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From solution space to interface

Six actions for landscape infrastructure design

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Over the last decade there have been tremendous conceptual and technical advances related to landscape infrastructure.[1] Like all landscape-related fields of work, landscape infrastructure ranges across scales from streetside bioswale systems to regional logistics networks[2] and coastal defenses.[3] The work of Alexander Robinson at the Landscape Morphologies Lab (LML) is a particularly interesting development in this vein.
The technical sophistication brought to bear on projects through both physical fabrication and digital modeling at the LML suggest a form of landscape research particularly attuned to large, complex landscapes typically dominated by civil engineering and the values of efficiency and control.[4] The projects developed through the LML call for a finely tuned form of modeling, a move from the engineered solution space to an *interface*.[5] The two projects presented and discussed here – *Greetings from Owens Lake* and the *Los Angeles River Integrated Design Lab* (LA-RIDL) – outline a framework for operating in ways that promise to figure cultural agency, memory, and human experience on equal footing with technical and engineering considerations, whether civil or ecological.[6] The intent is to augment and complement the goals of engineering approaches, which aim to characterize situations in terms of their problems and solutions.

Historically, concepts and approaches for the Owens Lake and the LA River were developed in an engineering *solution space*[7] – a modeling environment (today these might be programs such as Autodesk Civil 3D or HecRas) with implicit assumptions and where goals are worked toward deductively. While current designs for the Owens Lake[8] and the Los Angeles River[9] propose to expand their performance profiles beyond their primary goals of dust control and flood control respectively, standard tooling is poorly suited to integrate other values. Instead, values such as aesthetics, recreation, and habitat become points of design conflict and are considered as value-adds or extraneous, not integral aspects of the central performance approach.[10] The engineering methodologies that produce these designs rely on synoptic representations that efficiently facilitate primary goals but poorly represent the wide range of agendas and contingencies that are inevitably imbricated with any large-scale landscape system.[11]

Such an approach to design is insidiously powerful. Not only is it effective as a means to achieve prescribed ends; the ability to objectively measure the efficiency of performance goals satisfies governance requirements for sound public investment. To insist that subjectivity or "humanness" (such as serving an on-the-ground aesthetic reading) become an intimate part of these processes is to potentially undermine their source of power. But these subaltern considerations – including the needs of migratory birds and desires of local communities and tourists – persist in making themselves known.[12] In this context, what is design to do?

To positively consider the diverse milieu of agents that infrastructures operate within[13] (regardless of their original intention) requires entanglement with human cognition and elements that cannot be readily contained by metrics. In such cases a

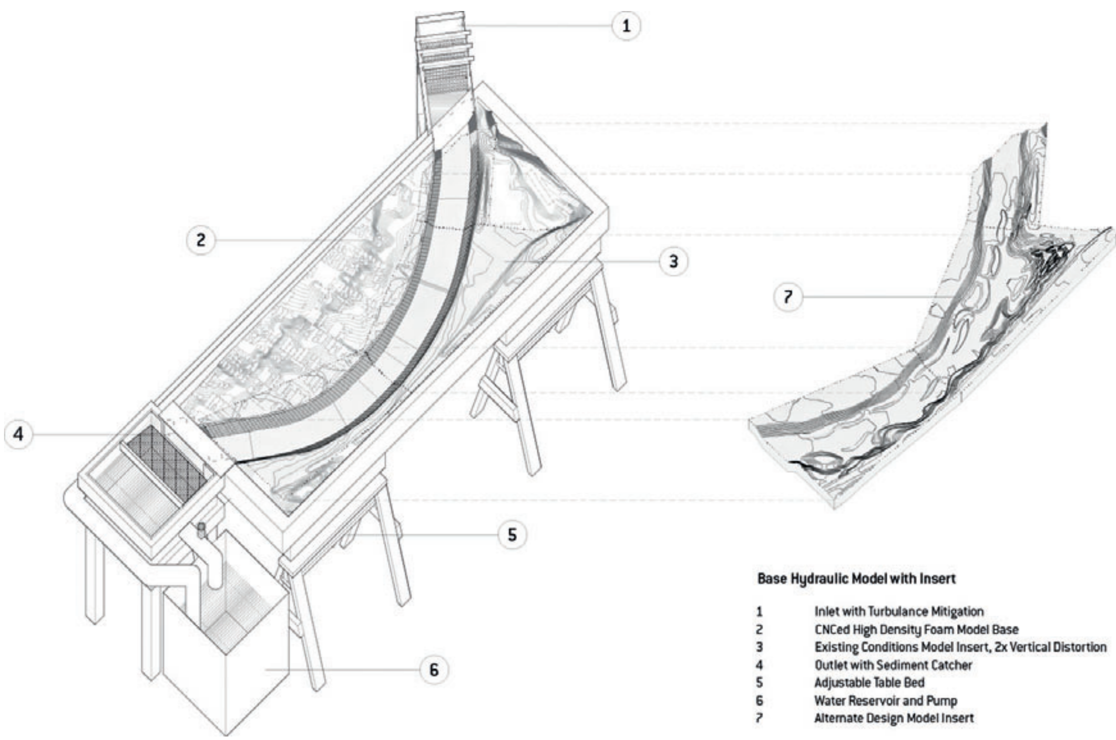

FIGURE 2.4.1 Create a methodological common ground. Diagram of Landscape Morphologies Lab's 2011 hydraulic model system for the Los Angeles River "Bowtie" site with example design insert. Vertical scale is exaggerated three times to improve hydraulic accuracy

Source: Designed and developed as part of USC Landscape Architecture and Urbanism graduate studio with assistance from the Los Angeles Bureau of Engineering, USC Viterbi School of Engineering, United States Army Corps of Engineers, and USC School of Architecture. Funded by the Los Angeles Department of Water and Power through the Los Angeles Bureau of Engineering specialized interface can be useful. It can serve as a means to relate human cognition with quantitative processes that bound and spatially determine an infrastructure design. An interface, as Branden Hookway declares, "describes the ways in which humanness is implicated in relation with technology."[14] An interface distinguishes itself from standard design practices by its externalized and transparent architecture of heuristic and metric analysis. It creates a hybrid modeling environment, one that allows the disparate determinacy of each representation to engage in a robust and calibrated back-and-forth. Its fundamental interest in human ergonomics has potential to assess the degree to which nondiscursive values are aligned with engineering performance goals.

The following proposes six actions that distinguish the interface's position in LML's practice that emerged in its work on the Owens Lake Dust Control Project and the Los Angeles River. Each segment – a dialogue between Alexander and Brian – describes, distills, and suggests actions for an infrastructure design interface. The actions are not design per se, but rather a catalog of interface devices and strategies; they are select crucibles by which the problem of landscape infrastructure design is reformulated and actively addressed.

Action 1. Create a methodological common ground (Figure 2.4.1). Even as its urban and ecological "revitalization" are now of paramount interest, the Los Angeles River, above all else, must protect the city's citizens and property from floods. Its radical reconfiguration into a featureless reinforced concrete channel reflects this need, a design that was validated and attuned by mid-twentieth-century physical hydraulic modeling of a "clean" (nonvegetated) condition. The design's success at transporting water at near highways speeds successfully protected the city from flooding and with time practically erased public consciousness of what was once a major regional concern. This has allowed public attention to shift to ameliorating the collateral damages of this severe solution.

However, the agencies mandated to manage the river remain justifiably fixated on its original performance design. They remain custodians to its original function of flood protection and the methodologies that measure its respective performance. Any attempt to amend the channel must satisfy an equivalency to its current antiquated performance paradigm, as overseen by its custodial entities, while also engaging new paradigms of synthetic design.

Our river design interface developed through the Los Angeles River Integrated Design Lab (LA-RIDL) aspires to bridge this gap by constructing a methodological common ground. Modern versions of the hydraulic physical modeling that originally optimized the river's flood protection are employed to satisfy the interests of the custodians but are modified to better represent and engage with other landscape qualities. The hybrid models adjust modeling parameters, such as eliminating extreme model vertical distortions, to judiciously trade hydraulic accuracy with the representational of other landscape values (such as realistic spatial conditions). While the system is not as hydraulically accurate as the final U.S. Army Corps of Engineering models, they allow designs to be "sketched" in a forum that better relates with the multiplicity of landscape factors contingent on the form of flood protection.

The first action is clear: establish common ground. Action One begins from a place of profound respect for the efficacy of earlier approaches that emphasized flood control through an understanding of river systems as plumbing problems.[15] Rather than simply trying to resist or undo the results of flood control projects that were so hard-won and have come to be relied upon, Action One instead reframes the problem. This is done with an emphasis on methodology and values. This action establishes a set of techniques, protocols, rituals, and concepts that can serve as instruments in identifying and exploring multiple forms of value.

The period just before and after the Second World War saw the simultaneous rise of environmentalism and technocratic approaches to engineering and planning. While the methods of these movements were similar, with an emphasis on increasing quantification and justifiable measurements, they tended to be rooted in radically different, equally ancient world views – humans as destroyers of nature whose actions must be ameliorated or remediated, and humans as improvers of nature. This situation usually resulted in standoffs and power plays: the EPA versus industry, the DOT versus the Sierra Club. It was a dialectic that played out on public lands and media, with uneasy battles and partial truces.

But Action One is not dialectical; rather, it is pluralistic. Instead of a serve-and-volley between opposing world views and working methods, it is a practice in which multiple states, frameworks, or approaches can be represented, even if only partially, or imperfectly. It rightly begins from a place of respect for the work that has already happened, even if the results have often been found wanting. It proposes to achieve the pluralistic condition not through revolution – throwing out earlier means and replacing them with the new – but by keeping the older ways and augmenting them. Ironically, it is an approach that is inherently pragmatic and historically grounded, even if its tools are primarily digital, virtual, and technological.

FIGURE 2.4.2 Address subjective and objective concerns. Screenshot of custom visualization and analysis software developed for Landscape Morphologies Lab's "Greetings from Owens Lake" design interface for the Los Angeles's Owens Lake Dust Control Project. During interface operation, perspectival visualization (left) of new dust control design is displayed on a screen, while the rendered planimetric view (right) is projected onto a sand model (or vacuum-formed mold of sand). The planimetric view includes real-time analysis of experiential and engineering parameters. The perspectival view is linked to controls that allow a viewer to move about the landscape and adjust design and analysis conditions, ranging from temporal lighting conditions to the distribution of dust control surface treatments

Action 2. Address subjective and objective concerns (Figure 2.4.2). Like many land-intensive, ostensibly single-purpose infrastructures, managing the driving performance goals of the Owens Lake Dust Control Project is best done through quantitative and planimetric representations of surface. At the Owens Lake all the currently implemented dust control methods are contingent on the coverage of a nearly flat and dry lake bed, making aerial or GIS representations fundamental for planning, construction, and monitoring.

In contrast, perspective views, as one might experience visiting the lake, are less obviously useful or significant. As subjective representations, they inherently contain distortions and limited vantages, both spatially and in judgment, giving them little obvious utility in logical planning decisions. Furthermore, perspectival representations of utilitarian systems are regularly aesthetically displeasing and can politically obstruct the project's objective performance goals and interests. This has helped cultivate a general suspicion and disinterest in a view that can elicit and empower nondiscursive criticisms of supremely rational and – by the project's synoptic metrics of success – optimal constructions.

While such a perspective view is the most apt representation of experience and "place" for visitors and constituents – often serving as the only placeholder for such concerns – it is regularly excluded from infrastructural design until major logistical decisions have been resolved. Such an approach has proven perilous.[16] By restricting the role of the perspectival representation to either public outreach "visualizations" or the actual experience of the built infrastructure the process cedes design entirely to engineering concerns and aesthetic judgment to volatile public entities and populations to judge postpartum. In such circumstances, aesthetic failure is common and its influence becomes more disruptive than productive. Aesthetics appear to be an erosive influence on effective plans and undermine large, otherwise successful, built projects.[17]

The LML design interface for the Owens Lake acknowledges the agency of perspective and its representations of place. It proposes that such an influence must be accounted for and can yield acceptable compromises. In this example from the LML's Owens Lake design interface, the perspectival, subjective view is given a prominent position with the planimetric and other metric measurements of performance and value. Analysis such as real-time viewshed analysis enrich and even directly map the relationship between different vantages. The arrangement serves to produce a dialogue that may minimize conflict scenarios and pent up reckonings between the disparate vantages. The system places the subjective in a position to redefine itself as a productive view, one that become an integrated or even equal point of reference, representative of its implicit agency and influence within infrastructural landscapes.

Action Two puts into practice György Kepes's exhortation that "we need to map the word's new configurations with our senses . . . discover in it potentialities for a richer, more orderly and secure human life. The sensed, the emotional, are of vital importance in transforming its chaos into order."[18] After common ground is established, Action Two emphasizes perspectival representation as an approximation of embodied human experience. It lets us consider what it could be like to be out there. Essential to this is the necessity of calibrating the simulated experience with field observations: can one really see the ridge in the distance? Do you really not notice the freeway to the left?

The emphasis on perspective as a device rather than, say, collage or video, establishes

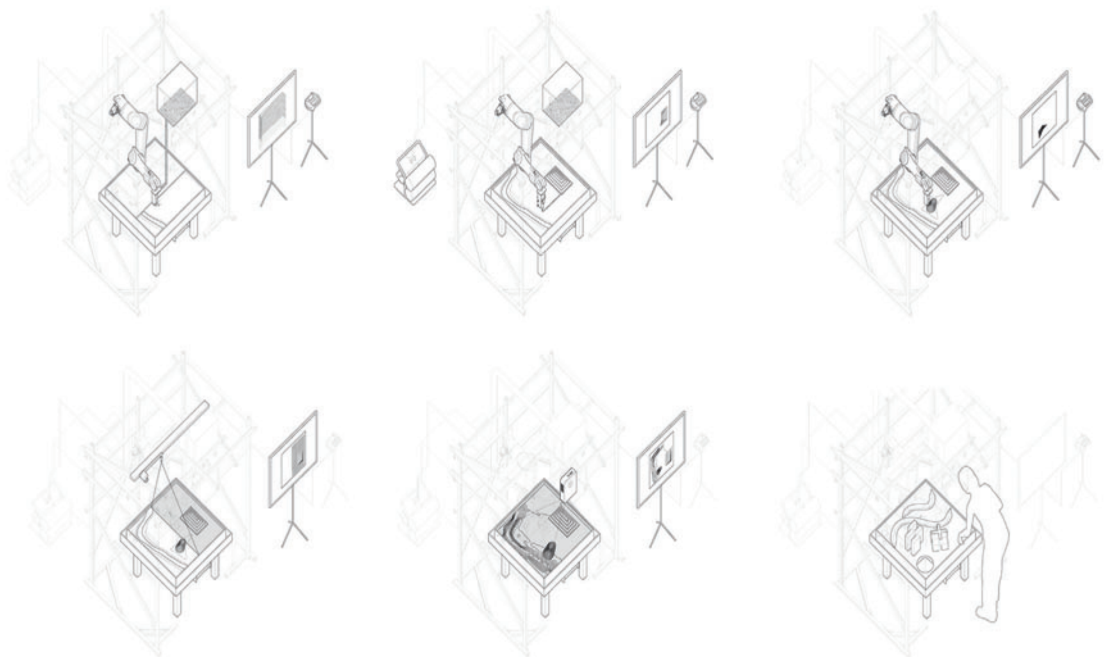

FIGURE 2.4.3 **Structure disparate representations in a pluralistic format. Diagrams describe an unsequenced multimedia design engagement with the professional "Greetings from Owens Lake" interface, developed for the Owens Lake Dust Control Project. From left to right: Subtraction – establishing existing site conditions using a vacuum tube mounted on a robot arm. Sand deposition – site modeling using a robot arm to create deposition. Sand manipulation – a digital arm aggregates and erodes depositions. Laser scan – a digital means of measuring and recording the effects of manipulation. Analysis – software uses digital scan for analysis of performance parameters, design, and rendered visualization. Hand manipulation – the modeling medium can be manipulated by hand, allowing for a more intuitive engagement with the site, rather than the more purely deductive interaction necessitated by digital modeling**

the landscape that is within infrastructure system control as a sort of middle ground between the surrounding area and the place one is standing. At first glance this seems trivial: how many people really want to drive to see the Owens Lake? But the implications matter. Action Two emphasizes this intermediate zone and reconstructs it as a modern Second Nature.[19] No longer simply a place of utility and production, outside the precious designed landscapes of the garden and between us and the wilderness this landscape becomes a cultural product and source of inspiration in its own right. It is here in this pluralistic intermediate landscape that not only are our livelihoods are won but our cultural values are formed and expressed.

Action Two promises the opportunity to genuinely consider experience, not instead of but alongside of other values. Integrating forms of representation that characterize the human experience of a place within the modeling process considers experience in reconstructing these landscapes.

Action 3. Structure disparate representations in a pluralistic format (Figure 2.4.3). The art of designing an interface for the Owens Lake is in the careful structuring of disparate representations. The "Greetings from Owens Lake" interface finds valence through its arrangement of multiple and disparate modes of site and problem representation. These include qualitative and quantitative: calculations of cost, water use, predictive habitat scores, and material spatiotemporal simulations. As is the nature of landscape, each representation of value or form is interconnected and interdependent with others. If habitat value diminishes or increases it impacts many other values and qualities. Few significant relations are linear (e.g., even water use and landscape quality is an irregular relationship) and no element can be assessed by a single measurement. Furthermore, metricized concerns and values, such as infrastructural performance or cost, lie in real, yet difficult to explicate, relations with qualitative concerns. Even as this suggests a kind of impossible solution space, there is a real need for some relation, however imperfect, between these different measurements of landscape, many of which cannot be assessed by some simple metric equivalency. My interfaces seek to place them in a dialogue to generate assessments to match the complex quality and paradox of landscape "problems."

In LML's Owens Lake design interface, physical sand models, software analysis, and algorithmic inputs are structured to spoil standard design problem hierarchies with a multiplicity of representations and vantages. The system creates a prismatic solution space indicative of landscape; it both diffracts parameters and presents itself as a multifaceted whole. It places the operator within an enriched milieu of landscape representations that overlap and interact with consequence and effect – making a design terrain textured with critical and project-defining objective parameters and qualitative, nondiscursive, representations of place. The power of the interface comes through an arrangement that does not merely repackage our systematic biases for a "problem" approach but stimulates a new open-ended and integrated avenue for design exploration and judgment. The diagram illustrates the multiple tools and vantages, digital, physical and hybrid that structure a enriched engagement with the design conditions.

Every form of representation carries its own blind spots and assumptions. Certain representations are good at capturing specific things but always leave out other considerations. In this case, a digital model works with assumptions or norms related to sand and water – shear coefficients, wind patterns, and water volumes. Of course, this can never capture what happens when a hose clogs or when a slope gives way.

There is a tendency toward determinism when working with one type of representation: "of course the proposal should be this way; just look at the model outputs." Pairing digital parametric models with another form of representation, in this case physical modeling – real piles of sand, produced using processes that replicate important parts of the environmental operations and context – introduces another, different set of assumptions and brings other mechanisms to the foreground. This is the great but often-overlooked lesson of pairing the section and plan – each is a method for understanding specific things about an object or place; each is related to the other, but different.

Tension and friction become desired and necessary components in the process as a means of figuring competing values. As an engineered solution, any given project

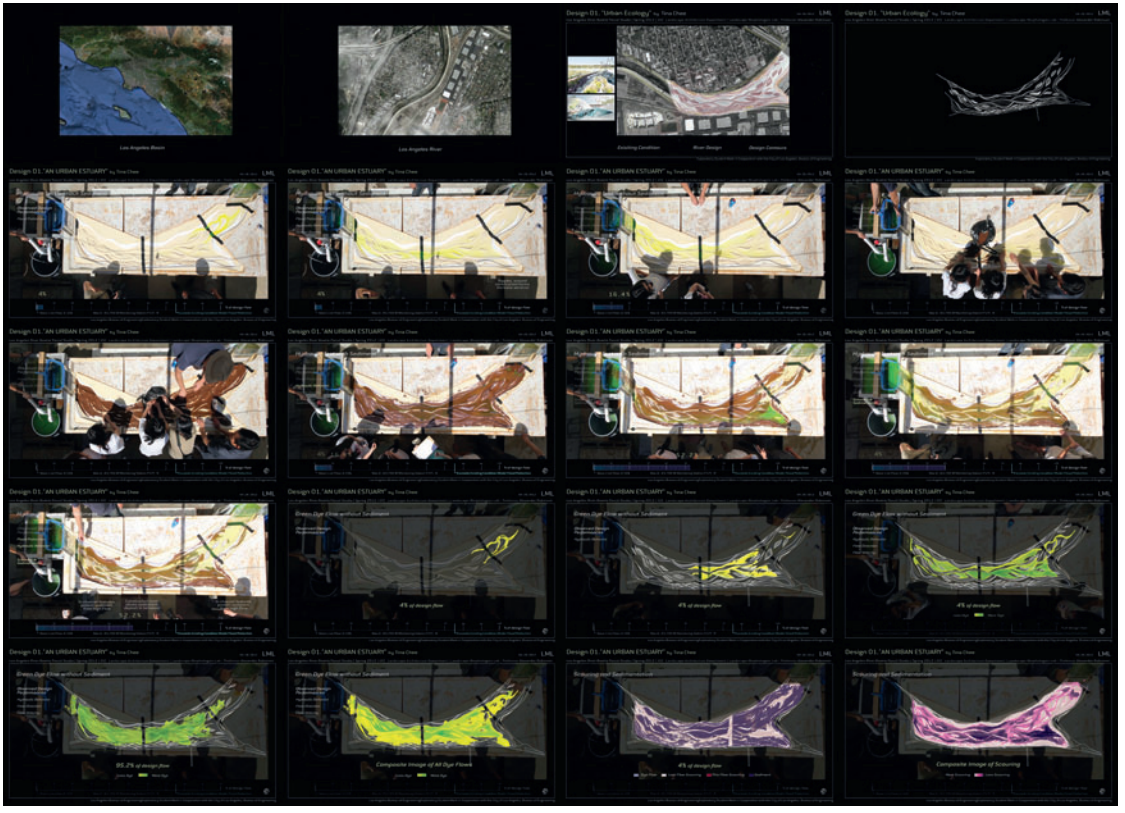

FIGURE 2.4.4 **Induce play by bounding and structuring the interface site. Screenshots from Landscape Morphologies Lab augmented time-lapse video of hydraulic modeling Los Angeles River "Bowtie" site designs developed by USC graduate landscape architecture students**

Insert created by Tina Chee

eventually falls apart because our knowledge is imperfect or values shift. But conceived as a landscape using multiple forms of representation, the project has the potential to maintain integrity and shift through time and space in response to multiple inputs, changing desires, or new context. The job is not to solve a problem but to exercise judgment to decide what constitutes the integrity of the project and just how it should be maintained, rather than projecting a synoptic or totalizing solution.

Action 4. Induce play by bounding and structuring the interface site (Figure 2.4.4). The flood protection system of the Los Angeles River is taut. There is a limited amount of "slack" by which one can deviate from the most efficient method of moving storm water. Design in these circumstances is highly restricted, defined by performance parameters only discernible through complex engineering analysis. Thus the problem of design is confounded by a contingency of challenges: draconian performance requirements ask for extraordinary innovation, a practice that is proportional to precisely representing complex and dynamic site phenomena. To proceed requires an awkward marriage of unorthodox thinking and systematic, highly technical representation of constraints; it is a challenge that begs for an advanced interface.

Fortuitously, the established methodology of hydraulic physical modeling works well in addressing this conundrum. With minor modifications it can become an effective medium to creatively explore taut design constraints. It both measures the controlling parameters of flood protection and operates as a spatial medium for exploring multivalent landscape characteristics. The system's most appealing attribute is its real-time spatial material representation of hydraulic performance. In this example on the Los Angeles River, the model's simultaneous computation and display of complex dynamic flood protection performance engenders an excited cognitive space. The sensuality and speed of the system becomes an invitation to *play* at the edges of what is hydraulically possible and to explore the limits of potential and suitable tangential values.[20] Rather than being inert abstract constraints, the performance boundaries are represented in a fabric and flux whose inherent meter, material, and phenomenality invite exploration. The material quality of these boundary representations cultivates playful human cognitive states where the constraints of an acutely complex and constrained territory demand it most.

Given the general difficulty of engineering analysis and the incompatibility of methods, the easiest approach is to allocate geographical areas outside performance territories, where subjective design and other not readily compatible values can occur more or less freely. Despite claims of objectivity, any engineering problem inevitably offers many possible solutions. Values are needed in order to develop and select from among these possibilities. In typical public projects these have for a long time been efficiency and control in the service of achieving the cheapest option. Through the interface approach, multiple forms of value are figured, cultural significance (through aesthetic effects) and ecological performance move from mere epiphenomenon to primary drivers alongside efficient solutions to the problem.

Play – a powerful human cognitive method for exploration within bounded space[21] – is an ideal nondiscursive means for studying modeled space through intricate work and calibration. The objective of this approach is to understand without destroying wonder, to discover patterns without reducing the complexity. In the words of polymath Herbert Simon, "the aesthetics of natural science and mathematics is at one with the aesthetics of music and painting – both inhere in the discovery of a partially concealed pattern."[22] This is the task of design, though it is often reduced to sophisticated problem-solving alone. The potential of an interface that emphasizes the concept of play is to explore the range of the possible from a set of givens. It moves modeling from a solution space, founded on deductive logic where the built-in assumptions fundamentally shape the outcomes, to a new type of formation space that is generative in nature, encouraging the production and analysis of novelty.

Action 5. Engage stakeholders with the interface (Figure 2.4.5). To engage a broader socio-political realm, LML's specialized design interface and design output for the Owens Lake Dust Control Project were refashioned within a custom stand-up arcade machine for public use and outreach. Users can select between a variety of vacuum-formed landscape sand models representing possible dust control designs, slide them onto the arcade tabletop, and then utilize buttons and a joystick to dress them with a selection of dust control technologies, modulate water use, and adjust experiential parameters, such as time of day and viewer position.

The system software simultaneously projects the surface treatments onto the plastic topographic model and presents a perspective simulation of the new dust control landscape. The interface is further augmented with instant analysis for a variety of engineering, habitat, and experiential considerations. The system gameplay broadly encourages users to employ *play* to find design configurations of their preference by rewarding them with a postcard depicting their selected design and its performance attributes. A public, constituent-based *Homo ludens* is let loose within the utilitarian solution space of *Homo economicus*.[23] The system keeps record of this interaction and collects the playful impulses and subjective judgments of constituents into a data set that better represents the nondiscursive values within the rational design frameworks. The interface becomes an important means by which we instrumentalize, measure, engage, and inform the social imagination in the strange hybrids of function and beauty that are infrastructure landscapes.

Place-based activism as a generative means in the design process has been popular in landscape architecture at least since the 1960s, with Lawrence and Anna Halprin's groundbreaking RSVP Cycles.[24] By adapting this ethos and approach to digital modeling capabilities, more people can be reached and a wider, perhaps stranger, set of possibilities can be explored. Such an engagement can help popularize and activate the suggested approach in multiple ways. First, by engaging a multitude of constituents in the nondiscursive assessments the results are legitimized by data quantity and provenance. Second, by engaging people within an

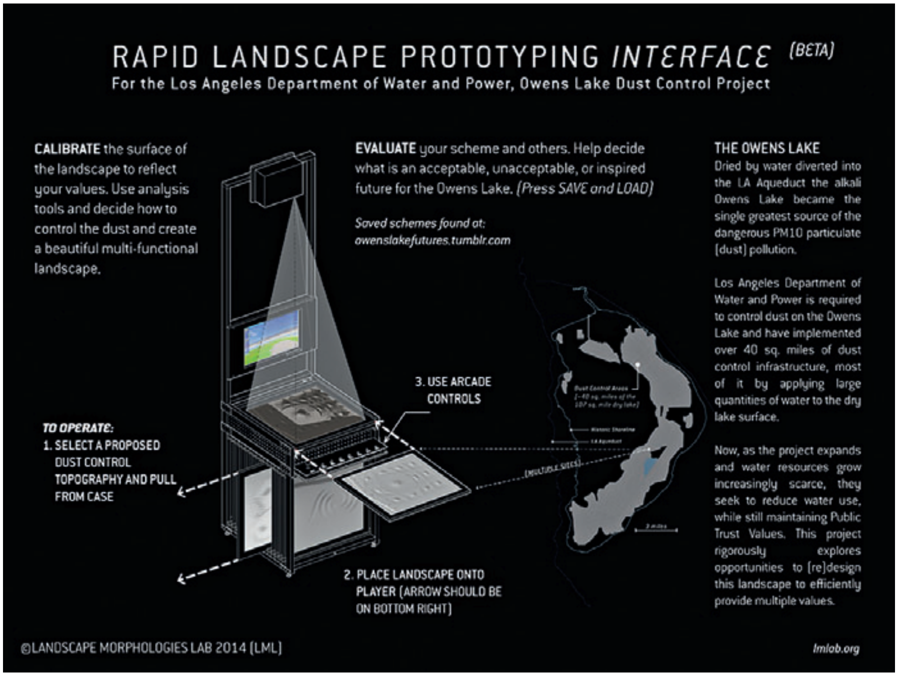

FIGURE 2.4.5 Engage stakeholders with the interface. Instructions for operating Landscape Morphologies Lab's "Greetings from Owens Lake" public interface. Players are encouraged to arrange and assess dust control surface treatments for a variety of prefabricated topographical treatments. The system records their preferences and rewards them with a postcard souvenir of their preferred design