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/ARTS AT MIT

Art for the Age of the Anthropocene

Tomás Saraceno's work with social spiders, their webs, and the wind

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Guest Contributor

When Tomás Saraceno first came to Massachusetts Institute of Technology (MIT) as a Visiting Artist in 2012, he met with the late Otto Piene, who was then Professor Emeritus of Visual Design and the second director of the influential Center for Advanced Visual Studies, founded in 1967. As Saraceno fondly recalls, their bond was not based solely on a creative interest in sky art, but also they shared a similar spirit in their approach to making work; Saraceno says he felt a kinship with Piene's immersion in the MIT community and his endless curiosity about the research being done around him.

Saraceno was the first visiting artist invited by the MIT Center for Art, Science & Technology (CAST) to participate in its residency program, which emphasizes the creative process; extensive interaction with MIT faculty, students, and researchers; and cross-fertilization among disciplines. According to CAST Director Leila Kinney, "The program is distinctive for its R&D nature and the openness of scientists and engineers to artists' speculative but hands-on way of thinking." Saraceno's ongoing collaboration with several MIT faculty members—including Lodovica Illari (Senior Lecturer, Earth, Atmospheric and Planetary Sciences), Markus Buehler (Professor and Head, Civil and Environmental Engineering), and Evan Ziporyn (Faculty Director of CAST and Kenan Sahin Distinguished Professor of Music)—testifies to his inquisitive nature, the expansive character of his work, and his valuable contribution to the culture of MIT.

At MIT in December, Saraceno met with meteorologist and director of the Synoptic Laboratory Lodovica Illari, whose research in synoptic meteorology, severe weather, and atmospheric blocking has involved modeling wind currents. This topic particularly intrigues Saraceno, who is well known for his inflatable and airborne biospheres. He speculates that deeper understanding of the topography of wind currents could aid human travel via solar vehicles that would be more sensitive to the planet than our current fossil fuel–guzzling modes of transport. In Peru, his work with solar balloons is already allowing for a new form of zero-emission aerial photography, which he and collaborating artists are using to document the Nazca Lines, ancient ground drawings that are disappearing because of the encroachment of surrounding villages.

His interest in air currents relates to his study of certain species of spiders that travel by a method known as ballooning. These spiders release their threads from a high vantage point and are able to glide up to 10,000 km on wind currents. In another species of social spiders that he is documenting, spiders cast their webs in the air together, and the atmosphere is responsible for weaving a kind of flying carpet on which they take off. As he points out, 50 million animals (mostly spiders and other bugs) already inhabit the air, and he postulates that "in the future, if we learn to be more sensitive to the weather and the climate and currents, we might inhabit not only the earth but the air space as well. It might give us a possibility to have a society without fossil fuel. We might learn to travel and have a different mobility."

14 Billions (2010) by Tomás Saraceno. Bonniers Konsthall, Stockholm, Photo credit: Studio Saraceno.

Markus Buehler, John Ochsendorf and Tomás Saraceno at "Reverberations: Spiders and Musical Webs," the MIT Museum, 2014. Photo: Barry Hetherington.

As part of his research into social spiders and their three-dimensional webs, Saraceno has been working with Professor Markus Buehler and Dr. Zhao Qin, a research scientist in Civil Engineering at MIT. In their recent talk at the MIT Museum exhibition "Reverberations: Spiders and Musical Webs," Saraceno and MIT Professor Markus Buehler discussed their research in materials and structures inspired by the intricate geometry of spiderwebs. Using the data from his digitally captured three-dimensional spider web, Saraceno reconstructed the web 16 times its original size for his installation *14 Billions (Working Title)*, 2010. Buehler's lab created a computer simulation of the data set generated by this project to reveal how the strands behave and interact in the physical web.

Saraceno developed an original tomographic methodı, using a laser sheet, to scan a three-dimensional web built by *Latrodectus mactans*. This pioneering technique made access to the complete and accurate three-dimensional data of a spider web possible for the first time. Such data

is useful not only for architects and artists but also for arachnologists, evolutionary biologists, ethnologists, physiologists, and engineers. In this panel, Buehler discussed the molecular structure of the proteins in spider silk and how art and engineering can function as mutually beneficial modes of discovery. He addresses this topic in his book Biomateriomics, which examines biological material systems and the transfer of biological material principles towards biomimetic and bio-inspired applications. Applying biomateriomics can unlock nature's secret to high-performance materials such as spider silk, bone, and collagen. "Spider silk is one of the strongest materials known. In fact, its strength is about that, or even larger, than the strength of steel," Buehler said. Despite its strength, spider silk is almost completely composed of proteins, which are simple, weak building blocks. Explaining how the silk gets so strong, Buehler said, "It's not because the proteins are so strong, but because of the way these proteins are connected and form patterns."

Understanding the chemical bonds of spider silk can potentially be useful for unconventional approaches to design problems. Dr. Qin demonstrated the analysis of Saraceno's data with the computer model developed in Buehler's lab, which revealed the elasticity and tension of the black widow's web that the artist scanned and used as a basis for his installation. At present, Buehler and Qin are cultivating several webs in their lab for further research, which Saraceno delivered and installed on his most recent visit to MIT.

Building on this fascination with social spiders and their webs, Saraceno is also working on a collaborative installation that uses a three-dimensional spiderweb as a musical instrument to embody the incredible structural and vibratory properties of spider silk. Saraceno began discussing the structure of this web-inspired instrument with Buehler and acoustic aspects of these musical webs with Evan Ziporyn last fall. Three pieces by Ziporyn were featured in a concert in Berlin in October, 2014 entitled "A Matter Theater," which was part of *The Anthropocene Project*. For this concert, Saraceno asked Ziporyn to contribute pieces to which live spiders in sonified webs could respond. Ziporyn explains, "Tomás described to me how the spiders seem to use web vibrations to communicate, but of course we don't as yet have any information about the details of this—it's more like a beautiful general impression, the idea itself. So I tried to find pieces that seemed to resonate with that idea that more or less concerned themselves with a single type of resonance." Saraceno is also collaborating with the Natural Science Museum in Berlin to understand better the ways spiders communicate. He hopes that codifying a certain type of vibration will enable us to "understand the language of the spiders."

An overarching theme in much of Saraceno's work is this sensitivity to nature. Saraceno points out that in this age of the Anthropocene, "We humans are the biggest geological force in the planet. We are producing climate change, which may forever transform planet earth." Saraceno's stated interest in, "co-dependency, interdependency, and the responsibility I have toward others, and how much I can perceive in the human and nonhuman world" is evident in his various bodies of work, including the solar balloons and inflatables, the web-inspired installations, and the sonified webs. "From small works like the spider webs themselves to the large-scale installations, there is always some sort of vibration, frequency, or relationship," he says. As he built a few structures to house the social spiders that he carefully transported to Buehler's lab, he reveled in how these simple practical aspects of these art works may lead to complex insights about our natural world: "Everything is connected. And through making, you realize there is another way of thinking."

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