

The On-again, Off-again Romance Between Nature and Technology in Healthcare Settings

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Healing architecture has a long and varied history. Every era is associated with sanative space typologies that embody the core values of the culture. The differences between these era-specific environments are multiple, and involve a variety of psychosocial, historical and economic factors. However, a central and persistent construct that distinguishes design eras is their relative emphasis on nature versus technology. The interaction between nature and technology is complicated by the different ways in which they influence and are influenced by culture. Evolving cultural needs impact the drive for technology, and new technology, in turn, changes the culture that introduced it. This complex interaction of nature and technology has resulted in an on-again, off-again romance between these two forces.

The purpose of this paper is to describe the relative influence and dominance of technology and nature in the development of healthcare facilities. Historical events, as milestones of culture, have had a significant impact on this relationship.

Two types of events, in particular, impact health design culture: scientific discoveries, and natural catastrophes. The former serves to inspire us, and the latter reminds us of our subservience to the forces of nature. Attempting to correlate design culture with these historical events is more art than science. Observers would likely find it impossible to predict the incubation period between a historical event and its physical manifestation. One would expect that the lag time would have been quite long at the turn of the 20th century when communication was slow. Now, in the 21st century, information is shared so rapidly that world events are absorbed almost instantaneously.

In order to facilitate an understanding of the history of healthcare design over the last one hundred years, the following discussion has been broken into four eras that are characterized by different attitudes towards technology and nature: the progressive era, the modernist era, the era of scientific humanism, and the era of evidence-based design. Although there are several historical categorizations that could be used, the designation of these eras has been reinforced by other authors.

For example, Verderber and Fine (2000) have identified six waves of healthcare architecture, Ancient, Medieval, Renaissance, Nightingale, Modern Megahospital, and Virtual Healthscape. The latter three intersect with the 100-year history associated with this paper session, and are parallel to the first three eras (progressive, modern and humanist) identified by this author.

The Nightingale era began in the mid-1850s and extended into the mid-20th century (Verderber & Fine, 2000). Among the design objectives of the period were the pervasiveness of natural light and ventilation. In this paper, this period encompasses the Progressive Era.

The Minimalist Megahospital, or healing machine, was often rendered in the International Style, a hallmark of modernism. These hospitals evolved into large, block buildings with minimal daylight in the central areas due to the deep floor plate. In this paper this era is referred to as the Modern era.

According to Verderber and Fine, the Virtual Healthscape wave developed during the 1980s, and was

a reaction to the technological emphasis of the previous epoch. Designers during this period attempted to produce environments that were softer, more residential, and allowed for the reinsertion of functions back into the community (Verderber & Fine, 2000). I have described this, in the context of nature and technology, as the era of Scientific Humanism.

An additional era has been added in this paper, which is the era in which we are currently immersed. Our contemporary hospital epoch, the Evidence-based Design era, uses science to inform the architecture of healing environments and describe the impact of nature.

THE PROGRESSIVE ERA (1890–1929)

Gould (1974) defines the Progressive era as a period of reform that considered technology and education as means of curing society's maladies; this approach suggests great faith in science and experts to execute appropriate change. Environmental determinism was a core component of progressivism (Buenker, Burnham & Crunden, 1977), which fed into the notion that technically developed environments had the ability to address health needs.

Prior to the Progressive era, hospitals were characterized by limited access to nature. These older hospitals were among the earliest of healthcare facilities, and often catered to immense populations. The Hôtel Dieu in Paris was a 5-story structure with 1,400 beds, serving 15,000 per year (McCullough, 2011). Patients were treated in long wards, of 100 beds (McCullough, 2011). Jones notes that some hospitals during this period were merely asylums for the incarceration of people considered to be public health risks (Jones, 1995).

Healthcare facilities in the Progressive era were impacted by the Florence Nightingale model, which both acknowledged the impact of the environment on healing, a Progressive notion, and the role of nature, including the use of natural light and ventilation. Interestingly, the Nightingale pavilion plan, which was developed in response to the miasmic theory of disease, persisted as the primary model even after researchers determined that these environments were not more effective than other designs (Miller & Swensson, 1995).

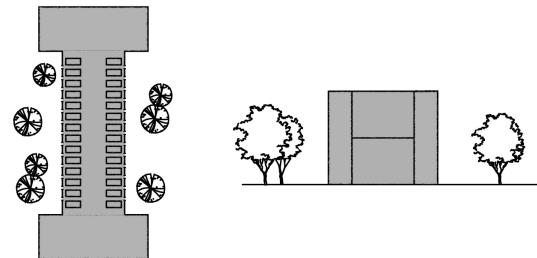


Figure 1. Nightingale era hospital plan and relationship to nature

At the end of the 19th century, engineers challenged architects to create a universal style that represented contemporary design (Farnham, 1998). Many architects looked to technology to help resolve divergent paths, believing that the profession would "regain its relevance" if it could bridge the divide between engineering and architecture (Farnham, 1998). Scientific discoveries, such as antisepsics and anesthesia, extended the power and effectiveness of diagnosis and treatment procedures and provided the fodder for typology coalescence around building design driven by technology (Jones, 1995). Prior to this, the architecture of hospitals was driven by the need to create environments that addressed infectious diseases, birthing, and anesthesia-less surgery (Jones, 1995). The power of these inventions and subsequent developments greatly influenced, and continue to influence the culture of healthcare delivery (Figure 2).

The capacity of the medical establishment to extend their contributions to diagnosis and treatment made hospitals more appealing to the upper class

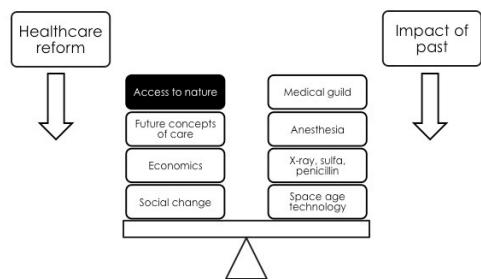


Figure 2. Weight of technology versus change in healthcare (derived from Jones, 1995). Access to nature added by author.

and abetted the transition from public and religious hospitals to profit-based facilities managed by physicians and corporations (Gorman, 2010).

THE MODERNIST ERA (1930-1959)

A cascade of scientific accomplishments accompanied the Modernist era. All of these events contributed to the culture of the supremacy of science and technology. The technology of the space age was adapted into revolutionary medical devices, including CRTs for monitors and imaging equipment (Jones, 1995). Access to nature played a minimal role and the image of the hospital as a monument to state-of-the-art technology dominated new construction.

According to Kellman (1995), modern architecture was intended to represent social progressiveness and quality, an approach adopted by hospital architects of this period. The aesthetics associated with modern architecture are represented in contemporary hospitals via clean and sterile compositions (Kellman, 1995).

The growth of technology and the further development of the germ theory, antisepsis, and heroic surgical procedures coalesced in the the modernist movement in architecture to create, by the early 1950s, sleek structures shorn of ornament and suggesting a hybrid between high-tech functionalism and a style suited to a downtown corporate headquarters (Miller & Swesson, 1995, p. 31).

Golding (1995) notes that many of the enclosed gardens that were previously associated with the Nightingale pavilion hospital fell victim to the efficiency of the high rise and the increase in land values. This phenomenon was demonstrated at the Rigshospital in Copenhagen; where, as a hospital expanded, the process was to complete campus by filling in the interior garden and tearing down the surrounding pavilions (Golding, 1995).

Additionally, advances in building technology enabled people to work 24 hours per day in an artificial environment, in support of centralized departments. Without sufficient consideration, artificial environmental mechanical and electrical systems were also applied to areas used as healing places for patients. Instead of providing the natural sunlight, fresh open air circulation and optimum room temperatures as recommended by Nightingale, artificial illumination, mechanical ventilations, and electrical heating/cooling systems were adopted (Nagasawa, 2000).

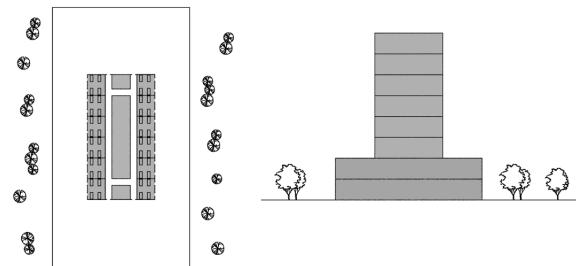


Figure 3. Modernist era hospital plan and relationship to nature

ERA OF SCIENTIFIC HUMANISM (1960-1989)

The 1960s was a decade advocating a return to nature, most clearly celebrated by Ian McHarg's *Design with Nature* (1969). Simultaneously, this decade ushered in the space age with the first human space flight and moonwalk, and first heart transplant. Perhaps the most significant expression of divine technology was the birth of the first test tube baby in 1978. On the other hand, the dangers of manipulating the environment were demonstrated by catastrophic events such as Chernobyl and the Exxon Valdez oil spill in the late 1980s. One of the ways designers and design researchers responded to these events was a more heartfelt consideration of solar design and alternative energy sources. Officially defined by the Brundtland Commission Report of 1987 (Kates, Parris, & Leiserowitz, 2005), sustainable development became part of the architectural lexicon, although it was a while before eco-effective design was incorporated in healthcare facilities.

In the 1970s, people began tiring of harsh medical environments and there was a desire for new universal values that support healing (Kellman, 1995).

On a certain level, our technology-laden culture has been striving to escape many inevitable things about human existence, and eventually the contradiction grew too strong. Unconsciously people began to real-

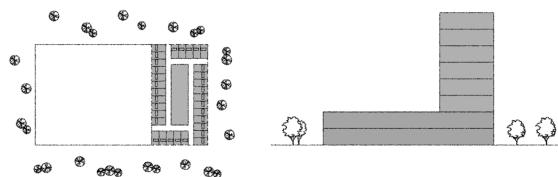


Figure 4. Scientific humanism era hospital plan and relationship to nature

ize that the places they were going for their health-care were not meeting a host of needs beyond the actual procedures rendered (Kellman, 1995, p. 38).

The notion of scientific humanism gained traction during this period. Wilson describes this era as an evolutionary version of a materialistic doctrine (Wilson, 1991), which is critical to the concept that the physical environment can impact the user in such a way as to positively address their innate needs. There are several theories that originated during the 1960s and 1970s, and were more formally articulated in the 1980s that attempt to explain our specific affiliation with nature. These theories, which significantly impacted attitudes toward design, include the Biophilia Hypothesis, Attention Restoration Theory, and Prospect and Refuge Theory.

Biophilia is “the innately emotional affiliation of human beings to other living organisms” (Wilson, 1993, p. 31). E.O. Wilson published the first book on this topic, *Biophilia* in 1984. At the core of the theory is the assertion that “much of the human search for a coherent and fulfilling existence is intimately dependent upon our relationship to nature” (Kellert, 1984, p. 43). According to the Biophilia Hypothesis our dependency on nature is built around nine factors: utilitarian, naturalistic, ecologic, aesthetic, symbolic, humanistic, moralistic, dominionistic, and negativistic. These factors can be interpreted as supporting the use of nature as a healing environment.

The Kaplan’s Attention Restoration Theory (ART) (Kaplan & Kaplan, 1989), suggests that people can focus better after pleasant interactions with nature. Based on the theory of William James, ART is founded on the notion that prolonged effort on a task results in attention fatigue (Kaplan, 1995). Kaplan and Kaplan suggest that elements of the environment that favor further exploration are those that are most valued and attended to (Kaplan, 1978). Kaplan and Kaplan (1989) identify four factors that must be incorporated in scenes (either those immediately understood or inferred) in order to be preferred: coherence, complexity, legibility and mystery.

Prospect and Refuge theory (Appleton, 1975) suggests that preferences in natural environments are established through a balance between an environment that provides the potential for learning and an environment that allows for safety. The origins

of this preference are both hereditary and cultural. “Taste is an acquired preference for particular methods of satisfying inborn desires” (Appleton, 1975, p. 210). The predominant perspective in the 1970s, to which Appleton reacted, was that preference was driven by culture and that innate need was not relevant (Appleton, 1996). Appleton hypothesized that preference is a result of appropriate prospect and vantage points and minimal number of hazards.

These three theories are representative of the objectives of scientific humanism and inspired by core values that were adopted in the period described by Verderber and Fine as the wave of the Virtual Healthscape.

ERA OF EVIDENCE-BASED DESIGN: (1990-PRESENT)

In the middle of the 1980s, due to a faltering economy and rising costs, the paradigm in which the provider was the primary focus shifted to a paradigm where the payer was the focus (Miller & Swensson, 1995). A transition was made from mitigating illness to health, from healing to well-being, and from institutional to non-institutional settings (Miller & Swenssen, 1995). A clear component of such shifts is higher priority given to access to nature.

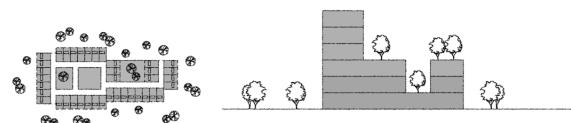


Figure 5. Evidence-based design hospital plan and relationship to nature

Although many hospitals in the United States still reflect the modernist vernacular of deep floor plates and long, double-loaded corridors, most new hospitals have been significantly influenced by Evidence-based Design (EBD). The intention of evidence-based design is “to make use of data from multiple credible sources to guide design-related decisions with the ultimate goal of improving the patient care experience, the staff work environment, and organizational performance” (Stichler & Hamilton, 2008, p. 3). The predominant typology in which evidence-based design has taken root is healthcare.

In addition to hospitals, two common venues for integrating nature into healthcare are assisted living, and hospice facilities (Figures 6, 7, and 8).



Figure 6: Gardens in senior facilities (photos courtesy of Susan Rodiek)

Several recent mega-analyses of the literature demonstrate an increase in the number of rigorous studies done in support of healthcare design, a preponderance of which address nature and access to natural light. A literature review on the relationship between nature and health (Health Council of the Netherlands, 2004) concludes the following:

- nature has a positive impact on health,
- nature helps recovery from stress and attention fatigue,
- exercise supports health, but it is unclear whether green, outdoor environments have a positive impact on exercise,

- nature may facilitate social contact, and
- nature can contribute to a sense of purpose.



Figure 7: Gardens in hospices (photos courtesy of Susanne Siepl-Coates)

One of the tenets of evidence-based design is awareness of the need for access to nature by patients. Virtually every new hospital has a healing garden of one kind or another, some of which provide the combined amenity of green roof and restorative garden.

The impact of positive distraction is one of the theories linking the science of evidence-based design to the incorporation of nature. Positive distraction is a hybrid of the previously described theories, applied primarily to health care settings, the purpose of which is "to allow the individual to shift focus from negative foci within the... environment to the more restorative aspects

of the world" (Shepley, 2006). The Theory of Supportive Design, Ulrich (1991) lists three factors that contribute to improved outcomes: increased control and opportunity for privacy, social support and positive distraction. Nature is a significant source of distraction (Figure 9).

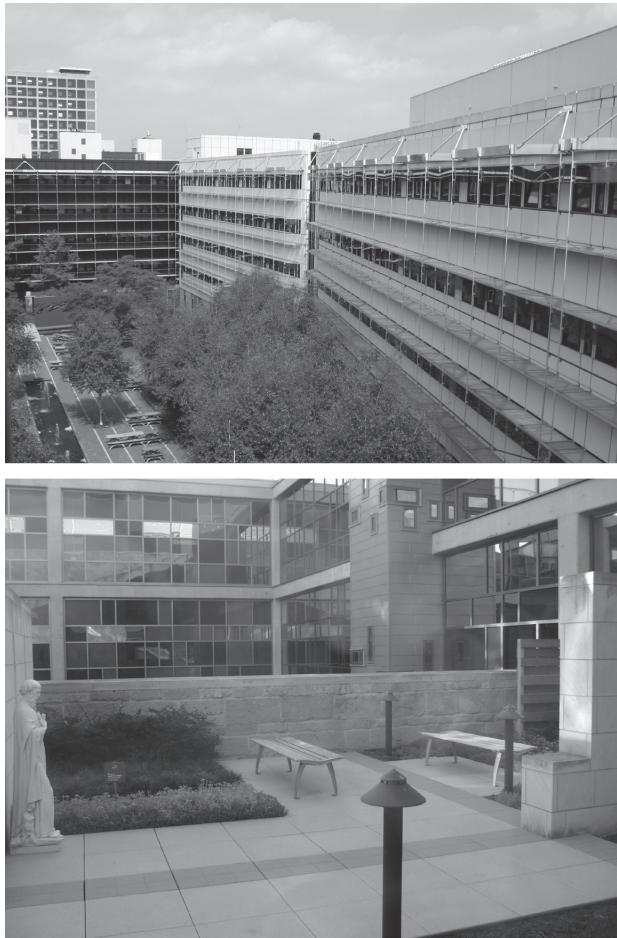


Figure 8: Gardens in hospitals (photo above courtesy of Alejandro Iriarte; photo below by author)

CONCLUSION

The debate on the relative role of nature and technology has engaged health facility designers over the last century. Is the primary purpose of healthcare buildings to reassure patients with state-of-the-art technology, or calm them with nature-imbued healing environments?

In the current decade, the role of nature drives a large body of research in evidence-based design

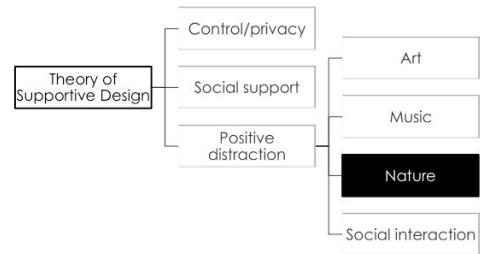


Figure 9: Ulrich's Theory of Supportive Design

that, due to its cultural attributes, has an impact on the external expression of technology in healthcare facilities. If nature and technology are the primary predictors of the future of health care design, their on-again, off-again in healthcare settings may be self-resolving. Our simultaneous desire for the most advanced technology and the most untainted nature are intensifying. This cozy coupling, which is currently articulately represented in the form of technological sustainability and biophilic healing, will likely be the hallmark of healthcare design in developed countries for the next half century, until at some point the two ambitions will find themselves fully melded.

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