

Architecture as Environmental Medicine

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INTRODUCTION

What is the practice of architecture? How does the public perceive what we do and how does that differ from the way we view ourselves? Are we artists whose ultimate goal is to express the "spirit of the age" or are we plan coordinators who add a touch of zeitgeist here and there for effect. As creators concerned with the influence buildings and landscapes have on the public's well being and as licensed professionals sworn to secure the health, safety and welfare of the public, it's time to acknowledge a part of us that we have failed to recognize or promote, that of "environmental physicians." Our history is rich with medical associations. The first recorded architect, Imhotep (designer of King Zoser's pyramid) was also a physician who after his death became the god of healing. Some of our most revered works: The Lovell Houses, Richards Medical Laboratories, The Salk Institute and the recently completed Neuroscience Institute in La Jolla, were designed in collaboration with the medical community. If we recognize the church as a spiritual as well as physical healer (most hospitals before the 20th century were run by churches) then our collaboration as builders of the houses of healing is extensive.

Throughout history, architects have examined and employed: 1. the properties of site, 2. the art of placement, and 3. the qualities of light and air to improve our health and quality of life. This re-examination of the historical writings and projects that have embraced environmental health issues (physically, psychologically and spiritually) from Marcus Vitruvius to Richard Neutra, and from Christopher Alexander to the Building Codes, indicates that we have contemplated health-conscious design for thousands of years. Understanding this history can help students develop responsible design convictions and furthermore act as a springboard for research and design methodology.

SITE, PLACEMENT, LIGHT AND AIR Protective and Sustainable Thinking

The first theorist to address environmental health issues was Marcus Vitruvius Pollio. Although little is known of Vitruvius, it is speculated that he was a high ranking military engineer

under Caesar Augustus, because a portion of his book *The Ten Books on Architecture* is devoted in depth to military breaching machines and fortification design.

Vitruvius, as a military engineer, was essentially a castle maker; thus his thinking was protective in nature. Architects are, in a way, castle makers who provide protection from the elements, casualties, and criminal activities. Shelter, our primary form of protection, is a form of preventative medicine. Likewise our skin protects our bodies from countless numbers of parasitic viruses and germs. But Vitruvius' thinking wasn't limited to protection alone; it also included ideas of sustainability (not the kind of sustainability that focuses on responsible ecological energy production and consumption, but sustainability as biological nourishment). His secondary duties as a military engineer consisted of finding healthy sites with clean water, air and vegetation for the set-up of military camps. For the remainder of this paper, this idea of sustainability and protection will include the physical as well as psychological and spiritual qualities in design.

Site

Both protective and sustainable thinking are inherent with Vitruvius' declaration in the *Ten Books on Architecture* that the first priority of site design is health.¹ He recommends not building structures or cities on a valley floor or near marshes because bad air and swamp creatures dwell there. (The ancient Asian art of placement, Feng Shui, makes a similar recommendation in not only avoiding the hill bottom but also the top to avoid harsh winds. Vitruvius advises that once a site is chosen, cattle should graze the area for a "sufficient time" after which a few should be slain to see if their livers have an unhealthy discoloration. If so, then like a good scientist, the architect should examine other cattle to determine whether the site is unhealthy.² (Can soils tests today claim to do the same)?)

Vitruvius also advises how to find and classify sites with health-restoring springs, declaring that sulfur springs cure pains in sinews and aluminous springs aid in the treatment of paralysis.¹ Today we still recognize the medicinal benefits of

hot springs. Cracks and fissures in the earth, where gases and springs emerge, are places where religious healings also tend to occur which explains the presence of temples in these areas. Throughout the centuries one religious temple has been replaced by another, according to the dominating religion of the time, on these same sacred grounds.⁴

Even in America, Christian buildings now have replaced Native American healingsites. An example of this can be found near San Bernardino at Arrowhead Springs located a few hundred yards from the San Andreas Fault. It was first used by Native Americans as a place of healing, but, after the Anglo-Americans took over the region, a bath house was erected which claimed to cure many ailments. Through mismanagement the business died, but today a religious retreat center called Campus Crusade for Christ occupies the site.

Placement

The correct placement of paths and buildings with the appropriate arrangement of their parts has been a strong concern in the history of environmental medicine. In ancient America and Europe, environmental shamans placed plazas, avenues and buildings in relation to sacred geographical and celestial features to help nature regenerate and heal itself so that, in the end, civilizations would not go hungry.⁵ In Asia the ancient art of placement, Feng Shui, prescribes sustainable and protective advice for the correct placement of buildings and components relative to each other and to the natural environment.

The *Ten Books on Architecture* also recommends the correct placement of temples. The Temple of Mars, Vitruvius advises, should be placed outside the walls of the city so that Mars can act as an advanced guard to protect the town from enemy attack. His advice on the placement of Vulcan's temple outside the city walls, foreshadows today's fire codes.⁶ Apparently Vulcan's ceremonial fues occasionally got out of control and spread to surrounding buildings. One could say that Vitruvius' concern with fire containment, through correct placement, has evolved into the complexity of today's building and fire codes. Since fire is the number one catastrophe that plagues our buildings and since fires are known to kill and maim thousands of people each year, it is imperative that students develop a respect for the codes instead of regarding them as a shackle to artistic creativity. Like the building codes, our own body's genetic code is full of contingency plans for the prevention and containment of disease. Despite the complexity of instructions in our genetic code, it does not appear to have compromised the richness and beauty of our species. Just as our own genetic code has evolved into a highly complex and redundant information system, we can only expect the building codes to do the same.

Basing the design of our environment, however, solely on the prevention of fues or accidents that may or may not happen a few times in a lifetime precludes the day to day, minute to minute sustainable, or nourishing, aspects that correct placement can provide. One book that counterbalances the protective attitude of the codes is Chnstopher Alexander's *A Pattern*

Language, which is an orderly listing of sustainable arrangements or "patterns." Although many consider *A Pattern Language* an insult to artistic expression, its prescriptions are generally backed up with scientific data or first hand observation, and its "patterns" (minus its construction details) are flexible enough to accommodate a variety of expressions. As most of us know, and as Alexander will admit, *A Pattern Language* is not the last word on healthy design; but it is not a bad start.

Light

The use of light as a regenerative and purifying agent has long been recognized in health conscious design, particularly in the design of temples, houses and hospitals. In the placement of temples, Vitruvius suggests that they face the west so that the worshipper can behold the morning sun when viewing the temple and its priest.' This theatrical maneuver is a reminder of the regenerative role of the sun with its life-giving light. A western orientation is archetypical, for it occurs not only in Roman temples but also in Ancient American temples and Early Christian to Gothic cathedral design. Greek mythology reinforces the perception of light as a healer by worshipping Apollo and his son Aesculapius as healers. Christianity sees Jesus as the "light of the world."

Abbot Sugier, the father of Gothic church design, took the regenerative role of light one step further with his design of St. Denis outside Paris. In the 1100's, St. Denis was the first cathedral to extensively use stained glass. Abbot Sugier's writings show that the immaterial can be reached by way of the material in the contemplation of certain pieces of art; mainly art using reflective gems. These "small lamps," as he writes, can help the individual towards redemption and thus spiritual healing.⁸ His fondness for reflective gems in the decoration of his art then carried over into his idea of installing large stained glass windows in St. Denis.

Eight hundred years later, Christian Shakers in America also looked to light as an aid to redemption. Shaker Eldress Arelia Mace wrote, "Good and evil are typified by light and darkness. Therefore we bring light into a dark room, the darkness disappears, and insomuch as the soul is filled with good,evil will disappear." Shaker communal houses, even barns and chicken coops are well lit with many large windows and sophisticated skylights. Interiors are painted white and trimmed with dark blue. Even interior hallways and closets borrow light from adjacent rooms by inside windows.⁹

The purifying effect of light was also recognized by the medical community around the turn of this century at the discovery that sunlight could kill bacteria. According to Brown University doctoral candidate James Ross, this discovery prompted sanitariums to orient windows to the south so harmful microbes could be killed by the sun.¹⁰ This in turn affected some of Frank Lloyd Wright's designs (further elaboration will be given in the section on air quality).

The regenerative qualities of a sunrise can not only rejuvenate the spirit but the body as well. Vitruvius advises

that bedrooms should face east presumably to help awaken inhabitants." Christopher Alexander gives similar advice, citing studies by Dr. London of the San Francisco Medical School on the effectiveness of our daily activities and its relation to how we are awakened in the morning. Alexander concludes from Dr. London's studies that if we are gradually awakened by the increasing light of the rising sun, we wake up in a refreshed condition which promotes a more productive day. In contrast, if we are jarred awake by an alarm clock, perhaps from a deep sleep, then we will wake up groggy and find it difficult to function normally during the day.¹² Vitruvius' and Alexander's advice is further buttressed by psychiatrist Daniel Kripke of the University of California San Diego, who claims that: people that sleep in bedrooms facing east are likely to get up earlier and sleep less than those who sleep to the west."

The regenerative benefits of light can also be found in Richard Neutra's book *Survival Through Design*. Here he cites an inter-professional study consisting of physicians, educators and illumination engineers that analyzed the light distribution in elementary classrooms. The investigators arrived at an optimum brightness ratio from 1 to 5 everywhere. The impact on the students was impressive. Sixty five percent of the children who suffered from refractive eye problems were liberated from their glasses after six months. Additionally, malnutrition symptoms dwindled, according to Neutra, "because energies were preserved by eliminating muscular strain caused by malposture and growth difficulties due to visual trouble." These results prompted further studies which found that "50 percent of dental trouble due to faulty jaw positioning may have been due to forced general posturing caused by poor light."¹⁴

Doctors today also use light to treat an illness known as seasonal depression. Because the lack of winter sunlight can cause severe depression in people who live above the 48th parallel, a bank of full spectrum fluorescent lights is prescribed to restore the body's normal balance of a neurotransmitter known as melatonin.¹⁵

Air

The quality of air that we breathe has long been of concern to architects. Once again it is Vitruvius who first discusses air quality and health. As mentioned earlier, Vitruvius recommended not to build on valley floors or near swamps because of the "bad air." Today we know that valley floors are places with the highest concentrations of air pollution. Vitruvius even distrusted the air quality of some winds because he noticed that certain winds bring a corresponding rise in sickness.¹⁶ Four hundred years earlier, Hippocrates, the father of rational medicine, noticed that some winds induce "dullness of hearing, dimness of vision, heaviness of head and languor."¹⁷ We know these to be fairly accurate observations for certain winds around the world such as the Santa Anas in Southern California, the Sharav in Israel and the Chinooks of the Pacific Northwest are known to have

major physiological and psychological impact. When these so called "witches winds" blow, there is a corresponding increase in colds, headaches, lethargy and emotional outbursts. Crime and suicides are known to increase sharply, causing some judges in Israel to give lenient sentences when the crime is committed during the Sharav wind.¹⁸ Although not without scientific controversy, some studies contend that these winds give the air a positive electrical charge, which causes an unmanageable increase in the flow of one of our body's neurotransmitters called "serotonin." Serotonin is a stimulant which, if left "on" for longer than normal, can cause a person to "burn out" and become irritable.¹⁹ Vitruvius' countermeasure to these winds is to orient the city streets at an oblique angle to break them up. Vitruvius also advises not to place alleyways parallel to the winds, which can rapidly spread noxious odors and disease through the town.²⁰

The effect of moisture on air quality has also been a concern from ancient history until today. Moisture from leaky roofs, walls and improperly drained soil that can filter into basements and crawl spaces, can be breeding grounds for mold. This mold then produces spores which circulate into the air and play havoc with some people's immune systems. These people can be sick for years without knowing the cause of their illness.

Vitruvius' advice for this malady was simple: stay away from swamps. Frank Lloyd Wright's was also simple: do away with damp basements and crawl spaces and build right on the ground.²¹ Palladio's advice was more detailed and practical. In the *Four Books on Architecture* Palladio advised that roof configuration was the key to keeping out water. He paraphrased Vitruvius' advice against flat roofs by pointing out that they are prime candidates for water leakage. A sloping roof with a 3:12 pitch is sufficient for water drainage...less pitch the more likely the roof will leak; more pitch will require unnecessary construction labor. (Note: the majority of Palladio's roof pitches are 5:12 which means that either he did not follow his own advice or the "3:12" is a misprint). To keep water away from the walls and foundations Palladio advised a 1½ foot roof overhang with gutter and a downspout that drained water well away from the foundation.²²

Before the Mid 1800's, "bad air" was seen to be the source of disease. The malady known as malaria simply means "bad air." The "bad air" or "miasma" theory of disease began to change around the middle of the nineteenth century. Scientists found that it wasn't so much the noxious gases from the earth which caused disease, but things carried in the air that was harmful. The "bad air" near swamps mentioned by Vitruvius is not detrimental itself, but the mosquitoes that breed in swamps can carry malaria. Harmful bacteria and viruses are also carried in the air. This was a fundamental discovery in the mid 1800's.

At the time, John Ruskin criticized the immoral effects of the industrial revolution and looked back in time for a more healthy version of artistic expression, the world of medicine

radically jumped forward. Two scientists: a Frenchman named Louis Pasteur and a Scot named Joseph Lister, revolutionized the medical community and in the end, significantly extended the length of our lives. Pasteur's work on bacteria, immunization and milk pasteurization effectively increased the medical profession's ability to prevent and combat life threatening diseases. Joseph Lister built on Pasteur's findings and promoted the practice of surgeons washing their hands and sterilizing instruments before surgery to prevent infection and transfer of disease. The findings of Pasteur became known as "germ theory" which effectively replaced "miasma theory." After the ideas of Pasteur and Lister were implemented and expanded upon by other scientists, life expectancy nearly doubled. They gave us a second lifetime.

These findings made a significant impact on building design at the turn of the century. Ways of eliminating germ build-up in buildings became a prime concern. According to Brown University doctoral candidate James Ross, who is working on a dissertation entitled "The Impact of the Nineteenth-Century Public Health Movement upon American Architecture," the health and safety of public buildings changed drastically.

In reaction to the nineteenth-century public health movement, design elements began to change. More glass began to appear in designs because it was discovered that sunlight killed tuberculosis and microbes. Since ornament collects dust and germs, stylistic attitudes began to change towards cleaner lines and flat surfaces. Good ventilation became a prime consideration in eliminating germs.²³

One of the building types most affected by these discoveries was the school building. Schools were, and still are, considered centers of disease transfer; therefore special consideration was given to their design. These schools implemented courtyard plans, high ceilings, large windows and raised first floors which encouraged the movement of fresh air to exhaust airborne bacteria. Additionally, large windows allowed in more sunlight to kill germs.²⁴

Frank Lloyd Wright and Irving Gill are two turn-of-the-century architects who utilized some of these principles. Gill wrote and spoke about the sanitizing qualities of his designs and implemented several innovative details in his house that simplified cleaning and minimized germ build-up. These details include, but are not limited to, rounded corners between floor and wall, flush trim and raised bathroom and closet floors. Some of his details are still found in hospital design today.

Wright's 1908 Robie House incorporated several germ-eliminating strategies. Doctoral candidate James Ross claims that the Robie House is similar to a sanitarium. As is typical with Wright's Prairie Style homes, the Robie House's main living areas is placed on the second floor because the space next to the ground was seen to harbor "bad air" and therefore more germs -- a leftover idea from "miasma theory." On the entire south side of the second floor are placed a bank of operable glass doors which allows plenty of sun and breeze

that minimize bacteria.

The recent concern for "bad air" takes the form of "indoor air pollution." Radon gas from radioactive soil **leaking up** into basements causes lung cancer. Inexpensive formaldehyde-based glues in plywood or particle board and gas leaks from stoves and furnaces are all released into the indoors. All of this can weaken our immune systems. Before the 1970s energy crisis, gases could escape easily through gaps in construction, but, since the energy crisis's mandate of airtight construction, they are contained and re-circulated in our buildings, causing higher rates of sickness. More ventilating and building with non-toxic materials, better HVAC systems and rigorous maintenance help relieve the toxicity of interior air.

VISUAL SUBJECT MATTER

So far, we have discussed the protective and sustainable qualities of site, placement, light and air. Additionally, what we see can affect our health. Historically, a great deal has been written on the aesthetics of what we see, but the medicinal consequences have not been discussed with any scientific validity. Can we say with certainty that it is healthier to look at an Arts and Crafts creation than a Deconstructivist piece? These movements may express a healthy social value, higher truth or zeitgeist, but how can we measure their biological or psychological medicinal value? Nevertheless, recent evidence is revealing that what we see could be of medicinal value. Color studies indicate that red increases our blood pressure while blue lowers it.²⁵ An investigation by Geographer Roger Ulrich in the seventies shows that the right kind of window view can aid the healing process. His study verifies that postoperative patients who were given a view of a tree recovered faster with lower doses of pain killers than patients with the same operations who viewed a brick wall.²⁶ These kinds of studies can open up a whole series of questions and avenues of research on the sustainable qualities of visual ambiance. What kinds of physiological reactions do we get from a horizontally, vertically or diagonally composed elevation? What effect does a floor plan, elevation, or space without a sense of repose have on us? Further research could help us find these answers.

CONCLUSION

Today, even though we have a multitude of health-conscious design information, it is underutilized in the studio environment. Part of the reason could be that the information is unorganized. Other than the Building Codes or Alexander's *A Pattern Language* there is scarcely a book that is similar to a medical reference book. The other problem is with the perception of these two books: they seem dogmatic and contrary to free artistic expression. Another problem is the perception that the environment's effect on our health is negligible. Evidence suggests otherwise. We seem to be at the same nebulous place the

medical community was 130 years ago before Pasteur's revolutionary discovery of bacteria's ill effect on health. With a focus on environmental health by: 1. integrating health subjects in architectural history and studio courses, 2. encouraging students to take courses in biology and medicine, and 3. by collaborating with the medical community in research, architecture could build on medical knowledge gained from traditional theory to become an effective form of medicine.

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