Functional Art and Water Science

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Guest Contributor

Recent interest in science-art collaborations seems to have focused on how artists can benefit from technological advancements in creating their works and how scientists can use the graphic arts to more effectively display their data. But interactions between science and art can extend beyond these established exchanges through functional art. Historically, functional art has referred to useful creations such as furniture, dishes, and lighting fixtures. More recently, functional art has appeared in the digital realm as infographics, visualizations, and interactive displays.

The physical, chemical, biological, architectural, musical, and artistic worlds are replete with examples incorporating identifiable patterns, rhythms, networks, and fractal-like relationships. In the field of water science, specifically, there is a fertile ground for physical and digital art to serve a functional role in researching, understanding, and providing practical design.

From "Drifters Project" by Pamela Longobardi. Image courtesy the artist.

Ocean Plastics: Artist Pamela Longobardi has documented and cleaned up plastic wastes on coastlines throughout the world. Her "Drifters Project" focuses on global-scale patterns created by the oceanic transport and deposition of plastics along the world's beaches. One facet of her art involves the use of selected plastic wastes to produce installations and exhibits that symbolically focus viewers' attention on the destructive usage and disposal of plastics. Possessing a scientific background, she approaches each site as a forensic researcher in distinguishing variations in the type and distribution of plastic materials that reflect their transport dynamics and pathways. The patterns of beach deposition can assist scientists, but are still unknown for many coastal areas.

Marine Habitat: Artist Mara Haseltine has created artificial reefs and other underwater habitats based on the geometry, patterning, and functionality of natural reefs in order to facilitate the reintroduction of marine organisms. In addition to structure, she has experimented with various materials (e.g., glass, metal, porcelain) in selecting the optimal substrates for the colonization of marine organisms. Particularly interesting is her use

of nature's microscopic structures and patterns to create macroscopic designs, such as incorporating the pattern of fish gills in building artificial habitat structures for oysters. Her artwork serves a valuable scientific purpose in uniting cultural and biological evolution through so-called geotherapy.

Wave Rhythms: Researchers are now able to transpose the vibrational signatures of chemical mixtures, marine algae, and even DNA molecules into the hearing range of humans to create "nature-based" music. A functional form of this music was composed from the sonification of ocean wave dynamics, which created audible versions of the graphical data and revealed nuances that were not visible in the graphics alone. Composer Bob Sturm mapped the temporal spectrum of ocean buoy data, characterized by the infrasonic frequencies (0.025 to 0.058 hertz) of ocean waves, into the audible frequencies (20 to 20,000 hertz) for humans. In doing so, he was able to produce stereo sonifications by using the various wave directions.

Warkawater. Photo courtesy Architecture and Vision.

Water from Air: As sources of high quality freshwater become increasingly scarce, recovering atmospheric water has captured the attention of engineers and designers alike. Two visionary architects, Arturo Vittori and Andreas Vogler, have created a passive water collector (i.e., no energy required to operate) composed of a nine-meter tall bamboo framework supporting a specialized fabric on which the nighttime fog condenses. Catching and accumulating potable water is a function of Warkawater's geometry and fabric pattern. It was modeled after a native tree in Africa, serves as an artistic feature and gathering place for the community, and can be assembled by local people using simple tools.

Artificial Watersheds: Water and ice in the form of rivers, oceans, and glaciers have cut through the planet's surface in ways that create landscapes that have been captured in various forms of digital artwork. Recent interest in emulating these natural patterns to design sustainable and eco-compatible creations (e.g., green roofs, artificial wetlands) relates to their influencing hydrologic regimes, temperature dynamics, and aesthetics of a landscape. Perhaps the world's most famous green roof lies atop the School of Art, Design & Media at NTU in Singapore, where the top of a five-story building serves as a gathering place for students, blends seamlessly into the surrounding topography, insulates the entire structure, and harvests rainwater for irrigation.

Water Flowforms: So-called water flowforms are constructed with different shapes, lengths, materials, and designed flow rates. Cascading down a stair-stepped series of vessels, the water vortices possess distinct patterns and rhythms that are evident in the designs of John Wilkes. Once considered strictly architectural features, flowforms were studied by a group of European naturalists who observed that water exiting these structures sometimes displayed properties slightly different from water entering them. While the mechanisms underlying such changes have not been described, flowforms are reportedly used to treat wastewater and irrigation waters.

The Blue Marble: The role of photographs in shaping people's views of Earth is increasingly important, and some people contend that such images are less prone to dualistic interpretation than are scientific or theoretical portrayals. Dualistic interpretations are those that separate nature from humans in presenting environmental issues. The famous blue marble photo taken in 1972 by Apollo 17 astronauts arguably captured humanity's attention more than any other. In doing so, it transcended political boundaries, man-made patterns, and the illusion of a terrestrial planet.

Aquifer Billboards: An international design award was recently presented to artist Richard Vijgen, who mounted an electronic display of images from NASA's Gravity Recovery and Climate Experiment (GRACE) in the midst of New York's Times Square for an entire month. GRACE consists of two satellites that track fluctuating groundwater levels worldwide on the basis of small gravitational changes. Perceptions gained from this type of public art and graphic design permit people a real-time recognition and visualization of how climatic and hydrologic patterns (both spatial and temporal) directly influence the water beneath their feet.

A Water Wheel: The Los Angeles River was once a source of water for local residents, but is now just a concrete flood control channel. Artist Lauren Bon of Annenberg's Metabolic Studio has received approval to construct one of the nation's largest waterwheels on a section of the river as a tribute to the many waterwheels of the 1800s. In addition to its artistic and historic significance, La Noria will actually deliver treated water to feed a small stream and to irrigate a large park located along the river. The waterwheel is part of a revitalization plan to restore riverine habitats and to draw attention to LA's dependence on scarce water resources.

Personal Water: Whereas the use of patterns and rhythms to communicate art, music, or dance is relatively straightforward, the use of spatial or temporal patterns to represent scientific data is not. Fernanda Viegas and Martin Wattenberg create data visualizations, such as their wind map, using patterns and layers that feature entry points for viewers, thus facilitating both their interest in and understanding of data via social, personal, or emotional relevance. The California Water Foundation enlisted the assistance of a software company to visualize household water use patterns, which are compared to those of similar households as a means of contrasting temporal and spatial data and of enticing people to compete with each other in reducing water use.

Image courtesy NASA Johnson Space Center.

Planetary Images: NASA's Applied Sciences Program displays satellite images of earth in a recent art book, *Earth as Art*, prompting people to look more closely at the earth and to ask themselves how nature was able to create such intricate patterns. The colors in every image are spectacular as a result of computer enhancements that highlight specific wavelengths of emitted light—the majority of which are not otherwise visible to humans. This art form has become a valuable tool for water scientists who discern spatial and temporal patterns for everything from vegetation health and lake temperatures to rainfall intensity and ocean chemistry.

Ocean Pollution: Artist Jane Quon has brought attention to the detrimental effects of ships' dumping ballast water into marine ecosystems by creating a project whereby each component contributed to a cumulative field of aesthetic communication with the public. In doing so, she created a kind of evolving language that is available to people through the medium of art without their having to engage the rational mind. Her art communicates, beyond words and numbers, the juxtaposition between the patterns of natural harmony and ecological dysfunction.

Artists and scientists are uniquely positioned via their respective training and creativities to view the world in different, but complementary ways. Functional art is just one of the ways that they can collaborate on designs that are aesthetically pleasing, practically applied, and designed to emulate nature's patterns and rhythms. Artists have been described as a kind of sensing element for humankind because they are often the first to notice disruptions in nature's rhythms. If so, it may behoove water scientists to consult with artists during all phases of research.