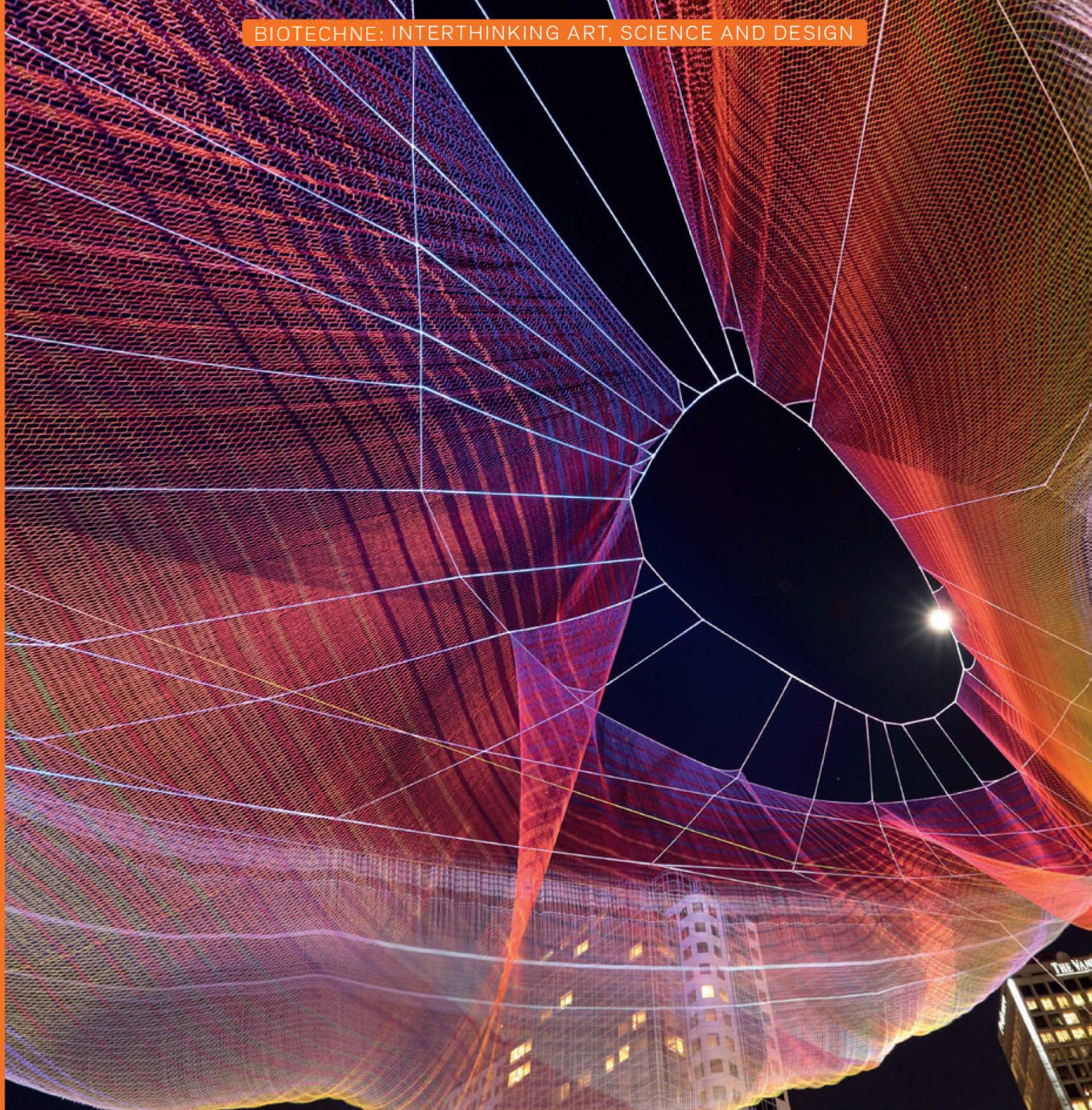


BIOTECHNE: INTERTHINKING ART, SCIENCE AND DESIGN



D'ARCY WENTWORTH THOMPSON'S GENERATIVE
INFLUENCES IN ART, DESIGN, AND ARCHITECTURE

EDITED BY ELLEN K. LEVY
& CHARISSA N. TERRANOVA



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FROM FORCES TO FORMS

B L O O M S B U R Y



Complex Systems and Morphogenesis

Thompson contributed to the development of complex systems, which inform much scientific research and artistic production. A brief background includes work of biophysicist Alfred Lotka who, in 1910, observed phenomena now associated with complexity, among them, chemical oscillations, predator-prey relationships, and autocatalysis in response to feedback systems.³ At a later date, mathematician Alan Turing showed that molecular-level interactions can lead to morphogenesis and cell differentiation. He cited Thompson in his own major work, "The Chemical Basis of Morphogenesis."⁴ Turing recognized that Thompson's application of mathematical modeling to visualizing form development established a basis for understanding morphogenesis.⁵ For example, reaction-diffusion systems provided developmental biology a working model for the growth of patterns on animal pelts and shells. Tracing the emergence of complexity, media artists Christa Sommerer and Laurent Mignonneau used the term "rational morphologists" to identify those involved early on with its principles, including Thompson, Conrad Hal Waddington, Richard Owen, and Hans Driesch.⁶ These dynamic principles were readily adapted by artists.

Artist Philippe Parreno generated his 2014 artwork, "With a Rhythmic Instinction to Be Able to Travel beyond Existing Forces of Life (Green, Rule #1)," by implementing successive states of an algorithm with a cellular automaton. It establishes dynamical transitions from one state to another based on mathematician John Horton Conway's program "The Game of Life" (Figure 11.1). Cellular automata feature some of the central characteristics of self-organized complex systems in that they proceed by applying local, simple rules.⁷ Cells are typically blackened according to whether surrounding cells are black or white. Emergent features may result, and the outcome relies on many factors interacting at different phases over time. Parreno prepared a context for the automata consisting of numerous drawings of fireflies in various developmental stages.⁸ The emergence, presence, and disappearance of lit cells determine the sequence of images and the intensity of sound accompanying his animation. Each sequence of drawings of a depicted firefly from various life stages enacts a life cycle that concludes with its "death" that lingers on the monitor for several seconds. Soon after, another life cycle ensues. It is Parreno's emphasis on dynamically simulating life cycles in multiple ways that differentiates his work from other contemporary artists who also incorporate algorithmic productions of text, sounds, and images and imbues his work with evolutionary-like processes. His choice of tools, ranging from graphite to new media, reinforces the viewer's sense of watching a life form through a progression of developmental stages.

Sculptor Janet Echelman explores complexity and morphogenesis, creating environments and unexpected configurations with reinforced fishing nets. Her works respond dynamically to the forces of wind, water, and light. In *Sculpture* magazine this polymath elaborates, "I began with the history of the site, a centuries-old fishing village that became an industrial zone in the last few decades. There are references to smokestacks and their red-and-white striped patterns, the angled masts and cables of



Figure 11.1 Philippe Parreno, “With a Rhythmic Instinction to Be Able to Travel beyond Existing Forces of Life (Green, Rule #1),” 2014. Eight Martin Professional EC-20 LED panels, ten Martin Professional EC-10 LED panels, Mac mini, speakers and amplifiers, dimensions variable. Courtesy of Pilar Corrias. Photo by Andrea Rossetti.

Portuguese ships, the patterns and forms of fishing nets and Portuguese lace.”⁹ In my conversation with the artist, she noted that the works can resemble sea anemonies and undergo shape-shifting in real time when acted upon by wind. Echelman’s netting initiates a range of analogies. As it folds and billows, the netting readily suggests phases of evolutionary development such as cell and organ differentiation. The artist forges a vivid comparison; one might think of the rope-like protein that forms a protective netting and surrounds the DNA at the core of the nucleus.¹⁰ An early work of Echelman’s appears to have undergone invagination, the process of being folded back on itself to form a cavity. Echelman’s distorted net suggests an unforced relationship to the deformed grid in Thompson’s famed topological transformations. She notes that her works may conjure pre-Cambrian life forms before the advent of multicellular life.¹¹ Her reference is clearly to Gould’s book *Wonderful Life: The Burgess Shale and the Nature of History* (1990), which considers questions of contingency regarding the great diversity of fossils from the Burgess Shale. Gould asks whether and to what

extent the same life forms might result if the process were to recur, finding it unlikely.¹² Echelman similarly courts chance in the morphing of her forms; the effects of weather in interaction with her structures are unpredictable.

Echelman's work effortlessly spans the three categories discussed in this anthology—fine arts, design, and architecture—while embodying Thompsonian principles of form generation. She works with a range of professionals and materials, utilizing high-tech fibers in addition to netting. In collaboration with media artist Aaron Koblin, an open source programming language called Golang was used to project sound and color onto Echelman's work *Skies Painted with Unnumbered Sparks*, installed in Vancouver, BC¹³ (Cover). She invited interaction; spectators were empowered to use their mobile devices to draw on the sculpture with light. The colors of biomorphic forms were altered in digital animations projected onto her work; the graphics were rendered in real time. The ropes are made of a fiber that Echelman states is fifteen times stronger than steel.¹⁴ Her monumental sculpture spans 745 feet between the 24-story Fairmont Waterfront and the Vancouver Convention Center.

Echelman places her sculptures in a variety of public environments, and her works and titling often have ecological overtones. In describing *1.8* (2016) sited in London (Color Plate 5), she explains that the title refers to the length of time in microseconds that the earth's day was shortened because of an earthquake that emanated from Japan and redistributed the earth's mass.¹⁵ Her stated aim is to show "the interdependency that we all have with the larger cycles of the planet."¹⁶

Thompson's pluripotent influence is palpable also in Oliver Laric's 2018 video *Betweenness* and sculptures. They were part of his installation "Year of the Dog," which explored both morphogenesis and allometry. His animation narrates the dynamic growth patterns of different parts of an organism. It features the unpredictable morphing of a black line drawn on a white ground that shifts continuously in scale and proportioning and can evoke processes of cell mitosis and conjure an array of animals, both real and mythological. For example, one still from *Betweenness* dynamically portrays an image of a bee as if snared between two lines, at right angles to each other. For me, the image evokes positioning between two different evolutionary lineages, vertical and horizontal. Viewers following the evolving line may also become aware of the critical points where a form can be identified as an entity or as one of several entities.

In related 3-D-printed and painted polyurethane sculptures that the artist titles *Hundemensch* (2018), the silhouettes of a human ear, a frog, and a crab appear in relief below the surface of each representation of a genetically modified creature's back (Figure 11.2). Laric states

I am not focusing just on metamorphosis, but also on the moments in between moments ... Along with the video I am showing three resin sculptures cast from the same mold of a half-human, half-dog animal holding another smaller dog. The three are like distant cousins, both similar and different, and, in a way, I'm uncovering the process of how that difference is made.¹⁷