Seeing, Thinking, Doing: The Technology of Environmental Design

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ABSTRACT
Technology driven design innovation is a timely issue in any age, but the concept is not new. In fact, the past tells us how to move forward well if we are also able to draw insights from our present circumstance. The case will be made that architectural design is rooted in technology but not the stuff of technology (the things), but rather the process of innovation that reveals insights, finds new applications, and perhaps most importantly, adapts existing strategies to situations in innovative ways. This paper outlines historic precedent, proposes a theoretical framework, and presents a case study proposal that draws on historic and emergent strategies and through synthetic modes of seeing, thinking, and doing, weaves technical, ecological, and social aspects as an essence of technology that is "by no means technological".

Keywords: Ecology, Design, Technology, Planning, Architecture

INTRODUCTION
We shape our buildings; thereafter they shape us.
-Winston Churchill

Churchill's quote was directed at the shape of the British Commons Chamber after being destroyed by Nazi bombing during World War II. Churchill argued that the historic rectangular form – rather than the proposed new semi-circular form adopted by the US and others – was fundamental to the adversarial two-party system of a successful parliamentary democracy. His expression has often been extended to more broadly highlight the critical impact of our built environments on individuals, societies, and our futures.

Gaston Bachelard, in *The Poetics of Space,* introduces fundamental relationships between our childhood homes and those experiences of: the cold, dark, and damp basement; the creaky and breezy attic; the amber warmth and crackle radiating from the hearth; and the smells that percolate through the air as food is cooking in the kitchen (Bachelard 1992).

Our individuality, and our poetic framing of the world around us and our joy are constructs of the accumulation of life experiences. Renowned Finish architect Alvar Aalto, suggested, during a 1957 lecture, that architects "wish to build a paradise on earth for people" (Vitruvius, 1960 translation). As such, it must be rooted in our experiences.

In the 21st Century, the role of the architect is accompanied by a host of specialized consultants more commonly being grouped as Architecture, Engineering, and Construction (AEC) that include consultants in lighting, acoustic, façade, color, indoor air quality, heating, cooling, structures, materials, circulation systems, life safety, and value engineering (Callough, 2023). Each consultant endeavors to optimize their project domain (and rightly so). Architects must direct these varied priorities to optimize the design toward a holistic result. Almost all projects are unique and 'optimal' design requires appropriate subordination of competing independent optimizations. No single aspect of a complex project will likely be optimized. Complimentary elements will be well-considered synthetically in a successful project. Architecture resolves hundreds to thousands of contradictory forces that must be brought into harmony. 'This harmony cannot be achieved by any other means than those of art' (Aalto, 1972).

Image 1 Hyvän Paimenen kirkko, Helsinki, Juha Leiviska.

The altar becomes a choreography of light, sound, and temporal change, protecting from the harsh Nordic winter while embracing the light of the sky and the verticality of the adjacent birch forest.

Environment and Technology

Considering the boundaries of environmental technology we might include *the interface among the dynamic natural environment, variable human sensation, and the variability of the psychology of perception*. Environmental Technology then, might be the range of techniques people have developed to control their environments and to make their dwellings and places more inspiring, useful, and comfortable.

Martin Heidegger offers an etymology of **'technology'** as being comprised

of legin (-logy), to speak of, and apophainesthia (techne), to bring forward into appearance – technology as a process of revealing or discovery (rather than invented). Revealing is not in itself a technological process, but rather a creative process. Heidegger argues that the essence of technology is largely ambiguous and a paradox in that 'exact science' could 'enframe' us preventing the process of revealing (creativity). Only through modes of art and poetry can this paradox be resolved (Heidegger, 1954).

The essence of technology is by no means technological
-Martin Heidegger

When we speak of the environment, we consider the totality of that which surrounds us (viron) French – circle, to turn, or around. Jose Ortega y Gasset describes the natural environment as "…an intricate net woven of both facilities and difficulties". In the case of the natural environment, we are considering the world that has not been altered by human civilization, the world of the out-of-doors (y Gasset, 1939). The world humanity first encountered inspired ingenuity and creativity as technology – "technology is man's reaction upon nature or circumstance. It leads to the construction of a new nature, a super nature, interposed between man and original nature".

Image 2 Garden at the Calligraphy Museum, Xi'an China.

Gardens have inspire many architects, including Frank Lloyd Wright, who celebrate the connection between architecture (“super nature”) and the natural environment.

Technology as Environmental Interface

Human beings continue to develop sophisticated social and cultural sets of activities and expectations – dwelling, industrial production, office production, worship, theater, cinema, education, laboratory, studio, hospital, warehouse, retail commerce, dining, and others. Program activities have specific environmental requirements typically narrow in the range of expected use or comfort.

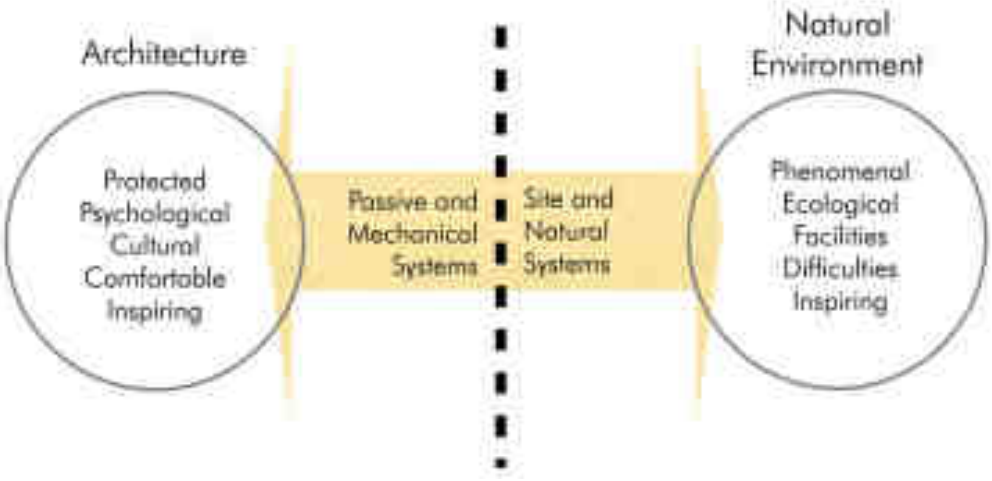

Image 3 Technology as the Interface between Architecture and The Natural Environment.

The interface between the natural and built environments requires strategies drawn from the facilities of the natural environment while reducing the difficulties toward dwelling that is inspiring, comfortable, and useful. In this framing of ‘technology’, people are connected to the phenomenal character of their layered environments while being supported and protected both physically and psychologically.

Objective and Subjective Measurement

Technology, is driven by aesthetic desire rather than need. Gaston Bachelard writes that objective reality is inherently scientific – ‘what it is as measured’ – and subjective reality is inherently human, asking ‘what it means’ to people (Bachelard, 1992). ***Environmental technology, then, as a fundamental element of architecture, must reconcile these seemingly divergent measures of reality as a fundamental aspect of the architectural design process.***

METHODOLOGY

Seaglass, an innovative community design proposal, explores emergent forms of ecologically sensitive development drawing from resources available on the barrier island Sanibel, Florida. This resource responsible community of dwellings gathers around an ecologically rich commons promoting sustainable and socially connected living.

Ecological sensitivity has been a Sanibel tradition dating back to the 1890's. Pulitzer Prize-winning political cartoonist J.N. "Ding" Darling established a national wildlife refuge preserving 6,300 acres of ecologically sensitive land in 1945. Ian McHarg, founder of the Landscape Architecture program at the University of Pennsylvania and author of *Design With Nature* (McHarg, 1971) drafted an ecological master plan for Sanibel adopted in 1976. The plan was credited by The American Institute of Certified Planners (AICP) 30-year test of time award in 2007.

Seaglass seeks to carry McHarg's strategies forward as an emergent sustainable development of twelve homes organized around shared commons. Design principles strive to spatialize normally hidden technologies toward a high-quality sustainable lifestyle deeply connected to place.

Rainwater harvesting; community gardening as social event; solar harvesting as shade and electricity; natural wetland gardens and ground surfaces as water stewardship and habitat diversity; and traditional vernacular strategies responsive to climate and place are the 'technologies' employed as strategies.

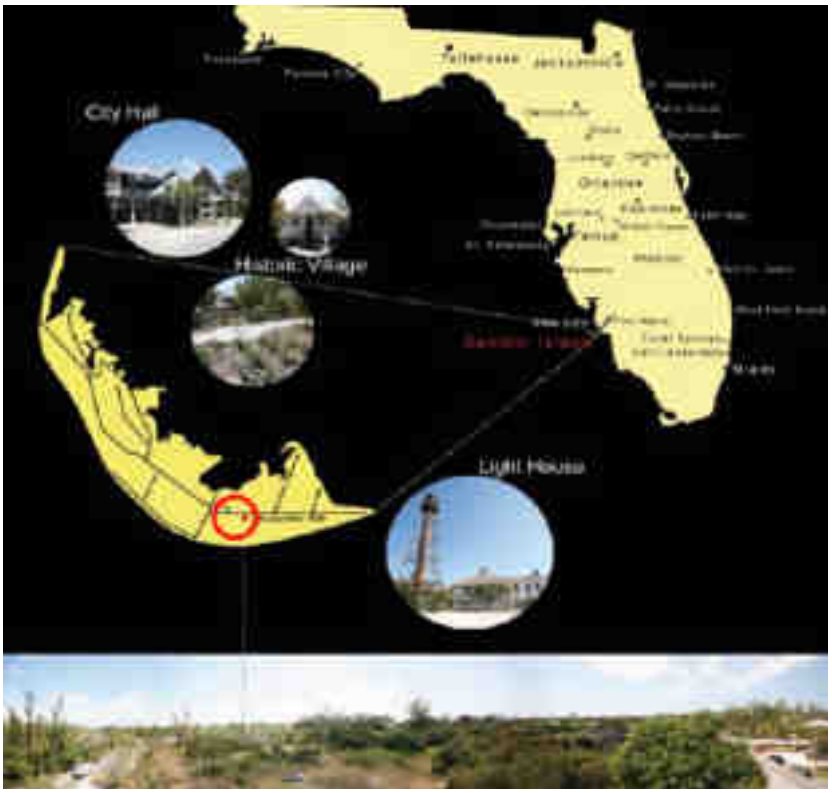

Image 4 Seaglass Project Location and Context.

Arial panorama shows natural vegetative landscape – a former plant nursery.

Automobiles, cyclists and pedestrians are gathered into an integrated civic street form — referred to as a Woonerf (Ben-Joseph, 1995) that enhances the civic, cultural and utilitarian aspects of the 'street'.

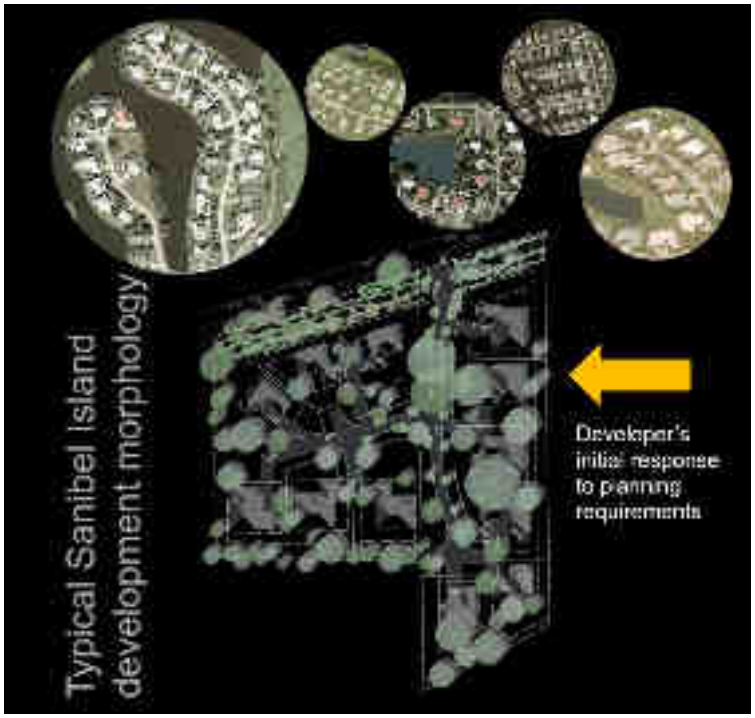

Image 5 Initial Response from Local Civil Engineers to Request for Development Plan for Seaglass Project.

The suburban morphologies shown in Image 5 adhere to McHarg's masterplan yet they fall short of fulfilling the 'design with nature' philosophy. Housing spreads over large distances requiring extensive road paving for automobile connectivity. Natural habitat is fractured and parceled into separated manicured lawns – often with fences.

Image 6 Four Ecological Design Strategies Revealing Organizational Morphology Reducing Built Area while Promoting Social Interaction.

Schemes

1. **Auto Court** traditional suburban cul-de-sac form adapted as 'auto-courts' that mix parking with natural vegetation – 'street' as a civic place.
2. **Butterfly Meadow** is a diverse grassy meadow as an insect (butterfly) and bird ecology drawing from the more formal renaissance ordered gardens.
3. **Civic Green Promenade** is a central green-space with civic promenade and natural walking paths.
4. **Eco Villa** is optimized by linking vegetable gardening, citrus groves, tennis and swimming (off-site) with walking paths and ecology niches forming the civic realm.

Design, as technology, reveals organizational morphologies that reduce built area while promoting social interaction. The 'woonerf' concept offers 'shared' social space as pedestrian, garden, meadow, and automobile circulation. Four conceptual organizations (Image 6) were presented to groups including potential buyers, municipal staff, and the developer in a workshop. Groups were asked to: 1) select 1 scheme of the 4 the team feels is the most viable; and 2) make recommendations for any improvements. Each of the independent groups selected the same Butterfly Meadow scheme – consensus as subjective measurement.

Image 7 Early Concept Rendering Integrating the Butterfly Meadow Scheme with a Woonerf Street.

Image 8 Butterfly Meadow Schematic Master Plan as Technology-Based Design That Unifies Multiple Potentially Un-Optimized but Necessary Ecological Elements.

The Butterfly Meadow master plan synthesizes 'technologies' or strategies for ecological living as a complex of natural and constructed ecologies. The primary social spaces are the Butterfly Meadow (Image 8: item 15) and Community Center (Image 8: item 9) which have connectivity to the Woonerf street – a combination of asphalt, pavers, and permeable concrete (Image 8: items 1, 2, 3) to operate as a series of pedestrian scaled foyers conducive to pedestrians, rather than as a suburban street. An organic community garden (Image 8: item 10) with associated citrus groves (Image 8: items 12, 13, and 14) provides an import communal space. Wet/dry and wet retention areas (Figure 8: items 7 and 8) capture and retain storm water surges while the wet retention provides natural habitat.

Design Technologies

Underpinning these master plan strategies are systems that gather, utilize, and recycle natural resources including breezes, skylight, sunlight, rain, vegetation, and the earth itself as a stable thermal heat sink. Design, becomes a response to these resource interactions in the fashion of Heidegger's notion of 'revealing' as a process of technology.

Hydrology

An ecological 'closed-loop' strategy is applied to gather stormwater, hold the water as an aquatic/hydric habitat, and utilize the water as a nitrogen rich irrigation source for organic gardens. The traditional approach sheds and discharges the water resource.

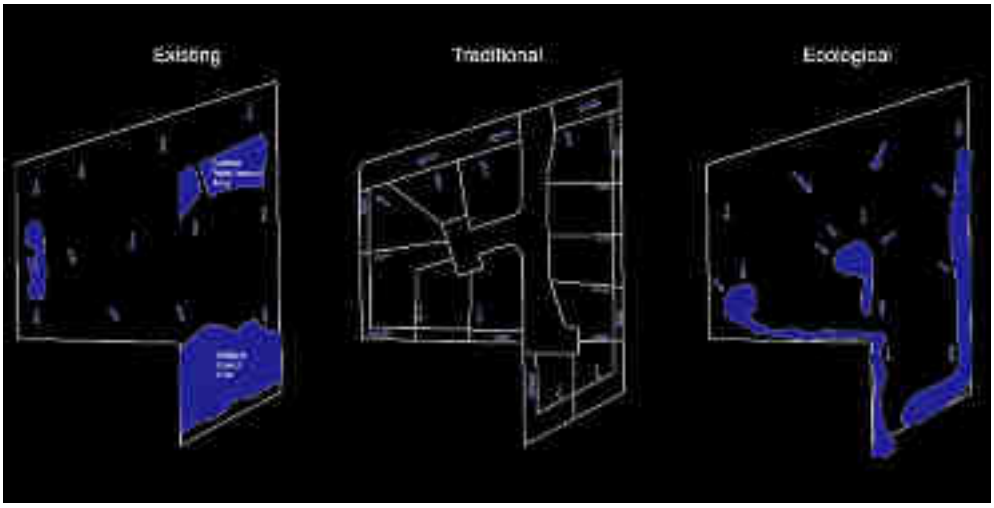

Image 9 Existing Site Water Flows (left), Traditional Suburban Hydrologic Flow (center), and Ecological Retention Plan (right).

Thermal Comfort and Heat Flows - Mechanical

Residential dwellings typically use individual 'split-system' heat pumps that transfer heat from inside to out or outside to in depending on the season. Outside units are very noisy and marginally efficient putting heat into outside air at 95°F (35°C) to 98°F (37°C). Alternatively, the ground offers a heat sink with temperatures of 72°F (22°C) to 78°F (26°C) – much more efficient heat transfer. A central chiller plant supplying chilled or hot water to each of the units that dissipates to or gathers from the ground using less energy and avoids noisy exterior condensing units.

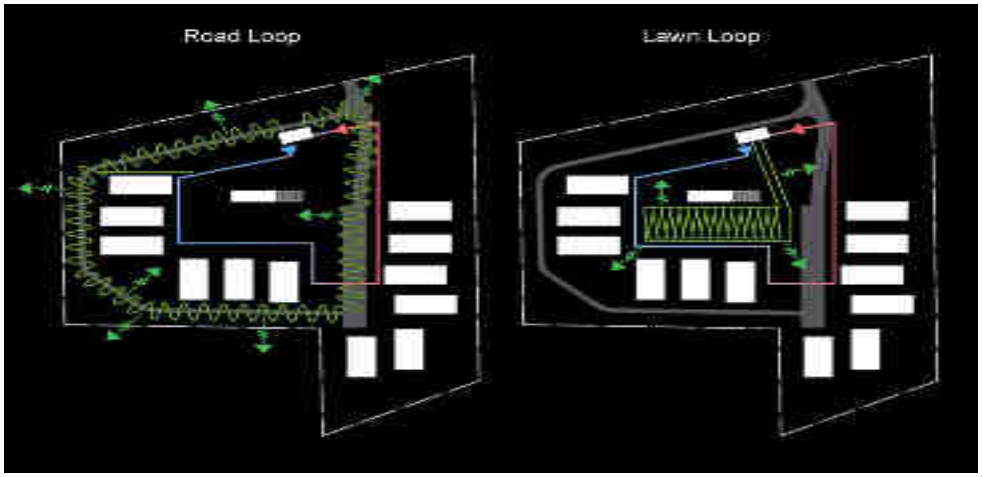

Image 10 Ground Coupled Central Cooling Systems (Road Loop and Ground Loop) Allowing for Access to Pipes Should a Repair be Needed.

Vernacular Technology

Drawing from Florida's history of 'Cracker Architecture' (Haase 2001), architectural form seeks to be thin and tall optimizing natural light and breezes within occupied spaces. Single Pen, Dog-Trot, and I-House typologies are precedent organizations compatible with Florida's hot humid climate.

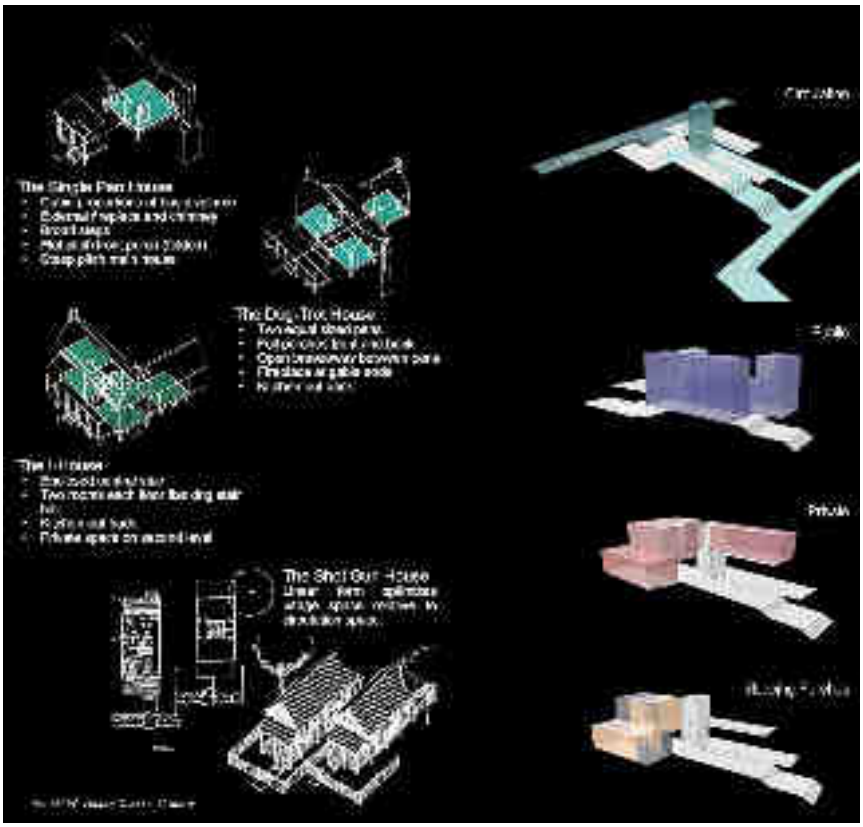

Image 11 Historic Technological Strategies Adapted to Future Viability.

CONCLUSIONS

The theoretical framework for design, as a technological process of revealing, suggests that seeing, thinking, and doing are the modes of technology, as a process toward innovative architecture. The methodology section, although limited to site and organizational strategies to meet space constraints, extends through the architectural design of the units. Seaglass – a case study – exemplifies historic and emergent strategies gathered synthetically to weave technical, ecological, and social aspects of design as an essence of technology that is "by no means technological".

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