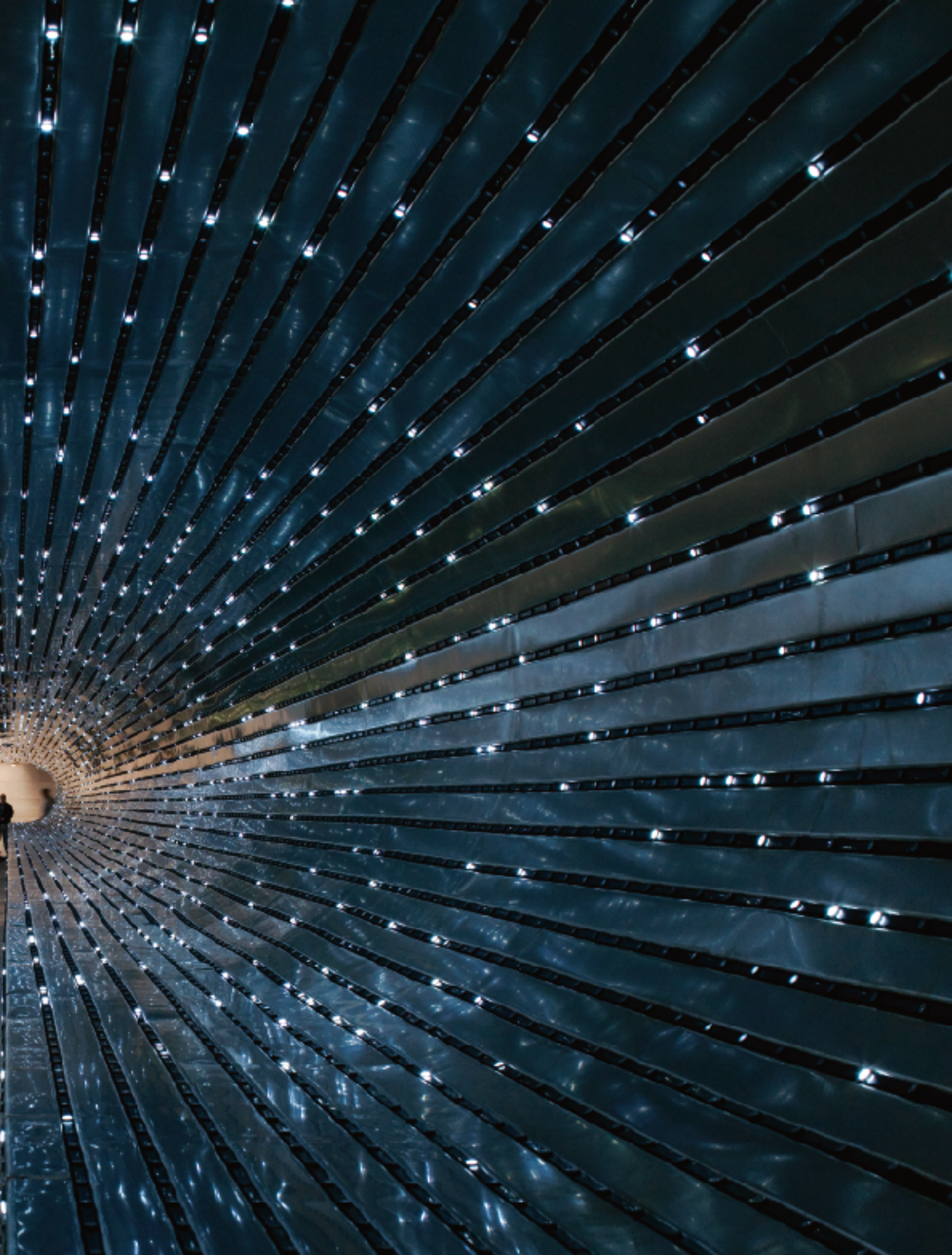

Top and detail: *Buckyball*, 2012. LEDs, custom software, electrical hardware, armature, and base, 30 x 10 x 10 ft. Installation at Madison Square Park, NY.

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BY JAN GARDEN CASTRO

Leo Villareal's work demonstrates that sublime experiences cannot be measured using words, images, or a single point of view. Describing the creation of *The Bay Lights* (2012–13), a monumental (and temporary) tour de force of interactive lighting along 1.8 miles of the San Francisco Bay Bridge, he evokes an intuitive palette that somehow reflects parting clouds, light-filled skies, and oscillating, reflective waters. The poetry of the instant is impossible to describe, but it is visible in his work—light sculpture that is almost natural in its ability to integrate many different kinds of input into its output and never repeat itself. His recent works include *Buckyball* (2012), an LED sculpture of two nested geodesic spheres commissioned by the Mad. Sq. Art program (Madison Square Park, New York City), and *Multiverse* (2008), a permanent, ever-changing configuration of 41,000 computer-programmed LED nodes wrapped around the 250-foot concourse walkway connecting the East and West Buildings of the National Gallery of Art in Washington, DC.

Jan Garden Castro: *Do you consider your programming of LEDs to be math or art?*
Leo Villareal: I'm interested in rules and underlying structures. I engage with mathematics, physics—whatever elements I can use—but in the end, I'm using them as artistic materials. I've found ways to grab hold of these complex systems beyond my understanding; through my software, I'm able to manipulate them and play with them, and that's how the work emerges.
JGC: *What is the science behind programming red, blue, and green lights to form 16 million color variations?*
LV: The big breakthrough in LED technology has been the invention of the blue LED and the ability to mix it with red and green. In the fixtures that I use, we expect values from zero, which would be "off," to 255, the brightest value for each of those three colors. By blending them, you can make 16 million possible variations. The monitor on the computer screen is called 24-bit color. I'm pretty much using things you see on

the screen—like a Quicktime movie in which each pixel corresponds to one of the pixels in the light. So it's a one-to-one relationship. It boils down to three numbers: 255 x 255 x 255.

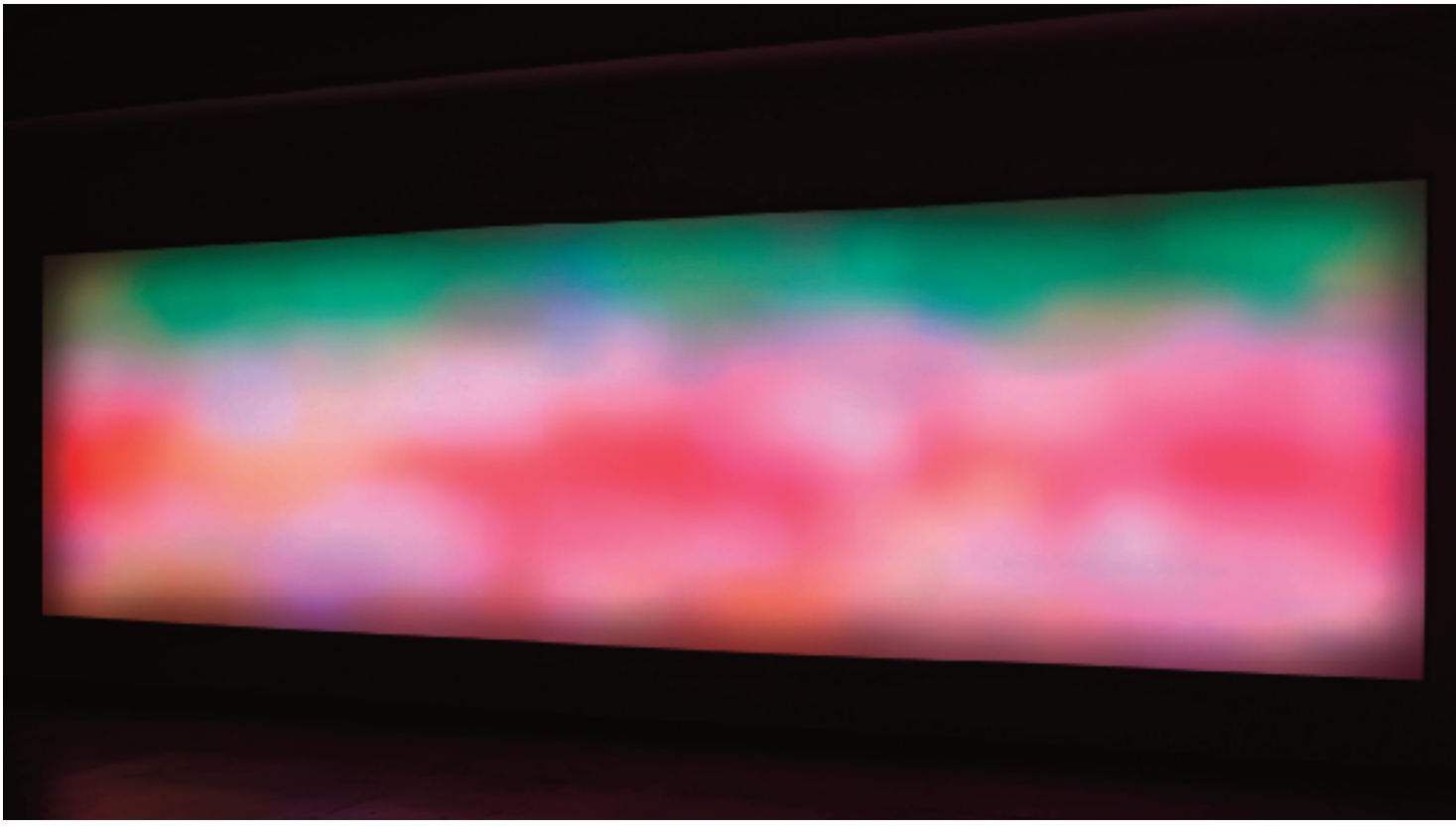
JGC: *What roles do speed and scale play?*

LV: Initially, I was using off-the-shelf, light-control software, but I quickly became frustrated with that and started working with programmers to create custom tools and sequences. Part of that is having precise control over speed, color, and real time—so I can see it on the screen and also on the lights themselves. I'm always looking at the lights directly because they behave differently than a representation on the screen as pixels. My challenge is to be able to see what I'm doing and have immediate feedback from the lights so I can begin to craft the sequences. There are a couple of different phases to my process. The first, discovering what's possible, is open-ended. I have certain ideas when I begin with a piece, but I'm interested in emergent behavior—creating the conditions for something to happen. I don't know the outcome exactly. During the randomness of that process, I'm hoping for a moment when I can grab something—a sequence that's compelling. After the discovery phase, I combine and layer the sequences. This is a process of refining, and it becomes very rich. Then, the refined sequences are displayed in a random order for a random amount of time. It all goes through an exacting process, but in the end, it's always dynamically reshuffled.

JGC: *How is* Buckyball *unique?*

LV: I've been interested in geometry from the beginning. I began working with the hexagon and made several pieces. Its simplicity

Above: *Hive*, 2007. LEDs, custom software, and electrical hardware, 96 x 96 x 4 in. Below: *Field*, 2007. LEDs, custom software, electrical hardware, and diffusion material, 7 x 24 x 1 ft.



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and underlying logic tie into my interest in rules. Eventually, the geometries became more complex. *Buckyball* is based on a carbon 60 molecule that was discovered by nanotechnologists at Rice University and named after Buckminster Fuller (the "Fullerine"). In Fuller's geodesic dome, the strut length is not equal, but the strut length of a carbon 60 molecule is equal, so I could use two-foot structures.

JGC: *I noticed that there are a few pentagons in the form.*

LV: Yes, that is exciting to me, as is beginning to deal with space instead of remaining two-dimensional. *Hive*, a work in the New York City subway [Bleecker Street at Houston, Manhattan], consists of 900 square feet of ceiling-mounted space—a grid of hexagonal tube formations. You can see it from the No. 6 Train and from two stories below. *Buckyball* continues the trend of getting my work out into space.

JGC: *What about the zero-gravity benches around* Buckyball*?*

LV: The zero-gravity position is a reclining position used by NASA in virtual reality experiments to distribute body weight equally. It was supposed to facilitate leaving one's body and going into another

Above: *Stars*, 2007. White LEDs, aluminum, custom software, and electrical hardware, 5 units, 140 x 140 x 4 in. each. View of site-specific installation at the Brooklyn Academy of Music, NY. Below: *Multiverse*, 2008. White LEDs, custom software, electrical hardware, 200 ft. long.

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***Sky (Tampa)*, 2010. LEDs, custom software, electrical hardware, and aluminum panels, 45 x 300 ft. View of site-specific installation, Tampa Museum of Art, FL.**

world. I was intrigued by that idea. A lot of my work in the early '90s was in virtual reality. In 2001, for a ceiling-mounted piece with 80 strobe lights at the Brooklyn Anchorage, I created a park bench-style version. I've been playing with the form ever since. It recalls traditional park benches with slats of wood, but it radically shifts a person's position.

JGC: *Who was the fabricator?*

LV: A carpenter named Naresh Sahadeo, who works in the Third Ward building in Brooklyn.

JGC: *In 2009, you told* ARTnews *that your work depends on rules and systems and, in that sense, you are closer to Sol LeWitt and Peter Halley than to Dan Flavin and James Turrell. What systems have you used—John Conway's Game of Life?*

LV: I was very interested in Conway's Game of Life, and my second light piece was a portrait of his rules. I then went on to try to find my own rules to my own software. I was looking for sequences that had personality, that appeared lifelike. I'm interested in computation and in visually manifesting computation in light—making these operations visible is at the core of my work. This connects to LeWitt and Halley in that there is a system with variations and constraints. I have certain frameworks—the lights in certain positions are set—then I can activate different parts. Sometimes I'm working with monochrome, so I have gray-scale values. Working with full color is another option. When you think about it, the parameters are constrained; I'm visually exploring that space and seeing what can be done within it.

JGC: *You've mentioned that Monet's* Water Lilies *and Rothko's color field paintings are suggested in* Field *(2007), your very large light work at MoMA. What is its algorithm?*

LV: *Field* was the first thing I showed at Gering and Lopez Gallery. It was an exciting piece for me in terms of scale; it was a wonderful expanse to work with. I was interested in its softness and atmospheric qualities because some of the other pieces I'd been working on dealt with points of light and had an energetic feeling. Other pieces used tubes and had a hard edge. *Field* is about total softness and seamlessness—you can really get lost in it. The speed was also interesting to me—making something very, very slow. It had to do with the speed of one's breath or heartbeat—the rhythms of our lives and bodies.

JGC: *Did you literally measure breath?*

LV: In some pieces, I've used that as a cue. With *Field*, I was interested in the moment when you couldn't tell if it was moving or not—the edge of what's perceivable. Engaging with that, losing yourself in the piece, was exciting. It connected back to some of the first artworks I saw at MoMA and other museums, as well as to Rothko, whose work I saw when I was an undergraduate at Yale. All of these things seeped in and came out later in interesting ways.

JGC: Field *is breathtaking in a sublime way. Do you try for that effect?*

LV: Absolutely. All of these systems and geometrical structures are connected to beauty, or what we perceive as beauty, because we respond to them. I don't think that my work is directly about beauty, but I'm using some of the same principles that you would find if you broke down a Greek sculpture or a Renaissance painting—there's an underlying structure, and you start to see these relationships in a mathematical way. That connection leads to what people would call "beautiful" or "sublime." I certainly take inspiration from things that I find in nature, natural systems in the sky, and things we see all the time, but I'm trying to distill how those things work and evoke them in an abstract way. I want to keep my work firmly abstract—not something you could immediately recognize or match, though you might have some association with it. The exciting thing is how a set of numbers can feel alive or beautiful and evoke all of these things: a set of LEDs and numbers that

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Top and detail: *Cosmos*, 2012. White LEDs, custom software, and electrical hardware, 68 x 44 ft. Site-specific installation at Johnson Museum of Art, Cornell University, Ithaca, NY.

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can make you feel as if you're looking at the most beautiful sunset you've ever seen—that's an area I'm interested in exploring.

JGC: *You've participated in the Burning Man festivals in Black Rock Desert, Nevada, since 1994, and some of your breakthrough uses of light began there. Why is Burning Man special for you?*

LV: I started going to Burning Man when I was doing a summer internship at a research lab in Palo Alto after I had finished grad school in technology at New York University. At that point, I was very involved in virtual reality. At NYU, I'd been doing laparoscopic surgery simulators, which are about navigation and how surgeons can stay oriented within the human body when they have to look up at a television monitor.

What I found in the desert was another type of space in which you could become disoriented and lost, where you needed to relearn ways of navigating. I made a connection between what happened in the computer in virtual reality and what happened in this actual space—parched, blank earth for hundreds of miles—a place of incredible purity and absolute beauty. Burning Man was a shift away from the alienating, lonely, empty worlds of virtual reality experiments. I discovered that you could build things—a city, in this case—collaboratively, working together to create interactive things. It was very social, and there were a lot of connections back to that space. I made my first light piece in '97 with 16 strobe lights. I'd gotten so lost at Burning Man in years past that I needed a way to get back to my mobile home at night. I built a practical thing for this particular set of circumstances, but it turned out that even at that level—it was programmed zero is off and one is on—the piece had a strong personality, almost a language to it. I was blown away by how much you could do with such a small amount of information. That was a key moment for me in which I connected software and light. I found a very rich area to explore that I've been at ever since.

JGC: *Do you have a color philosophy, or does it depend on the project?*

LV: I'm interested in Albers and color theory. I approach color as a set of rules. It's something I'd like to push further; at this point, it's been more intuitive. The palette emerges depending on the piece. I love color, and *Buckyball* is colorful—the programming with my team took a lot of time. Each piece is made site-specifically, so I have to sit with it and work with it. The public was very inquisitive about what was going on. It ended up as a set of sequences played by computer in random order for a random amount of time. Our software evolves constantly, and each piece requires something new. We've made a lot of advances recently.

JGC: *You've completed many light projects involving architecture, including* Stars *for the Brooklyn Academy of Music,* Multiverse *for the National Gallery of Art,* Cosmos*, dedicated to Carl Sagan, at Cornell, and* The Bay Lights *on the San Francisco Bay Bridge. What are some of the challenges in these architectural projects?*

LV: The Cornell work is mounted on the underside of the Johnson Museum, an absolutely stunning building designed by I.M. Pei. The lighting is all in white, as is the piece at the National Gallery. For me, it's about respecting the building. My first important work with architecture was *Light Matrix*, for the Gordon Bunshaft building at the Albright-Knox Gallery. I want these works to be integrated

***The Bay Lights*, 2012. 25,000 LEDs, 1.8 miles long and 500 ft. high. Work installed on the Bay Bridge, San Francisco.**

and not disturb the architecture. I've also worked with Stanley Saitowitz at the Tampa Museum and Kyu Sung Woo at the Nerman Museum of Contemporary Art in Overland Park, Kansas; with both, I was able to make a permanent work using the façade. It's great to find architects who are not afraid to work with an artist.

JGC: *How much more engineering and safety is required in an outdoor installation?*

LV: Making public art is a huge responsibility. *Buckyball* and *The Bay Lights* are the most engineered pieces I've ever done. Safety is paramount. To install 25,000 lights on a 1.8-mile expanse of the Bay Bridge, we scheduled more than 100 days of lane closures in the middle of the night. I did a cable walk up to the top. On one side, it's 220 feet down to the water; on the other side, it's 250 feet to traffic. We asked contractors to install this work in the middle of the night, hanging in harnesses from 11 p.m. to 5 a.m. It's one thing to render it in Photoshop; it's a whole other thing to go up there and see the reality of what we asked them to do. It's epic. They're all highly, highly professional—finding the right teams of engineers to work with is critical.

JGC: *How long do LEDs last?*

LV: It depends on the fixture, but they're incredibly durable. Some are rated for up to 100,000 hours, which would be 11.5 years if you were to burn them straight through at full power. In my pieces, the light levels are always modulating, so they're not on at anywhere close to full power. LEDs are extremely susceptible to temperature though, and the Bay Bridge will be an extreme environment. We worked with Phillips to provide the technology; their engineers have rated and evaluated it. We're optimistic that it will be virtually maintenance-free. It's a reliable technology, but we're not complete blind optimists; we have a maintenance budget.

JGC: *Your work references art, nature, mathematics, and systems. What are some of the specific influences that you're exploring today?*

LV: There's an artist-oriented programming language called Processing, which was invented at MIT. I learned it when I was in the Interactive Telecommunications Program at NYU. A large group of people know how to program in this environment, so I'm trying to expand what I can do with my sequences, and, in particular, with the Bay Bridge, where there's so much to respond to. I'm taking input from the water, the wind, and the traffic. I'm interpreting anything that moves and creating my sequences in response, so that it will feel very appropriate to the space. On one visit, I was on the cable walk on a cloudy day, and suddenly the clouds opened and light came down on the water—it was a sublime moment. I was taking notes, photographs, video— working directly with the interactions of light and water oscillations that I saw up there—and thinking: How am I going to ask my programmer to simulate these systems? I had a magical moment up there when I realized that I had so much to work with if I could manage to channel it.

JGC: *Any tips on how emerging artists can plug into new directions in programming light?*

LV: Get on the web. DIY culture has taken off to a degree that I find thrilling. At NYU, Dan O'Sullivan started a physical computing program, which is about using sensors and microcontrollers and not using keyboards and mice. That is directly related to things like *MAKE* magazine and the whole Maker Faire culture, which is blossoming. It doesn't require degrees, just finding like-minded hacker space groups where people are figuring things out on their own. LED technology is becoming more controllable, and the price is coming way down. I think we'll see a lot more work like this—I'm excited.

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