The Dream Vortex and the Demon Artist

There is no magic lens that will enable us to look at — to see nature unclouded…uncolored by any values, hopes, fears, anxieties, desires, goals that we bring to it.

— Evelyn Fox Keller [i]

In 2011, a known project and a secret hope brought me to the University of California, Davis (UCD), first as a visitor to a scientific visualization facility, KeckCAVES, and then as artist-in-residence at the facility's neighbor, the Complexity Sciences Center. The known project had a title: *Dream Vortex*, and an adventurous form: an artwork made with interactive 3-dimensional projection. But the only words I had for the secret hope were from a language of "shamanism" imbibed from artist Joseph Beuys. This essay follows the artwork and the hope as I groped my way forward, and tells how I found a better model than "shaman," hidden in the history of science and revealed by clues in the 57th Venice Biennale and the writings of Evelyn Fox Keller.

My hope sprang from the belief that art, the domain of "subjectivity" — values, hopes, fears, anxieties, desires, and goals — and science — the domain of "objectivity" —consistent and repeatable facts and realities — needed to talk if we were, as a culture, going to arrive in a future we wanted to live in. But "domains" don't talk — people do. Developing the artwork in collaboration with the UCD researchers would produce such talk, requiring interaction with them over time. I would talk with them about their dreams, make drawings based on the dream imagery, and feed them into a programmable, dynamic, vortex with which viewers could interact. At the end of the project, each dreamer would receive a drawing to complete the cycle of exchange.

Through this work, I positioned myself as an intermediary between scientific and artistic worlds. The artwork would be a social structure that held both domains in dynamic relationship without blurring them, just as its visual structure, the vortex, whirled together distinct streams of research and imagination.

Waves and Vortices

A memory: in 1991, my MFA cohort stood in the ceramic glaze room at Mills College, listening to sculptor John Roloff. He waved his hand at the bins of powdery mineral colors. "We have all this," he said, "because people need toilets. They're not grinding up mountains for art." His point, that art practice depends on an industrial base, stayed with me as I plunged into making art with media that barely existed at the time Roloff spoke. Historically, new technologies enable new art forms as they become widely available, as in the 1970s when the Sony Portapak triggered video art. I didn't know it then, but 1991 was an important

date in virtual reality, the year an effective 3-D display — more on that in a moment — was invented. That technology was expensive, and remained, for the most part, in laboratories, but two decades later, between 2011 and 2017, the video gaming market stimulated the introduction of home 3-D viewing systems. In 2011 sales of 3-D monitors, which could become interactive with the addition of gaming controllers, took off. [ii] In 2014, developer kits for the personal head-mounted 3-D viewer Oculus Rift became available; at this writing, consumer versions of head-mounted displays sell for around five hundred dollars. They are not in every living room, but they are showing up in major galleries and museums, for example as equipment in Carsten Höller's 2015 exhibition "Decision" at the Hayward Gallery in London and as content in Nathaniel Mellors and Erkka Nissenen's installation for the Finnish Pavilion at the 57th Venice Biennale.

And they showed up, before they were commercially available, in the Complexity Sciences Center.[iii] As I worked on the *Dream Vortex*, translating it into each successive "wave" of interactive 3-D visualization technology, I felt the fitness of the common digital metaphors of "waves" and "surfing." There were times when the ideas I stood on, from both contemporary art and its subset "art and science," seemed awkwardly shaped for the turbulent conditions. I would wipe out if I fell into thinking "Art will fix science!" I was a guest in the laboratory and I respected my scientific collaborators. There was plenty of work to do on the *Dream Vortex* and, as time went on, its daughter vortices, that required no philosophical speculation. So the project moved along, with the question of how to interpret my own "dream" — the motivation for investing years in the project — bubbling under the surface. Then, seven years in, I reread Keller's 1993 *Refiguring Life: Metaphors of Twentieth Century Biology,* in close proximity to viewing the 57th Venice Biennale, and out popped a much better model for my practice than "shamanism." But I race ahead of the story. For the model to make sense, you need to know something of the *Dream Vortex*.

Enter the CAVE

Even if I had known that a "CAVE" was a "computerized automated virtual environment," my first visit to UCD's KeckCAVES would have been a magical shock.[iv] In a room-within-a-room — 3 walls and a floor equipped with stereoscopic displays and tracking devices— scientists interacted with images of their data in real time, "touching," moving, and resizing 3-D projections as effortlessly as they might use a touch screen. Data from all kinds of studies, on subjects ranging from molecules to snowflakes to continents, was transformed into weightless, malleable imagery. It was like entering a room with physical objects and moving them around, except that you could also change their color, scale and position, orient them without regard for gravity, slice them up, and merge them.

CAVEs are an old "new media," dating back to 1991, when Carolina Cruz-Neira,

working with Daniel Sandin and Thomas DeFanti, created the first immersive projection environment as her Ph.D. dissertation.[v] They were, and are, an astonishingly vivid passageway between physical and virtual worlds. Because CAVEs are expensive they will remain exotic, but in many ways they still offer an unsurpassed virtual experience, with more flexibility of manipulation, movement and shared participation than head-mounted VR displays.[vi] [FIG. 1] Within twenty-four hours of that first visit, an idea for a multi-dimensional CAVE work came to me; I turned it into a storyboard proposal and sent it off to KeckCAVES co-founder and geobiologist Dawn Sumner, who miraculously responded "yes." We will turn to that proposal momentarily, but first a detour past a key question: Why did Sumner say "yes"? Why would a fantastically busy researcher —her work on early life, studying microbial communities in Antarctic lakes, had earned her a spot on the Mars Curiosity team and she was then a leader in the effort to choose a landing site— make room in her life to work with an artist?

"Haptic Creativity"

Over our seven years of work together, Sumner must have found several answers to that question, some of them embedded in adventure and growing friendship. But in the beginning, the "yes" arose from her research. At the time, the innovative way Sumner used the CAVE to investigate geobiological questions was under study by two anthropologists of science, Natasha Meyers and Joe Dumit, who sought to describe the relationship between her visualization tools and her thinking.[vii] The anthropologists limn her generative physicality, writing that Sumner and another scientist in the study "are constantly reworking their technologies while they develop and test their hypotheses. Both engage their technologies to get entangled kinesthetically and affectively with their data…they maximize their opportunity for what we are calling 'haptic creativity'… Their movements are provocations, questions that they pose inside their data-set: What if I try this? Or this? What can I see now?"[viii]

Sumner's use of interactive visualization to explore her data with movement and proprioception required that she continually and creatively develop her use of the CAVE. Within my proposal, she saw a set of unfamiliar questions — an artist's questions — but also a set of prompts for new movement possibilities. Imbuing the CAVE with the new movement functions for the artwork meant those functions would be available for science, too.

The Dream Vortex

The proposed work would mix old and new versions of human's oldest imaging technology, drawing, transforming physical drawings into a spinning vortex of projected images with which participants could interact. A dream-appropriate degree of surprise, provided by a hidden network of associations built into the programming, meant that as viewers interacted with the piece, elements would occasionally morph, unbidden, into new images. That was the vision, anyway.

Sumner's "yes" came with a rider: despite my effort to frame the proposal based on the demonstrations I saw, I didn't understand the technology very well and there was a significant gap between the capabilities of the extant CAVE programming and the artwork I envisioned. That gap was what appealed to Sumner. This is not the place for detailed discussion of the technical work that bridged it. Developing the new dynamics and interaction modes has engaged Sumner and others working to fulfill her design through more than five major programming stages.[ix] A sense of the distance we had to travel may be gained by contrasting our first prototype, a spinning network structure without images, with two stills from its current state. [FIG. 2]

There was another challenge: the researchers using the facility were not eager to sit down with a strange person and tell her their dreams. This was, after all, their work place, and a site devoted to "objective" matters. Quite a number of them were interested in art, but what they meant by "art" was, to me, historical. This was the gap that appealed to me, a gap that could be gently bridged to increase the traffic between art and research.

Help came from the Complexity Sciences Center, whose director, physicist Jim Crutchfield, had worked seriously with artists throughout his career. He provided the project with programming help, equipment, and a home base on campus. I started showing up in the lab, talking with people, working on the vortex, occasionally showing them works of contemporary art, becoming, in a small and quiet way, part of the lab.

Decentralized Cohesiveness

This situation might have been framed according to Beuys, who once said, "In places like universities, where everyone talks too rationally, it is necessary for a kind of enchanter to appear."[x] But the enchantment was flowing both ways; scientific pixel dust enthralling artist just as much as artistic vision beguiled the scientists. The *leitmotif* of the work seemed closer to "constant donation," to borrow a phrase from poet and scholar Lewis Hyde. Hyde writes, "…the giving of a gift tends to establish a relationship between the parties involved. Furthermore, when gifts circulate within a group, their commerce leaves a series of interconnected relationships in its wake, and a kind of decentralized cohesiveness emerges." [xi]

From my point of view, the "art" in the piece was the platform it offered for just such a "decentralized cohesiveness," for generosity, dialog, and co-creation. Everyone involved was giving a gift, of time, knowledge, and trust. Although in some ways this connected with Beuys's ideas, in practice he, as artist-shaman, was perched in a "special" position that distanced him from others. I was looking for something else — the version of creator on offer in the Pavilion of the Shamans, with its aura of mystical authority, was not for me.

But the version in the Finnish Pavilion might have been.[xii] Happily experiencing Nathaniel Mellors and Erkka Nissenen's multi-media installation *The Aalto Natives*, I considered its relevance to my search. [FIG. 3] Theirs is a gloriously ribald story of two terraforming gods who, long ago, made Finland and have returned to see how the Finns are evolving. The Finns attempt to fool the Gods with virtual reality, so that they won't see what a mess they have made of their world. It occurred to me that my *Vortex* crew was more likely to connect with *The Aalto Natives* ironic spirit than with Beuysian belief. But the thrust of *The Aalto Natives* is critical, and the thrust of the *Vortex* works is engagement. My aim is to create conditions for something new to emerge, not to critique what has already happened. A hook, a pitch, a metaphor, was needed, to encapsulate that idea so that it could be quickly offered to others.

A most extraordinary character

Serendipitously, I reread the work of Fox Keller, who argues that metaphors consonant with the "values, hopes, fears, anxieties, desires, goals" of a culture guide its science. In *Refiguring Life: Metaphors of Twentieth Century Biology,* she discusses just such a 19th century word-picture, one that is still active in scientific literature. In the mid-1800s, she writes, there emerged a terrible tension between physics and biology; between the second law of thermodynamics — understood to predict the "heat death" of the universe due to entropy — and Darwin's vision of nature evolving endlessly towards perfection. (The contemporary version might be the tension between socio-technically-induced climate doom and let's-be-cyborg enthusiasm.)

According to Keller, physicist James Clerk Maxwell "offered a glimmer of a solution" to this tension— an image of stability — in an 1867 thought experiment in which he invented an imaginary being who could circumvent the second law. Maxwell said this being had such acute perception that he could "follow every molecule in its course."[xiii] Due to this superior information, this "observant and neat-fingered being"[xiv] could separate slightly hotter molecules from slightly cooler ones and thus raise the temperature at one site and lower it at another without doing work, circumventing the second law of thermodynamics. Keller says, "…With this phantasmic conception enters one of the most extraordinary characters in the history of physics…whom [William] Thomson was soon to dub a Demon."[xv]

Maxwell's Demon — a "demon" in the sense of a "ministering spirit" — lives on in physics, indeed he occasionally appears at the Complexity Sciences Center, where Crutchfield is leading research in a "system that performs information processing as it undergoes controlled thermodynamic transformations." [xvi]Crutchfield explains the "demon" as an embodiment of the first, fuzzy intuition about what we now call "emergence," the seemingly spontaneous appearance of higher order structure from the interactions of simpler entities. [J.P. Crutchfield

2017, personal communication 13 June] The figure of the demon was a beginning, a strategy to raise a barely perceived question. As Keller says, "Making sense of what is not yet known is…necessarily on ongoing and provisional activity, a groping in the dark; and for this, the imprecision and flexibility of figurative language is indispensable."[xvii]

The Demon Artist

So here's *my* thought experiment: imagine an artist-being who spends time in the presence of a group of other beings, watching for a moment or an image of a certain quality and then, in some way, bringing it back to the attention of the group, recirculating it, intensifying awareness of it, making it "hotter." This being is observing and, in a light and weightless way, using the information she has to assist the circulation of certain energies in a human group. At present, this "demon artist" embodies a fuzzy intuition about a possible role for artists, not just for me, or for artists in labs, but in many different kinds of situations. (What if hospitals or bureaucratic departments or even businesses with ideals beyond profit had such artists embedded?) Like a "shaman," the demon artist would know her group and work with its "soul," but without the pretension of special access to another world — just a way of using images that augments thinking in this world. A "demon" is a "minor" spirit, but as we know from one of complexity theory's most famous results — the "butterfly" effect — in a dynamic system such as our human world, something doesn't have to be "major" to make a significant difference.

The image and metaphor of the "demon artist" doesn't yield a perfect description of the art practice I am imagining. No metaphor is the thing. And it's not the only way of describing art-making focused on a known community rather than an anonymous "market" or art-making as a form of exchange rather than the production of marketable objects. The demon artist doesn't even solve my communication problem. Even if it catches my meaning, a "demon" in Maxwell's sense requires just as much explanation to the general public as does "social sculpture" in Beuys's sense. But for now it is a reference figure for the work that I can share with enthusiasm: there are worse roles than being an "observant, neat-fingered being" associated with the hope of a stable world. In the words of Christine Macel, "art may not have changed the world, but it remains the field where it can be reinvented."[xviii]

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[i] Bill Moyers, "The Gendered Language of Science: Transcript of Interview with Evelyn Fox Keller," May, 1990, http://billmoyers.com/content/evelyn-fox-keller/. Accessed 17 June 2017.

[ii] In a post titled, "3D TV-Sales Growth," the Korean news agency Yonhap reported on March 18, 2013 that "3D TV shipments totaled 41.45 million units

last year, compared with 24.14 million units in 2011, according to the data by DisplaySearch. The figure marks a nearly 18-fold growth from 2.26 million units in 2010, when the market researcher began compiling the data." Global Post, https://web.archive.org/web/20130724082049/http://www.globalpost.com/dispatc h/news/yonhap-news-agency/130318/3d-tv-sales-growth. Accessed 19 June 2017.

iii Physicist and Director of the Complexity Sciences Center, Jim Crutchfield, had visited the Electronic Visualization Laboratory and seen the first CAVE in 1991. His interest in 3-D visualization for his work in complex systems led him to be active in software development for the CAVE and 3D flat screen monitors, and he invested in the Kickstarter campaign for the Oculus Rift. Mycelia, an immersive network visualizer used for the first Vortex prototype, was programmed by Crutchfield's graduate student Sean Whalen as a project for Raissa D'Souza's network science class.

iv The invitation came as part of a special 2011 initiative called "Expressing the Caves," organized by artist Robin Hill, anthropologist Joseph Dumit, and my soon-to-be collaborator, geobiologist Dawn Sumner. A University of California Institute for Research on the Arts (UCIRA) report on the initiative can be found at https://ucsota.wordpress.com/2011/11/30/joe-dumit-expressing-the-caves/. Accessed 22 June 2017.

v Carolina Cruz-Neira, Daniel J. Sandin, Thomas A. DeFanti, Robert V. Kenyon, John C. Hart, "The Cave: Audio Visual Experience Automatic Virtual Environment," *Communications of the ACM*, Vol. 5, No. 6, June 1992, 64-72.

vi CAVEs are not a standardized consumer technology; each one has been customized to address certain research questions and thus has unique features. The CAVE at UCD is distinguished by a high degree of interactivity while the CAVE at Villanova University, for example, is vision-centric, intended to show 3-D scenes of the "real world." Thus, artists working at CAVE sites — my predecessors in CAVE art include John Cayley, Patricia Olynyk, and Roderick Coover — have different sets of aesthetic choices and technical possibilities.

vii 6. Natasha Myers and Joe Dumit, "Haptics: Haptic Creativity and the Mid-embodiments of Experimental Life, from A Companion to the Anthropology of the Body and Embodiment, First Edition. Ed. Frances E. Mascia-Lees, Blackwell Publishing Ltd., Hoboken, NJ, 2011, 240.

viii Ibid., 245.

ix Among the many contributors to the project, computer scientist Oliver Kreylos and physicists Jordan Van Aalsburg and Christopher Ellison deserve special mention.

x Suzi Gablik, *The Reenchantment of Art*, Thames and Hudson, New York, 1991, 41.

xi Lewis Hyde, *The Gift: Creativity and the Artist in the Modern World,* Knopf Doubleday Publishing Group, New York, 2009, xx.

xii In addition to the central international exhibition, the 57th Venice Biennale included 83 exhibitions organized by national entities in "pavilions" surrounding the central, international exhibition or in other Venetian locations.

xiii James Clerk Maxwell, *Theory of Heat,* Longmans, Harlow, England, 1871, 308.

xiv "Chronological Bibliography with Annotations and Selected Quotations, from *Maxwell's Demon 2: Entropy, Classical and Quantum Information, Computing*, ed. Harvey Leff and Andrew F. Rex, CRC Press, Boca Raton, FL, 2002, 405.

xv Evelyn Fox Keller, *Refiguring Life*, Columbia University Press, New York, 1995, 53-54.

xvi A. B. Boyd and J. P. Crutchfield, "Maxwell Demon Dynamics: Deterministic Chaos, the Szilard Map, and the Intelligence of Thermodynamic Systems", *Physical Review Letters* 116 (2016) 190601.

xvii Evelyn Fox Keller, *Making Sense of Life: Explaining Biological Development with Models, Metaphors, and Machines*, Harvard University Press, Cambridge, MA and London, England, 2002, 118.

xviii Christine Macel, *Viva Arte Viva — Introduction*, exhibition wall text republished by Universes in Universe.com, http://u-in-u.com/venice-biennale/2017/viva-arte-viva/christine-macel-statement/. Accessed 23 June 2017.