Resurfacing the Topographic Imagination: landform, representation, & process

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ABSTRACT

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While social and environmental challenges are the focus of much of contemporary practice, the role of technical skills and basic knowledge of land manipulation has been marginalized within landscape architecture. This thesis explores landscape architectural pedagogy with a focus on the instruction of technical skills within landscape architectural curriculum through the lens of landform manipulation. As a fundamental operation in the practice of landscape architecture, landform manipulation is often taught from the perspective of land art, site engineering, or through the lens of representation separate from other design courses and studios. This study proposes an alternative model for teaching terrain manipulation as a creative endeavor that bridges the theory and practice of landform and representation. Drawing on readings, interviews, and syllabi, this study seeks to reflect cur-rent approaches to site grading instruction, while exploring opportunities for reconstituting and embedding history, theory, and representation within an alternative teaching format. A framework for landform manipulation instruction is created that expands the boundaries of traditional site engineering practices to explore production and representation as process through the lenses of cultural, spatial, and temporal aspects of topography that is inclusive of aesthetic, speculative, and theoretical practice. This approach is developed into a studio syllabus as an example for future implementation in a landscape architectural curriculum and as a catalyst for dialog on contemporary practice and landscape architecture education.

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INTRODUCTION

Landform is a critical component in the practice of landscape architecture. It is the foundation of the landscape, the surface that supports ecological function, it is spatial, and it shapes the experience of place. As a dynamic and sculptural material, landform can be shaped to draw attention to itself, be subdued by the events that occur upon it, and it can be a record of time and memory that is embedded with meaning.

I have had a deep connection to landform since, and possibly before, my introduction to landscape architecture. As the primary instrument of data collection it is important to acknowledge my own biases and values related to the subject of topography and technical instruction in landscape architectural education.[1] My views of both subjects have been shaped through my study of landscape architecture and professional practice. During my undergraduate studies in the late 1990's at the University of Kentucky, I had the unique opportunity to witness two projects in construction, the Louisville Riverfront, and the University of Cincinnati campus, both designed by the firm of Hargreaves and Associates. The way landform is expressed through these projects creates unique places and iconic landscapes that transformed Louisville and the campus of the University of Cincinnati. These projects

[1] John W. Creswell, *Research Design : Qualitative, Quantitative, and Mixed Methods Approaches*, 4th ed. (Thousand Oaks, California: SAGE Publications, 2014), 147.

changed the way I understood the grading of sites, from a functional act to an artistic expression. While the act of grading became a foundational element of my practice as a landscape architect, during my interactions with more recent graduates, I noticed a gradual shift in their skillset, specifically in terms of technical proficiency. Over an eleven-year period from 2004 to 2015 I was in a hiring position with a large landscape architecture firm, and during this time I had interviewed hundreds of potential candidates. Entry-level job candidates I reviewed would often fail to demonstrate a clear understanding of how to move from concept to detail, or the design implications of landform.

As I began this study, a question emerged in my mind; "What makes landscape architecture unique from related design and engineering professions?" While the profession bridges many areas of expertise, this question prompted reflection upon the disciplinary core of the practice of landscape architecture. Landscape architecture sits at the intersection of art, architecture, infrastructure, science, ecology, and sociology. The landscape is the thread that binds the built environment. It is a profession that is uniquely suited to engage a broad and expanding range of issues, as illustrated by the great diversity of project types landscape architects address. Current emphasis on ecological design, climate adaptation, human health and well-being, and the increased interest and involvement in social justice and design activism are part of the field's diverse skill sets. However, these are not necessarily the core, they are theoretical and practice frameworks that guide our designs. The values that shape decision-making and project approach compose the frames of practice, but not our common expertise in practice.

The critical competencies that form the disciplinary core comprise the foundation of landscape architecture. The concept of the core and the expanding edge is central to landscape architect and professor Brad Cantrell's foreword to *Innovations in Landscape Architecture* that refers to this

core as "our evolved disciplinary knowledge." This skill set resides in the first years of our professional education and as a foundation of professional operation. The edge is the expansion of the frames of our disciplinary boundaries as the practice evolves.[2] These edges, as Cantrell suggests, are necessary to the evolution of the practice of landscape architecture, but the frame relies on our disciplinary core; that shared aspect of all practice and the foundation of our professional education. Landscape architects structure and physically shape sites through the manipulation of landform, directing the movement of water through a site, and the use of plants to spatially define the designed landscape. Thus, land formation is a critical skill and knowledge domain in the practice of landscape architecture.

This thesis explores the idea of the edge and the core of the practice of landscape architecture with a focus on the ways in which technical skills are taught within the curriculum. By asking, "How can we embed cultural, aesthetic, conceptual, and theoretical practice into traditional site engineering instruction to explore the creative potentials of landform and materiality?" provides new opportunities. Landform manipulation is a fundamental operation in the practice of landscape architecture. However, within landscape architectural education, landform manipulation is often taught from the perspective of land art, site engineering, or as a subject of representation separate from other design courses and studios. To extend and enhance the student's representational, analytic, and modeling skills while also developing technical proficiency I propose a model for teaching terrain manipulation as a creative endeavor that bridges the theory and practice of landform and representation. The goal of this research is to develop a pedagogical approach to landform manipulation that expands the boundaries of traditional site engineering practices to explore production

[2] Jonathon R Anderson and Daniel H Ortega, Innovations in Landscape Architecture (New York, NY: Routledge, 2016), XX.

and representation as process through the lenses of cultural, spatial, and temporal aspects of topography. The opportunity is to be inclusive of aesthetic, speculative, and theoretical practice. To achieve this, I will explore this topic in three ways: landform, representation, and process.

Landform is the physical reality of the surface and strata of land that shapes our lives and our perception of the places we inhabit. This section will consider landform as physical and the way it reveals itself in our topographic memory and our relationship to place. Beyond the physical and personal, landform reveals itself spiritually as a symbolic gesture of our relationship with the earth and our universe.

Representation is how we understand, visualize, and describe realities and intentions. This section of the thesis focuses on traditional and emerging methods of representation as a means of describing and acting upon the land. This exploration considers representation as a means of thinking beyond documentation.

Process is how we deploy this knowledge and tools. It is a means of practice that emphasizes discovery and iteration and it is the craft in which landform and representation come together. Through process, experimentation and speculation on topographic potentials can be explored in the context of a design project. This section elucidates current pedagogical approaches to landform manipulation while proposing a framework for a new course.

LANDFORM

In defining landform, it is critical to consider its complexity and the multiple ways that landform manifests itself in the practice of landscape architecture. Landform constitutes a common framework for landscape and architecture while also serving as the basic condition for the ecology and flows of a site or piece of land. It is dynamic and constantly shifting through tectonics, erosion, and deposition, as well as within the built landscape, particularly shifting land uses. From burial mounds to landfills, from regrading a site to mass earthworks in the sea, landform is a cultural expression both performative and aesthetic. In this section I explore the ways in which we observe and understand landform and the dynamic processes that act upon and shape the terrain.

While most writing about landform in landscape architecture is from a perspective of site engineering or land art, a broader understanding can be gained through theory and history writings in art, architecture, and geology. These viewpoints serve as the foundation for this exploration into topographic manipulation and our relationship to landform. Serving as a starting point in this discussion is architectural theorist, David Leatherbarrow's book, *Topographic Stories: Studies in Landscape and Architecture*. In this book, he uses a series of essays to argue that landscape architecture and

architecture are not the same or distinctly different, but rather, similar and connected through the cultural framework of topography.[3] By describing likeness in the disciplines in the resistance of absorption and separation of the two, this book aims to re-establish the standing in modern culture of these two disciplines by acknowledging their connection to one another through their relationship with topography.[4] The chapters describe the plasticity of landform and its ability to accommodate the activities that occur upon it, yet remain recessive and latent within the landscape.[5]

Leatherbarrow asserts that the task of landscape architecture and architecture, as "topographic arts", is to provide dimension and expression to the routine patterns of our daily lives.[6] He furthers this argument when he suggests that the relationship of the fields has evolved into two like, but differentiated, disciplines.[7] This references how landscape once looked to architecture for ideas and methods, but more recently architecture has begun to turn to landscape for inspiration, specifically the phenomena of process and temporal unfolding, "registration" prompting articulation, and "mapping" as a survey technique for reading a site.[8] Leatherbarrow further argues that urban ecological thinking would allow architects to reconceive the nature of designing buildings so that buildings are active parts of the environment.

This argument is framed through a series of essays examining various ways in which topography mediates the design fields. Leatherbarrow explorers the temporal quality of experiencing the land in relation to the site's metabolism and capacity for continued relevance as well as time

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3 David Leatherbarrow, *Topographical Stories : Studies in Landscape and Architecture,* Penn Studies in Landscape Architecture (Philadelphia: University of Pennsylvania Press, 2004), 5.

4 Ibid.

5 Ibid., 15.

6 Ibid., 1.

7 Ibid., 5.

8 Ibid.

in one's experience of place. He suggests that the material, spatial and temporal qualities of topography can expand the cultural significance of architecture.[9] In this sense landscape and architecture are agents of culture. Topography for Leatherbarrow is more than terrain and includes traces of the past that are embedded in its layers, which he calls "topographic inscriptions."[10] Viewed in this way, topography is an expression of the relationship to a rich and layered past.[11] Architecture is situational and, therefore, cannot only present itself as "sceneography" but must consider through its material and spatial relationship to the terrain. Architecture can then reformulate modes of disclosure that go beyond image articulation.[12]

As a theorist and educator, Leatherbarrow takes an architectural approach to the topic of topography that respects and appreciates the influence of site and terrain on architectural form. When landscape and architecture are in harmony, a unique and mutually beneficial characteristic is achieved that is specific to its milieu.

Central to this examination of topography is its latency and the act of revealing. The great paradox of topography is its primacy and materiality in landscape architecture, yet, as Leatherbarrow points out, it is "manifestly latent" in the built landscape.[13] He distinguishes this in two motives, the passiveness of the undesigned and the assertiveness of the designed terrain.[14] Despite the emergence of land art and landscape architectural practices that have foregrounded topography as a landscape medium, in most designs, landform subsides within the landscape. In this sense, once a project is realized, the physical and material aspects of landform

9 Ibid., 10.
10 Ibid.
11 Ibid., 13.
12 Ibid., 9.
13 Ibid., 251.
14 Ibid.

often become and remain submissive to the objects placed upon its surface.

How do we perceive landform in ways other than through its physical and material characteristics? It is in the way topography is imagined and the ways it shapes our experience of landform. Landscape architecture professor Elissa Rosenberg explores this in her essay, "L'imagination topographique." She defines the "topographic imagination" as the shaping of the ground in relation to the philosophical ways in which "we know the world."[15] Her examination of topographic imagination moves beyond the relationship of the architecture and landscape to focus on topographic expression through the integration of perspective and the panorama. The staging of the garden as a cultural setting,[16] and the ways in which land artists of the 1960's and 70's began to use the landscape for sculptural expression often challenge the pictorial landscape aesthetic by exploring perception and the phenomenological aspects of the landscape, often expressed as large-scale earthworks.[17] These explorations illustrate how the manipulated landform shapes our experience of landscape as it unfolds before us. Rosenberg emphasizes the correlation of vision and movement using examples of topographic manipulation as a strategy in which the views created by shaping the terrain invite the viewer to move through the space, reframing the view as they proceed. The topographic imagination, therefore, is experiential, relying on the ambiguous relationship of vision and movement.[18] According to Rosenberg, landform design is a dialog between natural and cultural constructs. She develops a thematic strategy for landform design that articulates the role of land shaping as an expression of ideals through distinct topographic composition.[19] Recalling Renaissance notions of perspective,

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15 Elissa Rosenberg, "L'imagination Topographique," *Les Carnets du paysage* n° 8 (2002): 7.

16 Ibid., 13.

17 Ibid., 18.

18 Ibid., 24.

19 Ibid., 8.

Rosenberg suggests that the manipulation of landform is dependent upon the visual ordering of perspectival space. She suggests that alternative world views allude to varied attitudes to shaping the terrain.[20] The manipulation of topography in Rosenberg's examination is decisively experiential. The use of landform manipulation to enhance and transform experience throughout this historical perspective provides a foundation for thinking of topography and a phenomenological aspect of the landscape experience.

Rosenberg, however, also offers another critical point on the topographic imagination, that it is not only the final form of the land, but in the speculation and reconfiguring by the designer. She discusses how the expression of landform can be used to heighten awareness as an act of recovery that moves beyond the environmental art movement. Using landscape architect George Descombes' design of Parc Lacy on the outer edges of Geneva, she examines the incorporation of land reclamation, or, as Descombes described it, an "appropriation of place." This project would recontextualize a site that had been transformed through canalization, leveling of the land, and piping streams.[21] As Rosenberg suggests, Descombes' design topographically expresses a veiling of the past in a landscape that has been etched through alterations, charting the historical traces of time.[22] In this sense, topographic thinking as a means of recovery offers the potential to re-establish a site ecologically within its context.

Drawing on the examples of Leatherbarrow and Rosenberg, we begin to understand that landform is more complex than often thought. While Leatherbarrow's work suggests a bridging of the relationship of landscape and architecture through the physical connection of site and structure, Rosenberg's work demonstrates the ways that landform

[20] Ibid.

[21] Ibid., 21.

[22] Ibid., 24.

shapes our experience of place. In landscape architecture, it is important that landform not be reduced to an exercise in mathematics, nor be reduced to a leveled site – a blank canvas – as a necessary condition of development. To think more holistically about landform, we must expand our perception and definition of landform. I propose three manifestations: landform is physical, it is personal, and it is conceptual.

THREE MANIFESTATIONS OF LANDFORM

Landform is Physical

Landform is physical. It is the surface manifestation of the strata and the processes that have shaped the land. Landform is geologic and anthropogenic. Natural landform is a varied and dependent upon the geologic structure and surface and subsurface flows of wind and water. Geomorphology is generally identifiable, such as mountains, hills, plains, deltas, canyons. These landform patterns are regional and woven together. The geologic landform is a composition evolved slowly over thousands of years. Anthropogenic landforms vary widely as humans have modified the landscape for shelter, survival, and ritual for millennia. The extent of human intervention goes deep into the earth's surface from mining and excavation, and is built up on the surface from stockpiling and landfills.

Scholars have described the physical characteristics of landform in multiple ways. Landscape ecologist Richard Forman examines how these naturally formed and human altered landscapes compose the mosaics of our environment. In some cases, culture overpowers geomorphology, homogenizing once distinct landforms.[23] Forman accredits the process of inaugurating land as an evolution over time that begins with physical change, then perception of that change

[23] Richard T. T. Forman, Land Mosaics : The Ecology of Landscapes and Regions (Cambridge ; New York: Cambridge University Press, 1995), 301.

LANDFORM TAXONOMY

Figure 1: Based on the Glossary of Landform and Geologic Terms by the USDA Natural Resource Conservation Service, this diagram illustrates the geomorphological classification in type as well as subaerial and subaqueous states.

PERIGLACIAL

alas
block field
circle
coastal plain
earth hummock
frost boil
high-center polygon
hills
ice wedge
ice wedge cast
ice wedge polygon
low-center polygon
muskeg
nivation hollow
nonsorted circle
palsa
patterned ground
peat plateau
pingo
plains
polygon
rock glacier
solifluction lobe
solifluction sheet
solifluction terrace
sorted circle
string bog
stripe
thermokarst
thermokarst depression
turf hummock

thermokarst lake

MASS MOVEMENT (MASS WASTE)

ash flow
avalanche chute
block glide
block stream
breaklands
colluvial apron
complex landslide
creep
debris avalanche
debris fall
debris flow
debris slide
debris spread
debris topple
dissected breaklands
earth spread
earth topple
earthflow
fall
flow
foothills
hills
lahar
landslide
lateral spread
main scarp
minor scarp
mountain range
mountains
mudflow
rock glacier
rock spread
rock topple
rockfall
rockfall avalanche
rotational debris slide
rotational earth slide
rotational rock slide
rotational slide
sag
sand boil
sand flow
scree slope
slide
slump block
solifluction lobe
solifluction sheet
solifluction terrace
soil fall
talus cone
talus slope
terracette
toe
topple
toreva block
translational debris
slide
translational earth slide
translational rock slide
translational slide

sag pond

VOLCANIC & HYDROTHERMAL

aa lava flow
ash field
ash flow
block lava flow
caldera
cinder cone
corda
diatreme
dike
fissure vent
foothills
geyser
geyser basin
geyser cone
hills
hot spring
kipuka
lahar
lava dome
lava field
lava flow
lava flow unit
lava plain
lava plateau
lava trench
lava tube
louderback
maar
mawae
mountains
mud pot
pahoehoe lava flow
pillow lava flow
plug dome
pyroclastic flow
pyroclastic surge
shield volcano
spatter cone
spiracle
steptoe
stratovolcano
tumulus
volcanic cone
volcanic crater
volcanic dome
volcanic field
volcanic neck
volcanic pressure ridge
volcano

TECTONIC & STRUCTURAL

anticline
basin floor
batholith
bolson
breached anticline
canyon bench
cuesta
cuesta valley
diapir
dike
dip slope
dissected plateau
dome
fault block
fault zone
fault-block mountains
fault-line scarp
fold
fold-thrust hills
foothills
graben
half graben
hills
hogback
homoclinal ridge
homocline
horst
intermontane basin
louderback
meteorite crater
monocline
mountain range
mountain system
mountains
piedmont slope
plateau
rift valley
rock pediment
sand boil
scarp slope
semi-bolson
sill
stock
strike valley
structural bench
syncline
tableland
valley
window

EROSIONAL

badlands
ballena
ballon
basin-floor remnant
beveled base
breached anticline
breaklands
breaks
canyon bench
canyon wall
canyonlands
col
colluvial apron
cuesta
cuesta valley
dissected breaklands
dissected plateau
earth pillar
eroded fan remnant
eroded fan-remnant
sideslope
erosion remnant
foothills
finger ridge
free face
gap
groove
gully
hills
hogback
hoodoo
inselberg
monadnock
mountain range
mountains
notch
paha
partial ballena
peak
pediment
piedmont
piedmont slope
pinnacle
plateau
rib
rill
rock pediment
sabkha
saddle
scarp slope
slickrock
stack [geom.]
strike valley
structural bench
swale
tableland
terrace remnant
tor
valley-border surfaces
valley-floor remnant
wind gap
window

ANTHROPOGENIC

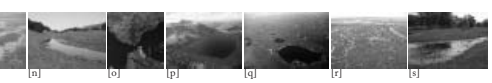
anthroscape
artifact
artificial collapsed
depression
artificial drainage pattern
artificial island
artificial levee
beveled cut
bioswale
borrow pit
bulkhead
burial mound
conservation terrace
(modern)
cut (railroad, etc.)
cutbank
dam
ditch
double-bedding mound
drainage ditch
dump
earth dike
fill
filled marshland
furrow
gravel pit
headwall (anthro)
hillslope terrace (ancient)
human-transported
material
impact crater
interfurrow
landfill
levee
leveled land
log landing
midden
mine spoil
openpit mine
play field
polder
quarry
railroad bed
reclaimed land
road bed
road cut
rice paddy
sand pit
sanitary landfill
scalped area
sewage lagoon
skid trail
spoil bank
spoil pile
surface mine
terrace
tillage mound
truncated soil

canal
coastal barrier
dredge spoil bank
dredged channel
dredge-deposit shoal
floodway
pond (human-made)

SUBAERIAL

SUBAQUEOUS


[13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25]


[n] [o] [p] [q] [r] [s]

aesthetically and economically, and finally, further action based on this new perception.[24] In this manner, the perception of built landforms is informed through experience with other landforms and then perpetuated.

Landform is not only expressive in its verticality, but also flatness. Landscape architecture professor Peter Petschek places landforms into three categories: concave, convex, and flat. Convex forms point to an apex, while concave forms point toward a low point in the terrain.[25] Flatness is the disrupter of both previous landforms. This verticality of landform effects the ecology and flows as noted by Richard Forman. This includes aspects of microclimates, materiality, water movement, and flora and fauna variation. A high degree of spatial variability in contrast to the human tendency toward uniformity is an important consideration in designing a sustainable landscape.[26] This translates to designed landforms as well. The physical shaping of landform has spatial and ecological implications.

Landform, whether natural or anthropogenic, is created through dynamic processes. Dependent upon its materiality, this process can be slow and imperceptible or seemingly instantaneous; it is constantly in a state of flux and never static. In nature, this dynamism is the result of opposing forces; building up, and breaking down. In the built environment, it is the continued shaping and reshaping of sites individually and connectively.

The dynamics of landform has also been a focus of practitioners as well as scholars. Landscape architect Lawrence Halprin addresses the influence of dynamic process in his 1962 essay, "The Shape of Erosion." Halprin likens the artistic act of sculpting – adding and subtracting mass – to the natural process

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24 Ibid.

25 Peter Petschek and Hochschule für Technik Rapperswil Landscape Architecture Degree Program., *Grading Landscapingsmart3d-Machine Control Systems stormwater Management*, (Basel: De Gruyter, 2014). 59.

26 Forman, 305.

of erosion. He calls for landscape architects to not imitate nature, but to take cues from natural phenomenon that reveal process.[27] Noting that visual artists use natural process to derive form in art, he suggests that landscape architects work in a similar fashion offering compositions produced through erosions introduce excitement and sculptural shape in the built landscape.[28]

Then, why do so many landscape architects design as if the landform were a static entity? While it is understood that landscape and ecological processes are in flux, it is important to consider that landform is also dynamic. Over fifty-years after the publication of his essay, landscape architects are considering dynamic landform within their projects, particularly those addressing coastal and sedimentation processes which occur quickly through wind and water with great influence to more static, controlled and constructed landscapes. Instead of establishing a static, finished landform design, an alternative project approach establishes frameworks for the emergence of landscape process. This approach predicts various possibilities through advanced modeling techniques that consider natural processes and evolution of landform to achieve an intended outcome.

The transitional landscape was the topic of an educational session at the 2014 American Society of Landscape Architects conference led by representatives of Biohabitats, Hargreaves Associates, and Ennead Architects. The session entitled, "The Future of Existing Conditions: A Multidisciplinary Approach to Resilient Coastal Design", focused on a design proposal for a coastal community in Far Rockaway, Queens: Fostering Resilient Ecological Development (F.R.E.D.).[29] In response to the coastal vulnerability as highlighted by Hurricane Sandy, the designers

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27 Lawrence Halprin, "The Shape of Erosion," *Landscape Architecture Magazine*, January 1962, 88.

28 Ibid.

29 Burdick, Andrew, Mary Margaret Jones, and Michael Spina. "The Future of Existing Conditions: A Multidisciplinary Approach to Adaptable Design." Education Session, American Society of Landscape Architects Annual Meeting, Denver, November 23, 2014.

articulated a goal to create a resilient coastal community design framework that was sensitive to the contextual conditions of the place. Notable was the consideration that the habitable spaces would be set back from the shoreline and elevated on piers so that while the built environment was static, the dunes and the landscape could naturally move and shift below.

In the transitional shifting landscape, sediment, through the movement of water and human intervention in the landscape, form subaqueous topographic changes that occur rapidly and require management. This is illustrated by events, such as Dredgefest, that focus on sediment management in various contexts. In contrast, with an understanding of this natural process, some landscape architects are designing with, rather than in opposition to, sedimentation. For example, SCAPE Studio's design for the Staten Island coastal barrier sets a framework for the evolution of topography as a solution to storm surge mitigation. As assistant professor of landscape architecture and current Dredge Research Collaborative member Brian Davis describes, through hydrodynamic modeling SCAPE determined that shallow land areas worked well for dissipating the severity of storm surges. These shallows are intended to create habitat and a barrier that allows for the flow of water instead of hard infrastructure to control it.[30] Similar to dune replenishment techniques now seen in the Netherlands, this framework acts as a barrier that allows sediment to build-up through natural processes. SCAPE's strategy uses dredge material as input for the shallows, allowing them to evolve and change over time.[31] Davis notes, the project centers process in a generative continuum in which human intervention and natural process work in collaboration.[32]

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30 Kate Orff, *Toward an Urban Ecology* (New York, New York: The Monacelli Press, 2016), 230.

31 Ibid., 232.

32 Ibid., 233.

Though F.R.E.D. and SCAPE's breakwaters projects focus on the movement of sediment, anthropogenic landscapes pose numerous challenges, such as lands of extraction (surface mines), or accumulation (landfills). These projects demonstrate the potential for dynamic process in design and the establishment of frameworks that permit rather than control physical process. As Halprin urged, by working with these processes, landscape architects can create speculative landforms as the foundation of socially and ecologically rich emergent landscapes.

Landform is Personal

Landform is Personal. It is made personal through the human scale at which we experience the places we inhabit. The terrain's physical form shapes our perception of space and the way we move through our environment. It is our conception of up, down, across, and through space. It further permeates our language- over the hill, plateaued, emotional peaks and valleys. These experiences form place identity and embed themselves within our memory.

The idea that landform is personal is explored by practioners and scholars through phenomenological aspects of the landscape. In *Experiential Landscape: An approach to people, place and space*, landscape architects Kevin Thwaites and Ian Simkins discuss movement as an important aspect in the experience of landscape.[33] As Rosenberg had noted in her discussion of perspective and the panorama and our experience of the unfolding landscape, Thwaites and Simkins note peoples preference for passage along curves and bends engage the imagination through the sense of discovery of what is ahead, often aided by landmarks along the journey.[34] Similarly, through vertical movement and undulation, landform creates

[33] Kevin Thwaites and Ian Simkins, Experiential Landscape : An Approach to People, Place, and Space (London ; New York: Routledge, Taylor & Francis Group, 2007), 33.

[34] Ibid., 42.

a sense of mystery and anticipation. The use of visual devices provides orientation and further shapes experience. Thwaites and Simkins argue that variations in view length and scale increase spatial awareness through a sequence of experiences.[35] The shape of landform creates the setting for experience that unfolds sequentially through movement. Landform encloses, confines, and opens space to create a sense of progression and orientation. As one moves through space, these changes in experience, the authors suggest, highlight contrasts that enliven space and enhance psychological engagement by the shifting aura in the procession through space.[36]

According to Thwaites and Simkins, the way we relate to our environment becomes ingrained and subconscious over time. In this sense, landform effects our interactions with space and, consequently, each other. Landform is influential as an agent of culture through the shaping of experience, yet, this setting lies in the background of human action. Though experience is individual, movement through space creates a collective, localized relationship to the terrain.

Landform is part of our identity as individuals, accumulated over time through experience. We each have a relationship with it based on our experiences of place that link us to the landscape in unspoken ways. As Bruce Lindsey states in his essay, *Topographic Memory*, "topography remembered is a kind of knowledge."[37] This form of knowledge is sensed before it is revealed and is the basis for the mental structure of the imagination. Intuitively, and often to our own astonishment, this knowledge is disclosed in the built products of the imagination.[38] Linsey suggests that as we recall from mental images, early memories can become confused with photographs

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35 Ibid.

36 Ibid.

37 Catherine Spellman, *Re-Envisioning Landscape/Architecture* (Barcelona: Actar, 2003), 41.

38 Ibid.

or movies of experiences. These images are filtered through a frame and lens. Lindsey observes "when the shutter is open, the eye is blocked" and, therefore, "when time is captured, experience is withheld" separating experience from its milieu and emphasizing detail over context.[39] He argues that the importance of landscape is not only in the image or the ways in which it is embedded into language, but how the shape of the landscape imprints upon our memories. Natural memory with which we are born, Lindsey notes, is susceptible to impression and long lasting in its influence. In this sense, natural rather than artificial memory more closely relates to terrain.[40] Over time, landform as a setting influences interactions within the environment which embed within the memory, linking itself to the events and places of past experience. Landform is personal in the accumulated experience of the individual and the memory of those experiences.

Landform is Conceptual

Landform is conceptual. It becomes conceptual when it exceeds physical expression, meaning is bestowed, and it becomes referential of greater authority. Landform, geologic and anthropogenic, in this context was viewed and used by ancient civilizations as part of a spiritual or celestial connection.

Art critic and author, David Bourdon, links meaning and spirituality to earthworks. In his book, *Designing the Earth: The Human Impulse to Shape Nature*, he outlines the use of earthworks as spiritual places.[41] For example, burial earthworks can be seen around the world, from the Ohio Valley tribes, to the Vikings, to the middle east and Asia. These mounds served as resting places for the departed and ceremonial places for the living. According to

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[39] Ibid., 44.

[40] Ibid., 49.

[41] David Bourdon, *Designing the Earth : The Human Impulse to Shape Nature* (New York: H.N. Abrams, 1995), 157.

Bourdon, landforms, such as mountains and caves, were often considered a sacred mediator of the earth and heavens. For some civilizations, mountaintops were points of departure for the soul to the afterlife, while caves were associated with origin stories.[42] Ancient civilizations also built effigy mounds, such as the Serpent Mound in Southern Ohio, believed to have been built by the Adena people.[43] It is inconclusive as to the specific purpose of these effigies, whether homage to the spirits, connection to the celestial cycles, or other theories, however, these landforms are expressive and meant to stand apart from the surrounding vernacular terrain.

This spiritual connection to landform begins to erode in contemporary land development practices. This inauguration of the land is described in *Civilizing Terrains*, by architect William Morrish, in which he discusses the shifting definition of earth and mountain. For Morrish this is a loss of the spiritual connection to the earth that prompted cultural action, which he describes in three parts. The first loss is naming a piece of dirt to elevate the community above the terrain. The second loss is naming a valley which transforms parcels of land into specific sites. According to Morrish, this requires a utopian topography that expresses landform as it relates to urban form. The third loss he describes is naming a place which defines the spatial domain. Without equipoise in the terrain, a tension develops between architecture and the land resulting in an unbalanced and discordant urban landscape.[44] Morrish describes the city as the "sacred mountain" which is the center where the heaven and earth meet. Through the term "sacred mountain," he is semantically reconnecting the spiritual and physical of the urban terrain where each is of equal value.[45]

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42 Ibid.

43 Ibid., 181.

44 William R Morrish, *Civilizing Terrains: Mountains, Mounds and Mesas* (William Stout Publishers, 1996), i.

45 Ibid., ii.

Morrish extends his discussion of changing values using the Arizona desert landscape as an example. He reflects upon his understanding of the shifting attitudes from Native Americans to present-day in which the spiritual qualities of the landscape in which the earth was linked to the heavens have been lost and contemporary builders see the land as a void for future development.[46] His examination questions a collective respect for geomorphic landform and the inability to recognize the opportunity of revealing the "sacred mountain" as a necessary driver and product of development.[47] Morrish seeks to reconcile the spiritual connection to landform and its ability to shape place. He argues current large scale land development practices emphasize site planning rather than building sites from landforms.[48] *Site planning*, he offers, is a generic portioning of the land, whereas *building a site* is a means of operating within a specific piece of land to establish a foundation for development.[49] The first being a reductive practice that ignores the spirit of place, with the latter being one of nuance where the land influences design decisions by acknowledging the existence and relevance of the "sacred mountain."

Morrish's desire to relink the spiritual and physical in the development of place is a catalog of the ways we inaugurate the land. Like Leatherbarrow's examination of leveling the land, Morrish is attempting to reignite the imagination by revealing the uniqueness of landform as a place defining actor respectful of its context, and not to simply an obstacle of development.

Similar to the spiritual use of ancient earthworks, the land art movement begins to reestablish meaning in landform through sculptural expression that heightens one's awareness to the environment or other narratives. This is

46 Ibid., iii.
47 Ibid., iv.
48 Ibid.
49 Ibid., v.

central in *Earthworks and Beyond*, by John Beardsley. In the introduction, Beardsley discusses the evolution of land art and its inspiration from early land artist such as Michael Heizer, Robert Smithson, Walter, De Maria, and Robert Morris. He offers that land art is "inextricably bound" to its site.[50] Although they could be created anywhere, these works are reliant on place to achieve meaning and intended to be experienced in the context of a specific location.[51] For some land artists such as Robert Smithson, land art was used to change people's perceptions of nature. Smithson believed that the landscape was a place of constant metamorphosis, revealing entropy, and that the landscape bares scars of disruption.[52] Beardsley observes that the relevance of these works is in the meaning and narrative created through the revelation of symbolic form and differentiation of context.[53]

Land art also uses landform in the remediation of damaged landscapes and to provide ecological function, with several examples in the region around Seattle, Washington. In 1979, a project named "Earthworks: Land Reclamation as Sculpture" was sponsored by the King County Arts Commission. This project invited seven artists to reimagine sites that included landfill, eroded creek bed, three gravel pits, an abandoned naval air station, and a noise control free zone surrounding Sea-Tac Airport. Of these projects, two were realized, a gravel pit by Robert Morris, and Herbert Bayer's "Mill Creek Canyon Earthworks."[54] Morris' design of "Johnson Pit #30" subtly altered the form of an abandoned gravel pit by regrading the site, which residents complained that he had "merely parodied a strip mine."[55] His position was that the role of the artist is not to "wipe away technological

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50 John Beardsley, *Earthworks and Beyond : Contemporary Art in the Landscape*, 4th ed. (New York: Abbeville Press, 2006), 7.

51 Ibid.

52 Ibid., 8.

53 Ibid., 9.

54 Ibid., 90.

55 Ibid., 225.

guilt."[56] The following project, Bayer's "Mill Creek Canyon Earthworks," challenged aesthetics as primary to address stormwater retention of excessive flow in a seriously eroded canyon. Bayer's design incorporates a series of earthworks that allow the park to flood during heavy storm events and then allow the water to release slowly back into the system.[57] Another example in King County is artist Lorna Jordan's "Waterworks Gardens" wastewater treatment facility in Renton, WA. Built in 1996, this project was sponsored by the King County Metro Arts Program and was completed in collaboration with the landscape architecture firm of Jones & Jones. In plan "Waterworks Gardens" looks like a blooming plant with leaf shaped ponds and stem-like paths that, as Beardsley suggests, evoke the narrative of the self-cleaning

Figure 2: Robert Morris, Johnson Pit #30, Kent, Washington. Photo by author, March 2017

56 Ibid.

57 Ibid., 94.

capacity of natural systems.[58] These influential works, along with countless other examples, serve as models for combining landform and ecology while evoking meaning, symbolism, and sculptural form in the landscape.

The pursuit of ecological function within a designed landscape inclusive of landform begins to blur the lines between the disciplines of art and landscape architecture. While the land art movement used landform sculpturally to reveal site narrative beginning in the 1950's and 60's, this movement spilled over into landscape architecture, taking hold in the 1980's and 90's, with the work of George Hargreaves and others. Beardsley recounts that upon discovering the work of land artists, such as Smithson, Hargreaves had been searching for an approach to landscape architecture to public parks that expanded beyond the English picturesque, and beyond the geometries of modernism within the urban landscape. Through his discovery of land art, such as the works of Robert Smithson, Hargreaves began to understand the capacity of the designed landscape to imbue meaning.[59] While the work of Hargreaves Associates is known for its large sweeping earthworks, Beardsley notes that Hargreaves considers his work as a framework for the land in which he relinquishes control to natural processes.[60] This is reinforced by other landscape architects, such as James Corner who describes land art as a factor of landscape recovery in that it is less of a passive setting and more a dynamic medium shaped through time.[61] The inclusion of landform, art, and ecological process in landscape architecture in conjunction with modes of practice as outlined by Hargreaves, and recalling the work of SCAPE Studio, put the designer in collaboration with natural process to create expressive and evolving landforms imbued with meaning.

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58 Ibid., 175.

59 Ibid., 191.

60 Ibid., 193.

61 James Corner, *Recovering Landscape : Essays in Contemporary Landscape Architecture* (New York: Princeton Architectural Press, 1999), 15.

CONCLUSION

As Peter Walker writes in his foreword to Peter Petschek's book, *Grading: landscapingSMART, 3D machine Control Systems, Stormwater Management*, grading practices were once manual and mass earthworks were expensive endeavors of society's elite. After the industrial revolution, and more so after World War II, the advancement of machinery reduced both time and cost associated with mass manipulation of terrain.[62] What was once a matter of shaping the landscape for habitation, agriculture, and gardens has evolved into mass earthworks projects where mountains are reduced and islands are formed in the sea. Today, as the cities of Boston, Seattle, and, more recently, Dubai among others demonstrate, there is no shortage of faith in our ability to engineer our environment.

An engineering-oriented sentiment is echoed in James Corner's essay, "Three Tyrannies of Contemporary Theory", in which he argues that the positivist attitude, based on data and "procedural theory," has led to the misconception and overestimation of humankind's ability to understand, intervene, and control natural processes. This approach, according to Corner, assumes that nature can be reduced to mathematical and scientific data used as a selective set of determinants in urban design. This approach to design produces reductive landscapes which, as Corner notes, are unimaginative and "usually mathematically efficient and economically profitable, while the poetries of place have been blindly erased.[63] When reduced to a technical exercise, landform sets a dull foundation of the landscape that ignores the unique characteristics of place, the traces of its layers, and the reciprocity of landscape to architecture.

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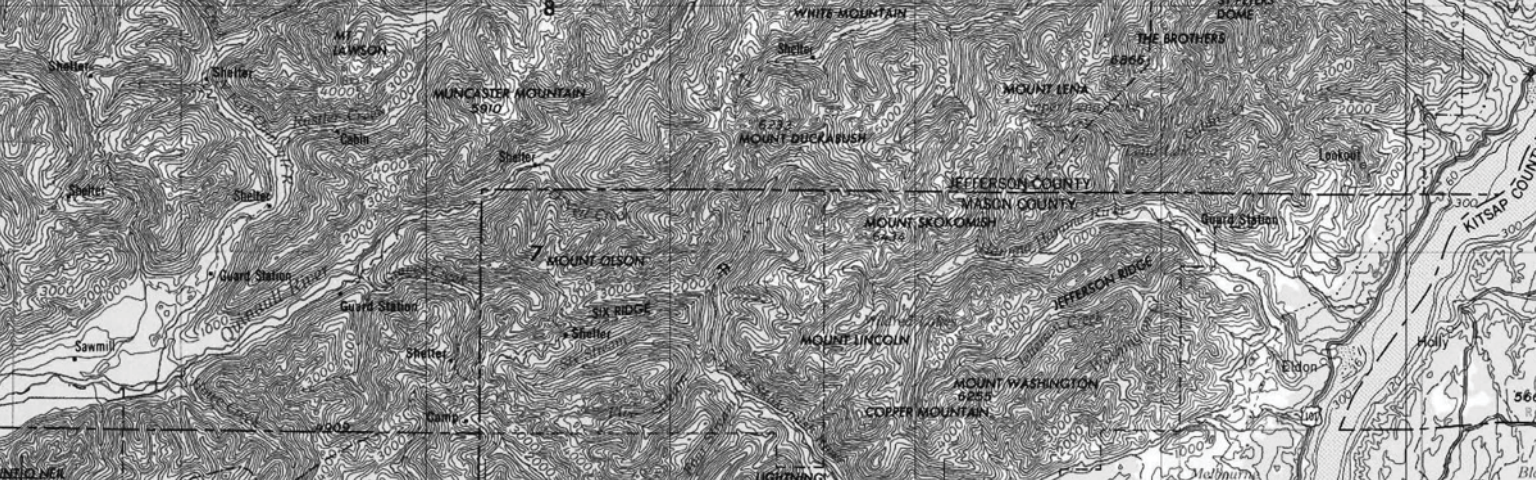
62 Petschek and Hochschule für Technik Rapperswil Landscape Architecture Degree Program. 9.

63 James Corner and Alison Bick Hirsch, *The Landscape Imagination: Collected Essays of James Corner 1990-2010*, (New York: Princeton Architectural Press,, 2014). 81.

As seen in the overlap of the physical, personal, and conceptual, the manipulation of landform cannot be reduced to a technical exercise of physical constraints. As James Corner, Richard Forman, and others have suggested, humankind's tendency to flatten and homogenize spaces of habitation and production leads to the denaturing of sites favoring uniformity in which functioning ecosystems are smoothed over and replanted in a simplistic organization of a limited palette of vegetation. As a critical core practice of landscape architecture, a leveled landscape should not be assumed as a necessary condition of development. It is essential to design a landscape foundation that shapes land and experience, is true and unique to the spirit of place, and has meaning. To do so, landscape architects must reveal what David Leatherbarrow refers to as topography's latency by thinking and seeing landform in its three manifestations: landform is physical, landform is personal, and landform is conceptual.

The practice of revealing landform's three manifestations composes the topographic imagination. It is the recognition of features and relations of a surface configurations – terrain - and our faculty to conceptualize the invisible dynamics acting upon, or through, the surface while considering the multiplicity of potentials for its transformation. It requires a blending of landscape architecture's creative and technical skills to reconstitute disjointed systems and the ability to see landform as a dynamic actor in our environment.

Figure 3: The hillside village of Fioni in the Barbagia region of Sardinia. Photo by author, May 2014



REPRESENTATION

The current practice of landscape architecture relies upon multiple approaches to representation for the conceptualization, communication, and construction of built landscapes. Representation is both an expression of the imagination and idealization of landscape, and it is an artifact of communication. The point in time that the practice of garden design transitioned to architecture of the landscape is the moment when landscape designers expressed a deliberate manipulation of the landscape through representation, as conceived in the imagination, to describe and communicate the actualization of the landscape project. The profession of landscape architecture relies upon the expression of ideas through the drawn plan, yet the making of the landscape medium requires translation of these plans by the builder. Representation of intention, therefore, necessitates clear and precise communication for actualization.

The act of landscape representation is one that has evolved as an expression of the imagination. As a conceptual and communicative device, representation has a long and, as of yet, not well-documented history in landscape architecture. Early practices emerged in the fifteenth and sixteenth century in the practice of architecture in Italy, while approaches to the painting of landscapes engaged the interests of artists from Leonardo

Da Vinci to Raphael. The role of drawing landscapes can also be traced through the work of the Dutch in the seventeenth century who began expanding beyond realism to explore the imagined. Renowned for the use of skilled observation and detail in painting, Dutch landscape paintings often reflected the imagination through recomposition and idealization of scenes. As examined in art historian Bob Haak's comprehensive review of Dutch painting, some of these paintings were created from field notes and sketches that were then assembled into paintings in the studio.[64] This separation of direct observation gave the artist agency in the recreation of the landscape in the final painting. Similarly, the practice of landscape architecture today is one of information collection, observation, and reassembly which often occurs separate from the experience of being on-site.

As the practice and profession of landscape architecture developed across Europe, the English Landscape School furthered advanced the role of drawing as a design tool. In the late eighteenth century, English Landscape School designer, Humphry Repton provided his clients with *Red Books* to explain the design intent through textual and graphic description. In these books, Repton used representation to show an existing condition transformed into a naturalistic landscape illustrated in "before and after" fold out water color paintings. Representation, to Repton, was a means of selling his ideas by demonstrating how the unpleasant realities of

Figure 4: Humpry Repton's before and after of Wentworth. From *Observations on the Theory and Practice of Landscape Gardening*

[64] Bob Haak, Elizabeth Willems-Treeman, and Prins Bernhard fonds, *The Golden Age: Dutch Painters of the Seventeenth Century* (Thames and Hudson, 1984), 138.

a client's property can be reconfigured into an idealized landscape.[65] Unlike the purely imaginative aspects of Dutch landscape painting, Repton's work was also speculative in illustrating an intention to modify the landscape.

Though there are countless other examples, these examples articulate the use of representation as an imaginative endeavor and as a device for communication. Similarly, representation in the practice of landscape architecture starts with a description of an idea that becomes more clearly defined and precise as the idea develops.

As the practice of landscape architecture has evolved, the representation of the landscape in mapping and surveying has continued to operate between ambiguity and precision, a common theme in the writings of landscape architect James Corner who describes these acts as "ambiguously precise" due to their omissive and imperfect qualities.[66] For Corner, the issue of precision in representation lies between the drawn intention and the production of the built landscape.[67] It is the divide that separates the designer and the builder. He states that, "unlike the painter, the musician, the sculptor, or the traditional gardener, the landscape architect rarely has the opportunity to significantly touch and mold the landscape medium as it plays on in response to intervention."[68] As Corner rightfully notes, the true difficulty in representation is in capturing the nuances of the tactile, material, and experiential qualities of site.[69] The division of design and making therefore necessitates thorough detail and precise description in the communication of intentions.

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65 Humphry Repton, *Observations on the Theory and Practice of Landscape Gardening* (Oxford: Phaidon, 1980), Introduction.

66 Corner and Hirsch. 155.

67 Ibid., 162.

68 Ibid., 163.

69 Ibid., 197.

Furthering his examination of the ambiguity and precision of representation, Corner shifts his attention beyond strict discussion of representation to measure and process.[70] He positions the creative process of mapping as an act of developing connections that reveal and realize hidden potential.[71] Contrary to other discussions of projecting power-knowledge, Corner suggests an alternative lens for viewing mapping as a freeing agent in the process of revealing potentials of a project.[72] Rather than a map as a "tracing" that reproduces what is already known, Corner differentiates the creative practice of mapping as revealing invisible realities, thus, as he states, "mapping unfolds potential; it remakes territory over and over again, each time with new and diverse consequences."[73] This form of mapping looks at the multiplicity of forces acting upon a site to not only reveal, but actualize its potential.[74] Maps have agency because of their dual nature, as a depiction of the earth surface on the one hand, and an abstraction on the other. While the design and planning community has taken maps as objective and rational, Corner argues that mappings are not representative of landscape or ideas, rather they influence their actualization.[75] Mapping, for Corner, is therefore an act that is less determinant than a plan in that it is an act of searching.

As a communicative device and mediator between design intent and actualization, abstraction and codification are necessary in the drawn plan to create a detailed description of an existing site and design intention. Corner states that an understanding of representation as an agent of actualization in the landscape one must look beyond the surficial and consider multiplicities of the landscape.[76] To achieve technical precision

[70] See Corner's essays, "Aerial Representation: Irony and Contradiction in an Age of Precision," and "The Agency of Mapping: Speculation, Critique and Invention."

[71] Corner and Hirsch. 197.

[72] Ibid.

[73] Ibid.

[74] Ibid., 198.

[75] Ibid., 209.

[76] Ibid., 182.

and accuracy, as Corner has pointed out, notation system of standards – conventions – is necessary to avoid mistranslation.[77] This is reinforced in Mohsen Mostafavi's foreword to *Cartographic Grounds*, entitled, "The Cartographic Imagination," in which he states the representation of a complex and layered surface requires and equally complex system of notation.[78] hile Corner maintains the position that a codified system of notation is a reductive muting of drawings to maintain objectivity and instrumentality,[79] Mostafavi emphasizes that cartographic conventions provides a common language of description. He further states that the relationship of reality, depiction, and built form is an inseparable connection of what is given and what will become.[80] Through the common language of notation, the landscape can be more fully described, translated, and actualized.

Interpreting Landform

Understanding that representation is a negotiation between the ambiguity of the idea and the precision of the technical document we then turn our attention back to the representation of landform. Throughout history, the representation of the terrain has evolved from ambiguous to precise. As seen in maps from the renaissance, the land was illustrated as a pictorial map, often as an elevation drawing of groups of hills or mountains shown as more of a descriptive pattern than an exacting account of the landscape. As described by architect and writer, Moshen Mostifavi suggests, the challenge, is the translation of the three-dimensional form into a two-dimensional surface, which paradoxically necessitates misrepresentation to more accurately depict reality.[81]

[77] Ibid., 174.

[78] Jill Desimini and Charles Waldheim, *Cartographic Grounds : Projecting the Landscape Imaginary* (New York: Princeton Architectural Press,, 2016), 7.

[79] Corner and Hirsch. 174.

[80] Desimini and Waldheim, 7.

[81] Ibid.

Figure 5: Ferrando Bertelli's map of Milan, Piamonte, Suizzeri and the surrounding region, 1567. Accessed online from Stanford University's Renaissance Exploration Map Collection.

In the representation of landform, accuracy is more closely achieved through a rejection of the pictorial for an abstraction of the surface. This is seen in the topographic maps used in the practice of land surveying and landscape architecture. While the act of mapping has agency and ambiguity through the bias and omissions of the map maker, in his essay, "The Uses of Cartographic Literacy," cultural geographer David Matless examines the emergence of the twentieth century regional survey as a common, banal document in an era of mass production.[82] Matless notes Brian Harley's view that the topographic map is the only map immune to the tendency towards "power knowledge" suggesting that the ordinariness of topographic map frees it from subjectivity.[83] While Matless' focus is on the ordinary and accessible, it is worthy of noting that the survey is the primary document for initiating site investigation.

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82 Denis E. Cosgrove, Mappings, Critical Views (London: Reaktion Books, 1999), 193.

83 Ibid., 194.

For landscape architects, the survey is the base for actualization and it provides the constraints and context for site intervention, yet, it too lacks precision through human translation. Fidelity can be lost through survey techniques, misrepresented field notes, omission, and through the production of the document itself. Although the site survey today provides a highly accurate foundation for design, it is yet again an abstraction of existing conditions subject to imprecision.

Abstraction as a means of precise representation is based on a codified system of notation, or cartographic conventions, that provide a mathematical, and supposedly objective, foundation of expression. In *Cartographic Grounds: Projecting the Landscape Imaginary*, landscape architects and educators, Jill Desmini and Charles Waldheim, examine the typical cartographic conventions of the topographic map as a means of reconciling the precision and agency of the plan with the physical and regional scope of the map.[84] They note the abstraction of the plan tends toward territorial and form legibility, but can be embedded with human perception and experience.[85] Like its counterparts, as the authors suggest, as a coded and flattened representation, the topographic map does not resemble the land.[86] As an abstract projection of the earth's surface, the topographic plan reflects scale and the horizontal spatial relationships of surface elements while also depicting vertical relationships through cartographic conventions – contours, hatching, spot elevations. Legibility of the plan is achieved through simplification and codifying information.[87] Desimini and Waldheim contend that the final form of the topographic map provides an accessible and accurate depiction of the terrain and human occupation providing an

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84 Desimini and Waldheim, 10.

85 Ibid., 13.

86 Ibid., 12.

87 Ibid.

immersive foundation for the imagination and design of the landscape.[88] The drawn plan, therefore, is enhanced through precision and visual clarity where topography is the base layer for multiple maps and plans.[89]

Emerging from early attempts to express landform in maps and plan, several conventions and graphic techniques have been used to more accurately represent the aerial view of the landscape surface. Central to the depiction of terrain in plan is the advent of the contour line. The contour line is a continuous horizontal line depicting slices of the earth surface at equal elevations, also known as isopleth, isoline, isogram, isarithm, and isohypse, while lines below the water line are isobaths.[90] A series of contours begins to represent the morphological characteristics of the earth's surface.[91] The contour evolved from the French and Dutch practice of marine soundings – spot elevations – as used in navigation. The first contour plans were smooth abstractions between the soundings of the water, the earliest of which is credited to Dutch surveyor Nicolaas Cruquius, who, in 1730, measuring depth sounding, produced a contour plan of the Merwede River.[92] Eventually, this technique made its way to the land surface by Jean-Louise Dupain-Triel's 1798-99 Carte de la France which uses surface spot elevations to construct landform contour lines, which as Desimini and Waldheim offer, is seen as devoid of the subjectivity seen in earlier mapping practices.[93]

The contour is of particular importance in the practice of landscape architecture as it forms the foundation of the technical operations in the manipulation of landform. The French again recognized this importance in the technical education of engineers in the nineteenth century at the Ecole des

88 Ibid., 13.

89 Ibid., 18.

90 Petschek and Hochschule für Technik Rapperswil Landscape Architecture Degree Program. 20.

91 Desimini and Waldheim, 47.

92 Petschek and Hochschule für Technik Rapperswil Landscape Architecture Degree Program. 22.

93 Desimini and Waldheim, 47.

Ponts et Chaussees. During this time, Jean-Charles Adolphe Alphand used the contour plan as a basis for transforming the Parc des Buttes Chaumont in 1867 in which he depicted both existing and new contours.[94] This use of contours created a technical foundation for the practice of landform description and transformation and is integral and necessary to contemporary practice. Understanding this abstract form of representation is vital to the practice of landscape architecture and the topographic imagination.

The contour, however, cannot stand alone in describing the three-dimensional character of the earth's surface; it is supported and gains fidelity through other forms of representation, and in particular, the section. The section is a two-dimensional vertical description of a slice through the contoured surface. As described by Desimini and Waldheim, the section is slice through the landscape along a line in plan that illustrates vertical and material relationships.[95] Through section one can begin to see and articulate the vertical relationships of the surface, its materiality, and the objects placed upon the land. As sometimes seen in engineering practices, the land is represented in section as a single line indicating finished grades for a road or site, devoid of materiality and context. Often misconstrued as an infinitely thin surface on which we design, it is important to recognize that we not only stand upon a surface, we stand upon a mass – the earth. Landscapes cannot be reduced to a simple surface, but are composed of rich layers of material. The section is an abstraction of those layers.

The importance of the section in the topographical imagination extends beyond its use as a representation of the physical or imagined terrain. Unlike the limitations of traditional static plan drawings, the section presents the possibility of representing the conveyance of time. Elissa

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94 Ibid., 48.

95 Ibid., 176.

Rosenberg notes that contemporary landscape design differentiates itself from the earlier Italian, French, and English gardens in that they are seen less as "theatrical spaces" but as surfaces of layered human occupation. She elaborates as inscribed surfaces, these landscapes foreground topography in design. These landscapes are based in the concept of layering, which transforms the notion of landform from a singular surface to a multiplicity of accumulated surfaces.[96] Rosenberg states that, the concept of the land as a surface of built-up layers has become a common narrative in the design landscape as a means of linking the physical form of site to its history.[97] To Rosenberg, the experience of time is through both the unfolding narrative sequence and the layered relationship of historical traces.[98]

The notion of topographic layering is based in the idea of multiple visible and invisible surfaces masked beneath the ground plane. As Rosenberg observes, the primary mode of revealing these multiple layers is the section which unmasks the tension of seen and unseen surfaces.[99] The ground plane, the visible surface, is a moment and the manifestation of a sites natural and cultural history.

When referring to the latent, seemingly passive nature of topography, David Leatherbarrow refers to the surface's making and remaking as the "unruly remnant."[100] When reading the surface for its potentials, the "unruly remnant" becomes a factor of design. Leatherbarrow calls this accumulation of remnants an absorption of meaning, and that this allows a landscape to prompt action through its saturation of the traces of time.[101]

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96 Rosenberg, 17.
97 Ibid., 20.
98 Ibid.
99 Ibid., 21.
100 Leatherbarrow, 254.
101 Ibid.

Landscape architectural historian and professor, Thaisa Way, expands upon the notion of tracings through her telling of the landscape narrative as read through the landform of Gas Works Park in Seattle, designed by Richard Haag, with a goal of telling the story of the site's toxic history.[102] Way recounts how industrial narratives are constructed through three significant projects: Jean-Charles Alphand's Parc des Buttes-Chaumont, Frederick Law Olmsted and Charles Elliott's Back Bay Fens landscape, and Richard Haag's Gas Works Park. Borrowing from anthropologist Clifford Geertz, Way suggests the term "thick sections" to describe the process of looking beneath the surface to uncover the situational complexities of place and time. She offers that "thick sections" reveal a rich natural and cultural history that more dynamically describes a place's layers of history.[103] The use of thick sections recognizes the site as a series of layers and narratives, built up over time, that give designers the opportunity to engage with this history when re-imagining a site. As Way notes referencing Gas Works Park, thick sections expose the difficulties of transforming places over time, translating generations of cultural evolution and uncovering the multiple narratives embedded in all landscapes.[104]

Indeed, Gas Works Park has a deep and complex industrial history, but as Way notes, the history of Seattle is filled with topographic narratives as the City sought to re-engineer and level the terrain. The geologic and anthropogenic history of the city's topography, from glaciers to earthquakes, and from Native Americans to the inhabitants of today, the accumulated layers offer a disorienting mix of time through its strata. Many of Seattle's most ambitious projects started at the beginning of the twentieth century when city engineers were inspired to re-engineer its landscape with a sense of emerging industrial might. Beginning with the Great Fire of 1889 as

[102] Thaïsa Way, "Landscapes of Industrial Excess: A Thick Sections Approach to Gas Works Park," *Journal of Landscape Architecture* 8, no. 1 (2013): 28.

[103] Ibid., 30.

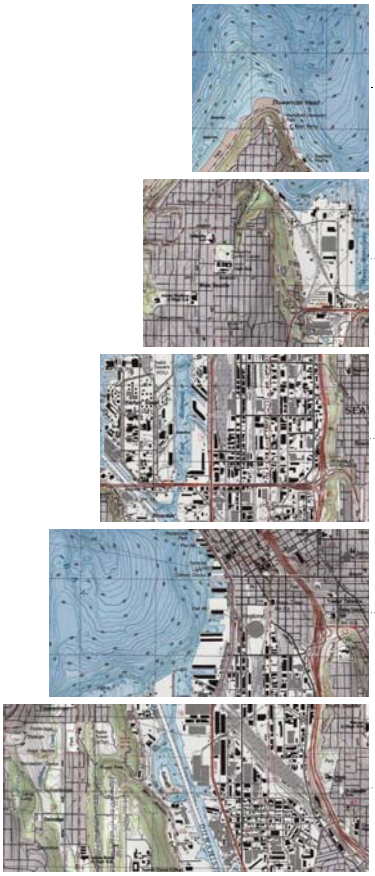
[104] Ibid., 38.

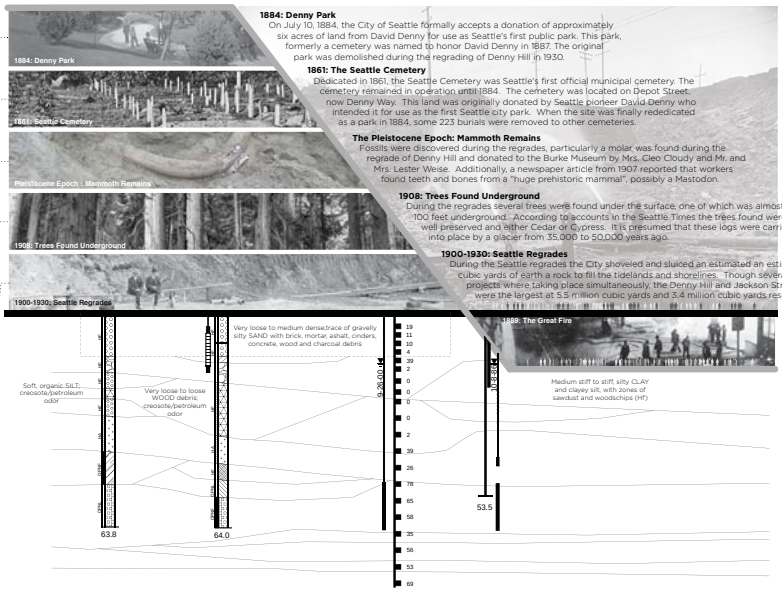
Figure 6: Kite Hill at Gas Works Park in Seattle, Washington. Photo by the author, March 2016

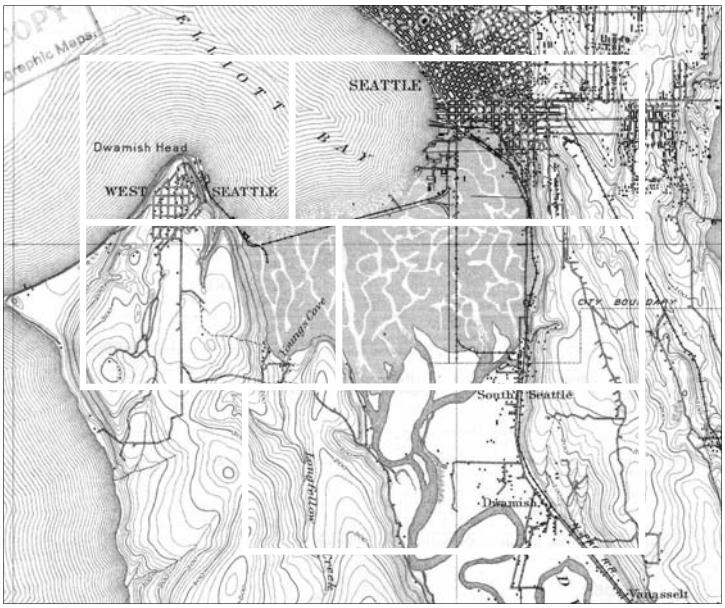
the catalyst, several of the city's hills were regraded, such as Denny Hill which was lowered so that the city's business district could more easily expand north. Denny Hill, along with other areas around the emerging city, was a topographic inconvenience and seen as a hindrance to progress. The Great Fire was an opportunity for the city's engineers to reconfigure the difficult terrain and level the landscape to make the city more habitable. This began by raising one area, which can now be seen in underground tours of Seattle. Removed by hydraulic water cannons, as had been used during the gold rush, the material was washed away and sluiced into the bay. Today, one can stand where the original street level was below them, and at the other where Seattle's first park was above them. Walking through this area today, experiencing only the surface, one would never know this topographic history. The thick section, as Way has proposed, is an opportunity to reveal this history and the disorienting layers of time through places covered and places that no longer exist.

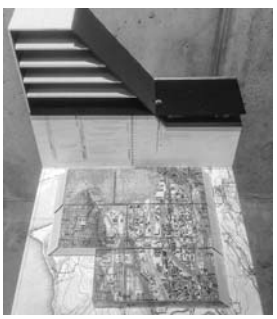
Figure 7 (above):
This section explores the leveling of Seattle by mapping in section using the Great Fire of 1889 as the catalyst for the re-engineering of Seattle's landscape. Mapping in section reveals the disorienting layers of time through places covered and places that no longer exist.

Figure 8 (below):
The section was developed into an interactive model that invites the viewer to participate in the creative act of mapping by removing the layers, discovering their relevance, and then restructuring them within the tide flats, the location of the displaced material, to reveal Seattle of today.




1884: Denny Park
On July 10, 1884, the City of Seattle formally accepts a donation of approximately six acres of land from David Denny for use as Seattle's first public park. This park, formerly a cemetery was named to honor David Denny in 1887. The original park was demolished during the regrading of Denny Hill in 1930.
1861: The Seattle Cemetery
Dedicated in 1861, the Seattle Cemetery was Seattle's first official municipal cemetery. The cemetery remained in operation until 1884. The cemetery was located on Depot Street, now Denny Way. This land was originally donated by Seattle pioneer David Denny who intended it for use as the first Seattle city park. When the site was finally rededicated as a park in 1884, some 223 burials were removed to other cemeteries.
The Pleistocene Epoch: Mammoth Remains
Fossils were discovered during the regrades, particularly a molar was found during the regrade of Denny Hill and donated to the Burke Museum by Mrs. Cleo Cloudy and Mr. and Mrs. Lester Weise. Additionally, a newspaper article from 1907 reported that workers found teeth and bones from a "huge prehistoric mammal", possibly a Mastodon.
1908: Trees Found Underground
During the regrades several trees were found under the surface, one of which was almost 100 feet underground. According to accounts in the Seattle Times the trees found were well preserved and either Cedar or Cypress. It is presumed that these logs were carried into place by a glacier from 35,000 to 50,000 years ago.
1900-1930: Seattle Regrades
During the Seattle regrades the City shoveled and sluiced an estimated an estimates 50 million cubic yards of earth a rock to fill the tidelands and shorelines. Though several of the regrade projects where taking place simultaneously, the Denny Hill and Jackson Street regrades were the largest at 5.5 million cubic yards and 3.4 million cubic yards respectively.
1884: Denny Park
1861: Seattle Cemetery
Pleistocene Epoch : Mammoth Remains
1908: Trees Found Underground
1900-1930: Seattle Regrades
1889: The Great Fire
Soft, organic SILT, creosote/petroleum odor
Very loose to loose WOOD debris, creosote/petroleum odor
Very loose to medium dense,trace of gravelly silty SAND with brick, mortar, ashalt, cinders, concrete, wood and charcoal debris
Medium stiff to stiff, silty CLAY and clayey silt, with zones of sawdust and woodschips (hf)
63.8
64.0
53.5


ELLIOTT WAY
SEATTLE
Dwamish Head
WEST SEATTLE
Young Cove
South Seattle
Duwamish



Modeling Terrain

As a means of representation, the section has great utility in reconciling vertical and horizontal relationships, as well as revealing materiality and narrative. However, the section, like the drawn plan, has its shortcomings in fully representing the complexities of a site as its precision lies in its specific location. It is unable to capture the full breadth of the landscape in which it resides, and instead only captures a specific instance of the terrain. These limitations of two-dimension modes of representing landform require a third mode to capture additional complexities: modeling.

Physical models have been used extensively in the practice of landscape architecture over the years. Whether clay, plaster, chipboard, or other material, modeling terrain is both experimentation of form and representation of the surface. These artifacts are a way of visualization and connection the three-dimensional surface with the design of landform through a process of making.

Landscape architects, like all designers, think visually when conceiving form, yet abstract two-dimensional representation is a necessity in the transference of the design idea to the built project. Three-dimensional exploration of landform in landscape architecture pedagogy begins to bridge that gap by allowing students to work between physical form and abstraction. In Kirk Rieder's essay, "Modeling, Physical and Virtual," he provides the example of the workshop approach to teaching landform design at Harvard's Graduate School of Design (GSD). This workshop was developed to expose students to the process of earthwork creation prior to subjecting them to the rigors of the more technical aspects of landform creation.[105] The workshops were established while George Hargreaves was Chair of the Landscape Architecture Department. For Hargreaves, a landscape architect with a propensity for landform in his built works, physical

[105] Marc Treib, *Representing Landscape Architecture* (London ; New York: Taylor & Francis, 2008), 173.

models were essential in exploring pure topographic form, not as a condition of a specific site, but to gain an understanding of landform's implications.[106]

The workshop sets forth three objectives: first, the development of basic landform vocabulary; second, the use of landform for spatial definition; and third, the acquisition of quick modeling skill to aid the preparation of grading plans. This workshop is done prior to teaching students the technical skill required to create detailed contoured plans and section drawings. Rieder states that the fundamental outcome of the workshop defined landform as a user-established rule-based and precisely articulated construction rather than a resolution to a grading exercise.[107] Though not consumed by technical knowledge, these explorations were guided by a set of rules that established a maximum slope. Other rules stipulate the additive and subtractive interaction and relationship of shapes.[108] This composition of additive and subtractive forms emphasized clarity of form and articulated surface intersections that accentuate topographic form in the landscape, running counter to the practice of seamless, smooth blending of landform into its context.[109] This attitude harkens back to Leatherbarrow's description of the latent manifestation of topography. The GSD's approach required students to grapple with intersecting geometries with the intent of preparing them to address the complex challenges of manipulating the terrain.[110] Recalling the earthworks of the Hopewell tribes of Central Ohio, Rieder suggests a foregrounding of topography using hard edges and geometries that accentuated the landforms improves their legibility in the landscape set within the context of structures and vegetation. The goal for the workshop

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106 Jillian Walliss and Heike Rahmann, *Landscape Architecture and Digital Technologies : Re-Conceptualising Design and Making* (Abingdon, Oxon UK ; New York: Routledge, 2016), 9.

107 Treib, 173.

108 Ibid., 174.

109 Ibid.

110 Ibid., 175.

was not the creation of a beautiful model, but a dramatic and inventive novel terrain highlighting the contrasts of the existing surface and the student's creation which allows the students to gain a broad understanding of landform manipulation that enabled them to embark on technical coursework.[111]

In contemporary practice and pedagogy, new digital tools have emerged that are reshaping how landform is analyzed, conceived, and generated, as examined by Jillian Wallis and Heike Rahmann in their book, *Landscape Architecture and Digital Technologies: Re-conceptualizing design and making*. The authors trace the history of digital technologies influence in landscape architecture beginning with the early 1960's introduction of computer aided design (CAD) software by Ivan Sutherland at the Massachusetts Institute of Technology[112] to the contemporary implementation of modeling, geographic information systems (GIS), and parametrics. In a broader context, these tools have the potential to blur the distinction of aesthetics and performance through the increased ability to connect the process of analysis and form generation.[113] The early limitation of the digital tools was that 3D digital modeling was not able to compare to the speed or flexibility of physical models.[114] The transition of these programs capabilities to more user-friendly and non-linear (less blocky) provided a platform for the generation of topographic modeling with both speed and flexibility. Wallis and Rahmann state that, "for a digital generation of landscape architects trained within a 3D context, the digital realm offers a design platform as intuitive, creative, and explorative as the clay models favored by earlier generations."[115] The incorporation of digital technology in practice is an evolution in the design process that presents new potential for physical and performative analysis and form generation of terrain.

111 Ibid.

112 Walliss and Rahmann, 1.

113 Ibid., 6.

114 Ibid., 9.

115 Ibid., 11.

Digital technologies now offer the tools to move between physical and digital modeling. This allows a deeper exploration of the performative potentials of landform. With the capabilities of laser cutting, Computer Numerically Controlled (CNC) milling, and 3D printing, one can now work with modes of digital and physical modeling with increased fluidity. In addition to these processes are those that blur the lines of physical and digital modeling, such as the Augmented Reality Sandbox, developed at the University of California Davis that allows users to shift sand and create landforms while a projection of the contours and elevation are instantly updated. This is particularly helpful in understanding the abstractness of a contour related the physical form and manipulation. Expanding beyond this is the advent of responsive technologies. These technologies use a physical model that receives inputs and digital feedback through sensors allowing for input adjustments. While still evolving, responsive technologies have significant potential for the use of technology to both model the landscape and to physically operate within the landscape.

CONCLUSION

Representation in the contemporary practice of landscape architecture operates between ambiguity and precision. It is the manifestation of an idea and a declaration of intention – projection – and it is the designer's mode of communication; a way of seeing that engages with a subject to understand its reality and expose its potential. Early stages of the design process favor ambiguous representation to visualize and solidify an idea, while the end stages of the process require definition and precision in technical detail. The early forms of representation reveal new potentials for landform through expressions of the imagination, as in painting and mapping. As positioned by James Corner, the act of map making is a creative

endeavor in its simultaneous ambiguity and objectivity. Corner reframes the projective nature of mapping in order to expose latencies and reveal new futures. Using this projective lens, cartographic practices can begin to view topography from multiple scales and time frames, not as a form of designed landscape, but of uncovering its past and future potential manifestations.

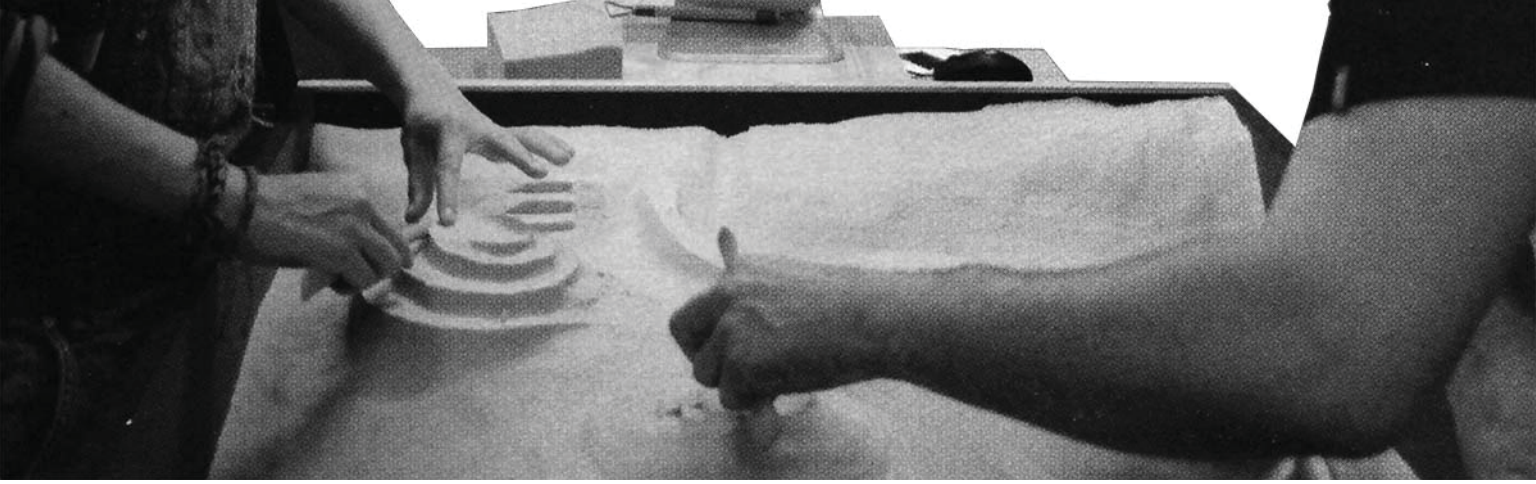
As the design process moves from the ambiguous concept and idea, where the details can remain fuzzy and abstract, to the precise lines of a technical document that articulates the intentions for the inauguration of land, landscape architects rely upon the drawn plan as a means of communication. Emerging from the survey, the designer operates within the realm of ideas in which each deliverable is a projection in various scales of complexity and detail. As one gains an understanding of what exists and a vision of what could be, the attention then turns toward precision. Each iteration of an intention is described in greater detail and accuracy as one moves through the design process. In landscape architectural practice, the survey is often seen as the foundation of precision and legal description of the landscape. Often created by multiple hands and susceptible to misrepresentation and omission, the survey base is an interpretation of the earth's surface and, to an extent, sub-surface translated into two-dimensional form. Upon this base, the landscape architect creates a projection as a suggestion of the potential for the built environment. Inclusive of both aesthetic and performative possibilities, the plan is designed to accommodate form and flow while also considering aspects of time such as material movement and transformation. The builder is then constructing an interpretation of the projection with both the plan and the built form being uniquely original.

Precision, however, still eludes the construction document as it is inevitably flawed in its detailed depiction of the proposed built form. The contour line drawn from points taken in the field, as a base, can never

achieve the exactness of the nuanced and complex form of the actual surface. The illusory pursuit of precision necessitates multiple modes of representation to visualize and detail landform to overcome ambiguity in the communication of the design intention. To that end, cartographic conventions – spot elevations, contours, sections – and abstraction is required to communicate the complexities of the vertical, horizontal and material form of the terrain. While the practice of landscape architecture has privileged two-dimensional representation, physical and digital 3D representation are needed to fully articulate the designed landform. In landscape architectural practice, the "ambiguously precise"[116] act of representation is therefore both process of the imagination and the production of intention that ranges in levels of realism, from ambiguous and idealized to precise descriptions.

As a technical core skill in landscape architecture, an awareness of the agency and limitations of representation are critical, as is a fluency in the cartographic conventions and modeling skills necessary to communicate intentions for actualization. While each mode of representation has limitations, the use of multiple forms of landform representation, from topographic maps and sections to physical and digital modeling, means landform can be expressed and interpreted in a way that narrows the gap of detachment between the design and making of the landscape.

[116] Corner and Hirsch. 155.



PROCESS

Process in landscape architecture is the interface of landform and representation. It is the combination of the art of imagining with the craft of making. Representational tools are an active agent in the design process, not merely a final product. In design pedagogy, it is necessary to engage in the various tools and methods of representation to develop an iterative design process, both manual and digital. Beyond their utility of observation and documentation, the tools of representation can be deployed in the discovery and form making of design through integration within the technical curriculum. Of equal importance within the technical curriculum is the inclusion of theory and making – the edge and the core – as an integrative process so that skill is developed as it would be applied in practice.

In this chapter, I explore an imaginative and technical integration through interviews with faculty members teaching design as well as through a review of syllabi for grading and drainage courses. In doing so, I built a broad understanding of the current teaching of landform manipulation within landscape architecture curricula. Through this research, critical competencies of landform manipulation are identified while opportunities to embed history, theory, and various forms of representation within the process of developing the technical capacities

emerge. A pedagogical approach to teaching landform manipulation and representation is developed to expand the boundaries of traditional site engineering practices and explore production and representation as a process inclusive of cultural, aesthetic, speculative, and theoretical practice.

While the thesis project includes a survey of teaching styles and methods, it is not a comprehensive review of all approaches taken at every institution in which site grading is taught. It is focused strictly on landscape architecture design pedagogy. While grading and drainage is taught in other programs, such as civil engineering, this study is only intended to discover opportunities within the landscape architecture educational approach that integrates the imaginative and technical.

METHODS

Through interviewing and data collection this study attempts to discover common ground to distill critical competencies as well as variation to approaches that may inform the design of a new class. The research was grounded in the need to survey existing approaches to the instruction of landform manipulation through an inductive approach built on qualitative methods.

The research process was initiated by identifying existing courses taught in landscape architecture curricula. This inquiry began by reviewing the websites of domestic accredited landscape architecture programs in the United States, as well as well-known programs abroad to identify key potential informants and relevant courses were identified to create an initial contact list. This list was further supplemented by recommendations from my thesis committee and other professional contacts. The initial list included twenty-one faculty members from eighteen institutions.

A request for a copy of the syllabus for the site engineering/grading and drainage, or related course and an interview was emailed to each individual on the contact list. From this initial contact, I received sixteen responses from individuals at fourteen separate universities, eleven domestic, and three international. Some responses led to additional referrals and responses from six faculty members and one new institution, resulting in a total of twenty-seven contacts and twenty-one responses.

Interviews

The purpose of this study was to better understand current approaches to the instruction of landform manipulation. As such, interviews were conducted to account for multiple perspectives and describe teaching approaches and frameworks. Of the respondents contacted, I conducted nine interviews in person, over the phone, or through video conferencing. Seven faculty members were from domestic institutions while two were international. Further, ten additional informants that had not been interviewed provided feedback via email.

In selecting informants, I looked for variables within the respondents. In Bruno Latour's *Reassembling the Social*, the author discusses "Actor-Network-Theory" in which the actors within this network are grouped based on a social parameter, however, the actors within that group have layers of multiplicities and singularities.[117] In choosing interview subjects I looked for singularities to provide contrast and different points of view on experience. Subjects selected were individuals identified as teaching site engineering or a related course. For variation, I identified multiple accredited programs in universities across the United States. Further, I looked to institutions outside of the United States that have recognized

[117] Bruno Latour, *Reassembling the Social : An Introduction to Actor-Network-Theory*, Clarendon Lectures in Management Studies (Oxford ; New York: Oxford University Press, 2007).

landscape architecture programs and faculty to capture differences in experience and backgrounds. Some had been teaching for over twenty years while some for less than one. This variation can account for changes in approach as well as the individual's experience in the field and classroom. The time variation also considers the profession's transition into a digital era which may offer differing perspectives. Finally, while I know some of the individuals personally, most I had not spoken to before. The comfort level for those interviewees I knew could have led them to speak more openly and freely, so balancing this with the responses from individuals I did not previously know was important in maintaining an objective framework.

My approach to these interviews was further influenced by readings on the philosophy and theory of multiplicity of the individual, as seen in the practices of Michel de Certeau. In Ben Highmore's book, *Michel de Certeau: Analyzing Culture*, he describes de Certeau's process of interviewing his friends and allowing the narrative to flow and unfold organically. I realize that the question I am asking in this project consists of many variables from the perspectives of the individual as well as variability in the environments in which lessons are learned. Within the practice of teaching there are no singularities and universals, but a series of complexities and nuances, or, as Highmore states, a "plurality of swarming singularities."[118] In the essay, *Wonderful Life : The Burgess Shale and the Nature of History*, Stephan Gould reinforces the assertion that there are no universal patterns, but that we should be looking for the singular and unique.[119] This is what interests me about education in a creative field; classes are structured to teach certain skills and ways of thinking, yet rarely is there a "right" or "wrong" solution, but perhaps better and worse. Awareness of variability is important in understanding

[118] Ben Highmore, *Michel De Certeau : Analysing Culture* (London ; New York: Continuum, 2006), 146.

[119] Stephen Jay Gould, *Wonderful Life : The Burgess Shale and the Nature of History*, 1st ed. (New York: W.W. Norton, 1989).

the ways in which a class is structured and the flexibility within it to allow for different instructional approaches to account for different learning styles.

Although I wanted the interviews to be open-ended and allow conversations to flow, my first inclination was to come up with a list of fixed questions that interviewees could openly respond to for a comparative study. However, as Robert Weiss suggests, the notion of fixed question and open response is an inadequate compromise, which led me to rethink the method in which I would conduct the interviews. Specifically, and as Weiss points out, I wanted there to be a looseness with the interview process, but not limit the response through the questioning. In an open-ended interviewing style an investigator asks "key respondents' for the facts of a matter as well as for the respondents' opinions about the events."[120] I chose to utilize this approach by asking key respondents about their experiences and opinions regarding the instruction of grading and drainage and its role within the technical and imaginative curriculum. By doing so, I wanted there to be an openness that might allow new directions and a greater story to unfold.[121]

While open-ended, the interviews were structured in a clear format. As Max van Manen suggests, interviews that go everywhere will go nowhere if there is a lack of strong orientation to the primary question.[122] The structured interview format would allow the conversation to remain open while providing a topic guideline that I could use to steer the interview and stay focused on the subject of teaching the grading and drainage class. In all cases, while following the general structure, I altered the questioning for the individual after researching their backgrounds

[120] Robert K. Yin, *Case Study Research : Design and Methods*, Fifth edition. ed. (Los Angeles: SAGE, 2014), 83.

[121] Robert Stuart Weiss, *Learning from Strangers : The Art and Method of Qualitative Interview Studies*, 1st Free Press pbk. ed. (New York: Free Press, 1995), 13.

[122] Max Van Manen, Researching Lived Experience : Human Science for an Action Sensitive Pedagogy, Suny Series in the Philosophy of Education (Albany, N.Y.: State University of New York Press, 1990), 67.

and publications and depending on if they teach site engineering or a related course, such as representation courses or design studios

For each interview, lasting approximately one-hour, I began by telling the respondents about my project and explaining my primary question; "How can we embed cultural, aesthetic, conceptual, and theoretical practice into traditional site engineering instruction to explore the creative potentials of landform and materiality?" From that point I had additional questions set aside as prompts if the interview was stalling or needed additional questioning to get going or keep moving. Once the informant had begun I tried to follow Weiss' suggestions on how to draw more out without being leading or directive with my questioning.[123] In using this approach, I was allowing the interview to go in different directions and possibly discover new information or further questions to ask to discover new details. The challenge was to get responses that follow my primary question in a way that the information is not necessarily comparable, but compatible in order to have a final outcome that can be consolidated in a logical manner. In addition, different approaches to the interviewing were used, in-person, over the phone, and with video conferencing primarily out of convenience and to account for variation in responses.

The structure of questioning was guided by three primary topics: general questioning about the individual's background and thoughts on the topic, questions specific to the instruction of grading and drainage, and questions related to the role and methods of representation in their teaching. While this was used as a guideline, it was not strictly followed as the interviews would evolve and conform to the individual being interviewed and the topics and ideas raised.

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[123] Weiss, 75.

The interview question structure was as follows:

GENERAL

+ How long have you been teaching and what motivated you to enter academia?
+ Have you seen a shift in the technical competency (skill/attitudes) of graduates over the years?
+ What role does topography- topographic expression- play in your approach to projects and in your built work? (if practicing)

GRADING AND DRAINAGE

+ At what point in the curriculum sequence does the grading and drainage class occur?
+ How is your class structured? (objectives, approach, order of instruction)
+ Does your class focus on the technical/procedural aspects of grading and drainage, creative exploration of landform manipulation, or a balance of both?
+ Is there integration or overlap with studios or other coursework? Do you see carry-over from these technical courses into studios or other classes?
+ Is the grading and drainage class approach based on individual exercises, or a project?
+ Do you reference history, theory, and/or precedents into your class? If so, how?
+ Are there discussions, or topics related to the dynamics of landscape process? (temporal, performative)

REPRESENTATION

+ What representation methods does your classes employ? (hand sketching, drafting, digital rendering, photography, etc.)
+ How about your practice? (if practicing)

+ Do you use modeling, and if so, what type (physical, digital)? If both, what do you see as the advantages and challenges?

These interviews were intended to provide detail on approach and process that cannot be ascertained in the review of a syllabus, however, it was not a search for a universal approach to teaching grading and drainage. The interviews offered the opportunity to understand the reasoning behind the structures given to the grading and drainage class as well as insights and experiences (lessons learned) from instructors. The interviews, therefore, were used to add substance beyond the class structure demonstrated in syllabi.

Reviewing syllabi

I received eighteen syllabi from eight institutions and collected ten additional syllabi from department websites for a total of twenty-eight. Twelve of these were specifically site engineering courses while the remainder were for studios or other courses which ranged in topics from representation to landscape dynamics and sensing. Of those respondents interviewed, six had also provided a syllabus for review and discussion. Additionally, five individuals were authors of books on grading and drainage or a related subject, such as digital technology and topographic interface.

To analyze the information provided in the various syllabi it was necessary to create a system that allowed cross referencing that would reveal similarities and variations in approach. To achieve this, a matrix was created that put the elements of each syllabus into a common structure so that related information could reside side by side. Through the initial review of the syllabi received, it was possible to establish a system for categorization of the information. Most syllabi followed a common structure or it could be deduced from the information provided.

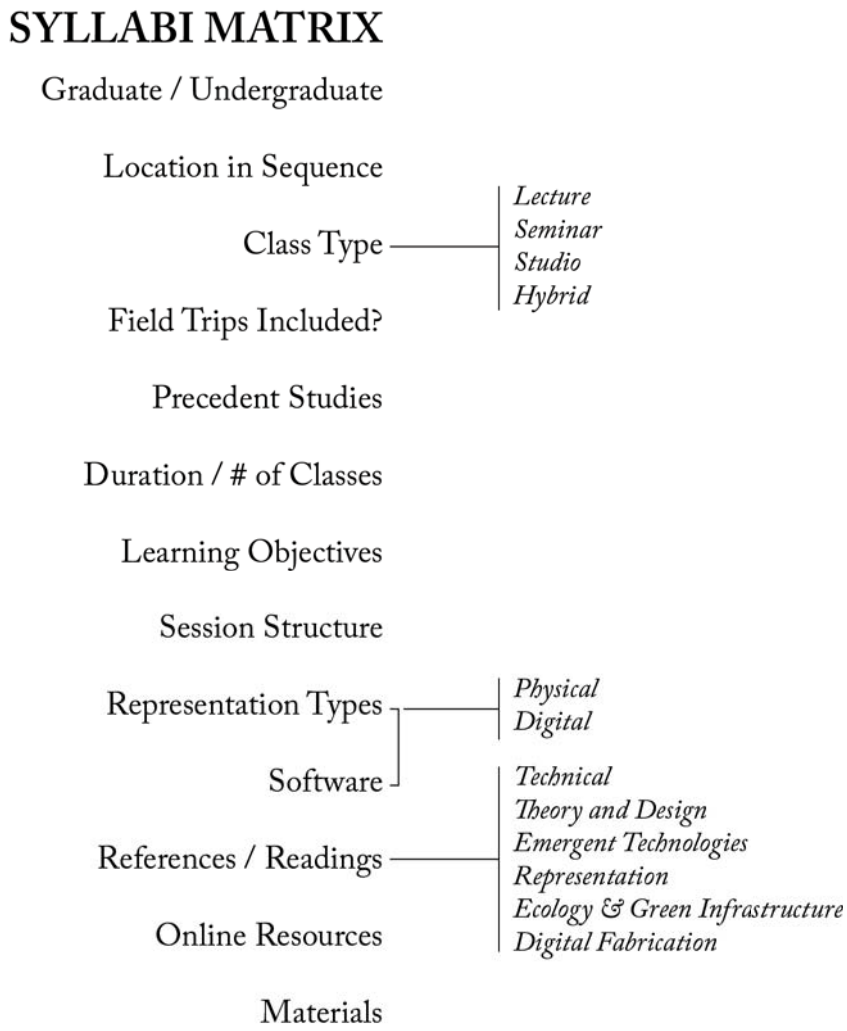

Figure 9:
Categories were established and organized in a table to highlight similarities and differences within the syllabi reviewed.

The syllabi matrix accounted for many aspects of the reviewed grading and drainage courses from student makeup to session details and references. Within these site engineering classes this matrix revealed several common factors. In general, the course sessions followed a basic common structure.

First students are introduced to the topic of landform and common representation practices. This includes landform types and terminology, landform and contour signatures, and landform constraints. Second, students are introduced to the basic formulas and procedure of grading a site.

This includes surveying, conventions and graphic standards, site circulation and movement requirements, and the concepts and mathematics of grading. Finally, the courses would end with a project that attempts to encapsulate all the skills learned through the course. In some examples, and to varied levels of detail, students were also introduced to additional considerations such as ADA and LID, subsurface drainage, and emerging technologies.

In reviewing the syllabi, I sought to reduce the course sessions to their core topics so as to be able to chart them on a skill matrix to see the skills most a least developed through the courses. As shown in Figure 10, common skills such as grading a line and a plane are taught in all courses reviewed, however, emerging technologies, cut and fill calculations, and subsurface drainage, a skill often defaulted to the civil engineer in practice, are taught much less often.

SKILL TOPIC	University A	University B	University C	University D	University E	University F	University G	University H	University I	University J	University K	University L
Landform signatures, constraints, contours, & slope	+		+	+	+	+	+	+	+	+		+
Slope calculation and slope analysis	+		+		+	+		+	+	+		+
Watersheds, slope formula & interpolation	+		+		+	+	+	+	+	+		+
Grading graphic conventions	+				+		+	+		+		+
Grading a line: path, sidewalk, curb	+	+	+	+	+	+	+	+	+	+	+	+
Grading a line: ramps, steps, terraces, walls		+	+		+	+	+	+	+	+	+	+
Grading a plane: pitch and fold	+	+		+	+				+			
Grading a surface / landform, berms		+		+	+			+	+	+	+	+
Road Alignment, drainage & culverts	+			+	+	+	+					+
Site Planning (LID, Circulation, programming, microclimate, and their impact on grading and drainage)	+		+		+	+						
Grading for mobilty: Code/ADA accessibility, edges and thresholds	+	+	+				+	+			+	+
Stormwater Strategies / water quality: retention, detention, infiltration, swales, & erosion control	+	+	+	+	+		+	+	+	+	+	+
Landscape technology, emerging technologies, high performance landscapes, living systems		+										
Integrating landscape architecture and ecological technology in urban design		+										
Earthwork quantity estimation				+	+					+		+
Subsurface drainage				+	+							

Figure 10: Skill topics as addressed by different universities.

FINDINGS

Based on the interviews and syllabi review, several common themes emerged. These themes frame the development of an alternative pedagogical approach to teaching landform manipulation. The following section is a summary of findings related to these themes.

Sequencing versus integration

A primary decision in the establishment of a new course in landscape architecture is whether it is an independent course, or integrated within a studio. Technical courses within landscape architectural curriculum are typically combined within a methods sequence that is often split over multiple quarters, semesters and years. This sequence may include grading and drainage, materials and methods, planting design, and design implementation. This separation within the curriculum, though efficient and seemingly logical approach, tends to segregate ways of thinking and challenges students as they try to connect and apply multiple skills taught in other course work. Interviews confirmed that this is a concern for many instructors, one noting that the shift of the technical aspects within the curriculum transcends the topic of grading and drainage.[124] Many interviewees noted that attendance and attention wains based on the demands of studio work. Thus, technical courses tend to take a backseat to studio.

As a core skill of landscape architecture, the student perspective that technical classes are of less importance is a difficult position faced by instructors. All instructors interviewed that teach grading and drainage or related courses are serious about the subject noting that topography and the ability to grade a site "is the bone structure for everything we do", it's the foundation and everything we do to act upon the land starts

[124] Professor A, interview by author, January 16, 2017

at this base.[125] These teachers believe students need to understand the technical to do the aesthetic, but often the students lack this prospective as they begin their journey into the field of landscape architecture.[126]

Interviews and syllabi revealed that of key importance in skill development and retention is the understanding of three basic questions- how, what, and why. In the interviews, it was noted that today a lot of emphasis is on the "what", and eventually gets to the "how", but not enough emphasis is on the "why."[127] In teaching you should start with the "why" so that students understand the significance of the skill they are learning within the practice of landscape architecture. Still, in combination with the "what" and "why", the "how" is a critical question in technical problem solving. One approach in conveying the "how" is to demonstrate the process of solving the problem, not just explain the method. It was further noted in interviews that it is not enough to be a good "chalkboard teacher", you must be able to demonstrate visually for the students to develop depth in understanding.[128] The problem can arise when a student listens to a lecture and is given an assignment without a clear understanding of how to begin to solve the problem. Understanding the "why" first can help students focus on the "how" through the understanding of the skills applicability to practice and thus improve skill development and retention.

Another challenge that instructors face is the need for deep attention to detail. While studio courses allow greater freedom of exploration around a topic, site, or other issue, technical courses require structured demonstration of procedure. There is a greater focus on detail and specificity of methods, and, to an extent, there is a right or wrong solution to the

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125 Lecturer B, interview by author, January 22, 2017

126 Ibid.

127 Ibid.

128 Ibid.

problems presented to students. This also entails the need for individual attention to ensure detailed procedural understanding is developed.

The emphasis on detail and the ability to think at multiple scales is a critical aspect of the design education. As one individual noted "the built environment is about the details, not the object."[129] In studios, students are often encouraged to think at a larger scale, the site, context, and region, to determine a solution and how their project fits within the existing environment. Technical courses, while encouraging broad system thinking, are grounded in the small-scale details. In the grading and drainage course this requires a development of a strategy for access, hydrology, and reconciling the context, but then focuses in to the spot elevation. To effectively actualize the idea, or the object, the ability to work at the detail scale.

Some faculty, depending on their comfort level with detailed design or based on other priorities, may not engage the technical landform skills in studio courses. An experienced professor noted that in his early years the technical portions of the curriculum were stronger as they were taught by studio teachers and integrated with studio pedagogy.[130] It was noted by a few of those interviewed that this can be a challenge, as some faculty may not have the practice experience, especially those coming from non-design undergraduate backgrounds, to instruct some of the technical courses, or they have been removed from practice long enough that they may no longer be qualified. This limits technical proficiency and practical aspects of practicing landscape architecture. It poses a challenge to integrating the technical within the studio if the instructor is not comfortable with technical skills and may just avoid introducing them into the studio project.[131] Without a solid commitment on behalf of the faculty to engage in both studio, theory, and technical teaching, the barrier to curriculum integration remains.

[129] Lecturer B

[130] Professor A

[131] Associate Professor G, interview by author, February 9,2017

This is not to suggest that the integration of technical instruction within the design studio is not challenging even with faculty commitment and knowledge to do so. The concept of curriculum integration attempts to blend technical courses within the studios. This involves different ways of thinking; one focused on broad and conceptual thinking and one focused on procedure and detail. Some attempts at greater integration of the two scales of designing include the implementation of a design project at the end of the term in which the students develop a design and then grade it in detail, or requiring students to develop detail level grading for a portion of their studio project.[132] In either case, it involves a high level of coordination between faculty, which is not always realistic with the tight timeframes to finalize class schedules and projects, often in a state of uncertainty up until the first day of classes.

Time of Study

A second consideration in developing a course is the time dedicated to skill instruction. Timing is a relevant factor in the introduction of the concepts and procedures of site grading. To understand the ways in which grading and drainage are being taught, it is important to decide when landform manipulation can be successfully taught within the curriculum. Recalling the core expertise of landscape architecture, if the intent is application and reinforcement of skills, early introduction in the landscape architecture curriculum is critical. This is especially true for landform manipulation where emphasis should be placed on 3D visualization and thinking, along with a fundamental understanding of landform as the foundation for any landscape design.[133] Almost all instructors interviewed agreed that learning about grading should come early in the curriculum because it applies to every project and it is fundamental to landscape architectural practice.

[132] Lecturer H, e-mail message to author, January 26, 2017

[133] Lecturer D, interview by author, January 11, 2017

In some cases, site grading is taught as early as first semester of a three-year graduate program and the first year of a four-year undergraduate program, and as late as second year of a three-year graduate program and the third year of a four-year undergraduate program. Introduction to landform manipulation and the methods of sculpting a site in the first year, it allows students to use and test their skills throughout their education.

Another important factor is the limit of instructional time within the curriculum. Typically, classes were taught within a quarter or semester system, and then placed within an allotted amount of time for the course in which specific skill development is the primary focus. The review of syllabi indicates that several topics are covered during the term, yet it was frequently noted in interviews that it is difficult to fit everything into one quarter or semester. A typical class session will begin with a lecture, may include demonstration, and any remaining time is used for questions or as work session. From the syllabi, the shortest amount dedicated to in-class site grading instruction, excluding office hours, was approximately 21 hours in a quarter while the most was 82 hours in a semester. This disparity highlights the challenges teachers face in fitting the required skill instruction within the quarter time system.

The limited availability of time requires instructors to make decisions on what topics they will introduce related to site grading, such as codes, subsurface infrastructure, and green infrastructure best practices. The interviews revealed that the amount of time dedicated to specific topics was often inadequate by the professor's standards, however, a little time was considered better that none. For example, one instructor noted that because of the importance of other skill development she was limited to one class session to convey the big picture and nuances of low impact development

(LID).[134] Other instructors noted that some of the student products were not as detailed or comprehensive as they had hoped in the exercises or final projects, so as they look towards altering the course for future classes they must reprioritize the information presented which again limits time available for the range of topics they feel should be covered.[135] Without reducing attention on some topics to accommodate others, class sessions dedicated to specialized topics tend to be more introductory to concepts with little opportunity for in-depth learning. However, teaching is always about selecting, and about teaching students how to learn rather than what to learn.

Appropriate time allotment within a curriculum is important so that technical skill development is not marginalized within landscape architectures core. A potential alternative is an approach taken at an international university interviewed. Although not the specific approach to site grading instruction, some courses taught at their institution span two quarters instead of confining them within one quarter.[136] This allows greater depth of instruction and a proportionate amount of time dedicated to core topics but fewer courses overall. Similarly, and perhaps more typically, classes can be divided into two parts, one introductory and the second advance. While some institutions may only dedicate one course to a topic, the intent is that students will have the opportunity to apply the skills developed in other classes and studios. For example, if students have taken a grading class, it is expected that they will repeat or reinforce that skill development in a soils and hydrology course, construction implementation course, and studio work. This implication relies heavily on the faculty of those courses to include and be critical of the further development of these skills, which may not be the case if the priority in learning is placed on the development of a different skill.

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134 Associate Professor C, interview by author, January 27, 2017

135 Lecturer I, interview by author, January 24, 2017

136 Associate Professor E, interview by author, February 17, 2017

Line, Plane, Surface

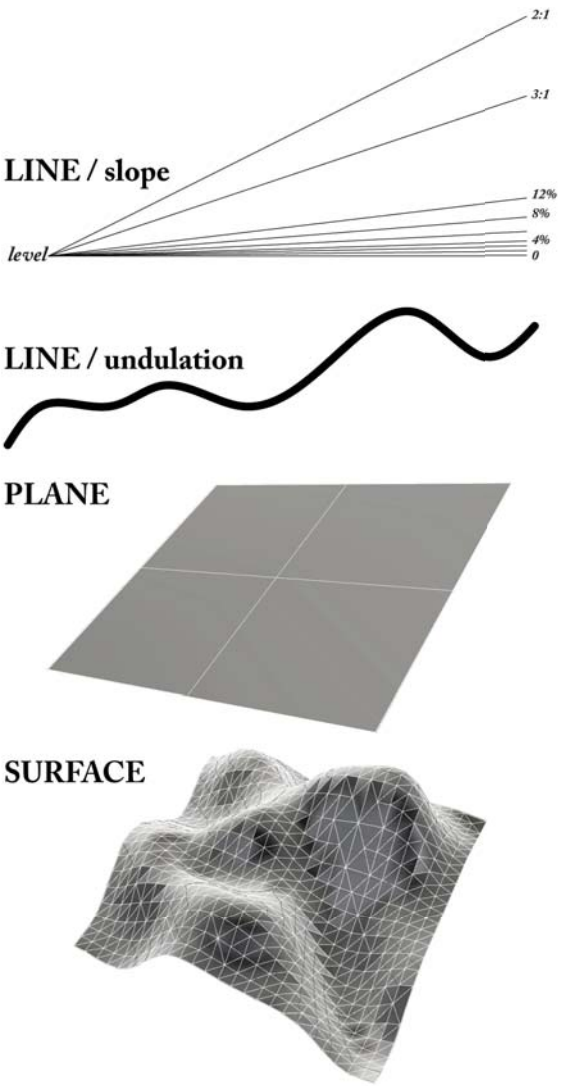

Figure 11: Grading a line, a plane, and a surface.

Since time is a limiting factor, it is important to select the critical skills to be the focus of the new course. All syllabi reviewed present grading in a series of steps. These were typically exercises and projects specific to a grading procedure, or spilt between fundamentals and a project. The fundamentals are usually taught through cut and dry smaller assignments of simple grading exercises, each emphasizing a tool/strategy to tackle any grading problem and then increasing in complexity. This strategy bridges the gap between the technical aspects of grading to a broader understanding of shaping terrain as a foundation of landscape design.

The critical competencies within a grading course are grading a line, grading and plane, and grading a surface. From these three practices one can expand to variations. For example, beginning with a line that becomes a path, a road, a wall, or steps.[137] This includes a focus on interpolation, slopes, spot grades, and contours. Second, students learn to grade a plane, which can be abstract - flat, warped, tilted - both bound and open as the two present very different drainage situations. The plane is particularly interesting in that

[137] Lecturer I

if it is not graded properly, even getting water to drain off pavement can look bad, as one interviewee noted. Grading flatness is very hard to get right. It is difficult if you want to keep a site planar and think of the site "as a carpet."[138] The instructor also noted that some of this cannot be fully taught in school, it takes experience to understand the nuances of grading - the fold, dimple, conceal, ridge, number of drains, and subtle patterns. The final step is to then ask students to grade a surface. While the line and the plane follow greater uniformity, the surface adds undulation and variation, particularly when relating it to context. Beginning with the fundamentals of line and slope, moving to grading a surface is a logical shift in complexity in which the surface demonstrates many variables. As one gains understanding of the surface changes and implications, variables can be added as constraints, including water movement and surface materiality.

As a culmination to grading exercises, some courses use a final project to have students think critically of multiple aspects of topographic manipulation. For this project, students may be asked to grade a site with multiple variables, typically on campus or nearby to allow students to visit the site. This approach also provides a real-world grading experience as it incorporates the constraints of an actual site, such as avoiding existing trees and drip lines, or connecting to existing grades at surrounding paths or building entries. For the final project, it is expected that students will apply several lessons learned and often include the production of models, sections, and details for elements such as steps and ramps.

While these elements compose the foundational elements of grading, a few courses cover the topic of subsurface drainage. It is primarily taught so that students understand the terminology and basics of subsurface grading to help prepare them to coordinate grading with a civil

[138] Adjunct Professor B

engineer. In this case, emphasis is placed on understanding the aesthetic implications, such as drain and manhole locations, while it is commonly left up to the civil engineer to complete the subsurface design in practice.

Reviewing the syllabi and through interviews, the critical competencies of grading a line, plane, and surface emerged. By distilling these necessary skills, the opportunity to embed the cultural and theoretical within the grading and drainage class becomes clearer. The process of determining what is most important sets the foundation for objectives for an alternative course by prioritizing the skills critical for development within the class, and those that can be expanded through experience.

Theory and Precedent

With a goal of embedding cultural, aesthetic, conceptual, and theoretical practice into traditional site engineering instruction it is necessary to understand the extent these aspects are already being engaged. Theory and precedent in the instruction of technical curricula are generally limited as most instructors prefer to stress the development of technical skills within the limited time they have available. Similarly, in my review of syllabi, I noted most readings, while directly related to the lecture topic, were typically technical in content and were focused on the conveying an understanding of the methods and procedure of site grading. Noticeably absent are readings related to theory and precedent beyond initial introduction to landform. While most instructors will discuss theory and precedent within the class, they are not the emphasis beyond lecture examples. One interviewee stressed that he encourages making over theory.[139] However, understanding landform requires theoretical and technical knowledge. To develop broader ways of conceptualizing landform, theory readings

[139] Ibid.

need to be pointed and limited or students either will not have time to do it, or it will be so much material that they will miss the point. Procedure is both important and difficult to learn in a limited amount of time, so you should not overburden students with an exhaustive reading list.

Although theory and history readings are limited, in lectures, most instructors incorporate precedent examples of the approaches of landscape architects, like Halprin, as references for best practices. In many cases instructors also use photos from their travels and experiences of projects with unique approaches that illustrate certain concepts, such as stormwater management practices. These are usually integrated into lectures through images of built works or photos of the construction process. Typically, these are included in introductory lectures that discuss topography and its conceptual underpinnings. When questioning an instructor that had taught grading and drainage at an institution abroad about cultural differences in the instruction and act of site grading it was stated that landform manipulation is a universal and fundamental act that transcends culture as humans have been reshaping the landscape in various ways for centuries.[140] Although there are cultural differences in attitudes toward landform, how it was used, and its meaning and cultural significance, reshaping and modifying the land is based in common procedure. These examples used are intended to provide a broad perspective are of topography that is both aesthetic and functional, and to illustrate the ways that grading has been done for centuries, such as runnels used to irrigate trees. This is communicated to students by faculty using a diversity of examples from various parts of the world.

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[140] Professor F

Site Visits

As instructors bridge technical instruction with built form, the inquiry shifted to the role of site visits. In addition to in-class and on-screen learning, time in the field is valuable in making topography real revealing details that are at times abstract in the classroom and in readings and exercises. Time outside is an opportunity to have students see and survey the ground to link the act of grading as a built form.[141] One faculty member interviewed emphasized the importance of on-site learning as he believed students seem to be losing a connection to the outdoors citing an example of a class that he had taught in which students were given shovels and simply asked to dig a hole. Some students had never held a shovel and one student, thinking it would be like "cutting butter" found it not only to be difficult, but when he struck concrete he was surprised at the discovery. To build this connection to the physicality and materiality of the landscape most instructors include these excursions, sometimes called "chalk walks", several times throughout the term. The landscape is not something "other," and to properly design it, one needs to understand what it feels like.

A greater emphasis on experiential learning engages how students see it, touch it, feel it, measure it. These field observations involve taking students to a location nearby, typically on campus that provides several opportunities to see different topographic features and treatments. Using tapes, levels, and visual cues, students are then asked to draw on the landscape to revel its form. Students are asked "is the site sloping?", and "by how much?" to help them observe the site and reconstruct it through observation.[142] Site visits provide this tactile and experiential component while addressing site specific topics, such as why a ramp is less than 5%, or what gives a space the appearance of flatness when it, in fact, is not flat. Site observation enhances classroom

[141] Lecturer H

[142] Professor A

learning by taking students away from the drawings and teaching them to read a site and understand the sculptural and tactile qualities of terrain.

This can also include visiting sites that are under construction. This can be especially beneficial to students by exposing them to the physical process of material movement and reshaping. In one instance the instructor had the benefit of many large projects in walking distance. For this instructor's classes the students would walk around and discuss design decisions and details, ask questions and point out problems they saw which were of equal learning value.[143] Seeing both final form and the construction process can give students a much clearer idea of how the decisions made during design and represented in their drawings physically manifest.

Finally, case studies of built works in which topography is a key driver in the spatial design can be included, requiring students to visit a site and conduct further research to understand its design at a deeper level. After completing design research, photographing and sketching the site, drawing plans and sections, or modeling students are asked to present these to the class to communicate what they had learned to their peers. This articulation is a way of reinforcing the students learning. Like case studies for studio work, these often lead to informative and challenging group discussions. [144]

Codes and Standards

A limited foundation of codes and standards are introduced within the grading and drainage courses reviewed. This requires a shift in learning from the conceptual and mathematic procedure of grading to the rules of that govern the grading of surfaces. With limited available instruction time, teachers must prioritize the depth and extent these standards are covered within the course.

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143 Professor F

144 Ibid.

Topography is context dependent and an important task of grading is stitching the edges of a site to its context, such as walkways and structures. Reconciling a site to its context requires consideration of human use and access and the materiality of the site. Site access, particularly in pedestrian surfaces, must contend with universal access and the currently stringent ADA laws. This point was emphasized in one interview with an instructor that splits his time between practice and teaching. He noted that in his region, lawyers are actively searching for access noncompliance as a basis for lawsuits, so his practice has taken additional measures to ensure compliance. In one example, he stated that the contractor had used too much pressure with an edge tool, slightly altering the slope one-tenth of a percent beyond compliance at one location along the edge of a walkway. In fear of a potential lawsuit, the contractor was instructed by a consultant to tear it out the entire section and redo it. Contractors in the region, now aware of this liability will pass on a project unless there is a greater tolerance between the designed slopes and the maximum allowable.[145] Though there are many examples of alterations made between the drawn plan and the built landscape, this example is representative of the importance of impressing upon students how to work within constraints and tolerances.

While exposure to common codes and standards is important, it should not overshadow the development of a theoretical and procedural approach to grading that can be readily applied in practice. Deeper understanding of codes and standards, as demonstrated in this example, develops through experience. Learning the "why" and "how" of grading allows that understanding to develop.

Teaching students these constraints and requirements within a limited amount of time requires the instruction of a site grading procedure to

[145] Adjunct Professor B

mathematically and methodically shape a site to adhere to a set of standards. This transition to method may occur too quickly before allowing students to absorb the sculptural quality of landform and its implications before shifting to the rules and procedures of manipulating terrain. Most grading courses begin with the basics of landform before moving into computational method, and provide little flexibility for student experimentation with landform, free from specific rules, to understand its three-dimensionality. In some cases, the instructor makes an effort to foreground topography and aesthetics in lectures and discussions while adding codes and restrictions in exercises.[146] While topography and the act of grading is based in rules, there is an opportunity to implement a heuristic approach with increased experimentation to further develop an understanding of landform changes and the implications to contour signatures, which in turn may aide faster development when adding constraints.

Visualizing terrain: types and role of media

The instruction of landform manipulation employs various modes of media and representation. Many courses heavily emphasize two-dimensional problem solving through hand drawing, or CAD software, especially those courses that followed the more traditional methods of site grading conventions and operation. Commonly, when on site, students are asked to do field sketches to learn through observation. One instructor stated that she does not allow students to use their computers in class, despite the student's desire to use the technology they have learned; instead she has them bring trace paper to class and draw by hand.[147] This approach encourages students to draw with greater intention to explore the spatial and mathematical aspects of topography.

[146] Lecturer H

[147] Associate Professor C

Another instructor labeled himself as "old school" in his method stating that "the hand draws the line and shapes the forms, not the computer."[148] Many instructors have students negotiating between the section and the plan in an iterative process emphasizing the need to draw, evaluate, and redraw , gaining increasing veracity. They emphasize the importance of reworking the shapes to eliminate kinks and bumps so that a contractor does not build them that way. This requires students to look, build, digest, and refine their work, which takes patience. In practice, landscape architects are often working in concert with civil engineers to develop a grading plan with a goal of controlling the aesthetics of the site, which account for the beauty and poetics of sculptural form. The implication is that landscape architecture is a profession that places a high value on aesthetics and should not approach grading in a simply pragmatic and efficient manner. Learning to grade in combination with site constraints and aesthetic form takes effort and practice, and does not "just happen" on the first attempt. When you are shaping a contour in plan, you are ultimately creating a three-dimensional sculpture in which the design aesthetic represents the form. Yet, it was stated that some students today seem content to quickly shift to the computer and "let the parametrics take over."[149] Requiring students to work by hand eliminates some of the distractions and reliance upon technology, while slowing the students down and allowing them to focus and internally visualize as they draw so that they develop this aesthetic value.

Some university programs have attempted to incorporate more technology into their landform manipulation courses. One instructor cautioned, though, that the demand to teach new technologies can result in a shift in priorities toward representation. This instructor observed that there is a trend toward less specific site design and planning and more

148 Adjunct Professor B

149 Ibid.

emphasis placed on representational strategies rather than the details of design. One example cited, though not grading specific, was a graduate student that presented a plan to him with no scale indicated. The student had drawn a pedestrian bridge, which made sense for the design and looked good in plan, but something was not making sense with the scale. The student clarified that the plan was scaled to the sheet and not to a standard scale. The result was a pedestrian bridge that was over one-hundred feet wide which the student did not think was a problem.[150] The instructor's point was that the shift toward representation places greater emphasis for students to produce a design that looks good in plan and in renderings, but it can result in losing touch with scale and context within their design work.

Clearly, hand drawing plays an important role in conveying aesthetic value and understanding of scale and grading procedure. However, teachers are working with a student body that has been raised in a digital era. Acknowledging the challenges this presents, it would be a mistake to discredit the value of technology in design education as it has played a much greater role in practice of landscape architecture over the last twenty years and will continue to have an expanded influence in design practices. The key for instructors is to recognize this trend along with technology's value and limitations, and to find a balance between developing a designer's hand and the technological skills to expand their abilities. It is not a binary discussion where one skill is switched for the other – hand to digital – but a negotiation between the two.

Regardless of approach to representation techniques, grading concepts can remain abstract while working in only two-dimensions. Understanding that a contour in a swale points uphill is far easier in a 3D representation than a plan because it provides the opportunity for students to connect

[150] Professor A

the physical form with the contour line. To address this, some courses begin with a basic modeling exercise related to understanding topography. Constructing a fictitious landform or a flat building footprint on a slope is one way to explore topographic form. The students produce a clay or cardboard model to establish a basic understanding of contour signatures and their relationship to three-dimensional form. Clay models are placed in a tub so that students can incrementally trace the contour lines. In one example, students were asked to take this a step further and photograph the model from directly above and then create a CAD plan and compare. The final step was to take the CAD plan and create a digital model in Rhino and laser cut the landform out of chipboard.[151] In this specific example the students were asked to navigate between a physical model, a contour plan, a digital model, and finally a chipboard model. By combining a variety of 2D and 3D representation techniques into one exercise, students could see and compare the relationships at each stage of the project. This is a critical in developing the students understanding of the methods of grading and the transition from three-dimensional object to two-dimensional plan.

Most land grading courses include modeling to some extent. During interviews, some faculty expressed the importance of working in 3D early, as previously mentioned. The fact that so much of classroom work is in plan or 2D section drawing demonstrates that there is perhaps an opportunity to rethink grading exercises to take advantage of new digital media and visualization practices. As illustrated in the previous example, abstract thinking is a necessary skill to grade a site in 2D, but the incorporation of 3D visualization might begin to enhance one's ability to abstractly visualize new potentials for a site.

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[151] Lecturer I

This tension between hand and digital representation is indicative of the transition taking place in practice. One professor noted the shift toward technology in the late 1990's from hand drafting to CAD. He thought that schools still taught hand drafting, not so that students become good draftsman, but so they could more clearly understand the thinking and organization, clarity of design, intent, and spatial understanding of drawings.[152]

Topography as a dynamic system

The emergence of digital tools and technologies are raising awareness of the dynamic qualities of landform and transforming the way it is perceived in design. New ideas about the role of technology in the landscape have surfaced in academia and practice, specifically regarding sedimentation and disposition and the understanding of landform and natural process. Landscape technologies that models and measures dynamic hydraulic processes and the resulting erosion and disposition are being explored in many classes, such as digital media courses, or those related to responsive technologies. In such courses, students have the opportunity to explore a variety of digital tools from 3D modeling, parametrics, sensing and measuring, and video. In these courses the emphasis is not placed a grading procedure as much as landform as a layer of design. In one example students are asked to focus on the hydrologic implications of topographic design. In addition, students had to consider thickness, process, and state change by working iteratively to explore how topography influences and is influenced by hydrologic regimes. Students in this class used a variety of digital tools and physical model sensing to document hydrologic behaviors in response to change, while not just focusing on the end product but the process of creation. Upon completion of these explorations, students are asked to produce

152 Professor A

physical models and sections for review and discussion. The final product is then used in subsequent courses to build additional layers upon it.[153]

A speculative approach to teaching landform focuses on the manipulation of landform, its materiality, and the relationship to site hydrology. Within the modeling are certain rules, such as maximum angles of repose for given materials, however, the class does not necessarily teach students to grade to specific accessibility standards. In this case, the institution offers a separate class with a more traditional approach to grading and drainage instruction, but the course described in the example is structured to build on the imaginative and novel approaches to landform design.

Through the implementation of sensing and measuring, such a course begins to address the role of time and dynamics within the landscape. Landform dynamics are underrepresented in most site grading courses which are devoted to technical methods and computations to produce a traditional grading plan for a site. The sole focus on procedure and production of a construction drawing is relevant to the contemporary practice of landscape architecture, yet it represents topography as a static element within the landscape. Speculative courses that incorporate responsive sensing and measuring technologies address the realities of a landscape, a living medium that is constantly in flux.[154] These courses offer a potential direction for expanding the understanding of topography, new directions for the practice of landscape architecture, and the ways that technology and the design process can be better integrated.

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153 Associate Professor G

154 Ibid.

Structuring a new course

How the topics are organized within a course shapes the potential for learning. As designers, we must navigate fluidly between abstract conceptual thinking and the technical and analytical thinking required to realize our intentions. This requires an iterative process of thinking at various scales and from systems to details to conceptualize design strategies and formulate solutions.

So, how do we conceptualize? This question requires a brief examination of the creative process. Creativity theory, such as Henri Poincaré (1913) and Graham Wallas (1926), suggest that creativity in problem solving is a subconscious process.[155] Generally, as one toils consciously with a problem, relevant ideas and fixed positions emerge. During a time of rest, or incubation period, the subconscious is actively working through multiple variations that free these fixed positions to reveal new potentials, or as some describe, the "ah-ha" moment.[156] Many students learn in the studio setting through research, design iterations, discussions, sketching, and note taking. In *Pedagogy of the Oppressed*, Paulo Freire writes, "knowledge emerges only through invention and re-invention, through the restless, impatient, continuing, hopeful inquiry men pursue in the world, and with each other."[157] As Freire suggests, design and creativity is a process of collecting information and experiences, trying multiple combinations and searching for connections in a sometimes-frustrating cycle. Ultimately, and often subconsciously, we are freeing these ideas and information to emerge as new possibilities and connections.

If creative thinking involves freeing ideas, then how can a technical course grounded in computation and adherence to method merge with

[155] E. Paul Torrance et al., *Handbook of Creativity, Perspectives on Individual Differences* (New York: Plenum Press, 1989), 5.

[156] Ibid.

[157] Paulo Freire, *Pedagogy of the Oppressed*, 30th anniversary ed. (New York: Continuum, 2000), 58.

conceptualization? There are multiple course structure typologies in higher education, such as lecture, seminar, or studio as well as hybrid variations, workshops, labs, and field studies. In landscape architectural pedagogy, studios, lectures, and seminars are most common. Typically, the studios are the primary focus of student's efforts, while technical courses fall within the supporting lecture format. This separation offers a clear structure, where objectives and methods and procedures can be taught in an efficient and logical order. However, it also separates skill learning and application that is not typical of design practice.

Studios are especially beneficial for learning when crossing over skills taught in other classes. Studios can be taught in a variety of ways depending on the teacher and the topic, ranging from more practical to theoretical approaches. The integration of technical skill development with conceptual thinking is critical for problem solving as one enters the profession. The crossover of technical education into the studio, therefore, provides the opportunity for students to bridge technical and conceptual approaches to projects with increase skill application.

With an understanding of the course scope and the goal of integrating technical curriculum within broader design pedagogy, an ideal format, studio, lecture, seminar, or hybrid, can be established. Although, for this study, the proposed course's emphasis is specific to landform, a broad range of skills and competencies is addressed. Given the amount of time required to focus, develop competency, discuss materials, and have time for work sessions and design experimentation, the studio format provides the greatest platform for student learning.

While all courses have learning objectives spanning both procedure and speculation, it is important to note that design studios should be taught with varying degrees of structure. In some cases, the project is established but the

actual project and outcomes might vary by each student in an "open studio." This can be a high risk, high-reward approach in which the instructor must be comfortable with being uncomfortable.[158] Think of staring at a blank canvas, empty sheet of music, or a cursor blinking on an empty page. The instructor must be comfortable as students struggle with a task, while being attentive and encouraging. In these situations, the breakthroughs begin to happen when students self-organize and begin to establish guidelines and structure to accomplish the given task. The instructor is allowing the creative process to occur freely so that a student's visions can be realized. This comes at the risk of the student not getting to a final product without additional guidance.[159]

Structure, however, is a necessary component of the creative process, especially when integrating technical procedures and detail. Structure offers boundaries and guidelines for grounding and catalyzing design exploration, or it can be clear-cut exercises focused on developing a very specific skill. Early in the design education more structure and constraints are helpful for students, especially for the logically minded as they ease students into the process of design. While structure can provide an established starting point, it can also leave room for rules to be broken. As students become more advanced in their education, less structure is generally needed as the students have developed the capacity to set their own parameters to address multiple variables, as they would in practice. There is comfort within specific boundaries, the key is to find a balance between structure openness that allows students to have a voice, but also guidance.

Open studio formats provide the student with the opportunity to screen ideas and devise a grounded solution while being held accountable for a logic, which can lead to unexpected results. In more grounded, practical, studio assignments it is easy to get caught up unnecessarily in design

[158] Associate Professor J, interview by author, May 24, 2016

[159] Lecturer K, interview by author, June 3, 2016

limitations. Even within the open studio environment, the instructor needs to provide a path for the student to learn how to look at things differently and set their own design parameters while developing their design values and theoretical foundation.[160] Design is about the process and how one gets to a solution through observation, distillation, and an appropriate response. Design education therefore should focus on the development of a cohesive critical thought process combined with the technical skill to execute solutions.

In either studio format, the challenge is the integration of technical learning. Alternative approaches to studio instruction attempt this integration in a format in which the studios and technical curriculum are blended. Edward Allen proposes this type of studio in his 1997 article for the *Journal of Architecture*, "Second Studio: A Model for Technical Teaching." In this approach Allen calls for the elimination of what he refers to as "support" classes, and replaces it with a primary studio and secondary studio.[161] While both studios would be focused on similar content, they would each have unique projects, except the secondary studio emphasizes technical detail. The emphasis of the secondary studio is in the application of technical skill to a design problem. In the secondary studio, informal lectures are conducted as needed allowing students to immediately apply facts and techniques to their project. In the secondary studio, focus is placed on the selection and integration of technical components within the evolving design.[162] Allen proposes the secondary studio as it has proven in his experience to increase technical application within the studio project much more so than the studio taught independently from technical, "support" classes. He also argues that it would be unreasonable to try to teach the technical skills within one primary studio as it would put too much pressure

160 Lecturer K

161 Edward Allen, "Second Studio: A Model for Technical Teaching," *Journal of Architectural Education* 51, no. 2 (1997): 92.

162 Ibid.

on one studio, teacher, and project to encapsulate many diverse aspects and demands of design. His approach considers the applicability of skills. When taught separate from the design problem, technical skill application may remain abstract and go underutilized in during the formative years of developing one's design process and later in practice. While the intent of Allen's proposal is improving application and technical skill, this approach also marginalizes critical thinking skills in design education by eliminating them all together, or reducing them to an "as-needed" learning session. The lack of depth in these skills may hinder learning in the broader context by reducing exploration of theoretical frameworks and historic precedent.

In *Inchoate: An Experiment in Architectural Education*, author and architect Marc Angélil describes another approach to studio instruction taken at the ETH Zurich that attempts to bridge the technical and experimental. To describe the architectural process as inchoate defies its proclivity for stability and accepts its continuously open and unfinished status. Teaching with an emphasis on "always a beginning" initiates excitement within students. Angélil suggests that design education should encourage experimentation and should inspire passion for the intellectual and physical practices of the profession.[163] In this sense, design and critical thought are of equal importance in the process of making. For Angélil, teaching is simultaneously about promoting understanding of principles and techniques while also providing space for exploration and challenging of presumptions. From this foundation, he proposes three forms of praxis responding to different modes of production: technical, intellectual, and intuitive.

Technical Praxis is the deployment of skill where the primary competency is form making, production and material execution. Its emphasis is on the "how" and methodology of making which

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[163] Marc M. Angélil, *Inchoate : An Experiment in Architectural Education* (Zürich: Swiss Federal Institute of Technology (ETHZ), 2003), 25.

determines form. It involves experimentation with tools and techniques and mediates between process and production.[164] Technical skill in this regard is the efficient and functional ability to actualize design.

Intellectual Praxis stresses conceptual foundation in design discourse and theory. Design understanding is put forward as a method of critical thinking. Emphasis is placed on the development of conceptual frameworks and the implementation of rational logic. It engages in cultural and theoretical positions, as well as contradictory viewpoints and other fields. And, as Angélil notes, the discipline of architecture is connected through its history of the dissemination of critical discourse.[165]

Intuitive Praxis is focused on the instinctive and imaginative aspects of design. This aspect of praxis is often overlooked in education or incorrectly viewed as arbitrary action. Through strategic methodology this form of praxis can become more integrated within the design processes. Intuition accelerates design investigations through unpredictable connections. This form of praxis must still hold up to critical analysis and reasoning. Angélil references Salvador Dali's "paranoid-critical method" in which design takes a rational and irrational approach that operates between the conscience and subconscious.[166]

While the *Inchoate* system of praxis is concise, it is also reductive of the more comprehensive framework of the *Taxonomy of Educational Objectives*. The simple explanations are persuasive; however, the technical praxis could productively include responding to and resolving physical and material problems. In this regard, the technical praxis and intellectual praxis are envisioned at opposite ends of a gradient in which intuition lies somewhere in between. Intuition is dependent upon the individual and its relationship to

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164 Ibid., 29.

165 Ibid.

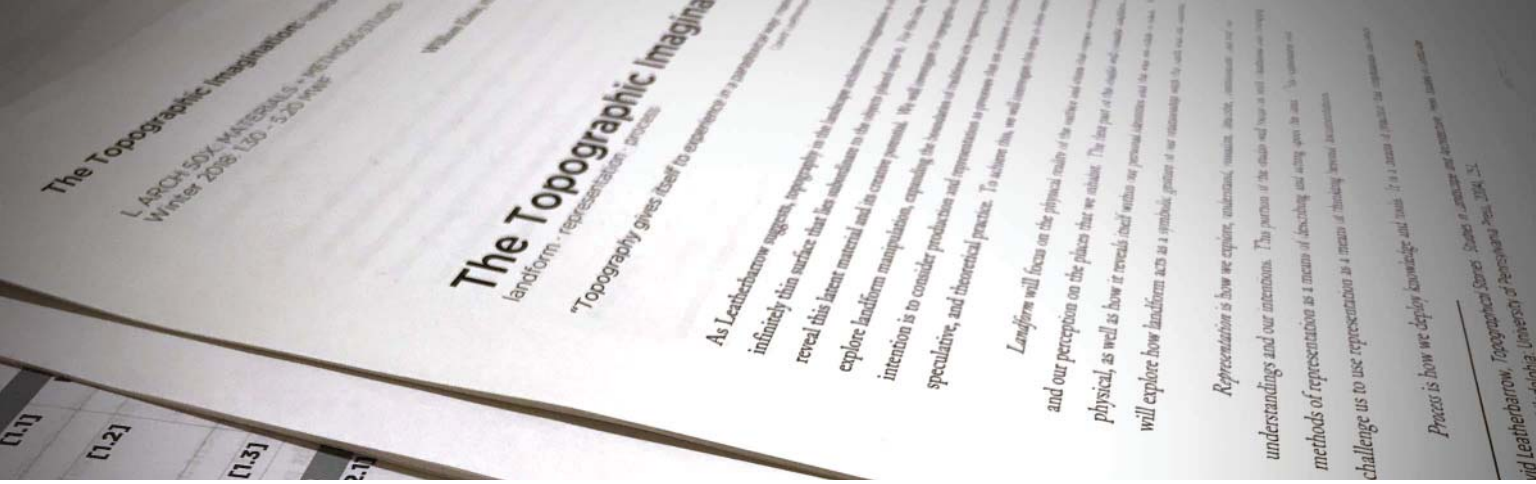
166 Ibid., 30.

the technical or the intellectual depends upon the individual's comfort level or predisposition towards a skillset of mode of thinking. Where this changes in relation to one's experience- through repeated application and evolving understanding. As one gains experience, the technical and intellectual praxis are pulled closer toward each other and effectively narrowing the gap of the three forms of praxis. The experienced professional thinks fluidly and, at times, instinctively blurring the lines between these forms of praxis.

Figure 12: Diagram of *Inchoate*'s three forms of praxis.

The *Inchoate* approach is deeply focused on experimentation and even with an acknowledgment of intellectual and technical skills, these are not the emphasis of the approach, nor does it offer a true integration of skill learning and application. Angélil, acknowledging this weakness, suggests there must be rigorous attention paid to method- the how- which in turn allows the what and why to be questioned and renegotiated. Process, therefore, is a transformative and continuous questioning of goals and assumptions, and not a means to a pre-determined outcome. In this sense Angélil suggests that, rather than focusing on pre-established ends, design evolves through questioning and method.[167] For Angélil, reprioritizing the question of "why" would place greater emphasis on intellectual thinking that would lead to the "how" in the design process. This is in contradiction to the interviews conducted that indicate that starting with the "why" seems to be what is lost on students in teaching technical skills, yet it highlights the fact that "why" and "how" are inseparable in the process of design. The proposed course draws on these dynamic discourses to bridge multiple forms of praxis in the study of landform.

[167] Ibid., 29.



ESTABLISHING an ALTERNATIVE COURSE

Drawing on the readings, interviews, and syllabi, an alternative course is proposed. The process began by deconstructing the grading and drainage course and creating a new framework of learning. This framework then guided the creation of a course syllabus that considers landform manipulation as a technical and intellectual practice.

Establishing a framework

As Leatherbarrow suggests in his writing, topography in the landscape architectural imagination is often a recessive surface that lies subordinate to the objects placed upon it. The framework for this course is split into five overlapping sections based on topography's modes disclosure. The goal for the proposed class will be to reveal this latent material and its creative potential in multiple ways and with increasing complexity.

In developing a framework for a new course the intent is to ease students into design experimentation and speculation by first establishing a structured foundation of study that is inclusive of theory and technical thinking. The course must also work with existing the landscape architectural curriculum. Technical courses are often taught within a sequence and are isolated from courses that engage cognitive process. Repeated application and integration

throughout the design curriculum is a necessary course of action. The framework for the course proposed here establishes a logical order of inquiry with increasing complexity and experimentation. The beginning provides a foundation, followed by technical skills, and finally speculation. The approach taken in developing the framework focused first on the end and then the beginning, knowing that the central portion of the class would emphasize the development of technical skill. It also recognizes the layered approach required for practice in which design and representation are a fluid process and both skills must be nurtured in context with one another.

The proposed course is outlined in five overlapping sections as follows:

+ ***Revealing Landform***
  The first part of the course will focus on revealing topography through observation, clay modeling, site surveying, and geomorphological understanding.

+ ***Representing Landform: part 1***
  This section will introduce cartographic conventions, their history, and use in describing landform. The concepts of abstraction and precision will be introduced.

+ ***Civilizing Terrain***
  The leveled landscape is the hallmark of civilization. The surface of habitation that is formed and reformed as sites are deconstructed and reconfigured. This portion of the course will introduce the operations of grading at their most basic levels- line, plane, surface. This portion of the class will also examine the history and theory of terrain manipulation through precedents and readings.

+ ***Representing Landform: part 2***
  This section will introduce the digital tools of landform analysis and design (GIS, Civil 3d, Grasshopper). The course will attempt to implement available software to expose students to different tools and encourage experimentation.

+ ***Emergent Topography / Topography in the Anthropocene***
  The future for landscape architecture looks toward remediation of sites, to reform the terrain and accept and reimagine the scars of human activities and disturbance to the environment. Beyond surficial, this affected nature is one that heals the landscape and (re)introduces ecological process. This portion of the course will focus on flows, disruption, and projection in reclaiming sites and establishing frameworks for emergent topographies.

There is inherent variability with the framework for this course; it could be used in multiple ways to fit within the curriculum as deemed appropriate. For example, this could be used to establish one class, or separated into multiple classes if the elements remain integrated so that topics are not extracted into narrowly focused courses as that would defeat the purpose. This framework also assumes that some skills, especially regarding the use of representation tools, need a base level of proficiency before one can expand into experimentation in the fourth and fifth sections.

Components of the Syllabus

Using the framework proposed, a syllabus structure is established as an example of what has been identified as best practice while also serving as an experiment in studio pedagogy. The course syllabus is designed to communicate basic course information to students. Best practices included format as well as presentation. Each course syllabus reviewed followed a similar format of essential information that provided a course overview and communicated the course goals, objectives, procedures, and student expectations. The syllabus serves as a guide for the teacher and student alike, while remaining a flexible document intended to adapt to opportunities or to adjust to the fluidity of the learning process and variabilities of student progress.

Typical syllabus format:

+ Basic course information including course title, instructors name(s) and contact information, office hours, and course time and location
+ Course introduction with a brief overview of the topic of study
+ Course goals and learning objectives
+ Course method explaining the teaching and/or learning approach
+ Required readings or textbooks
+ Student evaluation and grading
+ Course schedule with session outline including days, topic, readings, assignments
+ Materials list
+ Student expectations
+ University policies typically related to inclusion and academic integrity (if required, follows University guidelines)
+ Expanded bibliography of optional readings

In developing the syllabus content, it is important to first understand the student audience. Given that landform manipulation is a foundational operation of practice, a conclusion of this thesis argues that it is essential to teach the course early in the curriculum to increase the opportunities for application throughout the student's education. Students need to develop an ability to visualize and think three-dimensionally early so that it becomes an integral part of their design process during the formative years of studies. For this course, I am assuming a student in their first year of graduate study, or an advanced undergraduate student, that has completed the design foundations studio and an introductory digital media course. While some material may overlap with the foundations studio, the specificity of this course will allow greater depth of detail and exploration that the foundations

studio cannot offer as they are generally focused on a broader spectrum of practice. Alternatively, this course could supplant the foundations studio, though not assumed for this study, if the following studios or courses pick-up the skills omitted from this course. In that case, the exposure to technology would play a greater role in this course to build enough proficiency to get to more advanced applications and experimentation within the studio.

To establish goals and objectives it is ideal to determine critical competencies and a holistic framework that accounts for multiple learning objectives. In *A Taxonomy for Learning, Teaching, and Assessing*, editors Lorin Anderson and David Krathwohl present a revised approach to establishing a framework of educational objectives that expand upon Benjamin Bloom's influential work, *The Taxonomy of Educational Objectives, The Classification of Educational Goals, Handbook I: Cognitive Domain*. This framework focuses on what the objectives are and how teachers help students to achieve these objectives. The expanded framework presents a two-dimensional structure, the knowledge dimension and the cognitive process dimension. The Knowledge category is ordered in a continuum of concrete to abstract in four categories: *Factual, Conceptual, Procedural,* and *Metacognitive*. The cognitive process dimension is organized in a continuum of cognitive complexity in six categories: R*emember*, *Understand*, *Apply*, *Analyze*, *Evaluate,* and *Create*.[168] Using the taxonomy table allows an instructor to make choices regarding the content of the courses they are teaching. Through its use the teacher can refocus on the question, "what is worth learning?" to reveal gaps, or empty columns within the curriculum that alert us to deficiencies and guide curriculum decisions.[169]

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[168] Lorin W. Anderson and David R. Krathwohl, *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*, Complete ed. (New York: Longman, 2001), 5.

[169] Ibid., 8.

KNOWLEDGE DIMENSION	COGNITIVE PROCESS DIMENSION					
	1. Remember	*2.* Understand	*3.* Apply	*4.* Analyze	*5.* Evaluate	*6.* Create
A. Factual Knowledge	*Identify common landforms*	*Understand the history and use of cartographic convention to describe landform*		*Understand Landform Morphology*		
B. Conceptual Knowledge	*Identify common site systems as they relate to landform*	*Understand Dynamic Process of Landform Creation*		*Recognize site flows and dynamic process as they relate to landform*	*Understand hydrological and ecological implications of landform changes*	*Express topography as a physical form*
C. Procedural Knowledge			*Employ the basic and fundamental procedures of site grading line/plane/surface*			*Use digital tools as a means of design exploration and speculation*
D. Metacognitive Knowledge	*Explore topographic memory*		*Use readings (history, theory) as a basis for design decisions*		*Engage a site's challenges and constraints*	*Develop speculative and emergent solutions for a site*

Figure 13: Objectives are placed in the taxonomy matrix to ensure all knowledge and cognition categories are address.

Using this guide and referencing the objectives of other courses, the proposed syllabus incorporates course objectives including:

+ Identify common landforms
+ Identify common site systems as they relate to landform
+ Explore our relationship to topography- topographic memory
+ Understand the history and use of cartographic conventions to describe landform
+ Understand the dynamic process that act upon and shape landform
+ Employ basic and fundamental procedures of site grading
+ Reference readings (history and theory) as a basis for design decisions
+ Understand landform morphology
+ Recognize site flows and dynamic process as they relate to landform
+ Understand hydrological and ecological implications of landform changes
+ Engage a site's topographic challenges and opportunities
+ Express topography as a physical form- spatial, temporal, experiential
+ Use digital tools as a means of design exploration and experimentation
+ Develop speculative and emergent solutions for a site

Establishing a syllabus

While there are numerous ways in which the class could be structured within a curriculum, the proposed course is organized as one class within the quarter system timeframe. The proposed syllabus, as an example document and following the established framework, is therefore a condensed version of the studio. The syllabus could be immediately used without great impact to other coursework in an established curriculum and it could be expanded as appropriate to fit within the semester timeframe by allowing for deeper investigation. As a studio, the class would meet for four hour sessions three times per week, a total of up to 120 hours of instruction time.

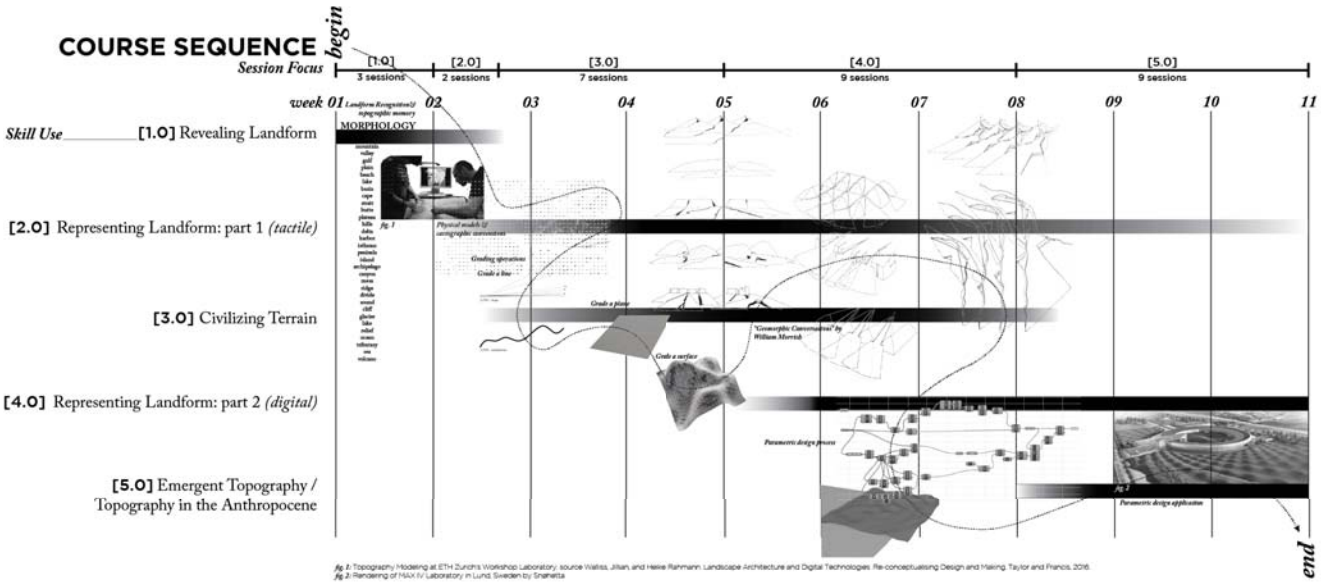

Figure 14: The framework serves as the basis for the sequence of instruction. After skills are taught they will be applied for an extended period so that skill development is overlapping and continuous.

The first three class sessions are devoted to an introduction followed by activities focused on revealing landform in its three manifestations, physical, personal, and conceptual. These classes include readings devoted to geologic and anthropogenic aspects of landform, topographic memory, and the ways in which landform has been given meaning. Class exercises include physical models of terrain, on-site observation and surveying, and creating a landform taxonomy of landforms encountered every day and identify the process that shaped such places.

The following two sessions of the course explore cartographic methods of describing landform. These include standard conventions, such as those outlined in Desmini and Waldheim's Cartographic Grounds including the contour, the spot elevation, and the section. These sessions introduce conventional rules and allow students, using these conventions, to break the rules and produce landform graphics that are experimental, graphic, and descriptive. Through notation and experimentation, it is intended that students strengthen their understanding of the necessary two-dimensional abstraction of the three-dimensional form of the land.

The next seven sessions of the course explore civilizing terrains and focus on ways in which to inaugurate the land. Technical grading procedures and methods are examined in grading the line, the plane, and the surface. Additionally, students explore the materiality of landform by looking at soils and hydrology as they relate to topographic form and form generation. During this stage, students practice grading operations through a series of standard grading exercises that teach interpolation, slope, folding, and variability within landform manipulation operations.

The following six sessions will focus on digital media as a design tool in topographic form generation. This section will focus on using a variety of digital tools and navigating between them as part of an

iterative design process of form making. This may include the use of CAD, GIS, Rhino, Grasshopper, and other tools as appropriate to the student's skill level and the intended outcome of the final project.

The final nine class sessions of the course will serve as a culmination of the course. The project will focus on topography as a dynamic element within the landscape. Students will be asked to analyze a given project site using the tools they have learned, including on-site observation, drawing, and the use of digital media. They will then be asked to develop a speculative topographic framework and then model its potential change over time.

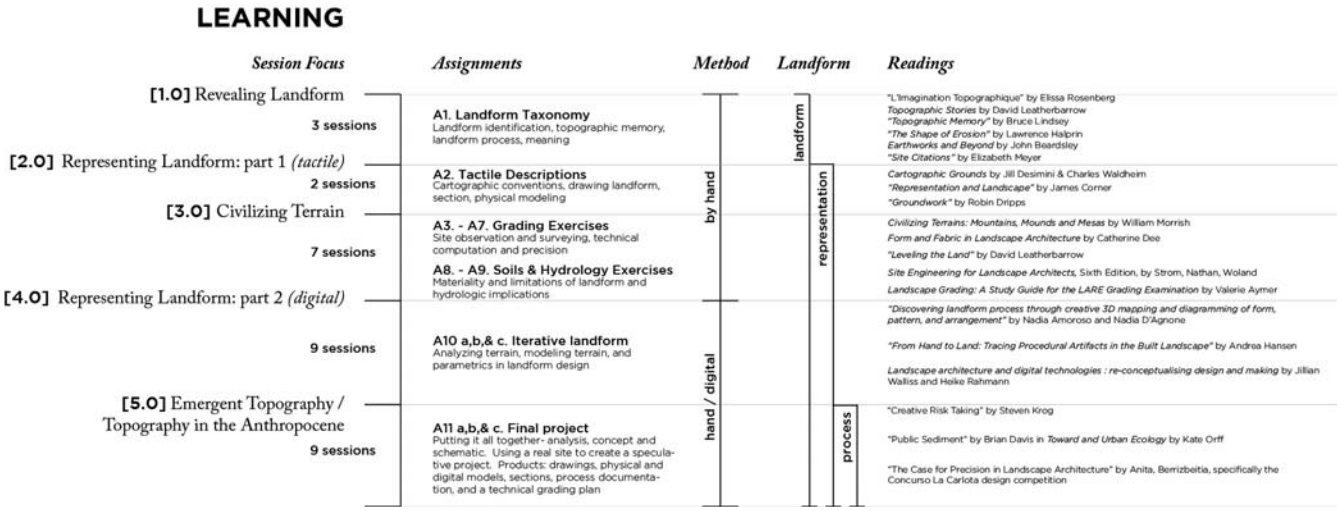

Figure 15: Syllabus diagram indicating the number of sessions per framework category, assignment framework, representation meth-ods, and readings. For the complete syllabus, refer to Appendix A.

CONCLUSION

The exploration of topographic and landform pedagogy and development of a syllabus has offered an opportunity to examine the edge and core of the practice of landscape architecture as it relates to the technical competency. The research verified that critical thinking and theoretical frames of design are necessary to solve the problems of the future, but need to be grounded in technical practice.

Landform, though physical, is most productively considered as personal and conceptual to understand the unique qualities of site, and to design landscape with meaning. While contemporary development strategies favor leveling and clearing the land, landscape architects, as stewards of the land, must advocate for these unique qualities, a site's historic narrative, and the spirit of place. Architect and professor, Robin Dripps states that "when valued as a cultural product as well as a natural resource the process, connections, stories, and meanings of the ground take on a different cast."[170] As with Corner, Dripps suggests that landform has cultural relevance that extends its meaning beyond the aesthetic and physical. Through revealing this latent materiality in design, landform begins to broaden the possibilities to include site poetics and become an active agent in the perception and experience of place.

To describe landform in technical practice requires multpile modes of representation. The act of representation, though sometimes taken as a precise given, operates on a spectrum that begins as an abstraction and develops specificity without ever achieving absolute precision. The design of landform, is a negotiation between abstraction and precision and a description of intention. As a communication device, the use of multiple methods of

[170] Carol Burns and Andrea Kahn, *Site Matters : Design Concepts, Histories, and Strategies* (New York: Routledge, 2005), 64.

representation – plans, sections, modeling – enable the landscape architect to overcome the limitations and ambiguity inherent in representation.

Research into the instruction of landform manipulation was a telling process. With the benefit of input from many outstanding faculty members and several universities, it was clear that there are many ways to teach landform, and all faculty, are continuously looking for opportunities to improve learning within their courses. For this reason, many instructors were receptive to discussing their approach and sharing anecdotal stories that deepened my understanding of teaching landform. I was also intrigued by the similarities from one to the other and from my experience in undergraduate studies in the mid-1990's. It is notable that there is a general standard of approach to the instruction of grading and drainage – instructors mostly taught how they were taught – yet the practice of landscape architecture is evolving, specifically in terms of technology in design. Many instructors were already thinking of ways that the design process might alter the instruction of their classes, yet stay grounded in what they already are doing well. With limited time to prepare, it is difficult to imagine altering an existing course to fit in more topics and process.

This project established an alternative framework inclusive of intellectual thinking and contemporary representation techniques. This framework could be used, in whole or in parts, to establish a new grading and drainage class, or to aide in altering an existing one. For this study, the syllabus created is one example and viewed as a starting point that needs to be tested and refined. As such, this thesis is viewed as a foundation for my development in sharing experiences in the classroom. Over time, and through the experience of teaching, I will revisit this document and the course structure to expand the study and improve the framework and syllabus with respect to student learning and input.

In addition, I plan to expand this study to include practice. As noted in the Landform section, several practices are thinking of landform in unique and projective ways. Hargraeaves Associates; Gustafson Guthrie, Nichol; SCAPE; Peter Walker, just to name a few, have been influential in the use on landform in practice. Through an expanded study, the gap between education and practice can be narrowed.

This study calls into question the way we define success and failure in design education. It is not about being "right, or wrong", but about experimentation, exploration, and the depths to which we can push the process. Some might argue that design education should be more "real world" in their application, but, actually, design education is about teaching an individual to learn and think critically while providing them with a basic foundation for entry into the profession. This reality requires acknowledgment and accountability among the professional community to commit to mentoring entry-level landscape architects so that we are not just creating a generation of production staff, but collectively and collaboratively we are providing an expanded education to create "real world" leaders with the ability to inspire generational change.

The proposed approach to the instruction of landform manipulation, inclusive of intellectual and technical skills, should inspire students to delve into this core topic and apply it in their design proposals. Early exploration of the broader way of seeing and relating to landform will strengthen the practice of landscape architecture.

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The Topographic Imagination: landform · representation · process

L ARCH 50X: MATERIALS + METHODS STUDIO
Winter 2018: 1.30 – 5.20 MWF

Instructors:
William Estes, PLA, ASLA, LEED AP: westes@universityx.edu
office hours: Thursdays, 11-1 pm.

Teaching Assistant: TBD
office hours: by appointment only

The Topographic Imagination

landform · representation · process

"Topography gives itself to experience in a paradoxical way: manifestly latent."[1]
David Leatherbarrow, *Topographical Stories*

As Leatherbarrow suggests, topography in the landscape architectural imagination is often a recessive and infinitely thin surface that lies subordinate to the objects placed upon it. For this class, we will explore and reveal this latent material and its creative potential. We will investigate the topographic imagination and explore landform manipulation, expanding the boundaries of traditional site engineering practices. Our intention is to consider production and representation as processes that are inclusive of cultural, aesthetic, speculative, and theoretical practice. To achieve this, we will interrogate this topic in three ways:

Landform will focus on the physical reality of the surface and strata that impact our everyday lives and our perception on the places that we inhabit. The first part of the studio will consider landform as physical, as well as how it reveals itself within our personal identities and the way we relate to place. We will explore how landform acts as a symbolic gesture of our relationship with the earth and our universe.

[1] David Leatherbarrow, *Topographical Stories : Studies in Landscape and Architecture*, Penn Studies in Landscape Architecture (Philadelphia: University of Pennsylvania Press, 2004), 251.

The Topographic Imagination: landform · representation · process

Representation is how we explore, understand, visualize, describe, communicate, and test our understandings and our intentions. This portion of the studio will focus on both traditional and emerging methods of representation as a means of describing and acting upon the land. This exploration will challenge us to use representation as a means of thinking beyond documentation.

Process is how we deploy knowledge and tools. It is a means of practice that emphasizes discovery and iteration and it is the craft in which landform and representation come together. Through process we will experiment and speculate on topographic potentials in the context of a design project.

Course Objectives

The LARCH 50X studio is intended to introduce technical procedure within the design process. Emphasis will be placed on developing technical proficiency while engaging intellectual capacities to build design approaches. Upon completion of this studio it is not expected that you will be an expert in all aspects of site grading, however, you will have a foundation from which to build upon in subsequent studios and design assignments. As a primary operation in landscape architecture, it is my hope that you will see sites differently - as topographic entities composed through dynamic processes and the unique potentials for reimagination. To see what exists and what could be, and to visualize and actualize your design intentions. To design is to think differently.

Learning Objectives

+ To understand and identify common landform morphology as understood in landscape architecture
+ To understand hydrological and ecological implications of landform changes
+ To explore social and human relationships to topography - topographic memory
+ To understand and utilize analog and digital representation techniques to describe landform
+ To develop and employ fundamental procedures of site grading
+ To use digital tools to explore and experiment with shaping land
+ To express topography as a physical form- spatial, temporal, experiential, spiritual

The Topographic Imagination: landform · representation · process

Studio Method

The class meets in the studio every Monday, Wednesday, and Friday from 1:30 to 5:30. We will begin each session as a group for lectures or discussions and the remainder of class time is expected to be used as a work session. On occasion, we will conduct site visits and research excursions. Pin-ups and project reviews will be conducted as a class or in small groups either in the studio or a location that will be communicated to you in advance.

The design studio is a space of experimentation and collaboration dependent upon your participation and active engagement. Throughout the term you will work both independently and in groups to complete design exercises and projects. We will learn through verbal and visual presentation of our ideas with peers and faculty through constructive dialog. Remember that design reviews are not meant as a one-sided conversation so be prepared to describe your solutions and to ask and respond to inquiries and questions. You will find that instructors and reviewers may have divergent perspectives that will add to your own. Be open and learn to listen carefully.

In the studio, learning is not only facilitated by the instructors or reviewers, but also through your interaction and discussions with peers. When you are completely focused on your project, actively seeking the input of those around you can uncover new directions and opportunities you had not yet seen, furthering the depth and breadth of your exploration. The studio, as a place of exploration, is your opportunity to try new approaches and methods. Now is the time the take risks, and you are encouraged to break from your comfort-zone and expand your design skillset and ability to communicate design intentions and respectfully collaborate with others. To design is to learn to learn.

The Topographic Imagination: landform · representation · process

Readings

Readings are assigned throughout the term to engage you in a variety of prospectives that offer new ways of thinking and seeing, new design processes and approaches, and examples and inspiration to enhance your work. These readings build on the lectures and assignments to further your ability to think critically and formulate your positions on topics and concepts. As such, it is essential that you complete the readings prior to the appropriate sessions, and be prepared to discuss during class.

Most materials will be available to you via the course website or on reserve in the College library. Throughout the term, we will refer to specific texts more frequently and you are encouraged to purchase them at the UX Bookstore.

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Materials + Technology

To delve into the iterative process of design we will utilize a variety of materials and techniques. The following is a list of materials you should have available at your workspace.

Physical Models (recommended):
Chipboard, cutting utensils, adhesives

Drawing Materials (recommended):
sketchbook, trace, vellum, drafting materials, scale, straight-edge, colored pencils, etc.

Software:
During the term, we will explore a variety of software in our design explorations. This is available on the UX/LA Department and the College computers, however, you are encouraged to acquire the

software for your continued exploration and use. Required software is available for download, or can be purchased through the UX Bookstore. Potential software used includes:

+ Autodesk AutoCAD (Free for students)
+ Autodesk AutoCAD Civil 3d (Free for students)
+ Autodesk 3D Studio Max (Free for students)
+ Autodesk Ecotect (Free for students)
+ ARC GIS (Free for students with code)
+ Rhinoceros 3D (UX Bookstore)
+ RhinoTerrain (UX Bookstore)
+ Land Rhino Plug-in (Free download)
+ Grasshopper Rhino Plug-in (Free download)
+ Kangaroo Rhino Plug-in (Free download)
+ Adobe Illustrator, Photoshop, InDesign (UX Bookstore)

Evaluations & Grading

As a graduate student, it is expected that you will complete readings, actively participate in discussions, be attentive during lectures, submit your work on-time, and engage in group activities. Since graduate studios are not graded on the 4.0 scale, you will be evaluated as pass/fail with an opportunity to receive a High Pass commendation. Your growth and development throughout the term is the primary factor in determining your success in the studio. Remember, we are entering this journey with different levels of experience and knowledge, so it is expected that some aspects of this course will challenge each of you in different ways. It is important to not judge your work on the work of your classmates, but to focus on your individual journey during this studio. If a classmate has a skill that is more advanced than your own, that is an additional opportunity to observe and learn.

The Topographic Imagination: landform · representation · process

Students will be evaluated on the following:

+ **In-Class Exercises:** During the studio, you will be asked to complete in-class exercises and projects intended to develop your technical skill in concert with your capacities for critical thinking. These assignments will be completed as individuals or in small groups.
+ **Case Study Investigation:** Working in pairs, you will be asked to prepare and present a case study to the class. The quality of the documents and your presentation are equally valued.
+ **Project Reviews:** Project reviews will be held to assess progress, to articulate your thought process, to discuss appropriate representation methods, and to build clarity on "next steps" for your project.
+ **Final Project:** Your final project marks the culmination of your studio activities and will be formally presented to an internal and external panel of reviewers. The final project should demonstrate expanded knowledge and skills gained throughout the term.
+ **Participation:** Active participation in studio activities is essential to your growth and success in the course. This includes desk-crits, discussions, site visits, and group projects and presentations.

Think of this studio as a model for practice. As a professional, absences must be communicated in advance, unexcused lateness is unacceptable, and due dates and times are deadlines not to be missed. These infractions reveal a lack of serious commitment to the studio and the profession you are about to enter, hindering your growth in this course.

One final but essential consideration is that craft in the making is of utmost importance. While design can be a messy process, how you communicate your ideas and intentions shape how it will be received. This includes desk-crits and pin-ups as well as formal presentations. It is expected that you will be "in-progress" at times, however, the work you present should demonstrate the depth of craft and thinking that is core to your explorations. In practice, deliverables are products and the craft with which we communicate design intentions to our clients.

The Topographic Imagination: landform · representation · process

Course Schedule [proposed, subject to change]

The schedule is organized in a topical framework of study as follows:
[1.0] *Revealing Landform*
[2.0] *Representing Landform: part 1*
[3.0] *Civilizing Terrain*
[4.0] *Representing Landform: part 2*
[5.0] *Emergent Topography / Topography in the Anthropocene*

		Session	Assigned	Due
WEEK 1				
[1.1]	Mon.	**Introduction to the Topographic Imagination | The Three Manifestations of Landform** Readings: Rosenberg, Elissa. "L'Imagination Topographique." *Les Carnets Du Paysage*, no. 8 (July 2002): 6-24. English Translation. Leatherbarrow, David. Topographic Stories	**A1. Landform Taxonomy**	
[1.2]	Wed.	**Revealing Landform: physical, personal, conceptual** Landform Taxonomy and Process | Observe and Document Readings: Lindsey, Bruce. "Topographic Memory" in Re-Envisioning Landscape/Architecture. ed. Catherine Spellman. 40-43 "The Shape of Erosion," by Lawrence Halprin in *Landscape Architecture Magazine* Earthworks and Beyond, by John Beardsley		
[1.3]	**Fri.**	Class Discussion | Work Day Readings: Meyer, Elizabeth, "Site Citations" in *Site Matters*. ed. Carol Burns & Andrea Kahn. read from 102-113		
WEEK 2				

The Topographic Imagination: landform · representation · process

Representation is how we explore, understand, visualize, describe, communicate, and test our understandings and our intentions. This portion of the studio will focus on both traditional and emerging methods of representation as a means of describing and acting upon the land. This exploration will challenge us to use representation as a means of thinking beyond documentation.

Process is how we deploy knowledge and tools. It is a means of practice that emphasizes discovery and iteration and it is the craft in which landform and representation come together. Through process we will experiment and speculate on topographic potentials in the context of a design project.

Course Objectives

The LARCH 50X studio is intended to introduce technical procedure within the design process. Emphasis will be placed on developing technical proficiency while engaging intellectual capacities to build design approaches. Upon completion of this studio it is not expected that you will be an expert in all aspects of site grading, however, you will have a foundation from which to build upon in subsequent studios and design assignments. As a primary operation in landscape architecture, it is my hope that you will see sites differently - as topographic entities composed through dynamic processes and the unique potentials for reimagination. To see what exists and what could be, and to visualize and actualize your design intentions. To design is to think differently.

Learning Objectives

+ To understand and identify common landform morphology as understood in landscape architecture
+ To understand hydrological and ecological implications of landform changes
+ To explore social and human relationships to topography - topographic memory
+ To understand and utilize analog and digital representation techniques to describe landform
+ To develop and employ fundamental procedures of site grading
+ To use digital tools to explore and experiment with shaping land
+ To express topography as a physical form- spatial, temporal, experiential, spiritual

The Topographic Imagination: landform · representation · process

[3.3]	**Wed.**	**Civilizing Terrain** Grading a plane Readings: *Site Engineering for Landscape Architects*, Sixth Edition, by Strom, Nathan, Woland *Landscape Grading: A Study Guide for the LARE Grading Examination*, by Valerie Aymer	**A5. Grading Exercises**	**A4. Grading Exercises**
[3.4]	**Fri.**	**Civilizing Terrain** Grading a surface Readings: *Site Engineering for Landscape Architects*, Sixth Edition, by Strom, Nathan, Woland *Landscape Grading: A Study Guide for the LARE Grading Examination*, by Valerie Aymer	**A6. Grading Exercises**	**A5. Grading Exercises**
WEEK 4				
[3.5]	**Mon.**	**Civilizing Terrain** Grading a line, plane, surface Readings: *Site Engineering for Landscape Architects*, Sixth Edition, by Strom, Nathan, Woland *Landscape Grading: A Study Guide for the LARE Grading Examination*, by Valerie Aymer	**A7. Grading Exercises**	**A6. Grading Exercises**
[3.6]	**Wed.**	**Civilizing Terrain** Surface materiality flows (soil + hydrology) Readings: *Site Engineering for Landscape Architects*, Sixth Edition, by Strom, Nathan, Woland *Landscape Grading: A Study Guide for the LARE Grading Examination*, by Valerie Aymer	**A8. Soils and hydrology exercises**	**A7. Grading Exercises**
[3.7]	**Fri.**	**Civilizing Terrain** Surface materiality flows (soil + hydrology) Readings: *Site Engineering for Landscape Architects*, Sixth Edition, by Strom, Nathan, Woland *Landscape Grading: A Study Guide for the LARE Grading Examination*, by Valerie Aymer	**A9. Soils and hydrology exercises**	**A8. Soils and hydrology exercises**
WEEK 5				

[4.1]	**Mon.**	**Representation 2: Digital tools and Design Process** Analyzing and reading terrain Readings: Amoroso, Nadia and Nadia D'Agnone, "Discovering landform process through creative 3D mapping and diagramming of form, pattern, and arrangement" in *Innovations in Landscape Architecture*. ed. Jonathan R. Anderson & Daniel H. Ortega. 90-101	**A10.a. Iterative Landform**	
[4.2]	**Wed.**	Work Day | In-class Critique		
[4.3]	**Fri.**	**Representation 2: Digital tools and Design Process** Terrain Modeling Readings: Hansen, Andrea, "From Hand to Land: Tracing Procedural Artifacts in the Built Landscape." Published in *Scenario 01: Landscape Urbanism*. Fall 2011. http://scenariojournal.com/article/digital-relics/	**A10.b. Iterative Landform**	
WEEK 6				
[4.4]	**Mon.**	Work Day | In-class Critique		
[4.5]	**Wed.**	**Representation 2: Digital tools and Design Process** Parametrics Readings: *Landscape architecture and digital technologies : re-conceptualising design and making*, by Jillian Walliss and Heike Rahmann, 1-43, and skim chap. 3 and 5	**A10.c. Iterative Landform**	
[4.6]	**Fri.**	Work Day | In-class Critique		
WEEK 7				
[4.7]	**Mon.**	**Representation 2: Digital tools and Design Process** Parametrics		
[4.8]	**Wed.**	Work Day | In-class Critique		

[4.9]	**Fri.**	**PROJECT REVIEW**		**A10.a,b,c. Iterative Landform**
WEEK 8				
[5.1]	**Mon.**	**Emergent Topographies: Landform and Dynamic Process** Project introduction | Research Readings: Krog, Steven. "Creative Risk Taking" in *Theory in Landscape Architecture: A Reader*, ed. Simon Swaffield. 58-64 Davis, Brian. "Public Sediment" in *Toward and Urban Ecology* by Kate Orff. 228-234. also see 222-223 Berrizbeitia, Anita, "The Case for Precision in Landscape Architecture", specifically the Concurso La Carlota design competition. https://dirt.asla.org/2016/04/26/the-case-for-precision-in-landscape-architecture/ and see the full presentation here: https://www.youtube.com/watch?v=xbXd1iznH7I	**A.11 Emergent Landform Term Project**	
[5.2]	**Wed.**	Site analysis | Desk Crits		
[5.3]	**Fri.**	Finalize analysis | Desk Crits		
WEEK 9				
[5.4]	**Mon.**	Analysis Pin-up | Concept Studies | Desk Crits	**A.11b Concept Design**	**A.11a Analysis**
[5.5]	**Wed.**	Concept Studies | Desk Crits		
[5.6]	**Fri.**	Concept Pin-up | Desk Crits	**A.11c Schematic Design**	**A.11b Concept Design**
WEEK 10				
[5.7]	**Mon.**	Model and Plan Development | Desk Crits		
[5.8]	**Wed.**	Model and Plan Development | Desk Crits		

[5.9]	**Fri.**	Model and Plan Development | Desk Crits		
WEEK 11				
[6.0]	**Mon.**	**FINAL REVIEW**		**A.11c Schematic Design**

RESOURCES

Technical

Site Engineering for Landscape Architects, Sixth Edition, by Strom, Nathan, Woland

Form & Fabric in Landscape Architecture by Catherine Dee

Grade Easy by Richard Untermann

Grading for Landscape Architects and Architects, by Peter Petschek

Landscape Grading: A Study Guide for the LARE Grading Examination, by Valerie Aymer

Time-Saver Standards for Landscape Architecture, by Charles Harris and Nicholas Dines

Landscape: pattern, perception and process, by Simon Bell

Responsive landscapes: strategies for responsive technologies in landscape architecture, by Bradley Cantrell and Justine Holzman

Land mosaics: the ecology of landscapes and regions, by Richard Forman

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Theory and Design

"L'imagination topographique" English translation, by Elissa Rosenberg

Land Form Designs, by Thomas Hazlett

Earthworks and Beyond, by John Beardsley

"The Shape of Erosion," by Lawrence Halprin in *Landscape Architecture Magazine*

Designing the earth : the human impulse to shape nature, by David Bourdon

The Landscape of Man: Shaping the Environment from Prehistory to the Present Day, by Geoffrey and Susan Jellicoe

Topographical Stories: Studies in Landscape and Architecture, by David Leatherbarrow

"Leveling the Land" by David Leatherbarrow, in *Recovering Landscape: Essays in Contemporary Landscape Architecture*, ed. James Corner

"Aerial Representation and the Recovery of Landscape" by Charles Waldheim, in *Recovering Landscape: Essays in Contemporary Landscape Architecture*, ed. James Corner

"Landscapes of industrial excess: A thick sections approach to Gas Works Park", by Thaïsa Way

Art into landscape, landscape into art, by A. E. Bye

Abstracting the landscape: the artistry of landscape architect A.E. Bye, by Eliza Pennypacker, Kristi Ann Wormhoudt, and Catherine M. Howett

Form and fabric in landscape architecture: a visual introduction, by Catherine Dee

"Hopewell ceremonial landscapes of Ohio: more than mounds and geometric earthworks", by Mark J. Lynott in *American landscapes*

"Synthetic patterns: Fabricating landscapes in the age of 'green'",by Karen M'Closkey in *Journal of Landscape Architecture*

Re-envisioning landscape/architecture, by Catherine Spellman

Representation

Cartographic grounds: projecting the landscape imaginary, by Jill Desimini and Charles Waldheim

Representing Landscape Architecture, by Marc Trieb

Representing Landscapes: A Visual Collection of Landscape Architectural Drawings, by Nadia Amoroso

Landscape architecture and digital technologies: re-conceptualising design and making, by Jillian Walliss and Heike Rahmann

Terrain Analysis; a Guide to Site Selection Using Aerial Photographic Interpretation, by Douglas S. Way

Digital Drawing for Landscape Architecture: Contemporary Techniques and Tools for

Digital Representation in Site Design, by Bradley Cantrell and Wes Michaels

AD Reader: The Diagrams of Architecture, by Mark Garcia

Else/where: Mapping new cartographies of networks and territories, by Janet Abrams and Peter Hall

Visual Complexity: Mapping patterns of information, by Manuel Lima

Mapping in the Age of Digital Media: The Yale Symposium, by Mike Silver and Diana Balmori

Taking Measures Across the American Landscape, by James Corner with Alex S. MacLean

Groundswell, by Peter Reed with James Corner, Peter Latz, Martha Schwartz, Ken Smith, Peter Walker, and George Hargreaves.

Drawing the Landscape, by Chip Sullivan

Points + lines : diagrams and projects for the city, by Stan Allen

Innovations in Landscape Architecture, by Jonathon R. Anderson and Daniel H Ortega

Online Resources

The Landformation Catalog: https://landformationcatalogue.squarespace.com/

Baird, Tim. "Herbert Bayer and the Art of Reclamation." City of Kent. Accessed October 2016. http://kentwa.gov/content.aspx?id=5956.

Pietrusko, Robert, Warning Office, “Grounds of Cartography” http://www.warning-office.org/#/grounds-of-cartography/

"Herbert Bayer and the Art of Reclamation", by Tim Baird, City of Kent, http://www.kentwa.gov/residents/parks-recreation-and-community-services/arts/earthworks/tim-baird-earthworks

US Green Building Council (USGBC) Leadership in Energy Efficiency Design (LEED) http://www.usgbc.org/leed

Sustainable Sites Initiative http://www.sustainablesites.org/

Council for Landscape Architecture Registration Board (CLARB) https://www.clarb.org/Pages/default.aspx

American Disabilities Act (ADA) Accessibility Standards http://www.ada.gov/http://www.ada.gov/2010ADAstandards_index.htm