

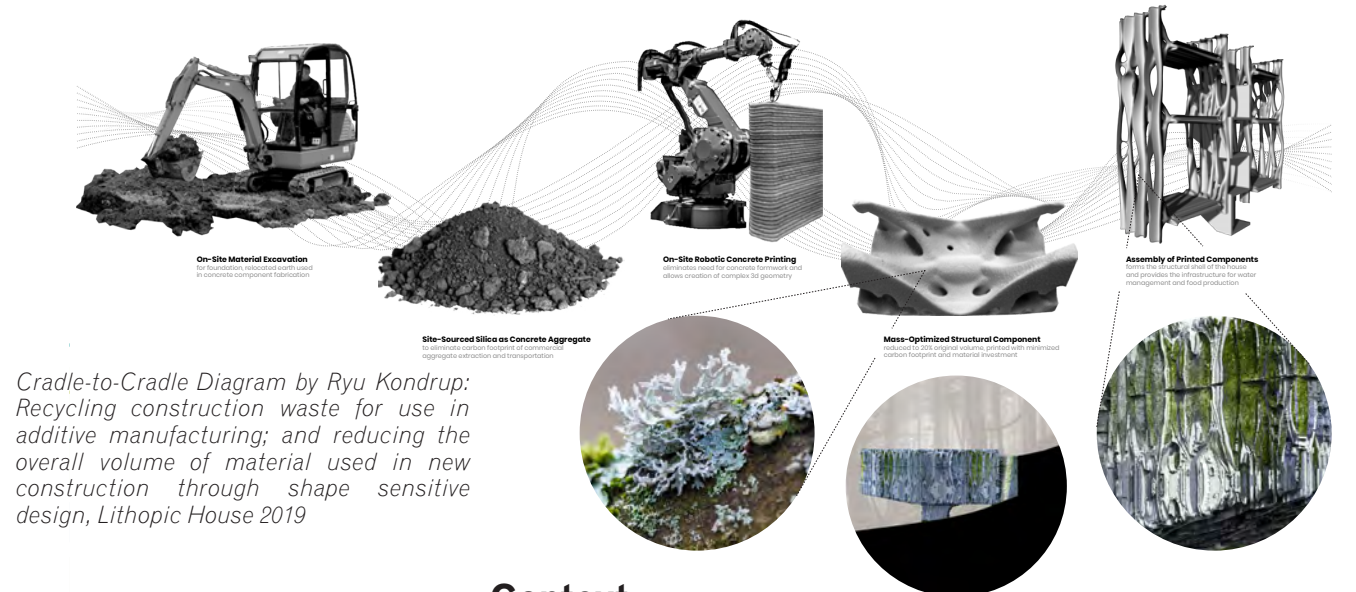
LITHOPIC co-HOUSE

*LITHOP = Living Stone
**HOUSE = "Here and Now" Competition

Ecologies of Shaping Waste and Earthen Matter Dana Cupkova

"The major problems in the world are the result of the difference between how nature works and the way people think."

Gregory Bateson



Cradle-to-Cradle Diagram by Ryu Kondrup: Recycling construction waste for use in additive manufacturing; and reducing the overall volume of material used in new construction through shape sensitive design, Lithopic House 2019

Context

Below: "The 1924 Ennis House, designed by Frank Lloyd Wright: The reinforced concrete blocks were all hand-cast on the premises using the site's own sand. Wright had a lifelong interest in periodic personal reinvention and in developing regional architecture while using local materials. His passion was closely tied to his ceaseless desire for technological innovation and, sometimes paradoxically, his interest in creating affordable housing for the middle class."



Above: "A small turf house in Fellabær, Iceland: Icelandic turf houses are the product of a difficult climate, offering superior insulation compared to buildings solely made of wood or stone, and the relative difficulty in obtaining other construction materials in sufficient quantities. Turf, or earth acts as thermal mass, making it easier to maintain a steady indoor air temperature and therefore reduces energy costs for heating or cooling."

The ambition of this studio is to examine architecture that inquires into embodied energy as a primary inspiration for formation of matter. Promoting a shift away from purely data driven rationales, the desire is to engage in the design framed by environmental ethics and sensory subjectivities as part of our collective aesthetic and ecological experience. Environmental aesthetics and aesthetics of nature are branches of philosophy that study appreciation of the world at large as it is constituted not simply by particular objects but by environments themselves. **Environmental empathy** is rooted in the concepts of otherness and difference. Design grounded in environmental empathy leads to more diverse paradigms in the redistribution of resources, new forms of co-shared domesticity, as well as social equity within our collective urban space, while being closely entangled within its ecological functions. We will seek to engage the notion of ecological attunement beyond the environmentalist paradigm, questioning the implication of binary logic between objects and environmental ethics.

Background

Building upon concepts of **material ecologies**, **circular waste-streams** and **synthetic natures** this studio is loosely based on the competition framework announced by The American Institute of Architects (AIA), Custom Residential Architects Network (CRAN) knowledge community: *HERE+NOW: A House for the 21st Century International Student Design Competition*. Students will be strongly encouraged to enter their studio project for the competition. Administered by the Association of Collegiate Schools of Architecture (ACSA) and sponsored by AIA CRAN, this program is intended to provide architecture students, working individually or in teams, with a platform to

explore residential architecture and residential architectural practice:

“According to the US Census, over 920,000 units of single family housing were completed in 2014. Many of these houses were built speculatively, as a generic prototype independent of context. Historically, Residential Architecture has represented a direct expression of culture and context, with local, vernacular elements informing the stylistic preference of the time. While the exterior of a house presents a more individualized image of its owner(s), the underlying design elements speak to broader cultural ideas of domesticity and family. Technological innovation, both in materials and systems, continues to advance the level of energy efficiency and resiliency in homes designed and built today. This competition challenges students to envision a house for HERE+NOW: informed by context, culture, and vernacular, but fully embracing 21st century technology and ideas of domesticity.”

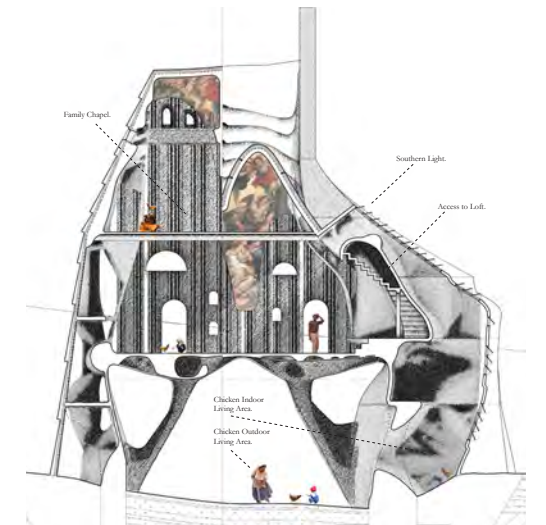
Program

Lithopic House is a co-House. It is rooted in concept of entanglement between shared ecological, social and spatial systems. Lithopic (Living Stone) co-House studio will negotiate physical prototyping with digital environments, while considering material ecologies of earthen composites central to design. Grounded in a potential of construction waste recycling through direct binder-jet printing this **cradle-to-cradle** method would reduce CO2 levels by reducing the volume of new architectural materials, as well as offset waste streams heading to industrial landfills. Shaping printable components for minimal material use aligned with structural and ecological potential is coupled with a desire to integrate new landscape and biomass directly into the architectural form, function and experience. Lithopic co-House will investigate the role of shape-factor in formation of architecture conceived out of local soils and granular waste-streams. The goal is to explore coupling of thermal pathways



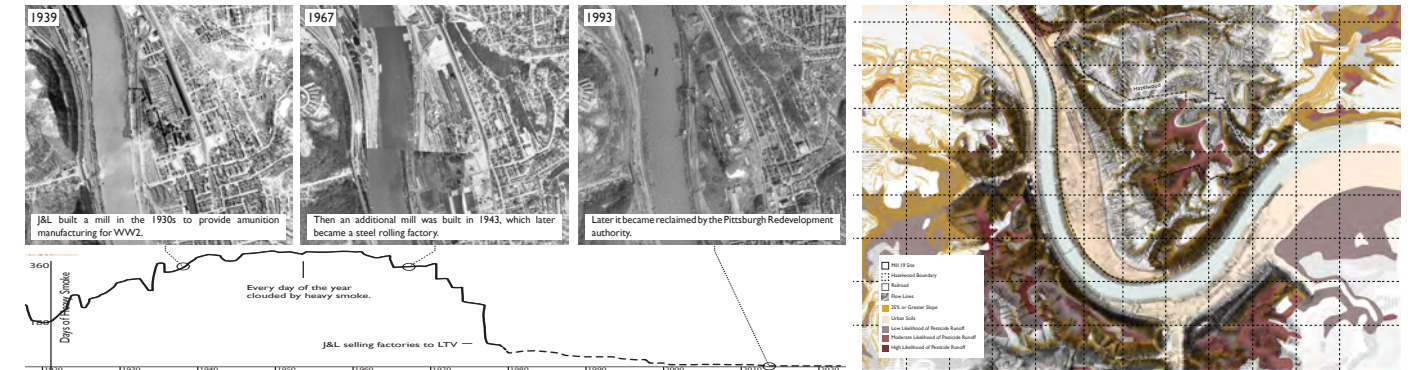
Above: (a) Alexander Wang + Longney Luk with a modular plug-and-play prototype of a sand print by Gil Jang; (b) Diagram of landscape integration strategy for Chicken House by Longney Luk and Louis Suarez, Lithopic House 2019
Left: GAN strategy in search for features that enable biomass integration into architectural form.

with biomass in the design of architecture. This studio will engage in computational shaping techniques relative to architectural component strength, structural flow and overall ecological potential. Such workflow is based in research into embodied energy of recycled construction waste that offers cues relative to volume to shape distribution of the composite material through use of additive manufacturing. Early state prototyping will lead into developing a specific design strategy for a house.



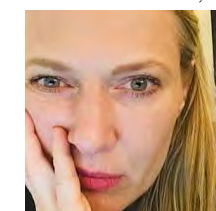
Chicken House proposal and component shaping strategy by Longney Luk and Louis Suarez, Lithopic House 2019

Hazelwood Site History and Pollution Patterns



Lithopic co-House will find its home within the vertical topography of Pittsburgh's neighborhood Hazelwood, which is prone to frequent landslides. Along with shifting and contaminated soils, Hazelwood's primary inhabitants belong to a racially diverse, under-served, economically and socially vulnerable demographic. The aim of this studio is to develop cross-scale connections between the households and landscape stabilization. Uncovering site's history and pollution patterns that are deeply-rooted in its current environmental conditions will help us engage with contemporary community concerns to better understand diverse needs and varied design potentials.

Above: The timeline above shows a history of visible air pollution mapped to the site history and map of soil contamination in Hazelwood area, illustrating underground conditions: soil quality relative to slopes, runoff, combined sewage outflows, and lead exposure; by Cupkova's MFI Research Team, 2019



Learning Outcomes

Computational processes profoundly impact our understanding of the world, and precipitate new forms of human awareness, empathy and interactions with the built environment. This studio will actively engage emergent technologies, material prototyping, and testing, in context of their impact. We will engage a non-figurative description of fictional objects and landscapes as a method for understanding thermodynamic behavior. Rather than relying on traditional simulation feedback we will explore image to form modeling techniques through GAN (Generative adversarial networks) experiments and engage structural analysis feedback in effort to reduce architecture's ecological footprint on this planet.