LIVING OBSERVATORY
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-Glorianna Davenport

LIVING OBSERVATORY: HOW CAN ARCHITECTS/URBAN DEVELOPERS USE TECHNOLOGY TO FOSTER THE HUMAN/NATURE CONNECTION AND IMPROVE OUR LIVES?

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Imagine you are at a conference; you have spent the better part of the day sitting in harsh light, concentrating on presentation after presentation. You decide to take a short break, and as you walk down the hall you come upon an egg-like structure. Made up of curved translucent panels, the structure is bathed in the afternoon light of natural wetland; a seat inside invites you to situate yourself in the Tidmarsh Portal. As you relax, you become immersed in a multimodal interaction with a marshland replete with the sound of birds, feel of the wind and the smell of marsh grasses and swamp water. After a few moments, you become aware of a different type of movement: at one corner of the pond, a muskrat swims rapidly past you with a piece of green in its mouth; a few minutes later, an adult mallard waddles up to the edge of the water, her brood of 8 very young ducklings dash past her and hurtle into the water. A prototype for this experience was recently designed, fabricated and is installed at the MIT Media Laboratory. Future research will allow us to better understand the restorative impact of situating such experiences of virtual nature into the built environment.

Placing the Portal in Context: The Challenge of Urbanization

Global urban populations have risen rapidly over the last 100 years and this trend is expected to continue as we move into the 21st century. A driving force behind the migration of people to urban environments is the desire for what we call “kinship,” a feeling of belonging, be it to a job, a neighborhood, or a social group. In his recent book, What Kinship Is—And Is Not, Marshal Sahlin, the Charles F. Grey Distinguished Service Professor Emeritus of Anthropology at University of Chicago, lays out the argument that the experience of “mutuality of being” that we call kinship is a cultural phenomenon, not a biological one. While biology certainly plays a role in the emotional attachment to family, Sahlin’s understanding of kinship as a cultural phenomenon provides a powerful framing for why people choose to migrate to cities to work, study, raise families, and enjoy common activities in close proximity with other humans.

Urbanization clearly presents many benefits to the individual and to society including economic opportunity, community services, and access to education. However, on the negative side, cities tend to be crowded, polluted, dangerous and more stressful than rural settings. An important factor in understanding urban stress is that people in cities tend to spend over 90% of their time indoors. Not surprisingly, this leads to a general decrease in physical activity. Urban conditions have also been shown to foster increased anxiety, obesity, poor mental health and other negative health outcomes. According to the World Health Organization, urbanization is now considered one of the most important health challenges of the 21st century.

Urban environments also cause stress to nature: in building our urban areas, we destroy large swathes of biodiversity both directly and indirectly. Cities also consume large quantities of natural resources that are harvested and consumed in order to deliver goods and services in an appropriate form. The waste from many of these goods and services is enormous, and disposal of this waste causes further pollution challenges. As human beings are crushed together into urban spaces, the life of the natural world is stunted into niches and corners, frequently making these nooks and crannies appear totally unnatural. A tree-lined street provides a very impoverished glimpse of a forest.

Urban planners, architects and designers draw on a panoply of nature-inspired elements for their designs of the built environment, including windows, interior and exterior view-scapes, natural materials such as wood and stone, fabrics and furnishings suggestive of nature, artworks, wiring for lighting and communication, tree-lined streets, landscaping for green parks smaller garden
areas. However, as Emma Wood and her co-authors point out, "not all green space is created equal." Variations in ecological quality (number of species, integrity of ecological processes) may influence how much an encounter with nature, be it through an image or in open air, benefits human health and well-being.

If we revisit the idea of kinship as a cultural phenomenon through the lens of connectedness — connectedness between humans and connectedness between the natural world and humans — there is clearly space for innovation. Why is this important? And how can we make nature more pervasive and more resonant in urban environments of the future?

**Selective Research Focusing on the Importance of a Nature Connection to Humans**

"Nature holds the key to our aesthetic, intellectual, cognitive and even spiritual satisfaction."

—E.O. Wilson, American Biologist and Active Environmentalist

What do I mean by pervasive and resonant? Obviously, we cannot bring the vastness of the Grand Canyon or a wetland marsh into our front yard physically. However, with creative use of modern technologies, we may be able to approximate that vastness using ubiquitous sensing and immersive displays.

E.O. Wilson, an American biologist, and Environmental activist believes that "Biodiversity is our most valuable but least appreciated resource." When we are in nature, we experience wonder for the scale of terrestrial space and beyond; we sense through multiple modalities the natural energy of the sun, wind, and water; and we feel connected to the immense community of living organisms of which we are but one. The experience of connectedness to nature invites us to relax, amble, appreciate complexity, bask with all our senses in the beauty of biodiversity.

Research studies suggest that connectedness to nature may provide an antidote for human stress and anxiety that are so prevalent in urban environments. Connectedness to nature invites empathy with nature that may ultimately contribute to individual and collective actions that promote the health of the planet and beyond. However, transporting ourselves from city to country for a short walk in nature adds further stress to people and to the environment; new
technologies offer alternative ways to invite connected experiences with nature back into our lives.

Studies that relate immersive experiences in/of nature to health and wellness outcomes are wide ranging. A few different imaging techniques have been used to identify the psychological and physiological stimuli that are generated by people immersed in nature. For instance, MRI technology was used to demonstrate the response of humans to different images: when subjects viewed natural scenes, parts of the brain associated with empathy and love lit up, and when they viewed urban scenes, parts of the brain associated with fear and anxiety were activated. In another study, salivary cortisol levels were used to measure how long positive feelings lasted, after they were released during a one-hour session at a natural site.\(^6\)

Other studies have focused on particular groups and situations. For instance, the exposure to natural scenes during painful operations was shown to distract patients from the pain and discomfort that they might otherwise feel. A study investigating the behavior of children with ADHD showed that time spent in nature increased children’s attention span later.\(^5\) Another study explored the impact of trees and green space on residents in public housing in Chicago. This study demonstrated that residents with “green” amenities had stronger feelings of connection and caring for neighbors than tenants who did not live near trees or green space; the presence of natural elements seemed to result in a reduced risk of street crime and of violence and aggression toward domestic partners.\(^7\)

**Mediated Atmospheres and Sensory Networks**

Given the advantages connecting with nature can bring to urban populations, an important challenge for the planner, architect and designer is how to purposefully and artfully situate encounters with nature within the larger urban landscape. Can we use high-resolution documentation of natural places in concert with computer-controlled lighting to shape virtual experiences in urban settings that other health benefits similar to those achieved by taking a 20 minute hike at the mountains, seaside, marshland or rainforest? Some recent research provides clues that may help us achieve this goal.

In her Ph.D. thesis in Media Arts and Sciences at M.I.T., Nan Zhao developed a framework that she calls **Mediated Atmospheres.** Mediated Atmospheres uses the design concept of a “scene” to capture content delivery instructions for multimodal display spaces. The “scene” incorporates both the sensing and display capabilities of a given space, can parse inputs such as camera images and heart rate sensors, and can send instructions to output displays including lights, speakers, visual screens, thermostats, air flow handlers etc. In her thesis, Zhao suggests that “scenes” could be collected, shared, and played, much the way we collect and play music today.

In order to achieve connectedness to nature in a multimodal space, it will be necessary to have content, and intense immersion and high-resolution fidelity across our senses. A “sensory network”\(^8\) developed and deployed by a group of researchers in the M.I.T. Media Laboratory’s Responsive Environments Group provides a prototype for capturing media at remote natural locations. The network has been capturing the changing presence of a marshland at Tidmarsh, twenty-four seven for several years. Located in Plymouth, Massachusetts, this marshland was a former cranberry bog that underwent the largest freshwater land restoration in the state in 2015-2016, and in 2017 became the Mass Audubon Tidmarsh Wildlife Sanctuary. Today, the network continues to stream data from microphones, video cameras and a large number of environmental sensors to servers at M.I.T where the information can be retrieved for real-time or delayed display in a designated installation or appliance. Over the past few years, the M.I.T. researchers have also explored various approaches to experiencing the marsh, including most recently the construction of the Tidmarsh Living Observatory Portal, which I describe in the opening of this paper. If several landscapes were instrumented with sensors, and if each rendering was programed as scenes, Mediated Atmospheres could provide a range of experiences for a portal delivery based on the visitor’s preference, or perhaps, their physiological or psychological state of mind. How differently would a stressed urban dweller respond to a cinematic rendering of the marsh compared to an immersive 3D rendering? These two visual and interactive styles provide very different experiences. The cinematic version immerses the visitor in a “realistic”-looking terrain replete with sounds of birds and insects; jumps in time or place are realized through cinematic edits; and while the movement of a muskrat through the water captures our attention, it is none the less a recognizable species and realistic habitat. In contrast, Doppelmarsh, the name we have given the immersive 3D visualization, situates the visitor in a more science fiction-like terrain on which geo-coded data bubbles appear and transmit local environmental data. Here, familiar sounds of nature are mixed in to a generative music track that is orchestrated by the sensor data and composed on the fly, even as mythical creatures roam the landscape and change appearance based on the real-time weather data. In this environment, the visitor might be given interactive controls to journey through space and time.

As we explore ways to connect people in urban environments with restorative experiences of nature, Mediated Atmospheres could serve as a control framework for a range of multimodal spaces that are optimized for different activities such as meetings, work, learning, or private relaxation such as the egg-like portal we describe in the opening of the paper. The sensory network suggests how different landscapes might be captured twenty-four seven in high fidelity; with this resolution, the scene can provide different levels of interactivity via direct manipulation or sensors worn by the visitor.

As an inviting and enveloping structure for connecting with nature, the Tidmarsh Living Observatory Portal invites us to consider how to situate these multimodal experiences within the city-scape socially, economically and architecturally. Future research will allow us to better understand, how would bringing the rendered experience of nature into our daily lives change our routines and our well-being? How would these encounters generate and advance the cultural sense of kinship that seems central to the integrity of urban space? How can these environments support learning about the natural world?
FOOTNOTES

1. In this paper, multimodal interaction (or multimodal) refers to a form of human-machine interaction using multiple modes of input/output such as gesture (input) combined with lighting or media such as video or audio.


3. According to the UN, 55% of the world’s population lives in urban areas today; this proportion is expected to increase to 68% by 2050.


6. See Wood et al., 2016.

7. See Wilson, 1984.

8. See Thompson et al., 2012.


10. See Rui, 2015.


WORKS CITED

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