Deep Time: 100 Years of CELA
LANDSCAPE RESEARCH RECORD is published annually and consist of papers focused on landscape architecture subject areas. Each issue is a collection of papers presented at the Council of Educators in Landscape Architecture annual conference of that year. Conference theme is expressed as the subtitle of Landscape Research Record. The views expressed in papers published in Landscape Research Record are those of the authors and do not necessarily reflect the views of the conference planning committee, or the Council of Educators in Landscape Architecture.

PEER REVIEW OF PAPERS: All papers published in Landscape Research Record have been reviewed and accepted for publication through the Council of Educators in Landscape Architecture's peer review process established according to procedures approved by the Board of the Council of Educators in Landscape Architecture. Reviewers are recruited by track chairs from among conference attendees and other outside experts. The track chairs also serve as co-editors in the peer review process. The Council of Educators in Landscape Architecture requires a minimum of two reviews; a decision is based on reviewer comments and resultant author revision. For details about the peer review process and reviewers' names, see REVIEWERS in Table of Contents.

IN THIS ISSUE: In 2020, the conference committee accepted 421 abstracts for presentation and rejected 36 abstracts. Authors of accepted abstracts were invited to submit a full paper. Because the conference was cancelled, only authors whose abstracts remained registered were eligible to submit a full paper to be sent out for review. As a result, and after initial screening, a total of 57 papers were received but only 32 papers were selected and sent out for peer review. Finally, 18 papers were accepted for publications in this issue, with 6 CELA tracks having no accepted papers. The organization of this issue follows the standard conference tracks listed in the table of contents.
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March 18-21, 2020 (canceled due to COVID-19)
Welcome to the ninth issue of Landscape Research Record, published by the Council of Educators in Landscape Architecture (CELA). In 2013, the CELA Board approved and adopted a procedure to become fully responsible for publishing peer-reviewed conference papers annually and named the publication Landscape Research Record (LRR). LRR is a post-conference publication and published online only.

This ninth issue of LRR is a collection of peer-reviewed papers originally scheduled to be presented at CELA 2020 in Louisville, Kentucky. The 2020 annual conference focused on research, scholarship and creative activity that highlighted the theme of “Deep Time: 100 Years of CELA” which entered into discussions and debates intended to celebrate the centennial anniversary of the existence of CELA and examine avenues of progress moving forward.

This issue contains 18 high-quality peer-reviewed papers resulting from the conference. We hope you find them to be a collection of provocative and insightful research that enriches CELA’s dialogue of research and creative inquiry on the processes of debate and discussion.

Galen Newman, PhD, ASLA, APA
Texas A&M University
Editor-in-Chief, Landscape Research Record No. 9
CELA Vice President for Research & Creative Scholarship 2018-2020
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DESIGN EDUCATION AND PEDAGOGY

Edited by Benjamin George
PRODUCTIVE LANDSCAPES PAST & FUTURE:
RENEWABLE ENERGY TECHNOLOGIES IN DESIGN PEDAGOGY

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1 ABSTRACT

Current research on the intersection of landscape architecture and renewable energy production has largely focused on mitigating the visual impact of large-scale installations, understanding the social barriers that may arise from the potential disruption to the way of life in certain communities, and site planning to maximize the efficiency of these technologies. Implicit in this research is the view of technology as an “other” to be mitigated, concealed, accepted, or maximized for its utilitarian purposes. Largely missing from the conversation is inquiry on how park and public space design can embrace aesthetic and humanistic qualities in the integration of renewable energy technologies.

This paper seeks to bridge that gap by presenting a historical overview of the integration of infrastructure and technology, and two case studies for incorporation of renewable energy in landscapes as part of design pedagogy. The case studies feature work from a graduate landscape architecture studio, and an architectural history class taught at the University of Massachusetts Amherst. Findings from the case studies point to several challenges, such as integrating technology from the non-expert approach; the difficulties involved in incorporating innovation while providing opportunities for learning basic design skills, overcoming the entrenched belief in the separation of landscape and utility, as well as opportunities for continued engagement with other disciplines. A call for pedagogical models, such as transdisciplinary pedagogy—which are capable of transcending knowledge silos and embrace aesthetics and technology—is made in order to increase designers’ ability to contribute to the social acceptance of renewable energy landscapes.

1.1 Keywords

Productive landscapes, renewable energy technologies, pedagogy.
2 INTRODUCTION

Climate change mitigation calls for the rapid implementation of renewable energy in order to halt rising temperatures associated with the use of fossil fuels (IPCC, 2014). The IPCC has urged the adoption of renewable energy—energy produced from solar, wind, tidal currents and biomass—and called attention to the need to overcome social barriers that impede swift implementation of these energy sources (Moomaw et al., 2011). Current research on the intersection of landscape architecture and renewable energy production has largely focused on mitigating the visual impact of large-scale installations (Apostol, et al., 2016), understanding the social barriers that may arise from the potential disruption to the way of life in certain communities (Pasqualetti, 2011), and site planning to maximize the efficiency of these technologies (Stremke & van den Dobbelsteen, 2012). Implicit in this research is the view of technology as an “other” to be mitigated, concealed, accepted, or maximized for its utilitarian purposes. Largely missing from the conversation is inquiry on how park and public space design can embrace aesthetic and humanistic qualities in the integration of renewable energy technologies.

Belanger has pointed to several current challenges related to the integration of infrastructure in the landscape—as one primarily designed by civil engineers favoring efficiency, centralization, standardization (2012). This has resulted in the invisibility of infrastructure, disconnecting the public from things like sources of power; the promotion of singular land use patterns, parceling and closing-off the landscape; the fostering of permanent solutions which create a risky over reliance on one specific energy source; and the contribution to social marginalization by creating unnecessary physical division. Furthermore, urban design opportunities for using infrastructure as a “glue” of urbanization have been missed (Allen, 1999). The exploration of alternative models that seek to integrate energy generation into the fabric of the landscape in ways that overcome these challenges, presents itself as a highly relevant topic for design education. In order to begin to address this gap of knowledge, this study will present the case for revisiting the past and imagining the future as pilot exercises which may contribute to sustainable design pedagogy, especially as it relates to the integration of productive systems in public space.

2.1 A historical overview of productive landscapes

How can the past inform our present approach to renewable energy technologies? In her recent book, Landscape and Infrastructure: Reimagining the Pastoral Paradigm for the Twenty-first Century, Vickery explores the role of the productive pastoral landscape in art and architecture since the 17th century, presenting the pastoral tradition as a means of bridging the urban and rural, productive and aesthetic landscape (2019). She builds on ideas Leo Marx presented in his essay, “Does Pastoralism Have a Future?” wherein he discussed the role of art and technology in the pastoral tradition. Considering the profound and lasting changes that have resulted from the Industrial Revolution, Marx (1997) argued that we are now in a place of greater awareness of our role in environmental degradation: “This wholly new conception of the precariousness of our relations with nature is bound to bring forth new versions of pastoral. ...pastoral has always served to represent humanity’s awareness of its location on thresholds between the complex and the simple, between art and nature” (p.222).

Vickery’s overview of art and architectural history in the western tradition begins with examples of landscape painting and design that wed utility with aesthetics, civic pride and patronage with recreation and a connection to the natural world. For example, rather than mitigating views of and connections to pre-industrial technologies, Dutch landscape painters such as Jacob van Ruisdael established a tradition which celebrated the infrastructural systems which brought prosperity to the Netherlands. In most Dutch landscape views, whether urban or rural scenes, windmills punctuate the skyline and vie with church steeples for height and visual impact. Van Ruisdael’s Windmill at Wijk, of 1670, (Fig. 1) includes visitors walking along the river’s edge, dramatic cloud formations, and the windmill boldly set off against the sky and kissed by the sun breaking through the clouds. The prominence of this structure highlights the crucial role it played in the growth and development of Dutch society. Windmills not only served industrial purposes, but pumped water off the shallow seas and over tall polders in order to claim and develop land for urban and agricultural purposes. Rather than minimizing the visual role the windmills played in the landscape, painters such as Ruisdael celebrated their productivity. In a similar vein, landscape paintings by Ruisdael and his contemporaries included bleaching fields and healthy dairy
cows in their works, subjects that were also key to the economic prosperity of the Dutch in the 17th century (Vickery, 2019).

Figure 1. Jacob van Ruisdael, *Windmill at Wijk*, c. 1670.
Oil on canvas (Rijksmuseum, Amsterdam: on loan from the City of Amsterdam (A. van der Hoop Bequest)

This visual unity of productive systems and landscape continued through the 18th century in England with the development of the English landscape parks and the tradition of the *ferme ornée*. From William Kent’s landscape at Rousham to Capability Brown’s constructed naturalism, these landscapes were valued for their aesthetic properties and poetic allusions. But equally, the health of the sheep and cattle, the fecund meadows and well-tended forests, represented the source of wealth and prosperity of the English landowner (Williamson, 1995). These were sites of recreation and pleasure yet the health of the flora and fauna on the estate was vital to the wealth of the gentry. What is key here is the close connection necessarily forged between productive systems that powered society and the users of those landscapes.

In general, with the rise of the Industrial Revolution, such connections between productivity, landscape, nature, and the community were lost. While the aesthetics of the pastoral lived on in public parks and suburbs, productive systems have been sidelined and distanced from those who often benefited most from their output. An exception to this was the development of the Fairmount Water Works by Frederick Graff from 1812-1815. Located along the banks of the Schuylkill River in Philadelphia, Graff dressed this dam and pumping station in Palladian garb, with a harmonious series of small classical temples set above the graceful arches hiding the water wheels within. The system pumped water up to a reservoir (now the site of the Philadelphia Art Museum). The productive pastoralism of the site offered residents clean water and became a tourist attraction, celebrated for its classical beauty, educational features, and much needed utility. These examples demonstrate how aesthetics, community engagement, civic pride, and productivity were woven to create celebrated landscapes.

### 2.2 Productive landscapes in contemporary practice

Recent works, such as the Whitney Water Purification Plant in Hampden CT by Steven Holl Architects and Michael van Valkenburg Landscape Architects, or the collaborative construction of the
Solrødsgård Energy and Climate Park in Denmark, by Gottlieb Paludan Architects and Henning Larsen Architects, are linked to historical productive landscapes presented by Vickery (2019). These projects help dispel the myth that infrastructure systems have always been, and continue to be, a separate 'other', something to be minimized or mitigated. Through their skillful integration of utility, ecology and aesthetics, these projects begin to answer Bélanger’s (2012) question: “how then can we re-bundle and redesign essential urban services...as living landscapes that span the divide between economy and ecology facing contemporary cities” (p. 284).

While these examples present possible templates for the melding of infrastructure, ecology, and recreation as part of the landscape architecture practice, much remains to be explored in the realm of implementation of renewable technologies in the design of parks and public spaces. Consideration for the integration of these technologies at the scale of a park—arguably one in which landscape architects may have most influence—has remained largely unexplored. Furthermore, landscape architects’ engagement with renewable energy technologies as a design element has been timid, with few examples such as Hood Design Studio’s, Solar Strand (2012). In this realm, artists like Dan Roosegaarde and organizations like the Land Art Generator Initiative are taking the lead in promoting artistic practices that radically reimagine the aesthetic qualities of renewable energy technologies. However, within the landscape architecture field, design exploration that investigates the aesthetic and perceptual qualities of energy-generating materials as part of public space and park design deserve more attention (Aragón, 2019). In particular, design investigations that explore the role of aesthetics and beauty in supporting the social acceptance of these technologies, as expressed more than a decade ago by Meyer in relationship to ecology and sustainability (2008), have yet to be fully explored. The classroom may offer an initial setting by which to begin to address these challenges.

3 RESEARCH OBJECTIVES

This paper seeks to explore how new approaches to framing the incorporation of technology in landscape architecture and architecture contributed to promoting students’ understanding of and ability to design public parks integrating productive technologies. In particular the study focuses on two questions:

- How does looking at the past contribute to a better understanding of the productive potential of sustainable design?
- How does designing for the future—exploring the (re)-introduction of productive technologies in the design of public parks—build skills for improved sustainable design?

4 CASE STUDIES

The courses used as case studies present new ways to consider how productive landscapes may be designed and understood as part of design pedagogy. The two case studies presented: Architecture Now: a History of Sustainable Architecture and FutureParks describe how an architectural history class and a studio course sought to improve student’s understanding of the role that design, landscape architecture, and architecture have in contributing to public understanding of sustainability. The case studies provide two different methodologies for increasing student engagement with the subject. In lieu of a comparison, the case studies demonstrate alternative pedagogical approaches and analyze their results providing insight into challenges and opportunities found in their implementation. The case studies offer a description of the teaching methodology and analyze student’s understanding and skill development around the integration of productive technologies in the design of buildings and landscapes. The term productive technologies, is employed in this paper to encompass renewable energy technologies, food production, and ecological restoration. Results from the two courses are presented and structured to provide insight on issues which may serve to structure future pedagogy focused on the integration of productive technologies in public spaces.

4.1 Architecture Now: a History of Sustainable Architecture

(Undergraduate Lecture Course with Friday Discussions: 25 students)

In her class, “Architecture Now: A History of Sustainable Architecture” Vickery once again stressed the importance of history. Students were largely architecture or landscape architecture majors in
their junior and senior years. The course focused on the architectural canon and its outliers in order to understand the past and present relationships designers created between users and the natural world. Mondays and Wednesdays were lecture classes and Fridays were reserved for discussions around primary source readings. Both lectures and readings shone an eco-critical lens on the traditional canon by urging students to question traditional values in architecture and see instead how those values have shaped our approach to climate, materials and ecosystems. For example, much is made in the conventional canon of le Corbusier’s references to nature, both in his urban plans and domestic architecture. Through readings and discussions, students were asked to look more closely at that nature as a passive backdrop or framed feature within his white, boxlike forms. This methodology served as a platform for a deeper discussion of what that over-used term ‘nature’ actually meant in the 20th century and what it could mean for us today.

Each week, two students in the class posted a “Problem/Solution” onto an online forum. They were asked to feature an environmental problem and a recent solution to that problem. These ranged from fire-resistant geodesic domes to floating farms and resilient landscapes in coastal communities. Student responses to these posts showed critical thinking about the solutions, their possible pitfalls and increasingly, as the course went on, an understanding of the systems at play and the cultural ramifications of the proposed solution. While the class was centered on architecture, examples that featured a unity of climate, landscape, and productivity in tandem with the built environment offered the most powerful paradigms for students. For example, when architects such as Glenn Murcutt zoomed out from the structure itself to consider the local breezes, solar orientation, and community, his buildings became much more meaningful. From examples of early vernacular architecture to the work of Frank Lloyd Wright, Emilio Ambasz, and Stefano Boeri, the pedagogical stress was on transdisciplinary thinking to include questions of equity, natural systems and habitats, active and passive energy, and heating and cooling systems. Key to studying the architectural canon through the lens of sustainability is the understanding that by increasing the users’ connections to and relationships with natural and designed systems of energy production, water treatment and food production, we create deeper understandings of those systems and the role they play in our lives. Making these productive systems visible and connected to users or inhabitants of the buildings is a crucial goal of architects and thinkers such as William McDonough, Juhani Pallasmaa, and Jason McLennan.

At the start of the course, Vickery asked students to briefly define their understanding of what the term ‘sustainable architecture’ meant to them. Answers varied, but common to most were ideas about material resources, high-tech energy efficiencies such as HVAC sensors, digital technologies for smart city growth, and advanced engineering of solar and wind production. For the final exam, the professor returned their definitions to the students and asked them to reflect upon and refine their ideas. Overwhelmingly, students’ answers were deeper and broader than when they began the course. On the whole, students understood low-technology solutions, such as passive heating and cooling, orientation and window placement, and a more intimate connection with the natural world as key to reducing energy use. As Table 1 indicates, the connection between the built environment and community, the present and the past, and low-tech solutions became defining features for most students (see Table 1).

Table 1. Defining Qualities of Sustainable Design from the Start to the End of the Course

<table>
<thead>
<tr>
<th>Defining Qualities of Sustainable Design</th>
<th>start of course</th>
<th>end of course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical Precedents</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Benefits local ecologies</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>Minimal Environmental Impact</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Low-Tech Solutions</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>High Tech Efficiencies</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Building Materiality</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Social Benefits of Sustainability</td>
<td>6</td>
<td>17</td>
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As the graph above indicates, by the end of the course, students understood sustainable architecture as benefiting an ecosystem with deep roots in past traditions, and as part of a wider social and cultural network. Students’ ideas around sustainability shifted as the course progressed. This change in understanding seems to indicate that a growing awareness of the environment and the problems it faces could be achieved through exposure to historical precedents and a pedagogical re-focusing on outliers in the historical canon and the values and solutions they present.

4.2 FutureParks

The graduate landscape architecture studio *FutureParks* took place over the last seven weeks of the students first year in the MLA program at UMass Amherst in 2018 and 2019. The primary goal of the studio was to explore how landscape architects can design public parks as productive landscapes, with special attention paid to renewable energy production. In order to achieve this, a highly creative exploration seeking to integrate renewable energy technologies and their implications for the design of a public park took precedence during the design process. The studio challenged students to re-imagine the experience of public space and invited exploration for how new technologies or programs can be incorporated in visible and experiential ways. Additionally, the studio site, located in a 6-acre abandoned drydock in a rapidly developing area in the South Boston Waterfront, provided opportunities for addressing issues of climate change adaptation and resilience, as well as challenges and opportunities of water-dependent uses. In doing so it asked the following question: *How can renewable energy production, or other types of production, be harnessed programmatically and/or experientially in the design of a park?*

The studio work was divided in three phases: an initial *Site Mapping*, a *Techno-Human Prototype* exercise, and a *FuturePark Design* phase. The *Site Mapping* exercise encouraged students to critically explore the site through research and visual representation. Using cartographic information, photography, and diagrams, students created visual compositions conveying multi-layered meanings and highlighting potential elements, or processes for future development in their designs. Temporarily leaving the site aside, the *Techno-Human Prototype* asked students to imagine new ways for how renewable energy technologies may be experienced in a pleasurable way in public space. After collecting information on the technical aspects of a selected renewable energy technology (including spatial, temporal, mechanical and performance-based requirements), students were asked to create section-perspective drawings indicative of a “moment” or a “snapshot” envisioning how people may interact with the technology (see Figure 2). The section-perspective drawing provided an opportunity for students to create a hybrid form of representation in which technical information, and experiential qualities were explored. In the final phase of the studio, *FuturePark Design*, students were asked to incorporate ideas and themes developed in their previous projects, and incorporate them in their proposal for the park. In order to help with the transition of concept and prototype to design, case studies of contemporary waterfront parks were conducted, as well as diagramming exercises of organization principles. The purpose of this phase was to provide introductory park design skills, while simultaneously encouraging students to develop an original approach responding to their selected technological, programmatic and site elements.

![Figure 2. Water Wheel Techno-Human Prototype.](image)

Marcos Gonzales, 2019. Reproduced with student’s permission
The results of the studio can be understood based on how goals of renewable energy integration were achieved, how visible was the technology or the productivity of the park, and whether this integration contributed programmatically and experientially to the design. In order to assess this, student projects from two years (n=14) will be analyzed. Students’ choice of technology supportive of a productive park relied primarily on tidal or hydroelectric (with 8 of the projects including a variety of systems), followed by ecological restoration and aquaculture (5 projects), wind (3 projects) and solar (1 project). While most projects had a singular technological focus, 3 projects employed hybrid approaches where multiple technologies were incorporated, see Table 2.

**Table 2. Technology selection for productive landscape park design**

<table>
<thead>
<tr>
<th>Tidal/hydro</th>
<th>Ecological Restoration/ aquaculture</th>
<th>Wind</th>
<th>Hybrid</th>
<th>Solar</th>
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<tr>
<td>Vortex induced vibration</td>
<td>Floating marsh</td>
<td>Power kites</td>
<td>Tidal fence + Piezoelectricity + Microwind turbines</td>
<td>Photovoltaic panels</td>
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<tr>
<td>Power generating buoys</td>
<td>Living machines</td>
<td>Airborne wind energy</td>
<td>Vortex induced vibration + Solar &amp; wind harvesters</td>
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<tr>
<td>Barrage</td>
<td>Seaweed farming</td>
<td></td>
<td>Electromagnetic induction tidal energy harvester + aquafarming</td>
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<tr>
<td>Water wheel</td>
<td>Coastal restoration (oyster, eelgrass, saltmarsh)</td>
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In terms of visibility of the technology, students’ responses took a variety of approaches, ranging from the barely visible to the iconic. In half of the projects, the productive technology had a minor visual or experiential impact in the design of the parks. This can be understood as the public’s perceived ability to become aware of the implementation of the technology in the park. In other words, the quality of the technology or method of production could easily go unnoticed. Projects in this category exhibited some of the following characteristics:

1) Invisibility of the productive technology was caused by the necessity of being implemented under water. This was the case for aquaculture and coastal restoration projects as well as some tidal energy projects.

2) The integration of technology under spatial infrastructure (paths or bridges) which may go unnoticed. This approach was used primarily by students employing tidal energy technologies such as tidal fences, vortex induced vibration, and barrages.

3) The difficulty in perceiving “productivity” in ecological restoration.

Efforts to overcome some of the challenges of invisibility included the artistic incorporation of elements that would heighten the experience of the phenomenon or serve as interpretive signage of technologies employed in the park. These ranged from lighted floating buoys marking aquaculture sites, the playful fish-shaped sculptures recording tidal shifts, and eelgrass inspired playgrounds (Figure 3).
Additionally, the purposeful design of built elements within the site created expanded opportunities for viewing and interaction. Viewing towers, floating docks, and large windows for viewing fish and aquaculture, created spaces to experience the parks’ hybridized approach to the built and the natural. Finally, programmatic enhancements to increase access and legibility of the productivity of the park were employed. These included kayaking around aquaculture buoys, fishing and cooking sites, and tidal swimming pools.

Projects in which the productive technology was highly visible or dominant exhibited the following qualities:

1) Landmark/focal point: an approach in which the technology became a dominant singular element or its singular grouping served to call attention to the park or organize the space. Examples include a large water wheel, a sculptural power buoy, and the clusters of power kites.
2) The productive technology necessitated or was interpreted to be deployed using major building infrastructure. These projects created large buildings on site to house living machines or to provide habitable spaces above the ground plane.
3) The technology was deployed in a visually significant manner across the park without obstructing human use through canopies, vertical and floating elements, or embedded in walkways.

Despite the various levels of visibility of the productive technology within the design of the park, the studio brought attention to how such incorporation could follow familiar patterns of spatial organization. These included strategies to define spaces, edges, paths, thresholds and foci (Dee, 2004). Table 3 describes how productive technologies were integrated using these spatial organization principles, while Figure 4 presents some examples.
### Table 3. Spatial organization of productive technologies

<table>
<thead>
<tr>
<th>Spatial Organization</th>
<th>Productive technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spaces</td>
<td>Solar panels (canopy)</td>
<td>Technology creates a continuous or perceived horizontal plane used to visual or experiential spatial definition.</td>
</tr>
<tr>
<td></td>
<td>Aquaculture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ecological restoration</td>
<td></td>
</tr>
<tr>
<td>Definition through horizontal plane: ground and canopy</td>
<td>Paths</td>
<td>Piezoelectric tiles</td>
</tr>
<tr>
<td>Threshold</td>
<td>Tidal fences</td>
<td>Technologies were embedded at the intersection of spaces, or the technology broke up the ground plane creating interstitial spaces.</td>
</tr>
<tr>
<td></td>
<td>Water wheel</td>
<td>An approach in which the technology became a dominant singular element or its singular grouping served to call attention to the park or organize the space.</td>
</tr>
<tr>
<td></td>
<td>Power buoy</td>
<td></td>
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<tr>
<td></td>
<td>Power kites</td>
<td></td>
</tr>
<tr>
<td>Foci</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edges</td>
<td>Power Kites</td>
<td>Technologies with vertical dimensions used to define edges.</td>
</tr>
<tr>
<td></td>
<td>Wind harvesters</td>
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</tr>
</tbody>
</table>

![Figure 4. Tidal fences as thresholds, Kinjal Desai; Wind harvesters as edges, Nigel Cummings. 2019. Reproduced with students’ permission.](image)

## DISCUSSION

Findings from the course and studio pedagogy point to opportunities for improving student understanding of the need for creating social acceptance of renewable energy technologies as part of sustainable design, as well as providing students with the expanded set of challenges and opportunities afforded by including productive technologies as part of the design process. The results of the course demonstrate the potential for including historical precedents and art history to the increased understanding of sustainability—one that includes culture, history, context, and human connection to technology. Additionally, exercises that ask students to investigate design and practical solutions to environmental problems may enhance students’ understanding of the connection between technology and social acceptance, as well as provide students with a route by which to envision themselves as...
advocates for this integration. Challenges found in the methodology of the course pointed to difficulties in questioning the architectural canon when not all students were well-versed in it. Additionally, the divide between landscape and productivity is deeply embedded in our conventional views of the natural world and breaking down those barriers remains an issue in our drive for productive landscapes.

The studio presented a different set of challenges and opportunities, as it sought to both increase students’ awareness of the need for integrating productive technologies, and challenged them to implement this as a major goal of their park design. Among the major challenges was the lack of familiarity with the technological requirements of renewable energy sources. The lack of expertise and unprecedented nature of the design challenge placed students in a position where they may have not felt the necessary confidence to adapt the technology to best be incorporated within the design. Perhaps through a more in-depth understanding of the technologies or through transdisciplinary collaboration with scientists and engineers, new and better forms of integrating productive technologies at a park scale could be attained. Additionally, questions related to the ability to scale and transform some of these technologies into elements that contribute to the experiential quality of parks remained. Issues of scale, such as the size and number of elements that may be required to provide sufficient output to be serviceable and contribute for their productivity, not just as a demonstration, surfaced during the studio. Additionally, some of the technologies presented limitations to their implementation as elements to enhance the user’s experience in a park setting: the power kites require a height that makes them too tall to provide significant opportunities for spatial definition at a human scale, working best as focal points or landmarks; tidal energy technologies may work best below the ground surface--making them largely invisible—or may require the fragmentation of the ground across horizontal and vertical planes; and the dynamic nature of the resource to be translated (wind, tide, sun) increased the level of difficulty in the design integration. Invisibility also was a major challenge for students. Underwater aquaculture and coastal restoration elements are difficult to use as design elements when they are hard to be seen or experienced.

Considering the studio involved students in their first year of a graduate program, these design challenges were a noticeable constraint. However, many of these challenges point to opportunities that can guide future transdisciplinary collaborations with scientists, artists, and the general public, to create innovative landscapes that can contribute to energy, resource production, or ecological restoration in ways that are effective, beautiful, and socially acceptable. For instance, in addition to maximizing energy output, can the design of renewable energy technologies be designed such that it can be implemented at the park scale? Can it be done in a way that it can provide public amenities? Can its output be made visible in such a way that it increases public understanding and appreciation of how it interfaces with the landscape? Furthermore, the studio brought forward the question of the incorporation of renewables as part of adaptation strategies—can berms, seawalls, and other waterfront structures designed to contain flood waters also harness tidal energy, support other forms of renewable energy production, or be used as productive landscapes? The studio piloted initial ideas and processes by which students were encouraged to design human-scale environments that actively connect the public to the production of energy, food and clean water, going beyond the goal of public acceptance to create moments of urban delight.

6 CONCLUSIONS

The integration of productive landscapes into design pedagogy calls for expanding students’ exposure to different bodies of knowledge. This includes historical examples and narratives from outside the canon; providing access to better understanding of technological information pertinent to the particular workings of each productive system; and active inquiry into the role that aesthetics and design may have in contributing to social acceptance of productive landscapes. The latter remain closer to the core of landscape architecture and architecture as they embody design and humanistic principles that can help translate or create engaging spaces where these technologies are embodied in ways that are not just acceptable but desirable and enjoyable. Overall, the case studies point to four directives which may be implemented to support the integration of productive landscapes in design pedagogy:

1. Expose students to a wide range of historical examples, especially those that reframe the perceived divide between productivity and aesthetics. Precedents, such as those discussed in Vickery’s book, provide ideal examples to explore this relationship.
2. Provide opportunities for students to imagine new solutions for integration of productive technologies. Both the studio and lecture course show the benefit of allowing students the freedom to imagine new ways to implement renewable energy technologies.

3. Increase and encourage knowledge outside the field through collaborations with scientists. Additional support and/or technical advice to better understand the workings of technologies would be highly beneficial. Active collaboration with scientists and engineers would allow for creative dialogue, the identification of challenges and opportunities in new forms of technological implementation, and provide better understanding of potential outputs or productivity levels for each system.

4. Encourage the use of spatial organization techniques as a way to incorporate technological elements. Using renewable energy elements to define spaces, edges, paths, thresholds and foci (Dee, 2004), can be effective in providing a seamless integration. Additionally, it can serve to bridge the perceived challenge of introducing the topic to entry level design students.

As we work to integrate new technologies into our public spaces to mitigate or manage our changing climate, we need to re-examine our connections to nature, landscape and productivity. The pedagogies outlined above offer the means of bridging the typical gap between public spaces and infrastructural production and point to the value of looking to the past and the future as part of the pedagogy of sustainability. In particular they call attention to the value of visualizing productive systems as part of a larger process of re-imagining our relationships with nature, renewable energy production, and the infrastructures which power societies. While there were many challenges related to the technological aspects of the productive systems, several opportunities for continued development through transdisciplinary collaborations were developed. The examples and case studies presented provide a pilot for pedagogical frameworks which may further a designer’s contribution to sustainable and resilient landscapes.

8 REFERENCES


THE “HERE AND NOW TIME”: TEMPORARY GARDENS AS DESIGN ENQUIRY

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1 ABSTRACT

The last few years have seen a surge in temporary gardens. The flexibility and new challenges involved in conceptualizing and building non-permanent landscapes, has made them a creative and stimulating testing ground for designers. A study of the phenomenon of temporary gardens is relevant for several reasons. First, because it expands the literature on ‘temporary urbanism’. Secondly, because it makes a relevant contribution to the disciplines of garden design and landscape design. The practice of temporary gardens involves a different conception and embodiment of time in design of space – from ‘linear’ time and cyclical time to ‘the immediacy of here and now’. The emergence of ‘temporality’ as design enquiry has prompted designers to look at practices other than garden design. The reason for the garden to assume a temporary form, is to respond to recent changing societal needs. The first ephemeral gardens are the well-known pre and post second world war ‘victory’ gardens (early examples of temporary or ‘meanwhile’ community gardens). However, the research has reconstructed a more complex story. The first substantial experimentation in temporary gardens has been made by performance, conceptual, and environmental artists in the 1970s. In their hands, the garden acquired a political meaning; it was a tool of the ecologically-driven global mass movement that was questioning and subverting mankind’s disruptive relationship with the environment. For the artists, the combination of ephemerality and the garden was a design strategy to manipulate the time expressed in ecological and social processes.

Since the 1980s, the ephemeral garden has been used as a form of public art to great advantage of the public and private sectors (Theokas, 2004). It has become an ‘exhibit’ showcased in the open-air museums of the ‘temporary garden festival’. The short lifespan, the small size and the status of exhibit, are conditions that have propelled designers to explore alternative expressions of time in space. The temporary garden is a ‘garden-installation’ – one where the spatial relationships between the actors and the artefacts are dynamic and subvert a linear or cyclical notion of time (Cauquelin, 2005); and a ‘conceptualistic garden’ (Richardson, 2008) – where temporality matches with generation and communication of rapidly changing ideas that inform evolving markets. The focus on ‘expression’ and ‘narrativity’ in design suggests that temporary gardens are an experimental ground of the broader discipline of landscape architecture, and are contributing to reaffirming it as a critical cultural practice.

The temporary gardens that have increasingly colonized the urban public space are bottom-up and grassroots expressions of ‘insurgent public space’ (Hou, 2010), or public-private led activities that expand the notion of public art by embodying transient modifications of place, and community participation. From temporary parks to pop-up gardens, these spaces combine multiple activities happening at the same time, organizing the changing and chaotic dynamics of nature, culture and the actors of such setting. This exercise of making time into space means essentially to amalgam a number of times -- individual, communal, biological as ‘mapping and overlay of the different rhythms and systems’ (Akiko, 2013).

In conclusion, the attribute of temporality in gardens does not simply affect the duration of the physical space of the garden, but it revolutionizes the whole concept and process of designing time into space. As such, the investigation of the practice of temporary gardens holds the premise of making a relevant contribution to both the practice and theory of design.

1.1 Keywords

Temporality; spatial design; design process; time-focused design
2 INTRODUCTION

As a practitioner within the design collective LAND-i archicolture, co-funded in 2000 with landscape architects Marco Antonini and Roberto Capecci, I have conceptualized and built till this day a number of 17 temporary gardens and landscape installation in the context of garden festivals and more recently in urban open space in Italy, France, Canada, England, Germany, Singapore and the United States.

For us, young architects and landscape architects just graduated from the University of Rome “La Sapienza”, the international competitions launched worldwide by private and public institutions since the late 1990s that oversaw the realization of temporary garden festivals, were a good opportunity to exercise our design skills, explore the theme of the landscape in a short-term format, and capture the attention of the international press. Little did we know that we were participating in a broader debate that was to influence the discourse on landscape design and garden design, and that the phenomenon of temporary gardens would soon spill onto the urban open space as part of the broader incidence of temporary urbanism.

The International Garden Festival of Chaumont sur Loire (France), started in 1992, and the Jardins de Métis Garden Festival (Quebec, Canada) started in 2000, are two of the most renewed venues where we have built a temporary garden. The French and Canadian garden festivals (on-going, yearly events) are indeed a “laboratory” of ideas for garden and landscape design, as many critics have commented. Winning projects are selected through an international open-ideas competition, and construction of the gardens is funded by the festival’s foundations. Designers take part in most stages of the life-cycle of the garden: conceptualization, including delivery of design concept and detailed design; construction of the garden (oftentimes in collaboration with local landscape architecture students involved in this process) and presentation to the public – this stage involves designers who inform the media and interpret the garden to visitors during the opening day.

Following the success of these festivals, measured both in terms of audience (they are open-air exhibits accessible through an entrance fee) and media coverage, many such events have come into being since 2000. Some events only last for a few seasons, for instance the Westonbirt Festival of the Garden (Britain, 2003—2005); while other events are on-going, such as the Ponte de Lima International Garden Festival (Portugal, yearly event since 2005), or are permanent exhibits, such as the Cornerstone Garden Festival (Sonoma, US, since 2005). Further, while these garden festivals take place in venues that are outside of cities, other similar events have come to be realized in urban open space. Well known are the Lausanne Jardins Garden Festival (Switzerland) reoccurring since 1997, the Temporären Gärten in Berlin (1997—2003), and the Bilbao Jardín Garden Festival (Spain, 2008—2011).

The media has increasingly turned its interest towards these temporary garden exhibits by publishing garden images in magazines ranging from general culture, to sports, home décor, garden design, politics and art. Garden catalogues from the festivals have attempted to interpret the gardens for visitors and the media, while several books concerned with landscape design and landscape architecture have critiqued many of these ephemeral gardens. By evaluating the gardens based on their supposed contribution to the conceptual sphere of garden-making, these publications reiterate the message that temporary gardens implemented in garden festivals are advancing the discipline of garden design. Ephemeral gardens implemented in these festivals are praised for their emphasis on production and display of novel ideas. Johnstone (2007) suggests these events have participated in “recovering the garden” and “infusing it with poetic meaning and expanding the very idea of what a garden is, or can be”. The temporary or “exhibited” garden is considered a new type resulting from the manipulation and alteration of traditional garden typology taking place in the controlled environments of garden festivals. Temporary gardens have been included in the broader sphere of “conceptualistic gardens”, a term coined in 2008 by the renewed critic of garden design, Tim Richardson, in his publication “Avant Gardeners”. The critic defines conceptualistic gardens as those whose uniqueness resides in being “underpinned by a single idea or concept, which informs every aspect of the design”. The numerous temporary gardens that he investigates in his book obviously inspired the term.

Having participated as a designer in the discourse around temporary gardens, and being also a teacher, I have become interested in the phenomenon per se, and its implications on design-based research. However, while several publications have addressed the theme of the temporary garden built in the context of garden festivals taking place since the 1990s, it seems to me the phenomenon has not been explored in its broader expression. First, there does not seem to be a publication that extends the study of
temporary gardens spanning from those implemented within garden festivals to those implemented in urban open space. As such, the phenomenon has not been historized. Were temporary gardens implemented in garden festivals from the 1990s the first of their kind? What were the underlying motivations that propelled institutions and designers to adopt and promote temporary gardens? Were garden designers responding to changing societal and political needs?

Secondly, in terms of design-based research, what are the characteristics that define the temporary garden and its supposed contribution to the discipline of garden design that could be useful to both pedagogy and practice? What does the temporary garden add to the conversation around temporary urbanism? Lastly, does the practice of temporary garden-making affect the way urban open space can be used, and in what manner?

3 METHODS

The scope of this research is multifold. On one hand, I have been interested in extending the history of temporary gardens by understanding its beginnings, the motivations and underpinnings of contemporary garden festivals, and the implications of temporary gardens in urban open space. Critic John Dixon Hunt remarks that temporary gardens are quite a recent phenomenon (Hunt, 2014). But how recent is this phenomenon, and what are its roots?

On the other hand, my interest is on the temporary garden as an extension of design-based research, the temporary garden as object of design enquiry. While several publications agreed that temporary gardens implemented in garden festivals have been indeed making a relevant contribution to the discipline of garden and landscape design, much could still be added to elucidate the manner in which this occurred? To accomplish these two goals, multiple paths have been taken.

First, a pure literature review to expand the history of temporary gardens. The definition for “temporary garden” was articulated by using a catalogue classification scheme (Deming and Swaffield, 2011). Gardens were classified and divided into groups, where different kinds of temporary gardens were described and organized, with main ideas discussed.

The catalogue is a collection of items identified and brought together based on some shared quality (for instance typical properties, pattern, behaviors or themes); the following step in classification is to search for patterns that might occur, which would afford further insight on the nature of the phenomenon. Classification research is designed to generate a sample that represents a range of differences and similarities (Deming and Swaffield, 2011, 129).

A particular kind of catalogue, which is very relevant for this study, is the “typology” – a classification scheme that seeks to categorize variant design forms typically as a response to pragmatic cultural and environmental problems (Deming and Swaffield, 2011, 133). My assumption is that the temporary garden is a new genre, an evolution of the garden into a defined typology. Also, that this overarching typology comprises a number of types that, although distinct in certain features, have some commonalities that define them.

Secondly, presentations of case studies are made, which not only describe the gardens and their process but compare them in order to present some generalizable data. This draws specifically on one quality or pattern analyzed, concerning the aspect of design in relation to the theme of time – to prove the thesis that the aspect of temporality does not affect only the duration of the work, but the whole concept and process of designing. The collected and elaborated data has been used as evidence to support this claim. (Booth, Colomb and Williams, 2003, 32).

The investigation therefore proceeded on different levels. Setting out to extend the history of temporary gardens, the initial literature review started from abundant publications related to garden festivals implemented since the 1990s and their temporary gardens, which seemed to be the most acknowledged form of ephemeral gardens. In the search for transient gardens implemented on urban open space, a literature review was made relating the phenomenon of “temporary urbanism” – the temporary use of empty spaces in urban areas aiming to revitalize them.

To decipher the temporary gardens, two actions were made: focusing the literature review to synthesize and abstract core concepts related to design critique; and then testing these assumptions on selected temporary gardens created across various years by a number of designers, artists, landscape architects, etc.
The selection of temporary gardens was made across three periods that saw the insurgence of temporary gardens identified from the literature review as defined by the researcher’s reconstruction of its historical evolution: the 1970s and the insurgence of temporary gardens made by avant-garde artists, the 1980s and 1990s with the consolidation of temporary garden festivals as forms of urban regeneration of cities and regions, and the recent phenomenon of temporary urbanism.

The study of the literature defined a potential list of gardens to be examined, which was shortened based on four distinguishing features -- the case studies needed to be designed for a purpose, to be a space, to contain plants, and to be conceptualized as temporary.

Parallel to the literature review, a progressive identification of some temporary gardens worthy of further studies was conducted on the basis of the four distinguished characteristics, and their designers were contacted to gain information (such as drawings, texts, images). As landscape design critics John Dixon Hunt and Karl Kullman point out, when criticizing ephemeral gardens designed for garden festivals “it is really only when a garden is explained [...] that these rather gnomic projects make much sense” (Hunt, 2014). A number of fifty designers gave their material. Recollecting such documentation, it soon became clear that designers extensively documented the garden, both in words and with other media. However, this effort was done as much to document, and display, the meaning of the garden, as to actually make such meaning alive, that is to transform abstract themes into concrete physical spaces.

4 LITERATURE REVIEW AND SYNTHESIS

4.1 Extending the History of Temporary Gardens

An extensive literature review resulted in the reconstruction of the historical evolution of the phenomenon of temporary gardens, identifying three periods that saw the insurgence of different forms of temporary gardens: the insurgence of temporary gardens made by avant-garde artists in the 1970s, the consolidation of temporary garden festivals as part of urban regeneration projects of cities and regions in the late 1980s and the 1990s, and ephemeral gardens implemented since 2000 in urban public space as part of the incidence of temporary urbanism.

The initial literature review was based on publications that essentially feature temporary gardens implemented since the 1990s for garden festivals. Amongst them were the catalogues of the exhibits, as well as books documenting those exhibits, or contextualizing temporary gardens within the broader sphere of contemporary garden and landscape design (Waugh, 2016; Barbaux, 2015; Zamora, Mola, Fajardo, 2010; Sanchez Vidiella, 2008; Barbaux, 2008; Bahamon, 2005; Hill, 2004; Pigeat, 2004; Cooper, 2003; Jones, 2003).

A constant trait that defined ephemeral gardens made in garden festivals seemed to be an association to art practices. Boudreau (2007, 159) highlights that garden festivals “offer an important and appealing space for artists seeking a wider audience”, and that garden art belongs to the sphere of public art, whose primary purpose is to connect artists to the general public. Johnstone (2007, 7-9) surfaces that artists’ interest towards the garden might have been connected to an earlier phenomenon when, in the 1970s, artists sought to break out of gallery contexts to explore new territories and question contemporary artistic practices. She alludes to the theories explicated by French garden design critic Cauquelin, who defines the temporary garden conceptualized for fairs and garden festivals as an “exhibited garden” and “installation garden”.

In highlighting the connection of the temporary garden with art practices, these suggestions paved the path to further research the relationship between avant-garde art, public art and the garden, as well as the significance of garden festivals as incubator of novel ideas around the garden, and the insurgence of the temporary garden as a possible mutation, or evolution, of the garden.

The connection between art and landscape architecture was restored anew in the 1990s by several renewed landscape architects, among whom Peter Walker and Martha Swartz, who both explored the theme of the temporary garden. Martha Swartz’s temporary “Bagel Garden”, which she built in her Boston’s house in 1979, is a notable precedent. Incidentally, Walker and Swartz were included in a new wave of “avant-garde” designers by landscape architect and theorist Brenda Brown, in her article ‘Avant-Gardism and Landscape’ (1991). She pointed out a movement of designers with an intention to bring innovations to landscape design, suggesting they “commonly express three fundamental objectives: (1) to make a landscape architecture that is art; (2) to make works that are visually strong; and (3) to make works that are
meaningful” (Brown, 1991). The term “avant-gardeners” is borrowed several years later by Tim Richardson 
(2008), who underlines that almost all renown contemporary landscape architecture firms have built a 
temporary garden -- including Dutch West8, Berlins Topotek 1, Canadian Claude Cormier, American firms 
Topher Delaney, Ken Smith, Gustafson-Porter, Michael van Valkenburgh and Cao Perrot. A community 
amongst these designers seemed to be their rejection of the “romantic” and “naturalistic” tradition of western 
garden design, in favour of the influences of “modernism, postmodernism, pop art, and land art”.

In his “Grounds for Review. The Garden Festival in Urban Planning and Design” Andrew Theokas 
reconstructs the evolution of garden festivals from horticultural events to temporary garden exhibits 
conceived as an amalgam of cultural and commercial imperatives. He makes the connection between 
garden festivals and public art-based cultural regeneration programs activated by governments in the 1980s 
and early 1990s. In the venues of garden festivals, public artworks and theme gardens came to be exhibited 
in an open-air museum setting, for instance in the Liverpool (1984), Stoke-on-Trent (1986), Glasgow (1988), 
Gateshead (1990) and Ebbw Vale (1992) garden festivals, which involved the requalification of large areas 
of derelict lands in Britain’s post-industrial districts. Progressively, in those venues the theme gardens 
became the sole attraction of the festivals, themselves assuming the status of public artworks.

The history of temporary gardens follows the evolution of horticultural shows that flourished in the 
west during the era of "industrialization", which focused on trade and display of exotic plants as well as 
technological advances and inventions in the field of horticulture and were connected to a general trend of 
world’s fairs and expositions designed by nations to showcase their achievements. However, in horticultural 
expositions the ephemeral gardens for a long time resulted in mere exhibits of plants or national gardens 
styles that did not propose much innovations in garden design. A notable exception are the temporary 
gardens designed for the 1925 Paris Exposition Internationale des Arts Decoratifs et Industriels Modernes. 
which focused on conceptual design, while their aesthetics were closely connected to the arts of that era 
(Dodds, 2002)

The “Petit traité du jardin ordinaire” by Cauquelin (2003) highlights that in garden festivals 
implemented in the 1980s, art and garden hybridized in new ways. Participating in the resurgence of the 
arts in public debate, the garden transformed into an object of aesthetic consumption, a “fashion victim”. 
She suggests that, in “importing” contemporary art in the garden grounds, a public mechanism seemed 
necessary to trigger the shift: this was the objective of the exhibition, be it garden festival or other. The 
garden hosted by the festival became the place where such exchange of culture took place: the “exhibited 
garden” was born as a contemporary variation of the garden, which was morphing into a public artwork. 
During this transformation, the garden left the classical and humanistic grounds that traditionally 
characterized it, to venture towards new territories (Cauquelin, 2005).

Theokas, Cauquelin and Johnstone agree that the practice of temporary gardens implemented in 
garden festivals has been making a relevant contribution to the discipline of garden and landscape design. 
They underline that a postmodern influence is responsible for the mutation of temporary gardens into public 
artworks, which is discernible in a re-invention of the traditional vocabulary that structures the garden: the 
use of an eclectic mixture of styles, the reference to different historic periods and the deployment of 
vernacular architectural details. Further, postmodern ideals have driven designers of themed gardens built 
for garden festivals to experiment with and combine different mediums. They employ mixed-media and 
materials that were not previously used in garden making. The new approaches to garden design in 
ephemeral gardens are contributing to the making of the contemporary idea of the garden as a “hybrid that 
draws on and is influenced as much by the garden and its history as by art and architecture, urban and 
industrial design, film theatre popular culture and new technologies” (Johnstone, 2007, 8).

Most importantly, in defining the temporary garden as “exhibited garden” and “installation garden”, 
Cauquelin surfaces that these novel statuses change drastically the way the garden is conceptualized, built, 
and experienced. The suggestion given by Johnstone exhorted me to check the role of avant-garde art, 
and artists, in the making of the temporary garden. The publication “Transplant: living vegetation in 
contemporary art” (Nemitz et A., 2000) studies the artworks made by a number of contemporary artists who 
have used living plants as their medium, including some temporary gardens. 

It surfaces that artists have been interested in nature for its intrinsic qualities of living, evolving 
material, starting to use it as a medium of expression since the 1970s. Finding the practice of working with 
nature exciting and unconventional, they engaged nature because working with life and death manifested: 
time, matter and decay, and the interaction of the artists and visitors with plants as live beings revolutionized 
the processes of conception and making of the art-piece. The author underlines that, in manipulating nature
in a garden, land artists, earth and environmental artists, as well as conceptual and performance artists, engaged a critique that influenced and triggered a public debate, thus making a fundamental contribution to the 1970s ecologically-driven global mass movement, which was striving to question and subvert mankind’s disruptive relationship with the environment.

In the artists’ temporary gardens, the ecological stance and the conceptualistic approach seemed to merge. Broadening the research to embrace the work of a number of avant-garde artists -- quite an exhaustive list is contained in the publication “Land and environmental art” (Wallis and Kastner, 1998); and contacting the artists directly -- revealed they used ephemeral gardens to explore a primordial state of things, the earth, life and evolution, and mankind’s destructive relationship with the environment. In doing so, not only did artists allowed nature to physically enter their work as a predominant feature, but also revealed the social and cultural aspect of nature.

The legacy of 1970s’ artworks on the conceptualization of the current idea of temporary gardens -- with artists and designers transforming gardens into installations, performances or events -- seems strong. Artists such as Helen and Newton Harrison, Robert Smithson, Bonnie Ora Sherk and Howard Levine, Liz Christy. Kate Ericson and Mel Ziegler engaged the theme of the temporary garden. Through their hands, nature acquired a political meaning; it was used as a critique, and the expression of certain ideologies. The research surfaced that artists employed nature to engage urban public space, proposing remedies for social or environmental concerns. They used the garden as the tool for a revolution, where nature was both represented in unconventional ways and manipulated to engage live processes.

The investigations of the explorative actions performed in the 1970s on and with nature in the city revealed a discourse that, mostly from the new millennium, has led to the widespread phenomenon of temporary gardens in the urban environment. Works such as the 1970’s Portable Parks I-III by Bonnie Ora Sherk and Howard Levine (Ora Sherk, 2020) -- replicated in Rebar’s PARK(ing) Day, an annual worldwide event where artists, designers and citizens since 2005 transform parking spots into temporary public parks and gardens -- or Liz Christy’ 1970s community gardens in New York (Green Guerrillas, 2020) have constituted a replicable model, in so far they impressed in people’s mind that public space could be re-imagined and debated by all, and in connecting the idea of nature and the garden to the city. Artists’ nature in the garden was charged with political meanings embracing the social and the environmental spheres: nature brought back to the urban environment for food produce; nature growing to mend the city’s polluted environments; nature as expressive form to denounce environmental concerns; nature revitalizing socially, culturally and aesthetically the ‘dead’ spaces in the city; nature that was portable and temporary, meanwhile, evolving; and nature brought back as collective or individual endeavor.

This new understanding was cross-referenced with a literature review revealing notions around temporary gardens that, since 2000, have increasingly colonized urban open space as part of the phenomenon of temporary urbanism. Similar to public art, these gardens advocate a role as catalysts of urban transformation. The critique claims that their condition of temporality is in fact the motor that triggers urban change (Overmeyer and Misselwitz, 2011).

The actors that promote and conceptualize temporary interventions in urban open space, including ephemeral gardens, range from the public to the private sectors, as well as self-empowered communities and individuals. Some temporary initiatives involve artists and are promoted by municipalities to improve an area’s image, with the ultimate aim of increasing land value. The main objective is to revitalize the social role of public space by involving the community in various ways. Ultimately, these projects encourage the creation of new social networks, eventually translating cultural vitality into economic dynamism. Inherent in these initiatives is a municipality’s tendency to understand temporary projects as forms of public art that have the potential to reinforce and build social capital, provide educational opportunities for residents, and help trigger a process of urban regeneration (Bishop and Williams, 2012).

The publication “Temporary Urban Spaces” (Haydn, 2006) examines meanings and perspectives of temporary and interim uses of urban spaces promoted in present times by the private and public sectors, as well as ephemeral interventions that sprout as bottom-up, grassroot activism. These various practices of temporary urbanism, which include parks and gardens, have two merits that pertain to their temporary nature as well as the practice of inclusion. The short span of existence of the work accounts for more intense interactions and deeper changes in perceptions. Through the act of participation, people became part of the artistic production, of the urban actions, while the event becomes part of them, and this ultimately implies radical change (Haydn, 2006, 92).
Temporary interventions, including gardens, have proved to be a good alternative to top-down government planning, which tends to be costly, slow, and constrained by bureaucracy, as well as primarily focused on end results. For many reasons, public authorities have embraced the “meanwhile” as a momentary solution for citizens and interest groups to appropriate mostly vehicular urban environments, transforming them into pedestrian and community-oriented places. By promoting the design of low-cost parklets in underutilized vehicular spaces (for instance car parks or excess roadways) the San Francisco’s “Pavement to Parks” program has augmented the creation of pedestrian-friendly spaces (Groundplay, 2020). This praxis learns from a tradition of parklets and other temporary landscape spaces and playgrounds popular in 1960s in American cities, especially in New York.

A different set of temporary gardens sprout from bottom-up, grassroots activism. They are amongst those temporary “claims” in the city made by involved citizens. These actions have been interpreted as urban ‘interventions’ or “reconfigurations” of space seemingly spontaneous or arising without consent, which vary from art installations to urban agriculture (Bishop and Williams, 2012). Temporary gardens are part of those ephemeral, meanwhile or interim social and artistic interventions implemented by citizens and communities in public space of cities around the world that often represent “small yet persistent challenges against the increasingly regulated, privatized and diminishing forms of public space” (Hou, 210). Hou claims that these temporary interventions are forms of “insurgent public space” that consist of reactions against the current state of urban public space, which is often configured as a place of exclusion.

Today’s temporary gardens, as previous pioneering artists’ interventions, often claim underutilized spaces in the city, or spaces which the community feels are less and less available to the population, privatized and commercialized – often defined as Privately Owned Public Spaces or POPS – or simply invaded by cars. Carried out on a larger scale, the grassroots, bottom-up activities involve a growing number of people in collective and individual experiments that reclaim meanwhile nature in the city, sending ecological and social messages in an informal manner, out of the rigid confinements and regulations dictated by conventional state-led urban planning.

In essence, the closer connection between art and garden that started in the 1970s, increased the popularity of the later, stressing the idea of the garden as a medium of expression, while making explicit that new forms of garden were possible, which could be temporary and itinerant. In the process of using the garden as art venue, the artists brought a novel sensibility, which differed from that of garden designers, and their endeavours widened the traditional vocabulary of garden design. By focusing attention towards nature in urban public space and placing an emphasis on process rather than product, artists revealed the natural inclination of the garden towards flexibility and variability, stressing an ephemeral and meanwhile quality of nature in the city, which paved the way for alternative, social forms of appropriation of urban space.

4.2 Deciphering Temporary Gardens

Deciphering temporary gardens meant to abstract from the literature core concepts related to the design critique. One of the scopes of the literature review was that of overcoming the distinctions in design critique that is usually operated both in public artworks and temporary gardens. The two prevailing critical paradigms that have been used to evaluate public artworks are the “productionist” and the “semiotic” paradigms. The “productionist” paradigm has sought to evaluate public artworks through the examination of practices, structures and procedures of production, while the “semiotic paradigm” employs the techniques of “iconographic reconstruction”, claiming that public art has the ability of turning “space into place” and arguing that there exists some “quality of place” that can be captured through the practices of planning and design, and that public art has managed to distil and articulate these essences, investing abstract concepts with a social meaning (Hall and Robertson, 2001).

In a similar manner, researchers that study the phenomenon of temporary urbanism – which includes temporary gardens built in urban open space – examine them as “actions” and “practices” implemented by the various actors who engage in the requalification of cities’ public space (Hou, 2010). On the other hand, ephemeral gardens implemented in garden festivals are praised for their supposed capacity to provide experiences, contributing to defining novel manners of infusing meaning to space and ultimately creating “place”. On these grounds, in 2008 Tim Richardson in his publication “Avant Gardeners” included temporary gardens in a broader sphere of “conceptualistic gardens”.
In short, there seems to be a divide between an understanding of public artworks (and temporary gardens) as cultural expressions -- an approach that recalls their ‘semantics’ -- that is relating to their meaning and how it is created through signs and symbols, the visual and linguistic; and as activities -- that is by looking into the practices and procedures of their production.

The divergence between “process” and “representation” in temporary gardens has been delineated by Karl Kullmann, in his evaluation of the temporary gardens built for the 2011 Xi’an International Horticultural Exposition in China (Kullmann, 2012). He divides the gardens made for the event in two groups: the “processual” type gardens and the “representational” type gardens, where the design of the latter focused on representation of landscapes – either mythical or nation-states, and the “processual” concepts were seeking to embody and amplify dynamic ecological processes, mostly by employing the inherent plants’ qualities of living, evolving material. Kullmann notes that the design-brief given to the teams participating to the garden-exhibits, challenged them to “move beyond ‘language, image, character, or subjectivity characterized by the romantic, expressionist, picturesque, or vernacular” (therefore a garden layout revolving around a thematic representation), by substituting in its place a methodology of “process… collective engagement [and] translative definitions”.

In his review, Kullman makes the connection between thematic design and meaning-construction (story-telling) in temporary gardens, an idea that is also placed forward by the garden critic Tim Richardson in his book. In “Landscape Narratives” (1998), landscape architects Potteiger and Purinton explore the concept of the landscape as a narrative. In their work, they attempt to decipher the significant relationship between narrative and construction of space in landscape architecture and landscape design. Furthermore, they attempt to understand the design processes and methodologies that have been used in landscape design and in the design of gardens to activate narratives through the manipulation of space. They recognize story-making or narrative as a practice that is necessary in garden and landscape design in order to link the intangible aspects of place-making – sense of time, event, experience and memory – to the more tangible aspects – forms and space, elements, and processes. This recognition follows the theories developed in the 1960s and 1970s by French philosopher Jean Paul Gustave Ricoeur, who expanded the study of textual interpretation to include the ‘narrative theory’. By theorizing that narratives combine two dimensions: a temporal sequence of events, and a non-chronological configuration that organizes narrative into spatial patterns, Ricoeur made the connection between ‘narrativity’ – or story-making -- and space-making.

For understanding landscape narratives, Potteiger and Purinton elaborate on key concepts adopted and adapted from contemporary narrative theory. They refer to the literary works of de Saussure, Levi-Strauss and Barthes. In the exercise of understanding the manners in which narratives have been constructed through landscape design, the theorists uncover the role of “figures of speech” or “tropes” such as metaphor, metonymy, synecdoche and irony, and discuss the concepts of the “realm of story”, “context/intertext” and “discourse” as components that are crucial to the understanding of the narratives of the landscape.

Incidentally, Potteiger and Purinton’s metaphor of the garden “walls” as “contextual/intercontextual realm” – a heterotopic site where space and the elements in space are strategized into a “cultural system of signification” that has to be contained within an enclosure – fits well the condition of the ephemeral garden built in the “fair” or “exhibit”, which intrinsically implies the construction of artificial settings that are centered on narratives and ideas. The design of temporary gardens made for exhibits revolves around the orchestration of an artificial world, thus pushing to the extreme the natural condition of the garden as artifice. The fair posed a novel challenge to the garden -- the absence of a context as reference for design; the traditional garden walls are the delimitations of the barren and compartmentalized lots of the exhibition, which appear much like empty museum rooms. However, despite the illusion of enclosure, the stories narrated by the garden are necessarily interrelated with other aspects “outside” the physical boundary of the garden exhibit.

Naturally, the exhibited garden becomes the ideal ground for experimentation that uses devices or schemes traditionally employed to construct meaning or narrative in the garden: metaphor (transfer), metonymy (association), synectode (fragment) and irony (incongruity), which perform the function of relating one thing to another. Specifically, those devices can be used by the designer to relate the garden-layout or some of the elements that compose it, to a wider context or landscape of reference, therefore opening “other associations, references and codes beyond the intention of the author” (Potteiger and Purinton, 1998).
On the same lines as Potteiger and Purington, landscape architect and critic Anne Whiston Spirn advocates for understanding landscape as a ‘carrier’ of meanings. She underlines that “landscape has all the features of language. It contains the equivalent of words and parts of speech – patterns of shape, structure, material, formation, and function. All landscapes are combinations of these”, and, in synthesis, that “Landscape is scene of life, cultivated construction, carrier of meaning. It is a language” (Spirn, 1998). Spirn explores ways of using the language of landscape to interpret the landscape, and also as a framework for action. Making a parallel between landscape and language, she analyses figures of speech and rhetoric as they can be employed to decipher the landscape and uses this approach as a vehicle to rehabilitate communities in the landscape.

In these theoretical underpinnings, “narrative” is seen as a procedure for form-generation and the construction of an experiential journey. However, as Alon-Mozes (2006) has highlighted, neither Potteiger and Purington nor Spirn translate this framework into a design tool kit, and the discourse is therefore still open to interpretation. Similarly, these experiences are of some help in attempting a design critique on temporary gardens, but do not entirely solve the divide between a semiotic and a productionist evaluating paradigm.

On the other hand, looking at the temporary garden as essentially an artwork, opens new perspectives. The book “Transplant: living vegetation in contemporary art” (Nemitz, 2000) suggests that for the artist that uses nature as a medium – the artist-gardener – “works with plants are dynamic forms that develop with temporal dimensions”. In a garden that is conceptualized mainly as a work of art, the artist encounters “something that is alive” -- the plants, which “exhibit relationships of dependence by virtue of the constant need for suitable living conditions”. As such, “the artist's intervention is a manipulation of life processes which in turn provide a feedback” (Nemitz, 2000). The publication suggests that time, and therefore process, is a key element that helps deciphering a temporary garden as much as an artwork. Permanent landscapes and gardens have a sense of time embedded in their physical aspect. It is expressed through cyclical times (the seasonal and ecological cycles) and linear times (the biological evolution of plants). The users of the garden inherently interact with these cycles. The temporary gardens, due to their limited lifespan, deploy plants to explore concepts of time, evolution and change, in a third dimension of time that is neither linear nor cyclical.

In comparing the ephemeral gardens made by the artists in the 1970s and 1980s, with temporary gardens implemented in garden festivals since the 1990s, it became clear that both used the ephemeral garden as experimental grounds for a physical or metaphorical use of nature. Some artist-designers employ vegetation as a medium to carry messages that recount mankind’s often difficult relationship with nature. While the issues at stake may be be partly social or historical, they also have to do with genetics, identity and artificiality. Others manipulate plants as material for scientific experimentations. The exposure and treatment of genetically modified plants or use of test-beds that study the plants' phases of germination and decay, ultimately propel the garden’s makers, and its users, to deal with the themes of life and death manifested. These ephemeral gardens expose controversial messages about our exploitation of the planet. Ultimately, in the exhibited garden, the designer, much like with a work of art, manipulates life-processes. However, while a gardener chooses biological considerations above the semantic ones – he is interested in plants for their productive use – in the arrangement of the garden the artist-gardener places meaning above utility, or decorative appeal (Herbstreuth, 2000, 143). The artist-designer chooses the garden as a medium to explore life-processes and to express these processes into a physical space. The garden gives him/her the opportunity of using plants to organize a situation where "artists and viewers have an opportunity to experience themselves within a living whole, and the roles of producer and recipient shift towards participation". The relationship between the plants, the objects in space and the visitors is then strategized as in installation art, with alternative scenarios that take place temporally as well as spatially. This key to reading a temporary garden – by understanding gardens as artworks and looking at time and process by hypothesizing different dimensions of time that are neither linear nor cyclical -- finds other confirmations.

Cauquelin (2005) reads temporary gardens as garden-installations. Her understanding of temporary gardens learns from Claire Bishop’s definition of “installation art” as “the type of art into which the viewer physically enters, and which is often described as ‘theatrical’, immersive’ or ‘experiential’”, although, Bishop remarks, the works appear very diverse in terms of appearance, content and scope (Bishop, 2005). Cauquelin suggest they take shape within the fundamental traits of the postmodern movement in relation to art, namely:
• Theatricality -- a concept relating to “performance” or “performativity”, to the actors as well as “acting” and “staging” a situation. The presence of actors -- live performers -- gives the installation an inherent theatricality. In both mediums, installation art and garden installation, the spectator is conceived as an active participant and contributor of the work, and an integral part of the significance of the project. The spectator is part of the piece, sometimes even author of the garden itself. The evolution of the user from “spectator” to “actor” underlines the inherent theatricality of the work.

• Narrative -- a concept relating to the notions of “acting”, “fiction”, “narration” and “narrativity”. The evolution of a narrative inherently brings-in and connects to time, which becomes an essential defining characteristic of the garden-installation, with respect to the intended ephemeral nature of the work, as well as the duration of the narrative experience. Developing a narrative in the temporary garden – the staging of a story that involves the actors and the space – means to use time and conceive of time as one would when strategizing an installation.

• Site -- the specificity of “place”, which appeals to the concept of “in situ” and “site-specificity”; it connects to the idea of constructing the garden as a defined, self-sufficient place, a “world by itself” or microcosms. In an installation its designer strives to set the displacement of visitors inside the fictitious site of the artwork, and builds the narrative as a measure of such displacement. The “exhibited garden” exists in the endless duration of the exhibit that one enters, in the process of timeless wondering within the work itself. Paradigm of the contemporary, scenography where the scenic space became “place”, the garden proposes/sets re-orientation and displacement as necessary measures to enact the performance. This novel condition of the garden oftentimes determines a complete detachment from the environment of the festival grounds. The site of reference of the garden is not the physical context of the fair, but the inner world that is created within the boundaries of the garden exhibit. The very essence of events such as fairs and garden festivals reside in their being “heterotopic” sites – fictional settings designed to provide visitors with novel experiences, whose layouts are devised as “worlds within worlds”. The “fair” is a real place that juxtaposes several spaces, thus dealing with and displaying various layers of meaning or relationships to other places foreign and “other” than immediately meet the eye. In this manner, the ephemeral garden pushes to the extreme the condition of the garden as an inner, self-sufficient, and enclosed magical world.

• Impurity – implies notions like “citation”, “fragmentation”, “heterogeneity”, “hybridization” and “interdisciplinarity”. This concept applies to materiality and cross-breeding of different media and materials. Garden spaces are not defined by their materiality. Artists and designers of temporary gardens use an unlimited diversity of materials. For the sake of interactivity, designers interbreed and weave varied media: sound, videos, photography and other technologies to complement, hybridize or substitute practices of horticulture and traditional elements that make the vocabulary of gardens. In this manner, the exhibition becomes a condition inherent to the work, and influences temporal and spatial practices.

In synthesis, the temporary garden is a garden-installation, and as such it defies the conventional notion of linear or cyclical times explicated in the logic of organization of space. The French-language literature on the practice of art installations, and how it relates to studies on landscape, is quite exhaustive. The publication “L’installation. Pistes et territoires” (1997, 26) edited by the Centre des arts actuels Skol, sited in Montreal (incidentally, the Jardins de Métis Garden Festival takes place nearby the city) points out that the art installation designates in the space an ‘open geography’ sculptural piece, while Cauquelin (2005) underlines that in the garden installation, “fragments”, “citations”, “allusions”, and “signals” interact with each other to multiply the possible readings of the garden, so that the interpretation of the work does not converge towards a final and univocal meaning.

One can derive that the installation garden, much like installation-art and environmental art, can be inscribed within a new understanding of the garden-artwork: the “time-space paradigm” (Centre des arts actuels SKOL, Cotton and Bérubé, 1997, 73). These theories resemble concepts expressed in the paper collected in Landscape Research Record No.01 “Sculpting in Time: Transient Landscapes and Time Focused Urban Design” (Akiko, 2013), which explores temporary, small-scale urban design projects. These projects are implemented in urban public space with the idea of temporality in landscape, proposing its role...
as an active and formative design element in shaping the contemporary landscape architecture discourse as well as physical design. The author suggests these recent transient projects seem to be successful in bringing a sense of being “here and now” into the public sphere. Transient interventions do not rely on sense of time embedded in the physical aspects of landscape itself, such as ecological cycles, biological evolution and expression of season, but exhibit a different aspect of designed time: “in contrast to a linear understanding of time […] the quality of contemporary transient projects can be said to offer alternative scenarios that take place temporally as well as spatially.”

With reference to the relationship between time and landscape design, the article suggests that designing a landscape “inherently involves setting up and organizing time –be it, expected plant growth, growth patterns, scheduled maintenance…” In essence, in a designed garden, as well as in a designed landscape, the “projection and manipulation of time(s) is perhaps as determining in the success of a design as the formal layout and materiality of physical space.” What we design as “landscape” is not a product/object, but we design the “landscape of becoming” (Akiko, 2013).

4.3 Time is the Variable that Defines the Design of Temporary Gardens

On one hand, the portion of research conducted through a literature review sought to extend the history of temporary gardens by understanding its beginnings: avant-garde gardens implemented since the 1970s, the motivations and underpinnings of contemporary garden festivals in the 1980s and 1990s, and the implications of temporary gardens in urban open space. On the other hand, the research also wanted to abstract from the literature review core concepts related to the design critique and test these assumptions on selected temporary gardens made along the years by various designers, artists, landscape architects, etc. This procedure wanted to use the garden as an object of design enquiry, in the belief that the investigation of the practice of temporary gardens would make a relevant contribution to both the practice and theory of design.

It is in the second instance – the design critique – that the research ultimately focused. Concepts abstracted from the literature review were used to criticise the design of temporary gardens. First, the use of a “semiotic” paradigm or “productionist” paradigm to evaluate the gardens, amply used in the evaluation of public artworks. While the first leverages the concepts of iconographic reconstruction, thematic design, production of “place” and “meaning”, and ultimately promotes conceptual design – a design whose uniqueness resides in its being underpinned by a strong idea, which informs all aspects of the design; the second paradigm evaluates gardens on the basis of practices, structures and procedures of production, an exercise essentially made to assess gardens built as recent practices of temporary urbanism.

However, these two paradigms seem to accentuate a divergence between “process” and “representation” in temporary gardens, which ultimately did not help in evaluating the individual garden. The extension of these theoretical underpinnings brought forward by Potteiger and Purinton, as well as Spirm, helped to tie them together. The narrative theory attempts to link abstract concepts to spatial patterns. While the critics refer to narrative as a strategy that means to connect the intangible aspects of place-making (such as sense of time, memory and event, experience) to the more tangible aspects (elements and processes, shapes and space) thus overcoming a divide between a semiotic or productionist mode of evaluation of the garden, they leave the design critique open to interpretation.

At this point, the critique revolving around temporary gardens manages to expand the above assumptions relating to the evaluation of public artworks, as well as complement the design critique concerned with landscape design and landscape architecture. Reading temporary gardens as exhibited gardens and garden installations, allows Cauquelin to explore further the “time-space paradigm” to substantiate an effective design critique that goes beyond the divide of “representation” versus “process”. First, she expands Potteiger and Purington’s metaphor of the “contextual/intercontextual realm” – the garden as a heterotopic site where space and elements in space are organized into a “cultural system of signification” contained in the enclosure. The installation garden is itself “site” or “place” – both representation and process – which, Cauquelin comments, exists in the duration of the exhibit that one enters, in the process of timeless wondering within the garden itself.

When confronted with an installation, the spectator does not just pass by or in front of the art-object but is integrated into a situation in which he/she is inherently part of the object. The installation and the staging of the “situation” resolves in the establishment of a unique set of spatial relations among the object and the architectural space, which forces the spectator to become part of the situation – the set of
circumstances - that are created (Centre des arts actuels SKOL, Cotton and Bérubé, 1997, 17). The installation-practice binds the "performance of the work" -- therefore a spatial dimension -- and the "performance of the actors" that are part of the work. As such, the garden installation, which is essentially made of the interactions between the "actors" and the "space", and the objects in space, takes place within a certain ephemeral dimension of time (Cauquelin, 2005).

In this manner, the garden is both a representation of an event, of a concept – a scenography – and a performance, a "work in progress". These assumptions imply that the temporary, exhibited garden, as installation, is the orchestration of a loose geography, or relationship, of people and objects in space that is not unidirectional, but multi-directional. The ephemeral garden, as installation is the organization of space as setting of parts into a relationship.

This takes the design critique of the garden to a further level. What emerges, although not explicited, is that time is the variable that defines the design of the space. Time in temporary gardens does not merely influence the duration of the garden, but changes the whole process of designing the physical space of the garden, and of orchestrating the relationship of people (users and designers) events, and objects in the space.

As Akiko (2013) highlights, the landscape planning and design discipline are based on a very linear, or cyclical, understanding of time. However, transient projects in urban space renounce this vision, to embrace the "spirit of the moment". He suggests that "instead of placing and organizing people, programs and events in a universal calendrical and linear time, understanding 'locality of time' is based on the idea that landscape architecture is made up of individual times, communal times, biological times, evolutionary times of the natural world, geological times, etc." A transient project, including a temporary garden, seeks a "locality of time", which ‘refers to the amalgamation of a number of ‘times’ as experienced and lived by people." In essence, the immediacy of the "here and now" time, as opposed to a linear, or a cyclical time, is what the temporary installation, including the temporary garden, is about.

5 RESULTS

The literature review has highlighted a constant trait in the process and outcomes of design in temporary gardens. Time as essential factor in design seemed to distinguish the overarching typology of the "temporary garden". To test the assumption that the attribute of temporality in gardens affects not merely its physical durations, but the whole process of design and the construction and experience of its space, a number of 70 temporary gardens have been analyzed. The information – texts, images, drawings, etc. describing the processes of conceptualization and construction of the gardens – were provided directly by their designers. The gardens have been divided into groups on the basis of two distinctive qualities abstracted as finding from the literature review: showcased, juried gardens, mainly built in garden festivals (oftentimes defined by the critique as “exhibited garden”, “installation garden” and “conceptualistic garden”), versus publicly accessible gardens, which are either grassroots gardens or commissioned gardens (overall, the urban gardens have been defined by the critique as "pop-up gardens", "guerilla gardens", "meanwhile" “interim” or “provisional” gardens, “activist gardens”, “community gardens” and “parklets”).

For each garden a description was made, and their design process was analysed. The research attempted a time-focused design enquiry into the four chosen defining characteristics of the temporary garden -- designed for a purpose, a space, containing plants, and temporary. The gardens have been compared in order to obtain some generalizable data.

Both the literature review and the examination of case studies revealed that purpose and promoters of the garden (whether it spurred as guerilla urbanism or was a commissioned, exhibited garden) have a major influence on its scopes and the processes of its design, including conceptualization, construction and use. The choice of a particular kind of catalogue – the typology – which seeks to categorize variant design forms as a response to pragmatic problems (in this case cultural and social challenges) was of use.

The condition of the exhibit consistently overlaps with the scopes of conceptual design – the examination of the gardens showed a design strategy essentially focused on placing forward an overlaying concept or idea that would attract visitors; strictly, time-focused design to translate an abstract concept into a spatial experience. The design process of the "exhibited garden" seems to constantly reflect on certain themes that are inherent to the praxis and theory of garden design. As Hunt remarks, in garden festivals "the history that is addressed directly, or usually by implication, is the tradition and idea of garden itself".
This is the reason why garden festivals have been defined as exciting venues “able to provoke rethinking about how to augment the traditional vocabulary of garden making” (Hunt, 2014, 146).

To evaluate the gardens, the critique had used the “semiotic” paradigm. However, it did not help much in the design-enquiry. A review of the process of conceptualization of the garden undertaken by each designer (so adopting a processual or “productionist” evaluating paradigm) and a comparison across different gardens, brought to light that almost all exhibited gardens shared a certain complexity in their conceptualization, mainly in the variety of mediums used by the designer to translate the idea into a spatial experience. An explanation is that models, sketches and other mediums produced by the designer in the conceptualization phase, help both the jury evaluating temporary gardens during the selective open-ideas competition, and the general public, who, once the work is realized, will appreciate its narrative both in person and through the published images.

These findings reinforce the presumed quality of the garden as space “designed for a purpose”, where time seems to be an active and formative design element that informs the process of conceptualizing the garden. Sketches, models and digital simulations help to concretize an idea or concept into three-dimensional space. The temporary garden “Stone’s Throw” (figure 1) shows various mediums the design collective LAND-I archicolture with the author used along the path of transforming an abstract concept into a space. Models, sections, plans and the collage were part of the conceptual design submission to the Cornerstone Gardens Festival in Sonoma.

As the artist LeWitt has pointed out, in conceptual art the “idea” or “concept” that the artist wants to place across is the most important aspect of the work. Exhibited gardens have been defined as “conceptualistic gardens” because they share the same philosophy. In conceptual art “all of the planning and decisions are made beforehand and the execution is a perfunctory affair” (LeWitt, 1967, 79-83). In this framework, time is a necessary element that shapes the process of exploring and expressing ideas through the constructed garden-space, much like it is a necessary element that shapes a conceptual artwork. Further, the timings of conceptualizing the garden, or the artwork, are neither linear or cyclical, as the designer’s productions (the sketches, models, etc.) develop in disparate directions and intersect, influencing one another.

In this regard, the temporary garden expands the praxis in landscape architecture and garden design. In his 1973 review of a Frederick Law Olmsted exhibition at the Whitney Museum, the land artist Robert Smithson observes that “the maps, photographs, and documents in catalogue form... are as much a part of Olmsted's art as the art itself” (Smithson and Flam, 1996, 119), an assumption that might be applied with equal validity to Smithson's modus operandi.

Figure 1. “Stone’s Throw” by LAND-I archicolture; Cornerstone Gardens, Sonoma (California, 2004). Sketches, models and images transform an element of the landscape (a stone) into three-dimensional dry garden space, with micro gardens placed in holes. Documents by the author, landscape architects Roberto Capecci and Marco Antonini.

Secondly, the literature review has highlighted that the spatial logic of the installation seem to consistently apply to exhibited gardens. A comparison of case studies’ spatial design under the lens of installation art,
has led to explore the use of time in relation to the design of “space”. The temporary garden challenges one of the conventional means that landscape designers employ in permanent gardens and parks to orchestrate a narrative as form-generation.

Traditionally, the garden is conceived not as object to be looked at, but as a route to be experienced. Its layout encourages users to deploy their time to understand the space and participate in an experience. By leading visitors in a motion throughout the three-dimensional garden space, designers activate the progression of time. The concepteur lays out the garden’s space so that it invites the visitors in a process, or deambulation – a ‘promenade’. Sequence after sequence, the spatial story made by the narrator, made of ‘stations’ and features of the garden dislocated in space, is disclosed to the visitor. This implies a use of linear time to orchestrate the space of the garden.

However, due to the limited space available and the design brief, which implicitly requires to construct a highly performative space, designers in temporary gardens activate motion by borrowing strategies from other visual arts, such as pop art, minimal art, postmodern art or performance and installation art. These practices result in artworks that provide the viewer with options and flexibility in his/her experience of the space. This means that the user can choose to interact with different things and situations simultaneously. Instead of an experience arranged through a linear passage of time, the designed space proposes dynamism and the “immediacy of the now”. The performance in the garden is achieved through the spatial relationships between the actors, the objects and various media that interact, each with its own performative time – such as sound, performance, video, etc.

The images of the temporary garden “Ombre” designed by LAND-I archicolture for the 2002 Jardins de Metis Garden Festival (figure 2) showcase the spatial experience of the garden from its entrance (a series of dunes which disguise the inner space, in order to create a feeling of anticipation), the array of seemingly identical hollows placed randomly that reproduce the bare landscape of a Mediterranean necropolis, and finally the close-up personal experience of the viewer who discovers diverse micro-gardens that populate the crates.

Figure 2. “Ombre” by LAND-I archicolture; Jardins de Metis International Competition (Quebec Canada, 2002). Documents by the author, landscape architects Roberto Capecci and Marco Antonini.

The idea of a temporary garden containing plants, holds both a challenge and an opportunity related to designing time. What showcases the passage of time in permanent gardens is primarily the growth of plants, and the decay of the built features that make the garden. Usually, a garden is made of living matter. In gardens the growth, the development and decay of its constituent elements actively involves and displays the concept of time. The evolving shape and colours of plants reveal the changing seasons; the interaction of living creatures sustains evolution and processes. Through the metamorphosis of living matter dictated by the passing of time, the garden acquires the ability to speak at a more conceptual and emotional level. However, permanent gardens engage a “linear” passage of time, in which past and present never meet or interact with each other.

In temporary gardens, the limited existence challenges the expression of time as linear passage showcasing the growth and evolution of plants, or the aging of its constituent features. To engage and display time, temporary gardens have to renounce the linear conception of time. They do so through a manipulation of natural elements that explores the concepts of “decay” or “entropy” (the inevitable deterioration of the artwork; a term used by land artist Robert Smithson to define his work). Natural elements
might well be plants, or some agent of weather that is embodied as active component of the work -- for instance sunlight and its visual effects in the garden -- the shadows; water, wind, and so on.

Other designers manipulate plants as material for scientific experimentations. The exposure and treatment of genetically modified plants, or use of test-beds that study the plants’ phases of germination and decay, ultimately propel garden’s makers, and its users, to manifest the themes of life and death. In a garden that is conceptualized mainly as a work of art, the artist encounters “something that is alive” -- the plants, which “exhibit relationships of dependence by virtue of the constant need for suitable living conditions”. As such, ‘the artist’s intervention is a manipulation of life processes which in turn provide a feedback’ (Nemitz, 2000).

Ultimately, the temporary gardens use plants to engage and display ecological processes and explore the concept of time, evolution and change. For the artist-gardener “works with plants are dynamic forms that develop with temporal dimensions”. (Nemitz, 2000). Some temporary gardens show ‘nature’ as commoditized aesthetic entity, exploited for economic gain, objectified resource for scientific enquiry. Searching a suitable paradigm for questioning mankind’s contradictory and evolving relationship with nature, designers oftentimes use the avant-garde device of the “inventory” or the “serial repetition”, showing plants trapped, caged or bottled. In doing so, they also expose, and criticize, some of the strategies employed in the landscape architecture practice to tame the environment.

In the garden-installation “Survival Piece VI: Portable Farm” (Figure 3), commissioned by the Houston Museum of Contemporary Art (1974), Helen Mayer and Newton Harrison arrange the plants in a situation where their physical development is accelerated (due to the light boxes). Visitors have multiple experiences of growth and decay of nature, which help them to grasp some of the social and environmental challenges of California’s landscapes. “The Eden Laboratory” (Figure 4, left) designed by Paul Cooper for the 2002 Jardins de Metis garden festival is described as “a machine to test and show visitors how plants respond to various adjustments in their natural growing conditions” (Jardins de Métis, 2002).

In the exhibited installation garden, the artist-designer chooses the garden as medium to explore life-processes and express them into a concrete space. Designers and viewers participate of a living whole, and immersive experience. As for installation art, in the installation garden alternative scenarios (the plants, the objects in space and the visitors, as well as the relationships among them) take place simultaneously, temporally as well as spatially.

Because of its hybrid, multisensory and interactive character (spectator vs. plants; plants vs. space; space vs. spectator), Kris Verdonck’s “Exote” garden (Figure 4, right) leans towards installation art. Displayed in a museum, it results in the staging of a situation where visitors interact with 100 invasive plant and animal species by walking around the garden in protective suits, having been previously provided with the list of plants, and their “travelling history” as invasive species. In Exote, objects and plants – animate and inanimate beings -- are placed in a theatrical environment in which visitors become part of the scene. While the use of plants in permanent landscapes and gardens shows a sense of time embedded in their physical aspect (expressed through cyclical times -- the seasonal and ecological cycles -- and linear
times — the biological evolution of plants, temporary gardens are performances and installations that stage the relationship between plants and users in the immediacy of being “here and now”, therefore in a dynamic space and a third dimension of time that is neither linear nor cyclical.

In temporary gardens made in urban open space, process, as it relates to the actors involved in the making and the use of the garden and their interactions (people interacting among each other, and with the work in progress) takes on a particular significance. This is quite a substantial difference that emerges when comparing gardens made in urban open space with the other category identified (the exhibited gardens), where designing with time essentially takes the conceptualization phase of the garden, or the orchestration of its spatial experience. In the exhibited garden, seldom the public is involved in designing or making the garden.

Temporary gardens that have increasingly colonized the urban public space are bottom-up and grassroots expressions of “insurgent public space” (Hou, 2010), or public-private led activities that expand the notion of public art by embodying transient modifications of place, and community participation. From temporary parks to pop-up gardens, transient garden spaces in cities combine multiple activities happening at the same time. This implies that the designer makes the effort of organizing the changing and chaotic dynamics of nature, culture and the actors of such setting. This exercise of making time into space means essentially to amalgam a number of times — individual, communal, biological as “mapping and overlay of the different rhythms and systems” as underlined by Akiko (2013).

A designer might frame the construction of the garden as an exploratory, open-ended design process, which could include various members of a community. This implies making space for the dynamics of the actors who make the garden, as well as the dynamics among those who use and experience the garden. These people, from mere “spectators” become participatory “actors”.

Artist Nicolas Pinier, author of the “Jardin de Voyage” (Figure 5, left) realized at the 2001 Berlin Temporare Garten, defines his work as an installation, urban action and garden. It is a D.I.Y. garden rolled out from a trailer, with connects to the context thanks to its interactive nature that incentivizes social networking. In the artist’s intentions, the garden’s mission was to challenge the relevance of daily behaviours and the reasons that motivate them. Orchestrated by time—gained time and lost time—and by space—permanent or to be travelled—socially determined behaviours are reviewed and reversed by the artist (Pinier, 2003).

“Public Farm 1” (2008), outdoor extension of the MOMA museum in New York, built by 150 volunteers and conceptualized by WORK Architecture, was intended to condense in one spot urban agriculture and a variety of recreational activities. The garden was made of a bridging structure of cardboard tubes filled with 23 types and 51 varieties of herbs, fruit and vegetables, shaped to carve a multitude of spaces below, including a large party space, more intimate zones for children and a pool. Its sectional drawing (figure 5, right) shows the arrangement of elements in space promoting activities and an overlapping program of
events, which gave visitors multiple choices prefiguring a focus on present time (as opposed to a linear or cyclical time experienced in gardens); people were then empowered to assume control on the rhythms of the passing of times in that space.


6 CONCLUSION

The paper proposes a key to reading temporary gardens – by understanding them as artworks, and looking at design process by hypothesizing different dimensions of time in space that are neither linear nor cyclical. The literature review cross-referenced with the examination of the case studies has surfaced several findings that extend the history of temporary gardens and showcase them as locus of design enquiry.

Across periods that see the birth and development of the contemporary ephemeral garden, the design processes that inform it have taken a point of departure from the practices of design of permanent gardens, and the reasons are multifold. Designers invented the temporary garden to respond to changing societal and environmental challenges. Further, not finding in garden design a suitable language, they borrowed the art's vocabulary and procedures of production. Spanning from the 1970s till this day, the temporary garden has been a tool for design-based research, which resulted in broadening the themes and processes that inform the making of the garden.

Ultimately, the hybridization with art practices placed a focus on design as process, rather than design as product. Process is explicated in the act of conceptualization of the garden – when designers use an expanded range of media to develop a concept into built space; in the orchestration of the garden’s space to frame a narrative where relationships among objects and people (designers and users of the garden) are dynamic. In the space, individual, communal and biological times overlap, interact and hybridize. Process is explored through the use of plants – the living matter. All these three manifestations of process defy the conventional linear or cyclical times of the garden, to explore a “here and now time”.

Lastly, in urban temporary gardens process is mostly explicated in the modality of use and management of the garden, which depends on a complex orchestration of interactive spaces and programs, combining multiple activities happening simultaneously.

In conclusion, the attribute of temporality in gardens does not simply affect the duration of the physical space of the garden, but it revolutionizes the whole concept and process of designing time into space. The temporary garden can be a useful medium for practitioners as well as for teachers to explore with students time-focused design processes involving conceptualization, spatial design, experiments with plants, use and management of gardens.

7 REFERENCES


HISTORY
THEORY AND CULTURE

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AFFORDANCE VALUE OF 2D PLAY ELEMENTS: ADDING PERSPECTIVES FROM LANDSCAPE ARCHITECTURE

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1 ABSTRACT

The affordance value of play spaces is a well-researched topic within the literature surrounding environmental psychology, childhood developmental psychology, and public health (Jongeneel, 2015; Sporrel & Withagen, 2017; Prieske et al 2015; Cosco, 2006; Croft et al, 2017; Kytö, 2002; Sandseter, 2009; Heft, 1988, 1989; Larrea et al, 2019; Withagen & Calijouw, 2017). Historically, there have been many challenges made to playground design, specifically arising from the issue of underutilized or unattractive spaces, and how to maximize developmental value within play environments.

This is particularly of note within the Canadian context, as parent groups are often responsible for the fundraising, planning, designing, and constructing of playgrounds for public schools. This paper will argue there are gaps within the existing research in which elements of a playscape are evaluated based on a current criteria for play affordance that does not adequately account for two-dimensional (2D) play opportunities, and thus does not provide a reasonable precedent for pursuing economically affordable and accessible alternatives to traditional three-dimensional playground design pursuits going forward.

We argue in this paper that the existing research studies on affordances within play environments do not adequately account for 2D play alternatives, and that landscape architecture and design is an overlooked perspective from the existing multidisciplinary studies. 2D installations can offer imaginative, self-directed play opportunities that are an economically viable alternative to traditional 3D play structures, and remain appropriately positioned within the context of affordance evaluation.

1.1 KEYWORDS

Affordance; environmental psychology; landscape architecture; affordance-based design; accessibility
INTRODUCTION

The development and study of play environments for children has long been a topic of research in the fields of child developmental psychology and public health (Jongeneel, 2015; Sporrel & Withagen, 2017; Prieske et al 2015; Cosco, 2006; Croft et al, 2017; Kyttä, 2002; Sandseter, 2009; Heft, 1988, 1989; Larrea et al, 2019; Withagen & Calijouw, 2017). Historical examples of the first playgrounds can be tracked to the mid 19th century and were functionally “industrialized” with permanent play elements such as steel swings, slides, and jungle gyms in the early 1900’s (Moore, 1993). The nature of these playgrounds has been an area of critical practice for landscape architects and architects for decades.

Following World War II, Dutch architect Aldo Van Eyck designed and installed hundreds of playgrounds around the city of Amsterdam that were inspired by “open function” and standardization (Withagen, 2017). His motivation originated from the desire to meet a critical social demand that was lacking in cities after the war, and he endeavoured to merge the boundaries between urban space and play space (Withagen & Calijouw, 2017). Many of his playgrounds contained geometrically spaced jumping stones that had aesthetic appeal and provided consistency across different locations throughout the city. These playgrounds, though few remain, inspired decades worth of discussion surrounding the nature of playground design and use of space, structure, and form, to maximize the play value of these spaces. Of particular importance to contemporary studies was the nature of these jumping stones and the way in which children interacted with three-dimensional play features.

Subsequent, though not causally connected, to the emergence of Van Eyck’s playgrounds was a growing theory of environmental psychology put forth by American psychologist James Gibson, which sought to explain the human perception of environments and the way in which we navigate within them. Critical to his research was the idea that the places where we live and play are not simply comprised of matter that is static in space and time, but that our environments are made up of possibilities for action (Gibson, 1979). The most direct definition provided by Gibson is as follows: “the affordances of the environment are what it offers the [user], what it provides or furnishes, either for good or ill” (emphasis by author) (Gibson, 1979). The argument by Gibson and Heft is that we perceive our environment in terms of the behaviour it affords. Heft offers “sitting” as an example to demonstrate this point. He says “what constitutes a seat (or affords ‘sitting-on’) will vary amongst individuals with significantly different body scaling [emphasis by author]. The relative nature of seat affordances can be illustrated by the fact that a surface perceived as a seat by a young child may not be perceived as such by an adult. Specifically, a foot stool might be perceived as a seat by a child and not as an adult as a function of leg length.” (Heft 1989). Perception and subsequent behaviour generally refer to factors such as comfort, security, reassurance, orientation, friendliness, accessibility, and the ability to relate to the surroundings. The variety of affordances offered by an environment are discovered as individuals change over time, whether in maturity, physical ability, confidence, or perceptive capacity (Heft, 1989).

The extension of this theory applies well to conversations of play environments. The affordance value of an interactive element within a play space (slide, swings, monkey bars, jungle gym, etc) is fundamentally the result of the evaluation of the play element in terms of what it can provide to the user (in this case children) in the form of recognizable opportunities that cater to their needs, interests, motivations, or capabilities (Kyttä, 2002). Traditionally, playground design is comprised of a collection of three-dimensional structures such as slides or swings that offer play opportunities and require certain abilities of the user. If we consider playgrounds through the lens of affordances, we instead recognize that playgrounds do not consist of pieces of equipment, but as a collection of things to sit on, climb on, jump across, etc. in the same way that a foot stool is a seating-element to some but not others (specifically children vs adults as indicated in the previous example by Heft). Many studies on affordances in play environments have proposed specific taxonomies (or typologies) of evaluation that attempt to clarify and categorize specific play opportunities within play spaces that qualify whether they are more or less effective at eliciting play. We were initially interested in this topic as it applied to the existing and future Canadian context, our understanding of which motivated our overall investigation into the economic drivers of playground design and quantifying the affordance value of elements in children’s play spaces to maximize the value of spaces for the lowest cost. However, it is easy to see how this research can extend beyond the borders of Canada to any similarly designed play environment where economic limitations determine final design and implementation options, for example in community and/or non-profit lead initiatives.

Our research question is predicated on the importance of the paradigm shift that took place following the implementation of Van Eyck’s geometric standardized play interventions and the emergence.
and expansion of Gibson’s affordance theory that favoured the behavioural relationship between users and environments. There has been a notable interest over the recent years in Aldo Van Eyck’s playground design and design philosophy, particularly amongst researchers concerned with child development and health (Jongeneel et al, 2015; Prieske et al 2015; Sporrel & Withagen, 2017; van der Schaaf et al, 2020; Withagen & Calijouw, 2017). Following WWII, Van Eyck proposed a theory that children are more attracted to “open function” play elements than fixed or single use structures (van der Schaaf et al, 2020). One of the most cited features of his playgrounds are the abstract forms incorporated into his designs, as Van Eyck believed they did not act as single-use elements, but provided options to children that encourage creative play and imaginative behaviour (van der Schaaf et al, 2020). His playgrounds were comprised of elements where the concept of improper use or attitudes that supported statements such as “not what the object was made for” were no longer applicable (Withagen & Calijouw, 2017). This attitude is directly comparable to the forthcoming theory by Gibson and Heft where physical elements of an environment offer different functions depending on the user (see again the foot stool example). These abstract forms were made up of simple geometric elements, such as rectangular and round frames for climbing (referred to as an “igloo”), a sandpit, and a group of circular concrete blocks for jumping across from one to the other. These concrete blocks became the element most consistently challenged by researchers focusing on the viability of creative play, open function play, and affordance theory in play environments, not due to their “open function design”, but because of the use of symmetry in their layout.

Due to the significant body of research that has since aimed to study the viability of treating play environments as a collection of opportunities for eliciting as opposed to prescribing action, we sought to investigate whether this body of research was exclusive to 3D play elements, or if 2D ground plane design elements (such as painted graphics, games, and shapes) were adequately accounted for in the taxonomic (or typological) breakdown proposed by previous researchers. Finding that in fact 2D play elements are not adequately accounted for in these studies, and using our previous research in ground plane design interventions in educational play environments, we endeavour to propose an argument in favour of incorporating 2D play elements into the discussion of affordance value as an economically responsible addition to conversations of playground design.

In response to previous case studies and preliminary investigations into existing literature and research, in this paper we will 1) introduce our interest, background understanding, and the relevance of this topic within the Canadian context as well as universally, 2) define the difference between two-dimensional (2D) and three-dimensional (3D) play elements, 3) provide a brief summary of existing research that focuses on play affordances in 3D environments that specifically focus on “gap jumping” as a play activity, 4) outline our methodology for approaching this research, and 5) demonstrate that there is a gap in the research regarding the investigation of 2D play elements and their respective affordance values by showing the existing categorical criteria for evaluations of affordances in play environments do not adequately or appropriately consider 2D play features and opportunities.

2.1 THE CANADIAN CONTEXT OF THE BUILT PLAYGROUND ENVIRONMENT (THE IMPETUS FOR ACTION)

Though our research ultimately seeks to explore the subject matter in a universal capacity, it was the particulars of the Canadian context that provided the impetus for action and generated our research questions for this paper. In Canadian elementary schools, parent groups (called Parent Advisory Committees / PACs) commonly fundraise, plan, design, and build play structures and play areas on community school grounds. This is brought about by school districts removing old play equipment in the name of safety (Miller, 2019), or never installing it in the first place after a new school is built (Tunney, 2017). In either case, it is the parents that must replenish or create the outdoor play environment for their children, bearing the brunt of the cost, which becomes a tremendous financial burden and logistical undertaking (Kadane, 2013). When parent groups do commit to this project, their engagement is enhanced when they have ready access to current knowledge and best practices in playground design and an opportunity to explore their planning and design options prior to seeking formal School Board Approval for project construction.

With the onus placed upon parents to become “informed designers” of the complexities of playgrounds in primarily elementary school environments, they then place their attention on researching their options, usually in the form of looking at other existing schools and parks, speaking with employees of the school district, exploring the catalogs of popular playground element manufacturers, contacting
charitable organizations that fund building playgrounds and general internet searches. What is germane to the approach of a landscape architect in the design process, materials selection and construction of an outdoor playground environment may prove to be a daunting and foreign task to the untrained. In addition to a whole playground environment being daunting is that aspects of breaking down and detailing spaces may not be included fluidly in their thought process. The focus most frequently turns to easy to understand, yet cost prohibitive manufactured playground equipment versus maximizing the potential of the many other materials that can make up a play environment, such as the ground plane and its potential contributions to play and child development.

While the origin of paper was fundamentally precipitated by engagement with parent and school groups within a Canadian context, the restrictions, challenges, and burdens faced by underfinanced or grassroots organizations is of universal applicability. Non-profit or community and parent driven initiatives exist on a broader scale, and the same findings and suggestions explored in this paper can be used to influence and motivate design interventions globally.

2.2 DEFINING 2D VS 3D PLAY ELEMENTS: PHYSICAL OBJECTS AND SURFACES

The difference between 2D and 3D play elements is intuitive. 3D play structures have a vertical element that provides depth or height relative to the ground plane. These types of elements can include traditional play features such as slides, swings, jungle gyms, and stepping-stones, or naturalized elements such as boulders, logs, trees and tree stumps, etc. Comparatively, we consider 2D elements as being defined by having no vertical elements that extend above or below the ground plane; they are the ground plane. In playground environments, the 2D ground plane is relatively flat and can include materials such as turf, concrete, asphalt, pour-in-place rubber, etc. The play features include painted graphics or material elements that produce a pattern or shape that are interactive and facilitate participation.

While this paper will focus specifically on the distinction between 2D and 3D elements, there is an additional type of 3D environment that falls outside the scope of our analysis: undulating ground planes where the ground itself is operating in three dimensions in the form of articulated topography or mounds that have verticality in relation to a base elevation. In playground environments, topography can be as simple as a slope and as complex as a field of small mounds. Built examples have been made from materials ranging from turf on compacted soil to wavy fields of asphalt and poured rubber. Though paint can be applied to slopes and mounds, such 3D painted features or graphics are excluded from this paper. Some examples of such mounded play environments that are outside of our study are Südliche Lohmühleninsel by Rehwaldt Landscape Architects (painted mounds that mimic topography), BUGA by Rainer Schmidt Landschaftsarchitekten (mounds with painted paths), and Potgieterstraat by Carve (mounds but no paint).

An additional element to the research is the differentiation between prescriptive and non-prescriptive play. For the purposes of this paper, we have chosen not to differentiate between prescriptive and non-prescriptive 2D play features. Games such as hopscotch would be considered a prescriptive play element, as it has specific rules and is designed to facilitate a specific game. Abstracted patterns and shapes of various sizes, colours, and placements would be considered non-prescriptive, in that they facilitate imaginative play opportunities that can change in function and purpose depending on the imagination of the user (what Van Eyck considered “open function”). Both of these categories of game and forms are encompassed by the term “painted lines” or “painted elements”. Painted lines or elements refer to anything painted on the ground plane that encourage or allow for prescriptive and non-prescriptive play activities.

2.3 EXISTING RESEARCH ON AFFORDANCES IN PLAY ENVIRONMENTS

With established and statistically significant evidence showing correlations between human health and the built environment (Cosco, 2006), landscape architects are uniquely positioned to design interventions that promote healthy lifestyles by creating active environments for children to be used during formative early years (while the importance of high value play opportunities are not exclusive to a particular age group, the vast majority of case studies take place in elementary schools). The question is what those environments look like if we are concerned with affordance value and promoting play from both a childhood development perspective, as well as an economically accessible design approach.
Assuming the goal of playground design is to provide environments that motivate play and physical activity, contrary to Van Eyck’s approach of symmetrical and equidistant blocks, diversity and challenge within these play environments is key (Cosco, 2006). This approach has led to studies world-wide on specific challenges within play environments, and evaluation of the resulting affordance value of various equipment designs. Climbing, jumping, and risky play are the notable focus of many of these studies – specifically because of the way in which these activities challenge behaviour and perception of space and ability. These activities provide young children with important opportunities to develop perceptual motor skills, and are thus highly prioritized by those seeking to promote public health (Croft et al, 2017).

Specific research on perception of “challenge” as it relates to use of space within play environments further justifies the use of affordances as a foundational method of evaluation of play elements. In the 2014 research by B. Prieske et al on children’s attraction to challenges within simple play spaces, the authors noted both the physical and psychological components of high affordance play elements (such as jumping-stones), and the arbitrary nature of “achievable” challenges. The reality of being able to “jump the gap” between these stones is not necessarily achievable by all children at any given time. However, the effort required to actualize or realize a play affordance contributes to the attractiveness of the activity (Prieske et al, 2015). This is perhaps the key criticism of Aldo Van Eyck’s playgrounds as his signature jumping stones prioritized the aesthetic, symmetrical form above functional challenge (Withagen & Calijouw, 2017). This line of criticism was not specifically attributed to those within the fields of science, public health, or developmental psychology either. Designers and landscape architects have since recognized the importance of challenging the notion of aesthetically motivated, symmetrical, and “standardized” play features. Dutch landscape architect Helle Nebelong was a notable and well documented critic of such standardization, as she claimed unchallenging play environments poorly prepare children for developing skills that require complex movements and spatial evaluation (Sporrel & Withagen, 2017)

As the target of many of these studies and criticisms, we have chosen gap-jumping as the key activity we refer back to throughout this paper. The reason for this consideration comes from the nature of the activity. Any play feature where there is the opportunity to jump from element to element is necessarily a “gap-jumping” exercise. This can relate to 3D elements, which are the target of the aforementioned studies in the form of blocks, and, in our case to 2D elements, such as jumping from painted shape to painted shape (the affordance value of which we have deemed understudied / not adequately researched).

2.4 SPECIFIC PLAY AFFORDANCES OF GAP JUMPING

Ultimately, Prieske’s study confirms Nebelong’s criticisms and suggests that a configuration aligned with Van Eyck’s symmetrical, geometric layout was insufficient to adequately account for variation in motor skills and physical ability amongst children. From a design point of view, gaps of various distances create variety, challenge, and affordance opportunity. An example of the difference between standardized and non-standardized layouts can be seen in Figure 1, which demonstrates the conceptual layout of jumping stones used by both Jongeneel et al (2015) and Sporrel & Withagen (2017) in similar research projects.
These aforementioned studies critically assess the value of standardized gap-jumping equipment in play environments. Both were critical of the predictable and geometric nature of Van Eyck's jumping stones, and both proposed that non-standardized layouts were far superior for eliciting attraction and voluntary play by children. Though Van Eyck was perhaps correct in his assumption that “open function” equipment and play elements were more attractive for play vs prescriptive structures, these studies illustrated that the symmetry (standardized) of his abstract forms was inferior to asymmetrical (non-standardized) layouts.

Similar to Prieske’s findings, the benefits of the non-standardized configuration of jumping blocks included affording children with varying abilities and capabilities the opportunity to find a challenge in the gap crossing (Sporrel & Withagen, 2017). Jongeneel et al concluded with complementary findings, demonstrating that when given the option to design their own play spaces, the majority of children created jumping stone playgrounds that were comprised of non-standardized arrangements of stones. There is a significant discrepancy between how children and adults design play spaces (Jongeneel et al, 2015) perhaps demonstrating that there is opportunity for further investigation into updating design approaches for landscape architects and designers.

The key issue from looking at these studies is the conclusion that the findings are not necessarily restricted to the design or implementation solely of 3D features. While the research demonstrates that children prefer non-standardized layouts to the jumping-stones, equivalent patterns and layouts can be achieved by using painted shapes on 2D surfaces. There is an element of risk that is involved in interacting with the 3D jumping-stones, which we acknowledge is an area of research we are not touching on within this paper (risky play), however the act of jumping from a defined feature to another defined feature should be extended to 2D play elements. This is a key conclusion and we believe demonstrates an opportunity to consider 2D versions of the same game within playground environments as a reasonable, accessible, and economically viable alternative to the 3D jumping-stones.
2.5 CANADIAN OUTDOOR PLAYGROUND CASE STUDIES: HIGHLIGHTING 2D PLAY ELEMENTS AND THE GROUND PLANE

Over the course of the past seven years, Prof. Kris Fox has been working with research teams at two separate universities (and cities) on various aspects in the outdoor environment at public elementary schools in Canada. The research has been conducted on many fronts including through technical design studios at the masters level at the University of British Columbia (UBC), participatory design seminars, and construction and materials lecture courses, the latter at both UBC and the University of Calgary (U of C). A major aspect of the technical studios was to explore spaces through a typological approach to elements that may populate an outdoor school environment, such as play equipment, outdoor classrooms, outdoor gardens, play equipment, sports courts, and ground plane elements. The case studies outlined below will illustrate that the ground plane became a major topic of conversation with one study, and the element of focus with another. The final case study is an alleyway installation project that illustrates a potential direction with low-cost 2D play elements.

Exploring this realm of turning parents and other stakeholders into 'informed designers' of playgrounds resulted in a multi-year research effort between Assistant Professor Kris Fox, while at UBC, and the Vancouver School Board (VSB). The end result of this research was the creation of The Outdoor PLAYbook, a “How-To” interactive web-based resource that incorporated a variety of leading research and best practices for school grounds including landscape architecture, sustainable design, economic and phasing strategies, child development, injury prevention, and outdoor educational opportunities. The development team included design professionals, design students, health practitioners, and education researchers from UBC working with parents, teachers, administrators, children, the VSB facilities office, and other community partners. One of the main sections of the website is titled “Play Elements”, which not only breaks down play elements by age and activity, but by typology or category. The exploration of play element typologies started with conversations with the school district and was enhanced through design work in technical construction studios with Master of Landscape Architecture students at UBC. It was finalized through thorough research of notable built playground projects both in Canada and abroad. Throughout the process, several departments within the VSB, such as facilities, planning and maintenance and operations expressed tremendous interest in the ground plane: grass play and sports fields, gravel soccer pitches and artificial turf (both of which work better with the combination of rain saturated soils of Vancouver and heavy foot traffic), sand, wood chips, rubber, asphalt, concrete and various forms of painted lines in the form of sports courts and games. The presence of 2D play elements and environments received attention that was on par with that of 3D elements. Research and interest in the potential of 2D play elements is of great interest to both schools and parent groups as they are both low cost and low maintenance.

In Calgary, Alberta, research currently being conducted with Prof. Fox, the Faculty of Kinesiology, the Cummings School of Medicine, and the O'Brien Institute for Public Health in partnership with the community organization Gift of Play is exploring the realm of 2D play in the form of painted line games on pavement with the Calgary Board of Education (CBE) and Calgary Catholic School District (CCSD). The overarching purpose of this research program is to conduct a mixed-methods pilot study examining the relationship between the playground, built environment, physical activity, and well-being of Calgary elementary school students. The study compares elementary schools with low-cost painted line games, installed by volunteers working with the Gift of Play, to schools that did not receive an installation (control group). In September 2016, the Faculty of Kinesiology of the University of Calgary sponsored the Gift of Play ($10,000 CAD total, effectively $222 CAD per school), to coordinate and lead an event where volunteers painted lines on playground tarmac surfaces at 45 Calgary elementary schools. The painted line games were economically accessible additions to the schools that received them, with the proposed research potentially showing that such interventions can also be an effective means of offering health benefits and play affordance opportunities to children. Though this research has brought up another aspect of the play context in Canada, research has been delayed considerably due to snow covering the installations for large periods of time. However, the schools of the in-depth pilot study represent just four schools amongst the thousands across the entire country, all of which have painted lines in their playgrounds.
The final case study project is the installation “G. A. P. JUMP” (2019), which was part of the Green Alley Project (GAP) in Calgary AB, which was a combined effort of the School of Architecture, Planning and Landscape at U of C with the Calgary Downtown Business Association. For this installation, a concerted effort was made to research ways of creating a painted 2D element that clearly encouraged gap jumping using anamorphic projection techniques with the 3D visual effect best viewed from a single, “privileged” viewpoint. It was completed with the U of C research team of Gordon Skilling (lead designer, MLA 2019, MEDes 2020), Emma Brodie (MLA 2021) and Assistant Professor Kris Fox. Also low-cost, this project had a total project budget of $4,000 CAD (40% of which was used for cleaning and site preparation). Though completed in two days, its ease of installation can be debated as anamorphic designs can be complex to install as they require high-powered projectors. The installation was impactful as local media attending the opening event featured the piece on the front page of the Calgary Herald (September 21, 2019 print edition). Our hope was that this piece could spur further discussion in the community about the potential of painted 2D play elements. In fact, one can find anamorphic and other 2D painted graphics in numerous locations in cities like Calgary, like this example of a “3D” crosswalk at a shopping mall, and elsewhere.

Conducting this research was borne out of need for high affordance value yet low-cost play elements, as this falls within the economic capacity of most Canadian parent groups. The previously mentioned Canadian context and installed demonstration research case studies highlight the realities of Canadian elementary playgrounds, making it clear that there is a great need for improved playground environments and that a great deal of strategy must be employed if parent groups will be successful in their efforts to plan, design, fundraise and ultimately build new play environments for their children. As such, the
focus turned to one of the cheapest play element types that could be installed: painted designs on the ground plane. The question then became, what are the capacities of 2D painted play elements in terms of play affordance value? The assumption was that research in fields other than landscape architecture would yield measured results. Instead, the research uncovered a lack of specificity with the 2D realm that made it difficult to draw conclusions when more detail from a landscape architectural materials and construction perspective was needed.

There is a question of using the aforementioned research to inform the way in which we, as designers, can approach 2D elements within playgrounds. While the affordance research mentioned thus far has been specific to 3D elements, the similar multidisciplinary research studies conducted by Assistant Prof. Kris Fox in cooperation with other faculties at the U of C focused on the outcome of incorporating 2D painted elements into play environments. This was done with the intention of studying whether patterns, shapes, or prescriptive game elements elicited different kinds of participation from children. This research was not conducted under the motivation of studying affordance value, however it was a preliminary step in determining how children interact with 2D elements.

Given the findings from these previous studies, as well as studies on affordances within play spaces, this lead us to our primary research question: do the taxonomic/typologies of 2D play elements correlate with their 3D counterparts to the extent that both are valuable under the evaluative criteria of affordance? This approach is driven by the question of whether there is a qualitative and quantitative benefit to offering 2D alternatives for lower cost, higher accessibility, and with reasonably similar developmental and psychological value.

We have constructed the following argument as a logical extension of the existing framework for playground design and have thus far identified the following claims: 1) affordances are a reasonable means by which to evaluate a play environment, 2) activities such as gap-jumping demonstrate how affordances can be maximized by including variable difficulties to attract a breadth of abilities, and 3) 2D elements can elicit interaction and participation in play environments. If we take these claims as true, it follows that we can integrate 2D design elements into taxonomic evaluations of play elements as reasonable alternatives to traditional 3D play features.

4 METHODS

With this research question in mind, the purpose of our study was to explore the potential that 2D elements could bring to the Canadian playground environment / context in a two-fold capacity: can 2D play elements be economically accessible designed elements and can they offer play affordances that could compare well with their more expensive 3D counterparts? While researched systematically, this literature review research was meant to provide an interdisciplinary and longitudinal perspective across multiple disciplines that would directly impact playground design and their constituent play elements.

Our investigation was focused on using online sources to identify leading research on affordances in children’s play environments. The investigation was structured to include results from multidisciplinary contributions to topic across areas of child development, public health, landscape architecture, design, and environmental psychology. This process included a review of available contributions using Academic Search Premier (EBSCOhost), Google Scholar, and the University of Calgary Libraries and Cultural Resource general search engine. We elected to limit our EBSCOhost searches to three databases; Avery Index to Architectural Periodicals, Environment Complete, and Urban Studies Abstracts.

Our searches specifically focused on affordance and affordances within play environments, and research studies on gap jumping, playground design, and the distinction between affordance values in 2D vs 3D environments. EBSCOhost Searches were conducted using the following words; ((playground OR play OR feature OR design OR element) AND (affordance OR psychol*) AND (environment OR development OR function OR taxonomy OR dimension)). Avery Index to Architectural Periodicals returned 281 results (none were deemed relevant), Environment Complete returned 8,109 (limited to top 100, 6 were deemed relevant), and Urban Studies Abstracts returned 1,720 (limited to top 100, 2 were deemed relevant). Similar word combinations were used in Google Scholar as well as the University of Calgary Libraries and Cultural Resource general search engine. Search results from these sources yielded significantly better results and advertised the relevant search results from EBSCOhost. Initial results were examined for ancestral and descendent citations, which expanded the results to the existing bibliography.
Searching for studies on two-dimensional play affordances yielded no results, which directed the
development of this paper. We became primarily interested in investigating whether existing research
approaches to studies in play affordance could be applied to 2D elements and features.

5 FINDINGS

The most immediate conclusion from our investigation of existing studies and literature is there are
two related “gaps” in the research. The first is outlined in section 5.1, which discusses categorical gaps in
the breakdown of currently used affordance taxonomies (in that they do not adequately consider 2D
elements as focuses for affordance evaluation), and the other is in section 5.2, which outlines the failure of
the conducted research to account for additional disciplines that can contribute to the research, primarily
designers and landscape architects and to conduct research in an interdisciplinary fashion. For clarity and
continuity relative to citations, “taxonomy/taxonomies” is synonymous with “typology/typologies”, which is
the more commonly used term by designers and landscape architects. This also outlines the division in
language and understanding between the disciplines as the research relates to many fields of study but is
often written for a single discipline.

When it comes to the tangible effects of this research question, there are lasting consequences
from these gaps in the research, specifically that there currently is not a clear path wherein a designer or
‘informed parent designer’ can link the value systems of cost and play affordances when looking at two-
dimensional play elements. Parents may have the ability to navigate through the cost landscape of play
elements ranging from 3D to 2D, but they may not be able to find equally detailed information on the play
quality / affordances of these elements. How then can parents know if 2D play elements, such as painted
line games, have play and developmental value to their children? Without a more thorough
acknowledgement of both 3D and 2D play elements, they conclusions they draw will be incomplete and
inaccurate.

5.1 CATEGORICAL GAPS IN EXISTING AFFORDANCE TAXONOMIES

The fundamental issue to date in the literature on affordances in play environments is the lack of
appropriate consideration for the value of 2D play elements. Beginning with Heft in his 1988 paper on
affordances within children’s environments, he proposed a categorical breakdown of different affordances
and correlated objects or locations used in his study (Heft, 1988):
Of the proposed affordances, only two relate to 2D elements ("run-on-able surface" and "ride-on-able surface"). In addition, the respective correlated "occurrences" (courthouse lawn, school yard, slope in school yard; streets, sidewalks, grass slope) do not account for a play activity that could take place on the surfaces themselves. The listed locations provide a passive surface for which other activity can occur (running on and riding on), but there is a fundamental gap in recognizing the value of the surfaces themselves as a location for a unique play experience and the affordance value of 2D elements that can be incorporated onto these locations.

Little evolution in terminology has occurred over the years, and a similar list has been used (though amended) by contemporary researchers (Kyttä, 2002; Larrea, 2019; Sandseter, 2009) to qualify the same kinds of play by children in relation to their environments. Kyttä (2002) identifies environmental qualities that support certain affordances, listing them as a functional taxonomy of affordances used in her study. These environmental qualities are outlined in Figure 5 below (Kyttä, 2002):

<table>
<thead>
<tr>
<th>Affordance</th>
<th>Occurrence (page location)</th>
<th>Affordance</th>
<th>Occurrence (page location)</th>
</tr>
</thead>
<tbody>
<tr>
<td>climb-on-able feature</td>
<td>railing of bandstand (168, 306, 318) garage in backyard (183, 385)</td>
<td>sway-on-able feature</td>
<td>crate (346, 347, 348, 349)</td>
</tr>
<tr>
<td></td>
<td>second floor home railing (187) a bench (306, 318)</td>
<td>pick-up-able object</td>
<td>green board (47)</td>
</tr>
<tr>
<td></td>
<td>a cradle (346, 347, 348, 349, 361) a fence (387)</td>
<td></td>
<td>small bat (48)</td>
</tr>
<tr>
<td></td>
<td>a tree (388, 403)</td>
<td></td>
<td>pieces of inner tube (51)</td>
</tr>
<tr>
<td></td>
<td>doghouse in yard (405)</td>
<td></td>
<td>shingle (117)</td>
</tr>
<tr>
<td>jump-up-on-able/</td>
<td>a retaining wall (41, 50, 165) a bench around Courthouse (177)</td>
<td>throw-able object</td>
<td>branch (237)</td>
</tr>
<tr>
<td>down-off-able feature</td>
<td>bandstand (307)</td>
<td></td>
<td>rock (246)</td>
</tr>
<tr>
<td>walk-on-able ledge</td>
<td>retaining wall (41, 186)</td>
<td>strike-with-able object</td>
<td>twig (302, 312, 363)</td>
</tr>
<tr>
<td></td>
<td>well by cellar windows (53)</td>
<td>dig-with-able object</td>
<td>piece of paper (305)</td>
</tr>
<tr>
<td></td>
<td>bandstand railing (168)</td>
<td></td>
<td>tea kettle (406)</td>
</tr>
<tr>
<td></td>
<td>ledge around Courhouse (177)</td>
<td></td>
<td>lid of can (401)</td>
</tr>
<tr>
<td>sit-on-able feature</td>
<td>bench (51, 171, 307, 312, 313, 15, 300, 322, 332)</td>
<td></td>
<td>green board (47)</td>
</tr>
<tr>
<td></td>
<td>stone slab (175)</td>
<td></td>
<td>pieces of inner tube (51)</td>
</tr>
<tr>
<td></td>
<td>stairs (338)</td>
<td></td>
<td>bat (187)</td>
</tr>
<tr>
<td>run-on-able surface</td>
<td>Courthouse lawn (48)</td>
<td>break-able object</td>
<td>rock (246)</td>
</tr>
<tr>
<td></td>
<td>school yard (57, 58)</td>
<td>tear-able object</td>
<td>dirt clod (365)</td>
</tr>
<tr>
<td></td>
<td>slope in school yard (58, 58, 61, 63)</td>
<td></td>
<td>lid of can (401)</td>
</tr>
<tr>
<td>ride-on-able surface</td>
<td>streets, sidewalks (204-206, 278-282, 200-292)</td>
<td>squash-able object</td>
<td>bat (167, 169, 171, 177, 187)</td>
</tr>
<tr>
<td></td>
<td>grass slope (204, 409)</td>
<td>pick-able object</td>
<td>bat (167, 171, 178)</td>
</tr>
<tr>
<td>jump-over-able feature</td>
<td>post (181)</td>
<td>mold-able material</td>
<td>bat (167, 171, 178)</td>
</tr>
<tr>
<td>hide-in-able feature</td>
<td>bushes (58, 59, 172, 178, 285, 292)</td>
<td>sandpile at school (116)</td>
<td>bat (167, 171, 178)</td>
</tr>
<tr>
<td></td>
<td>bench turned upside down (169, 307)</td>
<td>cement powder (238)</td>
<td>bat (167, 171, 178)</td>
</tr>
<tr>
<td></td>
<td>crate (345, 348, 349)</td>
<td>dirt in open pit (336)</td>
<td>bat (167, 171, 178)</td>
</tr>
<tr>
<td>hide behind-able feature</td>
<td>tree (172)</td>
<td>sound-producing feature</td>
<td>bat (167, 171, 178)</td>
</tr>
<tr>
<td></td>
<td>wall in open pit (364)</td>
<td>hi flagpole with bat (169, 170)</td>
<td></td>
</tr>
<tr>
<td>swing-on-able feature</td>
<td>tree limb (184, 185, 186, 385)</td>
<td>micro-habitat</td>
<td>bat (167, 171, 178)</td>
</tr>
</tbody>
</table>

Figure 4. Proposed affordance categories from Heft (1988) “Affordances of Children’s Environments: A Functional Approach to Environmental Description”, Figure reprinted with permission of Centre for Human Environments / Enviro. Psych., from Children’s Environmental Quarterly (1983-1990); permission conveyed through Copyright Clearance Center, Inc.
<table>
<thead>
<tr>
<th>Environmental qualities that support certain affordances</th>
<th>Affordances</th>
<th>Environmental opportunities for sociality</th>
<th>Affordances for sociality</th>
</tr>
</thead>
</table>
| Flat, relatively smooth surfaces                       | - affords cycling  
- affords running  
- affords skipping  
- affords skating  
- affords playing hopscotch  
- affords playing (football, ice-hockey, tennis or badminton) |             |                                           |
| Relatively smooth slopes                               | - affords coasting down  
- affords skateboarding |             |                                           |
| Graspable/detached objects                             | - affords throwing  
- affords digging  
- affords building of structures  
- affords playing with animals  
- affords using plants in play |             |                                           |
| Attached objects                                       | - affords jumping over  
- affords jumping-down-from |             |                                           |
| Non-rigid, attached object                             | - affords swinging on  
- affords hanging |             |                                           |
| Climbable feature                                      | - affords climbing  
- affords looking out from |             |                                           |
| Shelter                                                | - affords hiding  
- affords being in peace and quiet |             |                                           |
| Mouldable material (dirt, sand, snow)                  | - affords moulding something  
- affords building of snow |             |                                           |
| Water                                                  | - affords swimming  
- affords fishing  
- affords playing with water |             |                                           |
|                                                        | - affords role playing  
- affords playing rule games  
- affords playing home  
- affords playing war  
- affords being noisy  
- affords following/observing adult's businesses |             |                                           |

Figure 5. Functional taxonomy of affordances. Kyttä (2002) Affordances of Children's Environments in the Context of Cities, Small Towns, Suburbs and Rural Villages in Finland and Belarus. Figure republished with permission of Academic Press, from *Journal of Environmental Psychology* (2002); permission conveyed through Copyright Clearance Center, Inc.

Similar to Heft’s list, only one of these environmental qualities relates to 2D surfaces (flat, relatively smooth surfaces) and is again an overly simplified conception of two-dimensional surfaces, as it supports affordances that do not directly relate or interact with the qualities of the surfaces themselves (i.e. they afford biking, running, skiing, etc.) Granted, where Kyttä differs is in recognition that these surfaces afford games that exist on a two-dimensional surface and are created using painted designs, such as hopscotch. She also introduces in the above table an avenue through which to introduce the idea of 2.5D surfaces (with “relatively smooth slopes”) as they relate to our earlier definition from section 2.2. We are electing to exclude this category from the discussion but acknowledge future opportunity to investigate these categories of surfaces.

Nevertheless, the shortcomings of the research mentioned above is found in the lack of acknowledgement that there is an evaluative criterion missing from both of these lists, i.e. the evaluation of two-dimensional games themselves, and there is evidence to show this is perhaps a language application issue rather than a categorical oversimplification. Criticism has been waged against both Heft’s and derivative taxonomies (such as from Kyttä, 2002) in regards to the breakdown and application of the affordances listed in figures 4 and 5, specifically in understanding the linguistic differences between the affordance of a setting (action possibilities offered by a setting) and the affordance for an activity (features facilitating specific action) (Lerstrup & van den Bosch, 2017).
Two-dimensional games and activities are perhaps being overlooked because they reside on surfaces that are generally considered a setting. While the ground plane may always remain a setting for other activity, the location can be enhanced by a layer of intervention (painted lines, games, etc.) that should be independently evaluated for their activity and affordance value in the same way we would evaluate a 3D element as something similar to swings, slides, jumping stones, etc.

5.2 LIMITATIONS OF EXISTING RESEARCH APPROACHES

We believe that future research should be expanded to include a method of evaluation that utilizes the lens of landscape architecture and includes design professions in the discussion of evaluating the affordance value of play elements within play environments. When looking at the basic play design elements defined by Stein in Learning for Landscapes (1997), 2D painted play elements and line games of varying complexity, the paved surface they are painted on, and the simple material used to furnish the ground plane are all design considerations that either attract or dissuade play in children. These types of spaces are as follows: accessible, active, ones that can challenge a variety of physical abilities, are a type of hard multi-use space, ones that allow for both open and closed activities, ones that offer simple and complex uses and, finally, ones that can be either permanent or changeable (Stein, 1997). Interestingly, these are qualities that are not applied to the “flat, relatively smooth surfaces” mentioned by Heft, Kyttä, and others in their evaluation of the affordance value of surfaces, despite the fact that the quality of the ground plane has an enormous effect on the types of play that occur in these respective areas.

Further to this, in defining the physical constituents that make up play environments, Herrington points out that the ground plane, or ‘base plane’ is the “most intimate and defines how landscape is to be used” (Herrington, 1999). It may also be argued that children may be more engaged with painted ground plane elements than adults as “children are sensorial people. The younger they are, the more engrossed they are with their physical environment” (Herrington, 2003). If we limit the evaluation of the ground plane to something so simple as “flat, relatively smooth surfaces”, we miss the opportunity to take advantage of different sensory experiences that can be pulled from different materials.

Another value in landscape architecture is the notion of site specificity, which thus far is a wholly overlooked aspect of environmental evaluations. Stein’s notion of permanent versus changeable can be taken a step further as it then becomes a way in which schools can reflect the specific nature of the site, community, and regional context (Herrington, 1999). In fact, installing painted features on the ground plane is among the least expensive designed elements that can be installed to reflect local flavour. Within specific sites, there are many design criteria that can improve the overall quality of a play space. In Moore’s 1992 edition of Play for All Guidelines: Planning, Design and Management of Outdoor Play Settings for All Children, he lists a variety of site design criteria directly linked to the design and subsequent consequences of incorporating various design considerations. His criteria includes “flexibility” as a directly related point of consideration that influences and benefits from the low cost, easy installation options of 2D play elements. Just as Heft and Gibson outline changes in ability correlate to changes in psychological and physiological development, as children develop, their needs change in a play setting. According to Moore, “the environment should allow for easy rearrangement of elements for different programs and the addition or removal of special equipment for particular activities” (Moore, 1992). One could apply this notion of flexibility or “change” and the ability to manipulate space to painted 2D play environments as they become the easiest and lowest cost way to enact change in a play space. This idea of accessible, inexpensive, and flexibility in play elements responds to the needs of changing abilities, a concept fundamental to the idea of affordances.

When taking all of this into account, the lack of research focusing on the array of possible 2D play elements by those in the fields of environmental psychology, childhood developmental psychology, and public health makes the omission even more glaring. It also draws attention to the fact that research about the physical, designed landscapes of schoolgrounds should involve researchers and practitioners in landscape architecture and design if it is to be called holistic.
6 CONCLUSIONS

It is clear from this research that more is needed to supplement existing investigations in the area of play affordances. There is a need for a much more sophisticated understanding of the value of 2D elements, for all its material possibilities, in play environments as alternative or complementary features to their well studied 3D counterparts. Ideally, this would include studies conducted on 2D play elements that mirror the research methods previously used in studies on affordances in 3D environments. This includes comparative studies with participants as a logical next step.

From our evaluation of the existing taxonomic breakdown of elements within play environments, it is unclear at this time whether an alternative functional taxonomy is needed to adequately account for 2D surfaces, or whether affordances (such as jump-across-able features or balance-on-able features) can be applied not only to 3D structures, but to the evaluation of 2D play elements as well. Currently, the closest the research comes to measuring the affordance value of a surface is in the instrumental value it affords to other activities, such as cycling on, running on, or skateboarding on. This could be due to the linguistic confusion between affordance of and affordance for when it comes to the categorization of play surfaces.

Fundamentally, 2D play elements can offer many of the same opportunities as 3D play elements, especially when it comes to activities such as gap-jumping. There are games that elicit jumping across gaps, balancing on ribbons of color, identifying routes through patterns of shapes, and more. Combinations and permutations of paintings or designs on the ground plane can be utilized to promote the expression of different affordances depending on the goals of the designer and needs of the client or community. We believe this is where further research is needed to determine whether there is an opportunity to make qualitative claims that help inform playground design if the primary concern is maintaining or improving affordance value of a space.

With the unfortunate situation of play spaces being historically underused or rarely visited (Prieske et al, 2015), it is even more critical for Canadian parents to have success in designing attractive and inviting play spaces. They can ill afford to spend resources on spaces that provide little in the form of affordance value, especially when the goal is to maximize physical and social development. The Canadian context magnifies the importance of cost effectiveness, and the potential benefit of 2D play elements is found in cost savings, ease of implementation, temporary installation capacity, ease of fabrication, and scalability to different areas and locations. In order for Canadian parent groups to have the best information on the full spectrum of play elements that can go into a playground environment, more research will be needed on the affordance value and general capacity of 2D elements. To do this successfully moving forward, the exclusion of landscape architects and design professionals from conversations on play space design and development must be rectified. Our hope is that this paper becomes the first step towards completing a ‘catalog’ of 2D elements that reflect an interdisciplinary perspective to play space design which has been overlooked and underappreciated for far too many years.

7 REFERENCES


CINEMATOGRAPHY IN THE LANDSCAPE:
TRANSITIONAL ZONES IN THEMED ENVIRONMENTS

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1 ABSTRACT

While landscape architects are adept at transitioning between the indoor and outdoor and blurring the threshold between, less attention has been paid to the liminal space between landscapes and how built landscapes interact with each other. Transitions in constructed environments can be critical spaces and key to the success of adjoining landscapes. However, built landscapes often have stark adjacencies, making the construction of successful transition zones a challenging problem.

Thematically— the multidisciplinary practice of creating themed environments—is a language that evolved from filmic grammar. In cinematography, transitions between scenes establish continuity and narrative flow; cuts, wipes, and dissolves are common techniques that lead viewers through disparate settings with minimal disruption. These same techniques are employed in the spatial design of theme parks, moving guests between narrative elements of a themed space, and between distinctly different themes.

This paper suggests that many of the cinematographic techniques used to create thematic transitions can provide valuable principles for enhancing placemaking within and between built landscapes. Such themed environments are worthy of serious examination as they mediate multiple levels of content complexity and identity-laden forms across all the senses; seamless negotiations at once visual, tactile, auditory, and olfactory. Such filmic grammar may have wider application for landscape architects and other placemakers concerned with crafting environments which are simultaneously congruous experiences yet harmoniously diverse.

1.1 Keywords

Thematic design, theme parks, cinematography, filmic grammar, transitional zones.
2 INTRODUCTION

“Disney’s Magic Kingdoms are expressive landscapes with the power to move people….It is easy to praise Disneyland and Disney World, and easy to condemn them, but no matter whether one is an admirer or a critic, both are models of rhetorical expression. To know landscape poetics is to understand how such settings are fashioned and how they achieve their effects.” — Anne Whiston Spirn (1998, pp. 238–239)

When Spirn was crafting *The Language of Landscape*, the first real decade of rigorous scholarly dialog around theme park environments was beginning to wind down. Ironically, fellow critics before her had practically inaugurated the period, devoting the entire May 1990 issue of *Landscape Architecture Magazine* (LAM) to Disney’s landscapes (Ellis et al., 1990). When EuroDisney opened in 1992, it was declared a “cultural Chernobyl” by leading French academics (Lainsbury, 2000). Both the LAM special issue and the vast body of critical literature produced in the years following were similarly socio-political in nature, confronting issues of authenticity and illusion, power and control, and consumerism and entertainment. This discourse spanned sociology (Gottdiener, 1997; Hannigan, 1998, Zukin, 1993), anthropology (Fjellman, 1992), and art history (Marling, 1991; 1994). During this time—in which Disney began massive expansion around the world—historians began to wrestle with the faux cultural representations and sanitized political narratives of its theme parks (Findlay, 1992; Francaviglia, 1996; Wallace, 1996), as had theorists and philosophers been troubled earlier by their simulacra and surrealism (Baudrillard, 1994; Eco, 1986). The nineties ended with Alda Louis Huxtable decrying the establishment of an “unreal america” which had become overrun with theming (Huxtable, 1999). Conversely, there is a relative dearth of site-specific theme park documentation from a design perspective. Architecture critics are primarily concerned with privatization, loss of public space, surveillance, and aesthetic homogeneity rather than form and mechanics (Knight, 2014; Sorkin, 1992). Relatively few texts elaborate on theme parks’ design merits, though interest has grown in more recent years (Klingmann, 2007; Lonsway, 2009; Mitrasinovic, 2006). Yet Spirn’s point is well taken; theme park landscapes deserve design critique apart from dissecting them as societal organisms.

Because the design of themed spaces is derived from the cinema (Marling, 1997), it is natural to critique theme parks as media constructs. However, it is the visual grammar and metaphors of their constructed landscapes which we focus on. Transitional zones are of interest to landscape architects, especially the interaction between architecture and landscape (Waite, 1998). However, transitions between disparate landscapes are equally important. In this paper we discuss such zones as they appear in the contemporary theme park model, which emerged with the development of Disneyland, and how they were informed by filmic grammar. We first discuss the role of media in landscape design, as it evolved from painterly to theatrical representations. Next we briefly recount the origins and development of Disneyland park from a landscape architecture perspective before we outline the broader praxis of thematic design and the contours of its language to place those principles in context. Lastly, we provide a taxonomy and examples of transition types at a number of Disney’s parks. We intend that this brief history and taxonomy of cinematography in themed landscapes will spur other researchers to take a closer look at these spaces, provoke new dialog around thematic design, and prompt site evaluation of their spaces beyond social critique.

3 METHODS

This is a qualitative research paper; part contextual history and part analysis of built sites. In order to parse a taxonomy of filmic grammar, we have focused on Disneyland, as it is the sui generis contemporary theme park (Adams 1991; Lukas, 2008; Marling, 1997). Its design was executed by filmmakers; the vision for all Disney parks is a cinematic one. Naturally, there are many other large-scale practitioners of theming in landscape design around the world who have flourished in the decades since using similar means; Universal Studios, Cedar Fair, casino operators et al., (Gottdiener, 1997; Hannigan, 1998). To include site surveys of all of these here is not practical. We have, however, augmented and punctuated our discussion by noting transitional spaces in other Disney theme parks, whose multidisciplinary designers inherited the thematic praxis from their predecessors at Disneyland.

An on-site observation method was used to catalog transitional spaces at Disney parks according to their application of filmic grammar. Such an approach was deemed crucial because these landscapes are, by their very definition, experiential; they must be experienced to be understood. This documentation
included walking through transitional zones multiple times from all directions, as well as capturing the transit through spaces via video, photographs, and hand sketches. Further analysis was also conducted using Google Street View and a virtual reality headset in order to re-visit the sites in as close to an experiential manner as possible from a distance. Use of Google includes instances when we did not have the appropriate photo ourselves from a prior site visit to present here. Design elements in each transition zone were identified, cataloged and then compared to the filmic grammar to classify each type of transitional space.

4 BACKGROUND: PRE-THEME PARK REPRESENTATIONAL LANDSCAPES

Although the contemporary theme park model is relatively new, there is a tradition of constructed, mediated environments which incorporate experiential landscapes designed to entertain. Representational media has been interwoven with the design of environments for centuries. Painting played an important role in both documenting and inspiring garden designs from the Renaissance into the 19th century. The development in painting of precise perspective provided artists with a technique to accurately recreate real three-dimensional scenes. Using vanishing points, such scenes achieved a visual depth that seemingly projected to the horizon. The use of the vanishing point quickly became a common motif for landscape designers, who created long linear vistas that would project the visitor out into the landscape. This was often paired with forced perspective to elongate and amplify the apparent distance of the vista, creating landscapes that applied the painter’s visual lexicon to the landscape (Manca, 2015; Moore, Mitchell, & Turnbull, 1993). Vaux-le-Vicomte provides the exemplary demonstration of this technique through the gradual narrowing of the axis boundaries, combined with a masterfully subtle manipulation of elevation in order to create a powerful feeling of projection across the entirety of the site (Hazlehurst, 1980).

Similar cross-pollination is visible in Japanese and Chinese garden traditions. These landscapes mimicked local painting styles and aesthetic values, where the foreground was painted with fine details, yet backgrounds rendered with broad strokes and looser forms (Moore, et al., 1993). In the landscape, these painterly approaches were recreated with more finely textured plantings in the foreground and clear definition between plants, contrasting large massings of more roughly textured plants in the background. The Japanese in particular employed shakkei, which is the use of distant borrowed natural scenery from beyond the formal landscape.

Narrative-derived landscapes became prominent during the Italian Renaissance with the proliferation of books and ‘rediscovery’ of classical stories and texts. The deliberate creation of stories within the landscape would become more complex through the marriage of narrative with design principles; inspired first by painting, then opera, and finally cinema. Through statuary, fountains, and its ever-increasing complexity of structure, Villa Lante is meant to celebrate its patron, Cardinal Gamberaia, through telling a story of order, progress, and prosperity emerging from chaos (Lazzaro-Bruno, 1977). At Villa Bomarzo, a convoluted and brooding tale inspired by the Hypnerotomachia Poliphili and Orlando Furioso is told through a collection of larger-than-life statuary (Bosch, 1982; Darnall & Weil, 1984). While not leveraging a specific narrative, Capability Brown relied on literary composition to describe the structure of his landscapes, referring to visual breaks as comas, colons, and periods (Willis, 1981).

In England, landscape designers combined narratives with the medium, moving beyond just borrowing formal principles to actually recreate painterly compositions. The painterly movement of Claude Lorrain, featuring images of rugged landscapes from heroic epics of the past became particularly popular amongst the English elite. Landscape designers of the era were commissioned to create picturesque landscapes populated by classical ruins and statuary in the same vein as Lorrain’s painting subjects (Hunt, 1992; Manca, 2015). The painterly circuit gardens of England married picturesque landscape depictions with storytelling to guide the visitor through a series of scenes, conceived in the same way as a painting might be, as they progressed around a predefined path through the garden (Spiri, 1998). Most notable of these gardens is Stourhead, which many researchers believe borrows themes from Virgil’s Aeneid. Here the visitor is presented with a series of vistas of picturesque landscapes, classical temples, and architectural follies that suggest that they are traveling through an Arcadian paradise (Duclos, 1996; Manca 2015; Moore, et al., 1993). While direct links to the Aeneid at Stourhead have been challenged by some scholars, it is clear that the garden still presents the visitor with a narrative constructed of established views on a prescribed path, similar to a gallery of paintings (Cox, 2012; Hunt, 1992). Predetermining and controlling views for the visitor is one of the primary structural differences between pleasure gardens—such as
Stourhead or Stowe—and traditional gardens that leave exploration and experience up to the visitor to discover (Moore, et al. 1993).

The ferme ornée was also derived from painterly traditions in England, though it represents a rustic, as opposed to classical, footprint in the landscape. Most relevant to our discussion is the ferme ornée once located at Versailles, which was a detailed creation of an idealized village and farm. Here nobility could act as peasants in a safe and controlled manner. The contemporary visitor would have experienced a reenactment similar to a theme park or a cultural site such as Colonial Williamsburg, inhabiting an exquisitely detailed environment in which they could participate and play a role in a fantasy landscape with cultural underpinnings (Mitrasinovic, 2006; Spirn, 1998; Young, 2002).

While Stourhead represents a controlled experience structured and themed around the painting and literature of the time, other landscapes drew upon theatrics and opera. It was common to create garden theaters for holding operas and plays, with examples at the Tuileries, Versailles, Villa Reale, and Herrenhausen sites (Deguen & Thuillier, 2015; Gollwitzer, 1976). In many instances, theater influenced landscape design beyond the simple creation of a performance space in the garden. The presentation of theatrical elements in gardens, especially as a means of visitor interaction, was popular from the 16th–18th centuries. Hellbrunn Palace featured water-powered special effects in the form of fountains, comedic tricks, and even a walkway of moving dioramas reminiscent of the now common storybook cruise trope introduced at Disneyland (Adams 1991; Shakerin, 2005). Trick fountains were designed to transform visitors from a traditionally passive, observer role into an active and choreographed role as actor on the stage. Even if such participation may not have been entirely willing, these water features were very popular from the Renaissance through to the 19th century (Thacker, 1970).

An equally proto-themed built environment was the World’s Columbian Exposition held in Chicago in 1893. Under the guidance of Daniel Burnham and Fredrick Law Olmsted, theatrical environments there were meant to tell stories of modern progress and triumph. This was all cast in classical facades which evoked a nostalgia and yearning for something greater and grander in the public (Mitrasinovic, 2006) and later found further architectural expression through the City Beautiful movement (Steiner, 2011). Most of the structures themselves were conceived of as ephemeral; an inhabited built environment embodying the praxis of theater, a stage set built on the grandest scale conceivable (Hines, 1988).

Noted opera set designer Luigi Manini designed a theatrical garden masterpiece at the Quinta da Regaleira. The garden is constructed of a series of set pieces in the landscape, built around an esoteric story of ritual initiation drawn from elements of Christian, Templar, Kabbalah, and Rosicrucian traditions (Anes, 2010). At its core, the garden relates an archetypal descent—whether it be that of death itself or Dante’s journey through the circles of hell—via a series of tunnels carved into the mountainside, complete with subtle bestial outcroppings in the tunnel walls to create a discomfiting passage through darkness (Anes, Pereira, & Pereira, 1998). Where the tunnels terminate, an ornamental initiation well provides an ascent into the light and a return to the surface. Elsewhere in the garden, secret passages, caves, towers, bridges, fountains, and statuary create an immense garden stage in which the visitor participates in acting out the story.

These examples are not meant to explicitly argue or suggest that landscapes are a literal interpretation of an era’s popular media. There is no known instance of a Chinese or Japanese painting being recreated in exact detail as a garden, and Hunt (1992) persuasively demonstrates that while Stourhead borrows design cues from the iconography of landscape painting traditions popular at the time, none of the garden’s scenes have attempted to fully realize the painting in built form. Villa Orsini was inspired by—but does not faithfully retell—Orlando Furioso. The Quinta da Regaleira is theatrical in nature but bears little connection to any contemporary play or theatrical set. These spaces are not simulacra. Rather, such gardens demonstrate how designers were influenced by the visual and performing arts and explored their application within the landscape, borrowing their composition, stylistic tendencies, and visual grammar. Similarly, we argue that the contemporary theme park model draws heavily on the dominant visual medium of the 20th century, motion pictures, and that this is especially true of the transitional zones between its various areas or “lands.”
5 FOREGROUND: THEMATIC LANDSCAPES

5.1 From Backyard Railroad to Theme Park

Given this longer tradition of narrative gardens conceived to entertain and delight, it seems only natural that Disneyland began as essentially a landscape project. One might suggest Tivoli Gardens as a primary inspiration for what Walt Disney was trying to accomplish. From an outside perspective, it indeed borrows cues from earlier such parks (Clavé, 2007; Lukas, 2008; Mitrasinovic, 2006). However, Disney’s personal interest in Tivoli appears to have been operational rather than design (Marling, 1997). Though he had visited with his family repeatedly and the park did leave a strong impression on him when he returned in the summer of 1951 for research purposes (Nichols, 2018), his comments to his staff were praising how remarkably well-kept and clean the grounds were (Thomas, 1994). Tellingly, when Disney sought the consultation of Tivoli’s manager three years later, it was with regards only to crowd flow (Mitrasinovic, 2006). Less known is the seminal influence of the animation magnate’s five-acre backyard railroad (Barrier, 2007; Bright, 1987; Marling, 1991). Walt Disney built a one-eighth scale steam locomotive in the early 1950s and named the railroad the Carolwood Pacific after his home’s address (Pierce, 2016). The site plan was established by Eddie Sargeant with drafting by John V. Cowles, Jr., a Disney set designer with architectural training (ibid). There was a total of 2,615 feet of track on the property managed through eleven switches, including a dramatic forty-foot timber trestle (Marling, 1991).

Disney had to look beyond his studio for planning the grounds. Brothers Jack and Morgan “Bill” Evans were tasked with the job of landscaping the site (Marling, 1997). At the suggestion of studio construction supervisor Jack Rorex, Disney had a 90-foot tunnel dug underneath part of the property so that his wife Lillian would neither see nor hear the train (Thomas, 1994). Rorex also recommended that the passage be designed with a dramatic double curved ‘S’ so that passengers couldn’t see the end as they entered; in essence, this was the forerunner of the Disneyland “dark ride” experience (Marling, 1991). It was for this underpass installation and the elaborate flower beds above it that the Evanses subsequently became deeply involved with the project (Broggie, 1997; Kurtti, 2008). Landscaping was clearly essential to Walt Disney; all this took half his total budget (Snow, 2019). Landscaping was an integrated environment of both structures and landscape which served as an experiential prototype for his theme park (Marling, 1991). Transitions were at the heart of the project, and his railroad was a “system so carefully landscaped that it gave his guests an experience—a narrative, really—of shifting scenes, one blending smoothly into the next” (Snow, 2019, p. 43). This sequential, staged landscape—not unlike the Quinta da Regaleira—led directly to the Disneyland concept. As the park’s primary planner recalled years later, “[Walt] used his...railroad as an example of what he wanted to do next. There was a definite link between Walt’s train at his home and what he went on to do” (Janzen & Janzen, 1997, p. 10). A train circles the park atop an earthen berm to isolate Disneyland from the outside world, as was employed to shield neighbors from Walt Disney’s backyard railroad and provide privacy for his guests (Marling, 1997). All that had changed was the scale; quite literally, Disneyland was where Walt Disney “could extend his miniature set within a framework of realistic landscape” (Bukatman, 1991, p. 55). The Evans brothers themselves, neither of whom held landscape architecture degrees, were imported to the Disneyland site along with the train, tunnel, and berm concepts (Koenig, 2019).

5.2 Landscape Design in the Thematic Mode: Six Roles

Bill Evans retired from Disney in 1975 and by the early 1990s, Evans had had nearly four decades to think over his approach to landscaping in a thematic context. In a lengthy interview (Janzen & Janzen, 1996) he reflected on the uses of landscaping at Disneyland, since ported to all Disney theme parks. We have derived six primary roles from Evans’ remarks, all familiar to landscape architects. First, thematic landscaping provides enclosure by hiding the outside world from guests inside the park. Walt Disney is often quoted in company literature as having mused that “I don’t want the public to see the world they live in while they’re in the Park” (Sklar, 1969, p. 19). At Disneyland, this was accomplished with an earthen berm—a device borrowed from his backyard railroad—in concert with dense tree plantings about the perimeter. Second, such landscaping must also provide ambiance and set an overall tone throughout the park. Evans called this “visual mood music” (Janzen & Janzen, 1996, p. 8) and it includes the kinetics of
breezes blowing through foliage along with bird activity. Third, this landscaping must provide comfort, which in the context of the bright sun of Southern California or Central Florida means shade (or in the inclement weather of Tokyo or Paris, often shelter). Fourth—and this is landscaping’s narrative role—all plantings and hardscape designs provide a visual palette establishing the environment for each themed area or “land.” As Evans noted on another occasion, this is a subtle art, as his focus is on “growing things to look as if you had sort of stumbled across them and found them there naturally.” (Bright, 1987, p. 73). Fifth, landscaping in the thematic mode must provide separation and establish harmonious visual barriers between each visual narrative. This was particularly important at Disneyland, which differs from earlier parks as it has more than one theme, each with their own setting of time and place, unified by the Plaza Hub. For this integration to work, landscaping must clearly and harmoniously delineate each area. Lastly, just as the landscape must exclude outer distractions, it must obviate inner workings. Thematic landscaping provides concealment by keeping park operations hidden from guests, the intrusion of which would diminish the otherwise immersive qualities of these environments. Yet all six properties are equally invested in protecting fantasy and illusion, for thematic design requires “an atmosphere that encourages the guests’ suspension of disbelief” (Hench & Van Pelt, 2003, p. 124).

5.3 Landscape Design in the Thematic Mode: Cohesion and Transition

There are two additional principles which Bill Evans did not mention, and these arise from the first six elements operating in toto: cohesion and transition. While the Evanses were skilled in procurement and plantings, it soon became evident that the brothers simply had no training in planning and design (Pierce, 2016). Thus, it fell to landscape architect Ruth Shellhorn, educated at Cornell, to introduce these aspects to the Disneyland project. She is noteworthy for not only being the only woman on the site, but also a licensed practitioner and the only designer who was not hired from a Hollywood studio (Comras, 2016). Shellhorn’s diaries, available for study in the Charles E. Young Research library at UCLA, confirm the project was very taxing for her. She faced impossible deadlines and male colleagues who did not take her seriously (Comras, 2012). Her grading corrections were met with disbelief and resistance, and she was ostracized as a result (Pierce, 2016). Nor was she given credit. Disney management later had approval over a piece Shellhorn wrote for LAM in which Jack Evans insisted to the company that Shellhorn be “billed as his assistant” (Shellhorn, 1956; Snow, 2019). Despite all this, she was the one trained landscape architect of the entire site, and her top priority at Disneyland was cohesion. Having the park “hang together” was foremost on Disney’s mind, and Shellhorn proffered that a thorough landscape plan would address problems of visual disparity, crowd dispersal and flow, and site organization (Comras, 2016). Because each area or “land” had its own art director, and each theme establishes its own setting of time and place, landscaping at Disneyland serves as the single binding agent for the park. Over the years this philosophy of cohesion has become a core principle of Disney park design (Ellis, 1990).

Figure 1: Disneyland Paris (2008). Left: Adventureland, with a tropical, exotic jungle motif. Right: English portion of Fantasyland, which is styled with formal gardens. Photos by Gottwald.

In a survey of Disneyland park, Charles W. Moore noted the “remarkable use of propinquity, the close juxtaposition of very disparate places” (Moore, Becker, & Cambell, 1984, p. 38). This is, in part, due to the
application of cohesion. Perhaps even more crucial is transition. In her 1956 article, it is the single topic which Ruth Shellhorn is most concerned with. Bill Evans was clear about the role of separation, but because Disneyland’s visual realms are presented cohesively, the transitions between each are paramount in both blending the internally cohesive spaces together and in managing the movement and flow between each space (Figure 1). Shellhorn noted the challenges she faced, where often buildings were split depending on which theme they faced (Shellhorn, 1956). Moore praised the transition work of Shellhorn, noting that the park is actively “choreographing our walk through changing spaces….between the lands…appropriate landscaping and changes in architecture ease you from one to the other” (Moore, Becker, & Cambell, 1984, p. 38). This was not required, for example, at a primary antecedent to the theme park model, the aforementioned 1893 World's Columbian Exposition in Chicago (Lukas, 2008). Delineation between content zones on the Midway Plaisance was based on a grid plan (Adams, 1991). Exotic visual flavors as expressed in re-created villages from around the world were compartmentalized, and other exhibitions were presented completely indoors, isolated in large halls (Lucas, 2008). Exteriors were unified via Beaux-Arts architecture, thus various styles and motifs did not require negotiation (Mitrasinovic, 2006). So while the 1893 Fair and others like it did indeed present themes, they were not yet as such designed thematically. These environments lacked a praxis which did not yet exist.

5.4 The Thematic Praxis

Before looking at types of spatial transitions in the theme park model, we need to contextualize their cinematic roots. Thematic design refers to an interdisciplinary practice inclusive of planning and executing projects within the built environment; it is an environmental language employing architecture and landscape architecture yet distinctly independent of either (Klingmann, 2007; Lonsway, 2009). This vocabulary originated in filmic grammar, first fully expressed as noted above with Disneyland in the mid-1950s (Lukas, 2008). Disneyland is the sui generis source for the thematic praxis: a whole suite of visual, spatial, tactile, and olfactory techniques which are aimed at providing immersion in which “authenticity is created as a feeling” (Lukas, 2007, p. 6). We underscore that thematic connotes the working discipline itself—its philosophies, methodologies, and processes—whereas themed describes the resultant spaces (Gottwald & Turner-Rahman, 2019; Lukas, 2007). This praxis is antithetical to traditional architectural planning (Klingmann, 2007). Instead thematic design is a coalescence of film sets and the storyboard planning process within the built environment.

Set design is a natural extension of scenic design for the theater. Yet as cinematography advanced during the 1920s, adding dolly work and cranes, viewing a film became an active experience inseparable from the camera’s point of view (POV) (Affron & Affron, 1995). This shift necessitated new approaches to the design of sets. As the camera, and by extension the audience, could now navigate and penetrate the ‘stage’, sets had to evolve beyond crudely constructed flats. They became augmented with interior decor, furnishings, and props (Affron & Affron, 1995; Ramírez, 2004). Soon after, production designers trained in the theater arts were performing more architectural roles in both planning and construction, and many architects were employed by studios (Macfarland, 1920). Thus, what was once merely scenic was transformed into something environmental; these new sets became worlds for actors to inhabit (Affron & Affron, 1995). There are six properties of this new discipline which establish set design for early film as independent from traditional architecture: sets are ephemeral, fragmentary, hyperbolic, flexible and mobile, inconsistent in proportion, and only orthogonal when structurally required (Ramírez, 2004). Thematic design employs a hybrid form of this: permanent, fixed, and less fragmented (like architecture), yet still proportionally disparate and often wildly hyperbolic (like film sets). So while the structures of World’s Fairs and expositions prior were indeed exaggerated and temporary, they pre-dated motion pictures and were thus not influenced by set design (Silverman, 2019). The planning of these new cinematic environments is derived from the practice of storyboarding. In the late 1920s at the Disney Studios, storyboards were formalized as a sequential planning tool (Barrier, 2003; Finch, 2011). Such boards provide geography (backgrounds and settings), continuity (sequential action and motion), diagram (acts, scenes, transitions), and cohesion (a comprehensive plan) (ibid). The vital element which storyboarding contributes to thematic design is the notion of planning spaces sequentially as a series of interconnected scenes, rendering the built environment as a setting, edifice as façade, and interiors as vignettes. Spatially, this is a shift “from composition to choreography” (Klingmann, 2007, p. 206) and a radical departure from traditional architecture.
In summation, the thematic praxis favors the filmic over the architectonic; a set of linear, narrative sequences over a program; the emotional organization of space over the rational. Theme parks are cinematic landscapes. And unlike at the fairs of the 19th century, the immersivity and “total theater”6 makes transitions between each individual themed environment—each set of scenes—crucial. Like cohesion, transition is a core principle for Disney as “landscapes must smoothly guide guests from one stage to the next” (Markey 2006, p. 21). And those transitions come directly from film.

6 FILMIC GRAMMAR IN THE LANDSCAPE

6.1 Filmic Punctuation: Six Types

Cinema has long been described as a particular medium due to its sequencing. In 1936, French filmmaker and critic Roger Leenhardt declared that “continuity is experienced as rhythm” (Abel, 1993, p. 203) and noted “the unusual significance of transitions in the cinema, what could be called punctuation” (ibid). Leenhardt thus established a basic grammar for these transitions which have since been widely adopted and expanded upon by other commentators. Thus, we find a similar grammar being applied as was adopted by Brown in describing his landscape designs (Willis, 1981). In themed environments, transitional zones are a form of editing between spatial sequences (Hench & Van Pelt, 2003). This transference is not altogether surprising. For example, the editor of The Godfather (1972) and Apocalypse Now (1979), among many other films, once described editing as “not so much a putting together as it is a discovery of a path [emphasis original]” (Murch, 2001, p. 4). Similarly, the theme park model relies on such edits to form a path; to facilitate the negotiation of content visually, spatially, and cognitively. Just as with cinema, this “punctuation” in Leenhardt’s words is what manages the thematic experience, paces it, and allows its navigation and comprehension. The effect is a transformation of one’s relationship with the landscape from aesthetic to experiential (Truniger, 2013).

The cut is the crudest form of film editing. One shot is replaced by another, with no attempt at transition. Lacking duration, a cut is essentially timeless, and derives its meaning from juxtaposition, rather than interaction (Spottiswoode, 1962). In thematic design, such cuts are a common feature of less sophisticated environments such as those of Cedar Fair or Six Flags parks, as they are inexpensive and require less consideration. Yet cuts are also featured in the more refined designs of Disney and Universal. Typically these stark divisions between themed zones employ a blunt shift in the hardscape, and/or changes to adjacent accents such as railings, fences, lighting fixtures, and wayfinding. Sometimes the motif of façades are split directly down the middle, with care also given to the rooflines, as can be seen between Adventureland and Main Street U.S.A. at Disneyland park (Figure 2, left). Such a hardscape transition is implemented between Frontierland and Fantasyland at Disneyland Paris park (Figure 2, center), where materials transform curtly and without warning, creating a visible divide in the landscape and clear differentiation for the guest. This sort of abruptness is not unfamiliar to us, for it is seen constantly in urban environments. One site is designed without consideration for its neighbors and the edges between are defined by disregard for continuity. In a thematic context, such breaks are simply planned carefully and executed with greater attention to detail; abrupt, yet contiguous, paced, and sequential.

If the cut is the crudest, the **fade** is perhaps the plainest; an efficient transition which is softer than a cut yet lacks visual interest. Although an image can be faded into any dominant color, the most typical is a fade out—or “fade to black”—and a white-out—or “fade to white” (Arijon, 1991). The translation of fades into environments could be interpreted as instances where light levels are shifted, as when guests move into darkness or are compelled into bright areas; the time it takes eyesight to adjust is essentially the duration of the fade. A common example is when guests emerge from an interior or deeply shaded area into a space which is intentionally staged in direct sunlight. At theme parks, many attractions and experiences are indoors in either partial or full darkness, so in the course of their visit guests will encounter far more “fades” than they would in a typical landscape.

Related to the fade is “the essence of the cinema” (Abel, 1993, p. 203), the **ellipsis**. Roger Leenhardt noted that a fade “leaves a void but creates a bridge” (ibid) and that its duration controls pace and rhythm in film, perhaps allowing the audience some respite after a tense moment. Although Leenhardt considered an ellipsis a moment which could be fulfilled by either a fade or a wipe, as expressed in environments, ellipses are elongated pauses. By moving guests through a neutral area devoid of theming, they experience a refreshed visual palette. These zones allow for sensory modulation, preparing guests to cognitively adjust from one content focus to another.

Such an approach is used at the Magic Kingdom park at Walt Disney World in multiple locations. The most salient example is the transition between **Tomorrowland** to **Fantasyland** (Figure 2, right). In this instance, guests leave behind the bright concrete walls and playful neon lighting of the comic book retro-futurism of **Tomorrowland** and enter a meandering path that traverses an expansive lawn alongside the park’s railroad tracks. The black metal railings are nondescript and suggest no particular motif. Other hardscape elements are equally bland and purely functional. This space, especially combined with the subtle grade changes and mature trees, acts as a prolonged visual reset for guests before they arrive at the quite different Medieval European fairytale theme of **Fantasyland**. The drastic visual contrast between the two themes, as well as their physical distance from each other, makes an ellipsis the best choice in this instance. Transitions like this are effective but require more space than may be available to achieve the right duration.

In the case of a **wipe**, cinema appears to have borrowed a technique long practiced in constructed environments—a reveal. There are two kinds of wipes in film. The first is when a new scene appears from the left or right (or even above) and seems to “push” the current one out. In the second, a thin line travels across the screen, and the effect is that of a new scene being revealed “beneath” the departing one (Arijon, 1991). The critique leveled against wipes—which quite possibly led to their disuse—is their obvious self-awareness, by “drawing attention to the reality of the screen” (Spottiswoode, 1962, p. 121). Yet in architecture, this kind of reveal is timeless, and such transitions pose no experiential problems as we immediately interpret their constructed form and purpose (Ching, 1996). Reveals as one moves around an object is also a classic practice utilized by landscape designers. Mannerist gardens shifted the visitor on and off a main axis to repeatedly reveal the view of said axis; Le Notre revealed the gardens at Vaux-le-Vicomte through subtle grade change, and Olmsted used sinuous curves through the plantings of Central Park to reveal spaces and vistas (Hazlehurst, 1980). Constructed environments are replete with horizontal wipes; they essentially function every time a corner is turned, a wall ends, or a threshold passed.

The **iris** is perhaps the most common transition in themed spaces. In film it was first used as a shrinking circle to draw attention to an isolated element. Later it was overused as a transition and then only appeared to close cartoon shorts (Arijon, 1991). Today the iris is only a prop; like the wipe, it is employed either for nostalgia purposes or to self-reflexively establish a period setting. In thematic design, its translation lives on in the extensive use of tunnels and bridge underpasses to stage emerging viewpoints. Texts in landscape architecture admire space modulation as expressed by the compression and release afforded by tunnels; “one may, by planned intent, be so compressed into a low, tight, dark space, that release into a lofty, dazzling, free space is startling and dramatic” (Simonds, 1961, p. 152).
Figure 3. Left: Disneyland, east entry tunnel iris, exit view (2007). Right: Magic Kingdom, gateway iris between lands (2007). Photos by Gottwald.

It is uncertain whether Walt Disney knew this formally, but he certainly understood the concept instinctually. Two entry tunnels form the very first transitional zone at Disneyland park (Figure 3, left). Upon entering either the left or right tunnel from this plaza, the momentary darkness created by the passage heightens the feeling of anticipation of entering the park which is enhanced by the berm and railroad above. Although the tunnel is the most effective way to accomplish compression and release, theme park landscapes are also replete with bridges to walk under and or gateways to pass through which facilitate similar sensations (Figure 3, right).

Lastly, the **dissolve** is the most sophisticated transition in the thematic context. In film, the effect is particularly valuable for creating visual continuity between unrelated sequences when juxtaposition would be disorienting (Dmytrk, 1984). Two scenes are overlaid atop one another; the first fades out while the second fades in simultaneously. Dissolves are so effective because their lengths are variable, making a shift between disparate scenes as gradual as the editor desires. In the thematic context, once again, John Hench gives Walt Disney himself credit for this innovation, calling the technique the “three dimensional cross-dissolve” (Haas, 1978). Ruth Shellhorn began this practice in the landscape with her plantings at Disneyland (Comras, 2016). Yet for Hench, a successful dissolve is a completely **multisensory** technique, and when achieved, “there is no confusion for guests—the soles of their feet tell them where they are. Their hands feel it; their eyes and ears know it, too” (Hench & Van Pelt, 2003, p. 79). Thus a dissolve is complex, requiring a smooth interlock of all the various thematic elements—spatial, visual, tactile, auditory, and olfactory.


In Adventureland, such a dissolve is masterfully applied through the careful balance and shifting of all the environmental elements (Figure 4, left). Adjacent to the Plaza Hub, planting design immediately shifts to a palette of tropical understory plants. As guests progress, the ground plane transitions to warm flagstone with an irregular edge, shortly after the first fixtures with a jungle/tropical setting can be found. Next, the
railing changes to a bamboo fence. It is at this point that towering tropical plantings emerge in the form of a dense stand of bamboo. Lastly, architectural elements are encountered as guests are now fully immersed in the theme. Yet dissolves can also deliver a jarring experience when executed poorly. For example, the transition between Adventureland and Frontierland works well when walking from the Old West setting, as the stockade wall of that area’s fort extends into the jungle area and the plantings blend seamlessly. However, when approached from the opposite direction, the scene is starkly different, as the stockade wall is not readily visible from this direction and the lush tropical plantings overpower the mountain plantings of Frontierland (Figure 4, right). The result is a transition that inadvertently feels like an abrupt cut. Here we note that although the filmic grammar of Disneyland is well considered, it is not always applied successfully.

6.2 Filmic Ecotones: The Multi-Modal Approach

We suggest that the most effective thematic transitions are multi-modal; that is, they employ more than one type of filmic grammar. These more complex transitions provide greater subtlety and duration, especially when plantings are considered in concert with structural accents. At this level, filmic punctuation evolves beyond a form of mere editing to something of an environmental feature—what we term a filmic ecotone. This metaphor is sure to be provocative to ecologists, who employ ecotone to describe natural transitions, alternately called edge conditions or edge effects. Yet as Anne Whiston Spirn (1998) argues in The Language of Landscape, human environments are constructed of a grammar employing multiple metaphors, some of which connect directly to our experiences in the natural world. Though the translations are not literal, the affectations are authentic (ibid). Ecotones are where vegetation and animal life commingle in a single community or series of communities (Thomas, Maser, & Rodiek, 1979). An ecotone is thus less a juncture and more a collage, and it is common to find greater diversity of populations and of ecological complexity within an ecotone than in the bordering communities (Odum, 1990). The diversity of such an environment thus contributes to its vibrancy. Again, we stress our approach is metaphorical. In considering this complexity—structured, layered, and rich—experientially, we find that the multi-modal approach to transitions creates spaces which are also vibrant. The diversity of filmic grammar employed results in a transition between themed areas which feels uncannily natural and unplanned to the theme park guest. As in the natural world, intermixing often equals richness.

For a pronounced example of the filmic ecotone, we point to a pair of entries into the most recent addition to Disneyland park, Star Wars: Galaxy’s Edge. This new fourteen-acre themed land is connected to two far older and elaborately realized existing landscapes—Frontierland (the Old West) and Critter Country (the Antebellum Deep South). Both areas are lushly planted and establish not only Earth-bound motifs, but very specific American notions of time and place. The eastern transition between Galaxy’s Edge and Frontierland utilizes an iris, dissolve, and cut (Figure 5, top row). A tunnel under the railroad tracks serves as an iris transition. However, it is markedly different from other iris transitions in the park because of the wall treatments, ground plane, and fixtures which establish the cut and dissolve effects. Here repetition and overlay are employed to gradually shift guests from one land to the other. Leaving Galaxy’s Edge, the tunnel walls are composed of carved stone with horizontal striation. This abruptly cuts to railroad timber halfway through, including the ceiling, in keeping with the Old West setting of Frontierland. Both sides of the passage are flanked with appropriate sconces; somewhat otherworldly on the Star Wars side, with flickering hurricane lamps along the Western half. There is a distinct edge between, yet the overlying dissolves—through the use of repetition and alignment—blur the shift with added complexity and subtlety. The transition is further enhanced by the smooth, gray-toned concrete ground plane of Galaxy’s Edge extending two-thirds of the way through the tunnel, before changing to the warm tones of Frontierland. Likewise, the riprap at the base of the walls from Galaxy’s Edge extends by the same ratio. This mismatch between the reach of hardscape and the tunnel contours is deliberate and well considered, for the variety of cuts creates a gradual blend, what John Hench called “a flow of relations” (Haas, 1978, p. 16).

Unlike the transition into Frontierland for which a tunnel passage is the nexus, the connection to Critter Country is drawn out and primarily occurs in either direction prior to an open-air railroad bridge (Figure 5, center and bottom rows). When walking from Galaxy’s Edge, the first element to emerge is a dark, free-standing wall of stacked railroad ties on the south side of the path. The wall’s color tones match the bridge as seen further down, drawing attention onward. Past this initial wall, there is one last Star Wars lighting fixture before the lanterns of Critter Country begin. The hardscape cuts here as well, with the
exception of a rock curbing which continues all the way under the bridge. Plantings are well-blended, shifting from an exotic palette in Galaxy’s Edge to the varied forest of Critter Country. On the south side, a split rail fence from Critter Country extends to a point nearly opposite the wall on the north side, but a large standing rock in Galaxy’s Edge conceals this fence until the path turns to reveal it, creating a wipe transition. The seemingly incongruous dissolves on either side of the path make the most sense when considered from both directions. The “S” curve of the hardscape—a reveal that Walt Disney introduced in his backyard—combines wipes with various dissolves. This shifts sensory focus from left to right when entering Galaxy’s Edge, and the reverse when entering Critter Country. From an experiential, emotive perspective, this multi-modal transition is perhaps the most realized in Disneyland park. The iris serves as the anchor (certainty), the curve of the path forms a concealment and revealment from either direction (anticipation), and all supporting cuts and dissolves are multisensory, varied, and graduated.

Figure 5: Disneyland, Star Wars: Galaxy’s Edge multi-modal transitions (2019). Top row: east entry from Frontierland. Center and bottom rows: west entry from Critter Country. Photos by George.

7 CONCLUSION

As noted above, with the exception of Ruth Shellhorn, neither licensed design practitioners of landscapes nor the built environment was involved with designing Disneyland park. When Walt Disney was still alive, he acted as creative director to a handpicked staff of mostly animators, painters, writers, and production designers (Pierce, 2016). WED (as the shop was called in the earlier years)8 was run as an adjunct of the Disney Studios (Barrier, 2007). Yet in the decades since, the renamed Walt Disney Imagineering (WDI) has reorganized itself into more professional departments comprising some 140 fields from electrical engineering to psychology and became completely independent from the film and animation arms of the company (Bright, 1987). By the late 2000s, WDI had a permanent staff of at least a dozen landscape architects, with another dozen or so providing ongoing, embedded consultation; all licensed,
ASLA members (Jost, 2009). Today WDI’s design process is about as far from the ad-hoc Evans nursery days as it has ever been. Despite this formalization, the company’s filmic approach to spatial design remains paramount. Multisensory stories, conceived in sequence, are the desired product, and the architecture disciplines are employed to support that goal. “The stories [Disney’s designers] tell are not fine literature, but they add a richness not found in most landscapes….Everything must tie back to this story, from the plants to the garbage cans” (ibid, p. 54, 56).

One might suppose that, although arrived at via filmic grammar, the transitions at work in the theme park model are simply the same techniques which landscape architects have used for centuries; an iris is compression and expansion, a cut is juxtaposition, and so on. Yet it goes beyond vocabulary. What makes the spatial design of Disney’s themed environments unique (and powerful, and profitable, and yes, problematic) is the filmic approach, the focus on the emotional organization of space rather than the rational (Klingmann, 2007). Disney treats the visitors of their parks like “guests” which is to say, as an experiential audience (Marling, 1997). To that end they always design from a first-person perspective, from the POV of the movie camera (Hench & Van Pelt, 2003). This makes their parks highly immersive, stimulating, and above all, entertaining, where the story reigns supreme.9 Most of the company’s landscape architects do not participate in the writing process, but are called upon during the conceptual or schematic phase when the spatial narrative has already been fleshed out (Jost, 2009). And they are always called in the service of spatial experiences organized with filmic grammar. As Paul Comstock, lead landscape architect for Disney’s Animal Kingdom park, once put it quite literally, “Landscape is the set; it is the show” (Malmberg, 1998 p. 86).

The experiential power of filmic transition zones need not be limited to the theme park model. Thematic landscapes ought to be of special interest to designers because the adjacencies are often dramatic and conflicting, as is common to many urban settings, so negotiating diverse environmental motifs successfully is a challenging problem. In addition, thematic design places emphasis on an element which is often overlooked by designers of constructed environments: time. As the theme park model is a fusion of cinema and space, it is also an amalgam of time and place; a four-dimensional, temporal experience. Yet unlike film, where only a single transition is typically applied per sequence, the landscape has the capacity to simultaneously support multiple transitions. As we argue, such a multi-modal approach leads to richer, more naturalistic, and more experientially coherent results.

Designers of constructed environments, whether landscape or architectonic, may find many elements adaptable to a variety of projects by considering all the techniques outlined here. The concept of the filmic ecotone, in which a multi-modal approach of ellipsis, iris, and various wipes and dissolves are combined, provides the most seamless transition through a rich experience of passage through a shifting space. Often the edges between landscapes are not considered zones, but rather mere lines; firm, sharp edges which abruptly signal the passage from one to the next. As natural ecotones (as well as our metaphorical filmic ones) demonstrate, there is much more to interaction than boundaries; there is an undeniable vibrancy which contributes to flow and cohesion. Still, while the theme park exemplifies both filmic grammar and transitional spaces, both are of value outside the thematic context. Whyte notes that the success or failure of a plaza starts with the seamless transition from the street where “it’s hard to tell where one ends and the other begins” (Whyte, 1980, p. 57). As noted earlier, this is precisely what Charles W. Moore noted was so successfully executed at Disneyland. Designers of a public park might consider how the application of filmic grammar in a transitional space could heighten the sense of arrival and help transport the user to an experience of respite from urban life. In such ways, transitional zones in themed environments can inform the practice of landscape architecture in designing plans that more cohesively fit the gestalt of the surrounding landscape, both at a site and macro level. Furthermore, thematic design demonstrates that creating cross-site cohesion need not be dependent upon materials and plantings, but rather can be achieved by carefully staging filmic transitions that reflect and respect the adjoining sites. In this respect, when well-executed, these zones provide evidence of how successful innovative design can be in shaping identity and experience in the landscape. Despite this potential, future research is needed into the use of filmic grammar in landscapes outside of a theme park setting to better establish what impact such an approach may have and what modifications may be necessary.
8 ENDNOTES

1 Often the only reliable direct quotes and biographical profiles for Disney designers come from works published in one form or another by the company. References to these sources are limited to where it is most appropriate. See: Hench & Van Pelt, 2003; Kurtti, 2008 et al.

2 ~$250,000 in 2019.

3 This and similar quotes are taken from The “E” Ticket magazine, published 1986–2009. The title remains an invaluable independent primary source due to the number of interviews with Disney designers, and the issues are archived at the Walt Disney Family Museum.

4 When California enacted state licensing for landscape architects in 1954, both Evans brothers were "grandfathered in." See: Comras, 2016, p. 217.

5 Shellhorn left Cornell in 1933 without a degree, believing herself to be four units short. The fact that she had actually completed the full units for both a degree in architecture and landscape architecture was finally corrected by the university in 2005, a year and a half before she died. See: Comras, 2016.

6 When Italian philosopher Umberto Eco visited Disneyland in the early 1970s, he described the immersive qualities of the theme park as being "total theater" See: Eco 1986, 45–46.

7 Hench is widely cited as the most articulate Disney designer to describe the lexicon of thematic design and its close connections to filmic grammar. See: Haas, 1978; Hench & Van Pelt, 2003.

8 "Walter Elias Disney." The man’s full name, to distinguish the company from the Disney Studios.

9 "...our primary goal is to entertain." Jeff Morosky, ASLA, director of landscape architecture at WDI, quoted in Jost, 2009, p. 54.

8.1 REFERENCES


CHALLENGING FORMS OF HISTORY: THE DIALOGIC COUNTER-MONUMENT

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1 ABSTRACT

As monuments to once revered figures receive increasing public criticism for their celebration of problematic histories, a new type of monument is emerging in our time. As its name indicates, a dialogic counter-monument is a designed response to an existing monument that challenges the monument’s connection to place and expands and recontextualizes its account of history. The term dialogic suggests that the new monument does not ignore, erase, or supersede the collective memory that the existing monument produces but instead engenders an exchange between the two for observers. A dialogic counter-monument functions similarly to interpretive signage that provides crucial background and context, but it relies on physical spatial design over written text.

This paper presents the work of a graduate level studio where students were asked to design a dialogic counter-monument and harness landscape architecture as an effectual means of engaging collective memory (Wasserman, 1998). Critically, the site of this design studio was on the unceded, traditional, and ancestral territories of the ʷməθkʷəy̓əm, sḵwx̱wú7mesh, and selilwitulh people. The design projects had to recognize and respect that Indigenous connections to place have been severed by forces of colonialism that have effaced the ongoing traditional uses and aesthetic expressions of the landscape. At the same time as they sought to foreground these preexisting yet unacknowledged ties to place, students also endeavored to design for today’s transitory immigrant population, inhabitants who similarly lack significant relationships to land. Ultimately, the design work required a sensitivity to the plurality of affective memory experiences.

1.1 Keywords

Design studio, monument, place, land, decolonization.

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2 INTRODUCTION

Monuments, as intentionally designed objects that bridge landscape and architecture, are conceived to establish a link to the past and to anchor time in place. Constructed for the public sphere and, ostensibly for the public good, they represent people, dates, and narratives that become ingrained in collective social memory. A statue to Christopher Columbus, for example, establishes a temporal connection between his landfall on October 12, 1492, and the present day as well as a spatial link between the location of the monument and a larger notion of the Americas. After all, Columbus is not credited with ‘discovering’ Guanahani in the Bahamas, where he physically stepped off his boat, but instead the entire American continent. Individual statues of Columbus, therefore, link their locations together and help to build the concept of a connected territory, one that would later become occupied by European settlers in the years following Columbus’ voyage. In recent years, however, monuments to now controversial figures such as Columbus have become objects of increasing public scrutiny. The indelible link between Columbus’ actions, the subsequent genocide of Indigenous peoples, and the ongoing occupation and colonization of Indigenous lands are crucial factors to an increased desire to have monuments to Columbus and similar figures removed from public spaces and the collective consciousness. In recent months, statues in the likeness of Christopher Columbus have been removed from display in Illinois, Maryland, Massachusetts, Minnesota, Ohio, Texas, and Virginia, among many other locations.

Similar to the example of statues to Columbus, the current debate over monuments to controversial figures has been focused on their static control of collective memory. As Josep Lluís Sert, Fernand Léger and Sigfried Giedion state plainly in their Nine Points on Monumentality, “Monuments are, therefore, only possible in periods in which a unifying consciousness and unifying culture exists” (1958, p. 48). This statement accurately describes why, in our time of increased political polarity which has seen greater support for ongoing minority opposition to public monuments, that the existence of commemorative sites would be challenged. However, this assertion overlooks the ability of a monument to bring into being a greater sense of unity. Indeed, the very removal of monuments and the attendant forgetting has led some, like Kenneth E. Foote, to suggest controversial monuments, by their very nature, are important in order to focus dialogue and challenge what is and what is not included in our recollections of history (1997, p. 6). Others have argued that instead of removal, the building of more monuments is required, or more specifically the design of what has been called the “dialogic counter-monument”. This is defined by Quentin Stevens, Karen A. Franck and Ruth Fazakerley as a “monument that critiques the purpose and the design of a specific existing monument, in an explicit, contrary and proximate pairing” (2012, p. 952).

A dialogic counter-monument serves a comparable function to that of an interpretive plaque installed next to a controversial monument, yet importantly it aims to recontextualize an existing monument through a spatial design instead of written text. Maya Lin’s 1982 Vietnam Veterans Memorial is a well-known example of a dialogic counter-monument, which “establishes contrasting spatial, thematic and experiential relationships to Washington’s existing commemorative topography” (Stevens, et. al, 2012, p. 964). The imagined vectors extending from Lin’s ‘V’ shaped monument point to both the Lincoln Memorial and the Washington Monument, yet Lin chose to sink her structure into the earth and use a somber and reflective black granite surface material. Instead of an uplifting and hopeful monument to be seen from a distance, Lin produced an introspective space more reminiscent of burial and death. As an indication of how quickly the Vietnam Veterans Memorial was recognized as a counter-monument, and one that challenged the history of war as a glorious act, only two years after it was completed did Frederick Hart add yet another dialogic counter-monument to the Mall. Recontextualizing Lin’s monument, Hart’s 1984 The Three Servicemen reemphasized heroism and valor through three larger-than-life armed military figures.

As the works by Lin and Hart make clear, monuments are no longer necessarily static objects that preserve the memory of legendary figures and momentous one-sided histories. Rather, they engender contemplation and conversation, and often work in dialogue with other statues and sites. As opposed to listing dates and providing answers, they provoke viewers and invite questions. This paper explores the purpose, and the potential power, of monuments today. It presents the work produced during a graduate level studio from the University of British Columbia in which students were asked to design a dialogic counter-monument to Captain George Vancouver, a European seagoing explorer whose pursuits and actions, similar to Columbus, are being questioned, recontextualized, and reexamined. The student work reveals an expanded concept of the monument, where design becomes a reflective practice that challenges once celebrated pasts and rethinks history’s ties to place.
3 BACKGROUND

The studio course necessitated an understanding of the colonial history of Vancouver in British Columbia, Canada. 1827 marked a permanent change in relations between the Indigenous peoples of the land known today as British Columbia and seagoing Europeans. In this year, the construction of Fort Langley by the Hudson's Bay Company (HBC) established a permanent defensive trading center on the “Fraser” river. This fortification facilitated direct access to European markets and signaled a shift from an exploitation colonialism to settler colonialism (Harris, 1997, p. 76). Fort Langley was soon followed by Fort Victoria, built in 1843 on the island which would be renamed Vancouver Island. A few years later, in 1849, the entire island was claimed by the British Empire as the Colony of Vancouver Island to which the HBC was given exclusive property rights and as a result, increased efforts to establish a settler colonial city (Clayton, 2000, p. 386). The claim of sovereignty over the island was quickly followed by a larger territorial claim on the mainland. In 1858, Richard Clement Moody (His Excellency, Major-General The Honourable, a member of the Royal Geographical Society, the Institution of Civil Engineers and the Royal Institute of British Architects) founded the Colony of British Columbia as a representative of Alexandrina Victoria (Queen Victoria, Queen of the United Kingdom of Great Britain and Ireland, and later, the Empress of India). The Colony of British Columbia and the Colony of Vancouver Island amalgamated in 1866, and several years later joined the Canadian Confederation, becoming part of the Dominion of Canada under monarchical rule.

Already by 1881, the social, economic, and ecological organization of what became the Lower Mainland, on which today we find the city of Vancouver, had been radically transformed. Central to this transformation was the reorganization of land, its parcelization, ownership, lease and sale, combined with its occupation, working, and trade. All of this was dependent on a European imagination that conceived of land as an exclusive possession. Thus, in this “colonial regime, the emphasis of power had shifted towards the control of land and the management of movement thereon” (Harris, p. 101). Ultimately, this imposed spatial discipline forcibly reorganized, and continues to control, the ways in which residents and guests relate to, move through, and experience the land. As early settlers claimed property, Indigenous residents were forcibly resettled to discrete and isolated reserves. The First Nations village site of X̱w̓ayx̱way, for example, was demolished to make way for a road in what later became a park named after Lord Stanley, the 16th Earl of Derby and the sixth Governor General of Canada.

With control of land being both the object and the source of colonial power, it makes sense that the province was designated “British Columbia,” as this name is an assertion of national territorial control (Rose-Redwood, 2016, p. 194). A quick scan of the local geography reveals the comprehensive use of this strategy of naming and claiming: Port Moody, Moody Park, Moody square, or the City of Victoria. Incredibly, even time has been bent to recognize British rule, notably Victoria Day, a permanent holiday celebrating the birth of the Monarch. Vancouver Island and the City of Vancouver owe their name to one man, Captain George Vancouver, a British officer of the Royal Navy.

George Vancouver sailed along this coast years before Richard Moody and is best known for his five-year expedition that began in 1791. The plaque under his larger-than-life statue, which sits upon a plinth at a central location outside of Vancouver City Hall, reminds us that his “geographical accomplishments are venerated to this day.” Ken Brealey’s reflection on this point is instructive: “while taking nothing away from Vancouver’s navigational and surveying skills – evidenced in the almost exquisite details with which he measured and charts one of the world’s most convoluted coastlines – the professional detachment of his cartographic record is unsettling” (1995, p. 142). Unsettling is a key term in describing Vancouver’s maps. Even as the coastline was drawn with precise measurement, Vancouver recorded no Indigenous presence on the land. Looking back over the work, we feel unsettled not just by his singular focus but also, in a much more insidious way, by his maps’ displacement of local Indigenous peoples. With their presence, indicating details including habitation, land use, or named features, absent from cartographic representation, Vancouver’s work supported Britain’s claim to the region, as the discovery and naming of this coastline was now theirs. The maps supported the position that this land was terra nullius, or empty of use and available for new occupation (Simpson & Bagelman, 2018, p. 559).

However, it remains a fact that the city of Vancouver is fully within the unceded, traditional, and ancestral territories of the w̱məθkwəy̓əm (Musqueam), sk̓ʷx̱w̓ú7mesh (Squamish), and səl̓ílwəṭən (Tsleil-Waututh) people. To acknowledge that the land is unceded recognizes that this territory has never been
turned over to the British Crown by treaty, war, or other agreement. Any and all claims of ownership by the British Crown, and subsequently by colonial subjects, are matters of dispute. To be clear, this is stolen land.

Figure 1. Statue of George Vancouver (2019). Photo by Fionn Byrne.

Nevertheless, the City of Vancouver has overseen a capitalist development on and of the land, from a resource extraction port to today’s modern real estate driven metropolis. Ongoing control and access to the land is necessary for the success of the settler-colonial project, yet it is this same land which has continuously provided the material and spiritual sustenance of the Coast Salish people (Coulthard, 2014, p. 7). The relationship to land is then a matter of concern to Indigenous and settlers alike, and this idea served as the starting point for the studio course.

4 RESEARCH OBJECTIVES

The development of the city of Vancouver required the violent imposition of a foreign spatial order over the preexisting landscape (Simpson & Bagelman, 2018, p. 559). Abstract geometries of land division, usage zoning, and infrastructural servicing were inscribed into the material organization of the city, legible in the ground, water and air. Constructed through a foreign legal system and mediated with maps, the fabric of the city today reflects little of the traditional uses of the land, nor the ancestral connections established here. The Indigenous caretakers of this landscape have had their access to the past obstructed by an intentional and forced erasure of place. For example, the easily visible twin peaks among the North Shore Mountains, known by the Squamish name Ch’ich’iyúy Elxwikn (Twin Sisters), remains as a sacred ancestral marker of a historic peace treaty between the Squamish and Haida people. Yet in the late nineteenth century, John Hamilton Gray renamed these mountains The Lions because, it is said, they reminded him of Edwin Landseer’s Lion Statues in London’s Trafalgar Square. Thus, a long-standing connection to past and place for Indigenous peoples was superseded by a tenuous connection to a European motif.
Without suggesting an equivalence, the sense of disconnection from place is also pervasive among the diverse non-Indigenous settler population. While many in the city are first generation immigrants, even those who have grown up in Vancouver remain as uninvited guests residing on land where title is illegitimately held. Establishing connections to place and locating oneself in time through ancestral relationships has been challenged for settlers by parallel forces of colonialism that have effaced the ongoing traditional uses and aesthetic expressions of the landscape for Indigenous peoples. How does a non-European immigrant to Vancouver relate to the Lions of Trafalgar Square? How does an established settler appreciate the history of the Lions and Vancouver’s development while simultaneously accepting that this history is written over a longer and prior understanding of place? And equally challenging to answer, how is a transient mobile population, who will live in Vancouver for only a few years, expected to understand the history of this geography and establish meaningful connections to place?

In Vancouver, just like in any other modern colonial city, settlers remain profoundly unsettled as they move around the globe following capital, for education or work. As geographer Yi-Fu Tuan reminds us, the “modern [individual] is so mobile that [one] has not the time to establish roots; [their] experience and appreciation of place is superficial” (1977, p. 183). This has profound importance because as Tuan writes, and as we know intuitively, we have greater respect for the places to which we feel attachment. For Indigenous residents whose roots are forcibly severed and for the uninvited guests who are denied a way of life that facilitates establishing roots, connections to place wane. It is likely that this disconnection from place contributes to our patterns of consumption and waste, which, in turn, have had such negative impacts on the environment. We can speculate on whether a disconnection from place makes consumerism palatable or if a consumptive economy necessitates being mobile, but without doubt, it is certain that the earth won’t be able to accommodate this willful destruction of the environment for much longer without experiencing significant and irreversible changes.

Returning to the notion of the dialogic counter-monument, we are led to ask how one would design this type of monument to George Vancouver. Currently, his likeness rests at the entry to the Vancouver City Hall. Dressed in his Naval uniform, he is commemorated holding a scroll, perhaps a map or a claim of title to land, and he points north (Figure 1). Unsatisfied with resting in the city that bears his name, he aims forward, continually discovering, continuously expanding the Empire. This monument to consumption and motion seems prescient, preceding Manuel Castells and Ricardo Bofill agreement that “the new architectural monuments of our epoch are likely to be built as ‘communication exchanges’” (Connerton, 2009, p. 111), moments of transfer between networks in motion, like intermodal transfer areas. Think of Santiago Calatrava’s World Trade Center Transportation Hub, opened in 2016, for example, the epitome of commemorating consumption and motion. Communication exchangers, such as airports, railway stations, warehouses, or data centers, focus on speed of movement and are often experienced exclusively as interior spaces. Having limited connection to the environment, these sites necessarily negate the slowness and fixity of the landscape and nullify landscape’s ability to act as a site of collective memory.

There is, however, a different path which points towards an alternative type of monument for our epoch, one which is necessarily contextual, culturally engaged, and site specific. As Judith Wasserman argues, “landscape architects have a unique contribution to make to the memorial landscape” (1998, p. 60), and they can do this by designing spaces whereby the expressions of the physical landscape aspire to connect people to place. The work of the studio presented in this paper sought to reject the commemoration of excess wealth through ongoing exploitation of land, choosing instead to critique a colonial history and ask how we can design differently. The studio endeavored to better understand what the significance of memory is in a place that has purposefully, and violently, effaced connections to an ancestral past. Furthermore, recognizing that “the very processes of globalization have effectively abolished the temporal and spatial distance that previously separated cultures” (Enwezor, 2003, p. 57), this studio looked to landscape to reassert and make legible unique processes of nature inextricably rooted in time and place. Through this ecological lens, landscape emerges as a cultural project and a force of resistance against totalizing globalization.

Within this theoretical context, the focus of the studio continuously returned to two interconnected questions. On the one hand, how can architectural form be designed to generate (or recover), gather (or disperse), and hold (or forget) collective memory? To answer this question, we must presuppose that a relationship does indeed exist between physical form and the spatial politics of collective memory. When thinking about form this way, one can design to influence public interaction and behavior more purposefully.
On the other hand, a second question asks, in a multicultural society, how can a monument, through the experience of form, mobilize affect towards positive social change?

5 METHODS

This single-term studio was open to second- and third-year graduate students at the School of Architecture and Landscape Architecture (SALA) at the University of British Columbia (UBC), Canada, in the fall term of 2019. A group of twelve self-elected to enroll in the course. The class contained two graduate level architecture students (March) and ten studying landscape architecture at the graduate level (MLA). The studio was thirteen weeks long, with three process reviews, followed by a final review in the fourteenth week of the term.

In typical studio format, the majority of class time was scheduled for desk critiques, where students would meet individually with the teaching faculty. Yet unlike typical design studios, this course placed significant emphasis on reading and class discussion. The first half of the semester, divided into six one-week themes, required students to complete compulsory readings, prepare and present precedent case study investigations, maintain a sketchbook, and produce physical sketch models. As most of the students enrolled in the course were unfamiliar with the studio site and context, the readings had to cover considerable historical and theoretical ground.

The first week of readings introduced students to contemporary discussion around memorials, where Erika Lee Doss’s *Memorial mania: Public feeling in America* (2010) was a central text. The readings in the second week provided a design perspective to the subject, introducing students to Keller Easterling’s *Subtraction* (2014), John Brinckerhoff Jackson’s *The necessity for ruins, and other topics* (1980), and Kevin Lynch’s *What time is this place?* (1972). Students were then given design strategies in week three, and counter-strategies in week four, with key readings including Owen J. Dwyer and Derek H. Alderman’s *Memorial Landscapes: Analytic questions and metaphors* (2008) and Quentin Stevens, Karen A. Franck, and Ruth Fazakerley’s *Counter-monuments: The anti-monumental and the dialogic* (2012), respectively.

Week five initiated a conversation on the past and present of colonialism in British Columbia, relying on the work of local scholar Cole R. Harris’s *The resettlement of British Columbia: Essays on colonialism and geographical change* (1997) and Glen Sean Coulthard’s *Red Skin, White Masks: Rejecting the Colonial Politics of Recognition* (2014), among others. Finally, week six emphasized colonialism as an ongoing design project among the fields of landscape architecture, city planning, and ecological science. Students read, for example, Daisy Couture, Sadie Couture, Selena Couture, and Matt Hern’s *On this patch of grass: City parks on occupied land* (2018) and Michael Simpson and Jen Bagelman’s *Decolonizing urban political ecologies: The production of nature in settler colonial cities* (2018). In total, twenty course readings introduced the students to important themes and grounded their eventual design work in the literature.

To compliment the course readings, students also had to study precedent design projects. A set of twenty-one case studies offered a diverse range of responses to the act of making a monument. The students analyzed such well-known work as Maya Lin’s *Vietnam Veterans Memorial*, Geoffrey Jellicoe’s *John F. Kennedy Memorial*, and Hood Design Studio’s *International African American Museum*. Students also researched lesser known but equally significant projects, including Alan Sonfist’s *Time Landscape*, Gunter Demnig’s *Stumbling Blocks*, Agnes Denes’ *Tree Mountain*, and Jonas Dahlberg Studio’s *Memory Wound, 22 July Memorial*. In each case, students studied and redrew specific design details from these projects, including key dimensions, materials, or phasing.

In the second half of the semester, students worked to develop a single design proposal in detail. Specifically, they were required to design a dialogic counter-monument to the statue of George Vancouver at the Vancouver City Hall. With the readings and discussions intended to situate the students’ projects within the discipline of landscape architecture and with respect to the history and context of the physical site, students endeavored to apply the concepts and theoretical frameworks gained from reading and research toward their design proposals. However, students were encouraged to find their own voice in defining, designing, and defending a unique response to the studio brief. The location, scale, program, material, and specific objective of each project was self-generated, and students used their design work to explore the space between the course themes of memory versus history, place versus space, time versus chronology, and absence versus presence.

Design emphasis in this studio was placed on formal expression, ecological transformation, and programmatic occupation of a designed addition or subtraction to the site. Students were thus expected to
challenge the metaphorical and literal significance of the existing statue’s form, to question the unchanging material palette of the statue and its surrounding site, and to introduce novel programming that would engender new modes of public interaction. As students researched the various features of the existing statue, they were encouraged to respond with a designed alternative. Through this process of designing their own responses, students came to better understand how the existing monument operates on both personal and societal levels. Primarily interested in actions and intervention responsive to existing conditions, this studio treated the exercise of siting a new monument as a means of producing social impact through small-scale design, as opposed to a broader urban design challenge.

6 DISCUSSION

Four of the twelve students in the studio chose to work in partnership, which resulted in ten final projects. Each project was presented in the final week of studio to an external jury of peers. Students were responsible for positioning their project relative to the preceding readings, developing their own representation style, and articulating their own definition of a counter-monument. In the following discussion, four of the twelve projects are described in detail below. These four examples demonstrate the broad range of responses to the studio brief. Exploring concepts of time, truth, value, and engagement as they pertain to history and place, each project contributes to new understandings of the counter-monument and its design.

6.1 Time

Nicole Crawford and Karen Tomkins, two third-year landscape architecture students, explored the relationship between history and memory in their project “Chronos: Kairos.” Through their work, they sought
to respond critically to the ways in which monuments institutionalize and freeze time, preserving only certain moments in perpetuity. The students characterized the dominant mode of memorialization as marking an event or person as important, creating a distinct formal object to signify that which is to be memorialized, and selecting a material palette that will ensure the continuity of the object into the future. They understood that this act implicitly accepts a linear understanding of time, where past, present, and future line up sequentially and the objective of this form of memorialization is to unite the three for as long as possible.

To support this claim, Crawford and Tomkins drew from Sert, Léger, and Giedion’s *Nine Points on Monumentality*, referencing the statement, “Monuments are human landmarks which men have created as symbols for their ideals, for their aims, and for their actions. They are intended to outlive the period which originated them and constitute a heritage for future generations. As such, they form a link between the past and the future” (1958, p. 48). Through studying all forty monuments dedicated and designated by the Vancouver Heritage Register, Crawford and Tomkins learned that only a very shallow slice of history was being commemorated and preserved. The monuments they researched prioritized a colonial history of occupation, and almost all of them were dedicated to white men of European descent who lived in or visited Vancouver.

In response to their observations, Crawford and Tomkins designed three counter-monuments that critically reevaluated the temporal dimension of a monument. Sited in proximity to a pre-existing and permanent memorial in the city of Vancouver, their project gave form to a new type of monument, one that would register and make legible the passage of time. In their design, they mobilized the cyclical properties of nature and the concept of deep time through geology. For one of their proposals, the students envisioned planting a multitude of a flowering plants with rapid seasonal cycles of bloom and decay. The spent flowers would slowly accumulate into layers of sediment, marking the passage of time. In another proposal, the twice-daily rhythm of ocean tides would produce a living and visible ecological gradient across a semi-submerged Western red cedar. Of course, as sea levels rise, so to would this gradient slowly migrate upwards. Both proposed memorials would ultimately degrade and disintegrate, with the intent being to spark conversation about future sites of memorialization.

Returning to Vancouver City Hall and challenging the static and long-enduring representation of George Vancouver, the third act of this project proposed a subtle control joint cut down the center of the stairs descending form the base of the statue. During times of intense rain, this joint would gather and direct water (Figure 2). Detritus would also accumulate and provide the foundation for a temporary habitat. This small incision would mark time by generating a unique non-human micro-environment, constantly changing with minor fluctuations in hydraulic conditions. Running perpendicular to the stairs, this quickly noticed cut, would demand attention and refocus a visitor’s gaze away from the statue above and toward the ground underfoot.

Through designing interventions that would chronicle change, Crawford and Tomkins argued that connections to place can be made by recognizing and acknowledging one’s position in time. By highlighting the political dimensions of monuments, this project also sought to address the inherent conflict of forcing a future public to accept a present set of beliefs. In designing a monument to be temporally bound and relatively short lived, this work projected a hopeful view of the future, accepting that social developments in the decades and centuries to come may challenge or negate some of the vocabulary and social norms in place today. Thus, an important characteristic of the link between past, present, and future is change and progress.

6.2 Truth

Calvin Tan, a third-year landscape architecture student, imagined a massive, broken boulder resting at the entry to Vancouver City Hall (Figure 3). In so doing, Tan placed the rigidity, clarity, and openness of the formal design language of City Hall—its grand staircase and the statue of George Vancouver—into conversation with a new vocabulary of enclosure, separation, and void. The fragmented boulder symbolized the colonial dispossession and forced relocation of Indigenous people from this land, but the critique gained further sophistication through Tan’s choice of material and his formal design decisions. For example, the openings surrounding the perimeter of the object were brought close together, at times reaching only 500 mm. The passages then expanded as they extended inward, towards the statue of George Vancouver, producing asymmetrical conditions for those interacting with the boulder. From the exterior, the boulder appeared near solid and must be entered individually. The interior spaces, however, were suitable for
dialogue between small groups. Tan, furthermore, treated the surfaces to extend the juxtaposition between impenetrable and inviting. The exterior was rough and unfinished, while the passageways were smooth and reflective.

Tan’s project was influenced in part by Selena Couture, a local Vancouver scholar who led the class on a trip that explored the built legacy of colonialism in Vancouver’s Stanley Park. In her book *On this patch of grass: City parks on occupied land*, Couture says of parks, and of public space generally, “there is so much to love about parks, but they need to be understood not as natural or authentic, but as restricted, ordered spaces that clearly articulate what constitutes correct behaviour and acceptable interactions. And that exercise is intensely political and biopolitical” (2018, p. 41). Tan engaged this idea in his project by making legible, through negation, the formal organization and acceptable interactions possible at the steps of City Hall. In turn, by its very being, this imagined boulder reasserts the primacy of land as a driver of political discourse and facilitates new modes of interaction with the statue of George Vancouver. Ultimately, this counter-monument argued that both individual reflection and collective discourse are necessary for a meaningful reconciliation with the past.

6.3 Value

Mason Lam, a second-year landscape architecture student was also drawn to the writing of Selena Couture. When discussing city parks on unceded Indigenous land, Couture states, “the ongoing disobediences in the park – in almost all parks – are promising; they gesture towards larger possible refusals and reorderings in hopeful ways” (2018, p. 38). Lam’s project sought to formalize an act of landscape disobedience. To achieve this objective, he turned his attention to the community garden that occupies the lawn at the base of George Vancouver’s statue. Recognizing that fruits, vegetables, and flowers are all assets that the urban gardener defends and protects, Lam argued that the gridded garden is exclusionary.
and perpetuates colonial actions of claiming and privatizing land. The community garden operates more as a type of commodified real estate than as a site of social participation and dialogue.

In order to reverse this condition, Lam designed a weed garden. Cultivating dandelion, purslane, or crabgrass, for example, would allow the gardener to connect with plants in a way that denies easy privatization and commodification. Unlike a typical urban garden, which assigns a lucky few with individual raised planters, Lam designed a circular strategy of cultivating weeds between vertical flagstones. The landscape architect would strategize the initial setup but would quickly turn over design control to the public (Figure 4). Participants would move stones, fill cracks between them with soil, and tend to the weeds.

![Figure 4. Sow Many Weeds: Collective gardening (2019). Image by Mason Lam.](image)

In this imagined space, any city resident could participate in a collective act of gardening, enjoying the health and social benefits from engaging with nature.

Following Michael Simpson and Jen Bagelman’s description of early European settlers as “unable to recognize any forms of cultural intervention that did not resemble the particular linear order with which they were familiar in Europe” (2018, p. 559), Lam’s work prompted a reappraisal of the politics of gardening by producing a design concept that rejects a rigid and rule based system designed for the exclusive benefit of a few. The weed, a plant that by definition has no intrinsic use or aesthetic value, was the ideal tool for driving a wedge between gardening and commodification. This counter-monument operates not to continuously reinforce widely held values, but instead to challenge our assumptions about value in nature and to force a recognition of a plurality of value systems.

6.4 Engagement

The final example is the work of Weirong Li, a third-year landscape architecture student. As mentioned above, readings in this course focused a critical lens on the impact of George Vancouver’s mapping of the Pacific Northwest, with primary importance placed on the City of Vancouver and
relationships with Indigenous nations. Li researched the impact of George Vancouver’s travels beyond our local geography. Notably, although George Vancouver is buried in Petersham, England, his grave continues to be maintained by the City of Vancouver. This realization opened a line of reasoning that the statue of George Vancouver should be repatriated and installed at the gravesite where his body lies. While Li did not declare that the removal of Vancouver’s statue should coincide with a conversation around renaming the city, her project visualized the site of removal as an unfinished and, therefore, open-ended design project that was meant to pique curiosity, provoke questions, and incite dialogue and further action. Left to be colonized with ruderal vegetation, the absent statue and plinth elude to an incomplete act (Figure 5).

Figure 5. Going Home: Sharing the experience of colonialism (2019). Image by Weirong Li.

Li’s proposal also intended for the repatriation of George Vancouver’s statue to engender shared dialogue across locations and communities. Acknowledging that Vancouver had sailed to ports among many former colonies, this project proposed that the statue be installed temporarily at the city hall of multiple destinations. Before reaching its final resting place in Petersham, the statue would visit Oregon, Washington; Honolulu, Hawaii; Picton, New Zealand; Albany, Australia; and Cape Town, South Africa. At each destination, the statue’s shipping container would be dis-assembled and reassembled into a public gathering space. While the temporary installations would prompt each community to discuss its relationship to George Vancouver, the precise nature of these conversations would differ. Gathering spaces, for example, might prioritize assembly in one location, conversation in another, or observation and reflection at yet a third. The repeated removal and relocation of the monument, therefore, seeks to foster critical dialogue at many moments along a journey. Removal is neither a momentary nor a concluding act but an opening to engage a larger conversation about the legacy and impact of that which was previously memorialized. In this case, the opportunity exists to strengthen a conversation around the shared impacts of colonialism and the varied paths towards decolonization.
7 CONCLUSIONS

This studio was not interested in problem solving. Instead, the design work was meant to be instructive, teaching all involved to better understand our contemporary situation and ask yet more questions. If it has been successful, this work will necessitate a far longer engagement with the subject matter. This is recognized as a serious obligation for those who wish to practice landscape architecture in the city of Vancouver or in other similar environments. Recognizing the didactic nature of this project, we can also understand that the buildability of the proposals is secondary to the design’s ability to generate discussion and modify thought. Hence, the design work did not need to point to a forthcoming built project, rather, the design work itself was the project. This is part of the reason that this studio placed significant emphasis on reading, sketching, modeling, and discussion. As James E. Young argues in *The Stages of Memory*, it is the debate generated by the process of memorial design, which is most important, not the object of the finished memorial, stating, “in this view, memory as represented in the monument might also be regarded as a never-to-be-completed process, animated (not disabled) by the forces of history bringing it into being” (2016, p. 16). Acknowledging history as an incomplete project, open to influence from contemporary design, this studio proposed that the design process itself can act as an opportunity to decolonize thought by exploring and critiquing our personal and shared attitudes towards the land. The counter-monuments proposed by the class span themes of time, truth, value, and engagement, and each deploy landscape design to critically engage with the static monument of George Vancouver. Answering the two studio questions, these project examples assert that formal design can shape collective memory, and furthermore, that time based, temporary monuments which emphasize dialogue and active participation are valuable strategies to drive positive social change in a multicultural society with competing accounts of history.

8 REFERENCES


FOR WHITES ONLY:  
A TIMELY COMMENTARY ABOUT  
LATINOS AND LANDSCAPE ARCHITECTURE  

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1 ABSTRACT

Between the 1920s and 1940s, signs were spread across Texas blatantly discriminating against Mexicans in public places that read “We serve Whites only. NO Spanish or Mexicans.” Is this expression of repression still silently extant in our universities, professional organizations, and professional practice that prevents Latinos from entering landscape architecture? More Latinos will inhabit our landscapes and public spaces as the Latino population continues to grow. Those designs, however, might not have considered Latino representation, regional design traditions, and participation in the power structure that makes decisions about their environments. 

Several dominant cultures colonized America such as England, France, Italy, and the Netherlands. They influenced the political and sociological ideals manifested in professional organizations such as the American Society of Landscape Architects (ASLA). Analyzing the representation of Latinos in landscape architecture begins with briefly studying the history of colonization in the United States and its influences on the founding of ASLA in 1899 to the current issues that impact the Latino growing population. The exclusion of Latino culture in landscape architecture organizations institutions, whether through neglect or racism, ignores a contemporary need for Latino representation as designers and leaders in the decision-making process about environments, particularly where their demographic is increasing. This paper attempts to understand the making of a holistic system where Latinos can exist within the larger cultural profession to contribute to their knowledge about landscape and design.

1.1 Keywords

Latino landscapes, landscape architecture diversity, Latino studies, landscape and ethnicity, social justice
2 INTRODUCTION

Between the 1920s and 1940s, signs spread across Texas blatantly discriminating against Mexicans in public places that read "We serve Whites only. NO Spanish or Mexicans." These signs were a way of keeping Latinos segregated from the white population. There are no signs like these on doors to landscape architecture departments or offices but is this expression of repression still silently extant in our universities, professional organizations, and professional practice that prevents Latinos from entering landscape architecture? The lack of participation by Latinos and people of color (POC) has already been identified by the power structures in society and yet Latinos are not being attracted to the profession of landscape architecture. Since the inception of Landscape Architecture in 1899 Latinos have been underrepresented in number, in leadership, in their cultural values, in awards, in historical literature, and in the design of their communities. This paper suggests that attracting Latinos requires that we consider Pre-American history and its evolution to today making sense of the issues. In defining a preparation strategy and action for Latino arrival at the doors of our institutions consideration should be given to documenting their contributions to landscape architecture history and nurturing Latino members to be active members of the profession. As the Latino population of the United States (US) grows, there are more Latinos who inhabit our landscapes and public spaces. Latinos should be sharing in the leadership, the participation, and their representation on projects involving them and their neighborhoods. Latino landscape architects should be present as designers in their environments inhabited by its Latino users.

3 HISTORY

The formation and background of organizations and professions in the United States follows British and European values structuring them predominantly for the influence and protection of aristocratic classes. In Medieval Britain the medical profession set the model for professions using royal charters written from parliament that specified the workings of the group, administration, and application of medicine in Britain (Macdonald, 1995). Memberships were limited to graduates of Oxford and Cambridge and the Church controlled the Certification process. This led to limiting the number of physicians while at the same time ensuring that only the aristocratic class would be allowed to enter the profession. When the British arrived on American soil, it followed that they maintained that ‘aristocratic’ notion that was used as qualifications for members (Macdonald, 1995). At the founding of America, there were certain assumptions that were made about sovereignty in establishing a new ‘race’ – the American race. The language laid out by its founders suggested that every ‘American man’ would be free to express himself and not suffer religious persecution. What they really meant with the word ‘man,’ was specifically a free white male, property owner, aged twenty – one or older (Moen, 1999). Legal equality was not extended to all, denying other categories of citizens including blacks, women, indigenous people and Latinos any access to the enterprising development of this country. This action made certain the protection of white male privilege and class position (Moen, 1999).

Defining who were welcomed and protected by organizations and professions clearly reproduced European guidelines in America’s founding. Using the European model for organizations further explains how its predecessor in Britain had established a self-monitoring system for its governance that was replicated in American professions and organizations like American Society of Landscape Architects (ASLA). In the US, most organizations are not overseen by any governmental agency (a possible exception is licensing). Instead, organizations are governed by a body of peers who are elected or appointed from within the organization itself to oversee and enforce governance about licensing, business, and its mission statements. American organizations can exist by their own rules, have their own policing for enforcement, responsible for overseeing their elections of their governing body, and most importantly selecting its members. All this comes across as normal except when it comes to dealing with underrepresented minorities.

3.1 The story of the West

The allegorical history of the United States establishes its origin with the westward expansion of the pioneers and the settlers who developed settlements and spread across existing lands to form a 'new' American civilization. The new arrivals fought against the indigenous non-white peoples who lived there whom they labeled 'savages'. This not only included the Native Americans but also Latinos who had...
inhabited the land in the western parts of the United States (Dunbar-Ortiz, 2014). It is little known or recognized by current citizens that the western United States had been inhabited by Indigenous people first and then ruled by Spain and then by Mexico. In 1821, Mexico emerged from its three hundred years of Spanish rule and became the ruling majority of what we now know as Texas, New Mexico, Arizona, California, and Colorado (Dunbar-Ortiz, 2014). Mexican governance was short lived when in 1845, the US claimed Texas as American land, establishing their claim using the U.S. Army, its laws, and its new economy in the West. The United States proclaimed its sovereignty over all the new land and enforced all its laws to maintain it. The conquest had ripped territories away from the Indigenous and Mexican people and turned over all control to the white dominated society of Americans.

3.2 Latinos labeled as inferior

Howard Zinn, the Harvard historian and author of A People’s History of the United States: 1492-Present, makes the point that we cannot simply condemn Christopher Columbus and the many empires that reigned over their colonies. We should not accept the atrocities they did but we should allow for some capacity of objectivity of the offense. He suggests this tolerance be called ‘a moral proportion’ of objectivity (Zinn, 2003). The colonization by the American colonists left a much bigger scar on the people who lived in the West that cannot be tolerated and remains with Latinos and Indigenous people today. Seen from an historical perspective Latinos are depicted as a remnant of colonization who almost met their demise in a social Darwinist occurrence as America moved to control the West. They were seen as a people who were conquered for their ‘inferior’ way of life and for losing to the Americans. This idea is supported by historians who use for example the writing of Walt Whitman, the American poet laureate who wrote in support of the war with Mexico writing in an 1846 letter, “What has miserable, inefficient Mexico... to do with the great mission of populating the New World with a noble race?” (Dunbar-Ortiz, 2014). Anyone not of European descent was seen as a ‘savage’ and if ‘savages’ stood in their way, then they would be annihilated. Whitman exudes this attitude as he continues, “The nigger, like the Injun, will be eliminated; it is the law of the races.....” (Dunbar-Ortiz, 2014). Today Latinos and Indigenous people are no longer called savages but what lingers is that American citizens still consider them inferior.

A study undertaken by Celia Olivia Lacayo, professor at UCLA, discovered what white people thought about Latinos. In an essay based on research developed from her in-depth interviews with whites in Orange County, California, her findings show that the group of white Americans she studied believed that Latinos and Latino culture are deficient and inferior. Her study details that white individuals reveal that as a group Latinos are unable to assimilate into the greater white society and that whites believe Latinos pass down their ‘deficient’ cultural attributes to their offspring so they cannot change, adapt, or progress in American society. Lacayo has coined the term perpetual inferiority to describe how whites feel about Latinos (Lacayo, 2017). Judging another culture or ethnic group differently than one’s own is easier to do without willingness to understand the values of that culture. The perpetual inferiority label is being applied to Latinos in the United States and needs to be viewed carefully by landscape organizations.

3.3 History of the American founding of landscape architecture

The American Society of Landscape Architects (ASLA), was founded on January 4, 1899, by eleven individuals who wanted to establish the foundation for Landscape Architecture as a profession. This small group met in the office of Parson & Pentecost in the St. James Building at Broadway and 26th Street in New York City (Newton, 1971). The first meeting had eleven charter members, 10 men and one woman, Beatrix Farrand.

Norman Newton, Harvard professor of Landscape Architecture, wrote about the historical founding of our profession and forecasted that in the future, landscape architecture would not be an overpopulated profession. Newton’s statement suggests containing a limited amount of members in ASLA. He is ambiguous but he neither invites nor negates the future inclusion of underrepresented people into landscape architecture. There is no mention of race or gender as a factor in maintaining a small populated profession. Instead, he identifies qualities he deems important to successfully being a landscape architect. He indicates that the ability to be a well-rounded and capable individual would be required traits to be a landscape architect (Newton, 1971). Another historian, Melanie Simo attempts to
further describe the traits needed to be considered in a landscape architect in her essay in *100 years of Landscape Architecture*. She suggests that landscape architects would be “people who could analyze, synthesize, and deal with abstractions” (Simo, 1999). Given Newton’s and Simo’s critical observations of specific skills needed to be a landscape architect, what gets neglected is the opportunity to suggest the need for diversity and inclusion of race or gender in the future landscape architecture population. Missing this opportunity to recognize or nurture diversity, they are neglectful of building an inclusive vision in the future of the profession. Failing to recognize the future rise of the Latino population living in the United States meant creating a void about issues of recruitment, history, or defining a nurturing process for underrepresented minorities into the discipline. They did not help provide any meaningful future to accommodating Latinos and people of color (POC) who entered the profession.

3.4 From the founding of Landscape Architecture to Latinos today

Was the failure to recognize Latinos and people of color out of neglect or racism? Sociologists suggest that inviting, recognizing, and rewarding smaller underrepresented groups are successful ways for attracting and integrating people not of that group into the larger society. At the founding of Landscape Architecture in the United States and at the 100-year celebration of its anniversary, it was an opportune moment to redefine our next generation of professionals and recognize the nurturing and the participation of gender and ethnic diversity explicitly. If it was not racism that the organizations and authors were practicing, then what were we seeing? Landscape architects missed an opportunity. Instead, they impeded the organization from an opportunity to initiate a conversation with the outside group. Not addressing or placing it at the center of the conversation, it keeps the organization from moving towards progress in addressing issues of social and environmental equity (Low, 1999). Neglect like racism blocks the gateway to furthering the development of inclusion and the entry of Latinos into the discipline.

In New York City when landscape architecture was founded in 1899, the population was 3.5 million. It would have been different at that meeting in 1899 if the 2.5 million Latinos today comprising Puerto Ricans, Dominicans, Mexicans and several other Central and South American countries had existed in New York City. Today, the Latino population of New York City is recognized as a regional influence and consideration in the development of the city (Cordero-Guzmán, 2019). This idea that places evolve means ASLA and other organizations must be ready to develop a cognizant view of regional population shifts to view the future diversity of its members. Recognizing the ethnic diversity of population through numbers might function as the catalyst in establishing a priority for acknowledging and welcoming Latinos in larger populated areas of the country.

4 CULTURE AND VALUES

The issues that confront Latinos form a grave tone for landscape architects and Latinos to consider co-jointly. The Latino community faces significant challenges. Many issues such as affordable housing, environment, population growth, food security, immigration, education, economic development, working conditions, bio-politics, and high dropout rates are all being thrust upon Latinos as a group. While the Latino population is exploding, the Latinos have failed to address their needs in an organized concerted effort and with the help of Latino design professionals, they could build on cultural specifics around the science and research knowledge needed.

Vicki Estrada, FASLA, a Latino practitioner has identified that having few Latino practitioners is inadequate representation for Latino communities and an underrepresentation of Latino leadership. Her perspective is based on her work as a community designer where she has experienced many community meetings in Latino neighborhoods and many professional conferences where she has participated. From her observations, she points to a profession which she identifies as “predominantly white” (Fernandez, 2019). She explains that Latinos must take charge of being present in the disciplines of landscape architecture, planning, and urban design. Her point makes clear that she also calls on the organization to be responsible.

“Change happens slowly sometimes, and by us [Latinos] being involved and getting awards and being out there publicly and leading the community planning groups and making presentations, you don’t succumb to the single way of thinking, you become all-
encompassing. You celebrate all cultures and colors and races and ethnicities and male and female and in-between.” Vicki Estrada, Landscape Architect (Fernandez, 2019).

There is little to no current visible data in landscape architecture on Latino-design and culture, precedent in landscape architecture, historical design literature, or viable contemporary theory that would give landscape architects a clear picture of how Latinos coexist with their landscapes and environments. Formulating a fair and relatively objective standard for collecting data on Latinos (and other cultures) has not yet been prioritized or enforced by design organizations. Specifically recognizing Latinos in organizations would be a major step in fully acknowledging their presence and acceptance of their minority perspective. Not recognizing Latinos means lack of empowerment to be fully engaged in the profession and their environmental spaces. Lacking representation makes Latinos less accessible to designers and vulnerable for the insufficient knowledge and research available in creating agendas about their future. Looking at statistics about how many there are and where they are, makes the case for more research and more Latino recognition in landscape organizations.

4.1 Statistics on Latino population

This paper is being written on the eve of the 2020 census but even without the newest data we can look at the US census for patterns of Latino populations. From the US census we can see just how this country is experiencing growth of Latino communities across America (See Table 1). The Census Bureau explains they use the term Hispanic and Latino, interchangeably to define anyone as Hispanic by knowing their origins- heritage, nationality group, lineage, country of birth of the person, or ancestors before their arrival in the United States. “A Hispanic or Latino refers to a person of Cuban, Mexican, Puerto Rican, South or Central American or other Spanish culture or origin regardless of race” (Ennis, Ríos-Vargas, Albert, 2011).

Table 1. Increase in United States population compared to Latino population

<table>
<thead>
<tr>
<th>Year</th>
<th>US Population</th>
<th>Latino Population</th>
<th>Percentage of Latinos to US Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>281.4 million</td>
<td>35.3 million</td>
<td>12.5</td>
</tr>
<tr>
<td>2010</td>
<td>308.7 million</td>
<td>50.5 million</td>
<td>16.3</td>
</tr>
<tr>
<td>2019</td>
<td>328.2 million</td>
<td>60.6 million</td>
<td>18.4</td>
</tr>
<tr>
<td>Projected 2050</td>
<td>423 million</td>
<td>106 million</td>
<td>25.0</td>
</tr>
</tbody>
</table>

5 WHAT THE NUMBERS DON’T TELL US

The Latino community is growing and poised to become a major economic and political force in the United States and yet it is not clear to society what problems Latinos face in that growth. The community faces significant challenges in housing affordability; economic inclusivity to help build community; immigration issues; and a host of political class and social problems it must address. The broader organizations of landscape architecture have failed to diagram the needs of the Latino community in a systematic and sustained way. Latino communities are growing and evolving and will continue to play an integral role in this country but what is not clear is how to increase the levels of participation from the Latino community in the future.

5.1 Current rancor

The current rancor of society over the death of George Floyd made it a salient opportunity to revisit the topics of white privilege, Black Lives Matter, and sociological shifting in reviewing how America thinks about race relations. This has helped the Latino community to seize the moment and join the African American push for solidarity around the topic of racial injustice. The gravity of a black man being choked to death by a policeman gathered everyone (Latinos, African Americans, and POCs) together this
summer in supporting a call to action. The death of George Floyd, May 25, 2020, made discussion around race and ethnicity more visible. Instagram, LinkedIn, Facebook, and other social media were exploding with interest and expressing their demands for social change around a wrongful act that occurred in Minneapolis. At the same time, it was opportune for demanding organizations to supply culturally and ethnically responses to the incident and existing systemic racism. For landscape architects, this prompted a flurry of chatter about the lack of representation by POCs making the President of ASLA and various University institutions respond to handling of ethnic issues in the Landscape Architecture.

5.2 Suggesting new opportunities where Latinos offer contributions

It is slowly being acknowledge that different ethnic groups contribute to the professions for which their ethnic group shows an affinity. For example, Japanese gardeners, and Korean grocers, have shown that they are committed to occupations and businesses favorable to their community. Design sensitivity demonstrated in Latino communities in careers such as gardening, farming, labor intensive work, and cooking are some of the talent’s Latinos can make to landscape architecture. Identifying skills that are exhibited in the growing Latino communities and populations offers insight to their ethnic affinity for certain aptitudes. Creating a mutual benefit by contributing their Latino skills to landscape architecture introduces a positive move from assimilation to acculturation and offers a process of give and take. The outcome of acculturation has shown that it leaves the professional association and the individual with a positively marked relationship (Guy, 2004).

TEK (Traditional Ecological Knowledge) is a new way of thinking about applying traditional knowledge learned from ancestors and family relatives that indigenous and older ethnic groups like Latinos have about the landscape (Posey, 2000). In places like the south and southwestern part of the country where nationally the three largest Latino populated states are California (15.6 million), Texas (11.5 million), and Florida (5.7 million) Latinos may be useful in contributing their TEK in supporting the lives and landscape of that geographic region. Targeting the states with the largest percentages of Latino population and asking them to contribute what they know about landscape can create a strong Latino contribution to their environment. Latinos would also be displaying skills passed on to them from their parents who may have been husbandmen in the places prior to arriving in the United States. Many Latinos come from farming families in Mexico or have grown up in rural areas in the United States. Latino culture maintains a very reverent connection to their culture and the land. They often continue sharing their knowledge and talents with their offspring as they grow up. Interest in gardening and landscaping is special for Latinos. Landscape organizations can help Latinos make the leap from their working knowledge as gardeners to entering a profession like landscape architecture if their TEK is recognized.

5.3 Building a support system for Latinos and a sense of belonging

Looking for Latinos to recruit is not the only answer to involving them in landscape architecture. Institutions and organizations must consider building a system once they arrive at institutions ready to participate. In education, Christopher Bates Doob, a sociologist and researcher who writes about racism suggests that “an effective school establishes a nurturing environment that develops both a highly positive image and understanding of themselves [ethnic minority], and also the intellectual and emotional tools to do well in the modern world” (Doob, 1999). It is not clear how many universities or organizations have a strategic plan addressing what happens after Latinos are recruited. It is another step to take after recruiting Latinos, giving money to attend university, or giving them work in a firm.

The educational trip to enter the landscape architecture profession is a long journey for the beginning undergraduate student who has never had relatives attend a university. For many Latinos, they are the first generation children of immigrants who came to the United States seeking a better life. Still coping with providing their families with economic stability there is much fear and uncertainty in attending an academic institution that is alien to their comfort. The effective university will be tolerant and provide a nurturing environment where a first generation college bound Latino can develop a positive self-image and also learn the intellectual tools they are teaching.

What universities and organizations are doing is building a common bond between the organizations and academic institutions other than simply providing an education or a job. How you make
cultures feel welcome is by having them recognize that the organization values people that are ethnically different. In reconciling the attraction of Latinos to the landscape architecture profession will require more research. For leaders who are a principal of an office or a chair of a landscape architecture program, must be instructed in ways of interacting with Latinos. Recruitment rhetoric to formulate a massive change in accommodating Latinos in landscape architecture requires evolving thinking to consider a concerted effort in consistently building positive actions over the time a student or employee spends in either.

This means leadership must accommodate a sense of belonging for Latinos in organizations and institutions. Leadership in academic institutions must produce more PhDs who are trained in Latino history to support the curriculums being used in Universities. Leadership must also buildup organizations and institutions to offer a comfortable and welcoming environment that fits the Latino and not the other way around, where Latinos must solely conform to predominantly white traditions and values in offices and work places.

6 LOOKING FORWARD

There is little to no representation of Latino design culture or contributions in landscape architecture. Without representation there will be no attraction to this discipline. Formulating a fair and relatively objective standard for representing Latinos in the discipline is not yet prioritized or enforced. The organizations must explicitly identify Latino individuals as part of this discipline and be recognized for their presence and contribution as a valued people to the discipline. By recognizing their involvement and identifying their contributions in curriculums and in literature creates an inclusive landscape architecture history. Specifically recognizing Latinos in organizations means fully acknowledging their contributions and their minority perspective. Lack of recognition means lack of empowerment to be fully engaged in the profession.

Most humans join organizations when they see people that look like themselves enjoying similar activities. If Latinos do not see others like themselves in organizations and institutions, then it is likely that only the very brave few Latinos will join. In order to attract and maintain Latinos in the discipline, a carefully organized system must exist to accommodate them and give them a sense that they have some sovereignty in the organization. The white majority joins professional organizations for a feeling of safety, comfort, and to be valued within its professional organization. This same sense of belonging should be extended to fit other less represented groups and specifically Latinos.

7 REFERENCES


PEOPLE-ENVIRONMENT RELATIONSHIPS

Edited by Deni Ruggeri & Ole Sleipness
DRIED UP: The Challenges of Developing a New Planting Aesthetic for the Increasingly Arid West

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1 ABSTRACT

As climate disruption occurs, the Rocky Mountain West is forecast to become more arid due to anticipated declines in precipitation and increases in evapotranspiration resulting from rising temperatures. Simultaneously, the desire to grow economically, as evidenced in increased land developments accommodating population increases in the region, heightens demands on water consumption. As this demand for water to support land development is increasing, the amount of available water for irrigation is decreasing. It is foreseeable that due to these influences, the future landscapes of the Front Range of the Rocky Mountains will begin to look very different. This paper discusses the implications of factors and forces that create challenges to changing the current planting aesthetic of designed landscapes. This investigation unravels and reveals underlying values, circumstances, and political economies that support the persistence of the current planting aesthetics’ use, and which might prevent the development, acceptance, and appreciation of alternative landscape aesthetics. It begins by examining historic influences, specifically the lawn aesthetic, to understand its resilience as the dominant planting aesthetic of this region. It investigates why plants in these designed landscapes are “unseen” and undervalued, and critically reflects on how the current practice of landscape architecture’s reinforcement of this historic planting aesthetic contributes to continued plant blindness and cultural subjugation. Finally, it recognizes that the need to reduce the amount of water applied to designed landscapes creates the opportunity for landscape architects to lead the re-envisioning of alternative planting aesthetics that better address the communities’ values and identities, and envisions an environment that contributes to our future social, cultural, and ecological well-being.

1.1 Keywords

Planting design, arid landscapes, planting aesthetics.
INTRODUCTION

The designed landscape is generally “unseen” and taken for granted by the general public (Wandersee & Schussler, 1999). Simultaneously though, the designed landscape provides many important functions for communities. The benefits from these landscapes most commonly include both functional regulating services, such as cooling of the climate, flood prevention and storm water mitigation, and increased economic value to commercial and residential properties. Just as important as the functional and economic benefits, these landscapes visually create a cohesive community, and are crucial for the livability of cities and the well-being of its residents. The impact of designed landscapes and green space in cities on human health and well-being is increasingly understood. “While causal chains are generally complex and not always completely understood, sufficient evidence exists to reveal urban design as a powerful tool for improving human condition” (Jackson, 2003, p.191).

The Front Range of the Rocky Mountain West is quickly approaching a point of decision regarding the future of its designed landscape. As climate disruption occurs, this region is predicted to become more arid due to the anticipated decline in precipitation and increase in evapotranspiration resulting from rising temperatures. Simultaneously, the desire to grow economically through land development increases the number of people moving to the area thus requiring more water. The population of Colorado is projected to grow from over 5 million people to nearly double by 2050 and this growth will create a need for an additional 600,000 to one million acre-feet of water annually to meet future municipal and industrial (including self-supplied industrial) demands. (State of Colorado, 2015). As this demand for water to support land development is increasing, the amount of available water for landscape irrigation will decrease. The landscape of the Front Range of the Rocky Mountains will begin to look and function very differently. Therefore, it is important to explore alternatives to the plant palette of the designed landscapes that conserve water, sustain ecoservices, and support residents’ health and well-being.

This paper investigates the current planting aesthetic of the designed landscapes in Fort Collins, Colorado that occur in commercial, residential, institutional, and civic settings. The analysis of the planting aesthetic led to the identification of challenges and opportunities for developing a new planting aesthetic that addresses ecoservices, health and well-being, and the impeding reduction in water available for irrigation. The argument begins by examining historic influences effecting planting design in this region, specifically the lawn aesthetic, and discussing why these landscapes are often overlooked and undervalued. Finally, I argue that by critically reflecting on the current practice of landscape architecture’s reinforcement of a historic planting aesthetic, that practice contributes to continued plant blindness and cultural subjugation. Further, I discuss how landscape architects can contribute to envisioning new planting aesthetics that address these issues, as well as the implications of the increasingly arid Rocky Mountain West.

2.1 Regional context and current landscape aesthetic

Fort Collins is located in the Great Plains grasslands of northern Colorado, which lie in the rain shadow east of the Rocky Mountains. This region is also referred to as the northern Front Range. The Front Range is characterized by rolling plains with occasional valleys and buttes. The semiarid Steppe climate supports the shortgrass prairie with scarce vegetation, much exposed soil, and scattered trees (primarily Populus deltoides), occurring along water ways. This region generally receives precipitation below potential evapotranspiration, with more moisture than a desert climate and less than humid climates. Fort Collins’ average annual precipitation is 16 inches per year and the US average is 38 inches per year. Because the amount of precipitation is not enough to support the current landscape, irrigation is required.

While it is well documented that American Indians influenced the ecology of this region, the ecology of this landscape is fundamentally altered when European settlers arrive. The lack of water needed for farming, mining, and settlement in the Rocky Mountain West was clear. In the 1860’s Colorado adopted a set of laws regarding land ownership and water use known as the Colorado Doctrine. Settlers arrive in this region in the mid to late 1880’s and Fort Collins is formally established in 1883. With expansion westward, people migrating east from areas of greater precipitation brought with them plants and planting aesthetic(s) from their homeland to this much drier environment with less nutrient rich soil.
The majority of plants introduced to this region tolerate the cold winters but require several inputs; water, nutrients (modification to the soils), and human energy to maintain them.

Today in Fort Collins, and the majority of settled regions across the state of Colorado and the Intermountain West, lawns planted with deciduous trees compose the quintessential plant palette used to create a continuous landscape. Much like the ubiquitous white paint used on buildings of the Greek island Santoria, turfgrass is the primary groundcover successfully used to create a visually cohesive appearance and implies a unified community. This simplified landscape plant palette creates an aesthetic that is green, known, comfortable, and expected. The older parks of Fort Collins are typically inspired by the landscapes of Olmsted, and in residential areas generous tree lawns and boulevards with smooth green landscapes create a consistent living carpet connecting the individual residences and hiding property lines. Due to wide tree lawns and inexpensive water for irrigation, most residential streetscapes appear healthy and well-maintained. In the commercial areas of the city, planters with annuals add color, texture, and diversity of plants. These annual plantings are robust and well-maintained. As awareness has grown about using more xeric plants, newer developments have embraced designed landscapes with native grasses and perennials that provide texture and color throughout the season. These designed landscapes are a source of community pride and fit neatly with the current socially acceptable and fashionable landscapes.

3 HISTORY AND RESILIENCE OF THE LAWN AESTHETIC

This paper explores and exposes two underlying issues that contribute to the challenges of implementing alternative planting options: (1) residents’ attachments and loyalty to the pervasive lawn aesthetic of the past, and (2) the designed landscape is “unseen”, overlooked, and undervalued. Critical reflection on these issues provide clues to understanding to the following questions: Why is it so difficult to make the transition to a new planting aesthetic? What is underlying this resistance to change? What are the challenges and opportunities landscape architects face in leading this transition?

Before proceeding it is important to note that this paper is not making the argument that turfgrass is “bad”. This paper does not assert that turfgrass should be banned because it is not native or uses too much water. The lawn and its history exemplify the western migration of a planting aesthetic and are explored in this paper to better understand how lawn became the accepted norm. This investigation is meant to unravel and reveal underlying values, circumstances, and political economies that support the persistence of its use, and which might prevent the development, acceptance, and appreciation of alternative landscape aesthetics.

3.1 Underlying Values of the Lawn Aesthetic

The story of the American lawn and society’s attachment to it offer insights into the underlying values associated with the ubiquitous, cohesive lawn planted with scattered trees. Historian Virginia Scott Jenkins explains that before the Civil War very few Americans had lawns and it is during three different periods of suburban development that its influence spreads. The late nineteenth-century suburbs were directly influenced by the public park movement and the designs of Fredrick Law Olmsted where such communities frequently became named “Park,” as in Garret Park near Washington, D.C. These suburbs then became inspiration for suburbia in the twentieth century. Following World War II, the third and most extensive expansion occurred. The lawn is applied by builders of blue-collar tract housing to imitate the tradition of upper middle-class suburban neighborhoods. During this time, American advertising becomes instrumental in conveying messages of appropriate behavior and tastes to the growing middle class. In addition, the research collaboration between the U.S. Department of Agriculture and the U.S. Golf Association makes it possible to grow grass across the country. (Jenkins, 1994) “Front lawns begin as a luxury of the wealthy but became a status symbol of the middle class” (Jenkins, 1994, p.5).

Understanding the sequence of the American lawn’s peculiar history is not enough, there is also a need to further examine the relationship between the various forces and actors. Lawn People by Paul Robbins delves deeper into these connections and reveals the enmeshed relationships of the ecological, cultural, economic, and political dimensions of the lawn.

“[W]hile lawns are cultural (in the sense that they are meaning-laden), they are not the product of some pre-existing ‘culture,’ and are instead the meaningful expression of
political and economic forces. The meaning of the lawn and its position in urban and suburban political economy are inextricable. Lawns are propelled into the landscape both by economic imperatives, (e.g., real estate growth) and also by intentional and thoughtful efforts to produce certain kinds of subjects. Lawns are a strategy, therefore, both for capital accumulation and for making docile and responsible citizens” (Robbins, 2007, p.32).

Robbins uses Alfred Crosby’s concept of “ecological imperialism” to help explain the entangled relationships of humans, plants, and animals, as it relates to the normalization of the lawn. Ecological imperialism theorizes that the successful migration of Europeans was more a product of biological and ecological processes than military conquest (Crosby, 2004). Crosby explains as the emigrants progressed westward, they brought with them a vast array of species, which included diseases, plants, and animals. Their success was not the result of direct competition with native species, but rather it was that the allied species moved together and modified the landscape in tandem as they went (Robbins, 2007). “In this way Crosby demonstrates that environments and societies create one another, or more abstractly, they are ‘mutually produced.’ The success of grasses depends on the success of human settlement efforts that surround them and vice versa...The contemporary lawn does not deviate from this pattern” (Robbins, 2007, p.23). Clearly, as Robbins argues, the mutual interaction of both plants and humans, constructed the landscape image reinforced with the presence of lawn, as a pervasive result of ecological imperialism.

Robbins goes on to explain that the lawn and its human collaborators team together and began to adapt to early political and economic conditions in America. The first collaborator to “lay the roots for the contemporary contiguous lawns, and their public role in holding communities together” (Robbins, 2007, p.26) was Andrew Jackson Downing in the nineteenth century. A few years later the parks designed by Fredrick Law Olmsted, which celebrate large, open grassy fields, reinforce the communal activities and the “assumed connection between the type of landscape and a type of person” (Robbins, 2007, p.29). By the end of the nineteenth century, the lawn aesthetic linking the public, the private and the moral had been established. The following growth of suburbia in the twentieth century continued the lawn’s trajectory of normalization and its evolution into a predictable landscape aesthetic (Robbins, 2007).

3.2 "Unseen" Landscapes

In addition to the loyalty for the lawn aesthetic, there is the reality “that humans don’t see their surrounds by just opening their eyes” (Allen, 2003, p.926), or appreciate the significance of these public landscapes. These unseen landscapes are an integral part of both the current landscape aesthetic and the inability to construct alternate aesthetics. In 1998, Wandersee and Schussler introduced the term plant blindness to bring awareness to the reasons why plants are often overlooked and neglected. They “define plant blindness as (a) the inability to see or notice the plants in one’s environment; (b) the inability to recognize the importance of plants in the biosphere and in human affairs; (c) the inability to appreciate the aesthetic and unique biological features of the life forms that belong to the Plant Kingdom; and (d) the misguided anthropocentric ranking of plants as inferior to animals and thus, as unworthy of consideration” (Wandersee & Schussler; 1998a, Wandersee & Schussler, 1999, p.84).

Wandersee and Schussler researched the characteristics of human perception and visual cognition to explain why people overlook plants and identified five reasons: (1) People only recognize what they know and typically they know less about plants than animals. Once they acquire meaning, it is more likely to be seen. (2) If objects are not significantly different from the background, they are not seen. The homogeneity of plants green leaves and stems does not make them stand out from their background, except when they are flowering or changing color in the fall. (3) Plants appear rather static and grow close together, so they are grouped together as backdrop. (4) Plants can generally be ignored without consequences. (5) The brain uses space, time and color to differentiate, and plants offer fewer of those characteristics than animals (Wandersee & Schussler, 1999).

Unfortunately, this phenomenon of plant blindness is a default position for most humans that results in an under-appreciation of plants and provides a partial explanation of why designed landscapes are overlooked. Wandersee and Schussler argue there is a visual-cognitive-societal basis for why plants and the plant sciences are frequently ignored, and identify two critical factors determining whether or not people will remember an event: the degree of attention we give to it, and the meaning or importance
The recognition of *plant blindness* raises an important issue, if most people don’t recognize plants and the fundamental role they play in the community’s health and well-being, water conservation, and ecosystems services, society isn’t likely to prioritize or support the transition to an alternative landscape aesthetic.

### 3.3 The Role of Landscape Architecture

The practice of landscape architecture is woven into the story of the lawn’s expansion and adoption as a social norm. This begins with Andrew Jackson Downing, who extended the aesthetic of lawn from elite opulence to the lawns of the American home (Robbins, 2007, p.25). Followed closely by the public park movement ignited by Central Park and Fredrick Law Olmsted’s layout of suburban landscapes such as Riverside Illinois, as well as the City Beautiful Movement, which directly influenced the public’s embrace of the lawn (Jenkins, 1994, p. 25). These advocates believed this landscape aesthetic would create moral and civic virtue among urban populations.

Because of the influence of these early landscape architects, the discipline of landscape architecture has continued to perpetuate the ideals of citizenship and propagate the spread of lawn. Today, even in arid climates, the practice of landscape architecture continues to play a fundamental role in making the lawn aesthetic fashionable and socially desirable. Landscape architects are active accomplices in reinforcing the economic, social, and political subjugation of residents. Landscape architects started the lawn aesthetic, promoted it, normalized it, and are now struggling against the rigid social, economic, and political systems that resulted from its adoption as a social norm. Fortunately, the discipline of landscape architecture is in the position to respond differently to the changing ecological, political, and social conditions.

### 4 CONCLUSIONS / DISCUSSION

Research shows designed landscapes matter for our health and well-being providing both social and psychological services (Alizadeh & Hitchmough, 2019, p.178). Changes to these green spaces due to decreasing availability of water is inevitable, but these changes create an opportunity for the discipline of landscape architecture to part with past aesthetics and lead a conversation with municipalities, residents, developers, and the landscape industry about the co-creation of new, more appropriate and functional planting aesthetics.

“It might seem like an odd conclusion, both freeing and frightening, to suggest that the world is both profoundly structured but also totally malleable, that no one is driving this train and it has no track, but this is exactly what the lawn suggests. Unthinking the lawn is only the beginning, it seems. So we really ought to start now” (Robbins, 2007, p. 138).

It is imperative that landscape architects examine and understand the history the lawn aesthetic and its dominance as a plant palette. This reflective exercise, which Robbins refers to as “unthinking the lawn”, provides an opportunity to learn from the past by gaining insight into the resilience of the lawn aesthetic, especially when considering that such aesthetic reveals how the human social, economic, and political economies are inextricably linked to nonhuman subjects and ecologies, e.g. ecological imperialism. In addition, reflecting on the causes and implications of *plant blindness* upon the current pervasive landscape aesthetic, uncovers the visual-cognitive-societal biases against plants, and the need for increased recognition and understanding of plants and ecological systems. This critical awareness can generate an increased plant appreciation and conservation, which may assist in the formulation of alternative planting aesthetics that may better respond to the effects of impending climate disruption and population growth.

As landscape architects prepare for the challenge of developing alternative planting aesthetics to address reduced water availability as a result of climate disruption and population growth, there are several lessons to keep in mind. This endeavor needs both human (municipal, industrial, and individual) and nonhuman (birds, butterflies, and bees) allies. The planting aesthetic must be co-created with the regional populace, urban centers, human and non-human contexts, and leverage (or disrupt) political economies. Through such aesthetic construction, the practice of landscape architecture may operate to
challenge traditional economic, social, political, and ecological values and taken-for-granted aesthetic practices. In her book, The lawn: A history of an American obsession, Jenkins concludes:

“A new landscape aesthetic is a cultural creation, and it remains to be seen whether the environmental movement [and the discipline of landscape architecture] in this country can enlist as potent a group of supporters and teachers for the twenty-first century as the lawn industry, the Garden Club of America, the U.S. Golf Association, and the U.S. Department of Agriculture did during the twentieth century” (Jenkins, 1994, p.187).

The intent is not to replace the lawn aesthetic with a new or singular social norm. The planting aesthetic must respond to and incorporate human and non-human participants that are regionally appropriate. For example, the planting aesthetic in Fort Collins must be different than Las Vegas. Landscape architectural planting designs must incorporate diverse plantings, so as to create space, time, and color differentiations that results in improved plant recognition, revealed ecological processes, and contextually discrete spatial practices and planting aesthetics. It is through a critical awareness of the ubiquitous exercise of blind social, cultural, political, economic, and ecological practices of historic planting aesthetics, that landscape architectural practices may progressively address and respond to the impacts of forthcoming climate disruptions and population increases.

5 REFERENCES


SERVICE–LEARNING & COMMUNITY ENGAGEMENT

Edited by David La Pena & Benjamin Spencer
DESIGNING A LEGACY: CONTRIBUTIONS OF UNIVERSITY DESIGN ENGAGEMENT TOWARD ZION’S ICONIC WESTERN IMAGE

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1 ABSTRACT

Many landscape architecture programs have rich legacies addressing tangible design dilemmas through community engagement, service-learning, and engaged scholarship. Those situated in land-grant universities often frame these activities as contributory to their institutions’ missions—serving statewide constituents through engaging in tangible community-based issues. Southern Utah’s Zion National Park is one of the Intermountain West’s most iconic landscapes. However, inadequate amenities and increasing visitation threaten the quality of visitor experiences. Building on previous studies assessing the impacts of USU’s Extension landscape architecture’s engagement work, this study evaluates how university design programs mediate competing values through design engagement through a collective case study of its projects situated around Zion National Park. Through reflective evaluation of select engagement projects in the region surrounding Zion National Park, we assess the contributory roles that university-based design engagement projects play in mediating competing visions for the West held by different stakeholder groups in Southern Utah. The study found significant variation among projects’ outcomes, potential for projects clustered within proximity to achieve regional impacts, and the role of the department’s vertically-integrated annual charrettes in catalyzing additional work for both the department and professional design firms.

1.1 Keywords

Extension, gateway communities, Utah, community engagement, land-grant
2 INTRODUCTION & BACKGROUND

Early Hollywood cinematographers, authors, artists, commercial photographers, and social media influencers have shaped popular culture’s image of the landscapes of southern Utah. From Western films to high adventure advertisements, each has added to the iconography of the place and expectations of those who inhabit and visit these places. The iconic landscape surrounding Zion National Park has been long valued by indigenous populations, early settlers, and more recent international visitors. The majority of the park's visitors enter through its western gateway at Springdale, UT. However, with annual visitation rapidly approaching 5 million (National Park Service, 2020), public land management agencies, planners, and local stakeholders seek alternatives to ease visitor impacts to the park’s western entrance (Upchurch, 2015) by dispersing visitation throughout the region. Zion’s eastern gateway communities—long considered backdoors—have potential for absorbing park visitors while benefiting their local economies.

2.2 Landscape of Contention

At the state level, contemporary Utah grapples with complex planning and design issues. Natural amenity-driven population growth (Howe et al., 2012), and increased visitation present a unique set of planning and design challenges amidst the backdrop of southern Utah’s most iconic landscapes (Figure 1). While famous for its five national parks, southern Utah has also gained notoriety for divisions over competing visions for ownership and control over its public lands, and the preferred identity for the place. Within the Intermountain West, gateway communities—situated adjacent to public lands—are well documented for their group-based cultural divisions. Long-term residents, often dependent on traditional agriculture and natural resource-extractive industries (Travis, 2013), and new residents—urban immigrants attracted by natural amenities—often bring competing cultural, economic, and political views (Winkler et al., 2007). While these groups often share a common affection for their surrounding landscape, competing identities of place are often manifested in the natural and built environment—providing opportunities for design.

Grand Staircase-Escalante and Bears Ears National Monuments possess stunning visual and cultural resources (Figure 1). However, their monument designation was met with significant resistance from many local residents, given the area’s significant energy reserves and potential for providing extraction-related employment opportunities. Differences in viewpoints are often shaped generationally. With a unique appreciation for the landscape, long-time residents’ tenure is often multi-generational, influenced by the settlement decisions of previous generations (Jones et al., 2003). In contrast, new residents often choose to relocate to the area, drawn not by multi-generational ties, but by the landscape’s beauty and outdoor recreation amenities (Gosnell & Abrams, 2011). As natural resources are a common basis for both traditional extractive industries and outdoor recreation and amenity-based development, differences in management values often fuel tensions between groups. While community leaders may recognize the need for economic diversification and the aesthetic environment’s role in economic resilience, others fear changes brought by an influx of new residents or visitors who do not share their collective experience and cultural values.

In the Intermountain West, these tensions are often heightened by limited supplies of private land available for development (Howe et al., 2012), as a high proportion of the region’s land is managed by state and federal agencies such as the Bureau of Land Management (BLM), US Forest Service (USFS), and National Park Service (NPS). Proximity to public lands is often used to market the desirability of private lands in the West. Consequently, public lands management has significant impact on traditional natural resource extractive and agricultural livelihoods, as well as outdoor recreation, tourism, and real estate. Restrictions on livestock grazing, vehicular access, zoning of recreational uses, and oil and gas exploration are all viewed through different lenses. Regionally, tensions surrounding these issues are manifested through defiant ATV rides through Recapture Canyon, public protests over grazing, and occupation of the Malheur National Wildlife Refuge. With its unique settlement history (Arrington, 2005), complex relationship with the US government, and nearly 65% of its land managed by federal agencies (Congressional Research Service, 2020), Utah is at the crux of these contemporary conflicts (Freemuth, 2018). These include the Utah State Legislature’s attempts to legislatively and legally wrest control of federally managed public lands within the state, subsequent contention between state government and
the Outdoor Industry leaders, and the end of Salt Lake City’s 20-year stint as host of the annual Outdoor Retailer trade show. More recent administrative attempts at scaling back Grand-Staircase Escalante and Bears Ears National Monuments has heightened divisions over Utah’s public lands on the national stage. While successful mediation of these value-based differences may be viewed as a political challenge, they also present a wealth of opportunities for planners and designers. The landscape surrounding Zion National Park is a unique setting for exploring how design can engage various interests to reflect on the region’s powerful significance to its diverse inhabitants and visitors.

Figure 1. Much like Meinig’s (1979) *Beholding Eye*, Southern Utah’s iconic landscape has different meanings to different people (2016). Photo by the author.

2.1 Origins of an Iconic Image

The landscape has long held cultural significance as both a literal and spiritual homeland. Southern Utah’s early indigenous inhabitants introduced agriculture along Zion’s Virgin River, establishing semi-permanent settlements (Keller & Turek, 1999). Historic remnants, cultural artifacts, and regional permanences of the landscape such as Bears Ears still hold cultural currency for contemporary tribal members. Early Mormon pioneers settled the area in the 19th century and grazed cattle, grew crops, and established many of the area’s contemporary settlements with their own spiritually-rooted ideals of place (Arrington, 2005). However, for a broader audience, Zion’s sublime beauty received renown through early landscape painters, such as Frederick Dellenbaugh, whose work captured the iconic landscape for audiences across the country (Hassrick, 2008). Once nationally recognized, Zion was designated first as a National Monument and subsequently as Zion National Park. Rugged terrain limited accessibility and the park’s eastern edge received few visitors. However, construction of the mile-long tunnel in 1927 provided better access, and construction of a new interstate highway secured the park’s western edge as the primary gateway into the park. The region’s ruggedly austere landscape later provided a backdrop for early Hollywood Western films, eventually earning the nickname of “Little Hollywood.” Cinematographers, directors, and production companies portrayed the western landscape as vast, open, wild and dangerous. This imagery shaped generations of viewers’ perceptions of what a western landscape is, and their expectations of the West as a place, as an ethos, and setting for the American ideal of rugged individualism (D’Arc, 2010). Following its prominence in film, southern Utah and Zion National Park rose in visitor popularity. Today, Zion National Park is one of the three most visited US national parks (National Park Service, 2020) and overcrowding along its western edge and perceived erosion of gateway communities’ authenticity often contradict visitor expectations of an open, wild landscape experience.

Early landscape architects played critical roles in both the preservation and development of national parks, from identifying lands for preservation, siting and designing structures, and shaping other park infrastructure that millions of national park visitors would ultimately experience each year (Everhart, 2019). With high visitation, aging and inadequate infrastructure, and the landscape’s significance to a
broader audience, the 21st century brings a new set of design challenges for landscape architectural practice.

2.2 Existing Circumstances as Design Opportunities

While competing definitions of design abound, Simon’s (1988 p67) definition of devising “courses of action aimed at changing existing situations into preferred ones” resonates in its elegant simplicity and pragmatic application. Design has a long-established record of mediating disparate interests through cohesive design solutions, through a diversity of methods with varying degrees of public participation (Angotti et al., 2012; Arnstein, 1969; Thering & Chanse, 2011; Yocom et al., 2012). At the site scale, designers accommodate seemingly incompatible programmatic activities through appropriate placement, framing and screening of views. At the neighborhood, community, and bioregional scales, designers have established a record of achieving synergy between competing interests. And, through the process of visualizing existing conditions and potential alternatives, designers capture and reflect a range of observations, values, and ways of seeing the landscape (Lavoie, 2005; Meinig, 1979).

2.3 University Design Engagement as a Response

University design programs have established a variety of initiatives to address tangible local needs through design engagement and service-learning, often collaborating with university design outreach centers, community partners (Angotti et al., 2012), design-based Extension services (Sleipness et al., 2016; Sleipness et al., 2019), and in formulating design activities as scholarship (Hinson, 2007; Thering & Chanse, 2011).

For over 40 years, Utah State University’s Extension Landscape Architecture (LAEP) program has involved local community stakeholders through a variety of engagement formats. These formats include assisting the US National Park Service (NPS) in reviewing and evaluating applications for local design assistance from its Rivers Trails and Conservation Assistance (RTCA) program. USU Extension landscape architecture specialists have also provided design consultation to local municipalities, county governments, and other non-profit entities in collaboration with other Extension personnel. The department’s students have provided design assistance through graduate theses and other directed vertically integrated design charrettes, embedded within the department’s program curricula. And, the department’s student chapter of the American Society of Landscape Architects (ASLA) has completed numerous projects through its community design teams (Evans & Anderson, 2016). Lastly, Extension landscape architecture personnel have played an active role in soliciting, reviewing, and referring community engagement projects for the department’s planning and design studios. Since 1973, these engagements have resulted in over 300 projects concentrated in the Intermountain West.

Among these are several projects in the vicinity of Zion National Park, where LAEP has been invited by local community partners for projects covering a range of scale and scope. They have included large-scale master planning, community planning, strategizing improvements to visitor amenities at Zion National Park’s eastern gateway, regional-scale planning and design visioning, and site-based design projects.

3 RESEARCH OBJECTIVES

Building on previous studies assessing the impacts of USU’s Extension landscape architecture’s engagement work, this study discusses how university design programs mediate competing values through design engagement through a collective case study of its projects in vicinity of Zion National Park. Through reflective evaluation of selected engagement projects in the park’s region, we assess the contributory roles that university-based design engagement projects can play in mediating among competing visions for the West held by different stakeholder groups in Southern Utah.
4 METHODS

The collective case study analysis (Yin, 2013) includes analysis of data derived from project related archival documents and design products, reflective evaluation from key project personnel (Schön, 2017), and reconnaissance of project sites (Francis, 2001). Through evaluation of projects’ engagement formats; documentation of their analytical and experiential design processes; and reflective evaluation of the relationships between the university, public land management agencies, community partners, and professional firms; we describe and assess the projects’ processes, products, and outcomes. This analysis provides a foundation for discussing the program’s role in reflecting the competing values and subsequent visions for a place, how design’s reflection of these alternative visions might be used to mediate among alternative ideals, and identifying opportunities and constraints for design programs engaged in similar community engaged design practices.

4.1 Identification of Projects in Proximity to Zion National Park

First, we reviewed archival data of known USU engagement projects in southern Utah in order to identify those situated within the study region of southern Utah, with preference for those situated in close proximity to Zion National Park. From these, four cases were selected based on their close proximity to the park, presence of associated archival documentation, and availability of key project personnel with direct knowledge of the projects’ initiation, process, products generated, and resulting project outcomes and impacts. Selected projects include two department-wide charrettes, the first of which was for the Town of Kanab, a rural community southeast of Zion National Park, and also positioned as gateway to other national monuments and recreation areas. The second charrette was for Best Friends Animal Sanctuary, which owns significant real estate in and near Kanab. The third case was a studio design project for Zion Mountain Ranch, which owns thousands of acres of land at Zion National Park’s eastern gateway. The final case was a studio project for Springdale Memorial Grove, a 10-acre memorial park in Zion’s western gateway community of Springdale. Following selection, specific project profiles were constructed during an iterative process of gathering and reviewing archival documentation. Documentation formats included original hard-copy drawings, master plans, and digitally archived projects. From this archival documentation, each project’s process, products, outcomes, and key players were identified for collective review, reflection, and discussion among key project faculty with direct experience with each project.

4.2 Collective Reflection and Evaluation by Key Project Personnel

Six department faculty were identified who each had direct experience and in-depth knowledge of the four selected projects. During an iterative process of reflection, each faculty member individually reflected on each project’s process, products, as well as outcomes and impacts (Schön, 2017). Following this individual reflection, faculty members shared their reflective evaluation of each project in teams of two, followed by a reflective evaluation of each project in the broader collective group. A grounded theory approach (Strauss & Corbin, 1997) was employed to group and organize key elements into broader categories of thematic content categories of project focus and players (Table 1) and project process, products, outcomes, and impacts (Table 2). Tables provided a visual comparison of project parameters that then guided cross project comparisons.

4.3 Documentation of Physical Sites and Verification of Project Outcomes and Impacts

In conjunction with the interactive process of collective reflection and evaluation, each of the four selected projects were investigated through on-site reconnaissance, during which project sites were visited for documentation and corroboration of physical changes, other project developments, and verification of known project impacts within the immediate local and regional contexts. During these site reconnaissance visits, project features were mapped, photographed, and assessed for similarity—as well as substantial deviation from original design proposals reflected in the project documentation or known project outcomes.
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| External Players                     |                               |                      |                     |                                |
| Private Landowners                   |                               |                      |                     |                                |
| Business Owners                      |                               |                      |                     |                                |
| General Public                       |                               |                      |                     |                                |
| Local, County, Regional Gov.         |                               |                      |                     |                                |
| State Public Agencies                |                               |                      |                     |                                |
| Federal Public Agencies              |                               |                      |                     |                                |
| Non-Profit Entities                  |                               |                      |                     |                                |
| Tribes                               |                               |                      |                     |                                |
| Planning/Design Practitioners        |                               |                      |                     |                                |

| Internal Players                     |                               |                      |                     |                                |
| Faculty                              |                               |                      |                     |                                |
| Undergrad Students                   |                               |                      |                     |                                |
| Grad Students                        |                               |                      |                     |                                |
| University Administration            |                               |                      |                     |                                |
| Alumni & Emeritus Faculty            |                               |                      |                     |                                |

Primary
Secondary
Table 2. Process, products, outcomes, and impacts of selected projects.

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Primary

Secondary
5 FINDINGS

Key findings gleaned from the four selected cases included evaluation of their engagement foci, and the collective reflection on their processes, products, and impacts. In particular, we discuss the primary role of visual products and design imagery as key project outcomes, the catalytic impact of design charrettes on subsequent projects, regional-scale design opportunities arising from the externalization of NPS visitation impacts, and unique benefits and challenges of immersive site exploration. While we found significant variation among projects’ immediate outcomes, we found synergistic potential for projects clustered within proximity to achieve regional impacts. Following is a summary of key findings.

5.1 Visual Products and Imagery as Key Outcomes

For each of the selected cases, robust portfolios of imagery were key products of the design processes. These visual products included illustrations of analytical information, preliminary design alternatives, on-site sketches, and refined conceptual design imagery. The robust range of visual products reflects the key role of university design programs in enculturating their students in the habits and norms they will encounter in professional design practice, in both products and processes.

Iterative generation of imagery throughout the design process—particularly the use of photography and on-site sketching—reinforces the key role of creating visual content as an analytical tool. Beyond communicating ideas, these visuals were employed as a vehicle for seeing, appreciating, and understanding the landscape (Lavoie, 2005). In all cases, projects culminated in image-heavy presentations to the public, clients, or community partners. These image-laden presentations allowed community partners to see visual representations of their stated goals and aspirations.

During preliminary presentations, visuals guided discussions of design alternatives and were catalysts for valuable client feedback. Through deep conversations around images, community partners, stakeholders, and students were able to focus initial concepts, refined proposals, and develop a strong relational rapport through a common affection for the landscape. In many cases, these visual representations affirmed their previously stated project goals and objectives. However, in some instances, seeing these visual representations were useful in other ways, assisting the clients to understand what they thought they wanted is not what they actually prefer.

By listening to community partners, students are adept at generating imagery that reflects the vision of community partners—often in ways that their client may not have recognized before. In the case of Springdale Memorial Grove, seeing their requests visualized helped the community partner to adjust their aspirations for the site. Images are powerful tools of persuasion, understanding, and can assist stakeholders in understanding and mediating between different visions.

5.2 Design Charrettes Catalyze Subsequent Projects

The department has been engaging communities for over two decades through an annual departmental charrette. This week-long event involves all students (undergraduate and graduate), faculty, and visiting practitioners. This effort is focused on providing design and planning assistance to a community or organization with broad design and planning challenges. The community of Kanab, Utah was the focus of the charrette held during the 2011 academic year. During this charrette several central themes emerged as students identified and grappled with the iconic western film history of this rural community and explored and reflected on its identity. In addition to community-wide planning and design recommendations, students’ efforts resulted in a growing community interest in exposing and enhancing its unique sense of place at a variety of scales, a process that continued in subsequent projects (Figure 2). Student efforts and the positive outcomes of the 2011 charrette established a foundational relationship of trust between community leaders and the department faculty. This relationship opened the door for future opportunities for the department to engage more controversial topics in future design and planning projects.

During the 2011 Charrette in Kanab the Best Friends animal sanctuary was involved as a stakeholder in the charrette process. The relationship between the sanctuary and long-time residents had been tenuous as political perspectives, value systems, and perceptions of what the West means to each
group had resulted in conflict. In 2016 Best Friends approached the LAEP Department and requested the department consider the organization’s headquarters located near Kanab, and associated amenities located in Kanab for the 2017 charrette location. The 2017 charrette effort built upon the knowledge gained in the 2011 charrette and identified areas within the physical landscape and perhaps more importantly, the community fabric where strategic intervention was needed. Students played an important neutral observing and illuminating role in the process. Students questioned and exposed the unspoken, and often sensitive cultural divides within the community and the organization. Highlighting potential programs and design opportunities through diagrams, conceptual designs, and narratives uncovered unexpected design alternatives, such as those for workforce housing (Figure 3). One example occurred during the process when students proposed a unique space owned and managed by the organization but open and welcoming to visitors and the community. This concept became the design logic used by Best Friends when they involved a professional design firm to remodel a vacant motel into a private hotel with a quasi-public open space designed to host community events and allows hotel visitors and community members to interact. The existing relationships between the community of Kanab and the Best Friends Animal Sanctuary allowed the students observations, analysis, and design recommendations to be presented and discussed in an unoccupied, neutral space independent of the ownership or dogma of any single government entity or organization. This third space allowed where each participant an opportunity to approach ideas as an equal stakeholder in the future of their community, allowing them to evaluate the merits of the students work with less confrontation.

The department’s relationships with Kanab’s community leaders and organizations continues to grow and evolve today. After completing the Charrette process with Best Friends in 2017 the department was asked to partner with the community of Kanab to conduct another charrette during the 2019-2020 academic year. The charrette continues to build on the previous 2 years of student efforts to define community opportunities and challenges and establish a neutral, mediated space for discussions of visionary ideas, and contentious issues that shape the region’s sense of place and iconic image. The catalytic nature of intensive design charrettes and the mediated space they establish results in community interest for subsequent design projects for the university—and for practitioners who have engaged the community through their professional services.

Figure 2. In Kanab, students analyzed the landscape at a variety of scales ranging including site, community, and region (2019). USU LAEP Senior Capstone Studio.
Figure 3. Student renderings of proposed employee housing for Best Friends Animal Sanctuary in Kanab reflect vernacular forms and materials that students observed in their visits to the area (2019). USU LAEP Department Senior Capstone Studio Students.

5.3 Externalized Visitor Impacts Produce Regional Design Opportunities

The interrelatedness between public lands and their private interfaces and gateway communities emerged as a dominant theme. Changes in federal designation, expansion or contraction of the boundaries of National Monuments, or other federal jurisdictional issues were found to result in externalized impacts on adjacent communities. In some instances, these drive increased demand for new infrastructure, development, and design modifications to existing systems.

Communities surrounding national parks were once both physically and philosophically independent neighbors to their parks. In some cases, policies intended to preserve the landscapes within national parks have created situations wherein the mandated NPS processes are too cumbersome to adapt to rapidly changing visitation patterns. Consequently, parks and public lands are increasingly reliant on gateway communities to shoulder the planning and development impacts of visitation increases. Many small rural communities and private landowners are unprepared to deal with these unprecedented growth demands.

Today, parks are looking to these neighboring communities and landowners to partner on solutions to park specific challenges. This co-creation model has potential to stimulate rural economics and avoid additional internal park development that might compromise their institutional missions. However, this model also creates challenges when physical elements such as visitor's centers, lodging, and transportation are externalized beyond the borders and jurisdiction of the park. How to provide an authentic national park experience often results in a planning and design process mired in delays and conflict. In the vicinity of Zion National Park, Kane County, Zion Forever Foundation, and large private landowners had begun to conceptualize different strategies using a study of regional transportation alternatives, dispersing new visitor amenities at the park’s eastern gateway, and engaged planning and design firms, which resulted in preliminary study documents. Transitioning from a study to a broad vision was perceived as a critical but potentially controversial next step.

Because of its strong reputation for integrating faculty research expertise with students’ creative design energy, community partners invited USU LAEP to participate in the planning and design process and augment the work produced by firms such as Design Workshop, KFH, and the Conservation Fund in strategizing improvements to visitor amenities and gateway to Zion National Park on the adjacent Zion Mountain Ranch (ZMR). Incorporating a student design studio provided a neutral space for proposing and evaluating multiple design concepts.
Students focused their work on a site identified as a suitable location for a new visitor contact center, transit hub, and associated recreation amenities. Located just outside the bounds of Zion National Park, the site could incorporate a more innovative design program than typically allowed within the park’s restrictive jurisdictional bounds, and include amenities that benefit both public and private sectors. Students proposed a variety of innovative ideas to blur the boundary between Zion National Park and the adjacent agricultural landscape, reflecting the identity of both the park and the landscape’s agricultural heritage. By integrating site-specific proposals for locally produced food among visitor amenities and infrastructure, the students’ designs focused on enhancing a sense of place based in a local vernacular agricultural identity. These included master planning of orchards and agriculture production into outdoor gathering and event spaces, and integrating bicycle, pedestrian, and equestrian paths into agricultural fields. They also illustrated how transit stops and the proposed visitor contact center might be integrated into other agri-tourism and recreation-oriented gateway community amenities to educate park visitors about the area’s agricultural traditions. They contemplated different locations for the proposed visitor contact center, which will house administrative offices, interpretive displays, and facilities for Zion National Park, the non-profit Zion Forever Foundation, and other regional tourism organizations. One of most significant challenges was grappling with different transportation concepts, mitigating conflict between automobiles and pedestrians, and sequences of site entry. Student proposals included modifying the existing highway to decelerate traffic, different intersection and traffic pattern configurations, and locating and configuring over 600 parking spaces for shuttle and transit stops (Figure 4).

Figure 4. Students proposed alternative circulation designs for a proposed visitor contact center in Zion National Park’s eastern gateway, which influenced subsequent transportation decisions (2018). USU LAEP Department Student Credit: Evan Tanasiuk.

5.4 Benefits and Challenges of Immersive Site Exploration

To guide the design process for nationally impactful projects that millions of visitors will see and experience, LAEP faculty and students employed an experiential design approach—whether in vertically integrated department-wide charrettes or individual design studios. Following foundational research, students immersed themselves in exploration of their site and engagement with their clients and community partners. These provide opportunities for students and faculty to understand and formulate design concepts within the context of the broader regional landscape, meet with interested stakeholders, and conduct focused reconnaissance and ground-truthing of existing conditions. In the case of Zion Mountain Ranch, the landowner was impressed with watching students immersing themselves in exploring the site, “walking the land,” photographing its topographic and landscape features, and capturing its characteristics through use of unmanned aerial vehicles. For each of the projects, on-site immersive experiences were critical for developing intimate familiarity with unique landscape features, visual qualities and sightlines through sketching as a way of seeing, as well as to exploring design concepts in the field (Figure 5). When compared to projects that employed only long-distance reconnaissance or brief duration
on-site ground-truthing, extended site visits provided deeper understanding of site constraints and opportunities.

Figure 5. Digital sketching allowed students to overlay their ideas with the site's existing views while immersed onsite. USU LAEP Department Student Credit: Evan Tanasiuk

Immersive on-site experiences undertaken throughout these projects presented challenges as well. Visits to these sites, located 6 hours from campus, required a great deal of logistical planning, particularly in coordinating visits with all interested stakeholders and travel during inclement weather. While most students enjoyed on-site visits, some found the freedom of self-directed exploration to be daunting and preferred less-complex projects bounded by tightly-defined design constraints. While hypothetically based design problems can offer valuable learning opportunities for students, well-selected real-world projects have potential for not only providing valuable learning opportunities, but also elevating the profile of a department and awareness of what landscape architecture as a discipline can provide for communities and projects in conflict.

6 DISCUSSION

6.1 Perceiving and Envisioning as a Form of Mediation

Physical and social communities are shaped by their context and surrounding landscape. In southern Utah, the landscape of Zion, as represented through Dellenbaugh’s landscape paintings shaped American attraction to the ideal of an expansive and sublime landscape. As a cinematographic setting, Kanab had an active role in shaping the world’s ideas of the rugged individualistic ethos of the West. Subsequently, as the community grapples with development and change, its identity is evolving with more contemporary ideals of place. The ways of seeing taught within the discipline of Landscape Architecture can help places like southern Utah and communities like Kanab and Springdale untangle the complexities of a regional identity inexplicably tied to the image of its landscape.

The persuasive power of the image is recognized in film, applied visual arts, and design (Dondis, 1973). Imagery’s persuasive power—residing in its ambiguity, ability to elicit emotional responses, and multiple possible interpretations—has long been employed in advertising. From Humphrey Repton’s early use of images to convey a particular story about a designed place, landscape architecture has employed compelling images to convey narratives to convey the experience of inhabiting, designing, modifying, and consuming a landscape. As designers navigate their attempts to mediate among competing values, the power of the image remains an important means of communicating—and creating the image of a place.
While this study has focused on the process, products, and outcomes generated through a collective of cases, each project highlights the role of students, faculty, and students played in using imagery to showcase analytical conclusions, conceptual systems, and progressive ideas into a community space of conflict to create new images of a shared future.

6.2 Complex Client Relationships

One challenge identified through these university design service learning projects is the potential for complex client relationships. Through the design process students are purposefully given liberties, and often encouraged by faculty to explore topics that range beyond the focus of the original community or project sponsor. This effort is rooted in both a pedagogical purpose as well as an attempt to satisfy the larger community service role of the land-grant university. The university’s obligation to both a specific client as well as a larger community can place onerous demands on the student’s project scope. These community service-oriented design studios projects provide communities a relationship and product inherently different from those of professional designers. Because the intent of these projects is to generate an array of exploratory ideas rather than arrive at a finalized concept or set of conditions these projects are more catalytic than terminal. Because they are not created with finality in mind, communities often students’ unconventional ideas as non-threatening. Consideration of wide-ranging design ideas instead establishes a starting point for the community to discuss the potential directions and progress toward a desired outcome. As demonstrated in the diverse examples of service learning opportunities in southern Utah, multiple projects over decades continue to re-inform these communities, establish a revised starting point and new direction for the community.

For universities, the decision to engage is often value-laden, particularly in settings in which competing interest groups have very different ideal visions for the future. While the cases described in this study do not represent the full breadth of community partners, stakeholders, and clients engaged through the department’s legacy of community engagement, they do reveal considerations that should inform discussions of equity and inclusion when selecting projects. Within the contemporary fiscal context of universities, design programs are often under pressure to obtain grants, contracts, and funded projects. In addition to the requirement that community engagement projects fit within the parameters of program curricula, student learning outcomes, and individual course formats, the desire to seek funded projects can steer the type of projects and partners that programs choose to engage. Without precluding engagement with private clients, programs may be wise to also contemplate their public service roles and commitment to the public good.

6.3 Communities Give Students License to Design

For the selected projects, students produced a series of visually oriented posters, presentations, and final summary reports representing their ideas through a combination of schematic drawings, sketches, photographs, and digital representations. In order to catalyze conversations and generate additional work in collaboration with professional design firms, students’ design graphics intentionally reflected a schematic looseness. Reflection of these products as well as the process of immersive on-site experiences and project sponsor interactions revealed a common theme: students can approach a community, voice observations, and make suggestions in a way that is non-threatening—in a way that design practitioners cannot.

One such benefit was the rapid pace at which the studios progress. Due to all of the selected projects being constrained within an academic semester the level of detail and rigor remained at a non-threatening conceptual level. Another key benefit from the charrettes and studios was the sheer volume of design proposals generated. For each of the cases described in this study, the resulting volume and range of design concepts would not be temporally or financially feasible from a professional firm charging in billable hours. Rather than competing with professional practitioners, the studios intentionally framed their engagement as collaboration rather than competition. The department’s collaboration with the clients and firm principals augmented the valuable work of Design Workshop and other design firms provided Zion Mountain Ranch and Zion Ponderosa with a range of innovative ideas for enhancing visitor experiences along the park’s eastern gateway. By focusing on broad conceptual ideas, students’ visualizations
catalyzed discussion of the corridor’s potential future to our clients, local stakeholders, and state-level and federal-level decision makers. The project fueled additional design work for professional firms and several internships for design students to undertake more detailed design proposals. In preparing the next generation of designers, university design programs need to provide experiences for students to wrestle with complex value-based design problems they will encounter in their profession and begin to recognize their potential in using design skills to mediate these challenges.

6.4 Relationships, Credibility, and Legacy

As with other land-grant institutions, Utah State University’s land grant mission and statewide Extension activities provide a foundational repertoire advantageous for initiating relationships with rural communities often wary of outside assistance. Because of their traditional focus on agricultural, rural, and pragmatic research for the benefit of statewide constituents, land-grant institutions may enjoy higher credibility in rural communities. Extension faculty often form the initial relationships with community stakeholders and project champions that guide the project scope and initial expectations. These relationships are important to maintain beyond the academic calendar lifespan of the project. Collaboration with landowners, public agencies, and professional firms in high-profile projects have reinforced the department’s reputation and fulfilled the land-grant mission of extending knowledge and service to local communities.

University design programs should consider projects as opportunities for building legacies of regional impact. They should contemplate their desired legacy, and how selection of studio projects can strengthen it. Addressing tangible needs throughout their regional context demonstrates the relevance of landscape architecture in solving a broad range of contemporary problems. Within the regional context of the Intermountain West, gateway communities are an opportune setting for design programs to offer meaningful design involvement for design issues in high profile settings viewed and experienced by millions of visitors each year.

8 REFERENCES


SUSTAINABILITY

Edited by Sohyun Park & Mintai Kim
ABSTRACT

The likelihood of extreme heat events can be exacerbated by the heat storage capacity of the densely built environment of an urban area (urban heat island effect). Meanwhile, many residences in low-income neighborhoods may not have central air-conditioning systems (e.g., up to 50% of low-income homes in Polk County, Iowa) to mitigate these harsh climate conditions. Vegetation can mitigate the effect of extreme heat events in the built urban environment by reducing reflected radiation, surface heat fluxes, and increasing evaporation.

This study investigates the influence of landscape design strategies on building energy consumption in the age of climate change. The aim is to understand the microclimate effects created by planting design strategies in/on/around buildings in urban typologies for developing spatial design guidelines for energy savings. The implementation will also improve design prediction capabilities for urban energy models. Efforts to integrate these effects in combined building-microclimate energy models have only recently been attempted; thus, the combination of living systems like trees and green surfaces with spatial topologies is still not well integrated into building energy considerations. This paper describes the process of integrating appropriate living plant systems into a 3-D energy model for a generalized US Midwest urban neighborhood. This model was prepared using the Urban Modeling Interface (UMI) tools to analyze the effect of shading produced by tree and living surfaces on building energy consumption. Considering different urban typologies, densities, and climates, this Thermal Delight study improves our understanding of the relationships between natural infrastructure, building energy efficiency, and urban microclimate.

1.1 Keywords

Building energy performance; energy modeling; living plant systems; urban 3-d modeling; shading.
2 INTRODUCTION

According to the 2019 Annual Energy Outlook, residential and commercial buildings, together, accounted for more than 25% of U.S. total delivered energy consumption in 2018. Moreover, electricity consumption grows in both sectors as the result of increased demand for electricity-using appliances, devices, and equipment. The US Energy Information Agency (EIA) predicts that, from 2018 to 2050, the consumption of purchased electricity will increase by 0.4% and 0.5% per year in the residential and commercial sectors, respectively (U.S. Energy Information Administration, 2019). To reduce this demand and to estimate and optimize building energy performance, energy simulation tools have been widely used for building energy consumption assessments (Yan et al., 2017).

While the influence of urban tree shading and living surfaces on building energy performance have been recognized (Jaffal et al., 2012; Akbari et al., 1997; McPherson et al., 2003, Refahi et al., 2015), efforts to integrate these effects in combined building-microclimate energy models have only recently been attempted (Taleghani et al., 2016, Hwang et al., 2016, Morakinyo et al., 2018). Still, only limited tools exist for architectural, landscape, and urban designers to integrate the climatic impact of landscape strategies into sustainable energy use considerations for buildings (Hashemi et al., 2018).

This research is based on literature review, and data assessment, collected from urban modeling interface (umi), which is a design environment for Rhinoceros 3D (http://rhino3d.com), for evaluating the environmental performance of neighborhoods and cities with respect to operational energy use, walkability, and daylighting potential (Reinhart et al., 2013). Thermal Delight, adopted here from Heschong (1979), explores the impact of landscape design on building energy performance. Aiming to integrate micro-climate considerations with urban landscape typologies for energy efficiency, this research strives to connect the many facets of the urban landscape to building energy savings. Considering four different urban typologies, which include high-height high-density, low-height high-density, low-height low-density, and low-height low-density (Passe & Battaglia, 2015), and three distinctly different climates (Des Moines, IA; Miami, FI; Phoenix, AZ), the full Thermal Delight project is making steps towards linking ‘natural infrastructure’ to building energy efficiency.

The purpose of this paper is to quantify the impact of the vegetation in one of the above-mentioned urban scenarios (high-height low-density) in Des Moines, IA. The impacts or improvements expected from this research for regenerative and sustainable design are manifold. This project provides a novel investigation into qualitative and quantitative landscape design strategies to reduce building energy consumption and improve the climate of outdoor spaces in the age of climate change (Iowa Climate statement, 2018). This project will contribute to the improvement of design prediction capabilities for the integration of vegetation into a building and urban energy model. Metrics will predict reduced energy use intensity (EUI) for each proposed strategy per urban morphometry classification.

2.1 BACKGROUND AND RECENT LITERATURE

Energy simulation analysis allows users to carry out the calculation of building energy consumption as well as investigation of the impact of energy management strategies upon this matter (Poddar et al., 2017). The energy conservation effect of landscape parameters, as an example, has long been recognized. In previous studies, vegetation was considered as a measure of urban microclimate improvement for buildings and surrounding environments by reducing reflected radiation, alleviating surface heat fluxes, and increasing evapotranspiration.

The effect of trees on heating and cooling load reduction, as an energy management strategy, has been estimated by varies studies at the building, city, and regional scale (Akbari & Taha, 1992; McPherson et al., 2003, Hwang et al., 2016; Nowak et al., 2017; Hashmi et al., 2018). It is found that urban trees can alter building energy consumption through casting shade, cooling air temperature, and changing wind speed, (Nowak et al., 2017) and this is highly dependent on tree characteristics such as the tree placement (Donovan & Butry, 2009), canopy type (Simpson & McPherson 1998); and the size of trees (Wang et al., 2016). For example, precious findings indicate that 30% increase in vegetation cover of the neighborhood...
in Toronto can reduce the cooling energy demand in urban houses (10%) and rural houses (20%) (Akbari & Taha, 1992). Investigating the effect of tree placement on cooling energy demand, simulation results of Hwang et al. (2016) indicate that in southern cities of the U.S. a large tree on the west side of a building can reduce its annual energy consumption by up to 160 kWh. It is found that trees are able to lower residential sector energy use by 7.2% in national scale (Nowak et al., 2017) and the potential cooling use by 5% in the community scale with 40 buildings (Hashmi et al., 2018).

Generally, it is argued that there is a direct relationship between the size of a tree and energy-saving potential due to the value of shading (Donovan & Buty, 2009). In terms of placement, shading the east, and especially the west side of the buildings with trees, keeps buildings cooler during the summertime (McPherson et al., 2006). Also, energy saving can increase due to the shading density that depends on the density of a given tree canopy (Pandit & Laband, 2010).

Moreover, a group of studies has been developed to model the shading effect of vertical green systems as well as green roofs on building façade using energy simulation tools. (Alexandri & Jones, 2008; Wong et al., 2010; Stec et al., 2005). For instance, measuring the thermal performance of plants in a double skin façade, Stec et al. (2005) have found that energy consumption for cooling had been reduced by approximately 20%. Dahanyake and Chow (2017) found that green facades can notably reduce a building skin temperature during the summer (approximately 26°C reductions of exterior surface temperature). But, on the other hand, these greenery systems have the potential to increase heating energy consumption during the cold season due to the fact that they can block solar radiation from reaching the building surface (Dahanyake & Chow, 2017). Furthermore, by analyzing the thermal performance of green roofs, they have been found effective in reducing the building roof temperature by about 3-4°C (Zhang et al., 2017).

According to the studies mentioned above, although considerable attention has been directed towards the effectiveness of landscape features on building energy performance, yet little has been done to compare detached and attached vegetation systems in relation to building energy conservation. Moreover, traditional building energy simulation programs do not effectively simulate the energy performance of a group of buildings or a neighborhood altogether. Therefore, using umi, this paper's objective is to develop a workflow for an urban energy model of a block in the Midwest of the USA. In so doing, we employed a computer simulation tool to investigate how quality and quantity of shade cast by greening conditions on exterior façades impact the seasonal and annual energy consumption of a group of buildings. The hypothesis is that the results of the energy simulations will let us to choose the best greening way for the purpose of energy saving in a given building.

3 RESEARCH OBJECTIVES

The importance of sustainable architecture and green technologies have been increasingly topical to face the drawbacks of climate change. However, the comparison of the impact of natural features on architecture has too often been neglected in discussion on building energy saving. This study aimed to close this gap in the literature. Rather than viewing landscape design solely for adding style and serenity to architecture, we suggest accepting greenery of double façade and trees as energy saving strategies that should be considered and embraced. This project has been proposed in order to develop landscape strategies and spatial design guidelines for a number of urban and suburban spatial typologies to improve urban microclimate for buildings and surrounding environments. For this purpose, our project makes the following contributions:

1) Quantify the effect of trees and green surfaces on building energy consumption due to decreased electricity use for cooling;
2) Shows that when total energy use in buildings is different during the year, consumers drives different benefits from landscape features in various seasons;
3) Demonstrates, through energy simulation models, that properly positioned shade casted by trees or green façades can reduce electricity use during summertime;
4) Explore the average energy consumption in building caused by different opening area ratio on exterior skin in association with greening typologies.
4 METHODS

4.1 Case Study

In this study, we carried out building energy simulation in Des Moines, Iowa, in order to analyze the effects of the local climate on the energy conservation advantages of two main landscape strategies. Because the local climate is a crucial factor in energy usage (Hwang et al., 2016), this city with significant seasonal changes has been chosen for the study. Des Moines has a notable temperature difference between the warmest day in summer and the coldest day in winter (to 70°F) (Average weather in Des Moines, Iowa, United States, 2016). July is the hottest month for this city with an average high temperature of 85.6°F. The most pleasant months of the year for Des Moines are September, June, and May. January has the coldest nighttime temperature for the city, with an average of 12.5°F (Climate in Des Moines, Iowa, 2019).

Using Rhinoceros, a generic city block with an area around 78,000 m² was modeled. The model includes nine detached buildings and the related street canyons. The buildings are 22 meters (72 feet) in height, about 7 stories, and 12 meters (39 feet) in width. The roads’ width between the buildings is 18 meters (59 feet). Since this research is not limited to a season, the simulations examined the energy savings of the structures throughout the whole year consisting of summer (June, July, August), fall (September, October, November), winter (December, January, February) and spring (March, April, May).

4.2 Landscape Design Strategies

Landscape strategies were designed for the given urban density scenario. They included attached and detached living systems in/ on/ around buildings for developing spatial design guideline for energy saving (Figure 1).

![Figure 1. Landscape strategies. Strategy 1: Reducing surface temperature by shade trees; Strategy 2: Green surface for regulating building’s temperature; Strategy 3: Covering buildings with green roof. Graphics by the authors.](image)

and detached living systems in/ on/ around buildings for developing spatial design guideline for energy saving (Figure 1).

4.3 Modeling Landscape Features

In order to run the simulation in UMI, proposed trees (Celtis occidentalis or Acer rubrum) were transformed into 3-D shapes in Rhino 3D. Tree trunks were presented by the cylinder. We created the cylinder shape using three inputs, the base location, trunk radius according to data for tree diameter, and tree height. The paraboloid canopies were created as ellipsoid shapes (Hashemi et al., 2018). To include the measurement of the canopy radius, we used the data for tree diameter (Celtis occidentalis, 2019) (Figure 2). In addition, although there are different kinds of green walls and green roofs, this research used rectangular surfaces to represent the concept of these vegetation systems. The buildings’ façades and the
green surfaces are the same size in the model (Green walls are 22×12 m², and green roofs are 12×12 m²).

The Rhino models containing the buildings and the landscape features were then imported in UMI to create energy simulations. For the purpose of this research, we assume that the trees and the green surfaces are in full leaf all the year around. In so doing, we tried to minimize the variations, like seasonal changes of plants, encountered in the energy simulations.

Figure 2. Transferring proposed trees (Celtis occidentalis) into simple 3d model for energy simulation (Hashemi et al., 2018). Reproduced by the authors.

4.4 Modeling Energy Performance in UMI

Since this study is going to improve design prediction for urban planners and municipalities in terms of the integration of vegetation in the vicinity of buildings; hence, a simulation tool was needed that effectively model a group of buildings. In this regard, we used an urban modeling design tool called Urban Modeling Interface (UMI), which is a Rhinoceros-based program. Umi uses EnergyPlus for energy simulation and DaySlm for daylight and solar radiation. This program provides architects and urban designers with a familiar modeling environment in which they can merge the assessment of an urban environmental performance with design development in Rhinoceros and Grasshopper (Reinhart et al., 2013).

As a new generation of urban performance simulation tools, UMI can “efficiently model multiple buildings, approximate microclimatic effects, and consider multiple sustainable performance metrics.” (Reinhart et al., 2013). This program is able to provide users with meaningful information that facilitates the design process at both building and neighborhood scale (Ibid, 2013). Using umi, this study quantified the impact of shading cast by tree and green surface on the annual energy consumption of a prototypical structure model.

In order to evaluate the heat reduction and energy-saving effect of both trees and living surfaces, three scenarios were created by the abovementioned 3D models in umi: A) Scenario 1 includes the urban block without landscape features, B) Scenario 2 includes the urban block with four trees around each building that is shown as green 3D geometric shapes as noted above, and C) Scenario 3 includes the same

Figure 3. A) Energy modeling scenario 1, B) Energy modeling scenario 2, C) Energy modeling scenario 3. Graphics by the authors.
urban block with vertical green walls covering the facades and green roofs, illustrated with green color, with no tree around (Figure 3).

The EnergyPlus Weather (EPW) data file was downloaded from the EnergyPlus website for use in UMI. Typical meteorological year (TMY) using the TMY3 data set for Des Moines, IA was utilized for simulations (Weather Data by Region, 2019). Additionally, the appropriate software layers for various site elements were chosen.

In scenario 1, 2, and 3, the window-wall ratio was adjusted from 40% to 80% to include the impact of transparent façade elements building energy performance. The results of the models calculate the amount energy consumption for each building as well as the whole urban block. Considering the differences between the estimated energy consumption, which was reported in kWh, the results represent the impact of the landscape strategies on energy usage. Figure 4 shows the process applied for each of the scenarios in umi.

Figure 4. The energy modeling workflow in umi. Diagram by the authors.

5 RESULTS

Chart 1 reports the data of total annual energy consumption in all three modeling scenarios with varying window to wall ratios from 40% to 80% in the high-height, low-density urban block of Des Moines, IA. It shows that energy use gradually increases with the rise in the percentage of building opening ratio. It is obvious that energy consumption is always higher in scenario 3 (The urban block with living surfaces and green roofs) in comparison to other scenarios. While this amount increased from around 880,000 kWh with a 40% building opening ratio to about 1,120,000 kWh in 80% building opening ratio in scenarios 1 and 2, it grows from 1,157,000 kWh to 1,574,000 kWh in scenario 3 (Chart 1).

According to graphs 2 and 3, it is clear that the change in operational energy in buildings can be affected by adding vegetation cover around the buildings. Chart 2 and 3 illustrate a slight decrease in the amount of energy consumption in buildings by including trees around them during both warm and cold seasons. The level of reduction ranges from almost 2,000 kWh to 5,000 kWh based on the ratio of openings on facades. However, installing green walls and green roofs on buildings shows a different picture of energy consumption. According to the graph 2, applying vegetation cover on the buildings during the warm seasons decline the energy consumption enormously, from 203,912 to 91,988 kWh in 40% window-wall ratio (55% decline in energy consumption) and from 332,843 to 135,762 kWh in 80% window to wall ratio scenario in scenario 3 (Chart 1).

According to graphs 2 and 3, it is clear that the change in operational energy in buildings can be affected by adding vegetation cover around the buildings. Chart 2 and 3 illustrate a slight decrease in the amount of energy consumption in buildings by including trees around them during both warm and cold seasons. The level of reduction ranges from almost 2,000 kWh to 5,000 kWh based on the ratio of openings on facades. However, installing green walls and green roofs on buildings shows a different picture of energy consumption. According to the graph 2, applying vegetation cover on the buildings during the warm seasons decline the energy consumption enormously, from 203,912 to 91,988 kWh in 40% window-wall ratio (55% decline in energy consumption) and from 332,843 to 135,762 kWh in 80% window to wall ratio scenario (59% decline in energy consumption). Chart 3 demonstrates a significant rise during the cold seasons, from 441,591 to 674 800 kWh in a 40% window-wall ratio or 35% increase. Finally, in the 80% ratio, the energy consumption increases from 565,506 to 883,280 kWh or a 36% raise. Comparing the chart 2 and 3, it is clear that installing green walls and green roofs on buildings have a positive effect on declining operational energy during warm seasons; while, during the cold seasons they have negative impacts on energy consumption. (Chart 2 and 3). Due to the fact that the landscape elements lose their leaves during the winter, so their impact will be lower than the reported figures in this project.
Chart 1: Total annual operational energy of 9 buildings in high-height low-density urban block located in Des Moines, IA using UMI in scenario 1, scenario 2, and scenario 3

Chart 2: Total operational energy (June-August) of 9 buildings in high-height low-density urban block located in Des Moines, IA using

Chart 3: Total operational energy (December-February) of 9 buildings in high-height low-density urban block located in Des Moines, IA using UMI in scenario 1, scenario 2, and scenario 3
6 DISCUSSION

The study shows that urban trees, green walls, and green roof do not equally affect building energy consumption. Depending on the shadow area cast by vegetation, the building's thermal performance has some unique features. The high variability within the total annual operational energy resulted from the scenarios 2 and 3 in this study is a proof of this difference between the potential energy saving of living systems.

Taking only the barren built form in scenario 1 as the base line, the findings revealed that the energy-saving potential of trees in our model varies from 1% to 3% annually and seasonally. This confirms the result of the prior research on the cooling effect of urban trees through shading that enhances building energy efficiency (Wang et al., 2016). The low energy use reduction of the buildings in the second scenario can be explained with the small shaded area due to the dimension and the quantity of the trees. While this scenario seems to be less effective in terms of building thermal performance than the green surfaces during summer, it is clearly more efficient in winter. In places located in cold regions, it is believed that the main advantage of vegetation is wind speed reduction as the major contributor to total heat loss from the building façade (Poddar et al., 2017).

According to the results of the third scenario, complete vegetation covering five-building sides in scenario 3 represents various results. The findings prove the results of prior studies that heat gain through the green walls can be reduced significantly in summer (Poddar et al., 2017), which is at least 56% less than the bare walls. On the other hand, though previous studies have found that green walls (Djeding et al., 2017) and green roofs (Zhang et al., 2017) can reduce the underlying surface temperature in winter, this study produced the opposite effect in scenario 3. An explanation for this is most likely that all the exterior surfaces were covered and protected from direct solar radiation causing a significant increase in heating energy load for our considerable model. Additionally, the amount of the glazing percentage in all the sides seems to be one of the causes of the low efficiency of the plant layer in reducing building energy consumption during the year. The main concern, therefore, would be to decrease the cooling load on the buildings during the year while the area of the green façade added to the building surface. For this purpose, it seems that the green façade should not be impervious to solar radiation during the winter. To be noticed, further research seems to be required to explore the thermal performance of the buildings by covering a portion of walls and roofs with a green façade.

The maximum building energy saving, consequently, can be achieved through a desirable tree and green surface shade. Meanwhile, heating penalties in cold seasons from undesirable shade cast by landscape features should be avoided, significantly, in places located in the cold climate zone. Additionally, as Poddar et al. (2017) have found, in order to make energy-saving policy for buildings, their occupancy pattern, activities, and physical characteristics are also important parameters that need to be considered. Additionally, as a building opening is a contributing factor (Average weather in Des Moines, Iowa, United States, 2016) in its energy use, the vegetation cover should be selected and applied with respect to the proportion of windows to any given building skin.

To sum up, the higher energy saving of buildings in scenario 2 during the cold season supports the fact that trees work better than green façades under Des Moines's climate condition. Although this study is limited to a specific urban morphology regardless of the above-mentioned influential conditions, the method could be replicated where landscape strategies are going to be implemented for building energy-saving purposes.

7 CONCLUSION AND FUTURE WORK

This paper describes a technique to evaluate the cooling effect of landscape strategies on buildings in a specific urban typology, which is a high-height low-density urban block, in Des Moines, IA. We investigated both the influence of urban trees and green surfaces and simulated the buildings' thermal performance associated with increasing planting cover using a model of a block of nine detached buildings. Our preliminary results illustrate a relatively modest effect of trees on building energy consumption in both
warm and cold seasons. Although the plant surfaces reduce the buildings' energy use considerably, their impact on this matter is reverse in cold months.

The method presented here does provide the opportunity to easily explore the impact of living systems on building energy performance in other urban typologies and other climate conditions. However, it is noticeable that this method does not yet include other influential factors like evaporation, which is likely to change the effect of landscape features on building energy performance even more. The project proposes further experiments utilizing the Mobile Diagnostics Lab (MDL) (Iowa State University, n.d.) to test vegetation coverings and location in order to measure and validate the quantitative impacts. This equipment is designed for different building energy research applications. It is composed of an 8'(W) × 10'(L) × 9'(H) experimental cabin and an attached mechanical room on a 19' long trailer with air suspension. It houses programmable heating, ventilation, air conditioning (HVAC), and an expandable data acquisition system (DAS). The DAS can collect data at different frequencies with multiple sensors.

The research capacities of the MDL enable the study of diverse heat transfer paths through building assemblies, heat transfer between building surfaces and surrounding microclimate, baseline energy consumption for different climates, and computational fluid dynamics models for natural ventilation and passive heating.

8 REFERENCES

1 ABSTRACT

Use of unmanned aerial vehicle (UAV) technology is predicted to increase dramatically from more than 600,000 drones registered just with the US Federal Aviation Administration (FAA) to nearly 7,000,000 over the next 12 years (FAA 1,2). This popularity is evident in their increasing use in and around public outdoor spaces, including parks, stadiums, outdoor amphitheaters, festival grounds, or outdoor markets. While there is considerable research on unmanned aerial vehicle (UAV) applications and navigation (Koh 2012, Nemeth 2010) and an emerging body of work in landscape architecture (Kullmann 2017, Park 2016), there is no research addressing increasing conflicts between public space visitors, drone navigation in public space, and its effect on the planning and design of public space. The paper presents initial findings from funded research to develop landscape architectural design and planning responses supporting low cost detection technology to deter the illegal use of drones in public spaces. Methods of data collection employed surveys of botanical garden visitors concerning their preferences for site landscape features and experiences, their awareness, attitudes, and preferences about the presence of drones in public space, and potential aerial visual access to a range of forested and open landscapes frequented by visitors in the garden. Findings suggest that given public concern about the presence of drones, landscape planning and design of such public spaces should provide continuous landscape features with restricted aerial visual access surrounding and connecting public areas with open aerial visual access.

1.1 Keywords:

Drones, Countermeasures, Urban Design, Public Space
2 BACKGROUND

Use of unmanned aerial vehicle (UAV) technology is predicted to increase dramatically in the United States alone from more than 600,000 drones registered with the US Federal Aviation Administration (FAA) to nearly 7,000,000 over the next 10 years (FAA1,2). This projected dramatic increase is accompanied by their increasing presence in and around public outdoor spaces, including a wide variety of park settings, stadiums, outdoor amphitheaters, festival grounds, and outdoor markets. While there is clearly an extraordinary amount of anecdotal evidence, as well as considerable research on unmanned aerial vehicle (UAV) applications and navigation (Koh 2012, Nemeth 2010) and an emerging body of work in landscape architecture (Kullmann 2017, Park 2016), there is no research addressing perceived conflicts between UAVs and public space visitors and drone navigation in public space.

UAV presence in public space venues stems from heretofore unattainable vantage points and visual accessibility open to UAV users. To that point, most common drone applications utilize cameras for aerial photography capturing unique viewpoints that are often superior to flights using manned helicopters, at a fraction of the expense. With increasing hobbyist drone popularity, parks, gardens, and other open public areas have come to serve as important practice locations for drone navigation and videography experimentation. Accordingly, as drone use has increased, both amateur and commercial drone pilots have increasingly sought to capture the excitement of live music events (Carter 2013), to film exclusive angles of athletic matches (Petel 2016, Hammel 2017, Sportscaster 2017, Pekler 2016], or to create powerful imagery from landmarks and monuments (Thompson 2017, Kushir 2017).

The use of unmanned aerial vehicles (UAVs) with these purposes in mind has opened significant commercial opportunities (Cohn 2017). Public space managers holding popular events such as sports matches, music concerts, theater productions, or festivals actively seek aerial perspectives of their events for advertising or broadcasting. Because such events are often intermittent and can require a wide variety of spatial and technological configurations to meet those available through the use of UAVs, it is simply not physically or financially feasible to install permanent camera systems such as “Skycams” (Cone 1985) and other permanent systems commonly used in sports stadiums under these circumstances. With recent changes in FAA rules sanctioning commercial drone operations, drone aerial photography and videography services for these and other intermittent events have increased dramatically.

Proposed commercial UAV functions include the delivery of small to large payloads quickly across long distances, such as those proposed by Amazon’s PrimeAir service (Amazon 2017); those proposed for aerial shuttle service in to major airports like JFK; and those by proposed by citywide drone taxi services. Utilities and communication carriers are employing UAVs to improve public safety and improve efficiency in cases such as AT&T’s proposal to boost cell phone service at outdoor concerts and sporting events as a means for improving connectivity and patron experience (French 2017, Kastrenakes 2017), and PG&E is proposing UAVs to examine power line wear and potential failure of improving customer service and reducing chance of fire in wildlands. Whatever the rationale for their use, drones have great potential as collaborative robots working with humans in public spaces. Given this rapid increase in UAV applications and their increasing presence in outdoor public space it behooves landscape architects to consider not only how drones might be used beneficially in public environments, but also how they might negatively impact visitor presence and experience.

The unauthorized or illegal flight of drones in outdoor public space, however, pose risks for both venue management and users, potentially threatening the safe operations of legitimate drones supporting such events. Novice unauthorized drone pilots navigating these settings increase the risk of colliding with other UAVs or otherwise losing control and damaging people or property. Such incidents have occurred at music events (injuring singer Enrique Iglesias) (Reed 2017, Kuo 2017), at sporting events (Talinova 2017), at street markets (S B 2016), and the White House. There is evidence of UAVs use to intentionally harm or distress venue attendees and VIPs, and to carry weapons (kinetic, biological, or chemical) as part of an attack. Terrorist groups such as the Islamic State of Iraq and Syria (ISIS) and Hezbollah have used drones to carry explosives for such ends in the Middle East (Schmidt 2017). Drones have also been
used to make political statements, landing on the house of the Japanese Prime Minister carrying radioactive material (BBC 2017), and landing on a stage near German Prime Minister Angela Merkel at a speaking event (Bittel 2017). Some fear that just as UAVs might support improved cell phone connectivity, so might they also be used as a platform for hacking electronic devices to disrupt security and first responders.

Two principal approaches defining contemporary response to unauthorized drone use in and around public space, include: 1) Detection of potential threats within airspace of interest (“detection”), and 2) Appropriate countermeasures deployed to mitigate drone threats (“countermeasures”). Both approaches are inextricably related to drone function, capabilities, and flight location characteristics. Appropriate countermeasures employ three primary responses: 1) Regulations and standards, 2) Active controls, and 3) Passive mitigation [35]. Regulations and standards best address the administrative, design development and organizational capacities of national and local governments, industry and manufacturers, and professional organizations to oversee and control the manufacturing, operation and use of drones. Examples include the FAA mandate for registration of drones, requirements for unique UAV license and vehicle numbers, and integrated software development enforcing drone flight practices, such as geo-fencing. Geo-fences define enforceable geographic boundaries based on global positioning system (GPS) or radio-frequency identification (RFID) preventing drone flight. While regulations and standards present useful long-term strategies for accidental drone incursions, they have, however, been ineffective in counteracting custom drone builders with malicious intent.

Active countermeasures as a response to unauthorized UAV presence are intended to interfere with drone function physically preventing continuing flight [35]. Active countermeasures fall within three categories: 1) Electronic (including jamming, hacking, and spoofing); 2) kinetic (such as guns or mobile nets); and 3) Energy (such as lasers and electromagnetic pulse devices (EMP)). Electronic countermeasures are often used to interfere with UAV sensors or their communication capacities to direct unauthorized vehicles to ground or away from defined areas. Jamming and spoofing countermeasures prompt UAV default emergency modes or deceptive flight orientation. Hacking countermeasures manipulate UAV control inputs through vulnerable security programs. Similar to the application of regulations and standards to mitigate unauthorized UAV activity, there is evidence that skilled flight configurations can mitigate electronic countermeasures (e.g., a drone goes into radio silence on final approach to a target).

Kinetic and energy countermeasures such as net guns and lasers are increasingly utilized to physically disrupt or destroy parts of UAVs, causing them to crash. Because commercial drones are relatively fragile, and because both kinetic and energy countermeasures are effective in destroying most small UAVs, accurate tracking is mandatory to avert secondary threats to people and property from destroyed drones. In fact, all active countermeasures risk uncontrolled descents, and their unintended consequences, not to mention the often significant expenses associated with sophisticated system acquisition, and operator expertise.

Passive countermeasures, in contrast, do not target UAVs, but diffuse their threat through other means. Examples include directing people at risk to safety, or blocking drone visual access through fog, directed lights or camouflage. Advantages of passive mitigation accrue from their inexpensive tracking technology, lower risks from crashes, and flexible application across a variety of sites and uses. Passive countermeasures (particularly permanent ones), however, potentially impact visitor experience in outdoor public space, and if poorly executed can adversely affect cooperative positive UAV presence.

3 LITERATURE REVIEW

The subject matter at the heart of the paper draws on literature from design-based research (DBR) addressing landscape analysis and planning applicable to: a) the creation of “drone” tracking and monitoring systems; and b) the development of model countermeasures for their use in landscape settings (Hewitt&Nassar 2019). As a process, the paper’s methodological approach draws from literature describing DBR processes in terms of: 1) conceptual development of the design problems; 2) establishment of theoretical rationale for design problem
resolution; 3) development of relevant design principles applicable to existing landscape analysis and planning practices; and 4) iteration intended to resolve complexity in human/machine/environmental design problems (Reeves, T.C. 2006). Landscape assessment methodology was derived from the literature describing SOPARC: System for Observing Play and Recreation (Park, 2016) Survey questions were informed by literature describing public attitudes and perceptions related to drones and drone activities (Sakiyama, M., Miethe, T. D., Lieberman, J. D., & Heen, M. S., 2014). Conceptual analysis and planning of the garden’s landscape features relied on literature associated with “Prospect Refuge Theory” in recreation areas Ruddel, 1987).

4 METHODS

Research findings are in part derived from: a) garden visitor survey analysis; and 2) visual analysis of the garden’s landscape. Surveys of 144 self-selected visitors at the garden’s primary entrance were administered over two consecutive well-attended fall days in early November. Garden visitors were observed in its main gathering areas and principal paths those same consecutive days, congregating along forested walking paths connecting and surrounding garden clearings, and near the forest edges of garden clearings. Garden visitors were also observed in its principal open spaces in numbers consistent with visitor survey preferences.

Four representative squares of tree densities were selected for further analysis based on: 1) trunk and canopy outline; 2) ground design features (ex. pathways); 3) aerial photos of the forest canopy; 4) 3-D model perspectives of the canopy; 5) 3-D aerial views to the canopy; 6) 3-D view from understory to sky; and 7) a percentage of visual access generated through image pixel analysis. The sampled squares indicate what visitors might be doing based on features (ex. moving on pathways, resting), where they have the most visual privacy (ex. under a tree), preferred garden features (ex. views to nature), where drones have visual access to visitors, and where visitors can best see the drones. Mapped results (see Figure 4) indicate the extent of visual access throughout the garden.

5 RESULTS

5.1 Survey Responses

In brief, the survey respondents were comprised of first-time and frequent visitors travelling primarily less than 5 miles, but up to 50 miles to the garden. The vast majority spent less than 2 hours at the garden with most reporting stays between 30-60 minutes and more respondents preferring weekends, although the garden was visited throughout the week. Most respondents came in groups of 2-5, as couples, families, or groups of friends. Approximately 15% of visitors came alone.

Perhaps most relevant to the principal research issues, survey responses related to garden user preferences show that visitors utilized all areas of the garden with most visitors preferring active recreation, passive enjoyment of nature, relaxation/mediation or socializing as their primary purposes. Visitors clearly preferred three kinds of garden spaces: open space with clear views, semi-open corridors near sheltered areas, and secluded private forest areas. In their use and enjoyment of these garden areas, visitors most appreciated the garden’s trees and forest, as well as feelings of comfort and safety. Nearly half pf the survey respondents expressed their appreciation for the sense of privacy afforded by the garden.

Survey responses related to visitor awareness of drones and the use of drones in public space indicated that 98% of visitors were aware of drones and have heard about drones flying in public spaces through multiple sources. 11% of visitors reported owning drones. Significantly, 65 % of garden visitors reported they would be concerned seeing a drone in public space, primarily because of their fear of a loss of personal privacy or safety, for being photographed or concern about drone pilot intent. While the majority of visitors did not contemplate changing their public space behavior in the presence of drones, 41% of garden visitors said they would reassess their activities or move away from the drone, and 47% of the garden visitors indicated that public open space should be designed to deter drone intrusion.
As a whole, these responses suggest that nearly all the garden’s users across a range of ages, over a wide range of garden landscape features, preferences and activities, were familiar with UAVS, including drone capacity to photograph and otherwise observe their surroundings. As a whole, the surveyed garden visitors occupied portions of all defined areas within the garden, and when prompted identified three principal formal design characteristics defined by degrees of openness and tree cover, suggesting the relative importance of visual access and shelter as landscape experience in the garden.
In response to proposed scenarios contemplating changes in their experience, their garden preferences and behaviors in the presence of UAVs, the majority of garden visitors readily accepted UAV presence without garden behavior modification. However, nearly half of the garden visitors expressed enough concern to contemplate changing location to more forested space with less visual access in the presence of UAVs.

5.2 Visual Access Mapping

Because garden visitor opinions concerning their garden use and enjoyment in the presence of drones suggested the importance of garden features spanning a range of open to sheltered visual access, and that visitor concerns was closely linked to concerns about drone privacy violation and photography, aerial visual access throughout the garden was considered a significant characteristic for potential garden design consideration that might allay visitor concern about unauthorized presence of UAVs.

<table>
<thead>
<tr>
<th>More Dense</th>
<th>Less Visible</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-40 trees</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>20-30 trees</td>
<td>26%</td>
<td></td>
</tr>
<tr>
<td>10-20 trees</td>
<td>61%</td>
<td></td>
</tr>
<tr>
<td>0-10 trees</td>
<td>84%</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Visual access matrix representing tree densities in Sarah Duke Botanical Garden

Because the garden’s tree cover was relatively uniform in terms of tree size, canopy coverage, and composition, the garden was consistently divided into gridded 100’ squares consistent with SOPARC: System for Observing Play and Recreation and classified according to the number of trees per gridded square. The squares were subsequently categorized according to 4 tree densities, exhibiting degrees of visual access consistent with these densities. Open lawns were classified as completely visible. Mapped results indicate the extent of visual access throughout the garden.

Four representative squares of tree densities were selected for further analysis based on: 1) trunk and canopy outline; 2) ground design features (ex. pathways); 3) aerial photos of the forest canopy; 4) 3-D model perspectives of the canopy; 5) 3-D aerial views to the canopy; 6) 3-D view from understory to sky; and 7) a percentage of visual access generated through image pixel analysis. The sampled squares infer what visitors might be doing based on features (ex. moving on pathways, resting), where they have the most visual privacy (ex. under a tree), preferred garden features (ex. views to nature), where drones have visual access to visitors, and where visitors can best see the drones. (see Figure 4)
Figure 4. Visual access map representing tree densities in Sarah Duke Botanical Garden

Mapped results (see Figure 4) indicate the extent of visual access throughout the garden. The darker gridded squares representing moderate to very dense tree cover, form the exterior edge of the garden and cover most of the eastern half of the site. Two large connected open spaces run north to south along the eastern forested edge of the Garden. Tree cover and visual access are greatest in this portion of the garden. The large open space to the north is filled with a large pond surround by denser tree cover on its upper boundary, with less dense tree cover on its lower boundary connecting with the second large open space to the south. The second large open space is comprised of open lawn surrounded by less dense tree cover and is among the most used portions of the site, primarily for more active recreation and festivities. Pathways and corridors surround the large open spaces and connect dozens of botanical garden features throughout the garden.

Visitors have significant presence along the garden paths, which are largely covered with trees or border areas with tree cover. Accordingly, visual access throughout the garden features and connecting pathways is relatively good with intermittent pockets of visual access, affording the greatest shelter from UAVs. While the large open spaces offer the greatest opportunities for drone visual access, the edges bordering these open spaces allow significant additional visual access into the surrounding forest through views under the tree line, significantly reducing shelter from drones. For example, while the large open spaces in the garden occupy approximately 230,000 square feet in the garden, the modest tree cover surrounding the large open spaces and its greater visual access into the forest edges increases the drone visual access to areas in the garden to 410,000, not including the entire botanical garden boundary edges and other smaller garden areas with less dense tree cover. These additional areas add 690,000 square feet to visual access by drones. This 1,100,000 square feet of visually accessible garden represents approximately 64% of this heavily forested site, suggesting the extent of the potential influence of UAVs on the use and enjoyment of public space by a significant number of visitors to the Sarah Duke Botanical Garden.
6 CONCLUSIONS

These findings suggest that while the garden seemingly provides shelter for privacy though substantial tree cover plantings, it may otherwise be significantly compromised with the presence of commonly available drones. Accordingly, though seemingly secure, forest edge conditions can surpass open space as a means of overall visual access. These findings also suggest that while a significant number of garden visitors may contemplate adverse changes in their use and enjoyment of visually accessible portions of the garden in the presence of drones, the majority of garden visitors remain largely unaffected by the presence of drones in the garden. As a whole, these findings suggest the importance of aerial visual access as a potential significant determining factor in public space planning and design, especially as UAV presence increases into the immediate future.

7 REFERENCES


Figure 1. Select visitor landscape and personal preferences associated with visual access. *Diagram by author.*

Figure 2. Select visitor concerns about the presence of drones in public space. *Diagram by author.*

Figure 3. Visual access matrix representing tree densities in Sarah Duke Botanical Garden. *Diagram by author.*
Figure 4. Visual access map representing tree densities in Sarah Duke Botanical Garden. Diagram by author.

Acknowledgments
The paper presents initial findings from research funded by a multiyear NSF grant to develop landscape architecture design responses related to the use of UAVs in and around public outdoor spaces,
1 ABSTRACT

Depopulation is a severe problem in many urban areas globally. Massive population migrations can occur due to relocation after natural disasters and significantly change the demographic composition of regions and cities. The 2011 Great Tsunami in Japan resulted in a combined total of deaths and missing persons of more than 24,500. Post-tsunami recovery efforts resulted in widespread population relocation of high-risk communities into lower-risk areas. Using the Fukushima Prefecture in Japan as the study area, a region characterized by several depopulating cities both pre and post-tsunami, this research examines how the population relocation efforts have either exacerbated or assisted in lessening the effects of urban shrinkage and decline after the earthquake and tsunami of 2011. The results show that 30 municipalities have seen population and economic growth since 2011, and 12 municipalities are undergoing trends toward decline within Fukushima. Negatively affected cities tend to have larger populations than positively affected cities. Most of the small towns and villages closer to the inundation area are fall into the category of negatively affected areas. Moreover, the population increases in many post-disaster cities are primarily due to significant increases in elderly populations with minimal young persons that will inevitably decline in the next decade. By determining the effects of their relocation efforts, the government can better develop targeted strategies that good for the prosperity and development of the Fukushima Prefecture.

1.1 Keywords

Depopulation, Tsunami, relocation, demographic composition, Fukushima
2 \hspace{1cm} \textbf{INTRODUCTION}

Excessive urban depopulation, sometimes referred to as shrinkage, is a severe problem in many urban areas globally, impacting development and having large-scale socio-economic effects (Gu et al., 2019; Newman et al., 2019). Relatedly, massive population migrations can occur due to relocation after natural disasters such as earthquakes and tsunami and can significantly change the demographic composition of regions and cities. Large scale demographic shifts due to natural disasters in regions already experiencing depopulation can either help protect cities from the problems associated with depopulation (or reverse the condition) or further amplify the condition. The 2011 Great Tsunami in Japan resulted in a combined total of confirmed deaths and missing persons of more than 24,578 (15,893 deaths, 2,533 missings, and 6,152 injured) (Matanle & Rausch, 2011). Post-tsunami recovery efforts resulted in widespread population relocation of high-risk communities into lower-risk areas (Gauntt et al., 2012).

The massive population migrations resulting from the disasters significantly changed the demographic composition of the Fukushima region. Using the Fukushima Prefecture in Japan, a region characterized by several depopulating cities both pre and post tsunami, as the study area, this research examines how the population relocation efforts have either exacerbated or assisted in lessening the effects of urban shrinkage after the devastating earthquake and tsunami of 2011. The purpose of this study is to examine and compare the characteristics of growing (populating) and shrinking (depopulating) cities in terms of depopulation after the devastating Japanese disaster of 2011 and to offer future recovery and development plans and design suggestions.

It is important to note that the Fukushima Prefecture is shaped by not only tsunami damage and post-tsunami relocation efforts, but also by post-nuclear-meltdown evacuation and relocation. To examine this, t-tests are used to evaluate significant changes in total population, youth population rate, labor force rate, elder population rate, and unemployment rate. Based on these findings, we then develop a ranking system to identify the municipalities in Fukushima that have not only continued, but also reversed trends toward urban decline, comparing pre and post tsunami spatial conditions. A population migration pattern and decline analysis is conducted to indicate the key characteristics of the residents affected and the migrants moving in and out the region. Such studies are essential for future urban design to understand the dynamics of local residents before and after the effects of such disaster events. This study provides a blueprint for designing for urban areas in Fukushima in regards to urban form needs.

3 \hspace{1cm} \textbf{LITERATURE REVIEW}

3.1 \hspace{1cm} \textbf{Depopulation in Japan}

Generally, a shrinking city can be referred to as a metropolitan area, including a city, part of a city, or a town, that has experienced population loss, economic downturn, employment decline, and social problems as symptoms of a structural crisis (Martinez-Fernandez et al., 2012). Shrinkage has become a significant urban design issue globally, impacting development, and having large-scale negative effects on communities. Various factors contributing to shrinkage include deindustrialization, suburbanization, war, natural or human-induced disasters, an aging or low-fertility rate population, and globalization (Hollander et al., 2009).

Population aging and population decline draw increasing attention internationally. As of 2050, the estimated global population aged 60 years or over is expected to increase to reach 21.1%, an increase of 11.9% over 1990. The word’s elderly population living in developing countries will increase from 67% to nearly 80% by 2050 (Wang & Fukuda, 2019). Japan is one of the most aging countries in the world. For the next fifty years, Japanese children and working-age populations are projected to decline by nearly 50%, based on current projections (Matanle, 2014). The country is also becoming an aging society demographically due to people living longer lives combined with a lower birth rate (Matanle & Rausch,
The people aged 65+ years composed about 23% of the total population of Japan in 2009, the highest elderly population globally (Bachev & Ito, 2017). Based on current projections, one-third of the total Japanese population will be 65+ years, and one-fifth will be 75+ years by 2030 (Muramatsu & Akiyama, 2011). In contrast, the birth rate of Japan is the lowest worldwide and reached a postwar level of 1.26 in 2005 (Matanle & Rausch, 2011). These circumstances affect all areas of Japan’s healthcare, educational resources, infrastructure, and environment. The high economic costs required to maintain a hyper-aged society stand at around a quarter of the national budget. Japan’s population changes are primarily due to the country’s low fertility rate (Matanle & Rausch, 2011). Changes in the proportion of the population currently married as well as decreases in the amount of children among married couples are the two main factors contributing to this fertility decline (Atoh, 2001). As a result, the proportion of the aged sector of the population (over 65 years old) projects to be 40% by 2060 (Martinez-Fernandez et al., 2016).

Population dynamics associated with globalization can attract population and skills from unprosperous areas to the places with high levels of innovation and intellectual engagement. Under new globalization processes, many cities, towns, and villages are continuously losing capital and human resources, leading to significant social and economic challenges (Martinez-Fernandez et al., 2012). Spatially, depopulation effects many rural areas of Japan, mostly due to internal population migration. In general, younger adults are more likely to move from rural to urban areas for various opportunities in terms of education, employment, and social life; therefore, a large amount of older people have been left in neighbor-less communities (Matanle, 2014). As young populations migrate to prosperous areas, vacant lots, underused infrastructure, and closed commercial venues become common scenes, aggravating the isolation of elderly residents (Buhnik, 2010). Japan’s Ministry of Internal Affairs says that around 15,000 of Japan's 65,000 or so communities have more than half of their population over the age of 65 (Semuels, 2017).

3.2 Disaster events and depopulation in Japan

Over the past decade, multiple large-scale natural disasters have significantly exacerbated urban shrinkage worldwide. Globally, natural disasters were responsible for, on average, 60,000 deaths per year. Earthquakes have the highest lethality among droughts, floods, and other events (Bates, 2019). Because of its unique geographic location, Japan has an intimate relationship with earthquakes and tsunamis. Disaster-induced problems, such as mortality, health, fertility, and migration, greatly contribute to Japan’s demographic size and composition (Frankenberg et al., 2014). During the evacuation process immediately following a disaster, scores of patients and elderly residents can die due to interruptions in essential life survival services such as medical care, food, and water (Hasegawa et al., 2016). People stricken by poverty and of low socio-economic status are at greater risk than others during disasters, in both the response and recovery phases. In general, people of low socio-economic status tend to live in fragile housing in disaster vulnerable areas, when compared with more affluent persons (Masterson et al., 2019; Kim and Newman, 2019). They also have lower likelihoods of receiving warnings of disasters, being able to evacuate promptly, or accessing post-disaster aid (Newman et al., 2018; Meyer et al., 2018; Reja et al., 2017). In addition to direct death, the long-term impacts stemming from a disaster can harm communities for years, as fertility trends can be altered (Bates, 2019). Birth rates may be reduced in the months following a disaster because of miscarriages, declines in coital frequency, and lower relationship quality; simultaneously, many families that lost their children may intentionally try to conceive (Nobles et al., 2015). This replacement of fertility changes local area population compositions.

Population migration is a natural way to deal with disaster shocks when property or sources of livelihood are destroyed. Population displacement – either voluntary or involuntary – also occurs during a large-scale disaster event. The level of voluntary displacement is linked with the risk of exposure to shock, poverty level, and the diversification of assets and income. Depopulated areas, small communities, and communities with higher vacancy rates are more likely to experience large population losses after disasters. In contrast, wealthier communities tend to retain their population (Cross, 2014). After a disaster, socioeconomic, political, social, and personal emotional factors all affect the return decision process (Morrice, 2013). Some displaced populations may return home while others may permanently move to other less affected places. Therefore, disasters do not only impact affected populations but also the communities from which the migrants have or are moving (Frankenberg et al., 2014).
3.3 A paradigm shift in Japanese urban planning

To address the shrinkage issue, there was a paradigm shift away from the modern expansion model to a shrinking model in urban design and development in Japan (Stefan et al., 2017). The contemporary shrinking model, known as a smart decline strategy, aims to ensure the quality life of remaining residents, emphasizes reducing the overall financial burden by spatial consolidation, and reassures future development possibilities in a much longer term (Heins, 2012). The challenge with the smart decline model is about how to efficiently plan land uses that shape a concentrated urban structure while allowing for urban decline, but managing it (Stefan et al., 2017). However, acknowledging that some areas cannot be developed further can be difficult, especially after a large-scale disaster. The destroyed land, housing, and infrastructure in a disaster impacted area can sometimes promote economic development and increase population immigration into other areas (Albrechy, 2017). Relocation and recovery plans can bring related professionals, industrial workers, and their families from unaffected areas to affected areas. However, the influx of population changes after a disaster is a complicated issue and does not always follow a clear pattern. Demographic and social-economic changes occur over the long term as the impact of the disaster fades away. Usually, the reconstruction efforts tend to be expansion-oriented as the needs of reconstruction increases after a large-scale disaster. However, in an era of a sparse population like Japan, reconstruction plans need to be considered in the face of population shrinkage (Asano et al., 2018).

3.4 The 2011 Japanese tsunami

On March 11, 2011, a devastating tsunami following a magnitude 9.0 earthquake produced catastrophic damage to many coastal cities in northeast Japan. This tsunami caused widespread damage to buildings, roads, communications, and regional electrical power (Gauntt et al., 2012), and resulted in a combined total of more than 24,578 confirmed deaths and missing persons (nearly 15,893 deaths, 2,533 missing, and 6,152 injured) (See Table 1). Miyagi, Iwate, and Fukushima prefectures had the most significant number of victims as a powerful tsunami wiped out entire communities (Bachev & Ito, 2017). Another primary consequence of the tsunami was a meltdown of three reactors at the Fukushima Daiichi nuclear power plant, resulting in aftermath that was given a rating of 7 (the highest score) on the International Atomic Energy Agency (IAEA) nuclear event scale. It is still impossible to gauge the widespread health and environmental effects due to the radioactive leakage from the Fukushima nuclear accident (Gauntt et al., 2012).

Japan’s triple disaster of 2011 - earthquake, tsunami, and Fukushima Daiichi nuclear accident – largely impacted population movements, employment situations, and the gross domestic products (GDP) of many cities. Compared to 2010, the total net migration of disaster-stricken Tohoku prefectures of 2011 increased by 30,799 people. Because of the nuclear climate, the net migration of Fukushima was much larger than pre-disaster, which occupied around 80% of the total net immigration from the three disaster-stricken Tohoku prefectures. This resulted in a significant change in the employment structure, post-disaster. The labor force openings in the construction industry and public service sectors largely increased in many disaster-stricken areas in the Tohoku Prefecture, due largely to the reconstruction after the disaster. However, job hunters seeking local industrial jobs were less fortunate in the tsunami-hit region (Takabe & Inui, 2013). The Japanese economy was significantly affected by the disaster; the country’s total GDP reduced between 0.2 to 0.5 percentage points, however, its overall economic growth still increased by nearly 1% (Nanto et al., 2011).
Table 1. Number of confirmed deaths, missing, and injured person associated with the March 2011 earthquake (March 10, 2017)

<table>
<thead>
<tr>
<th>Prefectures</th>
<th>Deaths</th>
<th>Missing</th>
<th>Injured</th>
<th>Prefectures</th>
<th>Deaths</th>
<th>Missing</th>
<th>Injured</th>
</tr>
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<tr>
<td>Hokkaido</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>Gunma</td>
<td>1</td>
<td>-</td>
<td>42</td>
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<tr>
<td>Aomori</td>
<td>3</td>
<td>1</td>
<td>112</td>
<td>Saitama</td>
<td>-</td>
<td>-</td>
<td>45</td>
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<tr>
<td>Iwate</td>
<td>4,673</td>
<td>1,123</td>
<td>213</td>
<td>Chiba</td>
<td>21</td>
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<td>Miyagi</td>
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<td>-</td>
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<td>117</td>
<td>Shizuoka</td>
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<td>712</td>
<td>Mie</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Tochigi</td>
<td>4</td>
<td>-</td>
<td>133</td>
<td>Kochi</td>
<td>-</td>
<td>-</td>
<td>1</td>
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<tr>
<td><strong>Total</strong></td>
<td>15,893</td>
<td>2,553</td>
<td>6,152</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Source: National Police Agency

3.5 Relocation in Japan

There were more than 76,000 residents within a 20 km area surrounding the Fukushima Daiichi Nuclear Power Plant (FDNPP) prior to the nuclear incident (Nanto et al., 2011). Immediately after the accident, the Fukushima government ordered 1,864 residents in only 2km radius around the FDNPP to evacuate at 19:03 on Mar.11, 2011. By the evening of the same day, as the evacuation area expanded to 3 km, the affected residents increased to 5,800, including residents under instructions to take shelter within 10km of FDNPP. After the 1st explosion at nuclear reactor No.1, the government forced over 50,000 residents who lived within 20km from the FDNPP to evacuate on March 12, 2011 (Gemenne et al., 2012). By March 15, more than 97% of residents living in the 20 km radius had evacuated (Hasegawa et al., 2016). The government further instructed the residents living between 20km-30km radius from the Nuclear Power plant to stay inside their homes. On April 22, even residents within a 30km zone were recommended to relocate.

The government designated the “restricted area” within a 20km radius around the FDNPP (See Image 1), prohibiting entry into the area, excluding those engaged in emergency response (Fukushima Beacon for Global Citizens Network, 2017). In May, the government designated all areas having an air radiation dose of 20 mSv/year as “deliberate evacuation areas.” Residents from these areas were required to evacuate by the government. Until September 2011, more than 100,000 residents in Fukushima were affected under several evacuation orders, a large degree having to relocate away from their homes (Gemenne et al., 2012).

By March 2012, the areas to which evacuation orders had been issued were rearranged by the government into three areas according to the annual cumulative nuclear dosage:

1) The evacuation order cancellation preparation zone was designated areas where the evacuation orders were ready to be lifted in and the annual integral dose of radiation was below 20mSv. People were allowed to enter and pass through the areas temporarily, but the overnight stay was prohibited.

2) The restricted residence zone designated areas where people were not recommended to enter as the annual radiation dosage was 20 mSv or more, but were allowed to enter during the daytime.

3) The difficult to return zone defined areas where people were unable to stay as the annual integral dose of radiation was expected to be 20 mSv or more within five years and the current integral dose of radiation per year was 50 mSv or more. (Fukushima On the Globe, n.d.).
*Source: Fukushima On the Globe, n.d.

**Figure 1:** Restricted area post-tsunami

Source: Fukushima on the Globe

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**Figure 1:** Evacuation zones during the 2011 Japanese tsunami

Source: Fukushima on the Globe
The government gradually lifted the evacuation orders from some areas, including Kawamata Town, Namie Town, Litate Village, and Tomioka Town. The evacuation designated zones occupy about 2.7% of the entire area of Fukushima Prefecture (FukushimaVoice, 2013) (See Image 2).

3.6 Population redistribution post-tsunami in Japan

After the tsunami, municipal buildings, schools, and gymnasiums became shelters for evacuees who were eventually moved to transitional shelters, funded by the central government. The sites of transitional shelters were selected by the municipality. After, evacuees could either find public housing to rent or choose to build their own houses in permitted areas for permanent living (Gemenne et al., 2012). Among the evacuees, many who feared the radioactive leakage evacuated voluntarily, especially those in zones experiencing a severe lack of resources.

In Fukushima Prefecture, the number of displaced residents increased from 86,308 in March 2011 to 99,205 in June 2011. Moreover, voluntary migrants who moved out of Fukushima increased by 62,831 after the first year of the disaster, especially among families with children and younger populations (Hasegawa et al., 2016). Due to an exodus of younger persons, issues associated with aging populations in the affected areas were accelerated. In fact, in 2011, 10% (210,000) of Fukushima’s population were relocated to other places within the Prefecture after the disaster, including 77,000 in the restricted area, 10,000 in the deliberate area, 26,000 in the evacuation prepared area, and 117,000 in other areas within 30km (FukushimaVoice, 2013).

4 METHODS

4.1 Objectives and Data

This research examines the urban socio-economic recovery of cities and villages in Fukushima prefecture, a major victim of the 2011 Tōhoku earthquake and tsunami, comparing conditions before and after the disaster. The data was obtained from the Japan Population Census Data, which is conducted every 5 years since 1920. The unit of analysis is the household, formed by a group of individuals that share livelihood in the same residence. A family living in one house is a typical example. In addition, a member who is not a relative can also be counted as a member of a Household Unit when they share the same residence and livelihood. However, a person who lives independently can also be considered a Household Unit, even if he or she shares the same residence with others. Besides, to take economic characteristics into consideration, Gross Domestic Product (GDP) data, covering the annual GDP from 2003 to 2015 of each city and village provided by SNA (National Accounts of Japan), is utilized to evaluate the economic growth after the disaster.

4.2 Variables

The census data released by the National Statistics Center, Japan, are all in different scales and formats, and do not align to typical U.S census or parcel based analytic approaches. In this study, a 500m side mesh area tabulation is investigated to capture the most accurate population change in Fukushima Prefecture. The mesh area tabulation, known as “Regional Mesh Grid Areas”, is based on the Japan Standard Rectangular Grid Square System. Three types of mesh areas are covered in this data set: a) 500m Side Mesh Areas; b) 1 km Side Mesh Areas; and c) 10 km Side Mesh Areas, each is aggregated into territories. These mesh areas’ boundaries are not modified over time, so they are suitable to compare the census data results in different years.

For comparison of pre and post-conditions of the disaster of the 2011 Tōhoku earthquake and tsunami, census data from 2005, 2010, and 2015 are used to show the reduction or increase of socio-economic development speed before and after the disaster. This study is divided into 2 steps, focusing on the individual socio-economic characteristics, and a comprehensive ranking of the recovery of socio-economic aspects of cities and villages in Fukushima prefecture by using a t-test on before and after socio-economic characteristics and the changing rates of each mesh in each city or village.
During the analysis, urban decline issues, population loss, economic downturns, employment declines, and social problems are assumed to be symptoms of a structural crisis (Martinez-Fernandez et al., 2012). Population, age structure, GDP, labor force, and unemployment rate are the primary socio-economic attributes to be tested in this study. In this study, several socio-economic characteristics are interpreted for comparison. Besides the total population, as the aging problem is a vital part of population study, median age, elder population (population of age above 65), and minor population (population of age under 17) are taken into consideration. The unemployment rate and labor force are also utilized as essential indicators of socio-economic recovery. In addition, the GDP of each city and village is another indicator of the economic growth. To examine the patterns of recovery within the Fukushima prefecture, mesh data are dissolved and merged into city scaled data. The socio-economic characteristics prior to the Tsunami disaster are calculated with 2005 and 2010 census data. In order to normalize the size of cities and villages, changing rates are calculated to present their socio-economic changes before and after the disaster.

4.3 Ranking

To test the mathematic significance of the change of socio-economic characteristics before and after the tsunami, this study utilizes a Welch’s t-test. Each mesh in each city is considered as an observation. Selected socio-economic characteristics, including population, median age, elderly population, minor population, labor force, and unemployment rates, are then tested using this method. Using “x1” as the change rate before the tsunami and “x2” as the change rate after the tsunami, the null hypothesis assumes that there are no changes before and after the tsunami (“x1” – “x2” =0). If the p value of the test is smaller than 0.05, indicating rejecting the null hypothesis, we suggest that the socio-economic characteristics changing rate after the disaster are mathematically significantly different than it was before the tsunami. In this case, the result of “x1” –“x2” will show whether it is growing faster (“x1” – “x2” <0), or declining faster (“x1” – “x2” >0).

The ranking of the cities and villages in Fukushima prefecture is based on the following attributes: t-test results of population, elderly population, minor population, labor force, unemployment. Shapiro tests are also conducted to determine if the samples are normally distributed prior to the t-tests. If t-test results of population, minor population, and labor force are significant at 0.05 level under “x1” – “x2” <0 condition, indicating it increases after the disaster, ranking counts will increase by one. If it is significant under “x1” – “x2” >0 condition, the ranking counts will reduce by one. Otherwise, the ranking counts stay the same because there is no significant difference between pre and post-situation. To ensure the consistency of the result, we didn’t count GDP and median age into the ranking system because they are not the mash level data. However, we integrated GDP and median age data into later analyses to imply which cities or villages have comparatively recovered better and which ones are comparatively worse.

5 RESULTS

5.1 Ranking results

In the ranking results, there are 12 municipalities’ socio-economic attributes that appear to be worse than they were before the tsunami. There are 4 cities, 7 towns, and 1 village among them (see table 2). The one village that was negatively affected is Kawauchi Village, which has a minus 3 ranking counts. There are 6 partially negatively affected areas that have minus 2 ranking counts. Meanwhile, there are 5 minor negatively affected areas of minus 1 ranking counts. On the other hand, there are 30 municipalities with positive ranking counts, include 4 cities, 15 towns, and 11 villages (see table 3). The one positively affected area, which has a positive 3 ranking count, is Inawashiro Town. There are 15 partially positively affected areas with 2 positive ranking counts and 14 minor positively affected areas with 1 positive ranking counts. Figure 3 shows a clear pattern that negatively affected areas are more clustered around coastal flooded areas, positively affected areas are away from disaster areas, and neutral affected areas are scattered between them. Within the 20 km radius, towns and villages were hit the hardest compared to cities. Population compositions of Tamura city and Iwaki city were basically unaffected by the disaster, but people living in Kawauchi village, Naraha town, and Hirono town had difficulty returning to
their hometown after the disaster. There are few municipalities that do not agree with this pattern. Kaneyama town and Nishiazu town, the two of the most inland towns, are identified as partially negatively affected areas. Soma city and Shinchi town, located near the inundation areas are rated as partially positively affected areas.

Table 2. Ranking results of negatively affected areas

<table>
<thead>
<tr>
<th>City</th>
<th>Total Population</th>
<th>Youth population (Age &lt;14)</th>
<th>Labor Force</th>
<th>Elderly population (Age &gt;65)</th>
<th>Unemployment</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kawauchi mura</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
<td>-1</td>
<td>0</td>
<td>-3</td>
</tr>
<tr>
<td>Hirono machi</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
<td>-1</td>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>Kagamishih machi</td>
<td>-1</td>
<td>0</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>Kaneyama machi</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>Kawamata machi</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
<td>-1</td>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>Naraha machi</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>Nishiaizu machi</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
<td>-1</td>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>Date shi</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
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<tr>
<td>Fukushima shi</td>
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<td>Hanawa machi</td>
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<td>-1</td>
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<td>-1</td>
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<tr>
<td>Koriyama shi</td>
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<td>0</td>
<td>-1</td>
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<td>-1</td>
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<td>Minamisoma shi</td>
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<td>-1</td>
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</table>

Figure 3. Distribution of positively and negatively affected areas
### Table 3. Ranking results of positively affected areas

<table>
<thead>
<tr>
<th>City</th>
<th>Total Population</th>
<th>Youth population (Age &lt;14)</th>
<th>Labor Force</th>
<th>Elderly population (Age &gt;65)</th>
<th>Unemployment</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inawashiro machi</td>
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<td>1</td>
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<td>0</td>
<td>1</td>
<td>3</td>
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<td>2</td>
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<td>Hirata mura</td>
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<td>1</td>
<td>-1</td>
<td>1</td>
<td>2</td>
</tr>
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<td>0</td>
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<td>0</td>
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<td>2</td>
</tr>
<tr>
<td>Minamiaizu machi</td>
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<td>0</td>
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<td>2</td>
</tr>
<tr>
<td>Mishima machi</td>
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<td>0</td>
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<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Ono machi</td>
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<td>0</td>
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<td>2</td>
</tr>
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<td>-1</td>
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<td>2</td>
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<td>0</td>
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<td>2</td>
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<td>2</td>
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<td>-1</td>
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<td>2</td>
</tr>
<tr>
<td>Yabuki machi</td>
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<td>0</td>
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<td>2</td>
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<td>2</td>
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<td>2</td>
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<td>1</td>
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<td>1</td>
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<td>Kunimi machi</td>
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<td>1</td>
</tr>
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<td>Miharu machi</td>
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<td>0</td>
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<td>1</td>
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<tr>
<td>Motomiya shi</td>
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<td>1</td>
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<td>1</td>
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<td>1</td>
</tr>
<tr>
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<td>-1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Tanagura machi</td>
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</tr>
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<td>Tenei mura</td>
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</tr>
</tbody>
</table>

### 5.2 Socio-economic attributes

The specific socio-economic conditions are shown in Table 4. Population wise, compared with the previous rate before the tsunami, 10% of the positively affected areas' population increased, while 100% of the negatively affected areas' population decreased. In the youth population ratio analysis, 80% of the positively affected areas did not have significant change from the previous condition, but 40% of them were positively skewed. On the contrary, 83% of the negatively affected areas lose their youth population dramatically. When it comes to the elder population ratio, 63% of the positively affected areas have the same ratio changing rate with the former condition, and 83% of the negatively affected areas have
increased ratio changing rates comparing to the former condition. Meanwhile, 87% of the positively affected areas have increased labor force ratio changing rate, while only 33% of the negatively affected areas have increased rates. When it comes to the labor force ratio, the percentage of the positively affected areas with significantly increased labor force rates is 37% higher than of the negatively affected areas. Albeit there is a gap between positively affected areas and negatively affected areas in terms of labor force rate, 50% of negatively affected areas are positively skewed. Interestingly, almost all the areas, whether positively or negatively affected, have a decreased unemployment population ratio, decreased average age, and increased GDP. In a nutshell, after the tsunami, most positively affected areas have relatively stable total population, youth population ratio, and elder population ratio, increased labor force ratio and GDP, and decreased average age. For negatively affected areas, most of them have decreased total population, youth population ratio, and unemployment population ratio, and increased elder population ratio and GDP.

### Table 4. Distribution of different conditions among positively affected and Negatively affected areas

<table>
<thead>
<tr>
<th>Condition</th>
<th>Total population</th>
<th>Youth population ratio</th>
<th>Elderly population ratio</th>
<th>Labor force population ratio</th>
<th>Unemployment population ratio</th>
<th>Average age</th>
<th>GDP</th>
</tr>
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<tbody>
<tr>
<td><strong>Decreased</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAA (30)</td>
<td>7%</td>
<td>3%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>90%</td>
<td>83%</td>
</tr>
<tr>
<td>NAA (12)</td>
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<td>83%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>97%</td>
<td>75%</td>
</tr>
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<td></td>
</tr>
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<td>80%</td>
<td>17%</td>
<td>13%</td>
<td>50%</td>
<td>10%</td>
<td>17%</td>
</tr>
<tr>
<td>NAA (12)</td>
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<td>17%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Increased</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAA (30)</td>
<td>10%</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
</tr>
<tr>
<td>NAA (12)</td>
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<td>83%</td>
<td>87%</td>
<td>33%</td>
<td>0%</td>
<td>83%</td>
<td>92%</td>
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<tr>
<td><strong>Positive skew</strong></td>
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<td></td>
<td></td>
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</tr>
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<td>PAA (30)</td>
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<td>43%</td>
<td>0%</td>
<td>13%</td>
<td>50%</td>
<td>-</td>
</tr>
<tr>
<td>NAA (12)</td>
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<td>40%</td>
<td>17%</td>
<td>8%</td>
<td>0%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Normal</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
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<td>84%</td>
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<td>94%</td>
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<td>44%</td>
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<td>0%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Negative skew</strong></td>
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<td></td>
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<td></td>
</tr>
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<td>37%</td>
<td>13%</td>
<td>17%</td>
<td>7%</td>
<td>3%</td>
</tr>
<tr>
<td>NAA (12)</td>
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<td>8%</td>
<td>13%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Positively Affected Areas (PAA), Negatively Affected Areas (NAA)

*The underlined values indicate the most significant percentage under each category.

Additionally, investigation of the socio-economic conditions of the affected areas reveals much when based on the status of the municipality (see table 5). In Japan, three levels of the municipality - city, town, and village - are decided by the prefectural government based on the total population. Generally, a municipality with a population of above 5,000 is defined as a city; otherwise, it is regarded as a town or a village. Among city level samples, negatively affected cities’ labor force and GDP changing trend appear to be more positive than positively affected areas, including outliers. Among town level samples, negatively affected areas elderly population, average age, and labor force changing trend appear more positive than positively affected areas, including outliers. Among village level samples, negatively affected areas elder population, labor force, and GDP changing trend are better than positively affected areas, including outliers.
Table 5. Socio-economic attributes changing rates comparison

<table>
<thead>
<tr>
<th>Mean</th>
<th>Pop0510</th>
<th>Pop1015</th>
<th>Trend</th>
<th>You0510</th>
<th>You1015</th>
<th>Trend</th>
<th>Old0510</th>
<th>Old1015</th>
<th>Trend</th>
<th>Age0510</th>
<th>Age1015</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAA (city level)</td>
<td>-2%</td>
<td>-6%</td>
<td>-4%</td>
<td>-7%</td>
<td>-20%</td>
<td>-13%</td>
<td>12%</td>
<td>18%</td>
<td>7%</td>
<td>7%</td>
<td>6%</td>
<td>-1%</td>
</tr>
<tr>
<td>PAA</td>
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<td>-2%</td>
<td>0%</td>
<td>-7%</td>
<td>-9%</td>
<td>-2%</td>
<td>8%</td>
<td>12%</td>
<td>5%</td>
<td>6%</td>
<td>4%</td>
<td>-3%</td>
</tr>
<tr>
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<td>-6%</td>
<td>-2%</td>
<td>-1%</td>
<td>-2%</td>
<td>-2%</td>
</tr>
<tr>
<td>NAA (town level)</td>
<td>-7%</td>
<td>-20%</td>
<td>-14%</td>
<td>-10%</td>
<td>-33%</td>
<td>-22%</td>
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<td>11%</td>
<td>8%</td>
<td>1%</td>
<td>4%</td>
<td>2%</td>
</tr>
<tr>
<td>NAA (village level)</td>
<td>-10%</td>
<td>-29%</td>
<td>-19%</td>
<td>-13%</td>
<td>-60%</td>
<td>-47%</td>
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<td>2%</td>
<td>21%</td>
<td>11%</td>
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<td>-2%</td>
<td>-10%</td>
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<td>8%</td>
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<td>-6%</td>
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<table>
<thead>
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<th>Mean</th>
<th>Lab0510</th>
<th>Lab1015</th>
<th>Trend</th>
<th>Unem0510</th>
<th>Unem1015</th>
<th>Trend</th>
<th>GDP0510</th>
<th>GDP1015</th>
<th>Trend</th>
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<tbody>
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<td>NAA (city level)</td>
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<td>9%</td>
<td>17%</td>
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<td>25%</td>
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6 DISCUSSION AND CONCLUSIONS

The results show that 30 municipalities (4 cities, 15 towns, and 11 villages) have seen population and economic growth since 2011, and 12 municipalities (4 cities, 7 towns, and 1 village) are underdoing trends toward decline within the Fukushima Prefecture. To assist in interpretation, we characterize each city according to their demographic composition and GDP, finding that most cities have increased their GDP, decreased unemployment rates, and decreased the average age of residents. Expanding municipalities tend to have increased in total population, less aged populations, and more labor force than shrinking cities. However, many now populating cities which were depopulating prior to the tsunami, are doing so primarily due to significant increases in elderly populations with minimal young persons, indicating a short-term increase in population that will inevitably decline in the next decade or so in many cities.

The results also imply that negatively affected cities tend to have larger populations than positively affected cities. Large cities like Fukushima, Date, and Koriyama are more vulnerable than relatively smaller cities like Soma, and Tamura post-disaster. This abnormal condition could be caused primarily by the location of these cities. Most of the negatively affected cities are closer to the inundated area and are more likely to be influenced by the tsunami, while the smaller cities with more space for new residents appear to be the beneficiaries of the relocation of the residents from the disaster area. Although the government gave particular financial support for the 2011 disaster survivors, it was difficult for many who came from small towns and villages to pay additional living expenses to live in large cities.

Meanwhile, negatively affected towns tend to have smaller populations than positively affected towns, and negatively affected villages tend to have a smaller population than victory villages. For example, large towns like Inawashiro, Tadami, and Minamiaizu are doing much better than small towns. When it comes to...
smaller municipalities, they oftentimes lack the means, such as hospitals, rescue groups, related professionals, and mature autonomous structures to recover their populations sustainably (Matanle, 2014). The elderly population distribution in smaller towns and villages could be another factor that exaggerates this situation, considering the excess mortality of elderly persons during the disaster (Morita et al. 2017).

From results it appears that most of the municipalities closer to the inundation area are fall into the category of negatively affected cities, according to the ranking results, including Kawauchi Village, Naraha Town, Hirono Town, and Kawamata Town. Nuclear radiation concerns and governmental relocation plans could be reasons for the loss of population and economic decline. Kawauchi Village, Naraha Town, and Hirono Town were formerly in the restricted zone in the evacuation plan (Fukushima On The Globe, n.d.). There are also 2 partially negatively affected cities that are far away from the inundation area, Nishiaizu Town and Kaneyama Town. Both have only negative changes in the total population and youth population. The reason for this could be the national aging issue and the fertility problem in Japan (Matanle & Rausch, 2011). Among the municipalities, there are 2 positively affected cities close to the inundation area, Shinchi Town, and Soma City. Both have significantly increased in population and significantly dropped in the unemployment rate. The recovery project recruitment process could largely contribute to this phenomenon. Since the Japan Census Data include migrates as survey units, rescue teams, research groups, construction workers, and their families for the recovery project in the disaster area could be anchored in these closest and safe locations, increasing the local population and labor force. The detailed distribution of such a migrate population requires further research.

Post-disaster populating and depopulating cities require planners to adopt specific recovery strategies tailored to their characteristics carefully. The impact of reconstruction efforts on city structure sometimes surmounts even the disaster itself. The reconstruction efforts tend to be expansion-oriented as the needs of reconstruction increases after a large-scale disaster. In an era of the sparse population increases like Japan, reconstruction plans need to be considered in the face of population shrinkage (Asano et al., 2018). Below, we propose several suggestions to assist planners in developing proper recovery strategies for both populating and depopulating cities after the 2011 triple disaster.

For positively affected areas, most of which are small cities, large towns, and large villages, population changes need to be carefully monitored and predicted to avoid being fooled by illusions of population growth. Indeed, the destroyed land, housing, and infrastructure during a disaster impacted areas can sometimes increase the value of comparable land, housing, and infrastructure in surrounding areas, thereby potentially promoting the economic development of other areas (Albrechy, 2017). Also, the relocation plans and recovery plans have brought some of the population, such as related professionals, industrial workers, and their families, from other parts of Japan and even overseas to Fukushima prefecture. As the impact of the disaster fades away, such situation will gradually get back on original track. Although some evacuator who was living the temporary housing have started new lives in new cities, many will eventually return to their original communities due to emotional bonding and lack of confidence in living in a strange environment (Murakami et al., 2014). Moreover, the population increases in many post-disaster cities are primarily due to significant increases in elderly populations with minimal young persons. This short-term increase in population that will inevitably decline in the next decade. In the past, most housing developments for survivors have not been included as part of city urban designs or planning efforts, leading an inappropriate site selection for these houses. Unfortunately, the target group of housing development for survivors was rarely open to current residents, resulting in some of lots remaining unsold, especially for those with poor locational conditions. Additionally, since land acquisition is quicker and cheaper in the outer area of the city, it is easy to run counter to the compact development guided by infill-style development. Also, as a result of the demographic aging of the relocation, some new developments may not be used (or reused) on a permanent basis. Green infrastructure, such as community gardens, bioswales, retention ponds, constructed wetlands, or pocket parks, could be a way to achieve social and ecological services simultaneously. Therefore, for cities with a temporality increased population, sustainable urban designs and plans that can satisfy the rational demand of survivors and existing residents without overestimation and overplanning should become the goals for designers (Asano et al., 2018). Governments and designers must fully understand the long-term implications to avoid excessive investment, which would impose a greater financial burden on future generations.

In the case of the tsunami disaster in Fukushima prefecture, population loss, especially in the small towns and villages close to the inundation area, is severe. The reconstruction strategies for these
negatively affected towns and villages based on agriculture or fishery, such as Kawauchi village, Naraha town, and Hirono town, should be different from other positively affected regions. We need to keep in mind that it is difficult to restore or revive the population in these places, because many residents have relocated to higher lands, and there was a severe depopulation issue before the disaster. The reconstruction process of these areas should aim to return disaster-prone areas to their original ecosystems. Looking to the past, rural and ecological approaches are more likely to be overwhelmed by civil engineering, such as building concrete seawalls and raising lower-lying land. Emphasizing only economic services while neglecting ecosystem services can lead to increased social vulnerability. For example, sea walls can help prevent inundation by tsunamis but also can destroy fishery industries by cutting off the connection to the sea. However, some ecological approaches, such the multiple lines of defense approach and shore-parallel structural risk reduction strategies, have been approved to affect inundation reduction positively. Integrating these green infrastructure elements may help open up some of the coastal areas for fishing activities of remaining residents. Also, the vacant low-lying lands that cannot be used as residential areas could accommodate farmland, parks, shops, and factories to meet the needs of economic services, social services, and ecological services (Murakami et al., 2014; Morris-Suzuki, 2015).

Monitoring and predicting demographic composition and social-economic changes under close scrutiny is essential to avoid excessive investments when developing urban design plans for disaster effected shrinking cities, as it could impose a greater financial burden on future generations. In terms of urban planning and political decision making, switching from top-down mechanisms to a bottom-up model that involves the participation of residents is extremely important to build health cities under urban shrinkage. No matter if the areas are positively or negatively affected after the tsunami, envisioning a shrinkage-based model of urban design instead of an expansion model during disaster recovery processes is critical, given the background of the population decline situation in Japan.

7 LIMITATIONS AND FUTURE WORKS

Since the Japan Census Data are surveyed and collected every 5 years, we can only interpret the socio-economic data in 2005, 2010, and 2015. The tsunami occurred in 2011, so the census data may not precisely catch the changes before and after the disastrous event. The demographic data right before the disaster happened (2010 to 2011) is hard to incorporate into the analysis. Because of the 5 year interval of the census data, we have to include 2010, the year before the 2011 disaster, to investigate the demographic changes after the disaster. Besides, since the variables of socio-economic attributes from the census data are limited, there are some potential overlaps in our investigated variables, like youth population, elder population, and labor force ratio, which to some degree weaken the argument on ranking criteria. Regardless of these limitations, Japan Census Data are the most comprehensive and irreplaceable data to shed light on the demographic composition of the country. In addition, some geographical data are absent in this study, which constrains the investigation of the reasons for the uneven distribution of population change. When it comes to the relocation process, the amounts of immigrants from each municipality are unknown, which makes it difficult to rationalize the sharper population loss in big cities. Additional geographical analysis should be included in the future to help determine the difficulty of the relocation of the victim population from the inundation area.

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RESEARCH BY DESIGN

Edited by Brett Milligan & Kristi Cheramie
CURBING SEDIMENT: CLEANING STORMWATER TO PROTECT ECOSYSTEMS AND INVESTMENTS IN GREEN INFRASTRUCTURE

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1 ABSTRACT

Stormwater runoff transports pollutants including sediment, nutrients, bacteria, pesticides, metals, and petroleum by-products to waterways, often without treatment.¹ Once in rivers, streams, and lakes, they affect aquatic ecosystems through acute and chronic toxicity. Green infrastructure, primarily bioswales, has been widely used to help filter and slow water before it enters sewers and waterways. However, sediment frequently clogs bioswales and impairs storm drains on roadways where bioswales are not present or suitable. This research project, Curbing Sediment, challenges the design standard of the concrete curb and apron. Curbing Sediment investigates alternatives to this standard via alterations on the curb and apron face to reduce stormwater runoff velocity and collect roadway sediment before it enters and potentially clogs green infrastructure stormwater controls. Mock roads with custom curb and gutter designs were implemented using EPS foam and a CNC router. Simulated stormwater containing sediment was pumped onto the foam road section and tested for total suspended solids (TSS), particle size distribution (PSD), and turbidity. Combined curb and gutter designs were able to reduce sediment concentrations by as much as 89% between the inlet and outlet of the designed road section. This is above the minimum requirements outlined by the National Pollutant Discharge System (NPDES) permit for the state of Ohio of 80% reduction in TSS. Thus, this simple technology could be utilized, if maintained to replenish sediment capture capacity, to partially meet stormwater permits while protecting green infrastructure from clogging.

1.1 Keywords

Infrastructure, low impact development, sustainability, urban Design, sediment

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INTRODUCTION

A curb is a simple but ubiquitous thing. San Francisco, for instance, has approximately 275,000 curbside parking spaces, just shy of 5 million linear feet of curb.² The operation of a curb, gutter, and apron is transparent; they facilitate the movement of storm-water from the road to a storm drain (and then to a sewer) or, more recently, a bioswale. However, this straightforward gesture carries more than only water. First flush toxins and sediment accumulation on the road and during storm events are transported with the water along the gutter at the curbs base. Stormwater runoff transports pollutants including sediment, nutrients from lawn fertilizers, bacteria, pesticides, metals, and petroleum by-products often discharging to waterways, often without treatment.³ Once in the waterway, removal of the pollutants is challenging, so local, source control measures are needed. A typical curb and gutter is designed for conveyance of stormwater only, and so it does not provide any water quality benefit. Can we challenge conventional design standards, like the curb, to do more? With the widespread use of curbs, small scale changes have the ability to have regional impacts. As we improve design standards to increase functionality, can their design communicate complex relationships that exist between our cities and the environments they impact? If we can design a better curb, one that collects pollutants before they enter the waterway, we can improve the health of our watersheds.

BACKGROUND

Stormwater has become an international issue, as a result of poor water quality tied to city infrastructure, including impervious surfaces, combined sewers, and illicit discharges. Beach closures, algal blooms, compromised drinking water, and aquatic species decline provide some examples of the impacts our urban areas have on water systems. Stormwater carries with it suspended sediment, pathogenic microbes, hydrocarbons, nutrients, and heavy metals from watersheds and transports them to surface waters (Schillinger et al. 1985).⁴ The cities impervious surfaces limit the potential for soil- and
vegetated-based processes to treat pollutants transported during rainfall events. To mitigate some of these impacts, cities have turned to stormwater control measures (SCMs) that can be implemented to control flows and reduce pollutant loads from urban watersheds. One such SCM, bioswales, are integral landscape features that concentrate, collect, and remove sediment, pollutants, and debris from stormwater through a variety of mechanisms including sedimentation, filtration, and microbial action. They are reduce the volume of runoff from urban areas through evapotranspiration and groundwater recharge.

Stormwater control measures are required through National Pollutant Discharge Elimination System (NPDES) permits for new developments and are being retrofitted into existing developments as part of sanitary and combined sewer overflow control strategies. These practices are designed based on site conditions and to treat the first flush of stormwater runoff; in Ohio, this is the runoff from the first 0.9 inches of rainfall. Implementing SCMs improves water quality if long-term maintenance is performed to ensure hydraulic functionality.

The most common challenge with SCM maintenance is sediment and trash removal, which has been documented as a relatively large maintenance cost. While bioswales are a useful low-impact method stormwater treatment, improper maintenance often decreases their efficiency. Most notably, the accumulation of large sediments and trash reduce a bioswale’s ability to filter contaminants and result in unsightly conditions. In their Operation and Maintenance of Green Infrastructure Receiving Runoff from Roads and Parking Lots Technical Memorandum, the EPA cites construction activities, bare soil (i.e., poorly vegetated area) erosion, and winter sand application as common sources of sediment in urban runoff. Sediment accumulates on impervious surfaces and when routed to bioswales by stormwater, builds up at inlets, clogs soil, and smothers plants. Improvements in pretreatment techniques are needed to lessen the SCM maintenance burden.

Concern over microplastics has gained international attention. Pollutants from roadways can have similar effects on our waterways and ecosystems. Urbanization increases the amount of stormwater runoff which causes stream erosion, loss of in-stream habitat, harmful algal blooms and increased water temperatures. Fish gills become clogged as pollutants are ingested, furthermore and sediment impacts water clarity reducing the ability of fish to hunt for food and reproduce. Bioaccumulation within the aquatic food chain effects terrestrial animals and humans who consume fish and other aquatic animals. Pollutants are also found in drinking water. Although our drinking water is treated, according to the EPA, 51,573 of
150,436 public water systems in the US were in violation of federal drinking water quality standards in 2016.¹³ To help mitigate these issues, concrete curbs and adjacent aprons can be altered to collect sediment in advance of entering a storm drain or bioswale. Altered curb faces can also aid in reducing the velocity of stormwater runoff, ultimately reducing strain placed on existing stormwater management infrastructure.

4 METHODS

During the summer of 2019, the interdisciplinary research team comprised of Halina Steiner (Assistant Professor Landscape Architecture), Ryan Winston (Assistant Professor in the Departments of Food, Agricultural, and Biological Engineering and Civil, Environmental, and Geodetic Engineering), Avee Oabel (Undergraduate Student Landscape Architecture), and Alec Grimm (Undergraduate Student School of Environment and Natural Resources) tested twenty alternatives to the standard concrete curb and apron. Additional support was provided by Chris Strasbaugh (Digital Resource Archivist and Curator) and Mike Baumberger (Shop/Digital Fabrication Coordinator). The research was conducted at the MAT/FAB Lab’s outdoor pavilion at Knowlton Hall at the Ohio State University.

The team initially explored the use of digital simulation models in partnership with the Ohio State University Simulation Innovation and Modeling Center. Digital model capabilities included computational fluid dynamics allowing greater specificity of sediment size and storm events than a physical model. The digital model would have only been able to test one cross section of the curb, rather than a continuous curb face. Due to this limitation and the lack of ability to calibrate the model to real-world data, the digital model was not pursued further.

The team examined physical testing and determined it was a viable option to address the proof of concept goal. EPS foam was chosen for modeling due to the stock sizes available, its lightweight nature, and its surface textural properties. The 4’x8’x8” EPS stock size allowed the team to create full scale models, clearly showing and accurately simulating sediment capture. The foam’s light weight allowed the team to easily transport curb models and stock foam from storage to the various stages of fabrication and testing. The surface texture of EPS foam once cut with the hot wire and passed through the CNC router was similar to concrete. A total of 20 different curb and gutter modifications were tested during the experiment.

4.1 EXPERIMENT SETUP

The physical setup and materials included a 4’x8’ table with a vinyl gutter attached to one end, 4’x8’x8” stock pieces of EPS foam, two 31-gallon tote plastic tubs, an industrial mixer, scale, native soil, sand, sampler bottles, two Arduino microcontrollers with analog turbidity sensors, an ipad, GoPro Hero 6, three laptops, and a Sony a7RII camera. Tests were conducted on CNC milled EPS foam full scale curb and gutter models. Each 8-minute test simulated a typical storm event by pumping sediment-laden water over the models. Water turbidity was monitored using Arduinos and analog turbidity sensors. Furthermore, grab samples to measure sediment inputs and outputs were taken every two minutes. GoPro and Sony a7RII cameras took video and still images every 10 seconds. Triplicate storm events were utilized to test each design. An iterative design process was used to leverage data from each round of testing for the next set of designs to be tested.
Figure 3. Experiment set-up for testing included: 1. 117 liter plastic tubs to hold water at beginning and end of test 2. water mixed with native soil and sand mixture 3. 19 liter buckets to measure water at beginning and end of test 4. collection bottles to hold water samples taken every two minutes 5. analog turbidity sensors to monitor water clarity before and after passing over curb model 6. vinyl gutters used to direct water over model and into collection tub 7. scale to weigh water at beginning and end of test 8. computer used to monitor data from turbidity sensors 9. Hose 10. industrial mixer 11. submersible pump 12. box containing Sony a7RII and GoPro for trial documentation 13. camera mount to suspend camera box above model 14. concrete pillar used to stabilize camera mount. (2020). Diagram by the authors.
Figure 4. Process for each round of testing.

Figure 5. Test results from mill of initial potential patterns. (2020). Photograph by the authors.
Figure 6. Progression of iterative design process. (2020). Diagram by the authors.
The iterative design process began with pattern testing to determine the limits of the mills routers and to determine appropriate widths, depths and densities of the initial patterns. At this time re-milling was also tested. The initial round of testing was limited to manipulation of either the curb or the apron to determine the separate effect of each on runoff quality. The team wanted to test these independently to evaluate their performance before integrating the best curb and apron designs. When designing apron patterns, the team took inspiration from the dimensions of elements already present on roadways. Tactile paving units, made up of truncated flat-topped domes, are used to signal an upcoming intersection to pedestrians with visual impairments. The team used similar dimensions for the initial “dot” apron patterns. Design iterations featured similarly-scaled crenellations to ensure walkability and maintain safety of pedestrians and cyclists.

Each test involved 8-minute storm simulations, with a synthetic stormwater mixture pumped across the designs. Each model was tested three times with the sediment from previous rounds remaining on the model. After testing, designs were evaluated based on visual observations in sediment accumulation, measured turbidity reduction (i.e., a measure of water clarity), and total suspended solids (TSS) reduction data collected by sensors placed at the inlet and outlet. Water clarity was also observed in via grab samples taken throughout the tests. The initial round tested apron designs of lines, dots, and zigzag configurations. The line-based pattern performed the best for sediment capture and was selected for further study. The curb configurations were triangular, dimpled, and square, with the square collecting the most sediment.

Next variations on the line configuration were explored and the volume of sediment was increased in the storm simulations to test the longevity of sediment removal for each configuration. This included altering the angle of the line, making the line path into combs, squiggles, and cross-hatches among others. This allowed the team to examine the performance of the different configurations alone, then the best performing designs were re-milled to add curb crenellations. These designs were tested again with the curb faces altered. The team used this to explore different spacing and widths of the curb faces. Configurations connecting the curb and apron patterns in different ways also proved valuable. During each test the team paid specific attention to how the water and sediment moved over the patterns, not only looking at which collected the most sediment, but which were visually compelling or might be of interest to someone viewing the patterns during a rain event.
4.2 FABRICATING CURB AND GUTTER MODELS

To create the curb models, 4’x8’x8” stock pieces of EPS foam were cut down using a hot wire cutter. Stock pieces were cut to match the dimensions of a typical street section. Initially, pieces were cut to include a 6” curb and 3.5’ of roadway with a 1.5% cross slope. Later models were cut to include only a 4.5”-5” tall curb to allow for CNC routing without obstruction. Modeling the full extent of a 6” curb would have caused router bits to collide with the top of the curb model, damaging both the CNC router and the
model itself. Digital iterations of curb and apron alterations were then modeled using Rhino 3D Modeling software. The physical process of milling these iterations was then digitally simulated using RhinoCAM to map tool paths and predict potential tool collisions or inconsistencies from the original Rhino model. After simulating the models in RhinoCAM, a 5 axis G-code was created and exported to an ONSRUD 5-Axis CNC Router. The patterns and crenellations on the curb models were cut using a series of flat and ball mills ranging from ¼” to 1” in diameter. After routing, the curb models were cleaned of any residual EPS foam obstructing the apron and curb patterns and painted using a layer of Kilz Latex Primer to prevent the models from absorbing water during tests.

4.3 STORMWATER SIMULATION

Runoff was simulated using an adjustable submersible pump (maximum flow rate 400 gal/hour) with tubing extending onto curb/gutter models. Native soils used to simulate TSS in urban stormwater were sourced from a residential site in Dayton, Ohio. These were combined with play sand purchased from Lowe’s home improvement to simulate stormwater typically found in urban runoff. This mixture contained approximately 60-70% native soil and 30-40% sand. A high speed (2000 rpm) industrial mixer was used to keep sediment suspended in the synthetic stormwater. Each trial was run until the mixer blade was exposed above water. This was done to create similar concentrations of sediment entering the model curb and gutter throughout the simulated runoff event.

4.4 ANALOG TURBIDITY SENSORS

To measure turbidity, two Arduino microcontrollers with analog turbidity sensors were used. The sensors measure turbidity by detecting how much light is transmitted and scattered as water passes over the probe. The voltage reading is then converted to NTU (Nephelometric Turbidity Units) using a standard calibration curve. To ensure that water level was consistently over the sensor, small wood dams were implemented into both the inlet and outlet vinyl gutters.

4.5 TSS and PSD

Total suspended solids (TSS) and particle size distribution (PSD) were determined for grab samples taken 4 times throughout each event from both the inlet and outlet of the mock road. These were taken approximately evenly spaced (with time) during simulated runoff events. Samples were shaken thoroughly and split using a Y shaped PVC device into two graduated cylinders. Volumes were recorded and any remaining sediment accumulation in the sample bottle itself or at the bottom of the PVC splitting device was flushed using distilled water multiple times. TSS was measured using a vacuum filtration system with a 0.7 micron filter. PSDs were measured using a Beckman Coulter LS 13-320 laser diffraction particle size analyzer, which characterized particle size from 0.04-2000 µm.

4.6 EXPERIMENTAL DESIGN AND GRAB SAMPLE COLLECTION

Approximately 154-176 lbs of water was weighed and poured into a 31-gallon tote plastic tub near the inlet. The stormwater mixture of sand and native soil was then poured into the tub. An industrial mixer with a maximum 2000 rpm spin rate was used to create a uniform stormwater mixture in the inlet tub. Simulated runoff was then guided from the pump tubing into a small, 1.5’ by 0.5’ vinyl gutter to direct flow onto each model. At the edge of each model, effluent was recaptured in a 5’ piece of vinyl gutter attached directly to the edge of the table each model was placed upon. Water and sediment were routed to a second 31-gallon tote for collection. Grab samples were obtained for TSS and PSD during each trial at
both the inlet (directly from the pump tubing) and the outlet (as water cascaded from the vinyl gutter into the outlet plastic tub). Grab samples were taken roughly every 2 min with approximately the same volume of water in each sample. This was done 4 times per trial at both inlet and outlet locations resulting in one composite 250mL sample at the inlet and outlet.

5 RESULTS

Figure 9. Before and after images of comb square curb pattern. One of the top performing designs. (2020). Photographs by the authors.
Figure 10. Stills from the first storm even on each model from each round of testing. Pictures are in approximately 3 minute intervals. (2020). Photograph by the authors.

All designs collected sediment; three performed noticeably better. Multiple versions of curb and gutter designs were tested alone during preliminary trials to deduce the best designs for combined testing. Criteria used for determining the best individual designs to combine were visual observations of sediment accumulation, turbidity reduction, and TSS reduction. Of all the designs tested, those designs with a combined apron and curb pattern performed better than those designs with either a curb design only or apron design only. NPDES stormwater permits in Ohio require an 80% reduction in TSS for stormwater management. Seven of the eight combined curb and gutter designs met or exceeded 80% reduction in TSS during repeated trials testing. One pattern was able to withstand 7 simulated storms before inlet turbidity and was equivalent to outlet turbidity, meaning that further sediment reduction was not occurring. At this point, maintenance of the accumulated sediment would be needed to rejuvenate Curbing Sediment’s performance.

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</table>

Table 1: Results from eight of the combined curb and apron designs (2020). Diagram by authors.
Based on our initial testing, we determined the reduction in sediment discharging from roads due to the implementation of roughened curbs/gutters. With maintenance, this may serve as a new SCM to meet NPDES stormwater permit requirements or as a pretreatment device for other SCMs, including bioswales. Combined with street sweeping, Curbing Sediment may be a solution where physical limitations such as narrow sidewalks or rights-of-way, mature trees, severe slopes, street elements like fire hydrants and lamp poles, and high groundwater prevent the implementation of other SCMs may not be suitable for the site. This SCM is perhaps very desirable since it can remove pollution in the existing right-of-way, eliminating the need to acquire additional land for stormwater treatment. Additionally, it would be a relatively easily maintained system, likely requiring only street sweeping for regular maintenance.

In Autumn 2019, the team received a provisional patent from the Technology and Commercialization Office at the Ohio State University for all tested designs. The research team is meeting with representatives Ohio Department of Transportation and Ohio State University to construct a pilot project on campus.
This project follows current discourse in the academy and practice centered on two simple questions: can small scale changes within design standards have regional impacts? And, can small urban details communicate the complex relationships that exist between our cities and the environments they impact? The utilitarian and monotonous character of a street and sidewalk mean any shift in the standard design will spark interest. The addition of distinctive patterning may not initially communicate its function, but as one observes it over time its actions will reveal themselves. Even in a simple rain event, the behavior of the water moving over the surface shifts. The water moves slower and creates ripples and patterns of its own. This was evident during testing, watching the water and sediment move over the models captivated the team, but also others in the MAT/FAB Lab. Developing design details that are scalable, beautiful, and captivating is not new. DLANDstudio Architecture + Landscape Architecture, pllc. secured patents for the Gowanus Canal Street-End Sponge Park and HOLD System. Both projects identify an urban condition that operates at a site scale (a waterfront street-end and an elevated highway downspout), but is found throughout an urban system. Dr. Shimrit Perkol-Finkel's ECOncrete firm has developed new modular habitats used by Scape in their Living Breakwaters project and MVVA at Brooklyn Bridge Park: Pier 6. Associate Professor Jake Boswell, Ohio State University, has a provisional patent for floating concrete islands. Assistant Professor Richard Hindle, University of California, Berkeley, has written extensively on the subject of United States patents. More recently, Julia Watson's book Lo-TEK Design by Radical Indigenism examines “indigenous philosophy and vernacular architecture”.¹⁴ The myriad of approaches to the design standard within the academy and practice marks a distinct shift in landscape architecture. One where discrete standards are being leveraged to have larger systemic impacts. The designs rendered from Curbing Sediment fit within this discourse.

Reductions in the amount of sediment before and after treatment by Curbing Sediment give valuable insight on how well Curbing Sediment can impact SCMs. This study was designed to improve on
common pretreatment practices, such as forebays, storm drain sumps, or grassed filter strips. The aim of this research was to utilize the existing road surface as pretreatment by imparting roughness, similar to rumble strips on the highway shoulder, to promote sedimentation upstream of green infrastructure SCMs. Street sweeping, a practice which is currently undertaken by most municipalities, would then be used to “recharge” the ability of the indentations in the gutter and/or curb to sequester sediment. The research generated from Curbing Sediment provides a proof of concept. To advance these findings two topics - field testing and quantification - need further exploration. Field testing would allow the team to better understand how the patterns perform in varied rain events and further understand maintenance practices. Quantification will provide a richer understanding of the impacts of Curbing Sediment. For example, the City of Columbus is currently gathering GIS data on curbs in the city. The city has more than 14 million linear feet of curb. If Curbing Sediment was applied across the City, it would capture many thousands of pounds of sediment per annum. With more data from field trials, the team could produce a more definitive outline of how Curbing Sediment would be maintained and the impacts it would have at a systems and ecosystem scale.

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UNKNOW FUTURES LAS VEGAS
Landscape Strategy, Design Typologies and Design Speculation

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1 ABSTRACT

In Landscape Architecture, typological studies can be used to catalogue existing conditions and design responses; generate project-specific, combinable “kit-of-parts”; and/or index formal strategies within a specific category or functional categorization (Deming and Swaffield, 2011; Condon, 1994; Moneo, 1978). As a tool for both analysis and idea generation, typologies can help bridge the research and site design phases, as it allows us to understand large, complex sites through typical components, conditions, or forms. This approach can be used to speculate on future scenarios and outcomes, showing how a territorial design strategy lands on, modifies, or reconfigures the landscape, and allows for quick and iterative tests before diving into detailed site designs.

To test typologies and the typological catalogue as a format for design experimentation and idea generation, the author ran a 2nd and 3rd year Master of Landscape Architecture design studio at the University of Minnesota. The studio brief charged students with developing innovative urban and landscape forms that address future uncertainties due to climate change in the rapidly growing and sprawling desert city of Las Vegas, NV. Students worked between multiple scales throughout the semester - rather than narrowing down in scale linearly, assignments prompted students to consider at least two scales simultaneously. Considering future impacts of climate change and urban growth, students generated new urban and landscape typologies that addressed water scarcity and flooding, proposed new forms of desert urbanism, responded to a changing climate, and embraced unpredictability.

1.1 Keywords

Design research, typology, landscape frameworks, landscape strategy, design speculation
1 INTRODUCTION

In the landscape architecture studio, designers work across multiple scales, from the territorial, regional, site-specific, to the detail. We must consider both how a site design performs with a highly crafted and resolved consideration of details and materiality, as well as how design decisions impact a larger context and framework of landscape systems, culture, and history. Students are introduced to this concept early in design studios, with much time spent on grasping basic concepts and building complexity within design proposals. The challenge for students, often times, is two-fold - how to quickly learn to develop complex design strategies that operate at multiple scales, and how to successfully navigate the shifting scales when moving from a large scale research and analysis to site design?

This paper argues that in order to explore complex design relationships and physical manifestations of larger planning moves, many of which are difficult to spatialize and visualize, as well as experimenting with design form, function, and landscape performance, using typological cataloguing provides a useful working format. Designers are able analyze typical conditions, categorize and classify, to comprehensively understand a range of design interventions which may occur many times throughout a territory or region. Using a drawing standardized format and scale, such as axon or plan, designers can test and iterate on design ideas through modifying the typology within a predetermined frame or extents, rather than developing an entire new unique drawing. With the goal of creating a diverse and varied catalogue, a designer can quickly generate multiple ideas, without needing to yet determine fitness or suitability of a version to a particular site or context. With this, designers can work quickly and iteratively, to ideate and investigate ideas through drawing and making. The resulting catalogue of strategies can be adapted, combined, or modified to become the beginnings of a site design and incorporate site-specific information such as topography, access, and adjacencies. An iterative working method encourages non-traditional proposals, as being able to work quickly and ideate gives space to be bold, speculative, and “out there,” even more pressing when considering design responses to climate change, environmental equity, and the global health crises.

To test using typologies and typological cataloguing as a format for design experimentation and idea generation, the author ran a 2nd and 3rd year graduate landscape architecture design studio with MLA students at the University of Minnesota. The studio brief charged students with developing innovative urban and landscape forms that address future uncertainties due to climate change in the rapidly growing and sprawling desert city of Las Vegas, NV. Students worked between multiple scales throughout the semester - rather than narrowing down in scale linearly, assignments prompted students to consider at least two scales simultaneously. Considering future impacts of climate change and urban growth, students generated urban and landscape typologies that addressed water scarcity and flooding, proposed new forms of desert urbanism, responded to a changing climate, and embraced unpredictability.

2 METHOD // TYPOLOGIES AS A WORKING METHOD

Much has been written about typologies, and their use in architecture, urban design, landscape architecture, theory and ecology (Crewe & Forsyth, 2003). “Typologies” have been used to describe and classify forms, schools of thought, styles, and groups of objects characterized by the same formal structure (Moneo,1978; Crewe & Forsyth, 2003). As designers, we often intuitively work in this way, developing typical design responses that can be adapted using specific site considerations. For instance, a typology of built designed landscapes may include a clearing, allee, orchard, street, square, and yard (Condon, 1994, 80). They are forms with conventions, established through historical use and precedent, with a standardization of scale, materiality, planting form, and dimensions. It is not yet a “site design” until other aspects are considered, such as topography, access, physical adjacencies, users and program, climate, location of utilities, and soil conditions.

Deming and Swaffield’s definition in Landscape Architectural Research: Inquiry, Strategy, Design (2011) is effective to frame typologies as a method of inquiry and research:

“a taxonomic classification scheme applied comprehensively to entire categories of phenomena such as site conditions, forms, or concepts, the principles or performances that underlay the phenomena become part of a theory of classification… Studies of patterns and precedents (whether historic, organic, industrial or otherwise) may make valuable contributions to typologies of form, shape, structure, arrangement, association, materials,
construction technique - in short, if it can be named, it can be typed” (133-134).

Typological studies in landscape architecture can be used to catalogue existing conditions and design responses; generate project-specific, combinable “kit-of-parts” useful for analysis or prototyping; and/or index formal strategies within a specific category or functional categorization. As a working method, using typologies gives us a framework to classify or understand phenomena categorically, define a set of similarities or differences, and test theories about groupings.

Inherent in this work is using a classification strategy or scheme, where the investigation collects, organizes, and catalogues through drawing, measuring, and documenting. This uses site data and original, subjective data; cataloguing or organizing the collection based on categories; and weighing site information along certain categorical parameters and priorities. Designers can identify qualities and characteristics of built conditions, described through diagramming, and establish patterns of association that relate design elements across scales (Deming and Swaffield, 2011). In addition, this format can be applied to design interventions, creating a catalogue of formal design responses categorized, organized, and understood through individual moments (see Figure 1). These typical moments, organized within a series, emphasizes the relationship among elements that define a whole (Moneo, 1978).

Figure 1. Typological catalogue of existing conditions and design interventions along the flood control channels. Student work by Tyler Smith and Nikolai Fjelstad De Santiago (2019).

Current examples of typological catalogues include Dutch water infrastructure organized by scale (Pleijster, 2014), where the work describes the range of and relationship between traditional land-based and engineering responses to control water and flooding in the Netherlands. The responses include programmatic adjacencies, demonstrating how a typology may adapt or be modified in response to adjacent uses, such as residential or open space. In “Coding Flux,” Fadi Mausad organizes speculative landscape architectural and infrastructural form, organized by permanence and performance. Masaud takes a typical landform, such as a berm, and iterates to describe how a particular landscape typology may be modified or adapted for specific conditions – in this instance, dynamic to permanent – by changing form, materiality, programmatic uses, and scale (2017). Describing typical adjacencies and relationships, the project “Urban Metabolism” uses typologies to describe a series of typical conditions and landscape interventions. These axons are siteless, investigating material flows, energy infrastructure, transportation, and development typologies as part of a larger urban strategy proposal for re-using byproducts of energy extraction in Rotterdam (FABRICations, 2014).

The knowledge gap, which this paper and design studio sought to address, is in articulating
how and why typologies and typological catalogues can be valuable working formats to encourage design experimentation and formal explorations. As well, a gap exists in articulating how designers can quickly and comprehensively explore design implications and physical manifestations of large-scale urban and ecological planning moves, including visualizing designing for impacts of climate change and resilience.

In this studio, students used axon to quickly iterate and speculate on design proposals. The working process took advantage of axon as a drawing format by jumping straight into three-dimensional modeling to scale, rather than sketching concept ideas in plan. As well, the format gave students the freedom to speculate – there was enough site context to make a design "real" without the over-complexity and restrictions of a site design. This method encourages large-scale and systems thinking, where a formal design move may happen many times within an urban territory, providing a format to understand large-scale implications to urban and landscape systems, as well as formal exploration and design innovation. Moving out of an academic context, this thinking is applicable for design professionals to explore innovative designs and forms, work iteratively, and visualize physical manifestations of larger urban planning policies and proposals, a skill our profession excels in.

3 OBJECTIVE

The larger objective of the studio was to think speculatively about landscape architecture, work within large scale landscape systems, and develop design strategies at multiple scales. As the effects of climate change are felt more deeply across society, landscape architectural projects must respond to these new complexities as well as anticipate future uncertainties. Designers are asked to work with different kinds of information at a range of physical and temporal scales, including at the scale of territorial landscape systems. Working at large and complex scales is challenging even for experienced designers, where it is difficult to evaluate the impacts of design decisions, and often overwhelming with the amount of information and data able to be generated through GIS and other sources.

Using typologies as a working method, designers can isolate typical moments within large systems, which may happen multiple times throughout a space, city, region, or territory. These moments are both site-located and site-less, generic yet specific in responding to a set of challenges or concerns. Through creating a system to categorize, organize, and simplify a range of conditions within a field, designers can understand similarities and differences within sites in isolation, such as landscape, urban or infrastructure types, adjacencies, scales, and construction methods. Breaking down large scale landscapes creates digestible pieces to understand complex systems through a series of pieces or components, isolates conditions for studying, and can bridge large scale research and site design. Similar to Christopher Marcinkoski's "Chunking," where the author describes using axon "chunks" as a working method to understand complex sites in discrete smaller pieces, describing adjacencies, differences, and landscape processes without designing the entire site or becoming overwhelmed with an unlimited set of conditions (Amoroso, Nadia. ed., 2015).

Using the same framework and classification method for both, we are able to assemble a catalogue of existing and proposed design typologies. Developing a proposed design catalogue, as a whole, shows how a large scale design strategy lands on, modifies, or reconfigures the landscape, and allows for quick and iterative tests using a set of typical conditions. Typologies can be thought of as "the frame within which change operates," exploring (formal) changes, adjacencies, and relationships (Moneo, 1978). The quick iterative approach can build variety, be speculative, and generate bold designs - developing 30 iterative design ideas, rather than a single design, leaves room for experimentation and design testing. It also very quickly establishes a graphic and formal language for a project and describes a design intent clearly (Crewe & Forsyth, 2003). By creating a set of design ideas described in the same way, such as section, axon, and/or plan, it gives a simple frame to quickly understand and compare design moves.

Designers then can use the work developed through these isolated design components when moving to the site scale. At this point in the design process, many pieces of a design idea have been articulated, including a conceptual framework, a formal design language, and a graphic language, so designers are not starting from "zero" when approaching a smaller scale design. Designers can transform, overlap, stack, thicken, and combine to build complexity and respond to site-specific conditions (Moneo, 1978). With this method, designers understand how their site design fits into a larger framework and how design decisions stack and carry through a larger scale, understanding implications at a regional watershed scale or measurable impacts to the urban heat island effect, for example.
With regional or territorial mapping using GIS, designers are able to identify where and at what frequency certain landscape types occur, building off of suitability analysis and overlay methods to determine the “fitness” of a specific program for a particular area (Steiner, 2000). With this as a framework, designers are able to quantify, for example, the amount of hardscape within a territory, then measure urban runoff if that amount of hardscape was reduced by 40%, as well as provide a range of design strategies that achieve these goals. This method merges scales and tasks typically reserved for urban planners with the formal, spatial, and ecological strategies of landscape architects.

4 STUDIO FORMAT

The studio integrated 2nd and 3rd year MLA students in a “Vertical Studio” series at the University of Minnesota and was one of three option studios for students to select based on site, brief, and studio approach. All three Vertical Studios worked at multiple scales; investigated landscape systems across scales and developed a deeper understanding of at least one; addressed climate change, adaptation, resilience, and/or emerging technologies; and emphasized an iterative working structure.

This studio brief charged students with developing innovative urban and landscape forms that address water scarcity, future changes due to climate change, in a rapidly growing desert city. Lectures and assignments guiding students to consider two or more scales simultaneously, mirroring how projects in professional practice happens, rather than a more typical studio structure where students move from one scale to another in a linear fashion (either large to small, or small to large). The studio was organized as an open studio, with multiple methods and venues to encourage collaboration, provide critical feedback, and share information, work and research among students. The working process heavily engaged Rhinoceros 6.0, Adobe Illustrator, Adobe Photoshop, and iterative physical model making, working primarily through technical axon and perspective.

Students visited Las Vegas, Nevada, for a week at the beginning of the semester to meet with University of Nevada-Las Vegas Landscape Architecture students and faculty, residents, ecologists, planners, hydrologists, and Southern Nevada Water Authority (SNWA) representatives and visit sites of interest. They collected research on site through documenting site impressions, taking photographs, recording sounds, documenting smells, and cataloging materials and textures. During the trip, students presented preliminary design work and concepts for feedback to multiple local stakeholders.

4.1 Context

The largest challenge in Las Vegas is water - both too much and too little. Located in the Mojave Desert, Las Vegas has limited local water sources and relies on the Colorado River water infrastructure to provide 90% of its water. This water begins as rain and snowmelt in the Rocky Mountains and imported thousands of miles away through a series of water channels, reservoirs (including nearby Lake Mead), and aqueducts, ultimately distributed to approximately 40 million people across seven western states and the country of Mexico (Mulroy, ed. 2017).

Water in Las Vegas is distributed through a complex and energy-intensive system managed by the SNWA who extracts and pumps from Lake Mead, cleans and distributes to residents, and treats recovered wastewater to return to Lake Mead (SNWA, n.d.). The SNWA receives “return flow credits” for this recovered water which allows for additional extraction. Locally, however, more than 60% of water is used as irrigation and considered “lost” from the system due to runoff, evaporation, and over-irrigation. As a result, the primary focus from regional planning and SNWA is on domestic water efficiency, including replacing lawn and tropical planting with drought-tolerant vegetation. The burden of water conservation falling disproportionately on the residents, with the Strip and tourist amenities spared from such drastic cuts.

It rains an average of 20 days a year, however when it does, it floods quickly and dangerously, due to the high level of man-made and natural impervious surfaces. In response, the Clark County Flood Control District has spent $1.9 billion since 1991 to construct flood control channels and detention basins within the urban fabric to move water quickly out of the city and down the watershed to Lake Mead (see Figure 2). There continues to be more built more today as the city sprawls outward (Michor, 2019). As well, with a lack of comprehensive city planning, many developers have built within natural washes, interrupting historic water flows, producing more flooding, and increasing the need for additional infrastructure. This mapping and research highlighted the fragility of the regional water infrastructure system as minor flooding causes destructive flooding and loss of life (Rossi-Mastracci, 2020).
Impacts of climate change are felt acutely in the region, with the number of days per year above 100° F increasing and overall precipitation decreasing. Due to increased demand from rapid population and urban growth in the region, more pressures have been placed on a diminishing supply. This will potentially dramatically affect both Las Vegas and the larger the Colorado River Watershed, including those locally who rely on water for residential use and globally who benefit from agricultural exports (Groves, et. al, 2013). While this could seem dire, the studio approached this changing reality with optimism, generating new urban and landscape typologies that addressed water scarcity and flooding, proposed an adaptable desert urbanism, responded to a changing climate, and embraced unpredictability.

**Figure 2.** Water systems across scales and systems. Work by the author, Erin Schregardus, Sonali Devarajan, Christopher Ototo, Sheng Dong, and Tyler Smith (2019).

### 4.2 Studio process

The overall goal of each assignment was to understand impacts of climate change on water scarcity and flooding, regional landscape systems, and urbanism, and develop design strategies to create adaptive landscape frameworks. Each assignment encompassed multiple scales (territorial, regional, and site) to varying degrees. As a prompt, the studio asked the larger question: **How can Las Vegas’ DNA as a place that embraces speculation, takes chances, and attracts people from all over inform a new form of urbanism for arid cities?**

Students began by working in small groups to understand “Water in the West” at multiple scales. One group studied at the Territorial (Colorado River) scale and how water policy and climate change projections impact water availability in Nevada and Las Vegas. Another looked at the Regional (Las Vegas Metro/Clark County) scale to understand the drinking water and flood control systems. The third group dove into the detail scale, understanding the role of materials, assemblies, and vegetation in the water system. This work created a database of research for students to draw upon throughout the semester.

The following project, “Research + Gathering,” integrated research work with developing a conceptual framework that the students would operate under throughout the semester. Students were initially paired based on complementary research proposals, then worked to synthesize and expand ideas. Each pair developed a set of research drawings and diagrams to support their larger conceptual framework with collected data, GIS map layers, aerials, historic photographs, and site impressions from their trip to Las Vegas. Upon returning to studio, students worked to clarify their conceptual framework, determine their largest scale (either the regional/Clark County scale or territorial/Colorado River watershed scale), and identify pertinent landscape systems such as public space, ecology, hydrology, and urban form. Using their
gathered data, students identified a range of site types or conditions based on their self-determined parameters, and organized under some framework, such as site categories, similarities, a catalogue of conditions, or a kit of parts, setting the stage for typological cataloging explored in further assignments.

Students were then given a definition of typologies, as described in this paper previously, and shown example typological catalogues: landforms organized by formal moves (work by the author), Dutch water infrastructure organized by scale and form (Pleijster, 2014 and Prominski, 2012), landscape architectural and infrastructural form organized by permanence and performance (Masuad, 2017), and proposed adjacencies and spatial relationships (FABRICations, 2014). We discussed how an iterative design process and drawing format could facilitate idea generation and multiplicity of ideas, and how to adapt previous thinking and research on typologies to our design studio. As well, students read articles on landscape strategy (Corner, 2004 and Allen, 2012) to understand methods of approaching large scale design through a flexible framework plan or diagram, rather than a traditional site plan, allowing for ephemerality, function stacking, and adaptation at the regional scale. Further readings and discussions focused on how to develop a large scale design and typical components that encompassed a range of site conditions, scales, and adjacencies. Through this, students were able to combine their own definition and working knowledge of typologies and strategy, generated from the previous assignments, with readings, lectures, definitions, and examples provided to them. They were also prompted to develop adaptive and flexible design strategies, rather than fixed, permanent, or static designs.

Students developed their typological catalogue, using the sites determined previously in “Research + Gathering.” They each selected a typology to investigate, drawing the existing condition in axon in high detail and documenting materials, assemblies, dimensions, water flow, and other phenomena. The typology was limited to a piece of hard infrastructure, such as walls, concrete stormwater channels, roads, and parking lots. To explore design modifications, students worked iteratively through physical models, implementing action words such as deconstruct, bury, transform, grow, or remove in their transformations (see Figure 3).

![Figure 3. Iterative model making - deconstructing the concrete stormwater channel. Student work by Tyler Smith (2019).](image)

They then selected one model or action, or a combination of multiple, to develop further through drawing and digital modeling: in technical axon, exploring scale, materiality, and details using Rhinoceros 6.0, Adobe Illustrator; and in perspective, exploring the experiential and performative characteristics, using Rhinoceros 6.0, Adobe Illustrator, and Adobe Photoshop. Students used annotations, text, dimensions, and icons to diagram landscape performance, describe landscape change, and document ephemerality and landscape processes. Students then developed existing and proposed typological catalogues in axon, with emphasis on digital modeling and drawing (see Figure 1). There was no set number, but this needed to encompass the range of conditions identified previously - more conditions necessitated using a representation style that allowed students to work quickly and iteratively, where fewer conditions encouraged students to develop each in greater detail. Design development initially focused on formal responses that used landscape moves as the primary organizer for space, rather than simply placing an object or locating programs, such as a material and assembly change, topography, and planting. As students worked, this expanded to include the design and placement of site furnishings, structures, and architecture.

After and for the remainder of the semester, students both zoomed back out - to think strategically
about design within large scale landscape systems; and zoomed in - to select a site and work through
detailed site design. Their catalogues gave students beginning point for their site design, where forms could
be combined, modified, or adapted to respond to specific site conditions and constraints.

5 OUTCOMES

5.1 What worked well?

All students, to a certain extent, were able to use the process of generating a typological catalogue
to experiment with representational techniques, adaptable landscape and urban forms, and integrating
landscape processes and change into their designs. The most comprehensive (in terms of integrating the
above aspects as well as getting further into detail design) projects were able to leverage the use of
typologies in developing their design strategy at multiple scales, generate typologies that encompassed the
range of site conditions and designed with site specificity, and operate on multiple landscape systems such
as water, ecology, and transportation. This set students up to use typologies as a beginning point for site
design, and develop, adapt, reconfigure, combine, or thicken, generating unexpected and unconventional
designs.

One pair proposed a decentralized water infrastructure, with a redesign of typical details to support
a large-scale policy shift to local water collection, use, and distribution determined by regional watersheds.
They produced a large conceptual framework that worked at multiple scales, designed components at each,
and articulated complex relationships clearly through consistent and layered graphics. They leveraged
typologies to explore potential futures and a re-organization of urban forms through a kit of parts, testing
ways of configuration and scalability of the system. Through their work, the students demonstrated an
understanding of the relationship between a broad range of typologies and site-specific designs, further
articulating materials, detail assemblies, and site performance (see Figure 5).

Another student developed a series of typical sites and with design responses for each, then
worked to advance them further as site-specific designs adapted to site conditions, connections and
adjacencies. They began to explore what the components or typical “moves” were and what was happening
in between these specific moments. As an exploration of a series of sites, the project was successful in
creating site designs that responded to specific conditions, typological designs, and a kit-of-parts that could
work along the entire length of their chosen flood control channel (see Figure 4). The proposal incorporated
previous studies of deconstructing the flood control walls lining the stormwater channel and using
landscape moves to create (floodable) connections and public space across and within the channel
corridor.

As well, the studio projects as a whole had clear and grounded conceptual frameworks and were
well articulated graphically, using diagramming, labeling, technical precision, and dimensions to describe
both the existing condition and design modifications. In the course, there was a strong emphasis on a
technical exploration through developing measured axons in Rhinoceros and Adobe Illustrator to
understand forms and infrastructures then think about modifications, giving work a level of grounding and
precision. Students experimented with both physical modeling techniques and hybrid drawing to describe
landscape change, site processes, quantifiable data, and project future scenarios (see Figure 5).

Projects ranged from reimagining detention basins as tourism and spectacle, deconstructing walls

Figure 4. Typical sites and adjacencies of residential neighborhoods and the stormwater channel.
Student work by Yungui Cai (2019).
to create floodable public space and pedestrian connections in the channel corridors, reconceiving the urban fabric as an ecological bird corridor, reducing impermeability in streetscapes and parking lots to capture urban runoff, and rethinking the water infrastructure and urban framework to reduce dependence on the Colorado River. Students were also able to scale up and articulate the impact of their design at their largest scale: quantifying the impacts of increasing permeability on all of the urban streets and parking areas in Clark County; designing public space and breaking barriers in all of the stormwater channels; and locating specific programs and spectacles in all of the 50 largest detention basins.

Figure 5. Proposing a new decentralized water infrastructure and development – technical axon. Student work by Erin Schregardus and Sonali Devarajan (2019)

Figure 6. Proposing a new decentralized water infrastructure and development – speculative collage. Student work by Erin Schregardus and Sonali Devarajan (2019)
5.2 What did not work well or should be improved?

The main challenge for some students was moving their typologies forward and developing the work into a detailed site design(s). This can be summarized in four main overarching challenges and difficulties - differentiating between a site design and a typological design; moving between scales and representing design moves differently at each; developing typologies that address the range of unique conditions and respond accordingly; and using typologies to speculate on new landscape form and change. Rather than suggest solutions or improvements to the course or teaching methodology, which there of course are many, each challenge poses a series of questions – many of which are larger than one design studio and I argue need to be addressed by our profession and educational frameworks as a whole.

The students that had difficulty distinguishing between a site design and a typological design struggled with the process of moving from a site-less design strategy to a site-specific design. At the earlier stages, they were not able to determine a set of design interventions that could be built upon or combined. Typologies were not “generic” enough that allowed for exploration, combination, and thickening, yet they were not specific enough to describe nuances, connections, and adjacencies, and fell confusingly somewhere in between. While for many students, using typologies and typological catalogues was a useful framework to do this, what other methodologies can be developed or adapted that specifically address both territorial and site designs?

Others stumbled with developing a design strategy that worked at multiple scales as well as articulating their design at each. At the furthest range, some students found it difficult to change scales, and balancing development of a large-scale strategy with a detailed design. One pair developed a good and highly relevant large concept, with very articulated details, but were not able to develop a typological scale that allowed for flexibility or adaptability at the site scale. They were also unable to zoom back out to the strategy scale and articulate how their design modified larger scale landscapes. What design process or framework can enable students (and designers) to understand implications of large scale designs as well as site specific and technical considerations?

Some were not able to determine and categorize overall site characteristics, including why is one type of site is different than another, and how to use this as a basis for design. In developing their range of designs, they could not articulate why one typology was fundamentally different than another, nor describe what conditions they considered in their overall catalogue. This could have been bolstered by more thorough site analysis at the systems scale to ground the site design, however they, like many other students, struggled with compiling, sorting, and prioritizing data, often overwhelmed with quantity and unable to find quality GIS layers. What new methodology for site analysis needs to be developed – one that addresses the need for landscape architects to understand large scale systems at multiple scales and that is suitable for sorting or filtering the amount of data we presently find ourselves in? As well, how can this new or adapted methodology incorporate less traditional data, such as observed ephemerality, site impressions, and user-generated data?

The format of the design exercises encouraged speculative design and formal exploration through iterative modelling and hybrid representation modes; however, for many, they were unable to move beyond typical landscape architectural forms and generic design responses. As new pressures are placed on urban areas and our landscape, we need to develop new modes of practice and forms that are site-specific and projective. How can we push landscape architecture as a discipline to develop new forms that anticipate future unknown conditions and embrace landscape change, generating adaptable forms and embracing landscape performance?

6 CONCLUSION

Using typologies as a working method is inherent to landscape architecture and working with large scale landscape systems. It is a method that many of us work with intuitively to classify and categorize formal design moves, programmatic elements, and theoretical frameworks. Pushed further, this design approach can be used to speculate on new landscape forms and future scenarios and outcomes, showing how a territorial design strategy lands on, modifies, or reconfigures the landscape, and allows for quick and iterative tests using a set of typical site conditions, before diving into detailed site designs.

This process can generate design proposals that re-imagine the scope and realm of landscape architecture including integrating energy generation, proposing cultural and arts programming, spurring economic generation, improving air and water quality, and proposing adaptable landscape and urban forms. Innovative thinking is highly relevant as we urgently need to develop new landscape types that work at
multiple scales and address future uncertainties due to the overlapping present day crises of climate, health, and equity.

Landscape architecture also needs to re-engage in planning scale and policy work, as we are trained to visualize design, planning, and policy implications, comprehensively engage with large scale systems, and understand how design decisions impact multiple scales. Our profession has the ability to create (and visualize!) adaptable urban and landscape forms that treat landscape as generative, create habitat for people and animals, address inequalities rather than perpetuate environmental injustice, and weave together multiple disciplines. We should be pushing our profession to respond more critically to these challenges and others, particularly in developing landscape and urban typologies that respond to climate and place and move the conversation in water scarce environments beyond low-flow fixtures and drought tolerant vegetation. As a whole, this studio and working process can serve as a case study to argue for the expanded role of landscape architecture in an age of uncertainty, and urgently presses us to develop design strategies that are more than “less bad” but intrinsically different, generative, and productive.

7 REFERENCES


GEO-SPATIAL AND DIGITAL ANALYTICS

Edited by Hong Wu, Brian Orland, & Caroline Weswort
A WEB APP FOR URBAN POLLINATOR SITE ASSESSMENT

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1 ABSTRACT

This paper presents a new web-based planting design tool for assessing urban pollinator habitat quality and resiliency. Worldwide, pollinator populations are crashing. This decline is due primarily to habitat, and plant diversity losses resulted from land development and management practices, homogenous planting design, and climate change. While emerging planting design and site management efforts support pollinators, they often only focus on foraging opportunities and replicate historical plant communities, which are potentially vulnerable to changing climates. Design computing and geospatial analyses can facilitate a better understanding of existing habitat quality and the effectiveness of proposed planting schemes, assisting designers in creating healthy, connected, and resilient landscapes in the face of climate change.

Based on existing, paper-based pollinator habitat assessment guides for agrarian and rural landscapes, our protocol identifies four critical assessment categories - foraging, nesting, water, and landscape management. It evaluates planting resiliency with the measures of plasticity, ecological resilience, and floral diversity, emphasizing bloom phenology, biodiversity, and plant responses to extreme events. The app integrates RShiny and databases, including the United States Department of Agriculture (USDA)'s plant database, from which we derive plant characteristics.

The prototype shows significant potential in allowing designers to rapidly iterate planting design assessments across multiple resiliency factors and visually present biodiversity and resiliency deficiencies. However, observations also suggested substantial gaps in the USDA plant database concerning plant climate resiliency characteristics. Future research may expand the app to include plant structural diversity and explore using citizen science to augment the habitat assessment database.

1.1 Keywords

Pollinator habitat; site assessment; resiliency; web app
2 INTRODUCTION

2.1 Background

Worldwide, pollinator populations are crashing. This decline, in large part, is due to habitat and biodiversity losses from industrial agriculture practices, land development, homogenous residential and commercial planting design, and climate change (Browers et al., 2002; Pennsylvania Game Commission, 2015). Landscape management practices such as pesticide and herbicide use, repeated mowing, and inappropriate timing of prescribed fires have also contributed to the decline (Goulson, Nicholls, Botias, & Rotheray, 2015; Young, Schweitzer, Sears, & Ormes, 2015). For example, the Monarch butterfly (*Danaus plexippus*) has lost approximately 90% of its population due to the loss of milkweed (*Asclepius app.*) in the United States and Canada, as well as the illegal logging in Mexico (Browers et al., 2002). Indeed, Pleasants (2017) estimates that between 1999-2014 milkweed habitat in agricultural fields in the Midwest declined by 40%, corresponding to a loss of potential monarch support capacity of 71%. While in Mexico, illegal logging has degraded over 60% of the overwintering forest in the Biosphere Reserve. This 59,259-ha sanctuary protects eight of the fourteen overwintering colony habitats, estimated to contain 70% of the total overwintering Monarch population (Vidal, López-García, Rendón-Salinas, 2014). Bee populations are facing similar losses. Although exact numbers of native bees are hard to come by because of their solitary nesting nature, Cameron et al. (2011) reported sharp population declines of multiple bumble bee (*Bombus*) species at the national level. Samson and Knopf (1994) estimated that the United States had lost 82-99% of its tallgrass prairie, a critical bumble bee habitat. Pennsylvania, specifically, has only ten known remnant xeric limestone prairies totaling < 1 hectare, a once more significant landscape in Central Pennsylvania (Laughlin and Uhl, 2003). These pollinator population crashes and habitat losses are critical because pollinators provide life-supporting ecosystem services that include agricultural production—a $260 million value to Pennsylvania’s economy (Penn State Center for Pollinator Research, 2018).

To address these declines, many pollinator-centric design initiatives have been developed to conserve or restore pollinator habitat quality. However, they often focus solely on foraging habitat, neglecting that rich pollinator habitats require interconnected systems of foraging, nesting habitat, and water, without harmful land management practices. Additionally, these studies focus broadly on all pollinators or heavily emphasize honeybee health, not native bees. Yet, native bees are facing similar levels of declines. The lack of research and design efforts focused on native bee health is concerning since they are more efficient pollinators and cover a more comprehensive range of diverse systems (Vicens & Bosch, 2000). Moreover, many of the research efforts are rural or suburban in nature due to their agricultural interests (Kaluza, Wallace, Heard, Klein, & Leonhardt, 2016). Finally, current design interventions often replicate past plant communities, which are not adaptable to changing climatic conditions (e.g., changing USDA plant hardiness zones) or responsive to extreme weather events (e.g., drought or flooding) (Maschinski & Haskins, 2012).

With these limitations in mind, our pollinator site assessment tool helps landscape architects to more efficiently design healthy, connected, and resilient landscapes. It sets itself apart in three ways. First, it focuses on urban settings. Second, it evaluates urban, native pollinator habitat. Third, it evaluates the resiliency of both existing and future habitat quality. Landscape architects can play a critical role in ensuring urban communities provide pollinator habitat because research has shown that small-scale, diverse, and interconnected habitat is a valuable strategy in stabilizing and even increasing pollinator populations (Hall et al., 2017). By incorporating critical native bee habitat requirements (e.g., foraging, nesting, and water) as well as potential responses to extreme weather events and climate change, this tool can help designers better understand the effects of planting designs on pollinators while ensuring that habitats can assist the species movement necessary for their survival of significant disturbances. Additionally, understanding the patterns of deadly land management (e.g., pesticide use, over mowing, and pesticide-laced genetically modified organisms) can help landscape architects avoid creating habitat adjacent to unhealthy landscapes. Sections 2.2 and 2.3 will discuss gaps in existing site-scale habitat assessment protocols and how our proposed tool incorporates critical habitat requirements and evaluate habitat resiliency under climate change.
2.2 Site-scale pollinator habitat assessment

2.2.1 Existing protocols

There are two types of site-scale pollinator habitat assessment protocols identified in the literature. The first type is a species- or guild-specific assessment guide created due to the unique life-cycle requirements of each pollinator. They often focus on the larger, showy, and endangered pollinators (e.g., the Monarch Butterfly and the Rusty Patch Bumble Bee) or honeybees due to their agricultural importance. Examples of the species-specific guides include Hatfield, Jepsen, Jordan, Code, and Carpenter (2017) and Jordan et al. (2015). Despite their importance, it is worth noting that wild bees, particularly ground-nesting bees, are underrepresented in the habitat conservation and assessment guide literature. This absence is concerning given their pollinator services extend across a host of natural and agricultural vegetative communities (Hall et al., 2017; Kammerer, Biddinger, Joshi, Rajotte, & Mortensen, 2016; Koh et al., 2016; Winfree, Williams, Gaines, Ascher, & Kremen, 2008). The second and more common type of assessment guides is general in nature and focuses on land use typologies, primarily rural and agricultural landscapes. A majority of these guides were developed by or with the support of the Xerces Society, often in collaboration with state agencies and universities. As the leading science-based conversation organization in the United States regarding pollinator initiatives, they have been engaging scientists, land managers, educators, policymakers, farmers, and communities for nearly 50 years. The protocols they developed by land-use type include agricultural hedgerows (Neumann, 2016); agricultural landscapes (Jordan et al., 2015); and natural areas and rangelands (Jordan et al., 2014). However, protocols that assess urban pollinator habitats remain mostly absent.

The two types of assessment protocols share some commonalities. First, all protocols assess the four categories of connectivity, foraging and nesting habitat, access to clean water, and landscape management practices. The primary intent is to protect or enhance the quality of suitable nesting habitat, where pollinators spend most of the year and nest adjacent, early-, and late-season foraging habitat. The details of each category are dependent on the guild or individual species of concern. These protocols also exhibit several common gaps. First, despite their species-specific nature, they often lack the identification or scoring of key-indicator floral resources. For example, protocols usually do not identify critical plant materials necessary for specific pollinator life-cycles (Xerces Society’s Pollinator Conservation Program & Pennsylvania NRCS, 2014). Second, due to the rural and agricultural focus of most protocols, landscape management emphasizes pollinator-friendly agricultural practices such as no-till, cover crops, and harvesting regime timing (Jordan et al., 2015; Ward et al., 2014). However, such agricultural practices and associated assessment protocols do not apply to urban environments. Therefore, input for urban landscape management has often been distilled to a simple question of whether or not the site uses pesticides.

Nearly all of the existing protocols are paper-based, which do not leverage the citizen science potential a digital application and database could provide in assessing habitat. To the authors’ best knowledge, the only digital tool currently publicly available is the Beescape web application developed by Penn State’s Center for Pollinator Research (2019). It is an online tool for beekeepers, gardeners, growers, and land managers to assess landscape quality for supporting managed honeybees and wild bees. While this tool is appropriate for rural landscapes, it is not ideal for urban areas because the primary dataset is the USDA-NASS Cropland Data Layer (CDL) and only details four levels of developed or urban areas: developed/open space, developed/low intensity, developed/medium intensity, and developed/high intensity. Additionally, the resolution of the Beescape data is 30 or 56 meters depending on the state and year of the CDL data. This resolution is inadequate for medium to high-density urban areas because multiple parcels could have drastically different landscapes but read as a single pixel. However, Beescape can provide an assessment of habitat connectivity at landscape scales. It also allows citizen scientists to supplement remotely sensed data with on-the-ground bee health assessments such as mite infestations in honeybee hives. In summary, substantial efforts are required to improve emerging digital and online tools toward broader applications, especially in urban areas.
2.2.2 Critical habitat requirements

To address the critical gap in protocols that focus on solitary ground-nesting bees, we selected mason bees (*Osmia* spp.) as the species of concern for this pilot study. Below we explain the significance of mason bees and highlight their critical habitat needs. Compared to honeybees (*Apis* spp.), mason bees are stingless but very efficient pollinators, providing an excessive amount of ecosystem services for their size and habitat demands. First, their body size and shape allow for a large amount of contact between pollen carried by the bee and the flower’s stigmas, thus enhancing the chance of pollination. Indeed, a single mason bee visit to an apple (*Malus* spp.) flower is enough for pollination, and females may visit more than 22,000 flowers during a 15-day flowering season (Vicens & Bosch, 2000). Second, mason bees forage for longer during a single day and across a broader range of temperatures (Young, Schweitzer, Sears, and Ormes, 2015). They also promote pollination in trees that need cross-pollination by switching between rows of trees in an orchard (Young et al., 2015). Additionally, mason bees can pollinate plants grown in greenhouses, whereas honeybees cannot (Young et al., 2015). Finally, while some mason bee species remain relatively abundant, 27% of the 139 native North American species are at risk, including 14 that have not been recorded for several decades (Young et al., 2015). While exact numbers are hard to collect, others estimate moderate to severe decline (Centrella, 2019; Young et al., 2015), including the local extinction of certain species of concern such as the *Osmia lignaria* (Orchard Mason Bee) (Bartomeus and Winfree, 2013). Next, we elaborate on the critical habitat requirements, including foraging, nesting, water, and management, for mason bees (Table 1).

Table 1. General mason bee habitat requirements.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foraging</td>
<td>The site shall contain at least five blooming species for the following seasons: spring, summer, and fall. In particular, ensure early spring blooming species, as mason bees can emerge in early spring.</td>
</tr>
<tr>
<td>Nesting</td>
<td>The site shall contain areas of well-drained, non-flooding bare sandy or sandy-loam soil.</td>
</tr>
<tr>
<td>Water</td>
<td>Pollinators shall have access to clean water free of all pesticides, herbicides, insecticides, and urban runoff.</td>
</tr>
<tr>
<td>Management</td>
<td>The site shall be free of all petrochemical herbicide, fungicide, or insecticide use.</td>
</tr>
</tbody>
</table>

First, creating and managing mason bee habitat requires managing floral resources, also known as foraging. For foraging requirements, site assessment needs to account for not only the abundance and diversity of spring-blooming plants but also the co-evolution of pollinator, flower morphology, and pollen chemistry. First, mason bees require an abundant diversity of spring-blooming plants for foraging, especially those from the *Berberidaceae* (barberry family), *Ebenaceae* (ebony family), *Ericaceae* (heath family), *Fabaceae* (pea family), *Fagaceae* (oak family), *Grossulariaceae* (currant family), *Rhamnaceae* (buckthorn family), *Rosaceae* (rose family), and *Scrophulariaceae* (figwort family), in addition to early blooming fruit trees and shrubs (Young et al., 2015). Second, flower morphology and pollen chemistry limit mason bees. It appears that mason bees forage for nectar from a broader range of plants than they do for pollen. For example, research has shown that over half of the mason bee species, unless specialized, almost exclusively avoid the Aster (*Asteraceae*) plant family due to the chemical properties that interfere with their digestion by the larvae (Haider, Dorn, Sedivy, & Müller, 2013).

Additionally, flower architecture plays a pivotal role in shaping the host plant preferences of certain species, such as the *O. ribifloris* (Young et al., 2015). For example, the *Ericaceae*, *Berberidaceae*, *Ebenaceae*, or *Grossulariaceae* play a predominant role as pollen hosts even though they all have their...
anthers concealed inside bell-shaped flowers of a relatively small size. Research has shown that each season (i.e., spring, summer, and fall) should have five or more blooming species, with a variety of flower colors and morphological types to ensure foraging floral resource diversity (Xerces Society’s Pollinator Conservation Program & Pennsylvania NRCS, 2014).

Second, protecting nesting habitat is essential because it is where bees spend most of the year (Everaars, Strohbach, Gruber, & Dormann, 2011; Gruber, Eckel, Everaars, & Dormann, 2011). Mason bees have been known to use a wide range of nesting sites. For example, they have used abandoned beetle tunnels in living trees, other insects’ abandoned nests under shrubs or tree bark, underground, under rocks, mud, in sand or dunes, in hollow reeds or other plant stems, and even in snail shells (Young et al., 2015). Despite this wide variation of nest types, there are similarities. Most females chew leaf pulp and mix it with mud, sand, and other plant fibers to cap their nest entrances (Cane, Griswold, & Parker, 2007). Indeed, certain species, such as the *Acanthosmioides* spp., prefer a range of sand and sandy-loam soils and the *Helicosmia* spp. prefers clay banks (Cane et al., 2007).

Third, access to clean water is crucial to pollinator life cycles. Clean water provides supplemental macro-nutrients and assists digestion, bathing, and nest building. The literature defines clean water as free of all pesticides, herbicides, insecticides, and urban runoff; however, current assessment protocols often do not clearly define clean (Xerces Society’s Pollinator Conservation Program & Pennsylvania NRCS, 2014). Defining clean is particularly crucial in urban environments because urban runoff is often a toxic amalgamation of pesticides, herbicides, insecticides, and petrochemicals that in high concentrations can cause acute toxicity. Managing these pollutants is essential because they are disruptive to bee development, digestion and can lead to intoxication in the short-term (Young et al., 2015), with permanent and lethal effects in the long-term.

Last, the site should manage their landscapes to avoid mowing or burning on potential nesting habitat or alternate these management activities annually to avoid the mortality of larval, pupal, and dormant life states (Young et al., 2015). Protect nesting areas from extreme weather events such as flooding to promote breeding by cavity-nesting species (Cane et al., 2007). Avoid spraying pesticides on spring-bloom crops and avoid using systemic pesticides at any time of the year because they are highly water-soluble and can persist for months in aerobic soil, degrading pollinator health (Samson-Robert, Labrie, Chagnon, & Fournier, 2014).

While bees may fulfill all their needs within a single location, habitats should be interconnected to ensure resiliency in needs and genetic diversity. Hence, each urban habitat element, i.e., foraging, nesting, and water, should be interconnected, which for small solitary bees is defined as no further apart than 91.44 meters (300') (Gathmann & Tscharntke, 2002; Greenleaf, Williams, Winfree, & Kremen, 2007). However, the challenge in evaluating urban habitat needs at such high resolution is data availability. Current urban soils and vegetation datasets are inadequate to assess solitary, ground-nesting bee habitat at landscape scales. Yet, ongoing citizen science efforts, such as the Beescape mentioned above, could be combined with the application proposed here to create higher resolution assessments of urban pollinator habitat connectivity.

### 2.3 Evaluating planting design resiliency

The cascade of urban planting design effects caused by climate change necessitates new approaches for evaluating planting design resiliency. Warmer average temperatures and greater temperature and precipitation extremes have contributed to changes in seasons, phenology, and the geographic distribution of plants (Hunter, 2011). Phenology shifts can cause bees to emerge from their winter nests before the availability of floral resources. Likewise, floral resources can bloom before bee emergence, only to be killed by a late frost. These differential responses among plants and pollinators will disrupt networks of community interactions, including pollination. Indeed, fruit trees have been observed to bloom weeks earlier than pollinators have emerged for the season (Forrest, 2015). Despite these challenges, planting design climate adaptation guidance remains limited, and designers are only just beginning to address the need for protocols to assess planting design resiliency. To the best of the author’s knowledge, all existing protocols adopt overly simplistic measures of resiliency. Resiliency measures were embedded by asking if five or more blooming species were present during each bloom season to ensure only functional redundancy. However, no protocols assessed existing habitat resiliency to climate change.
or associated changes in extreme weather events. Nor did they evaluate the specific resiliency of each plant species.

Planting designs should help ensure the plants we choose create climate-compatible foraging and nesting habitat to support the shift pollinators will need to track their favored climates and foraging resources (Young et al., 2015). To address the resiliency of foraging resources to climate change and associated extreme events, we have adapted Hunter’s (2011) planting design strategy, which is based on the ecological concepts of plasticity and resilience.

Plasticity is defined as how well species perform across a range of environmental conditions (Hunter, 2011). The greater the plasticity, the greater the species’ ability to persist under diverse environmental conditions and changes. Specific to pollinator foraging resources, plasticity is expressed through a plant’s ability to respond to broad hardness zone and soil moisture changes. For example, between the two species in the Fagaceae family that mason bees frequently visit, the White Oak (Quercus alba) has greater temperature plasticity because it grows in USDA hardiness zones 3-9, while the Scarlet Oak (Quercus coccinea) only grows in zones 4-8. Thus, if a site only contained a Scarlet Oak that is unlikely to survive the hardness zone shift, then mason bees would be left without a key plant species.

Ecological resilience is the “ability of an ecosystem to maintain function in the face of environmental disturbance.” Designers and researchers have operationalized ecological resilience through the concepts of functional redundancy and response diversity. Functional redundancy is defined as the number of species contributing to an ecosystem function (Lawton & Brown, 1994), whereas response diversity is defined as the variety of reactions to environmental change among species contributing to the same ecosystem function (Elmqvist et al., 2003). In the case of pollinators, to achieve functional redundancy, plant palettes must include species with multiple overlapping bloom times to ensure numerous foraging resources at any given time throughout the pollinator season. For mason bees, it is also incredibly important to ensure early-season foraging functional redundancy due to the bees’ early emergence, lower temperature foraging tolerance, and the uncertainty of spring bloom times (Stubbs, Drummond, & Allard, 1997; Young et al., 2015). To ensure response diversity, plants must collectively exhibit a broad range of tolerance to extreme events (i.e., drought, fire, and flood) within a single season, while still achieving functional redundancy in foraging resources. Plant choices should also ensure that if climate change or extreme events favor certain species at the expense of others, there will still be a diversity of nectar and pollen resources provided throughout the pollinating season.

3 RESEARCH OBJECTIVES

Landscape architects, through planting design, can positively impact and reverse pollinator decline by ensuring the conservation and design of resilient quality habitat. Thus, the objectives of this research are to create a web-based application that serves two purposes. First, to assess and archive the ecological health (e.g., redundancy and diversity) of site-scale, urban pollinator habitat. This assessment will inform the designer of current habitat quality. The archival information stored in this database can be used to track trends of habitat quality through time. Second, to evaluate and provide a visual record of the resiliency of proposed site-scale planting palettes considering extreme weather events, climate change, and changing USDA plant hardiness zones.

4 METHODS

4.1 Pilot study site

We selected a 791-ac area of downtown State College, PA, familiar to the researchers as the pilot site (Figure 1). This area contains multiple urban and suburban parcels of varied size, land use, ownership, and habitat types. Penn State is the largest single landowner, including the golf course. The remaining parcels are moderately dense, small residential single-family and multi-family, student housing, and small-scale commercial development. Note, since this paper was a proof-of-concept pilot study, we focus on demonstrating the application development process instead of presenting a full assessment of the study area’s pollinator habitat.
4.2 Assessment protocol descriptions

The completed tool includes two assessment protocols for both the site and the planting. The site assessment protocol consists of nine questions in three themed tabs. Table 2 outlines its tab themes, questions, and associated response thresholds. The planting assessment protocol consists of three resiliency characteristics: plasticity, function redundancy, and response diversity. Plant plasticity was evaluated using the work of Parker and Abatzoglou (2016), which projects that our pilot site is moving from a USDA hardiness zone of 7a/b to 8a. The USDA Plant Database (United States Department of Agriculture & National Resource Conservation Service, 2020) was used to derive the remaining resiliency characteristics. Table 3 documents the operationalization of each planting design resiliency measure, criterion, and data source.

Figure 1. Pilot site location and land use map. Map by authors.
Table 2. Pollinator site assessment protocol, questions, and response thresholds.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Question</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foraging</td>
<td>Enter Parcel ID</td>
<td>User input parcel ID number</td>
</tr>
<tr>
<td>Spring</td>
<td>Number of native blooming species</td>
<td>0; 1-2; 2-4; or 5+</td>
</tr>
<tr>
<td>Summer</td>
<td>Number of native blooming species</td>
<td>0; 1-2; 2-4; or 5+</td>
</tr>
<tr>
<td>Fall</td>
<td>Number of native blooming species</td>
<td>0; 1-2; 2-4; or 5+</td>
</tr>
<tr>
<td>Nesting</td>
<td>Percent of the site with untilled, well-drained bare ground or with sparse vegetation</td>
<td>&lt;5%; 5-19%; or &gt;20%</td>
</tr>
<tr>
<td>Water</td>
<td>Percent of the site with sand to sandy loam soil</td>
<td>&lt;5%; 5-19%; or &gt;20%</td>
</tr>
<tr>
<td>Landscape Management</td>
<td>Is there a clean water source available on site</td>
<td>&lt;5%; 5-19%; or &gt;20%</td>
</tr>
<tr>
<td></td>
<td>Does the site use herbicides, fungicides, or insecticides?</td>
<td>Yes or no</td>
</tr>
</tbody>
</table>

Table 3. Planting assessment protocol resiliency measures, criteria, and data sources.

<table>
<thead>
<tr>
<th>Resiliency measure</th>
<th>Criteria</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasticity</td>
<td>USDA hardiness zone change</td>
<td>(Parker &amp; Abatzoglou, 2016)</td>
</tr>
<tr>
<td>Functional redundancy</td>
<td>Bloom phenology times and color</td>
<td>USDA plant database characteristics – bloom period and flower color</td>
</tr>
<tr>
<td></td>
<td>Drought</td>
<td>USDA plant database characteristics – drought tolerance</td>
</tr>
<tr>
<td>Response diversity to extreme weather events</td>
<td>Flood</td>
<td>USDA plant database characteristics – precipitation, maximum</td>
</tr>
<tr>
<td></td>
<td>Wildfire</td>
<td>USDA plant database characteristics – fire resistance and tolerance</td>
</tr>
</tbody>
</table>

4.3 Application development

The application was developed between January 2019 and May 2020. Two components comprise the application: 1) the site assessment, assess existing site-scale pollinator habitat conditions; and 2) the planting assessment, to assess the quality and effectiveness of proposed planting designs. R (3.6.1) within RStudio (1.2.1335) and RShiny (1.4.0), an open-source interactive web application development package created by Rstudio, was used to code the application. The databases, site assessment survey results, plant database, and plant schedules were created as comma-separated values (CSV). The following additional R packages were necessary for recording survey inputs, mapping, analysis, and computationally scoring habitat quality: data.table (1.12.8), digest (0.6.23), dplyr (0.8.3), DT (0.11), ggplot2 (3.2.1), leaflet (2.0.3), rgdal (1.4-8), shinydashboard (0.7.1), and shinyjs (1.1). Figure 2 outlines the inputs, protocols, structure, supporting technologies, and outputs of the application.
The site assessment component (Figure 3) has two sub-components, both of which are embedded within the RShiny application. The first sub-component is a leaflet map (Fig. 3, A) containing the 2018 Centre County Parcels data layer downloaded from the Pennsylvania Spatial Data Access (PASDA) Geospatial Data Clearinghouse (Barger, 2018). The data was processed to the study area boundary, reprojected to WGS 84 (EPSG:4326), the default Leaflet for R coordinate reference system. The second sub-component is the site assessment survey, created in RShiny. To complete the site assessment, the user first clicks on the parcel data layer to obtain a unique parcel identification number and then fills out the site assessment survey (Fig. 3, B-D). The survey answers are pushed to a CSV file; upon receipt, the database triggers a function that calculates the final scores for each assessment category and a composite score for the site, which is reported back to the user in numerical and chart form (Fig. 3, E).
The planting design component has three sub-components (Figure 4). The first sub-component is the plant database, which is embedded within the RShiny application as a CSV file. Details regarding the plant database attributes were outlined in Section 4.2. The second sub-component is the user-provided plant schedule, which is uploaded as a CSV file and must contain a column identifying each plant’s scientific names (see example in Table 4). The third sub-component is the planting design assessment dashboard, which consists of various inputs, RShiny scripts, and a table and chart assessment output. To complete the planting assessment, the user first uploads their plant schedule (Fig. 4, A). The RShiny application performs a table join via the plants’ scientific names, and the results are shown as a bloom phenology chart (Fig. 4, B) and plant schedule table (Fig. 4, C). The default view is all plants under current hardiness zones without extreme environmental events. The user is then free to choose projected hardiness zones and one of three extreme events: fire, drought, and flood (Fig. 4, D). Once choices are made, the application updates the phenology chart and plant schedule. Plants deemed not resilient to the chosen changes, or extreme events are identified in black on the phenology chart. Hence, the user can visually identify if their selected plant species still ensure functional redundancy.
5 DISCUSSION AND CONCLUSION

Wild pollinators are gaining increasing attention within the habitat assessment literature; however, existing protocols focus on mostly rural or suburban efforts and are still largely paper-based. The application described in this paper; adapted and improved upon previous protocols by modifying them into an urban context, incorporating climate change, and facilitating planting design iterations. Moreover, it began to transition the paper protocols into a digital database.

The uncertain climate future requires designers to iterate plant selections and evaluate their fitness for effectively achieving valuable ecosystem services under uncertainties. Therefore, tools such as ours can be so important. The iterative and rapid assessment of plant schedule designs will help ensure future planting designs maintain vital pollinator ecosystem services in the face of climate uncertainty.

Transitioning to a digital database adds the ability to leverage geospatially derived citizen science to inventory and analyze the landscape mosaics of urban pollinator habitat, a previously challenging task given the potential heterogeneity of homeowner landscape decisions. One significant improvement we plan to incorporate into the next iteration of this application is the use of citizen science and other input mechanisms to augment the database towards a long-term and large-scale record of landscape quality. The improved tool will be able to facilitate cross-geographic and -temporal scale analytics on habitat quality and
resiliency, something traditional, paper-based assessments are incapable of doing. Moreover, landscape architects can take advantage of this database to identify critical gaps or leverage points for new areas of planting design. Knowing the habitat gaps also ensures that landscape architects are not designing ecological traps - places that appear attractive to pollinators, but do not have the interconnected resources or management practices to sustain them.

The authors would like to note that, following the prototype’s completion, a new urban- but paper-based habitat assessment protocol was published by Jordan et al. (2019), which addresses many of the issues noted in the work presented here. We intend to incorporate this new protocol in future application iterations. For example, we will include a broader range of pollinator species and guilds, and include assessment of critical life-cycle vegetation requirements (e.g., milkweed for monarch butterflies). We will also have a more comprehensive array of landscape management assessments, such as minimizing mowing and prescribed fire disturbance during critical nesting and foraging seasons. Also, we will assess the spatial arrangement and composition of foraging resources on-site more specifically by calculating the percent cover. Plant resilience will be expanded to include structural diversity assessment of bloom, plant, and twig morphologies. Finally, we will broaden our ecological assessment to include habitat connectivity beyond a single site, through the integration of Beescape.

To broaden the application of our tool, one significant gap to be addressed in the near future relates to the USDA plant database. Our initial efforts attempted to rely on the USDA plant database exclusively; however, three issues emerged. First, many of the plants have incomplete plant characteristic data. Some plants have no characteristic data at all, while others are missing data. It is unclear if this data is genuinely missing or if it means the plant is intolerant of the documented extreme weather event. Second, the flood tolerance information relies exclusively on precipitation maximum, which does not adequately represent soil saturation or inundation. Third, obtaining, transforming, and downloading the database is time-consuming and inefficient, especially given its other deficiencies.

Lastly, concerning the usability of the tool, we plan to develop a more graphic interface with an in-application guide that assists users in defining key elements such as “clean water for pollinators.” The updated guide and protocol will also include visual cues to guide habitat connectivity assessment.

While the individual application sub-components are modifications of existing research, their power comes from consolidating all functionalities into a single digital application. The application developed allows designers and landowners to iterate planting design assessments across many resiliency factors rapidly, produces a visual record of foraging biodiversity and resiliency deficiencies, and helps to ensure the climate adaptability and resilience of future pollinator habitat.

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Site Assessment RShiny Application

Inputs

User Input

Assessment Database (.csv)

Parcel and Project Boundaries (.shp)

(see Figure 3 for details)

Planting Assessment RShiny Application

Inputs

User Input

Plant Database (.csv)

Plant Schedule (.csv)

Processing Table Join

Foraging Phenology Charts

Extreme Event Choice

Upload

Processing Update

March 18-21, 2020 (canceled due to COVID-19)
Artificial intelligence systems for automated site analytics and design performance evaluation

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1 ABSTRACT

Post occupancy evaluation is time consuming and captures an incomplete picture of site use over time. Few firms invest in assessment of their built works and designers too often miss valuable lessons that could be learned from seeing how sites are used, maintained, and impacted by (or placing impacts on) local context. Existing digital systems lack the granularity of recording human behaviors capable through in-person assessment and are unable to capture observed mood, interaction, and socialization of site occupants. Meanwhile, in-person evaluation does not offer a complete analysis of a site across all hours of the day and is missing granular environmental and historical data to determine influences on human behavior. This project demonstrates the early stages of an artificial intelligence (AI) based camera vision system, capable of tracking individuals through designed space, while using consumer-grade hardware. This system differs from those currently available as it uses multiple cameras at different angles, distances, and fields of view, to offer more complete site coverage without typical occlusion, lighting, or perspective distortion issues. Additionally, data collected avoids the realm of privacy concerns and can track individuals without recording personally identifying information. Tracking data can then be analyzed through both automated and manual methods (for validation purposes) to determine underlying patterns of use, impacts of spatial and programmatic elements, and influences of environmental conditions on site behavior.

1.1 Keywords

Artificial Intelligence; automated site analytics; design performance evaluation
2 INTRO & BACKGROUND

Computer technology has a profound impact on design process, production, construction, and administration. For example, digital drafting methods ease document editing and inter-office communication when compared with traditional non-digital methods. Designers are entering a new era of digital opportunity as artificial intelligence and machine learning algorithms become more robust and translatable to design processes and professions. Landscape architects have rarely taken, or been provided, the opportunity to contribute to the tools that have become ubiquitous in the day-to-day aspects of design. This has resulted in the profession forcing tools to fit the demands of practice instead of working with specialized tools and systems crafted for landscape architectural analysis, design, documentation, and management.

Design professions continue to be influenced by technological innovation, including automated algorithms, processes, and workflows. Parametric modeling allows for rules-based iteration and form generation to occur with minimal designer oversight, leading to custom generated design options and analysis processes. While the ultimate product of these processes can and have been produced through traditional methods across decades of design work, digital systems have sped design workflows, construction detailing, and administration. Students and practitioners alike have become increasingly accepting, and in some cases reliant, on digital processes, trusting data and results from algorithmic analysis and design. The merits of this (often blind) trust is open for debate and requires further study, but the increasingly dominant role of digital systems in both academia and professional practice is clear. Designers have always used data to inform and influence design decisions. This data has increased in complexity from the basics of client input and programming, to “design with nature” principles, to sociology driven concepts in post-modern and new urbanist design. Systems analysis at multiple scales are more available and more robust than ever through GIS and geodesign principles. As a result, today’s desire for automation, especially in collaboration and construction operations, has required a seemingly exponential increase in data required to perform design tasks. Designers can find themselves paralyzed in the design process due to a lack of data to input into a system or during attempts to design systems that are not yet ready for such detail. Additionally, young designers are often overwhelmed by either (or both) incomplete or too much data, resulting in misguided solutions or incomplete work. This is not to say that data is inherently bad, but it takes time and experience to be able to filter through information to what is necessary and informative for a given task.

Digital tools enable new and exciting forms to be explored with novel materials seemingly impossible through traditional methods. Programmatic gaps, opportunities, and constraints are easily identified (if data being fed into the system is complete and unbiased) and connections between systems can be modeled, tested, and assessed for performance before a single shovel breaks the earth. Building Information Modeling (BIM) processes have enhanced inter-office design development, allowing for faster and more accurate coordination. Construction and fabrication processes have been enhanced by BIM technologies due to object embedded meta-data and direct fabrication methods like 3D printing, CNC routing, and laser cutting.

Many students, and often practitioners, allow digital tools to replace traditional methods in analysis, design, and visualization processes. While new efficiencies and interactions may be made available due to the advent of computer-based tools, a hybrid approach co-mingling digital and traditional methods and processes remains a viable and attractive option. One system should not be a replacement for another, instead methodologies can enhance each other for a richer and more robust product.

3 POST-OCCUPANCY EVALUATION – EXISTING METHODS

Traditional behavioral mapping has been established as a method of recording site usage and human behavior in both design and environmental psychology studies since the mid-1960s. (Ittelson, Proshansky, Rivlin, & Winkel, 1970; Winkel & Sasanoff, 1966) This process of site visitation and manually recording behaviors and site usage (post-occupancy evaluation, or POE), while valid, has some severe limitations that affect the quality of the data and its validity in design decision making.

Design firms can rarely budget for a designer’s non-billable time to visit existing designs and record site usage, and clients are rarely willing to include allowances for post-occupancy evaluation in design and administration contacts. When POE does occur, evaluators typically have limited time on site...
across a limited number of days, conditions, and programed events. Additionally, data is only available from what evaluators can see at any given moment, decreasing accuracy and validity as site scales increase. The depth of data for an evaluation is a direct quality of the recording speed of the observer or the accuracy of an evaluator’s hand. Data can also be biased by the recorder, as one can unintentionally enhance or neglect site activity based on personal interests. Data is only available in the moment of its occurrence, with no ability to review or validate activity or its recording. The presence of the recorder may influence the behaviors of site occupants due to the Hawthorne effect, as people’s behaviors tend to change when they are aware of being watched. Each of these issues result in data that is easily biased and limited in scope of application unless evaluators are exploring specific and visible scale space or programming.

Despite these issues, human observers can perform analysis simultaneous to recording usage of a space, assigning professional opinion and expertise to notation. Computer driven systems are only able to record usage “inventory” of a visible area, with analysis to be processed later. Analysis still must be managed and completed by a human designer since artificial intelligence systems are not yet able to make intuitive judgements or incorporate subjective elements into the data.

The ubiquitousness of cell phones and the amount of data they tend to record can improve recording of site behaviors for post-occupancy evaluation, but this data has limitations as well. Correlating location data with cell phone usage has produced interesting studies (Neuhaus, 2011; Tulloch & Im, 2019; van Zanten et al., 2016), but they are typically filtered through specific app-based lenses that fail to present holistic interpretations of a sites use over time or rely on evaluation methods that generate generalized information as opposed to element or program specific data.

Cell phone data in the form of Location Based Services data (LBS), presents a different set of issues for consideration in determining human location and movement through the built environment. Firstly, access to LBS data is expensive and must be purchased in discreet time segments from a cellular service provider’s defined area independent of a designer’s boundary or locale interests. Data has variable accuracy depending on whether a phone has GPS enabled and the strength of its antenna, otherwise defaulting to location triangulation based off data transmission time pinging off service towers. Satellites over urban sites are heavily impacted by weather and surrounding architecture and vegetation “shadows,” introducing variable and unpredictable error to data results. Additionally, the use of this data has larger privacy concerns as data often comes with information regarding personally identifying information and activity outside of a study area, focus, or timeframe. LBS data is useful for studying trends amongst larger populations, including qualitative metrics through assigning location to social media posts and related events through time, but is less appropriate for granular site scale studies requiring higher degrees of accuracy.

Site specific technologies involving video recording of site usage has been evolving, notably through SWA Group’s “Plaza Life Revisited” studies. (Schlickman & Domlesky, 2019; SWA, 2018) SWA investigated use of Tom Balsley’s New York City plazas, setting up a temporary camera on a pole within or next to the designed space to be studied, recording short segments of video, then analyzing recorded video once back in the office. While the findings from these studies provide great value to the practice of small-scale urban site design, the methodologies are difficult to transcribe to other locales and designs where visibility is limited, or cameras cannot be placed without disrupting site use. As the locations studied by SWA were in the urban public realm and cameras had not been installed as part of the initial project, a single portable camera was used for short time durations due to legal issues in impeding movement in the public realm. This observation process carries many of the same issues and errors as traditional POE methods though recorded video could be assessed and reassessed as needed after the recording was completed, resulting in a strong series of design guidelines and recommendations based on the study findings.

Single camera methods as used in the SWA studies follow similar protocols to one generated and rejected by this research team as demonstrated in Figure 01, where video data is treated as a collection of individual still images instead of a linear system of images that can reference each other through time. While fast and accurate within a single camera’s view, this process is not viable for complex scenes or large scales, necessitating multi-camera systems. In a single camera system, occlusion (where a person is blocked from camera view by an object or another person) becomes a major issue. If not corrected for manually, an occluded person will not be counted as being present for a given analyzed video frame. Worse, if a person has an AI assigned ID number and is then occluded in the next video frame, a new ID
is often assigned when the person is once again visible to the camera. This results in double counting of people and an inability to track movement paths of people throughout the entirety of a designed space for later analysis.

![Diagram of human ID and tracking software process]

**Figure 01: A common single camera human ID and tracking software process**

While mobile and temporary single camera systems are affordable options, especially in situations where fixed cameras are unable to be included in a contract’s scope, the limitations and issues inherent to the system (limited timeframe of recording resulting in incomplete recording of use of space, miscounting and mis-identification due to occlusion and lighting inequalities, etc.) mean that results generated from its use should be used as suggestions and guidelines instead of hard and fast rules to be applied holistically.

### 4 POST-OCCUPANCY EVALUATION – PROPOSED METHODS IN PROGRESS

Starting in 2018, a faculty led team of undergraduate researchers in landscape architecture, computer science, electrical and computer engineering, and applied statistics at Purdue University have been working towards addressing issues in evaluating human behaviors within the built environment. While the eventual goal is to deploy a system across multiple space typologies (both interior and exterior), the team has focused on controllable spaces on Purdue’s campus as case study to avoid public privacy fears and project startup slowdowns.

The goal of the system is to develop a database of human behavior in the built environment across a variety of spatial, cultural, and environmental conditions. This database can then be used to generate AI driven “actors” that can occupy and interact with an as-yet-unbuilt space or intervention in the landscape in order to simulate how a space may be occupied, moved through, and how it may encourage or inhibit human social behaviors. Simulations such as these are already part of the digital ecosystem in the form of video games where non-player characters are given a set of behavioral “rules” to follow in order to mimic personality traits and responses to a real person’s input. The database that will be collected will be able to act as the blueprint for randomizing behavioral traits for artificially created people within a digital model, allowing a designer to test various structural, programmatic, and environmental options as part of the iterative design process.

To achieve this goal, the study aims to answer the following questions:
1. Can we create a better site usage observation and tracking system compared with existing human driven methods using video cameras and deep learning software?
2. Can that data inform site analysis and post-occupation evaluation better than current systems and processes or in unexpected new contributions?
3. Can we use this data to simulate and test proposed design options to reveal unintended design and usage issues before beginning construction?

These questions will require intermediate milestones to be accomplished before the complete system can be realized. At this time, development is nearly finished with step 3 as outlined below:

1. Develop a robust multi-camera reidentification system based around video camera data
2. Record attributes of people and objects within a camera’s vision while maintaining privacy of people in frame
3. Map the location of people within a defined area of the built environment in three dimensions with corresponding temporal data included
4. Observe video of people within a given space and record behaviors of occupants linked with their AI provided ID codes. This requires expert opinion from environmental and social psychologists, sociologists, etc.
5. Develop and distribute a network of sensor packages that measure temperature, humidity, air quality, light intensity, wind flow, and other environmental factors
6. Compare human behaviors and activity with designed intent and environmental conditions of a constructed space, developing a library of designerly terms and programs that influence human use of space (attractors, repulsors, thresholds, gathering areas, movement areas, calm spaces, energetic spaces, etc.)
7. Develop an AI actor model within an existing video game engine (Unreal, CryEngine, Unity, etc.)
8. Recreate a real space within the game engine and run the simulation, comparing AI behaviors with those of the real site
9. Make a structural change in the digital model and analyze how it changes use of a space
10. Recreate the same change in the real environment and compare the digital and real in a test of accuracy and validity

Figure 02: The current multi-camera workflow process
The system in development begins with recorded video from multiple cameras that are time-synced to each other in a managed database (see Figure 02). From there, human figures are identified, given bounding boxes around the extents of their figures, and automatically cropped out of the full frame for system analysis. These cropped representations of people are pushed through an attribute feature extractor and stored with a unique ID code per individual. This process does mean that errors can arise when different people generate similar attributes, but the project team experience shows that the 20+ point attribute system (as described in Zheng, 2015) is robust enough to handle dozens of people at this stage of development and will become more diverse and robust as more object data options are included in the identifier process. At this stage, the X,Y coordinates in a 2D photographic plane are recorded for the lowest center point of the cropped human figure. Using standard mapping projection and correction formulae, these perspective distorted coordinates are converted into real world location data within a pre-defined space. These points can be normalized and connected to draw a vector line representing the movement path of a person as shown in Figure 03. The system can determine movement speed from the distance shift between known time durations (sampled framerate), color coding lines for intensity of speed or in the illustrated case below, assigning random unique colors per ID.

Figure 03: Unique ID codes in a test site using triangulated drone cameras, sampling at two frames per second and normalized to better describe paths of movement. Each node indicates a projected location with larger nodes indicating first “discovery” of a new individual to the scene.

While there are some few similar products on the market, this project differs due to its modularity and the multi-camera setup which increases accuracy and coverage within a study area. The metadata recording and output system takes post-occupancy evaluation and analysis into account from the beginning. Capturing features from an individual who has been identified in a scene can inform individual choices such as wearing long or short sleeves and whether someone is standing or sitting. As object detection opportunities expand in the system, determining modes of transportation (skateboards, scooters, bicycles, walking, running, etc.) along with carried items like backpacks, shopping bags, or cell phones can determine site usage or environmental reaction to conditions. Combining time stamps with tracked locations on a site can illustrate speed of movement which can then be interpreted into
differences between lingering and moving through a space. Projected locations of individuals coupled with time stamp data can be used to detect proximity and conformity of movement or gathering, resulting in identification of solitary or group size behaviors.

With abilities to output either vector point or line data, and with Open Street Map coordination, data is easily usable for local analysis or web-based presentation as desired. Aiming to be software written by designers, for designers, the project team plans to make the ID and tracking system open source and available once a stable version is completed. From that stage, the team will move towards refinement and advanced applications that further enhance the understanding of our built environment.

5 DISCUSSION

At the time of publication, the project team has developed the multi-camera re-identification system to an acceptable accuracy rate, minimizing both false negatives and false positives though more work can be done streamlining the process and making it less processor intensive. Superficial human attributes are embedded as metadata alongside the ID code assigned by the re-ID system and no personally identifying information or photographic images are retained once a person leaves a study area. The map projection and tracking processes are complete, with output formats and visualization options still under discussion. Post-detection and projection options are being considered for analysis opportunities that can generate a series of site inventory maps that can be used for post-system analysis by design professionals. While much work remains to be completed towards the ultimate goals of the project, the progress made to date shows promise and has generated actionable data for designers to use in understanding the built environment in its present form.

5.1 Opportunities & constraints of the proposed multi-camera system

Current products and processes tend to rely on either temporary cameras (that capture incomplete segments of use over a given time period) or solitary cameras that can suffer from incomplete views of space, subject occlusion, or imperfect angles or fields of view. These typical conditions can be worked around, but they are far from ideal. A multi-camera system can not only capture a more complete picture of a site at a given moment, it can increase the accuracy and breadth of the data captured compared with a single camera view. Multiple cameras that are networked together can triangulate an individual's location and even locate a subject in three dimensions. Additionally, they can aid in data accuracy as multiple views can combine to generate a more valid dataset for subject identification and tracking as demonstrated in Figure 04 below. Each camera runs as an independent process, with each sending its own video through the system for analysis. Upon completion for a given time frame, output is compared across camera results, with those exhibiting the highest confidence score for accuracy kept and less accurate results dropped for that specific collection of time matched frames. This results in the most accurate identification possible by the system for any given time while minimizing people being double counted or incorrectly missing from a scene. Examples of where this methodology can provide benefits over single camera systems are in spaces with vegetative cover, vertical structural elements, or crowds that may occlude individuals from a single camera’s view. Where occlusion is likely to either misidentify an individual across video frames, or fail to identify them altogether, a multi-camera system can coordinate to foster more complete visual data across the entirety of a space.
Figure 04: Multi-camera identification accuracy and data validity is higher compared with a single camera system, solving issues of occlusion, person directionality, and out-of-frame issues.

Issues with identification and tracking of people and elements within a single camera system have largely been solved and are in the process of refining systems towards optimization. The introduction of multiple cameras that must work in tandem to identify and track individuals within a space is exponentially more complex. This proposal uses combinations of video image manipulation methods, machine learning algorithms, recombinant neural networks (RNNs), and coordinate projection mapping (all written primarily in Python and Pytorch) to provide human location and movement data across the entirety of a space, 24 hours a day, with consistent and repeatable results.

Independent of whether a system uses one or multiple cameras, identification of people and elements (bicycles, scooters, dogs, etc.) are only as good as the data used to train the system. Once applied to real world conditions with variable human appearances, changes in lighting and shadow, occlusion, introduction of out-of-set elements, etc., accuracy and validity decreases below acceptable levels. These data sets can also be unintentionally biased as evidenced by difficulties in facial recognition by Google, Amazon, Microsoft, IBM, and Apple, where distinct ethnic groups or genders were misidentified as animals or as different people. (Singer & Metz, 2019; Wong, 2019)

There are numerous training data sets publicly available; this project has primarily used the Market1501 training data set (Lin et al., 2019; Zheng, 2015), but they are often developed for specific uses and are overly optimized to produce internal success. Market1501 was used for this study due to its collection of images from multiple camera sources, reflecting the style of data that will be fed into the proposed system. To train the system in preparation of analyzing new video data, first a series of pre-defined images, with one person per image, is run through the system (using a Multi Granularity Network (MGN) or Kernel Null Foley-Sammon Transform (KN-FST)) while being told that each person to receive an ID is unique. Multiple images of the same person are introduced, and the resulting identifier scores are averaged together to generate a “true” target for that particular ID. The deep learning mechanisms of the software are told to attempt to move the aggregate numerical “score” of an image that represents each unique individual to be as close as possible within a pre-defined margin of error. Lastly, paired images of different people are introduced, with the system attempting to move their identifiers away from each other.
Once complete, the system can be checked by introducing new matched and unmatched groups of people into the system and seeing how well the software copes with the new data, comparing results to expected output metrics. Other internal validation processes are being used by the research team to maximize accuracy across various environmental, cultural, and spatial conditions that could influence system accuracy and confidence.

Single camera systems can detect pixel-by-pixel changes across video frames to identify human figures and objects within a scene. Once multiple cameras are introduced, videos must share a common set of identified attributes to match individuals in one camera’s view with that of another camera. This additional complexity means that new modes of data processing must be considered to accurately analyze video data.

If a designed space is controlled and all possible occupants are known in advance (as in the case of a secure facility or linked database), identification of individuals is a simpler task. This closed set of possible identities aids in the digital object detector process since it has a pre-populated gallery of images to match with. While ideal, a closed set system is not feasible in most designed spaces where the list of possible occupants can include anyone on Earth. Instead, open set solutions must be investigated, where the identification gallery is populated at the same time the object detection and tracker systems are running (see figure 05). This generates a series of issues that have dramatic impacts on the accuracy and validity of data output by the automated systems. This can include incorrectly creating new ID codes for people already identified within the scene, resulting in incomplete paths and inflated counts of people using the study area.

![Figure 05: Closed set -vs- open set systems for unknown user groups](image)

To date, the open set problem has resulted in various mis-identification issues due to lighting differences across cameras, occlusion and associated limited visible attribute features across cameras, and duplication of individuals within the same time and scene. Various attempts at utilizing triggers or “fences” that once activated, an image of a person is pushed to the attribute feature detector and recorded as a new individual in a space have been attempted with varying rates of success. The result of these efforts indicate that a plug-and-play solution is not yet feasible, and that some amount of custom system setup by the end user is necessary if similar systems are to be deployed in different locations. Current developments show promise and have acceptably low incidents of incorrect ID results.

This system relies on multiple un-obstructed cameras to be installed on site, in unobtrusive locations, with minimal obstruction from vegetation or similar site elements. While not currently a standard in most design contracts, firms with strong research interests, university and corporate campuses, and commercial retail sites may have vested interest in what can be learned from including cameras into the project scope. Automated digital systems can record video and interpreting data 24 hours a day, 365 days of the year. As long as a system remains operational, it should provide data for designers to interpret and analyze and from which site managers can make informed decisions. Even if cameras were to be placed and operated for a limited duration, the lessons learned can work to minimize safety issues, enhance site and program engagement, and to predict or determine maintenance needs before they become actual problems. These cameras would need access to a hard-wired power source as a solar or wind array wouldn’t be feasible for current equipment due to power needs. Wireless
transmission of recorded video is possible, though bandwidth is limited until 5G networks can roll out in full. The question of who owns the recorded data is at issue as well, whether the site owner, site occupant, design office, or site user is granted access or is responsible for storing the video will need to be determined on a case by case basis until municipal or federal data laws come into effect (similar to Europe’s General Data Protection Regulation (GDPR)).

6 PRIVACY

While public areas and those visible from the public realm harbor no expectation of privacy for occupants, that does not negate privacy issues concerning who has access to the camera feeds or the associated data. While this study does store images at a pre-selected framerate for processing, those images are purged at set intervals and as individuals leave the cameras view, with filenames overwritten and reused to ensure no records are kept long term.

The algorithm does not identify an individual as a specific person. Instead, data generated from camera views are generalized into broad characteristics associated to abstracted appearance that generates a unique numerical identifying code. This feature-class system of identification disassociates the data from an individual’s recorded image, removing most privacy concerns from consideration. In fact, generating attribute features from an image, then analyzing the same image does not return a result with 100% confidence (sometimes mis-identifying a person altogether), demonstrating the disassociation between the data and the video representation of an individual. In addition, facial blurring processes that occur within the camera itself are being explored so that all recorded video is deidentified without affecting the validity of the data.

It should be noted that this project does not include facial recognition tracking or technology. In exterior fixed view cameras, it is difficult if not impossible to record enough facial detail from an individual necessary to identify any specific person. Even with the current best available consumer technology, camera resolution is too poor to resolve a face that is only a few pixels tall. This technological limitation generates issues with human and element identification as well, though its impact is greatly reduced through multi-camera systems and cross-view validation.

7 FUTURE STEPS AND REFINEMENTS

Recording where people are within a site does not provide enough information alone towards understanding how a design is utilized. The data can be automatically analyzed for movement speed, groupings of people -vs- solitary individuals, movement modes (walking, running, bicycle, etc.), and direction of focus. Even this will not provide a clear enough picture to understand human behavior within a determined space. Behaviors are influenced by environmental factors, so temperature, humidity, wind speed, and air quality monitors are necessary. Site usage changes based on local events and issues, so context becomes vital in coding human action (is there a nearby parade, a sporting event, a shopping center, etc.) Lastly, demographics have serious import into use of space. Men and women are likely to act and react differently to spatial organization and events, as will different age or cultural groups.

Human tracking and movement data will be coupled with low cost and low power environmental sensors (currently under development) and contextual cues (building entries/exits, crosswalk zones, attracting or repulsing elements, seating and gathering areas, etc.) to determine how climate, programming, and off-site context influences on-site behavior. These sensors not only contribute to studies on human behavior and site programming, but they can form a larger network that evaluates environmental conditions on both micro and macro scales.

Once human and environmental factors can be recorded and correlated, non-human elements and accessories should be identified to generate a more nuanced picture of how people use the built environment (see figure 06). It isn’t enough to know that people are moving through a space, their mode of transportation and the speed at which they’re moving are vital in determining if a design is operating as intended or in discovering unintended consequences of site programming and arrangement. If software can identify whether people are typically carrying bags, are in groups or are solitary, are looking at their phones, or are walking a dog, not only will post-capture analysis be more informative and descriptive, but the accuracy of the human detection process should increase as well due to increased detail about an individual and decreased “visual noise” getting in the way of a valid identification.
Even with the best available current technology, the ability to operate identification, tracking, and projection systems in real-time are nowhere near possible. While this project aims to minimize processing time through code optimization, the most realistic way to deal with speed issues are to drop frames well below standard camera recording rates of 30 frames per second. A balance must be struck between feeding the system enough data to be accurate while determining the minimum amount of data necessary for data within an acceptable margin of error. The framerate itself is dictated automatically via a subprocess as described by Mohan et. al. based on a user determined level of acceptable accuracy and data validity. (Mohan et al., 2018) Additionally, the system must include a way to address common issues like reflection to avoid false identifiers from distorting the data. Currently, the research team has developed a trial solution to this issue, as exterior reflections are typically less vibrant or saturated than the person or object being reflected. This should result in a lower confidence re-ID result for the reflection, removing that ID from consideration.

Attempts have been made by others to use machine learning algorithms to determine age and gender of people as well, but even with perfect lighting conditions and full frame high resolution images, accuracy remains well below an acceptable threshold. Once reduced resolution images (based on a person’s distance from the recording camera) and sub-optimal view angles are added to the recording and identification process of outdoor environments and spaces, these levels of data capture remain outside of the realm of possibility.

Tracking and projection alone does not generate actionable data for developing future designs. Instead, designers must analyze the data themselves through traditional methods to generate lessons learned of actual movement and use of a site compared with original designed intent. Additionally, automated findings will be coupled with site user surveys, video stream analyses, and correlating use of space with external programming (sporting events, class or shift scheduling, lunch times, etc.) in order to develop a database of common human behaviors, typical use and use groups of site amenities, and influences of spatial arrangement on movement and lingering behavior. This database will then be used to populate artificial intelligence driven “actors” for use in simulating interventions into existing spaces, and testing efficiency, emergency access, and intensity of use for designs under development.
This process, along with similar systems, can in no way automate design professions into obsolescence. Instead, they work to distil and improve information describing the built environment to enhance understanding in hopes of improving future designs. While the ultimate goals of this project will take years to achieve, significant milestones along the way can provide meaningful contributions to landscape architectural discourse, analysis, and understanding of how our impacts on the built environment are used.

8 REFERENCES


LANDSCAPE ARCHITECTURE FOR HEALTH

Edited by Sungmin Lee & Shan Jiang
FINDING COMMON GROUND FOR AN INTERDISCIPLINARY APPROACH TO GREEN INFRASTRUCTURE

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1 ABSTRACT

Green infrastructure that supports physical activity integrates infrastructure such as parks, sidewalks, trails, bikeways, and street trees with water management areas, wildlife habitat areas, urban agriculture, utility rights of way, riparian corridors, and vacant lands. Multiple and concurrent uses in multifunctional landscapes often lack a holistic approach in planning. Differences in disciplinary perspectives and agency silos may limit boundaries for a more interdisciplinary framework to support physical activity. This paper examines the opportunities and limitations to an interdisciplinary approach to green infrastructure. Methods include 1) evaluation of operational definitions of green infrastructure from disciplinary perspectives, and 2) semi-structured interviews (n=44) with design professionals, agency personnel, and developers participating in the regulatory process in four US cities known for green infrastructure initiatives (Austin, TX; Denver, CO; Louisville, KY; and Portland, OR). Emergent patterns from analysis were compared among cities. Findings suggest a high awareness level of green infrastructure among respondents, yet descriptions and definitions of green infrastructure are multiple and varied depending upon disciplinary interests and responsibilities. Different municipal agencies prioritize particular aspects of green infrastructure over others. Interviewee responses reflect the distinction between agencies that manage land and those who do not with respect to green infrastructure planning and implementation. Respondents make a positive association between green infrastructure and physical activity as contributing to safe places where people can recreate. This research highlights the need to develop common terms and an interdisciplinary framework toward a holistic approach to green infrastructure that supports physical activity.

1.1 Keywords

Green infrastructure, ecological infrastructure, physical activity, interdisciplinary

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2 INTRODUCTION

Green infrastructure has emerged as a topic of significant interest in research and practice for its potential to address sustainable urban planning and design for ecological and human health. One of the benefits of green infrastructure (GI) lies in its application to a broad range of benefits (Mell 2009), including affordances for human physical activity. GI in support of physical activity combines public infrastructure components such as parks, sidewalks, trails, bikeways, utility rights of way and street trees on lands that concurrently provide for stormwater management, wildlife habitat, urban agriculture and riparian corridors. Multiple uses in shared space lack a holistic approach to planning and land management (Lovell and Taylor, 2013; Young and McPherson, 2013). Differing interests competing for land resources compound the critical shortage of public open space, often resulting in interrupted ecological patterns and processes, fragmenting urban open space, and adversely impacting urban ecosystems (Benedict and McMahon, 2006; 2002). In today’s human-dominated ecosystems, there is a challenge for multifunctional green space to support healthy environments that promote physical activity.

The synthesis of concepts into a holistic approach for landscape planning has advanced a GI agenda that commands an interdisciplinary approach. With origins in landscape ecology (Forman, 2002), GI has evolved as a multifunctional solution to support sustainable planning through collaborative partnerships at both municipal and project levels (Johnson et al., 2019). Rather than reliance on a single discipline, expertise from landscape architects, engineers, planners, ecologists, public health professionals, among others, contributes toward sustainable project solutions. In practice, functional landscape performance strategies incorporate improving water quality and accommodating treatment of stormwater runoff, affordances for physical activity, planning and policy development for land conservation, design and implementation of elements for climate mitigation, and provisions in support of wildlife habitat, among others. Calls to action for a multifaceted approach range from research to explore human health benefits of urban green space (Eisenmann et al., 2019), involvement of multiple disciplines to establish a common understanding of nature-based solutions (Nesshöver et al., 2017), integrating ecologists on design teams addressing urban green infrastructure (Felson et al., 2013), to the need for interdisciplinary continuing education for green infrastructure practitioners (Johnson et al., 2019). A demand for interdisciplinary notwithstanding, disciplinary perspectives and agency silos may limit the potential for a more interdisciplinary framework (Botchwey and Trowbridge, 2011; Coutts and Hahn, 2015) in the planning design of such areas in support of physical activity. Furthermore, the lack of a common definition may work to conflate the concept.

In this paper, I examine opportunities and limitations to an interdisciplinary approach to green infrastructure in a twofold approach. First, I examine GI concepts by comparing operational definitions from particular professional and disciplinary perspectives. Then I evaluate the results from individual perspectives of GI gathered in semi-structured interviews (n=44) with participants involved in various phases of project development. Interviews were conducted with design professionals, agency personnel and developers participating in the regulatory process at the project and municipal scale in four US cities known for green infrastructure initiatives – Austin, TX; Denver, CO; Louisville, KY; and Portland, OR.

I begin with a review of key constructs from green infrastructure literature, followed by the association of GI and physical activity. I then describe qualitative methods employed in the study. Findings provide a discussion of emergent patterns among the definitions contained in the body of literature and interviews, pinpointing varied and multiple descriptions and priorities discovered related to perceptions of GI. This study probes GI perceptions to better understand the common foundations needed for successful collaboration among different disciplines and professional interests. I conclude with recommendations in support of an interdisciplinary approach to green infrastructure.

2.1 Evolution of green infrastructure concepts

Sandström (2002) introduced the term ‘green infrastructure’ in his evaluation of urban greening in Sweden, yet the operationalization of the term in the United States dates back to the late nineteenth century. The work of landscape architect Frederick Law Olmsted provides salient examples in projects such as Boston’s Fens and Riverway, and Central Park in New York (Little, 1990; Rybczynski, 1999). Built on a site of tidal flats that was impacted by sewage and industrial effluent, the Fens and Riverway project formed a multi-functional landscape system in its construction of a wetland, interceptor sewer, parkway and streetcar line (Spirn, 2002). The system accommodated the movement of people, flow of water, flood prevention and
waste removal (38). Olmsted recognized the detriment to both physical and mental health in the artificial context of the urban environment. His organizing framework connected both cultural and ecological components of the community.

The integrative nature of green infrastructure invites multiple interpretations of its concepts. An appeal to a wide range of academic disciplines and practitioners offers a human-based approach to landscape planning and design, emanating from foundations in landscape ecology (Roe and Mell, 2013, p. 670). Concepts have been associated with sustainability in terms of the social, ecological, and economic benefits of urban green space (Tzoulas et al., 2007; Pauleit et al., 2011). Urban form and aesthetics of green infrastructure contribute to the image of a city and its quality of life (Pauleit et al., 2011; Lynch, 1981). Green space has been linked to human health for its positive influence toward psychosocial and physical well-being (Tzoulas et al., 2007; Young et al., 2014; Austin, 2014). As interest increases among disciplines to describe characteristics of green infrastructure for research and practice, understanding of disciplinary perspectives and perceived differences in application is needed to foster collaboration for effective solutions that promote ecological health and human wellness.

From a regulatory standpoint, water quality improvement mandates emanating from the Clean Water Act (CWA, 1972 and as amended) continues to drive infrastructure projects in the United States, greatly influencing land use decisions by prompting implementation of green solutions for stormwater management. Prior to CWA and its requirements, stormwater was considered disposable waste (Forman, 2002). Federal mandates provided the motivation to reconceptualize stormwater as “a resource to be managed, treated, and distributed for re-use where feasible” (86). Administered by the Environmental Protection Agency (EPA), requirements for green infrastructure processes and permits have had a significant impact on how green infrastructure is conceptualized, implemented and maintained. EPA employs the definition from CWA Section 502, as “…the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters” (EPA, 2019). From a stormwater management perspective, this legislation effectively elevated GI green infrastructure equal to conventional gray infrastructure (Wright, 2011). As cities adopt programs to address stormwater attenuation, water quality, and climate conditions, finite definitions may limit the capacity for multifunctional applications.

GI exists as both object and process. Benedict and McMahon (2006) outlined GI as an “interconnected network (GI as object) for green space that conserves natural ecosystem values and function and provides associated benefits to human populations”. In response to degradation of resources from conventional land development practices, a more holistic approach envisions a process to establish a balance between an ecological approach to development and conservation of natural resources. Such a framework aligns with municipal goals of working toward a sustainable, healthy city.

2.2 Linking green Infrastructure and human health

Austin (2014) focused on a thematic relationship between ecosystem and human health, developing a GI model composed of the interaction of three systems: ecosystem services, ecosystem health and human physical and psychological health. Classified in four groups, ecosystem services include provisioning services that combine with built, human and social capital to produce benefits such as food, water, timber, or other material or energy benefits; regulating services such as flood control, water purification, pest and climate control; cultural services that combine capital to provide recreation, aesthetic, or other cultural benefits; and supporting services that indirectly affect human well-being such as habitat for animals, soil formation, and carbon fixation (MEA, 2005; Costanza et al., 2011; Costanza et al., 1997). Austin’s perspective aligns with that of previous GI interpretations in its inclusion of components as system, ignoring isolated site scale elements. The expansion of GI concepts to incorporate representations of nature that intend to “restore and replicate” natural conditions prior to those of human manipulation (Coutts, 2016) further shifts the focus to positive health effects of nature in an urban environment and for opportunities to optimize the multifunctionality of ecological infrastructure. Multifunctionality contrasts with that of sustainability in its goal to consider ecological function, production and cultural roles on the same site (Lovell and Johnson, 2009), and its use of an ecosystem framework for planning to understand the landscape at multiple scales (Spurr, 1985). GI provides several health benefits in multifunctional landscapes—affordances for physical activity, mental wellbeing, mitigating noise and air pollution and addressing health risks associated with climate change (Scott et al., 2019). The ecosystem services and societal needs in
multifunctional landscapes operationalize both the concept and process for GI and its compatibility with physical activity.

2.3 Compatibility of physical activity and green infrastructure

Rather than a single purpose infrastructure of consumption, GI that supports physical activity often occurs in multifunctional landscapes. Physical activity refers to any bodily movement that results in the burning of calories (Casperson et al., 1985). Empirical studies associate physical activity and the built environment (Sallis et al., 2006). Policies, programs, and initiatives have been guided by the development of a National Physical Activity Plan in 2010 and as updated in 2016 (Roetert and Pate, 2019). Studies relating GI and physical activity reflected a positive relationship (77.55%) between green environments and increased levels of physical activity (Coutts and Hahn, 2015). Criteria for physical activity goal attainment fall within two categories: moderate intensity, such as walking or gardening, or vigorous—as in running or cycling. The Centers for Disease Control and Prevention (CDC) outlined types of physical activity recommended on a weekly basis to improve health in its Physical Activity Guidelines for Americans (US Department of Health and Human Services, 2018). Muscle strengthening, bone strengthening and aerobic activity recommendations offer a variety of ways in which to meet goals for improved health.

The configuration and connectivity of green infrastructure as a system of hubs, links and sites lend itself to a suitable environment for physical activity. The hubs serve as an anchor for the network, providing space for different types of natural processes, as well as an origin or destination for wildlife (Williamson, 2003). Links are corridors that provide connections between the hubs, connecting existing parks and preserves. River corridors may provide opportunities for recreation while maintaining a corridor for migration of wildlife. Sites are typically smaller in size than hubs, and may not have a direct connection to a larger overall system. The land uses and ecological functions of the hubs and links identify the level of human interaction appropriate for physical activity. Preserved lands and conservation corridors experience less human interaction, with recycled lands higher levels of human interaction. Areas generally targeted for engaging people in physical activity include parks and open space areas, and landscape linkages. Such linkages may include cultural and historic resource areas, streetscapes and recreational trails. This general concept of compatibility and occurrence is illustrated in Figure 1. In this network approach, multiple uses can be operationalized where compatible.

![Figure 1. Representative compatibility of green infrastructure and physical activity](image-url)
2.4 Interdisciplinary approach

With multiple disciplines gaining interest in research, the growing body of GI literature offers perspectives from differing vantage points. The majority of built projects completed in professional practice involve either parallel multidisciplinary or integrative interdisciplinary efforts. Levels of integration ascend from disciplinary (project in a single discipline), to multidisciplinary (project with multiple disciplinary goals), or interdisciplinary (project with several disciplines, working across boundaries with a common goal (Tress et al., 2006). One of the challenges in GI research stems from a lack of common understanding of terms used, and principles applied (Bryan et al., 2011). Integrative tactics may work to further GI in theory and practice. Current thinking on interdisciplinarity in GI must address two challenges to engage an advanced approach. The first involves the evolution of physical infrastructure as a holistic concept in terms of design, implementation, operations and maintenance (Grabowski et al., 2017). Additionally, political aspects of infrastructure must be acknowledged to minimize a “silo-based decision-making processes around single systems” (2). Combining multiple GI functions and activities requires an integrated approach.

Accommodating numerous dimensions and applications of GI demands expertise from multiple disciplines often in the same spatial area (Johnson et al., 2019). At a project scale, an urban park illustrates a case in point of the expertise and coordination required for successful implementation and functional operation of GI. Such efforts include; engineering in water quality improvement and stormwater management detention facilities and outfall to regional GI system, ecology in establishing wildlife habitat areas and determination of plant species for biofiltration of stormwater management areas, landscape architecture for design of recreation areas for physical activity and strategic placement of trees to provide shade for climate mitigation and human comfort. An interdisciplinary approach requires each project team member look beyond an individual specialty to integrate knowledge toward collective solutions that promote human health.

3 METHODS

Methods employed rely on two sources of data. The first involved collection of data relative to GI descriptions from current peer reviewed literature, and professional organizations incorporating green initiatives in policies and projects. Secondly, I conducted semi-structured interviews (n=44) with individuals from both private and public sectors, including personnel from local agencies and professional consulting firms between September 2013 and November 2014. The protocol consisted of questions relative to individual interpretation of GI, and its relationship to affordances for physical activity. The semi-structured format permitted the interview to stay focused yet allowed each participant to recount perceptions of GI based on project experiences. Participants were selected through a snowball sampling method (Morgan, 2008). Early respondents acted as sources in recommending other potential participants in each of the cities in the study-Austin, TX; Denver, CO; Louisville, KY; and Portland, OR. Each city was selected based on its strong reputation for being ‘green’ from several perspectives, 1) U.S. and Canada Green Cities Index; 2) American Fitness Index from American College of Sports Medicine—ranking the top 50 ‘fittest’ cities in the U.S. on an annual basis; 3) 25 Active Living by Design Partnerships (Brennan, et al., 2012)—an analysis of cross-sector multidisciplinary community partnerships funded through the Active Living by Design National Program; and 4) GI case studies (Rouse and Bunster-Osso, 2013) from the American Planning Association (APA) report on GI initiatives in U.S. cities. Participants in each city had worked on the same or similar multifunctional GI project(s) within subject jurisdiction. Interviews were conducted in person where feasible, or by phone and digitally recorded and transcribed.

Interview transcripts were coded using predetermined keywords, to identify emergent patterns through a process of recursive abstraction. Terms included green infrastructure, urban green space, ecological infrastructure, and physical activity. Table 1 provides a summary of the interview population.
Table 1. Summary of Interview Population

<table>
<thead>
<tr>
<th>INTERVIEW SETTING</th>
<th>Austin</th>
<th>Denver</th>
<th>Louisville</th>
<th>Portland</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total formal interviews (no. of persons)</td>
<td>14</td>
<td>13</td>
<td>9</td>
<td>8</td>
<td>44</td>
</tr>
<tr>
<td>Interviews conducted in person, recorded</td>
<td>13</td>
<td>9</td>
<td>8</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Interviews conducted by phone, recorded</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Interviews conducted in person, not recorded (by request from respondent)</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

LENGTH OF INTERVIEWS

<table>
<thead>
<tr>
<th>Length of Interviews</th>
<th>30-60 minutes</th>
<th>1-2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>13</td>
<td>31</td>
</tr>
<tr>
<td>Austin</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Denver</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Louisville</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Portland</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

RESPONDENTS

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Austin</th>
<th>Denver</th>
<th>Louisville</th>
<th>Portland</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents with municipal agency affiliations</td>
<td>10</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>Respondents with regional or county affiliations</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Respondents working in professional consulting business</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>

4 FINDINGS

Findings suggest a high awareness of green infrastructure and its importance. Responses varied concerning the disciplinary interests and participant responsibilities. Multiple definitions appear in green infrastructure literature, generally aligned with disciplinary interests. Differences lie in four areas: scale, national and local planning cultures and needs, disciplinary perspectives and types of research questions posed and professional practice interests. Findings reflect general perceptions found in GI literature and national (US) organizations, followed by results from semi-structured interviews. General perceptions pertaining to municipal and project scales are then compared to those documented in the interviews to inform a better understand contributions valued in an interdisciplinary approach to GI.

4.1. General perceptions of GI

Building on theoretical perspectives (Wright 2011), a synthesis of viewpoints links GI theory, policy, design and implementation (Table 2). Definitions highlight environmental and social issues particular to each source. Descriptive terms most cited include the concepts of scale, connectivity, multi-functionality and network. Aligning with disciplinary interests, planning sources focused on theoretical constructs (Ahern, 2007), linking theory and policy (Kambites and Owen, 2006) and linking theory and practice (Benedict and McMahon, 2006). Accordingly, the Green Infrastructure Community of Practice—composed of more than fifty professional organizations, public agencies, corporations, consulting firms, non-profit groups and government agencies—reflects its advocacy of national conservation policies in its GI definition. Professional organization websites offered meanings consistent with its respective goals and policies. The American Society of Landscape Architects (ASLA) relates its description to design and implementation of GI. ASLA recognizes a hierarchy of spatial scales, citing “interconnected networks at a national or regional level.”
Such networks comprise a balance of conservation and working landscapes—park systems, wildlife corridors, water management areas.

### Table 2. Representative Definitions of Green Infrastructure

<table>
<thead>
<tr>
<th>Definition</th>
<th>Source</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Green infrastructure is an emerging planning and design concept that is principally structured by a hybrid hydrological/drainage network, complementing and linking relict green areas with built infrastructure that provides ecological functions.”</td>
<td>(Ahern 2007, 267)</td>
<td>Green infrastructure theory</td>
</tr>
<tr>
<td>“Our nation’s natural life support system—an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks and other conservation lands; working farms, ranches and forests; and wilderness and other spaces that support native species, maintain natural ecological processes, sustain air and water resources, and contribute the health and quality of life for America’s communities and people.”</td>
<td>(Benedict and McMahon 2002, 12)</td>
<td>Linking theory and policy: Balancing conservation and working landscapes</td>
</tr>
<tr>
<td>“Green infrastructure is taken…to encompass connected networks of multifunctional, predominantly unbuilt, space that supports both ecological and social activities and processes.”</td>
<td>(Kambites and Owen 2006, 484)</td>
<td>Linking theory and policy</td>
</tr>
<tr>
<td>“Green infrastructure uses vegetation, soils and natural processes to manage water and create healthier urban environments.” Definition is subdivided into levels of applications for community (patchwork of areas for habitat and flood protection, improved air and water quality), and neighborhood (stormwater management systems that mimic nature by treating and storing water).</td>
<td>Environmental Protection Agency</td>
<td>Policy and Implementation: stormwater management, flood mitigation</td>
</tr>
<tr>
<td>Strategically planned and managed networks of natural lands, working landscapes, and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations.</td>
<td>Green Infrastructure Community of Practice</td>
<td>Policy and implementation: conservation</td>
</tr>
<tr>
<td>“Green infrastructure can be considered a conceptual framework for understanding the “valuable services nature provides the human environment.” At the national or regional level, interconnected networks of park systems and wildlife corridors preserve ecological function, manage water, provide wildlife habitat, and create a balance between built and natural environments. At the urban level, parks and urban forestry are central to reducing energy usage costs and creating clean, temperate air.”</td>
<td>American Society of Landscape Architects</td>
<td>Design and implementation</td>
</tr>
<tr>
<td>“Green infrastructure (GI) is the network of green spaces that protects natural ecosystems and provides associated benefits, such as clean water and air, to communities. For these reasons, its protection should be a high priority for local governments.”</td>
<td>American Planning Association</td>
<td>Policy and planning</td>
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</table>
At a local or project level, parks and urban forestry work to improve air quality and reduce energy costs.

The American Society of Civil Engineers (ASCE) website references the definition derived from Section 502 of the Clean Water Act (CWA). Similarly, the Environmental Protection Agency (EPA) relies on the CWA description, expanding it to include community and neighborhood scales. Concentration focuses on policy and implementation for stormwater management and flood mitigation. APA places its emphasis on a network of green spaces to protect natural ecosystems, while providing associated benefits of clean air and water. Recognizing GI importance across scales, APA targets the local government level in particular as a place to prioritize GI policies.

Across professional and disciplinary constructs, general perceptions acknowledge GI as a multi-faceted concept, emphasizing distinct elements at various scales, reflective of both ecological and social perspectives. Variations occur by disciplinary interest and areas of expertise in defining GI and describing its concepts.

### 4.2 Interview results

Participants generally expressed positive perceptions of GI in terms of its definitions, descriptions and interpretations, with a consensus that GI is a widely-held community value. In each city, interviewees recognized differences in levels of support and applications. Similar to differences in concepts described by professional organizations (Table 2) applications and approaches by discipline were also expressed.

Results reflected common themes across the four cities, yet some were in direct response to a particular location. In Austin, responses reflected the extended process of revising the land development code to better address GI. Denver participants drew upon a strong heritage of the city beautiful movement in its influence of the aesthetic qualities of GI. Confronted by a consent decree from EPA to improve the quality of stormwater runoff, Louisville interviewees shared their concern for residents to understand what GI means and how it should be operationalized. In Portland, known for its pioneering efforts in green stormwater management treatment, participants observed GI to be an integral part of the city’s urban fabric.

While perceptions associated with green infrastructure were generally positive, variations in approach were noted throughout the development process. One development agency director summarized his frustration in dealing with city agencies:

“You could probably get one hundred opinions on how they view [GI], depending on which department you are talking to.”

A public health official embraced the concept, but found limitations in GI:

“I don’t think folks know what the term means…it sounds very tree huggerish...there is a disconnect in understanding the importance to economic development and social capital.”

One reason for the lack of understanding was attributed to an insufficient number of examples demonstrating GI principles, particularly in outlying areas. Some embraced the term GI, others questioned its reach, stating that there was a disconnect between its inclusion in policy and its lack of activation on the ground.

Interviewee responses highlighted a distinction between agencies that managed lands and those who did not in green infrastructure planning and implementation. Agencies such as Parks and Recreation, Watershed and Environmental Protection assume responsibility for planning, land acquisition, implementation, and management of GI; planning and public health responses focused on policy issues related to GI. According to one planner,

“we are setting the stage for it [GI] to occur and people seem attracted.”

Policies being put in place for GI were well received, yet departments were sometimes competing for the same resources. A development agency staff member summarized the need for collaboration among city departments by stating,

“...it’s time we connect the dots.”

Responses relating GI to physical activity were generally favorable, acknowledging shared benefits. Correlation between mental health and natural areas were cited, with an emphasis placed on meeting multiple goals concurrently. Acknowledgement was given to the advancement of GI to provide a safe, inviting place for people to participate in physical activity. According to one urban planner,

“Places can be co-located so that they share benefits: trees for shade in a walkable environment.”
A municipal bicycle coordinator explained the association as one providing capacity for the other in that green infrastructure provides the facility necessary to participate in physical activity. One landscape architect summarized the relationship, offering,

“Physical activity needs to be completely interwoven with green infrastructure…I don’t think you can have good physical activity without some amount of green infrastructure.”

Principles of GI were seen to be congruent to goals for physical activity, citing connectivity and a full range of activities where compatible within a designated space.

<table>
<thead>
<tr>
<th>Table 3. Summary of Major Findings by Theme</th>
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<tr>
<td><strong>Emergent Theme</strong></td>
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<tr>
<td>Positive Perceptions</td>
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<td></td>
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<tr>
<td>Negative Perceptions or Need for Improvement</td>
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When comparing the results from the definitions found in peer reviewed literature and in professional organizations with those obtained from the interviews, an attempt to align responses was limited to the range of responses provided by participants. The interview protocol focused on perceptions of GI and its compatibility with physical activity; categorization by keyword was not a one to one match of response to each predetermined keyword or code. Rather, the interviews informed interpretations of GI by participants relating experiences vantage points relative specific professional roles and task responsibilities. The process of recursive extraction was effective in teasing out emergent themes, but less so than a one to one alignment of terms from the two data sources. The definitions from professional organizations appear consistent with interview responses, suggesting a disciplinary orientation that generally aligns with those in GI practice. Emergent themes collated evaluation of common responses from all participants. A direct city to city comparison did not allow for differences in governmental structure and organization.
5 CONCLUSION

The elements and characteristics of GI contribute to a comprehensive ecological framework that provides a wide range of benefits for human health, including affordances for physical activity. Findings suggest a positive perception of GI, with definitions and concepts varying by individual and collective interests. A favorable awareness of GI as it relates to physical activity was consistent among participants, as was a concern for ecological health. Multiple and differing definitions, however, confound a collaborative approach. Varied interpretations were found between participants responsible for GI land acquisition and management than those who did not, resulting in a power struggle among agencies. An engineering perspective was driven by compliance with federal regulations for stormwater management treatment that limited definition and interpretation of concepts. In recent years, however, an expanding body of literature by topic and discipline represents the growing interest in GI and its multiple aspects. GI calls for an integrative approach to realize its potential in an urban ecological framework.

This research highlights the need to develop common terms and an interdisciplinary framework for GI. With a multiplicity of functions, GI provides a reason for several disciplines to engage—landscape architecture, urban design, planning, engineering, ecology, public health, among others—to seek environmentally sensitive and creative solutions in planning, design, implementation and long-term care. Additional skills and practices are needed to integrate interdisciplinary knowledge. Interdisciplinary skills must be introduced in university curricula through studios and seminars, and followed with continuing education for working professionals. Interdisciplinary efforts include the establishment of a working vocabulary of key terms to better understand differing viewpoints to advance GI in both research and practice. Policymakers need to be informed by those who design and manage GI in terms of what will work and what may not, so that broad range visions may come to fruition. Interdisciplinary training in both academy and practice mandates an understanding of multiple viewpoints and the establishment of common terms.
6 REFERENCES


100 Years of CELA: Past, Present, and Future

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THE IDEOLOGY OF CRITICAL REGIONALISM AS A TEACHING AND DESIGN RESOURCE FOR THE NEXT 100 YEARS OF CELA

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1 ABSTRACT

Since its introduction as a term by Alexander Tzonis and Liane Lefaivre (Tzonis and Lefaivre, 1981), Critical Regionalism has emerged as a significant ideology in contemporary landscape architectural discourse worldwide that continues to merit closer attention as a framework for creative regional design. Kristine Woolsey wrote that the only constant in the process of Critical Regionalism is the quality of the ideological position of the architect that evolves over time through practice, experience, and the international debate of the profession (Woolsey, 1991). Looking towards the next 100 years of CELA, it is worth reflecting on where we are ideologically as a profession in relation to Critical Regionalism.

Critical Regionalism can be broadly summarized as an embrace of contemporary and historical world culture as an indispensable part of a creative and expressive regionalist design process, a desire to provoke both intellectual (critical thinking) and sensual reactions to a design by the end user, and a broadening of the experience intended by design to embrace the importance of non-visual experience. Personal ideological positions related to Critical Regionalism are informed and modified by influences of region, contemporary culture, and aesthetic components such as environmental psychology, cultural rules, personal growth and creativity, and the appropriation of regional ecology and environmental forces.

The author has used research into Critical Regionalism as a guiding ideology for both practice, research, and education for the past 25 years. This research is informed by continuing and extensive literature reviews, interviews with dozens of regionalist practitioners throughout The United States, criticism and documentation of regionalist built projects in 11 countries, and the use of Critical Regionalism as the overarching theme of a graduate landscape architecture design studio taught yearly since 2004.

This essay proposes a future viability of a Critical Regionalism that is resilient, continuously adaptive, open to continuing influences from throughout the world and made relevant by the creativity of individual designers that anchor it in the present.

1.1 Keywords

Critical Regionalism, landscape aesthetics, postmodernism, regionalism, creative landscape architecture

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2 INTRODUCTION

Critical Regionalism is a term applied to regionalist trends that have been evolving since regionalism became an important feature of the design debate at the beginning of the modernist period. As with other productive areas of intellectual ferment, Critical Regionalism was a logical culmination of the best ideas by the most committed writers dedicated to the greatest good for the greatest number of people—the type of thinking that funnels design insights into a resonant relationship with each other at a particular point in time.

Critical Regionalism is a flexible and adaptable ideological framework and aesthetic construct that can be used to guide underlying design methodologies—an ideology that will productively produce future viable landscape architects and landscape designs. Landscape architects are always thinking ahead as we project our design ideas first mentally and then physically onto the landscape. We work to make our designs as durable and adaptable as we can to provide value for our clients and to integrate our visions with the end-users who lead their lives in our creations.

The design fashions and the barrage of technical innovations of the day force us to seek verities that will guide our work into a future that is only partially knowable at best. As educators, the problem is compounded. We are teaching future designers of future landscapes. When considering the long career of someone graduating in their early twenties and the projected longevity of the designs that they will participate in over the course of a career, it is not unreasonable to start thinking in terms of the next 100 years of CELA—even as we look back at the first 100.

A hallmark of the theory of Critical Regionalism is its constant reinvention. This is true for the theory and for the original principles as they are clarified and amplified to respond to the priorities of various design disciplines. It is also true for new priorities that layer onto the many design parameters that have created successful landscapes of the past. This paper will discuss some of the key original elements of Critical Regionalism considering current and speculative future priorities of landscape architects, a nuanced evolution, in some cases, diverging from the ideas of architects and historians who originally developed the term.

One of the most rewarding things concerning research into regionalism is the opportunity it affords to inform and to accelerate our evolution as designers and as educators. Many of the people who write about regionalism have a deep commitment to creating “habitat for humanity” that facilitates a future viable flourishing for both people and the bio regions in which we dwell. Tracing the evolution and persistence of the ideas of regionalists breeds confidence for projecting the evolution of their core principles forward to our students and to our clients as adaptable verities that are worthy of perpetual renewal.

Critical Regionalism can be broadly summarized into a few concepts that offer profound insights when their ramifications are applied to the planning, design and development of regions. These ideas include an embrace of contemporary and historical world culture as an indispensable part of a creative and expressive regionalist design process, a desire to provoke both intellectual (critical thinking) and sensual reactions to a design by the end user, and a broadening of the experience intended by design to embrace the importance of non-visual experience. These and many more elements of the theories of Critical Regionalism will be explained and expanded in this essay.

3 TRACING REGIONALISM THEORY WITH THE ADVENT OF CELA IN 1920

The most influential modern regionalist thinking can be traced back to roughly the time of the founding of CELA in the 1920s. This was the time when the machine age was beginning to be absorbed as a design ethos and not just as a practical reality of industrial development. This paper is primarily intended to look forward, but it is important to trace a few of the important building blocks that led to Critical Regionalism. Just as historical building styles can be fodder for contemporary creative regional designs, the ideological building blocks inform a contemporary ideology of regionalism that embraces both the verities from the past, and potential future priorities of landscape architects and architects.

The landscape architect and planner Patrick Geddes (1854-1932) is a seminal figure in the modern evolution of the idea of a region as the most logical repository for connecting all of the human
activities that unite what he saw as the two opposite poles of rural and city life. He was one of the celebrated founding fathers of the modern town planning movement, the inventor of 'conservative surgery', (careful editing and adaptive reuse of historical districts) and the creator of the term 'conurbation', (groups of cities now referred to as metropolitan areas) used the tri-partite structure of place, work, and folk: the geographical, the historical, and the spiritual to understand the evolution of cities (Welter, 2002). This contemporary exigency was presciently articulated by Patrick Geddes in 1915 when he related the persistence of culture to the ability of plants to survive through adversity from one growing season to another (perennation).

“Our record of local history and achievement is...a perpetual renewal of certain recognizable elements... It is of the very essence of our growing sociological re-interpretation of the past to see its essential life as continuous to the present... and so to maintain the perennation of culture, the immortality of the social soul” (Geddes quoted in Welter, 2002, p.47).

His interest in typologies led him in 1909 to develop the idea of the “valley section” that follows a river course from its inception in the mountains to the sea. The section connected the various topographic regions and demonstrated the interconnected occupations that benefit from regional relationships, such as the miners and woodsmen in the mountains, the hunters and the shepherds in the grassy lower hillsides, and the farmers and fishermen in the valleys closer to the sea. The occupations join together to form a cooperative society of people in the same way that communities of plants form mutually beneficial relationships (Welter, 2002, p. 60). Geddes' regional ideas were originally inspired by regional plant associations which he studied during his academic tenure as a biologist. This conceptual connection of biological and cultural organization has found continuing resonance with regionalist thinking. It has elevated the influence of Geddes in contemporary discourse beyond his peers, and his historical influence with such regionalist luminaries as Lewis Mumford.

The American historian, sociologist, philosopher of technology, and literary critic Lewis Mumford (1895-1990) was a strong supporter of Geddes' ideas and equally influential in the development of Critical Regionalism theory. He believed that we should never consider regional ideas without mentally “adding to it the idea of the universal”—a prime tenet of Critical Regionalism (Mumford, 1947, p. 101). The universal, both contemporary and historic, is seen as an indispensable tool for regionalist thinking in order to gain the perspective necessary to understand and develop the best ideas that will help a region celebrate itself.

Mumford criticized the pervasive functionalism prevalent during the modernist period for making engineering an end in itself rather than a foundation for a more humanized form by stating that “the brotherhood of the machine is not a substitute for the brotherhood of people” (Mumford, 1952, p. 86). Unlike many of the contemporary modernists of his day, Mumford always included the local in conjunction with the universal in his design theory and criticism. According to Mumford, by rejecting traditional architecture, modernists “... also rejected the human needs, interests, sentiments, and values that must be given full play in every complete structure” (Mumford, 1952, p. 86).

Aldo Leopold (1887-1948) is a seminal figure in the ongoing evolution of environmental and ecological thinking in the United States and more important to the regionalist thinking of landscape architects than to the early iterations of the theory of Critical Regionalism as espoused by architects. Leopold was very well known as a professor during his lifetime but is best known today for his work and writing on natural aesthetics, environmental ethics, wildlife management, wilderness preservation, conservation economics, ecology, the land ethic, and agriculture.

His career as a thoughtful professional gradually evolved from its beginnings in forestry as he looked more and more deeply into the root causes of the environmental and ecological dysfunction that he saw around the world in the early 20th century. His huge influential work, _A Sand County Almanac_ (published posthumously in 1949), shows us that most of the issues, aesthetics, and ethics of land use that are still considered environmentally and ecologically forward thinking have been with us at least since the Great Depression era of the 20th century. It also makes clear that these imperatives are another area that requires constant nurturing and renewal by thoughtful design professionals and educators today. As Aldo Leopold wrote, "We can be ethical only in relation to something we can see, feel, understand, love, or otherwise have faith in" (Leopold, 1986, p. 251). Leopold understood that the "death
of nature”, which began with the enlightenment and continues to this day with the ethos and professional practice of many design professionals, can be addressed by increasing both ecological and aesthetic appreciation of plants and other biota. Critical Regionalism in landscape architecture, particularly as applied to planting design, can be a very productive tool in that process as the human relationship to all biota and the resulting reconceptualized landscape designs and methodologies are added to a new definition of Critical Regionalism.

Another seminal figure, involved in the evolution of the experiential aesthetics that are an important component of Critical Regionalism, is John Dewey (1859-1952), a philosopher, educator, and founder of The New School for Social Research. Dewey described aesthetic experience as a combination of desire and thought, the sensuous and the intellectual. He was an early proponent of the tri-partite aesthetic construct of environmental psychology (which he referred to as human nature), cultural influences, and personal growth and creativity. These three key elements of landscape aesthetics were used very compellingly by Steven Bourassa in his book The Aesthetics of Landscape to shift the primary focus of Critical Regionalism away from its original concentration on form and to properly situate it within experiential landscape aesthetics (Bourassa, 1991).

Dewey summarizes experiential aesthetics as the enhancement and intensification (emphasis mine) of everyday experience. This broad and comprehensive definition is meant to encompass both sensory and intellectual components, key elements of Critical Regionalism. The intellectual engenders a prolonged contemplation of the object as the object triggers ideas that are beyond the landscape, or other design, that is readily perceptible. The sensuous aspects, however, facilitate an immediate and powerful emotional engagement and provide the psychological benefits of bringing people mentally into the present (Meyer, 2016, pp. 136-137).3

Dewey’s ideas are also important for an understanding of how the creativity encouraged by Critical Regionalism moves culture forward through the dissemination of innovation. The natural fit of a creative designer and a culture that is ‘ripe’ for appropriation of his ideas was described by Dewey and is a key issue in Critical Regionalism.

Dewey divides artistic innovation into three stages:

1. Experimentation that is generally condemned by the public. Ricoeur describes this initial stage as bringing forth “something which will be shocking and bewildering at first” (Ricoeur, 1965, p. 51);
2. The new style is used to modify previous styles and so is given a “classical” validity; and,
3. “Technique is borrowed without the urgent experience that at first evoked it. The academic and the eclectic result” (Dewey, 1980, p. 42).

The third stage above is the one that is most relevant to the constant reinvention that is a salient component of Critical Regionalism. This reinvention is as important to the original innovators as it is to the designers under their sphere of influence or to the culture that stays vital because it is in a constant process of renewal. The continued flood of new ideas created by a sensitized experience of region and the transformation of regional influences into creative design solutions helps prevent designers from repeating themselves and becoming creatively “switched off.”

By the first third of the 20th century, the trajectory was set for what would evolve into Critical Regionalism in the early 1980s. Many influential writers amplified and reinvented the ideas about region and districts, combining the local and the universals, bioregions and ecology and experiential aesthetics, and how all of these relate to environmental design in a rapidly developing and commodifying world. The early principles of Critical Regionalism are a snapshot in time created by people with specific professional biases and the trajectory of these ideas has continued and will continue far into the future. It is productive, therefore, to consider in greater detail the principles of Critical Regionalism and how adaptable they might be to future circumstances in the next 100 years of CELA.

“History is not ended with our historian’s “periods”; the world is ever beginning anew, each community with it, each town and quarter…. How then shall we continue the past tradition into the opening future?” (Patrick Geddes quoted in Welter, 2002, p. 82).
4 DEFINING CRITICAL REGIONALISM

The contemporary use of the term “Critical Regionalism” with regard to architecture and planning was first introduced by Alexander Tzonis and Liane Lefaivre in “The Grid and the Pathway” in Architecture in Greece (Tzonis, 1981). Critical Regionalism grew out of the need to find a way for rooted, regional cultures in developing countries to adapt to rapid economic progress and the resulting foreign, social, and technological influences, without dissipating “the cultural resources which have made the great civilizations of the past” (Frampton, 1983, p. 148).

More recent theory applies the ideology of Critical Regionalism to a wider variety of geographical areas, especially areas in advanced countries that have also become culturally dissipated. Rather than preserving a rooted culture, the problem in developed countries is to mitigate the sense of cultural estrangement engendered by the homogenous, “placeless,” endless megalopolitan developments built during and since the era of modernism and the international style, functionalism, and the excesses of consumer culture. Melvin M. Webber famously called this “community without propinquity” [kinship] or the non-place urban realm (Frampton, 1987 quoted in Canizaro, 2007, p. 382). The influential 20th century philosopher Paul Ricoeur summed up the problem succinctly: “There is the paradox: how to become modern and return to sources; how to revive an old dormant civilization and take part in universal civilization (Ricoeur, 1965. P. 47).”

Critics of Critical Regionalism sometimes wonder if Critical Regionalism is so dialectic, personal, and broadly applicable that it no longer has any meaning or can hold together as a theory of process. The contention here is that Critical Regionalism is not a theory of process, but rather it is an ideology—a philosophical posture and habit of mind—that sets the priorities for a variety of subsequent design methodologies. To hold Critical Regionalism together as an ideology, designers must uncover within themselves the elements that are most aesthetically resonant and practical, thereby establishing the continuing relevance of the theory to their professional practice.

This research focuses on the theory of Critical Regionalism most relevant to landscape architects and other designers and steers clear of most of the Marxist criticism that is such an important component of long-time architecture professor and writer Kenneth Frampton’s early ideas on the subject. If the theory is to be relevant in the United States and many other developed countries, it must be in concert with both our democratic and social institutions and our capitalist system of landscape development. A focus on aesthetic experience puts the rationale for Critical Regionalism into a proper context for working designers. The theory is not primarily subversive, political, or even economic, but rather a very practical way to encourage the creation of landscape designs that are creative, expressive, and that move culture forward in a positive direction.

Much of the early writing about Critical Regionalism was done by architects and historians so it is not surprising that the ideology of landscape architects was often minimized. Translating the tenets and methods of Critical Regionalism into the sensibilities of landscape architects provides a window into the flexibility of the concepts as we speculate on their future viability.

5 ELEMENTS OF CRITICAL REGIONALISM

The theories of Critical Regionalism have been emerging and transforming since their inception in a reconceptualization process that is a hallmark of the theory itself. Writings about Critical Regionalism have shown a great diversity of opinion as to what elements constitute a critical regionalist design. The elements listed below were uncovered in my first foray into Critical Regionalism research in the mid-1990s. The definitions of these elements have evolved in the intervening decades but their relevance as a framework for the ideology of design has stood the test of time.

1. A critique of the perceived excesses of modernism, functionalism, and enlightenment rationality;
2. A critique of the romantic, picturesque, and commercial approaches to regionalism;
3. An embrace of the postmodern emphasis on place, rather than primarily forms and space;
4. An embrace of regionally defining physical, tactile, environmental/ecological, social and cultural elements;
5. a desire to create designs that balance a celebration of regional character with the influences of world culture;
6. a striving to make the landscape an object for intellectual contemplation as well as sensual pleasure;
7. a distrust of grand design solutions and an embrace of incrementalism; and,
8. a desire to create an imageable bounded place where the excesses of endless megalopolitan development and a consumer driven culture are resisted (Hopman, 1998, p. 11).

The detailed descriptions of elements of Critical Regionalism that follows is taken from a wide variety of writers, primarily from short essays. These elements and others are greatly amplified and illustrated with many successful projects in Hopman, D (forthcoming).

5.1 The excesses of modernism, functionalism, and enlightenment rationality

Despite our being firmly rooted in the postmodern age, these issues continue to be paramount. Technology has with its rapid and increasingly facile ability to reproduce landscapes and buildings both visually and physically and its inevitable connection to efficiency and profit, continued to push development away from the psychological anchors and creative potential of regional modifiers. The resistance to global modernism and functionalism has moved in some very productive and unforeseen directions since the early 1980s. For example, the so called “Vancouver Style” has demonstrated that the sense of place can be defined by low buildings, other experiential streetscape elements, and carefully calibrated distant sight lines, even as the tall glass curtain wall buildings loom almost invisibly, blocked by lower pedestrian-scale facades. This focus on landscape as an increasingly important tenet of district and regional character shifts some of the focus of Critical Regionalism away from the stylistic debate in architecture that helped trigger the idea.

It is also imperative that designers resist the functionalism that is stripped of aesthetic experience in any future Critical Regionalism over the coming century. People that don’t understand or sufficiently value environmental experience will continue to find new ways to denigrate the poetics of design and elevate other functional priorities such as environmental performance, programing and human use, increasingly sophisticated algorithmic design, or pure economic factors. Critical Regionalism is an ideology that fights back and makes sure that this is never an either-or proposition. As Elizabeth Meyer has written:

“We are sustained by reducing, editing, and doing less harmful things. But we are also sustained through abundance, wonder and beauty. The performance of a landscape’s appearance and the experience of beauty should have as much currency in debates…as the performance of its ecological systems” (Meyer, 2016, p. 147).

5.2 The romantic, picturesque, and commercial approaches to regionalism

Romantic regionalism grew out of the picturesque art tradition of the late nineteenth century and is one of the most pervasive elements of worldwide capitalism. The term picturesque was first applied to landscape paintings, then romantic gardens, and finally to the architecture set in picturesque landscapes. The romantic regionalism tradition can be prominently seen today in the tourist industry where such interests as “unspoiled nature, ancient history, distant lands, and exotic peoples” have captured the public imagination and have been used as thematic lures for countless commercial projects (Wilson, 1997, p. 111).

Many influential writers have addressed romantic regionalism as a pervasive component of contemporary culture to be resisted. Tzonis and Lefaivre refer to this type of regionalism as commercial regionalism, which they criticize as “pornography of sorts,” due to the emphasis on emotion over rationality and the ease with which one can become totally possessed by it in a purely sensual way. It is “the professional architecture of the genius commerciali of tourism and entertainment which…offers to alleviate the pain of atopy and anomy of contemporary life in as-if settings, simulacra of places, facades, masks of environments offering the illusion of participation, …of a feeling of ‘being there’ (Tzonis & Lefaivre, 2002, p. 18).”  The writer, farmer and teacher Wendell Berry calls it a “regionalism based on
condescension, which specializes in the quaint and the eccentric and the picturesque (Berry, 1972, p. 37).” Paul Ricoeur, professor and one of the most influential philosophers of the 20th century, calls the spread of pure consumer culture and its manifestation in design as “absolute nihilism in the triumph of comfort. The whole of mankind becomes a kind of imaginary museum: where shall we go this weekend—visit the Angkor ruins or take a stroll in the Tivoli of Copenhagen” (Ricoeur, 1965, p. 48)? The Finish architect and former professor Juhani Palasmaa echoes this sentiment by asking if the worldwide move to a consumerist culture is dooming our culture to “lose all its authenticity and turn into a planetary waxworks show…a naively shallow architectural souvenir” (Palasmaa, 1988, p. 133).

The ideology, rigor, and creativity of design consultants are often better predictors of a design team’s ability to transcend these problems, rather than just the fact that a project has a commercial imperative. Good design is possible in any type of landscape and architecture, including commercially driven design, and not just for the boutique clients with the loftiest aesthetic aspirations. The tenets of Critical Regionalism are an ideology that helps designers work through these contradictions and produce designs that will meet both the narrowly commercial and the broader socio-cultural imperatives of development well into the future with appropriate rigor and integrity.

5.3 The postmodern emphasis on place, rather than primarily forms and space

![Figure 1. Bloedel Reserve on Bainbridge Island near Seattle provokes critical thinking by juxtaposing intense and carefully maintained expressions of local nature with rigorously crafted geometry.](image)

Buildings, other cultural artifacts, un-designed areas, and people contribute to a “sense of place.” This is a term that is often applied by designers in many professions as an important criterion of beauty or aesthetics. Geographer John Agnew describes place as “the local structure of feeling” that pervades being in a particular place (Moore, 2005, p. 435). The structure of feeling is another way of describing experiential aesthetics. Other people would refer to it as the character of a place or even as the “vibe.” Professor of architecture (now emeritus) Steven Moore proposed a conception of place as “a dynamic process that links humans and nonhumans in space at a variety of scales (Ibid).” The scale that is most important to the ideology of Critical Regionalism is a small enough area that the human poetics of space are experienced directly. The scale of direct experience can reflect and trigger thinking about larger areas than those that are immediately perceptible. However, it is the direct experience that is the most important focus of Critical Regionalism.

As the ever-increasing billions of humans on earth exert greater and greater control of the environment, educated resistance to physical and cultural entropy should continue to rise as a priority of
design. Using both natural and cultural history as key building blocks in the design process will both keep the design process fresh for designers in diverse locations, and also keep the landscape and structures emotionally accessible to inhabitants. This ethos is especially important with the advent of advanced manufacturing, artificial intelligence and the ever-accelerating waves of engineered design tools and components. Cognitive psychologist Daniel Levitin wrote that “in 2011, Americans took in five times as much information as they did in 1986”, a symptom of what has been called “the quickening” that is accelerating and outstripping our ability to adjust (quoted in Spirn, 2016, p. 66). The pace of change and the sense of place that facilitate appropriation by a local community will need to be very conscious parameters for designers and decision makers when pursuing large-scale parametric interventions. The acceleration of change will require continuing psychological research for us to understand how we can keep designs both innovative and psychologically accessible. We will also need to increase the focus on celebrating particular geographical locations with their attendant population groups, biota, weather, topography etc.—a celebration that goes beyond creating a completely or primarily invented or transferred experience of place.

5.4 Regionally defining, tactile, environmental/ecological, social and cultural elements

Creative observation and understanding of both visual and non-visual regional signifiers are indispensable elements of a design process that leads to Critical Regionalism. A discussion of this complex topic is beyond the scope of this paper. A more in-depth understanding of regions, creative seeing, and non-visual design cues are explored in Hopman, D (forthcoming).

5.5 Embracing a celebration of regional character with influences of world culture

World culture is often referred to by writers on Critical Regionalism as Universal Civilization. Paul Ricoeur, professor and one of the most influential philosophers of the 20th century, describes universal civilization as both the scientific thinking that will lead people with similar intellectual backgrounds to the same conclusions and to technical expertise that diffuses continually throughout the world to all people and to all places.

“Mankind as a whole is on the brink of a single world civilization representing at once a gigantic progress for everyone and an overwhelming task of survival and adapting our cultural heritage to this new setting. To some extent, and in varying ways, everyone experiences the tension between the necessity for the free access to progress and, on the other hand, the exigency of safeguarding our heritage” (Ricoeur, 1965, p.43).

Places are moving towards a universal economy and common way of living involving such items as transportation, human relationships, comfort, leisure, and news programming. Designers have an opportunity to bring lessons learned from the excesses of consumer culture in developed economies to developing areas. One of these lessons is the imperative to celebrate the vastness and richness of cultural diversity that enhances human existence by pushing back hard against cultural homogenization.

“As with a human being, every culture must both be itself and transcend itself: it must make the most of its limitations and must pass beyond them: it must be open to fresh experience and yet it must maintain its integrity. In no other art is that process more sharply defined than in architecture” (Mumford, 1941, p. 101).

The quote above from Lewis Mumford shows his belief that it was impossible to produce a design that was in tune with the needs of its time by exaggerating “the local at the expense of the universal (quoted in Alofsin, 2005, p.371).” He stressed that it was much more important to study and learn the ideas and conditions that were the genesis for historical forms than merely to imitate those forms. This understanding will lead to new creative design solutions that address and contribute to continually evolving contemporary conditions.
In Critical Regionalism practice, universal civilization is not primarily seen as an alien force proceeding without our control or something that is being done to us. It is a continually transforming design parameter, based on the ethos of the day, which provides an important global experiential frame of reference for travelers and migrants, and unites all people on the planet. At the same time, however, the most important theorists of Critical Regionalism recognize that significant opportunities for regional expression are frequently lost when technology (universal civilization) replaces older regional responses to building technique, climate control, expressions of local ecology, etc.

One of the difficulties in defining modern technology in terms of landscape design is that the most advanced and forward thinking technical solutions can turn out to be a return to the natural systems that were in place before they were replaced by ‘modern’ mechanical systems. For example, a concrete culvert might be removed and replaced with “softer” vegetative erosion and flood control measures, or bioremediation could replace a complex mechanical system of sewage treatment in the postmodern search for future viable design and infrastructure solutions. Another example is ethnobotanists who study historical agricultural practices that created productive farms without irrigation in areas, such as Spain, with very low rainfall. The forms and techniques of these vernacular technical solutions can then become ‘contemporary technology’ as sustainable responses to the imperative to reduce the carbon footprint of agriculture and address changing rainfall patterns caused by global warming and the climate crisis. An ideology that continually questions the ideal balance of local and universal influences is one of the strongest arguments for using Critical Regionalism as an overarching framework for future design philosophies.

5.6 Designing landscapes for intellectual contemplation as well as sensual pleasure

John Dewey describes aesthetic experience as a combination of desire and thought, the sensuous and the intellectual. The intellectual engenders a prolonged contemplation of the object as the object triggers ideas that are beyond the landscape, or other design, that is readily perceptible. The sensuous aspects, however, facilitate an immediate and powerful emotional engagement and provide the benefits of bringing people into the present (Meyer, 2016, pp. 136-137). Regional elements that trigger emotional connections will fall into the sensuous, the intellectual, or even the subconscious categories of perception. Critical Regionalism is an ideology that moves design thinking towards having “the substantial cake of reason while also enjoying the sensuous pleasure of eating it” (Dewey, 1980, p. 258). The theory and design tools of Critical Regionalism such as defamiliarization and creative regional perception can be used to design what Anne Whiston Spirn refers to as the New Aesthetics “that encompasses both nature and culture, that embodies function, sensory perception, and symbolic meaning, and embraces both the making of things and places and sensing, using, and contemplating them” (Spirn, 1988, p. 108).

It is easy to see how new and currently underappreciated priorities may arise in the future. When Critical Regionalism was first articulated as a term in the 1980s, some of the most pressing emergent issues of our time were mostly absent from consideration by most landscape architects. The influence on the design methodology of global warming and the climate crisis, the increasing imperative to include the ideas and desires of shifting populations groups into the design process (De la Pena et al., eds., 2017), the general acknowledgement that we are now in the 6th mass extinction and that, like global warming, it is caused by global human land use practices, and the new challenges faced by designers as they address advanced manufacturing and artificial intelligence, are examples of more recent imperatives that can benefit from a design approach that uses the landscape to educate and to provoke critical thinking about region.

5.61 Defamiliarization

“All product that is not of the very ‘easy’ sort exhibits dislocations and dissociations of what is usually connected... It brings to definite perception values that are concealed in ordinary experience because of habituation. Ordinary prepossession must be broken through if the degree of energy required for an aesthetic experience is to be evoked” (Dewey, 1980, p. 173).
Critical thinking is triggered within a Critical Regionalism ideology by integrating an appropriate level of defamiliarization into designs that makes future cognitive goals accessible to users of buildings and landscapes. Defamiliarization is one of the prime tenets of Critical Regionalism and also one that needs a nuanced explanation when applied to landscape aesthetics. For a landscape to provoke critical thinking, it must first be noticed. Designers using Critical Regionalism principles strive to create thought provoking perceptions of and reflections about landscapes through a heightened or altered psychological sensibility in the process called defamiliarization. The term is borrowed from the study of structures of consciousness as experienced from the first-person point of view called phenomenology. In phenomenology, as in Critical Regionalism, attention is directed toward some object experienced by virtue of its content or meaning which represents the object (Smith, 2013). From a phenomenological perspective, defamiliarization is a way of breaking through what is referred to as “natural attitude”—the unnoticed and unquestioned acceptance of the things and experiences of daily living. The landscape becomes, through defamiliarization, a focus of attention and an object for reflective analysis (Seamon, 1991).

The American literary critic and Marxist theorist Fredric Jameson advocates using defamiliarization as “a way of restoring conscious experience, of breaking through deadening and mechanical habits of conduct, and allowing us to be reborn to the world in its existential freshness and horror (Jameson quoted in Castro, 1991, p.208).” Does this mean that a Critical Regionalism landscape design needs to be extreme enough to provoke the existential “horror” of human existence as Jameson suggests? I propose that the ethos of landscape architecture is more aligned with the creation of softer defamiliarized elements within regional contexts and established neighborhood patterns, and not primarily to make the project stand out for purely artistic, or philosophical reasons that are overly idiosyncratic to the designer.

If a landscape is a creative act—an original landscape—it will be noticed, experienced and understood on its own terms in the present, rather than evoking a past experience—an experience that has been mentally processed to the point that it is no longer a subject of attention or of interest for critical reflection. By consciously making the landscape perceptible through defamiliarization, Critical Regionalism allows the thinking and imagination unique to every person to be brought to bear on the design. The echoes of past personal experiences are thus blended with immediate sensual perception.

Figure 2. Purposefully defamiliarized abstract elements designed and created by subtraction, by landscape architect Bill Wenk, at a deconstructed former sewage treatment plant. Northside Park, Denver, Colorado (2006). Photo by author.
Designers must mitigate personal aesthetics with contemporary cultural modifiers, or they may grow too aesthetically distant from the users of landscapes and become marginalized in the ability to create expressive designs in the same way that many avant-garde artists are. The relative degree of defamiliarization required to make a landscape expressive and not overly eccentric, and hence alienating, or invisible to notice, will be entirely dependent on the local context and the conditions of a future time. As such, defamiliarization will continue to be a viable means of anchoring people into the experience of the present and for triggering reflections about their region as the world adapts to changing circumstances in the future.

The philosopher Friedrich Nietzsche and other influential pre-modernist thinkers promoted a minimalism that evolved into modernism and the international style as an antidote to what they perceived as overly chaotic cities at the turn of the 20th century. They saw the need for an architecture that minimized distractions by the senses and encouraged people to turn inward for reflection and happiness (Welter, 2002, p. 221). The emphasis here on an intensification of experience through defamiliarization that brings people mentally into the present turns this idea on its head with more recent research findings based on environmental psychology and happiness studies (Widdicombe, 2015; Chaykowski, 2017).

5.7 A distrust of grand design solutions and an embrace of incrementalism

The larger the development, the greater the risk that a new landscape design will be dysfunctional aesthetically, socially, economically, environmentally, and/or ecologically. Distrust is the key word—not an outright rejection but a healthy skepticism that the many stakeholders in a massive new development will have the foresight and expertise to avoid some of the many mistakes that have contributed to our “placeless” urban realms. Designers often believed that they were doing the right thing. However, a look back at both the designed projects and at the design education literature from historical periods that steered landscape architects in many unproductive directions shows that good intentions are sometimes not enough. This is particularly true when designers are confronted with vast new spaces or large buildings where there is only so much creativity, rigor, and care that can be lavished on any particular space. Our contemporary multidisciplinary design teams have much more evidence-based information than we had in past decades, but we are still likely to look back in future years and bemoan what we missed in the many large construction projects currently underway throughout the world.

A focus on the value of incrementalism is highly relevant to the practice of landscape architecture as an alternative posture as we make small but impactful day-to-day decisions on landscape developments that are either part of the problems or part of the solutions. There can be incremental regional changes or “punctuated equilibrium” that produces what is at first perceived as a radical departure, but may be seen in time as a more logical series of regional transformations that are triggered, redirected, or aided by the designer. Chris Reed, an educator, researcher, landscape architect and the director of the firm Stoss Landscape Urbanism, applies these concepts to adaptability by writing that “…the designer becomes a producer or curator of effects, dynamics, and of a whole range of socio-environmental and urban conditions” (Reed, 2016, p. 341). This post-modern focus on incrementalism and process over fixed and immutable solutions will contribute to the future viability of landscapes over longer periods of time.

5.8 Creating imageable bounded places to resist the excesses of megalopolitan development and consumer driven culture

Critics of Critical Regionalism sometimes ask, “does regionalism have to apply to broad geographical parts of a nation or state, or can we have micro-regions within cities” (Judith Butler quoted in Allen, 2005, p.423)? The idea of the enclave (the micro-region) is one of the prime tenets of both Critical Regionalism and postmodernism. Critical Regionalism’s most prominent cultural precept is creative ‘place’ creation that acknowledges local culture, social institutions, political issues, ecology, construction techniques, climate, topography, and many other elements of the regional context (Bourassa, 1991). Albert Mayer defines the “place” or enclave as a “tapestry of many figures, each distinct with its own color and character but [interpenetrated] into a total interrelated excellence” (Mayer, 1971, p. 257).
The boundary of the region is not where something stops, but rather where an enclave begins—what the German philosopher Martin Heidegger calls its “presencing.” This more indefinite boundary encourages designers to consider not only the enclave that is the object of a design, but also its relationship to other areas within a reasonable sphere of influence by car or mass transit. The boundary is where the collision of styles and forms is most likely to create innovative ideas that can be developed later in the centers of the established enclaves. This regionalist trend appears to be accelerating as people gravitate towards places that are both authentic expressions of the regional context and imageable as distinct places within the region. Designing these enclaves will help the individual designer by keeping the design process interesting and engaging with continually renewing district character to play off and to combine with both the regional and the universal. The creation of imageable enclaves may, in turn, exhibit an expressive and compelling enough character to become attractants within the fabric of a region and thereby contribute to the development of the overall regional character or to world culture.

5.81 Resistance

The idea of resistance is very useful and appealing to landscape architects and architects who must deal with a wide variety of influences that come between the first flash of design inspiration and the final completion of construction that realizes that inspiration. Resistance is an important element of a rigorous Critical Regionalism design process that will help prevent a design from devolving into something trivial, overly sentimental, or merely functional. The resistance that is a characteristic of Critical Regionalism is in concert with a growing movement that seeks to mitigate the excesses of technologically enabled cultural globalism. The resistance advocated here is not necessarily radical or heroic with “bellicose visual rhetoric (Cassidy 2000, p.418).” Rather, it is a resistance that is appropriate to a region, at a certain point in time and against specific problematic influences.

Frampton provides a very comprehensive description of resistance that encapsulates both Critical Regionalism and the ethos of post-modernism.

“Resistance against the domination of positivistic technology and its involvement in the maximization of production and consumption, wherein the dominant attitude towards nature is always violent and exploitive…., the resistance of locally grounded cultural form as opposed to the phenomenon of universal technology, …the way in which bounded form can be brought to resist the space endlessness of megalopolitan development, ….a resistance to an emphasis on the visual experience of place over the senses of hearing, touch and smell …and the establishment of bounded domains and tactile presences with which to resist the dissolution of the late-modern world” (Frampton, 1987).

The path to direct experience afforded by all the senses (tactile presence = experiential aesthetics) and not just vision will also help resist the focus on information over experience, the cognitive over the affective, that is a feature of formalist designs.

The cultural geographer and educator Chris Wilson writes of a resistance to “the tendency to turn culture and the environment into exploitable commodities,” a corollary to preconceived or overly sentimental thinking such as is found in romantic regionalism (Wilson, 1997). This resistance encourages the designer to rethink past regional experiences, without dismissing them, in order to imagine the landscape in new ways. The result can be a new creative design that will not be purely personal, academic, or derivative, but rather an honest creative expression of the sensibilities of the designer linked to a creative expression of the regional context and the zeitgeist.

Critical Regionalism provides a valuable framework for a future resistance that facilitates “learning how to change in order not to be changed” (Brian Walker quoted in Lister, 2016, p. 314). Each designer and design team must continually and consciously assess both the categories and the intensity of resistance that will be most productive to moving their design vision forward as conditions and priorities evolve over time.
6 CRITICAL REGIONALISM, PLANTS AND NATURAL SYSTEMS

Plants and natural systems are important landscape design elements where ideas developed by architects for Critical Regionalism need significant translation and expansion to apply to landscape design. The reconceptualization that is a hallmark of a Critical Regionalism ideology has led to many interesting and instructive approaches to the creative possibilities inherent in plants and natural systems. Some approaches are historic and well resolved, and some are very new, experimental and creative, redefining the way nature is expressed and the role of plants within an increasingly complex cultural context. Both hardscape materials, such as concrete and stone, and plants address environmental effects including the carbon footprint of the material. However, plants have a much more direct impact on the often neglected but increasingly critical area of ecology.

Reconceptualizing nature as part of a Critical Regionalism methodology is no trivial matter. It is one thing to address the visual aesthetic forms of nature in a naturalistic planting design as part of a Critical Regionalism ideology, and quite another to bring ecological functioning into the design process, particularly in urban or urbanizing areas. The level of understanding required to accomplish the latter calls into question the way landscape architecture practice is presently constituted, and the skill sets that will be required in the profession moving forward. Patrick Geddes famously promoted the use of biological principles to observe humans in their ‘natural environment’. This imperative has now flipped, and design professionals must once again become as adept at observing and appropriating the local natural environment as they have now become at observing human behavior.

There are myriad planting design styles from every region of the planet and thousands of years of history that can be used as elements of universal civilization for a Critical Regionalism design approach. French, Italian, New American, Japanese, Chinese, English, Minimalist, and many other garden traditions from across The United States and around the world have been successfully adapted for new regions and used as part of Critical Regionalism ideology and methodology. Similarly, any personal style can be used if it is adapted to local expressive cultural referents and/or the local environment and ecology. The horticultural adaptation is especially important in non-temperate areas such as the Southwestern United States.

Plant materials have a unique place in any consideration of landscape architecture and Critical Regionalism. They are the most complex and the most interesting materials that landscape architects can take advantage of to create expressive, creative, and future viable designs. With over 24,000 plant species documented growing without human intervention in North America alone, the possibilities for unique expressions are almost limitless (Maina and Villa-Lobos, n.d.). A focus on planting design also elevates the case for landscape architects as the lead designers for landscapes far into the future over the increasing encroachment of architects and planners who are only peripherally knowledgeable about this important arena of design.

7 CONCLUSIONS

Looking back at regional trends around the time of the founding of CELA and at the original ideology and subsequent theories of Critical Regionalism as set forth almost 40 years ago in the early 1980s, demonstrates the durability and the evolutionary potential of the concepts. The ideology of Critical Regionalism will continue to be a very productive means to shape new emergent design ideas for practice, criticism, research, and education.

The guiding principles of Critical Regionalism have deep and broad implications for the many polarities that will be a part of current and future design debate by members of CELA and their students. Many of these polarities are already part of the literature surrounding Critical Regionalism such as local/universal, affective/cognitive, creative/expressive, inner form/outer form, creative regional seeing/non-visual regional cues, etc. Many more unforeseen propositions that are also not either/or will emerge within the flexible ideological framework that is Critical Regionalism.

As a landscape architect and a professor in the United States, I have personally found Critical Regionalism to be a very helpful framework for understanding and guiding our purpose as designers and educators in society at large. This useful and flexible “ism”, that helps designers resolve the myriad claims on the design process beyond the primarily utilitarian, has been embraced by many luminaries of the
practitioner realm of landscape architecture as well as the writers who study and critique their work. In the next 100 years of CELA, Critical Regionalism will require ongoing advocates who can research the concepts and apply them to contemporary conditions in both practice and academia. The new evolving ideology and theory derived from this ongoing research and philosophical reflection will provide enduring benefits to world-wide regionalist designs on the land.

8 REFERENCES


9 ENDNOTES

1 For a critical review of Geddes contributions to the evolution of regional thinking and to city and regional planning, see Welter, V. M. (2002)

2 For an image of the valley section, see Welter, V. M. (2002).

3 This expands on the idea that beauty is only arrived at through an intellectual process, a critical analysis, as promoted by art critic and philosopher Arthur Danto and others. Environmental psychology shows us that we can experience beauty in a subconscious or pre-conscious way, before critical analysis or moral judgement. See Meyer (2016).

EARLY HISTORY OF LANDSCAPE ARCHITECTURAL EDUCATION IN THE AMERICAN SOUTH

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1 ABSTRACT

The history of landscape architecture education in the United States is poorly documented. A few schools have written preliminary histories of their programs, but these are typically autobiographical or self-fulfilling narratives that lack critical inquiry. The more comprehensive of these are focused on programs in the Northeast or West coasts. There are no broader histories of landscape architecture education in the American South. This paper will present a comparative history of the first three accredited landscape architecture programs in the American South, informed by recent archival research. All were initiated in the late 1920's, started in horticulture departments at land grant universities, and all three identify with a charismatic founding director. The earliest program began at North Carolina State College in the 1920's under the leadership of Joshua Plummer Pillsbury, although its modern form dates to the School of Design established in 1948. Hubert Bond Owens is known for growing the profession regionally with the program he started at the University of Georgia in 1928 and his leadership in the national professional organizations. Landscape architecture instruction at Louisiana State University similarly dates to the late 1920's, although the current program identifies exclusively with Robert S. Reich as the founding director in 1941. The paper concludes by discussing similarities between these origin stories.

1.1 Keywords

Landscape architecture education; American South; professionalization; regional development
2 INTRODUCTION

The American South shares a long history with the profession of landscape architecture. Frederick Law Olmsted in part bookended his career there, first with his famous travels through the region which went towards informing his understanding of landscape and culture, and then with the Biltmore Estate, which was one of his last major commissions and a fitting synthesis of the profession’s wide scope. Other noted works by Olmsted, Eliot and iterations of the Olmsted office included Pinehurst, NC; Druid Hills, GA; Roland Park, MD; and Battery Park, SC. Warren Manning completed as many as 240 projects in the South (Bertone-Johnson, 2012); John Nolen and his protégé Earle Sumner Draper practiced widely in Virginia and North Carolina; Wisconsin born Charles Gillette, an apprentice of Manning, established a successful landscape architecture office in Richmond, VA, and practiced widely in the region. The South was also home of two early prominent women in landscape architecture who started in the 1930’s. Elizabeth Lawrence was the first woman to graduate with a landscape architecture degree from North Carolina State University in 1932 and author of the famous book A Southern Garden (Hood, 2006). Edith Harrison Henderson was born in Charlotte, N.C., practiced in Atlanta, G.A., wrote an influential column in one of the largest newspapers in the South, and was the first woman to be elected as an officer of the ASLA (Catron, n.d.).

The history of landscape architecture in the American South is a vibrant narrative with significant resonances across the profession, but it is a story that is largely yet to be written. Most histories of landscape architecture focus on iconic projects. This paper takes an alternative approach by exploring the professionalization of landscape architecture in the South through selected early 20th century academic programs established in the region. Specific training has long been identified as an important part of defining professional disciplines (Ockman, 2012). The design and planting of outdoor environments has a much longer history in departments of horticulture at land grant universities across the country, but it was particularly prominent in early 20th century departments of horticulture in the less developed American South.

3 EARLY ACADEMIC PROGRAMS IN THE AMERICAN SOUTH

This paper, informed by recent archival research, looks at the establishment and early history of the first three accredited landscape architecture programs in the American South: The University of Georgia, North Carolina State University, and Louisiana State University. All have roots going back to the late 1920s, identify with an individual leader, and were housed at land-grant institutions. This research was largely informed by archival materials at North Carolina State University Libraries (Lewis, n.d.) and the University of Georgia Libraries (Hubert, n.d.). Archival materials related to the program at Louisiana State University are missing, although there may be some privately held materials that have yet to be made publicly available. It is beyond the scope of this paper to explore each of the programs in the American South that developed later, although this review of programs may encourage further investigations into history of landscape architecture in the American South.

3.1 NORTH CAROLINA STATE COLLEGE

Joshua Plummer Pillsbury (1873-1952) initiated the first course of study in landscape architecture as a division in the Department of Horticulture at North Carolina State College of Agriculture and Engineering (now N.C. State University). Originally from Ohio, Pillsbury first studied garden art under William Trelease in a 4-year program at the Missouri Botanical Garden before teaching in the horticulture program at Pennsylvania State College (now Penn State University) from 1898-1911, where he also completed a master's degree. One of Pillsbury's students at Pennsylvania State University was Karl Lohman, who later went on to be one of the early faculty of landscape architecture at the University of Illinois (Deming, n.d.).

Pillsbury initiated the landscape architecture curriculum at Penn State in the fall of 1910, the sixth such program in the country at the time. The following year he came to Raleigh as head of the Horticulture Department at N.C. State College. He quickly developed classes in landscape gardening and served as university landscape architect, but it would be many years before he was able to develop another landscape architecture curriculum. N.C. State College first advertised the career option of Landscape Architect for graduates of landscape gardening as early as 1923. In 1927, Earle Sumner
Draper convinced N.C. State College president Eugene C. Brooks to have Pillsbury develop a program in landscape architecture. The curriculum officially began the following year with Herbert L. Whitesell as professor of landscape architecture while Pillsbury spent a sabbatical year apprenticing at Harvard University (Pillsbury, 1945).

Pillsbury had a very comprehensive vision of professional training for landscape architects which, if not common at the time, surpasses current standards. This four-part process began with a professional four-year course of study in landscape architecture, followed by graduate work leading to the Master of Landscape Architecture degree, then one or two years of travel, followed by one- or two-years apprenticeship. At the same time, he understood that this 8-11-year process was not viable for all students and that the undergraduate program must be sufficiently comprehensive as to prepare students to enter professional practice. This was the premise behind the new program at N.C. State (Pillsbury, 1945).

The curriculum in landscape architecture initially began as a concentration within Horticulture, but quickly developed into a separate degree program. Interest in the program grew rapidly despite the nationwide economic setback of the Great Depression; the program had an enrollment of eight students in 1929, which more than doubled to seventeen by 1932 (North Carolina, 1931). The first degree was awarded in 1932, and a total of 25 professional degrees in landscape architecture were awarded through 1942, when enrollment ceased for World War II. Among these early graduates, four continued on for a master’s degree in landscape architecture, six went into professional practice, eight worked in government practice, two went into teaching landscape architecture, and four into the landscape nursery business (Thurlow, 1968). Elizabeth Lawrence, author of *The Southern Garden* and pioneering woman in landscape architecture was also one of these early graduates. N.C. State College was the first program in the American South to apply for ASLA accreditation in 1934 but was denied because they did not have enough instructors with an M.L.A. degree (Pillsbury, 1945).

![Figure 1: Landscape architecture student Loddie Bryan (Class of '57) arranging a model in a photographic model box. 5"x7" Photographic print, 1956. Item # 0018972, Special Collections Research Center, North Carolina State University Libraries, Raleigh, North Carolina.](image)

Although housed in the Horticulture Department, Pillsbury was adamant that the new landscape architecture curriculum not be confused with landscape gardening or “appreciation courses,” which he noted were offered “in almost if not all, similar institutions in connection with departments of horticulture"
Instead, as stated in the *North Carolina State College of Agriculture and Engineering Catalog* (North Carolina, 1931), the new program was premised on the idea that “Landscape Architecture is one of the arts of design, and is correctly classed with Architecture, Sculpture, and Painting” (p.79). The curriculum was clearly organized towards professional practice at the time and included coursework in Plants, Theory of Landscape Design, History of Landscape Gardening, Architectural Drawing, Planting Design, two Landscape Design courses (which appear to be project driven studio courses), separate courses on City and Suburban Planning, Landscape Construction, and even a course on "Office Practice."

Pillsbury retired in 1945 and was replaced by Edwin Gilbert Thurlow (1909-1997) as head of the Landscape Architecture program. Thurlow was a 1932 graduate of the program and continued graduate school in landscape architecture at Harvard University before practicing with the Florida State Park System and the Federal Housing Administration. He started teaching in January 1947 as head of Landscape Architecture and was joined by Lawrence Albert Enersen and Morley Jeffers Williams in September 1947. Shortly thereafter, Landscape Architecture was separated from the Horticulture Department and moved with the Architecture program (formerly in the College of Engineering) to a newly established School of Design (Figure 1). The School officially launched in Fall 1948 with 5-year professional Bachelor of Architecture and Bachelor of Landscape Architecture degree programs, and the landscape architecture program was professionally accredited by the American Society of Landscape Architects (ASLA) in 1951 (Clark, 2007; Landscape, 1951). In the first 15 years, two BLA graduates received fellowship at American Academy in Rome, the first in South (Thurlow, 1968).

### 3.2 UNIVERSITY OF GEORGIA

The landscape architecture program at the University of Georgia more closely follows the legacy of a single individual over the course of its evolution. Hubert Bond Owens (1905-1989) grew up in northeastern Georgia, in a small countryside town 50 miles outside of Athens, Georgia. He claims to have discovered landscape architecture during high school and enrolled in the University of Georgia with the understanding that a landscape architecture program would be established in the very near future. This never happened before he graduated in 1926 with a degree ultimately in agriculture. The state government finally appropriated funds to start a Landscape Architecture program in 1928, and Owens was subsequently hired to initiate the curriculum. He spent that summer taking classes at Cornell University and learning how that program was organized, followed by four summers at Harvard University (Owens, 1983). One of his instructors at Harvard was Morley Williams, who later taught at NC State.

The 1929 stock market crash dramatically blocked Owens’ momentum, but the program grew slowly and steadily. Landscape Architecture was initially founded as a separate department offering a Bachelor of Science in Landscape Architecture (BSLA) degree in the Horticulture Division of the College of Agriculture. It was soon moved to a new Division of Fine Arts in the College of Arts and Sciences in 1932, at which time the degree was changed to a Bachelor of Fine Arts (BFA) in Landscape Architecture. In 1950, the program moved back to the College of Agriculture in its own Division of Landscape Architecture and the degree changed to a Bachelor of Landscape Architecture (Figure 2). The program was accredited by the ASLA in 1951, the 10th such program in nation (Owens, 1983, p.83). Although they emphasize being the first accredited program in the South, they only beat NC State by one month (Accreditation, 1951; Landscape 1951).

Owens and the University of Georgia landscape architecture program were also largely responsible for introducing the national body of professionals to the burgeoning landscape architecture of the American South. Whereas in the first half of the twentieth century there were a few professionals from the Northeast practicing in the South (such as John Nolen, Earle Sumner Draper, and Warren Manning), by 1950 there were enough graduates trained through Southern schools and a growing interest among the public to support a substantial regional body of professionals. In June 1952 Owens hosted the National Conference of Instruction in Landscape Architecture (NCILA) at the University of Georgia for the first time in the South (Layton, 1952). The following year in January 1953 the American Society of Landscape Architects annual meeting was held in Atlanta, ASLA’s first annual meeting south of the Potomac River (From the Universities, 1964). It was officially hosted by the Southeastern Chapter of the ASLA, but Owens served as general chairman of the meeting and his students played a large role in hosting the gathering. Both the NCILA and ASLA meeting returned to the University of Georgia and Atlanta respectively in 1967 for a second time (Owens, 1983).
3.3 LOUISIANA STATE UNIVERSITY

Like NC State and UGA, landscape architecture at Louisiana State University started as a program in the department of horticulture. Most histories of the program date to Robert Reich’s arrival on campus in 1941, but landscape architecture instruction actually dates back to 1927 when W.K. Hanson announced a four-year curriculum as a subsidiary of the School of Forestry and Horticulture (Danos, 1999; Reich, 2007; School, 1927). Although housed in the College of Agriculture, Hanson intended the curriculum to appreciate landscape architecture as a fine art, incorporating courses from the Colleges of Fine Arts and Civil Engineering. It was planned as a proper professional design curriculum similar to other landscape architecture programs at the time. Unfortunately, Hanson only remained at LSU for a couple of years, and although individual landscape architecture classes were offered sporadically thereafter, the program lost momentum towards developing into a full curriculum until Robert Reich arrived fourteen years later.

Robert S. Reich (1913-2010) was born and raised in Manhattan. He first studied landscape architecture at Cornell University, where he was classmates with Jim Rose. He continued on for graduate studies at Cornell under Joseph Porter, and then spent a year teaching at the University of Connecticut before coming to Louisiana State University in 1941 as a professor of landscape architecture in the horticulture department (Reich, 2007). The following year Reich was drafted into military service, so it was not until 1945 that he was able to start a new curriculum. He finally started a Landscape Design program in 1946 as a separate curriculum in the horticulture department, which he spent the next fourteen years growing as the sole instructor, (Figure 3). In the late 1950’s there was a concerted effort to grow the program from a handful of undergraduate students into a professional degree. The College dedicated a second faculty line to the program in 1959 in anticipation of professional accreditation by the American Society of Landscape Architecture. In 1960 the program changed names from landscape design to landscape architecture, established a professional Bachelor of Science in Landscape Architecture degree, and was officially accredited by the ASLA. There were 43 students enrolled that year, up from five in 1957, plus seven graduate students in the new MLA degree (School 1961). It was the fifteenth accredited program in the United States at the time, and the third in the South.

Figure 3: Robert S. Reich (center) with landscape architecture students Carol Bowman and Frank Akin, 3-May-1960. Image courtesy The Daily Reveille.
Reich, or “Doc” as he was affectionately called by students and alumni, was mainly responsible for growing the program into what it is today. He trained under a more classical tradition of design at Cornell University, which is the model he initially carried forward at LSU. In 1951-1952, Reich spent a sabbatical year in southern California apprenticing with Garret Eckbo, which proved to be a transformational experience for his professional development where he formed an appreciation for modernism in design and landscape architecture. He returned to LSU set on introducing the program and the state of Louisiana to modern landscape architecture and brought a series of guest speakers to campus. Some of the most prominent names of the many speakers that were introduced to the program before 1960 included Garret Eckbo, Thomas Church, Robert Royston, Hideo Sasaki, and Richard Haag.

The program grew rapidly throughout the 1960s and 70s. Landscape Architecture separated from Horticulture to become its own department in 1964, the same year LSU hosted the National Conference of Instruction in Landscape Architecture for the first time. Two years later landscape architecture was transferred out of the College of Agriculture and grouped with the Department of Fine Arts and Department of Architecture into a new College of Environmental Design. Also, in 1966, the degree changed from a four-year BSLA to a five-year Bachelor of Landscape Architecture. Enrollment surpassed 100 students in 1968, surpassed 200 students in 1974, and reached its highest level with 236 students in the undergraduate program in 1978 (Cox, 2018).

4 DISCUSSION

On November 6th and 7th of 1959, the University of Georgia hosted a “Regional Survey Conference on Research in Landscape Architecture,” planned specifically for professionals and academics in the area encompassed by the Southern Association of Colleges (Owens, 1959). Hubert Owens coordinated the event and presented a paper on “Regional Opportunities—Southeastern U.S.A.” where he offered a background of landscape architecture at the University of Georgia, particularly his own educational “in-breeding” (Owens, 1959, p.50). He identified the department’s success on support from professional landscape architects “from other areas” who had recently established in the region, as well as “lay citizens…amateurs, who have revealed a genuine interest in [landscape architecture]” (Owens, 1959, p.50). This gets at an important point in the development of professional landscape architecture in the South: the regional appropriation of outside methods and practices.

All three programs owe their pedagogical design to schools in the Northeast, mainly Harvard University and Cornell University. Lacking formal training in landscape architecture, Joshua Pillsbury completed a several week study tour hosted by Harvard University in summer 1910 on “Masterpieces of American Landscape Architecture” with the explicit purpose of securing a series of photographs for teaching before initiating the curriculum in landscape architecture at Penn State the following semester. This was a model repeated for several years at Harvard University and aligned with the contemporaneous view of history as a vocabulary of precedents for professional practice. Pillsbury returned to Harvard University in 1928 for a sabbatical to study with the faculty there immediately upon initiating the landscape architecture program at NC State (Pillsbury, 1945). Hubert Owens spent one summer studying at Cornell University and four summers at Harvard University in his first few years of teaching landscape architecture at the University of Georgia. Owens directly states, “My summers of academic work at these two Ivy League Colleges were intellectually stimulating, and I tried to bring back to the Classic City of Athens, Georgia, a broad concept of landscape architectural education and professionalism” (Owens, 1983, p.20).

Much of the early faculty at NC State and the University of Georgia (after their respective founding directors) came through Harvard University. All of the subsequent landscape architecture faculty at NC State in the 1940’s and 1950’s either graduated or taught at the Harvard University Graduate School of Design, which is particularly notable in contrast to the N.C. State Architecture faculty that had a much more diverse background, even after the modernist revolution of design education at N.C. State in 1948 (Clark, 2007). Most, but not all, of the faculty at the University of Georgia follow this pattern as well. This is in part due to a lack of qualified M.L.A. graduates from other parts of the country and is not necessarily uncommon to similar programs starting in other regions at the time.

The program at Louisiana State University followed a notably different path. There is the obvious connection to Cornell University as Robert Reich’s alma mater, but a surprisingly low percentage of subsequent early faculty traced their professional training through Harvard University. There were a few alumni of the LSU undergraduate program that completed an M.L.A. at Harvard before returning to
Louisiana State, but throughout the 1960s and 70s others came with graduate work at Southern universities in disciplines peripheral to landscape architecture. The West Coast culture of modern landscape architecture was much more influential at Louisiana State University, most prominently through Reich’s work with Garrett Eckbo and the subsequent entourage of West Coast designers he paraded through Baton Rouge at midcentury.

The State of North Carolina was powering forward with a progressive economic and cultural agenda in the 1950s and 60s, and the establishment of a new School of Design staffed almost entirely with faculty from foreign states and nations was part of this change. Athens and Baton Rouge remained in the middle of a fairly conservative culture of the Deep South throughout the middle decades of the twentieth century. Owens and Reich recognized the limiting effects of this cultural isolation on their students—who themselves largely came from rural backgrounds with limited experience outside of their hometowns—and they responded by separately instituting a series of travel tours to expose their students to outside landscapes and ideas. Beginning in 1930, junior and senior landscape architecture students at the University of Georgia were required to take two field trips per year. These trips were usually to surrounding states, from Florida to Ohio, and while initially heavy on visits to country estates in the grand manner (e.g., Biltmore), later works of the Civilian Conservation Corps and other Works Progress Administration programs in the 1930s and 40s provided a greater variety of larger-scale public projects for students to visit. Louisiana State University faced a similar problem with their domestic students, but they also had a notable international student population as LSU was a popular place for students from the Caribbean and Latin America to come study in the mid-twentieth century. Reich started organizing semester field trips to the East and West coasts in 1967 and 1969 respectively so the students could experience a quality of designed landscapes that was not available regionally in the Gulf South at that time. In 1971 Doc and Professor Max Conrad began offering international travel excursions for students in the summer, first to Europe several times, and then to expanding Asian countries in 1977. Max Conrad continues these trips every year as of this writing.

5 CONCLUSION

The early history of landscape architecture education in the United States began at a handful of institutions separated by great distances across the nation, from rural New York and urban Massachusetts out to Michigan and Iowa, and clear across to California. The local cultures and economies of these various places resulted in different programs developing at their respective schools. This paper has taken a somewhat more narrowly defined look at the history of landscape architecture education at similar institutions in a very specific geographic region to clarify parallels between them.

This is not a comprehensive history of landscape architectural education in the American South. Although not accredited until the 1950’s, instruction in landscape gardening and design dates back to the late 19th century at many programs across the nation and including the South, particularly at land-grant institutions. This paper makes a distinction as to when curricula began to self-identify as landscape architecture as a fine art distinct from landscape design or horticulture. Even still, comparing the first three accredited programs is not a comprehensive history.

Auburn University shares a similar history. It first offered a Bachelor of Landscape Architecture in the School of Architecture for the 1929-1930 academic year under principal instruction of John Worthington Hyde, around the same time that NC State and UGA started their programs (Catalog of Alabama Polytechnic, 1929). Courses in landscape architecture taught within the School of Architecture began two years prior, and landscape gardening had been taught in Horticulture for many years before. Low enrollment ended the program in the early 1950s, and it wasn’t until professional licensure came to Alabama in the 1970s that Auburn restarted the landscape architecture program and eventually gained accreditation.

The University of Florida first offered a curriculum leading to the Bachelor of Science in Landscape Architecture housed in the College of Architecture and Allied Arts in the 1933-1934 academic year, although before that Landscape Design was a separate curriculum in the College of Agriculture (University Record, 1933). Clemson University first offered a Bachelor of Science in Design with a concentration in Landscape Architecture in 1984-1985, although an ornamentals option in horticulture offered courses in landscape design for several years prior (Clemson Catalog, 1984). The “Landscape Arts” was taught alongside architecture at Texas A&M at least back to 1928 (“Architects Dance,” 1928).
This paper has explored the early beginnings at the first three accredited landscape architecture programs in the American South, while also recognizing a larger history to be compiled in future research. All three programs originated in departments of horticulture at land grant universities. Each program was heavily influenced by an individual leader who pulled from training at Cornell University and Harvard University. All three programs were originally founded on the concept of design as a fine art, despite the sometimes misguided but persistent conception of landscape architecture programs in colleges of agriculture being more closely associated with landscape gardening.

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The Landscape Research Record publishes top quality articles selected from manuscripts submitted to the Council of Educators in Landscape Architecture (CELA) annual conference each year. The Record serves the mission of the CELA, that is, to encourage, support and further education in the field of landscape architecture specifically related to teaching, research, scholarship, and public service. The Record contains recent research and scholarship in all aspects of landscape architecture, distributed in the following tracks:

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The steps and typical timeline of the peer review are described below.

**Abstract Submittal: September**
Peer-reviewed article publication on the Record starts from the abstract submittal to the CELA annual conference. The CELA executive office sends out Call for Abstracts around August each year.

**Abstract Review: September-October**
The Vice President for Research leads the track chairs in the abstract review. Double blind review is used. Each abstract is reviewed by at least two reviewers.

**Paper Submittal: January 20-25**
Authors of accepted abstracts receive the invitation to submit a full paper in November. The deadline is in January of the following year. The papers submitted at this time are not peer reviewed but only edited to satisfy the conference standard. Papers that do not follow the template of the conference are rejected.

**The CELA Annual Conference: Canceled**

**Paper Review: May-June**
Papers that are submitted in time in January and stratify the conference standard become eligible to enter the peer review for the publication in the Record. The track chairs manage the review for their tracks and select high quality papers based on the score of abstract review, grammar, completion of study, contribution of new knowledge, format quality, etc. The track chairs then send out selected papers to at least two reviewers.

**Review Result and Revision: July**
Track chairs collect review results and make recommendations on the manuscripts. Papers that are accepted with revision requirement will be sent back to the authors in July.

**Final Manuscript Submittal: August**
Authors submit final manuscripts by August 31st. All papers are published by December 31st.

**The Outstanding Paper Award: December-March**
The CELA Executive Committee has authorized The Outstanding Paper Award for published papers in the Record. The Vice President for Research and track chairs collectively select the winning paper. CELA notifies the winner(s) of the award, which is presented at the following CELA Annual Conference.