Three Cases of Re-configuring Scope, Agency, and Innovation for Landscape Architecture

Adam Mekies[1] PLA, Daniel Tal[2] PLA

[1]Harvard Graduate School of Design, Massachusetts/USA · amekies@gsd.harvard.edu
[2]DHM Design, Colorado/USA · Ambit3d@gmail.com

Abstract: Landscape architecture is not a profession huge in numbers with deep financial pockets … Yet, we've made enormous contributions, many unsung, and have much more to offer. We need to find ways to innovate – ways to grow. Landscape architecture's nascent forays in computational ecologies, construction innovation, creativity, and entrepreneurial skills for our private real estate and development clients, can help fund the profession's own research and development in the agency of our practices. Three technological practice tracks in landscape architecture have emerged. In this paper, we present implemented cases for each:

1) In-House / Firm-based superusers
2) External technology consultants
3) Most recently landscape architecture technology start-ups and development ventures

Having practiced in each of these settings, and through implemented project cases, the authors will demonstrate how landscape architects can leverage imaginative digital technology, and informative data tracks in contemporary practice, for the entrepreneurial purposes of the landscape architect.

Keywords: Construction, landscape practice, 3D scanning, parametric, software

1 Introduction

This discovery paper of potential toolsets is developed by and for landscape architecture. This paper sheds light on the revenue generating potential and human innovation development role in profitable practice formats for the landscape technocrat. The examples presented are condensed in length for this publication. We provide tangible applications for revenue generating engagement being used in the implementation phases of landscape architecture practice.

Myriad publications and studies provide foundations for technology in analysis, form-based design and planning. We focus on the construction and implementation of the great landscape gardeners, the origins in landschaft architektur – crafting private or luxury enclaves has always brought excellence in materiality, form, and innovation to the profession. The contemporary counterparts to these landscape gardens in private resorts and luxury residential sectors have provided the fodder for broader implementation in our practices and now to the public sector.

Dilemma

Landscape architecture and the design professions, in a broader context, have a long history of innovation and value creation for our clients and the profession. However, the advent of the 21st century has highlighted the profession's aversion to implementing new practices and appreciation of the value these technologies bring to their built work. While our profession is altruistic in nature with its proclivity to ecology and design for community and the public

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realm, we have restrained ourselves, mostly through liability and scope constraints, from innovating and delivering at higher levels. We offer the same scopes today that we did 20 years ago. Yet, today, we can design with entirely different tools and data sets. Here, we suggest expanded scope and value capture through technology for the professional agency of landscape architecture.

Many landscape architects are at the mercy of reduced fees, greater levels of competition than 20 years ago, and reliance on "tried and true" digital and methodological approaches for the acquisition and execution of projects. Some practices have separated themselves from the landscape, producing legal documents as opposed to direct immersion in the construction of their designs. The status quo devalues invention in the interest of slimmer margins, assured profits, and repetitive work.

1.1 Thesis

Leveraging the tools of landscape architecture to document construction systems beyond current operational norms, presents new opportunities for landscape architecture and consultant roles.

Just as the European landscape gardens of Capability Brown were so often field-directed exercises, architecture began with similar origins of "the master builder" role. However, as architecture has evolved similarly to landscape architecture, differentiating itself from the construction aspects of the project, the landscape or site components of a project are still dramatically under-systematized in their evolution.

The challenges of computing or automating the translation of these customized, site-specific landscape systems are experienced in both the physical implementation, and the digital 3D modelling realms. Thorough and detailed geometries and construction documents are the current best methods of communicating high levels of design intent to contractors for execution. In the previously referenced name for the process, "detailing" requires an increasingly large scale of paper to communicate larger and larger sites – unless one reduces the scale and level of detail shown. The enlargement of drawings sets, through countless "windows" into the project, at various levels of resolution, proliferates the possibilities for un-resolved design intent or misinterpretation by the constructing entity.

Contractors have recently claimed the "pre-construction" scope of work. Contemporary landscape architects' liability and firm financial practices must yield to new scopes of work in the "post-design" or construction phases. We, as landscape architects, must return to the field, and get paid for those services.

The construction sector of today could not be more primed for disruption and innovation – particularly in the landscape or ecological construction sector. A chronic gap exists in efficiency, productivity, and skilled labor within the construction market. Our construction sector remains (at least in the United States) at a post-World War II productivity level in construction, according to the Bureau of Labor Statistics.

The following examples are entirely software agnostic, focused on custom tools created by, and for, the presenting landscape architects. The projects emphasize methodology of "value add" to clients' projects, but also the yield of greater "value capture" for the landscape architecture practice in the construction phases. These "value-captures" are demonstrated to illustrate the potential engine of propulsion at the disposal of the profession.

2 Case Studies

2.1 In-house – Design Workshop, Inc.

Residential design comprises the largest market sector of the landscape architecture profession. This sector is often the testing grounds for innovation and state-of-the-art materials. However, the tools for communication often do not extend beyond traditional graphic and documentation standards. The landscape architect challenged this notion after being approached by a residential client with an interest to create a small pool and landscape inspired by the rugged beauty of naturally occurring tarns found throughout the Rocky Mountains of Colorado. These small mountain lakes are captured within boulder outcroppings at high elevations, possessing natural beauty through their unexpected and irregular forms.

Fifty-five large boulders, each weighing between 1 and 3 tons, and thirty pallets of smaller slag material were obtained with the intent of integrating them seamlessly throughout the bodies of water as outcrops of rock and talus slopes resembling broken rock slides. The boulders would need to be placed in deliberate and subjective ways by the landscape architect to achieve the intended aesthetic. This process necessitated precise cutting, structural support and methodical construction sequencing. The selected boulders were jagged and irregular, and their sheer weight eliminated opportunities for experimentation.

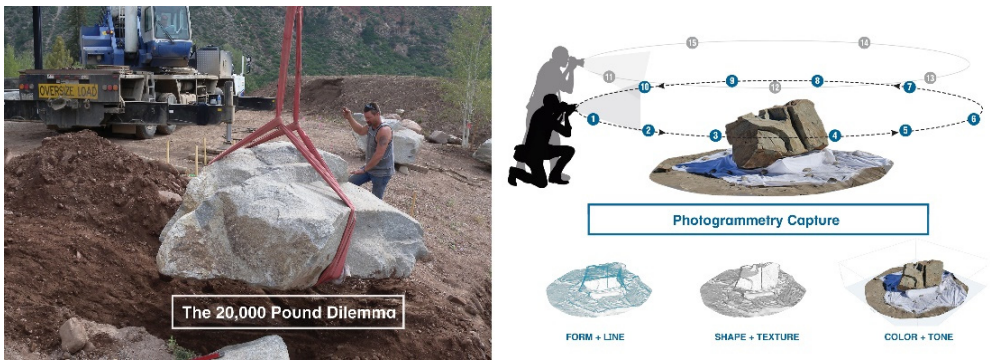

Fig. 1: Images by Design Workshop Inc.

The typical approach to construction requires the landscape architect to be present on-site and observe/direct construction crews at every step of the process: boulder selection, placement, positioning and guidance regarding cutting or other fabrication. This trial-and-error method is time-intensive, technically-challenging and mistake-prone. Most concerning, waiting to finalize the design vision until the middle of construction sequencing often results in – “it’s too late for field adjustments”, and “we can't achieve the desired design outcome.”

The technologies of 3D scanning, modelling, and printing are traditionally used in the industry to communicate design vision; however, these technologies are rarely used to close the communication gap between the Owner, Landscape Architect and Contractor (OAC).

The team developed a digital 3D model of the intended landscape water features. Structural walls and pool shotcrete thicknesses were accounted for to facilitate discussion of construction sequencing, boulder stabilization and owner understanding of design intent. This base model was then printed at 1"=10' (1:120) scale. Next, the purchased landscape boulders were digitally scanned via photography. Several images were taken of each boulder from multiple angles. The boulders were tagged with an identification number to track them through the digitalization process and for later reference on-site during construction. A proprietary AutoDesk program stitched together the boulder images to generate accurate 3D models printed with each boulder's unique shape, natural cleft, and granular texture. This allowed the design team to precisely place modelled boulders with intentional orientations on the base model. To improve communication of design details, the models were used in OAC meetings to glean design review and construction implementation feedback. After iterative rounds of design and constructability review, a final vision was documented for the site.

Cost of Process

Scanning $2,000

File Prep. $2,500

3D Printing $3,950

Scale Base $4,650

Scale Cabin $1,050

Total: $14,150

Fig. 2: Images by Design Workshop Inc.

Prior to the boulder modelling, early construction estimates varied as much as 200 % in subcontractor fabrication costs. Responses to RFI's to clarify the construction drawings only caused subcontractors to pad estimates further. As a result of OAC design sessions with the physical model, subcontractor bids levelled into comprehensive and accurate pricing proposals. The landscape architect was then able to refine the design approach to meet the client's budget goals, and a subcontractor was selected based on qualifications and thorough understanding of costs.

The technology and communication approach allowed for boulders to be digitally staged before physically arriving to the site. The constrained site offered no space to layout boulders for on-site review, guaranteeing that a traditional trial-and-error method would have been fraught with missed opportunities and poorly informed design decisions. Beyond this example, the methodology represents a new way of communicating ideas, transferable to other non-standard construction materials within the industry of Landscape Architecture.

2.2 Consultant – Adam Mekies (Site Innovations Lab) to Balmori Associates

Leveraging the tools of landscape architecture to document construction systems beyond current operational norms presents new opportunities for landscape architecture and consultant roles. For the new Hancher Performing Arts Centre, translational construction systems modelling presented efficiencies to the primary firm (Landscape Architect of Record) during the construction documentation phase. Further questions by the contractor about the design model and consultant engagement provided originally unintended but highly practical assistance in pricing, pre-fabrication, and in-field construction.

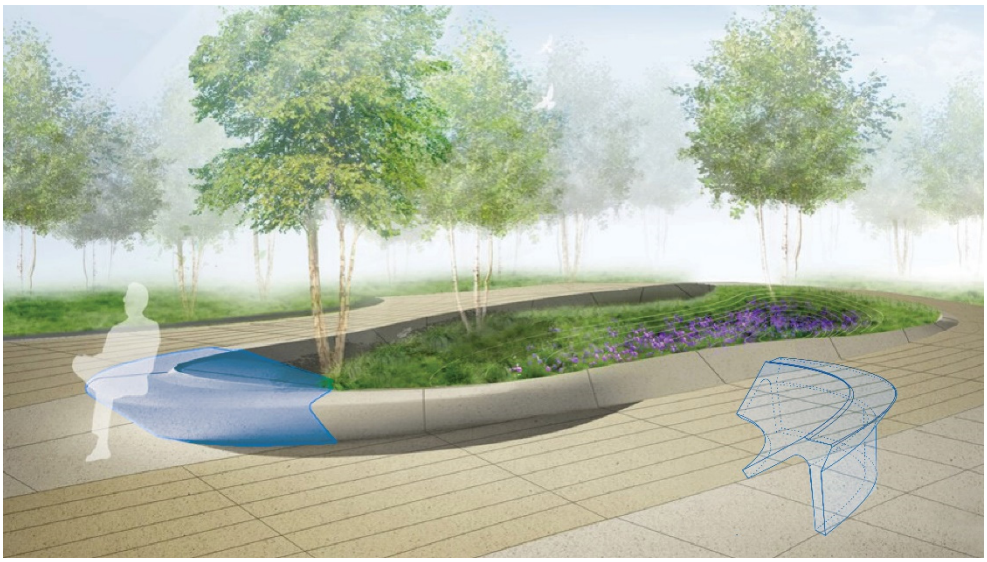

Fig. 3: Design Rendering by Balmori Associates

Through "traditional" NURBS-based modelling and extraction of two-dimensional drawings, the complex form and static construction document requirements could be accomplished. However, with numerous design revisions, Grasshopper was employed to "flex" the digital-model in response to linked two-dimension CAD by the Landscape Architect of Record.

With the next phase of contractor pricing, immediate questions of concrete volume, finished surface area, and additional cross sections for rebar calculations were requested and provided. Staged pours based on equipment availability could be calculated with scripted expansion joint locations based on shotcrete volume and designer review.

With two Grasshopper models linked to the active / iterative two-dimensional CAD files of the landscape architect, and three-dimensional parameters approved by initial design modelling intent, updates could be made seamlessly. One script drove the two-dimensional horizontal control plans for the construction set. A second script drove three-dimensional costs data points and construction-based geometry for formwork and reinforcing steel layouts.

The translational role of this project documented the "inverse" of a typical construction set. The consultant deliverables focused on metrics needed by the contractor and design intent through three-dimensional representation and computed two dimensional CNC files of the formwork or negative of the final desired volume. Critical audience understanding, in what drawings vs. simple metric take-offs the various parties needed, was key to this scope of work.

By engaging a consultant as the translational role from positive to inverted construction geometry, the landscape architects could focus on design and other aspects of the project intent with critical deadlines to be met. Completing the translation from intent to a potential means and methods provided the contractor greater assurances of scope and requirements, thus removing concern for padded bids and contingencies.

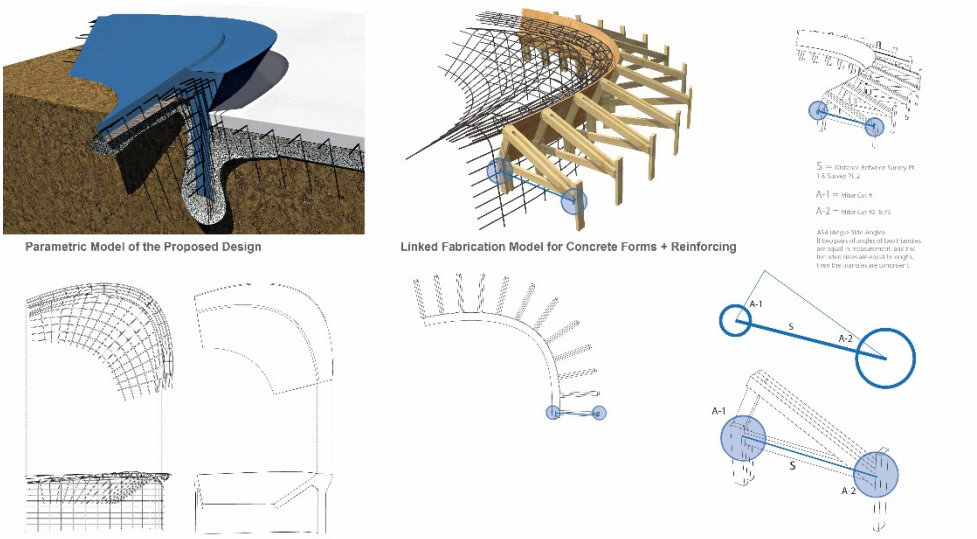

Fig. 4: Parametric Formwork + Reinforcing Steel Models by Adam Mekies (siLAB)

The profession often encounters liability concerns regarding designer involvement in the construction means and methods of a project. Additional information can be found within the AIA's Contract Documents, but of critical concern, for the translator's role in design, is to maintain a "professional" vs. "product" liability approach in their standard of work. Tangible results of US. Legal precedent and the impact of the design team in construction applications can be gained from SHoP Architect's Barclays Center in New York.

A translation role in landscape architecture, takes perhaps its best reference from the survey industry. A surveyor sets preliminary baselines for the design intent early in the project; they often return late in the project for the contractor to set in-field construction conditions.

Fig. 5:
Completed / Built Project
(Photo Credit: Pelli Clarke Pelli)

2.3 Custom Software Development – Find Your Own Efficiencies

The landscape architecture industry is tied to several mainstream software packages to complete most design and construction work: AutoCAD, Photoshop (Adobe products) and SketchUp, Revit, etc. Four decades later, AutoCAD still dominates the landscape, so to speak.

There are many reasons for the continued reliance on applications created at the dawn of the consumer software age. Standardization of product, drafting and adoption by public and private entities have tethered the landscape architects work to these applications.

The software development ecosystem of multiple software languages and coding methods on the surface do not seem like something LA's are trained to accomplish. But the software world has evolved and is now accessible to the average firm or individual. Hiring a coder to develop a small custom script or app to assist work is not only possible, it is cost effective and easy to manage within reasonable limits.

PlaceMaker, is a plugin for SketchUp and Revit. PlaceMaker accesses various free and for-pay data sources and converts the information into usable, digestible 3D information of urban streets, buildings, aerials, walks, water and vegetation.

Fig. 6: The extension allows for the import of rich 3D urban data

PlaceMaker was born from the desperation of having to build context for site design and infrastructure modelling with limited budgets and time. What normally takes hours or days to model, research or draft, PlaceMaker can complete in minutes. And it's not a new idea; the very nature of GIS has been to make this type of data available to the landscape architecture community. PlaceMaker was cheap to create. It required three months of full-time development to achieve an "'alpha' version," a functional proof of concept that requires polish and minimal additional features.

And here is the important consideration: It did not require any knowledge of coding or software. Working with a coder from the SketchUp / Revit community, a proposal outline was written for an app that imports in 2D and 3D data, geo-located information. This information is converted into 3D volumes based on the desired software; SketchUp or Revit.

The coder reviewed the application, met on-line to discuss expectations and after a week, quoted a price and length of development. The coder is a small two individuals "mom and pop" shop, which have sprouted all over the world.

Three months later a working version of the app was delivered which was immediately implemented into project work. Another 3 months after that, a commercial version was released. A commercial version offers the firm another business development opportunity and passive income. PlaceMaker has proven to be lucrative and has had a sustained demand.

How to Develop and App

The skill set required to develop a proposal or software outline for a coder is similar to that of writing a landscape architectural scope of work.

1) Identify the Problem – What issue do you need solved? Want to have all the streets in your 3D model have centerlines? Need parametric construction tools for 2D or 3D? Want a file type converter to work across different applications? Identify a process or method that is time consuming or frustrating and streamline it.
2) Create the steps to a solution – Be as detailed as possible. Understanding the limitations of the software you are using (AutoCAD, SketchUp, etc.) is an important starting point. Knowing what the platform is capable of but does not (yet) do is the goal of any custom application.
3) Write out the User Experience– Create an organized detail User Experience (UX) design. Visualise how you would use the tool, in what steps and input required from you to get to the desired result. Create examples of desired outcomes. The tool you want to create will repeat and automate this process.
4) Research and Find a Coder – The app you will create will be coded in one of these languages: C++, C-Sharp, Ruby and some Python. Find these coders: www.upwork.com, www.Chetu.com are examples. Engage with the coders through a detailed outline. Make sure to have NDA's in place.
5) Start Simple – Find an issue that is straight forward to solve.

Ai is Here

PlaceMakers future development is the integration of AI generated data. The Remote Sensing industry is going through an AI revolution. Photogrammatic AI generated data is realizing rich accurate 3D information. Companies like Ecopia Tech are generating survey quality in-

formation for large areas at a fraction of tradition costs and quick turnaround. Nearmap offers super high-resolution aerials, up to 3.5 cm and is starting to release 3D Mesh data, all created using custom cameras and smart software. PlaceMaker is integrating with this data to allow for greater flexibility.

3 Contemporary Implementation of Computational Trades

1) GPS Grading / Laser Guided Equipment;
2) 3D Scanning and application to organic material typologies, and existing conditions surveys;
3) 3D printing at scale and 1:1;
4) Drones – aerial and ground implications in sensitive ecologies for invasive species, reforestation, and avoidance of soil compaction with heavier equipment;
5) Numerous "hard-lined" mega-projects of mining, pipelines, airports, tunnels, highways and bridges around the world have required and been built in part by leveraging automated technologies.

Each of these technologies are invaluable and have been implemented independently on projects around the world. However, as a site industry, we lack the ability to integrate these systems of automation like those of our architectural counterparts, for the challenges listed above. Erik Brynjolfsson and Andrew McAfee in their book, The Second Machine Age illustrate the critical nature of combining technologies rather than single-use implementation as the key to real innovation.

BIM technologies have become "a general purpose, or everyday technology" for architecture. In contrast, landscape architecture, in particular for the customization of the exterior realms, still awaits implementation of this ubiquitous technology. However, until we can modularize cities, and order not just the playground but the actual hills, meadows, and functioning stream ecologies which make up a park, to be delivered on the backs of trucks or drones, the role of a "translator" (in-house, consultant, or specialist developer) will re-main a critical element in connecting the virtual informational model" with physical reality.

4 Conclusion

Landscape architects can develop time saving apps, access and augment data or customize smart functions to enhance practice. Designers can bypass the limitations of standardized software and limited responsiveness of large software developers. A small amount of investment can yield direct results impacting budget, workflow and design.

Current urban construction systems are based on rusty metal pins physically located at the corners of properties by surveyors. Our cities are built on a Cartesian coordinate system of X, Y, and Z indicators for physical, social, and even ecological resource locations. The model of contemporary surveyors offers perhaps the best parallel to future systems of construction for dynamic systems.

Each of the examples shared above represent but one of a myriad of new computational trades in the direct realization industry. This translational sector can be claimed by either the design or construction side of the project, where "pre-construction" scopes of work have been growing over the past decades and are commonplace for the contracting team.

It is by far time that "post-design" continue to expand in the critical aspect of the landscape architects' scope of work. We must overcome the liability gap in our industry and take on active roles in the implementation of our visions. We are the best suited trade for translating landscape and ecological visions to reality.

References

BERNSTEIN, P. G. (2018), Architecture Design Data – Practice Competency in the Era of Computation. Birkhäuser, Basel, Switzerland.

BRYNJOLFSSON, E. & MCAFEE A. (2016), The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies. 1st Edition. W. W. Norton & Company, New York, NY.

CANTRELL, B. & MEKIES, A. (2018), Codify: Parametric and Computational Design in Landscape Architecture. Routledge, New York, NY.

DEAMER, P & BERNSTEIN, P. G. (2010), Building (in) the Future – Recasting Labor in Architecture. Princeton Architectural Press, New Haven, NY.

ROWE, P. G. (1987), Design Thinking. MIT Press, Cambridge, MA.

YU, F., PASINELLA, M. & BREM A. (2017), Prototyping in theory and in practice: A study of the similarities and differences between engineers and designers. Wiley, New York, NY.