RESPONSIVE LANDSCAPES

STRATEGIES FOR RESPONSIVE TECHNOLOGIES IN LANDSCAPE ARCHITECTURE

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ROUTLEDGE

Responsive Landscapes

The sensing, processing, and visualizing that are currently in development within the environment boldly change the ways design and maintenance of landscapes are perceived and conceptualized. This is the first book to rationalize interactive architecture and responsive technologies through the lens of contemporary landscape architectural theory.

Responsive Landscapes frames a comprehensive view of design projects using responsive technologies and their relationship to landscape and environmental space. Divided into six insightful sections, the book frames the projects through the terms: elucidate, compress, displace, connect, ambient, and modify to present and construct a pragmatic framework in which to approach the integration of responsive technologies into landscape architecture.

Complete with international case studies, the book explores the various approaches taken to utilize responsive technologies in current professional practice. This will serve as a reference for professionals and academics looking to push the boundaries of landscape projects and seek inspiration for their design proposals.

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Justine Holzman is a landscape researcher and adjunct Assistant Professor at the School of Landscape Architecture at the University of Tennessee, Knoxville, USA. She received a BA in Landscape Architecture from the University of California Berkeley and an MLA from the Robert Reich School of Landscape Architecture. Her current research recognizes the inherent responsive capabilities of landscape through its materiality and her work in ceramics and digital fabrication has been exhibited across the United States.

Rapid Landscape Prototyping Machine

Owens Lake, California, 2011

University of Southern California's Landscape Morphologies Lab

Collaborators: Alexander Robinson, Andrew Atwood of Atwood-A and First Office is a partner in the project

Project Budget: Advanced Design Tools for Reconciling Scales of Use and Perception in Large-Scale Infrastructures initiated with a USC Arts, Humanities, and Social Sciences grant in 2011. Lauren Bon and the Metabolic Studio supported this research

Scope: This project undertakes designing and building a custom landscape prototyping machine in order to improve the design of dust mitigation landscapes at the Owens Lake in Lone Pine, California

Technology: Physical Sand Model manipulated with a 6-axis Robotic Arm equipped with a custom set of End of Arm Tools, Digital Projection, 3D Laser Scanner, and a Custom Software Suite

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Alex Robinson and the Landscape Morphologies Lab have developed a sophisticated and computationally advanced design methodology for modeling and simulating future landscape processes and conditions in Owens Lake, California. The former Lake Owens, drained by the water-demanding Megalopolis of Los Angeles, is now the source of hazardous dust storms ironically requiring substantial amounts of water for mitigation. Through the hybridization of robotics, digital projection, and 3D scanning, Robinson explores the potential of autonomous land construction to mitigate hazardous dust storms by regrading the landscape to require less water and maintenance.

The *Rapid Landscape Prototyping Machine* (RLPM) is a method for virtualizing and projecting the physical world that pulls from methods of landscape construction, landscape modeling, and representation—then brings them together into a highly specific and multi-dimensional platform. Pulling from methods of both digital and physical modeling practices, the RLPM is composed of a 6-axis robotic arm with a custom set of end-of-arm tools designed specifically to engage with sand-forming processes such as digging, piling, pushing, and raking—thus, forming a uniquely landscape oriented method of digital fabrication. To test the potential of regrading areas within Owens Lake, a series of tooling paths are designed for the robotic arm without dictating a topographic form, rather the topography is a material response: "driven by algorithmic tool-paths, the medium simulates the sedimentary assembly of landscape."[38]

The use of digital fabrication (mainly CNC milling) as a method for designing topographic conditions in landscape architecture (as well as architecture) has been criticized for its superficial engagement of surface, ultimately filtering out the material and dynamic qualities of

Figure 06.18 Digitally fabricated physical sand model, Rapid Landscape Prototyping Machine, *University of Southern California's Landscape Morphologies Lab, Owens Lake, California 2011*

Figure 06.19
Custom fabrication lab, Rapid Landscape Prototyping Machine, *University of Southern California's Landscape Morphologies Lab, Owens Lake, California, 2011*

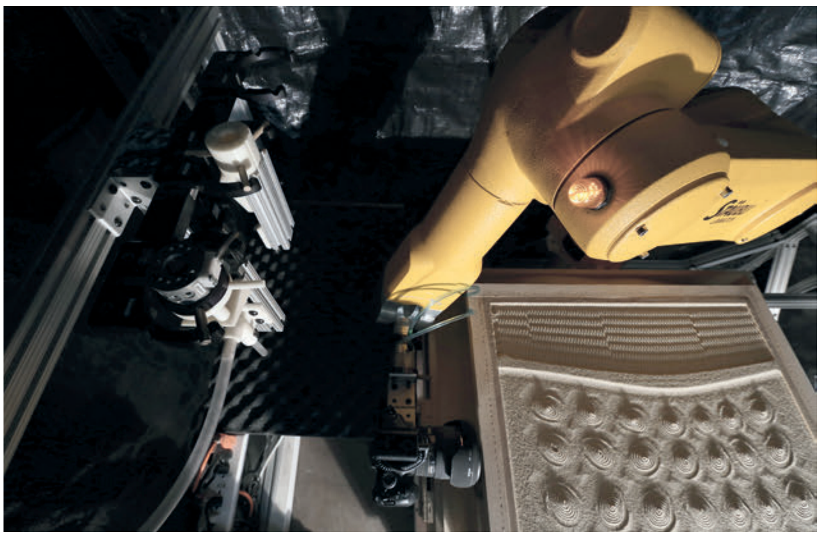

Figure 06.20
Robotic imaging of the Sand model, Rapid Landscape Prototyping Machine, *University of Southern California's Landscape Morphologies Lab, Owens Lake, California, 2011*

landscape.[39] The potential for translating complex computational tooling and patterning into earthen forms has been recognized. However, reductively carving a homogenous material to reveal surface textures fails to relate to the practices and performance of constructing landscape, resulting in a model that operates as an "image" rather than an expression or evaluation of a process oriented practice.[40] The RLPM bridges the ineffectiveness of current rapid prototyping efforts for landscapes to have relational material significance by employing the "effortless computational power and capacity of sand."[41]

As landscape architecture increasingly engages with large-scale disturbances, there is room to challenge civil engineering's "radical adherence to instrumental interventions" resulting in "unconsidered

Figure 06.21
Custom robotic end arm pieces, Rapid Landscape Prototyping Machine, *University of Southern California's Landscape Morphologies Lab, Owens Lake, California, 2011*

and unmeasured spatial consequences." Using a 3D scanner, Robinson is able to re-digitize the results of the sand modeling and "[enhance] the sand forms with morphologically-based adjustable surface treatments" with "real-time perceptual analysis tools."[42] Based off of methods commonly used within GIS to understand water levels, vegetation growth, aspect, and viewshed, the visualization of the analysis is projected back onto the Sand Model providing 3-Dimensional feedback. In addition, Robinson has created a game-like interface using the data from the 3D scan and subsequent analysis to navigate and render these conditions in real-time with given flexible parameters.

While the RLPM has been categorized within the chapter *Displace*, the project encompasses elements from the chapters *Elucidate* and *Compress*, expressed by the ability of the custom software suite to not only render but also project site-specific future landscape conditions. The simulations effectively portray seasonal water levels

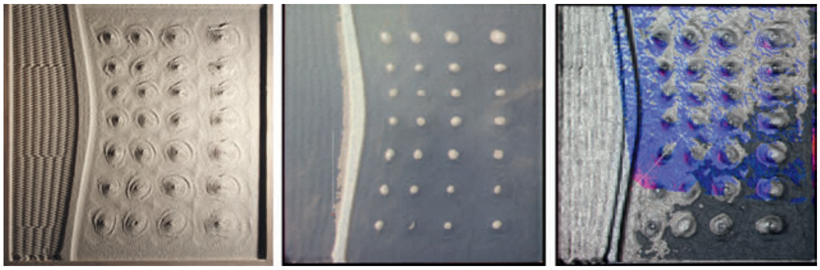

Figure 06.22
Analysis projections onto Sand models, Rapid Landscape Prototyping Machine, *University of Southern California's Landscape Morphologies Lab, Owens Lake, California, 2011*

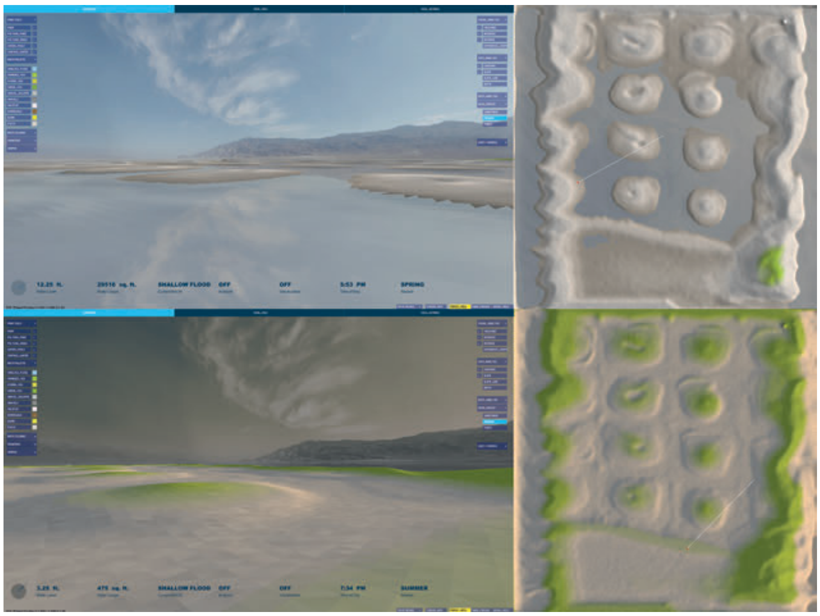

Figure 06.23
Real-time graphic simulation of Sand model landforms, Rapid Landscape Prototyping Machine, *University of Southern California's Landscape Morphologies Lab, Owens Lake, California, 2011*

and vegetative growth as well as daily and seasonal atmospheric conditions described by sunlight, shadow, and pigmentation of the sky and landscape.

This design tool becomes accessible beyond design professionals by linking together design methods with the representations required to facilitate design into a real-time feedback loop—allowing the user to visualize in real-time what would normally require a lot of post-processing. Robinson has streamlined these processes to craft experiential and analytical readings of landscape within a physically displaced location and predictive of possible future conditions—building a more immediate and illusory experience. Though sensory data is not being sourced in real-time from the actual landscape under investigation, this workflow is predictive of future working methodologies for process-driven dynamic landscapes, embracing a real-time connection with the landscapes they construct as a way of layering, nudging, and evolving ecological systems.

NOTES

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