

Communicating Natural Systems

In urban centers our daily lives are disconnected from local environmental patterns. Our built environment reflects, and contributes to, our conceptualization of the environment as a threatening force to overcome. Awareness of environmental issues permeates some level of intellectual common consciousness. Chicagoans accept the reality of climate change. Rhetoric of “green” products and systems abounds the consumer marketplace. However, even as we intellectually grasp ecological issues, our stunted relationship to the environment hinders our personal connection to the issues at stake. Instead of sealing us off from outdoor elements, architectural interventions that adapt to weather conditions optimize the spaces they inhabit and communicate climatic conditions. By reframing architecture’s function as providing access to environmental patterns, architectural interventions viscerally connect us to ecological issues.



“Bloom” by Doris Kim Sung demonstrates the properties of thermal bi-metals

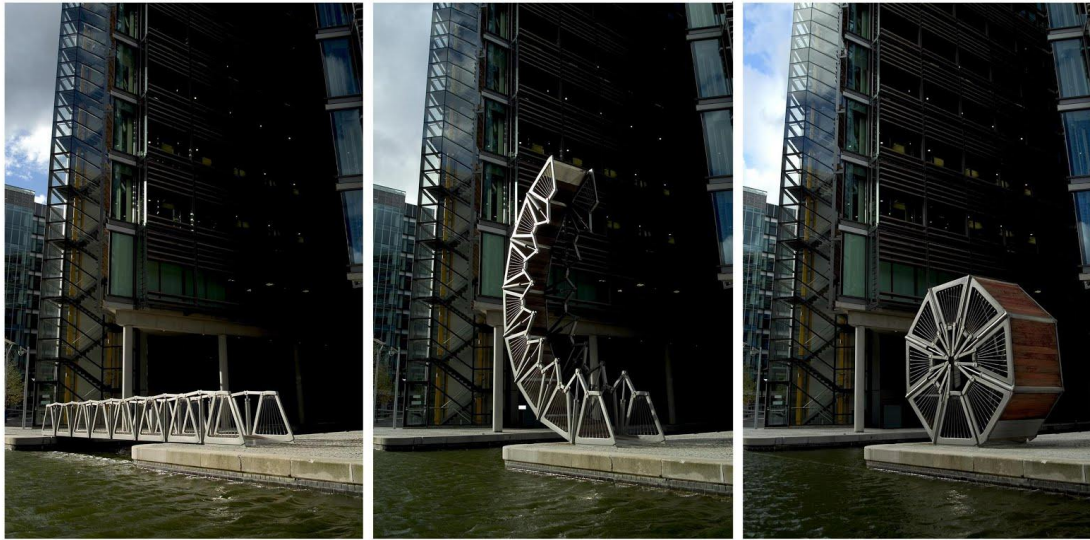
In his book *Biophilic Cities: Integrating Nature Into Urban Design and Planning*, Timothy Beatley argues that the expulsion of nature from our urban lifestyle has dire consequences. Biophilia, a term introduced by Edward Osborne Wilson, is “the urge to affiliate with other forms of life” and to understand the natural systems that sustain life. E.O Wilson argues in the forward to *Biophilic Cities* that “the evidence is compelling that frequent exposure to the natural world improves mental health, it offers a deep sense of inner peace, and, in many ways we have only begun to understand by scientific reason, it improves the quality of life”. Timothy Beatley explains that when residents are personally connected to natural spaces, they “care about nature and work on its behalf locally and globally.” Urban centers need to provide venues of cultural support for biophilic tendencies by prioritizing green spaces and by implementing technology that works with natural systems to optimize space and communicate the ecological patterns that surround us.

Several architects have gained recognition for implementing weather-adaptive kinetic elements to optimize the fuel efficiency of buildings. Doris Kim Sung develops building skins using thermo-bimetal meshes that expand to create reactive blinds when heated by the sun and contract to allow for airflow during moments of shade. Her building skins do not require any digital control or energy, but rather harness differing thermal expansion rates of metals to create the adaptive surface. Similarly, William McDonough’s design for the NASA Sustainability Base, features a ventilation system that opens and closes cross-breeze vents according to weather differences between the interior and the exterior of the building. The building is located in California, where the days are hot and the nights are cool, so the system typically opens the vents in the evening to allow fresh air into the building, and closes them during the day, when automatic blinds shade the interior from the sun. The simple technology of these systems allows for the climate regulation of an interior space to work with, not against, exterior weather conditions: a notion Amjad Almusaed refers to as bioclimatic architecture.



Santiago Calatrava's Burke Brise Soleil

Kinetic elements in outdoor structures can also be deployed to allure visitors into public spaces. Santiago Calatrava, for example, designed the Burke Brise Soleil Pavilion for the Milwaukee Art Museum with louvers that open and close the entire structure, creating a movement reminiscent of the flapping of a bird's wings. Calatrava conceived of the gesture as a communication device to signal the opening of a new exhibition. Sensors automatically close the wings if wind speed reaches a velocity that would strain the structure of the building if expanded. Weather-reactive kinetic technology, as employed by Calatrava, expands the range of safe architectural forms. The Rolling Pedestrian Bridge by Heatherwick Studio in London creates a new twist on the drawbridge by designing an increased range of motion. The bridge clears the water by curling into a circular shape. It opens by unfurling across the water. Its movement creates a lively expression for visitors to engage with.



“Rolling Bridge” by Heatherwick Studio

As Timothy Beatley argues, green spaces connect people to the local environment, and heighten their involvement in ecological issues. Bioclimatic architecture demonstrates how we can implement technology to create “smart” infrastructure to work with natural forces and harness resources sustainably. Kinetic elements in public space engage visitors with their surroundings. GFRY studio’s proposal for 10 E. Lake Street creates a lively biophilic and bioclimatic public arena that draws from these theories and precedents.

The weather adaptive system I am proposing for the site centers around a rainwater collection and distribution system that provides water to plant beds, and uses kinetic gestures to describe weather patterns and demonstrate the harnessing of rainfall. The canopy’s position communicates current barometric pressure, an indicator of rain. When rain is likely, the canopy stretches to form funnels and peaks to direct water to drains leading to underground storage cisterns. The cisterns circulate the water to a fountain, which demonstrates the quantity of water currently stored in the system: the fountain spews a rushing current of water when the system’s storage nears capacity, and dribbles a sprinkle during dry conditions.

The system demonstrates a method for utilizing hyper local resources. It does not require water from a municipal system; it consumes only water that it gathers, working on

bioclimatic principles. Because the plants on site rely on rainwater collection, weather patterns directly affect the health of the gardens. The design reveals our common vulnerability to ecological forces. As visitors become viscerally connected to the weather patterns through the movements of the canopy and the fluctuating stream of the fountain, they connect with issues surrounding ecology in general, and with issues surrounding water. We may take fresh water for granted now, but as hydraulic fracturing expands and corporations buy up international water rights, the availability of fresh water becomes increasingly perilous.

Biophilic sites connect visitors with nature. This proposal reflects upon this connection by communicating the patterns of the most elemental life force: water. Just as habitual observation of a stream provides an understanding of local precipitation patterns, the canopy and fountain communicate these patterns in an urban context. The proposal for 10 E. Lake Street works to connect visitors with natural systems and propose methods for harnessing natural resources in sustainable, closed-loop systems.

Bibliography:

Almusaed, Dr. Amjad, *Biophilic and Bioclimatic Architecture: Analytical Therapy for the Next Generation of Passive Sustainable Architecture*; Springer-Verlag, London, UK. 2011

Beatley, Timothy, *Biophilic Cities: Integrating Nature Into Urban Design and Planning*; Island Press, Washington, DC. 2011

Braungart , Michael and McDonough, William, *The Upcycle*; Farrar, Straus and Giroux, New York, NY. 2013

Milwaukee Art Museum website
Mam.org/visit/details/detail_burke.php

Heatherwick Studio website
www.heatherwick.com/rolling-bridge/

Journal of Building Appraisal- Sustainable Vision of Kinetic Architecture
<http://www.palgrave-journals.com/jba/journal/v5/n4/full/jba20105a.html>

TED Talk
Doris Kim Sung: Metal that breathes
http://www.ted.com/talks/doris_kim_sung_metal_that_breathes.html