BETWEEN MAKING AND SEEING:
OVERLAY DRAWING PRACTICES IN 1960’s-70’s ENVIRONMENTAL DESIGN

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ABSTRACT

In the absence of significant written histories, American landscape architects often characterize 1960’s-70’s disciplinary shifts in biographical and ideological terms. Many accounts exclusively credit Ian L. McHarg with the development of environmental design, reporting that his embrace of ecological methods engendered a radical break with previous ways of designing. In order to counterbalance the predominant narrative, this paper shifts attention from ideology to practice, investigating the innovative ways of drawing through which environmental design evolved. This begins with a historiographic exploration of drawing, leads into a brief history of modernist and cybernetic approaches to hand-making, and closes with an investigation into the overlay drawing practices in three early environmental design projects: a methodological experiment by Christopher Alexander and Marvin L. Manheim at MIT in 1962, a 1967 studio taught by Ian L. McHarg at the University of Pennsylvania, and a 1973 environmental survey conducted by the firms Steinitz Rogers and Johnson, Johnson & Roy.

By investigating the history of environmental design through the skilled actions of drawing, we can track how designers embraced – and grappled with – a progressively systematic approach to landscape. The resulting history involves not one innovative figure, but many; not a break with prior ways of designing, but an extension of them; not a newly scientific form of design, but rather new ways of drawing. By iteratively crafting new representational approaches to a growing abundance of landscape data, environmental designers increasingly embraced drawing practices that deprioritized the revelatory potential of hand-making in order to project scientistic certainty and embrace a more efficient economy of image production.
BIOGRAPHICAL SKETCH

Prior to attending Cornell University, Margot Lystra taught and practiced landscape architecture: teaching studio, drawing, and ecology courses at California Polytechnic State University – San Luis Obispo and University of Detroit Mercy, and practicing design with Conger Moss Guillard in San Francisco, CA. Margot has a Master’s in Landscape Architecture from the Harvard Graduate School of Design, and a Bachelor of Arts from Swarthmore College.
For Joe, steadfast companion.
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PREFACE

My landscape architecture training occurred in a transitional moment, when the field was poised between waning earth art inflected postmodern design and nascent landscape urbanist methods. In the first year of study I learned to design through hand making, exploring the tactile inspirations of model, section, and montage. In the second, I learned mapping and analysis methods, simultaneously navigating GIS software and taking coursework that promoted the ideas and methods of environmental design.

As a student and practitioner both, I have experienced the revelatory potential of data-based exploration, growing familiar with mapping’s unique capacity to invite, engage, and reimagine the complexities of landscape. Yet I have also encountered the creative limitations of GIS-based environmental design approaches – particularly the ways these practices can constrain the designer in an almost ritualized set of actions and outcomes. I have discovered first-hand that there is little room for individual invention or experimentation within that process. In contrast, I have realized that modernist and postmodern design methods place a great deal of emphasis on individual creativity, sometimes at the expense of collaboration.

These experiences have revealed an ongoing friction in the practice of landscape architecture: between acknowledging and engaging the vast complexity of landscape, and maintaining creative, revelatory agency within the design process. Curiosity about this unresolved tension has, in turn, brought me to investigate the early environmental design work of the 1960’s-70’s. My historian and designer sides alike have been fascinated to encounter creative and haptic agencies hiding within the history of environmental design – an area that above all has been touted as unified, objective, and scientific.

In the earliest examples of environmental design, before its methods became more codified and digitized, we can find glimmers of creative ambiguity and generative openness. One encounters traces of the designer’s hand, explorative experiments in decoding aerial photography, and
creative choices regarding uses of texture, shape, and line. One also senses early environmental designers’ palpable excitement to realize the incredible abundance of information suddenly available within the design process.

Yet as environmental design developed further and available data continued to multiply, this abundance somewhat paradoxically prompted increasingly narrow drawing practices. At stake in this narrowing was the degree to which various actors – human and nonhuman alike – were able to exercise agency within the design process. Also at stake was the form of their relationship – the character and quality of that delicate, negotiative, nature/culture collaboration that is enacted when designing a becoming landscape.
CHAPTER 1
INTRODUCTION

When stripped of pomp and pretensions, at root art merely means skill and science means knowledge.
- Ian L. McHarg, To Heal the Earth1

To be objective is to aspire to knowledge that bears no trace of the knower – knowledge unmarked by prejudice or skill, fantasy or judgment, wishing or striving.
- Lorraine Daston and Peter Galison, Objectivity2

If you want to look at what draws things together, then look at what draws things together.
- Bruno Latour, “Drawing Things Together”3

Focusing on the role of drawing in the 1960’s-70’s development of environmental design, this paper describes a moment when many within the discipline of landscape architecture sought to explain and depict landscape in new ways. At a time when ecology was gaining new disciplinary power and computer rendering was on the rise, environmental design methods offered new ways to engage large, complex landscapes. These methods were linked to a range of agendas and outcomes. Some were ideological, involving efforts to imbue design with scientific authority. Others were representational: certain ways of drawing were promoted, and others became increasingly obsolete. By embracing environmental design, landscape architects altered the very ways that art, science, skill, knowledge, and objectivity were perceived and enacted within their field.

To explore these changes, I will discuss the drawing practices of three projects from different moments in environmental design’s development: a 1962 methodological experiment conducted by Christopher Alexander and Marvin L. Manheim at MIT; a 1967 studio project guided by Ian L. McHarg at the University of Pennsylvania; and a 1973 environmental survey conducted by the

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firms Steinitz Rogers and Johnson, Johnson & Roy. Each of these projects marks a moment of innovation in the overlay drawing process, which was the primary form of representation used in environmental design.

Overlay drawings are analysis drawings – depictions of the landscape to be designed. As such they comprise only a portion of the broad array of drawings that are created in landscape architectural design. Although analysis is one part of the design process, it plays a crucial role: by generating a foundational representation of the existing site, it defines the character and qualities of that site, thereby influencing the types of design interventions that may occur.

But why should we seek to understand environmental design through its analysis drawings, or through drawing practices at all? The answer lies in a persistent tension between the ways that landscape architecture is written and practiced. To explain this tension, we must consider the predominant narratives through which environmental design has been previously described.

**Traditional Narratives: Environmental Design, “McHargian” Design**

Environmental design is a relatively new field, and few histories have been written regarding its development. In the absence of extensive written material, abundant informal histories circulate among landscape architects, in practice and academia alike. Both written and informal accounts of environmental design’s development tend to focus on the writings and legacy of Ian L. McHarg, and often lean heavily on McHarg’s own accounts in order to do so. There are good reasons for focusing on McHarg: he was an influential figure in environmental design, and in landscape architecture. McHarg was chair of the Department of Landscape Architecture and Regional Planning at University of Pennsylvania from 1954 until to 1999. As a founding partner in Wallace, McHarg, Roberts, and Todd, he worked on many large and influential planning projects. More uniquely, he achieved fame beyond his profession, writing the popular book

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4 Though I will use the term “environmental design” in this paper, this landscape architectural sub-field has been called by other names as well. McHarg usually referred to it as “ecological design;” it has also been referred to as “environmental planning,” and “landscape management.”
Design With Nature in 1969, and hosted the television series The House We Live In, which was broadcast on CBS in the 1960’s. McHarg’s achievements were notable and significant for his field.

However because of this fame, it is common for landscape architects to think of environmental design history as McHarg’s history, and his alone. At their most hyperbolic, such narratives cast McHarg as a lone trailblazer who initiated a radical break with the modernist movement by single-handedly inventing environmental design. These heroic tales, though delightfully laudatory, nonetheless allow the polemical passion of McHarg’s writing and the ardor of his followers to obscure the broader context in which his work emerged, thus eliding several significant aspects of environmental design’s development.5

There is a deeper problem here as well. In the absence of written histories about environmental design, McHarg’s own writings are often relied upon as accounts of the field’s development. These texts were predominantly ideological. McHarg’s soaring proposals celebrated the broad environmental potential of uniting science and design, without critically investigating the methods and actions that comprised scientific practice, or rigorously investigating the ways in which design practice could incorporate them. Indeed, his writings rarely mentioned design drawing at all. As a result, significant aspects of environmental design’s history have become obscured – in particular, the praxiographic dimensions of environmental design have gone unaccounted for. This leaves many stones unturned – and important stones at that. For as we will

5 Informally, landscape architects have been known to refer to environmental design as “McHargian” design, and a similarly laudatory attitude often imbues published works about him. See Omar Faruque interview, July 3, 2012; Roger Osbaldeston interview, June 13, 2012. See also Lynn Margulis, James Corner, and Brian Hawthorne, eds., Ian McHarg: Conversations with Students, Dwelling in Nature, eds. (New York: Princeton Architectural Press, 2007). Reinforcing this, during his career McHarg sought to amplify his reputation as a trailblazer in the field: he wrote extensively about the revolutionary capacity of his approach to design, was notoriously bad at citing influences and sources, and was also known to claim credit for work that was not his own. See Anne Whiston Spirn, “Ian McHarg, Landscape Architecture, and Environmentalism: Ideas and Methods in Context,” in Michel Conan, ed., Environmentalism in landscape architecture (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 2000), 102. Seeking to remedy this, some articles have begun to contextualize McHarg’s work more fully. See Spirn, Ibid., and Susan Herrington, "The Nature of Ian McHarg's Science," Landscape Journal 29.1 (2010).
see, landscape architectural design practices – and drawing practices in particular – underwent significant shifts with the adoption of environmental design.

**Uncovering New Narratives**

How can we reveal those environmental design histories that have largely remained hidden? In order to do this I will focus, not on polemics, but on practice, sidestepping ideological discourse in order to uncover the ways environmental design drawings were physically made. The resulting narrative involves not one innovative figure, but many; not a break with prior ways of designing, but an extension of them. It involves not a newly scientific practice, but new drawing practices – ones that deprioritized the revelatory potential of hand-making in order to project scientific certainty and embrace a more efficient economy of image production. These aspects of environmental design’s history, though underexplored, nonetheless continue to influence the ways that landscape architects design today.⁶

Uncovering this history is not merely a matter of looking at drawings – it is a matter of exploring the myriad actions that comprised their making. Thus I will begin this paper with a historiographic discussion of drawing, considering how it has been depicted in landscape and related disciplines. Next I will describe two postwar movements: modernism and cybernetics, showing how new environmental design methods often built upon earlier modernist and cybernetic ambiguities regarding the authority of objectivity, the role of mechanization, and the inchoate nature of creative intuition within the design process. Finally, I will look at environmental design drawings themselves, investigating several different innovations that altered landscape architectural drawing practices in the 1960’s-70’s. These alterations enabled

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new levels of landscape complexity to be engaged in the design process. They also projected scientific certainty in ways that falsely equated science with objectivity and deprioritized the revelatory potential of hand-making.

The shifts I will chart here were not master-planned or simply conceived. Rather, they took place over more than a decade, in many different hands. As such, they involved cumulative responses to an increasingly overwhelming complexity of landscape data, one paradoxically unleashed by the same approaches that would later be used to control and circumscribe it. We might best understand this history as a grappling with that complexity – a bodily one, undertaken through the practices of drawing – their materialities and their skilled actions.

As we will see, the development of environmental design precipitated a rebalancing of the roles of drawing and observing within the design process. These changes in drawing practices had ramifications: they reconfigured the complex of relationships among body, materials, and practices through which the becoming landscape circulated. Each of these elements thus morphed into something different than it had been previously – its agencies, tendencies, and capacities were significantly altered. These changes in turn transformed the ways that landscapes were conceived, designed, and ultimately built.

Methodology
Going forward, this paper will be laid out as follows. I will begin with a discussion of existing literature that addresses drawing. Because there is a relatively small body of work on this topic within LA, I will rely on an interdisciplinary range of texts in order to build a clear precedent for a discussion of landscape architectural practice. I will also spend some time discussing the theoretical basis for this approach, in order to build a conceptual underpinning in the absence of extensive historical precedent.

With this historiographic and theoretical framework in place, I will discuss the historical context out of which landscape architects developed environmental design methods. Two postwar design
movements are particularly relevant to this discussion: American modernism as developed at the Graduate School of Design (GSD) under Joseph Hudnut and Walter Gropius, and cybernetics as developed at MIT – first by mathematicians such as Norbert Wiener, and then by Gyorgy Kepes and Kevin Lynch. These movements are relevant for two primary reasons. First, the environmental design projects we will discuss were developed by individuals who studied at the GSD and MIT between the 1940’s and 1960’s. Second, certain conceptual and praxiographic aspects of environmental design work can be traced back to trends that were apparent in the modernist and cybernetics movements that developed at the GSD and MIT during the postwar years. Considering these trends informs an understanding of the emergence of environmental design practices.

Finally, I will look closely at three environmental design projects from different moments in the development of the field: a 1962 methodological experiment conducted by Christopher Alexander and Marvin L. Manheim at MIT; a 1967 studio project guided by Ian L. McHarg at the University of Pennsylvania; and a 1973 environmental survey conducted by the firms Steinitz Rogers and Johnson, Johnson & Roy. All three of these environmental design projects used overlay drawings: plan-based transparent analysis drawings produced at the same scale, that were layered on top of each other so that designers could observe and respond to the complex relationships between different factors and conditions. All three of these projects were simultaneously real-world projects and subjects for academic scholarship and writing, created by individuals who worked as both practitioners and teachers. These projects were not only sites of redefining landscape – they were sites through which the individuals involved defined their own identities as scholars and designers. Accordingly, these projects entailed active, intentional redefinition – of individuals’ careers, of the practice of landscape architecture, and of the very definition of landscape itself.

Through discussion of these drawings, I will chart representation practices as they developed over a decade of innovations. Two trends will be particularly important here: a shift from making
to observing as the locus of the designer’s agency, and an increased emphasis on precision and efficiency in drawing. I will show how these trends related to each other. I will also show how they were results of landscape architects’ efforts to incorporate scientific authority and technological change.

At this point, I must make a brief caveat regarding content and method. The ideal approach to a study of practice would involve extensive ethnography and oral histories. However, particularly given landscape architects’ collective lack of practice talking about practice, building a full ethnographic history on the topic is largely beyond the scope of this thesis. Therefore, in order to piece together an understanding of environmental design drawing practices in the 1960’s-70’s, I will use a range of historical materials: drawings, literature, interviews, and occasionally, my own experiences in the practice of design.

Furthermore, this text hones in on a specific set of techniques within the broad array of practices that comprise design drawing. As a result, the material dimensions of drawing are not explored as fully as they could be. The invention of mylar and markers and their influences on design drawing; ways in which collaboration shifted the drawing production; effects of furniture layout on the performative dimensions of studio and office work; ways in which site visits may have altered how designers understood sites in plan-view; the degrees to which hierarchical power dynamics between professors and students may have affected drawing innovations; all of these topics – and more – are undeniably significant to a discussion of environmental design drawing practices. And yet they are not included in the following account. This is partly due to the parameters of this brief work. More importantly, however, limiting the breadth of this account enables us to focus attention on a particular set of actions and relationships. I forego a more inclusive account of drawing practices in order to draw attention to the actions of hand and eye in the moment of marking the page.
CHAPTER 2
ON DRAWING

It seems to me that the most powerful explanations, that is, those that generate the most out of the least, are the ones that take writing and imaging craftsmanship into account. They are both material and mundane, since they are so practical, so modest, so pervasive, so close to the hands and the eyes that they escape attention. Each of them deflates grandiose schemes and conceptual dichotomies and replaces them by simple modifications in the way in which groups of people argue with one another using paper, signs, prints and diagrams.\(^7\)

There is a making of landscape that occurs before any shovel is put to soil. It takes place not onsite, but in the studio, through the myriad practices that comprise the design process.\(^8\) Like the landscape to be built, the landscape enacted in the design studio is both material and experiential, constituted of tangible objects and living, changing relationships. More than the landscape to be built, this landscape exists largely in a state of virtuality – it is actively, continually brought into being over the life of the design project. In this sense, we might understand the studio landscape to be \textit{a becoming} landscape: defined by its ongoing, gradual transformation towards a more stable form, which will eventually be translated onto a site.\(^9\)

Within the field of landscape architecture, this becoming landscape operates through a wide range of practices. It occurs through various phases of the design process: analysis, documentation, ideation, schematic development, and public presentation. It occurs through


\(^8\) In this paper, I often use the term “drawing” to reference a range of image-making methods (pencil drawing, model, montage, digital drawing, etcetera). This is not to discount the many different ways that design representations are made, but rather to hone in on the particular set of relationships that occur when the designer produces representational imagery by hand. I do occasionally use the term “making” in this paper as well, when discussing the production of design drawings. I use this term to call out distinctions between actions of the hand (drawing) and actions of the eye (observation) within the design process. I tend not to use the term “representation” very often here, except when referring to the images that designers produce through drawing. Although many landscape architects often use “drawing” and “representation” interchangeably, the latter term highlights the object-nature of the image over the active nature of the practice. Particularly given the praxiological focus of this paper, I prefer to use the term “drawing” here.

\(^9\) This term “becoming landscape” is an adaptation of Albena Yaneva’s notion of “becoming social,” which is itself an extension of Bruno Latour’s term “reassembling the social.” Yaneva writes: “following the proactive power of architectural projects to mobilize heterogeneous actors, convincing, persuading or deterring them, buildings will be tackled here as \textit{becoming social} (instead of hiding behind or serving the social), as active participants in society, design – as a process of recollecting, reinterpreting and ‘reassembling the social.’” Albena Yaneva, \textit{The Making of a Building: A Pragmatist Approach to Architecture} (Oxford, England: Peter Lang, 2009), 18.
different practices within the design office: discussion, writing, presentation, and drawing. It is engaged by numerous participants as well, both human and nonhuman: designers, clients, users, sites, desks, computers, paper, mylar, pencils, printers, plant species: all participate in – and significantly influence – landscape’s becoming.

Drawing practices are central to design process: they are the primary means through which designers develop and communicate their ideas. Drawings are used in order to understand existing sites, develop design ideas, test ideas against site conditions, communicate proposals to clients, and direct contractors in constructing the site. They are crafted differently depending on their intended uses and audiences. Rough materials and loosely sketched lines may be used in ideation, while presentation drawings are often highly polished: drawn in computer programs, with hours of care spent on their rendering. Often these different types of drawing are engaged in repetition: analysis, conception, refinement, and presentation can take place in several cycles for a project, with each phase bringing greater detail and specificity to landscape design.

Throughout all these phases, drawing practices have the potential to engage multiple moments of revelation.10 This revelatory capacity of drawing is often cited by those who practice, teach, and learn landscape architecture – as exemplified in the common statements, “drawing is thinking,” or “you have to draw it to understand it.” Otherwise described as intuitive leaps or creative insights, such moments advance the design process by bringing vague ideas into sensible existence. Revelations often involve a feedback between immaterial (idea, vision, information) and material (paper, computer screen, model) states: drawing the initial idea usually transforms it into something different; juxtaposing an idea against site conditions often enables new understanding. In this way design revelations do not merely bring ideas into form – rather, they generate a set of relationships between idea and materiality, enacting a becoming landscape through the actions of design.

10 The term “revelation” is borrowed here from James Corner. More will be said about his use of the term shortly. James Corner, “Representation and Landscape: Drawing and Making in the Landscape Medium,” Word & Image 8 (July-Sept. 1992),” 275.
What precedents can we mobilize towards writing about the practice of design? To answer this question, I will discuss relevant literature in the design fields and related disciplines. Both historical and theoretical texts will be discussed.¹¹

**Drawing in Landscape Architecture**

The topic of drawing has been underexplored in LA writing. In fact, design process has rarely been discussed within landscape architecture literature – historical or otherwise. Related to this lack of discourse, designers usually don’t discuss the historical context of drawing practices they engage. This silence on drawing history is deceptive - for drawing practices are anything but unchanging. In fact, they have often been called into question over the course of the twentieth century. Such questioning has been most acute during periods such as our current digital one – when the incorporations of new forms of technology and new scientific methodologies have resulted in new methods and practices.¹²

Over the past couple decades, a small but significant discourse has formed regarding landscape architectural representation. The writing and editorial work of Marc Treib has been influential in this regard. In “Mapping Experience,” Treib describes in great detail the inclusions and exclusions of maps, and considers their effects on the viewer’s experience.¹³ Two books edited

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¹¹ Some of the scholarly works that I touch upon here cite the influence of Merleau-Ponty’s phenomenology; others reference Lefebvre’s notions of practice. However, they have also diverged from these earlier works in significant ways. Therefore rather than beginning this discussion with Merleau-Ponty and Lefebvre, I will instead focus on contemporary studies that investigate practices of designing built environments. Likewise, rather than defining practice itself in strictly Lefebvrian terms, I will instead detail more recent notions of practice, which tend to focus on the pragmatics, materiality, and productive agency of making.

¹² Though in the design professions, the term “practice” often refers to the professional office, I do not use the term for that purpose here. Rather, I use more akin notions of “spatial practice,” a concept that has been abundantly adopted and articulated since Lefebvre wrote about it. One such recent articulation is Jane M. Jacobs and Peter Merriman’s notion of “practising architecture,” which they use in order to shift an understanding of architectural practice from a prevalent focus on the artifact to a more productive focus on the everyday process of making. Used in the context of landscape architecture, this “practice,” or “practicing,” points to an often under-articulated aspect of the field – that of the landscape architect’s daily, haptic activity of designing through making. Jane M. Jacobs & Peter Merriman, “Practising architectures,” *Social & Cultural Geography* 12:03 (2011), 211-222. In this paper, I tend not to discuss practice as broadly as Jacobs and Merriman do – instead I focus on a few specific praxiological aspects of drawing.

by Treib explore the significance of representation within landscape architectural practice: *Representing Landscape Architecture*, and *Drawing/Thinking: Confronting an Electronic Age*. Within these volumes, various writings address different forms of representation. In *Representing Landscape Architecture*, for example, Dorothee Imbert discusses the prevalence of axonometric drawings in the presentation sets of modern gardens, while Peter Walker and Kurt Rieder each detail the use of models within the design office.¹⁴

Texts such as these have successfully established representation as a topic of research – as such, they begin to fill an important gap in landscape architectural discourse. However, there is much that remains to be explored. Existing texts often do not often consider the haptic dimensions of drawing. Instead, they tend to describe representation as either an object seen by the viewer, or as a tool of strategic persuasion. The process of drawing is occasionally discussed, but it is predominantly described in either loose, romantic terms or in technical, functional ones. Some writings consider representation in its historical context, but many do not. Thus while these texts usefully begin to open a discussion on landscape architectural representation, they rarely consider representation as a practice – a historically embedded, culturally contingent, experientially inventive, and relational process.¹⁵

Nonetheless, some landscape scholars have indeed begun to discuss drawing on just these terms. In “Plus and Minus: Critical Drawing for Landscape Design,” Catherine Dee considers how certain actions that occur as part of drawing – erasure, marking territory, speeding or slowing time – can amplify the designer’s capacity to engage critical thinking while designing.¹⁶ In “Drawings at Work: Working Drawings, Construction Documents,” Laurie Olin discusses the drawing of construction documents, describing how the use of AutoCAD has brought about

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increased iteration in the design process. Olin offers historical context, reviewing early landscape architectural uses of section. In these ways, he charts how the practice of drawing and ideas of landscape have shifted together over time.17

In a somewhat different vein, Charles Waldheim has discussed the historical role of aerial imagery in shifting landscape architects’ ways of seeing landscape.18 More recently, "Indeterminate Emergence - Problematized Authorship in Contemporary Landscape Practice" considers the agency of the designer in relation to contemporary landscapes.19 Here Waldheim notes recent tendencies for landscape architects to question their own agency. He identifies three trends in this respect: new uses of automatic form generation, desires to acknowledge urban cultural complexity, and conceptions of ecological systems as indeterminate and self-regulating. Waldheim describes projects that exemplify each trend, noting that “equally in each of these examples the privileging of landscape strategy and ecological process distances authorial control over urban form.”20 Though he does not explain the mechanisms through which distanced authorial control may be enacted, Waldheim does imply that the agency of the landscape architect is directly connected to kinds of projects they engage.

Perhaps the most influential works on the practice of drawing are the early theoretical writings of James Corner. Seeking to describe specific representational practices through which the landscape architect might develop a nuanced and complex, rather than geometrically reductive, relationship to landscape, Corner has often argued that drawing’s potential to engage creative and metaphorical dimensions lies in how it is practiced. He writes,

20 Waldheim, "Indeterminate Emergence," 88.
Images in design cannot properly be considered as mute or neutral depictions of existing and projected conditions of secondary significance to their object; on the contrary, eidetic images are much more active than this, engendering, unfolding, and participating in emergent realities… the paper surfaces and computer screens of design imaging are highly efficacious operational fields on which the theories and practices of landscape are produced.21

By activating the role of images in the design process, Corner highlights the capacity for designers to conceptualize and redefine landscape through the very act of making images. Expanding on this idea, Corner has repeatedly reinforced this notion of landscape as something comprised through the actions of drawing. Accordingly, when considering how one should design, “the question, then, concerns not so much the kinds of images designers should work with but rather what kinds of imaging activities should be developed and advanced.”22

Elsewhere, Corner reinforces describes this phenomenon. He writes,

On the one hand, the drawing can be an impotent impostor, an impossible analog, dangerously reductive and misused; whereas, on the other hand, drawing holds the possibility of forming a field of revelation, prompting one to figure previously unforeseen landscapes of a richer and more meaningful dimension.23

This “field of revelation” recognizes that the practice of drawing is a generative activity – one that conditions the way the designer relates to the landscape, and the resulting design as well.

Taking a position similar to Corner’s, Alison Dutoit has described the space of drawing as a “surrogate” for the 3-dimensional landscape site, highlighting how the act of drawing conditions the designer’s way of seeing landscape:

What one sees is shaped by the means by which we see it… exploratory drawing forces the engagement with the visual, phenomenal, and haptic cities, dampening the primacy of the aesthetic impact while fostering a deeper comprehension of the multiple, messy, lovely qualities of place and its boundaries.24

Here we see a new notion of drawing emerge: one in which landscape architectural image-making comprises a real, active, productive landscape condition in its own right. From this angle, the design studio can be understood as a site; the actions of making as capable of generating, not only drawings or ideas, but of enacting landscape itself.

**Drawing in Architecture**

There is a growing abundance of architectural writing regarding the history of the practice of drawing. Mario Carpo takes a long view on the historical development of drawing practices, highlighting how material aspects of renaissance and contemporary technological advancement have influenced architects’ ways of thinking and producing. Mark Wigley describes Constant Nieuwenhuys’ uses of iteration and ambiguity. Simultaneously explores the drawings’ making and viewing, he gives equal weight to the haptic practices of design and observation.

Robin Evans wrote extensively on renaissance representation practices, noting that “few things have had greater significance for architecture than the introduction of consistent, coherent parallel projection into architectural drawing, and few things have been more transparent to critical attention.” In “Architectural Projection,” Evans considered the nuances of drawing techniques in great detail. Discussing the difference between orthographic and perspectival projection, he wrote: “the advantage of orthographic projection is that it preserves more of the shape and size of what is drawn than perspective does. It is easier to make things from than to see things with.” By distinguishing between a drawing’s design and documentary capacity, Evans developed an understanding of drawings that was inseparable from the ways in which they were drawn.

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In “Architecture and its Horizons,” David Leatherbarrow also considers renaissance drawing practices, juxtaposing them against twentieth-century practices. Describing how the gridded geometry of constructed perspective simplifies the spatial qualities of the site represented, he identifies “a paradox: the way of seeing that leads to academic (lifeless) painting is just the way that architects see things, even see the world; that is, seeing through things, cutting them… and grasping the dimensions of their outlying lines and angles.”29 Leatherbarrow explains how Alberti’s mapping techniques engaged the horizon to generate geometrically reduced and simplified representations of cities, and discusses tensions between Le Corbusier’s beguilement with the aerial view and commitment to a more grounded viewing position. Describing the opportunities and constraints of various representation techniques, Leatherbarrow illustrates how architects, when discovering new ways to define space, fundamentally alter how they perceive and construct space as well.

Focusing on the modern era, Paul Emmons explores the generative capacities of making diagrams. In “Intimate Circulations: Representing Flow in House and City,” Emmons introduces the concept of “architectural play:” “a flow line drawn on a plan can be a meandering doodle that invites imaginative inhabitation in order to view a future realm of rich experience.”30 In "Embodying Networks: Bubble Diagrams and the Image of Modern Organicism," Emmons charts twentieth-century links between the emergence of a networked body image, a networked natural world, and the architectural use of bubble diagrams.31 He notes that architects’ uses of bubble diagrams vacillate between topologic and Euclidian spatiality; sometimes architects engage them as scale-less diagrams, and at other times they translate them directly into spatial

form. Emmons proposes that this vacillation is a significant part of how architects invent space, enabling them to alternate between imaginative and functional concerns.

Emmons again emphasizes this productive tension between invention and practicality in *The Image of Function*. Here he describes diagrams as “thick descriptors” – drawings that contain both functional and mytho-poetic significance, thereby serving both rational and imaginative purposes. Emmons not only asserts that diagrams have significance both as viewed and interpreted, and as part of a process of making. He also identifies specific dynamics within the process of making – tensions between imagination and measurement – through which architects access invention.\(^{32}\)

In addition to architectural historians, cultural geographers have also begun to consider the space-making practices that occur within architectural design. Rob Imrie conducts ethnographic research regarding architectural ideas and drawing practices, proposing that architects tend to design for a measured, normalized, objectified body, rather than a sentient, variable, experiential one.\(^{33}\) He suggests that architects’ normative notions of the body ought to be problematized: “an important component of this is for architects to identify the multiplicity of corporeal or postural schemata of the body.”\(^{34}\) Though Imrie’s concern is primarily with the body as a subject of architecture, rather than with the architect’s body as a practicing entity, his ethnographic approach can also inform discussions of practice. It enables him to observe, for example, that architects often tend to reference their own bodily experience as a standard for all bodies.

In “More-than Visual Approaches to Architecture: Vision, Touch, Technique,” Mark Paterson proposes that geographers should investigate the “more-than-visual” dimensions of architectural practice in order to more fully understand the workings of the profession. He proposes that


\(^{34}\) Imrie, “Architects’ conceptions of the human body,” 64.
focusing on techne enables the scholar to recognize the significance of the haptic within practice. Related to this, Paterson identifies the diagram as a particularly haptic drawing form: “Although simplistically put, that shift from ‘representation’ to ‘operation’ and from ‘contemplation’ to ‘involvement’ is based on an expanded notion of the ‘diagram’, the diagrammatic as a process that enfolds thinking and creative practice.”

**Relationship, Agency, Becoming: Science and Technology Studies**

Some of the most useful precedents for the discussion to follow can be found in science and technology studies. The field’s scholars often investigate interactions among human and nonhuman actors within the skilled disciplinary environment of scientific practice, seeking to understand such interactions in terms of relationship and agency. This work offers a particularly useful mix of interest in skilled bodily practice, sensitivity towards questions of power, and attunement to histories of scientific and technological development. In essence, science and technology scholars are developing highly nuanced studies regarding histories of practice and nonhuman agents – natural, technological, and cyborg. These studies do not usually address matters of representation in particular – but they do explore questions of practice more generally in ways that provide compelling models for discussing similarly praxiographic issues in the field of landscape architecture.

In *The Companion Species Manifesto* Donna Haraway seeks to transform the human project of engaging the natural world from a matter of “acting-on” to a matter of “relating-to,” describing Andy Goldsworthy’s work as a form of “heterogeneous relationship” with numerous nonhuman

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36 This mixed focus is particularly useful in understanding the development of environmental design in the 1960’s-70’s, through which the field of landscape architecture was actively engaging scientific and technological change.

37 Indeed, the very notion of a cyborg, or natureculture, hybridity that science and technology scholars promote relates remarkably well to the subject of landscape, in which nature is continually engaged as something entwined with the human – to be constructed, strategized, and related to through the project of designing landscape.
entities. Through this term, she proposes a nebulos condition – one in which many interrelated actors might come together and part, forming a milieu rather than a single identifiable configuration. Haraway’s notion of heterogeneous relationship enables us to ask, broadly: what happens if one attempts to understand landscape, not as something spatially located, but as something interrelational – enacted through the desiring ethics of accumulated human/nonhuman encounters?

Annemarie Mol embraces a praxiographic approach to the work of medical research and treatment. In *The Body Multiple: Ontology in Medical Practice*, she uses the term “enactment” to describe action that is materially productive via bodily practice. Mol proposes that if we look closely at the many enactments of disease that are practiced by medical doctors and researchers, we will discover that a single disease can take many discrete forms – some of which directly contradict each other. In this way, she argues that investigating bodily practice can reveal a multiplicity of definition – one that is often elided if one employs a more empirical view.

Science historians Lorraine Daston and Peter Galison have specifically explored the history of visual representation in the sciences. In “The Image of Objectivity,” they discuss the emergence of “mechanical objectivity” in the drawings of mid- to late nineteenth-century scientific atlases, identifying this emergence as the moment when the scientist’s role began to be idealized as that of a disinterested observer. They also describe the ways in which scientists began using imagery

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38 “How to live ethically in these mortal, finite flows that are about heterogeneous relationship – and not about ‘man’ – is an implicit question in Goldsworthy’s art.” Donna Haraway, *The Companion Species Manifesto: Dogs, People, and Significant Otherness* (Prickly Paradigm Press, 2003), 24. In a similar vein, Landscape Architectural scholar Maria Hellstrom Reimer proposes that in order to successfully engage the dynamic character of landscape, Landscape Architects must learn to resist preoccupations with visual beauty in favor of engaging agency and performativity. Maria Hellstrom Reimer, “Unsettling Eco-scapes: Aesthetic Performances for Sustainable Futures,” *Journal of Landscape Architecture* (Spring 2010), 24-37.

39 Mol is not the first to use the term “enact” in this way. Among others, Lefebvre himself used the term: proposing that “space does not consist in the projection of an intellectual representation, does not arise from the visible-readable realm, but that it is first of all heard (listened to) and enacted (through physical gestures and movements).” Lefebvre, *The Production of Space*, 200.

40 Yaneva proposes a similar situation: “When you observe architects at work, you see that there is not merely one time and space: they rely on subversion, disjunction, displacement and rescaling. In their activities architects are constantly modifying the scales and the relations between actors in space.” Yaneva, *The Making of a Building*, 29.
in ways that reinforced this ideal. By depicting connections between visual representation and constructions of professional identity, Daston and Galison show how specific image-making practices can be engaged in order to redefine the maker’s authorship and agency.\textsuperscript{41}

Bruno Latour has also written on the role of representation of scientific practice. Latour is particularly concerned with scientific uses of drawing, which tend to prioritize objectivity and seek to maintain close relationships between invention and data collection. Yet his approach is also useful in considering the design professions, particularly because he targets material, haptic, and relational aspects of the drawing process, highlighting the role of the body in skilled practice. In “Drawing Things Together,” Latour articulates a general tendency for scholars to ignore the bodily dimensions of representation, noting:

There are two ways in which the visualization processes we are all interested in may be ignored; one is to grant to the scientific mind that which should be granted to the hands, to the eyes, and to the signs; the other is to focus exclusively on the signs \textit{qua} signs, without considering the mobilization of which they are but the fine edge.\textsuperscript{42}

The potential for applying Latour’s work to architectural study is explored by Albena Yaneva. In \textit{The Making of a Building} she adapts Latour’s Actor-Network Theory for architectural study, applying it to an ethnographic study of design practices in the architectural firm OMA. Extending Latour’s notion of “reassembling the social,” Yaneva writes: “following the proactive power of architectural projects to mobilize heterogeneous actors, convincing, persuading or deterring them, buildings will be tackled here as \textit{becoming social} (instead of hiding behind or serving the social), as active participants in society, design – as a process of recollecting, reinterpreting and ‘reassembling the social.’”\textsuperscript{43}


\textsuperscript{42} Latour, “Drawing Things Together,” 52.

\textsuperscript{43} Yaneva, \textit{The Making of a Building}, 18.
Andrew Pickering has also directly considered architectural projects, exploring how research and design might contribute to open-ended, rather than deterministic, human/nature relationships. In “The Politics of Theory,” Pickering asks,

Instead of continually struggling to impose this dualist telos on nature, might it be possible to go with the flow – to organize our lives in ways that thematize and take advantage of open-ended performative dances of agency instead of seeking to extinguish and efface them?44

Towards this end, Pickering discusses several cybernetics-inflected projects, including Cedric Price, Joan Littlewood, and Gordon Pask’s Fun Palace. He proposes that such projects, in their openness to uncertainty, offer models for “ways of acting in the world that do not feature a telos of dualist [human/nature] separation and that thematize open-ended becoming instead.”45 In resonance with James Corner’s focus on the revelatory potential of design, Pickering connects this orientation towards open-ended becoming with Heidegger’s notion of “revealing.”46

Those referenced above all share a particular perspective: that investigating bodily, material practice can reveal new information regarding the making of authority, nature, culture, and space. Towards a richer understanding of such makings, many of these scholars intentionally blur lines between the social and the natural, the human and the nonhuman, in order to source a more experiential and less categorical form of relationship – one that emerges through actions.

Applications

Before moving on, I will highlight a few of the concepts and terms mentioned above, for they will occasionally be used in upcoming passages.

44 Andrew Pickering, "The Politics of Theory," Journal of Cultural Economy 2 (2009), 198. On the same page, Pickering also offers a fairly clear description of the practice-oriented approaches of science and technology studies: “studies of scientific practice conjure up a new and different ontology, a quasi- biological one, of the world as itself a lively place, itself a reservoir of endlessly emergent agency, that can always surprise us in its performance, and that we always have to get along with and accommodate ourselves to, rather than seeing through and controlling. We are always, so to speak, in the thick of things, and history is thus a decentred process of the co-evolution of the human and the nonhuman.”
45 Ibid.
James Corner’s *field of revelation* shares some characteristics with Paul Emmons’ descriptions of the inventive and imaginative dimensions of architectural practice, as well as with Andrew Pickering’s focus on Heideggerian revealing. Borrowing from Corner’s terminology, I will engage the notion of revelation in later parts of this text. It will be particularly relevant in discussing various ways in which environmental designers resituated the role of drawing within the design process.

Albena Yaneva and Andrew Pickering both use the term *becoming* in order to highlight the ways in which design drawing practices are virtual, open-ended, and continually in a process of being made. I will build off their uses of this term, sometimes referring to the *becoming landscape* that is enacted through design. This becoming landscape is collaborative and generative – a production that is not only social, but hybridly so, involving myriad relationships between and among cultures and natures, humans and nonhumans. This notion of becoming will enable us to focus on the dynamic ways in which new environmental design drawing practices generated – and were conditioned by – new landscapes.

When applied to a study of landscape architecture, Annemarie Mol’s notion of *enactment* can illuminate ways in which landscape architects engage a myriad of practices to actively, performatively generate landscape. This notion substantiates design practice so that we can understand it, not as merely evanescent, but as a materializing force in its own right. Going forward, I will occasionally use the term *enact* to highlight how various historical becoming landscapes were created through different drawing practices – not as objects or outcomes, but performatively and relationally – in and through the moments of their drawing.

Finally, I will occasionally reference Lorraine Daston and Peter Galison’s notion of *mechanical objectivity*. Daston and Galison use this term to highlight how, at certain historical moments, new scientific practices were closely linked to the construction of newly authoritative identities for scientists. As we will see, a similar dynamic emerged in environmental design’s cultivation
of a more data-driven approach to landscape architectural design. Considering the cultivation of mechanical objectivity will enable us to focus on ways that new environmental design practices often served to cultivate authority and remake the identity of the landscape architect.

Somewhere at the intersection of these kindred terms and accounts is a nascent understanding of landscape architectural drawing as it is practiced: a simultaneously analytical, revealing, and social action; an exploration of potentiality; a co-making. As informed by the accounts and terms mentioned here, landscape architectural design can be seen to enact a landscape at once material and virtual. It is a relationship among designer, drawing, and material, which together comprise a becoming landscape.

In the passages that follow, I will explore how 1960’s-70’s shifts in representational practices corresponded to increasing concerns for objectivity, productivity, and measurability. I will seek to glimpse the praxiographic dimensions of an emergent design methodology that claimed to be more scientific – and therefore supposedly more objective – than the processes that preceded it. I will ask: what was the nature of becoming that occurred in through environmental drawing practices? Where and how did revelation occur in the environmental design process? And where in these emergent drawing practices was the complex openness of landscape able to grow and change – in essence, to live?

To begin this investigation, I will briefly consider movements that led to environmental design. I will describe the landscape architectural climate of the 1960’s. Then I will look back to earlier influences on environmental design, movements through which landscape architecture became newly systematized: postwar modernism and cybernetics at the GSD and MIT.
CHAPTER 3
ENVIRONMENTAL DESIGN AND ITS INFLUENCES

The 1960’s-70’s was a period of significant transformation for the field of landscape architecture. Federal funding for highway infrastructure and related increases in suburban development created abundant large-scale landscape projects. As a result, many landscape architects began cultivating strategies for designing and planning at the regional scale. At the same time, a rapid rise in popular environmentalism brought new opportunities and expectations to the field, creating novel roles for those landscape architects who could incorporate ecological perspectives and conservation priorities into their work. The materials, technologies, and data available for representation also changed rapidly during this period, due in part to new domestic applications for wartime inventions. The use of computers in design, while still rudimentary, was on the rise. Anticipating their increased use and seeing their value in data management, by the late 1960’s some landscape architects were actively experimenting with their application, in both professional and academic contexts.47

Conceptions of relationship between humans and nature underwent radical changes during this time as well. The interactive investigations of postwar cybernetics and systems thinking influenced how practitioners in many fields conceived of their roles in relation to their environments and their subjects of study. These roles were increasingly seen to be dynamic and reciprocal – imbued with multiple cycles of feedback and communication. Accordingly, questions regarding the role of the designer and the agency of nature found their way into landscape architecture: through systems ecology, experimental music and dance, and cybernetic theories.

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Responding to these changes and seeking to capture new clients and opportunities, landscape architects began embracing experiment and innovation, drawing from various interdisciplinary sources in order to develop new approaches to landscape architectural design. The profession’s focus began to shift away from modernist site design towards stewardship, mediation, and land management. New sub-fields began to emerge: community design, score-based design – and environmental design.  

Finding inspiration and precedent in the late nineteenth-century landscape projects of Frederick Law Olmsted and Charles Eliot, environmental design integrated planning techniques and ecological principles, using government-produced geographic data in order to illustrate and address environmental aspects of large-scale development projects, both public and private. Environmental design ideas increasingly circulated through the profession and teaching of landscape architecture, disseminated through research, writing, and through drawings. 

Seeking ways to incorporate large-scale, multi-layered data into drawings, environmental designers explored representation methods that could capture complex interactive phenomena, such as ecosystem types, rates of flow, wildlife distributions, and various land uses. Often in collaboration with ecologists, foresters, hydrologists, and geologists, landscape architects collected and arrayed data in order to generate abstract representations of complex, changing landscape systems. To do this, they explored a wide range of modeling techniques, including matrices, graphs, sectional charts, and plan-view overlay-based land classification. The results

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48 Perusing the issues of Landscape Architecture Magazine between the years 1963-1971, illustrates these trends towards environmental design and community design. Published projects notably increase in scale during this period, and public projects are increasingly represented. By the late 1960’s and early 1970’s, these shifts were being discussed at length in various magazine editorials. See, for example, Grady Clay, “Still Gouging Away: That Old Cut and Fill Gang,” Landscape Architecture Magazine 59:1 (1968) 20-22; Donald Appleyard, “Elitists versus the Public’s Cry for Help,” Landscape Architecture Magazine 60:1 (1970), 24-25, 55. For further discussion of government’s influence on 1960’s-70’s landscape design and planning, see Frederick Steiner, Gerald Young, and Ervin Zube, “Ecological Planning: Retrospect and Prospect,” Landscape Journal 7:1 (1998), 35-36.


50 The development of these drawings is summarized in Spirn, “Ian McHarg, Landscape Architecture, and Environmentalism.” See also Herrington, The Nature of Ian McHarg’s Science.
were measurable, action-oriented data sets that were seen as proxies for shifting landscape conditions, and analyzed in order to make decisions regarding a landscape’s ideal management and modifications.

Many of the landscape architects who experimented with environmental design felt that its significance was nothing short of revolutionary. Ian L. McHarg was perhaps the most outspoken on this matter. McHarg’s influential writings embraced ecological ideas, finding in them a new conceptual framework and motivation for design. In his 1965 article “An Ecological Method for Landscape Architecture” McHarg proposed that with the arrival of ecology, “the caprice and arbitrariness of ‘clever’ designs can be dismissed forever. In short, ecology offers emancipation to landscape architecture.” According to McHarg, ecology’s systematic method provided a means for completely reforming landscape architectural design, for it had the potential to simultaneously provide “the perception of form, an insight to the given form, [and] implication for the made form.”

**Spatial vs. Ecological**

Despite the reformist fervor of landscape architects such as McHarg, nascent environmental design methods were not initially considered to be in opposition to more spatial methods of landscape architectural design. In the early 1960’s, many landscape architecture programs integrated environmental design experimentation into their curricula, teaching landscape analysis and spatial design methods side by side. Roger Osbaldeston, a landscape architecture student at Penn from 1959-61, remarks that he practiced and improved his perspective-drawing skills greatly while studying under McHarg (then department chair). In addition, Osbaldeston and many of his Penn classmates were recruited to work for Lawrence Halprin and Dan Kiley – both of whom were highly spatial, Bauhaus-influenced designers.

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53 Roger Osbaldeston, interview.
By the late 1960’s however, attitudes towards spatial and ecological approaches had become highly polarized. A 1970 written debate between Garrett Eckbo and Neil Porterfield in Landscape Architecture illustrated this division in sharp relief.54 Eckbo feared that environmental design approaches suffered from “analysis paralysis,” and that “the design process is being rationalized out,” warning that ecological methods risked jettisoning the creative aspects of landscape architectural practice in favor of “narrow-minded and arbitrary cultural restriction.”55 Porterfield, in turn, accused spatial designers of “fantasy fatigue,” warning that they evoked “mystical, indefinable talents… to rearrange large land areas under the title of ‘artistic license.’”56 This debate clearly engaged some hyperbole, for spatial and ecological practices continued to mix and mingle in firms and schools, often being used for different scales and styles of projects. Clearly something other than firm profiles or client bases was at stake in the Eckbo/Porterfield debate: at question were the identity of the profession and the very definition of landscape.

Underlying the sweeping statements of debate, however, was something more rarely articulated by landscape architects – the way in which landscape architectural design was practiced. Environmental design did bring about significant shifts in the practices of landscape architecture – but these shifts did not necessarily entail more scientific methods than had been used previously. To illustrate this, we will now consider the design methods that preceded landscape architects’ embrace of environmental design.

Here I will consider differences and similarities between environmental design and preceding methods, focusing on those links that were particularly influential on drawing practices. In

55 Eckbo and Porterfield, “Too Much Analysis or Designers’ Fantasy?” 201.
56 Eckbo and Porterfield, “Too Much Analysis or Designers’ Fantasy?” 201-202.
particular, I will discuss on the modernist era of design at Harvard and MIT. I will describe some of the attitudes towards drawing practices that were espoused during the Gropius/Hudnut years at the GSD, and touch upon ways in which cybernetic approaches developed at MIT migrated into design, bringing new systems thinking, computer rendering, and conceptions of ecology.

I zoom in on these institutions and this era for two closely related reasons. First, the environmental design innovators whose work we will discuss all studied at Harvard and/or MIT during the height of modernist and cybernetic approaches to design. Their educations either coincided with or followed both the Gropius/Hudnut era at the Graduate School of Design (1938-1952), and formative years for cybernetic studies at MIT. Second, some of environmental design’s praxiographic tensions could also be found in both modernist and cybernetic approaches to practice that were embraced at the GSD and MIT in the postwar period. Because practice has generally been underexplored in histories of environmental design, and narratives have instead emphasized environmental design’s break with modernism, certain of these practice-oriented influences have gone largely unacknowledged.

Throughout this historical discussion, three things are of particular significance: the practice of drawing, the concept of objective vision, and an embrace of technological advancements. Maintaining a focus on these aspects will reveal that while certain aspects of environmental design practice did indeed break from preceding spatial/modernist design practices, others actually grew out of prior modernist and cybernetic approaches that had taken root in the postwar period.

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57 Isolating developments in modernism and cybernetics to the GSD and MIT, respectively, is not entirely true to the complexity of these movements, the ways in which they moved through institutions, or the ways in which they influenced each other. However, since this is a brief overview rather than a comprehensive exploration of these movements, and since the GSD and MIT were sites of significant innovation and dissemination of these respective modernist and cybernetic thought and practice, I will primarily discuss modernism in connection with the GSD, and cybernetics in connection with MIT.
Modernism at the Graduate School of Design

From the years 1936 to 1953, Joseph Hudnut served as dean of a newly integrated design school at Harvard. In 1938, he hired Walter Gropius as head of the architecture department, with the intent to modernize the program. Gropius did indeed bring Bauhaus methods to the GSD, and the Gropius/Hudnut period altered the disciplines of architecture, planning, and landscape architecture throughout the United States, ushering in and then cementing shifts from Beaux-Arts to Modernist practices and perspectives. What’s more, many landscape architects who emerged from the GSD during this period – Garrett Eckbo, Dan Kiley, Lawrence Halprin, Ian L. McHarg – went on to be influential figures in the field. Successes aside, Hudnut and Gropius clashed over differences in pedagogical priorities throughout the 1940’s; by 1953 had both left the GSD.  

The Hudnut/Gropius years have been well documented. They have also developed their own mythology: inaccurate narratives abound, as do accounts that seek to set the record straight.

Because this information can be found elsewhere, I will not recount that general history further – instead, I will focus on some aspects of GSD history that reflect specifically on the relationship between the concept of objectivity and practices of hand-drawing, as promoted and taught during this time. These aspects illustrate the GSD’s integration of Bauhaus drawing processes, and also highlight tensions that would later become significant in the development of environmental design practices.

Of particular interest is a peculiar friction propagated by Gropius (and somewhat unsuccessfully resisted by Hudnut) between embracing the explorative creativity of designing by hand and promoting “objective,” mechanized viewing. Gropius’ interest in cultivating an intuitive, haptic design process was primarily manifested in his instantiation of a Basic Design course at

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the GSD. This course, modeled on the introductory course taught by Joseph Albers at the Bauhaus, brought students from all programs together in their first year for a series of lessons in general design principles, with a focus on learning through making. One of Basic Design’s purposes was to forge connections between tactility and abstraction, based on the belief that design was best learned through explorations that focused on material, texture, and tactile experimentation. In contrast to this promotion of tactile intuition, however, Gropius celebrated seeing as an objective, technical act. He proposed that the eyes operated in a manner similar to more mechanical forms of visual recording, arguing that Basic Design embraced “a new ‘objective approach’ towards a language of vision.” He also advocated for that the art-based explorations of Basic Design should be learned separately from later technical courses.

This joint focus on tactile intuition and visual objectivity created something of an unresolved tension within GSD design pedagogy. On one hand, Basic Design promoted generative, materially inventive, intuition-oriented aspects of drawing. On the other hand, it separated this creative process from more technical aspects of design. The result was a somewhat erratic mixing of references to subjectivity and objectivity: Gropius’ polemics seemed to merge them without tension, but the practices he espoused did not. This very lack of coherence concerned

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60 The Basic Design course was a primary, but not the only, instance in which making was promoted as an essential means of learning design principles. Anthony Alofsin notes that the GSD’ official register in the 1940’s suggested that applicants should gain experience in the practice of design, particularly in “making and doing.” Alofsin, The Struggle for Modernism,” 197.

61 Herdeg, The Decorated Diagram, 90, 92.

62 Pearlman, "Joseph Hudnut and the Unlikely Beginnings of Post-Modern Urbanism at the Harvard Bauhaus,” 470. Furthermore, Herdeg writes, “although there are recurrent, if rather vague, references to ‘creativity,’ inspirational spark,’ and a ‘new language of vision’ throughout Gropius’ writings, in particular, his essay ‘Blueprint of an Architect’s Education,’ the act of seeing is fundamentally assumed to be (or perhaps desired to be) an objective, measurable process with codifiable causes and effects.” Herdeg, The Decorated Diagram, 95.

63 Ibid.

64 This tension could also be found in the Bauhaus pedagogy that Gropius sought to emulate at the GSD. Marcia Feuerstein describes one example of this in the Bauhaus work of Oskar Schlemmer, suggesting that the Bauhaus involved, not only the rational and objective approaches advertised publicly by Gropius and others, but also a “dark side,” an irrational aspect manifested by the approaches of Schlemmer and Johannes Itten as well. Marcia Feuerstein, “Body and Building Inside the Bauhaus’ Darker Side: on Oskar Schlemmer,” in Body and Building: Essays on the Changing Relation of Body and Architecture, eds. Dodds, George, Robert Tavernor, and Joseph Rykwert (Cambridge, Mass: MIT Press, 2002), 226-237.
Hudnut, and fed the growing schism between Hudnut and Gropius. However, in this matter Gropius prevailed: the GSD continued to operate on his model through the 1960’s.

Klaus Herdeg has referred to this modernist tension between making and vision as “a subjective/objective seesaw.” Others have written on it as well, as a phenomenon of the modernist movement in general. According to William Tozer, “the Modernist agenda of functionalism masked the actual changes that were taking place in architecture creatively, particularly in the processes of architectural form-making.” Similarly, Paul Emmons has described how Bauhaus architects took up various objective/functional interpretations of flow, noting how modernist diagrams operated in purportedly scientific, but praxiographically ludic ways.

Here, then, is a clear paradox in GSD postwar education between intuitive hand making and objective, mechanical, observation – one that also calls out a distinction between modernist architects’ stated agendas and their actual practices. The Hudnut/Gropius years at the GSD propagated a friction between an embrace of technology and a belief in individual creativity. This was manifested in unresolved pedagogies, and also in differences between descriptions and practices of design. Gropius’ tendency to understand hand-making as intuitive and seeing as objective one effected different roles for drawing and observation within the design process.

This rift will become significant in our upcoming discussion of environmental design representation practices. As we will see, environmental designers’ association of observation

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65 “[Hudnut] took issue with the [Basic Design] course’s schismatic approach to designing-the fact that students studied only formal/artistic problems and that technical/construction issues came separately and afterward, in later courses.” Pearlman, “Joseph Hudnut and the Unlikely Beginnings of Post-Modern Urbanism at the Harvard Bauhaus,” 471.


67 Herdeg, The Decorated Diagram, 90.


69 Emmons also notes that, “conceived within scientific management as transparent, [flow diagrams] became a narcotic of facticity.” Emmons, “Intimate Circulations,” 52.
with objective analysis, their expansion of the role of viewing in this design process and their reduction of a role for hand-making were in many ways alterations of earlier Bauhaus-based, GSD-taught, design practices.

**Bauhaus / Cybernetics at Massachusetts Institute of Technology**

The field of cybernetics emerged out of World War II weapons engineering. Conducting research for the US military, MIT mathematician Norbert Wiener sought to build an anti-aircraft machine intended to improve firing accuracy by anticipating the movements of enemy aircraft. After the end of the war, Wiener and others continued to research the use of feedback to direct and control multi-part electrical and communication systems. Supported by a robust military-industrial complex, studies of feedback in complex systems saw enormous development in the postwar United States. Disseminated through various conferences and publications, cybernetic ideas and methods became popular in a wide variety of fields, including biology, anthropology, and the arts.

As the primary hub of cybernetic research, MIT was an amplified microcosm of this larger interdisciplinary trend: here cybernetics gained popularity throughout numerous departments.\(^70\) This included MIT’s School of Architecture and Planning, where Wiener’s cybernetic ideas influenced the MIT-based art and planning work of Gyorgy Kepes and Kevin Lynch. Kepes had been invited to start a program in visual studies at the school in 1947, and taught there until 1974. Lynch taught planning at MIT from 1949 to 1978. The two collaborated from 1954-59 on a Rockefeller-funded research project, “Perceptual Form of the City,” in which they proposed to analyze the health of the urban environment through visual analysis.\(^71\)

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\(^70\) “In the 1950’s MIT was a hotbed of investigations into machinic processes.” M. Christine Boyer, "The Two Orders of Cybernetics in Urban Form and Design,” in *Companion to urban design*, eds. Tridib Banerjee and Anastasia Loukaitou-Sideris (Milton Park, Abingdon, Oxon: Routledge, 2011), 71.

Cybernetics was first and foremost a practical framework: initiated by, and seeking to advance, technological innovation. Much like design ideas, cybernetic ones were intrinsically linked to material investigations and outcomes. Wiener, for example, simultaneously wrote broad-ranging, ideological works and worked to develop practical applications. Accordingly, in cybernetic discourse, technology was continually referenced both as an analogy for the human mind and as an emergent, rapidly evolving set of tools that were actively changing methods and practices. In this way, advances in computerization were intrinsically linked – practically so – to the project of learning to perceive complex systems. Therefore for cybernetics-influenced designers such as Kepes and Lynch, the eye and the computer were understood to be closely interrelated in part because new developing technologies invited, and often required, new ways of seeing.

Christine Boyer details the myriad ways in which Kepes’ and Lynch’s collaboration was inflected with cybernetic thinking, detailing how their interest in visual syntax was influenced by “the cybernetic discourse on cognition being defined at MIT as computation performed on symbols and codes.” Furthermore, Boyer also describes how Kepes applied cybernetic ideas towards computational notions of vision and the human mind, noting: “it was Kepes’ pedagogical aim to train the artist and the scientist to become sensitive decoders of messages sent and received from a variety of sources in the modern world.”

This notion of vision as something trained and mechanical was, of course, not unlike Gropius’ notion of objective vision. There is certainly reason for this: Kepes in particular was highly influenced by Bauhaus thinking, and a mix of Bauhaus and cybernetic influences can be found throughout his 1965-66 Vision + Value book series, which brought together a diverse set of modernist and cybernetic thinkers. Thus Kepes and Lynch integrated Bauhaus and cybernetic

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74 Among others, contributors to the series included Christopher Alexander, Johannes Itten, John Cage, Buckminster Fuller, Marcel Breuer, Marshall McLuhan, and Ludwig von Bertalanffy.
ideas on vision: promoting practices that deployed visual syntax-based analysis in order to
dedupe logics underlying both natural processes and urban systems.

Reinhold Martin has written at length about this period at MIT, investigating the influence of
cybernetics on Kepes’ and Lynch’s notions of the structuring capacity of vision and strategies for
perceiving urban form. Martin asserts that in Kepes’ and Lynch’s approaches, “the body into
which [the viewing] sensorium is embedded is decisively flattened. What was once a "thing" in
space, an organism made up of carefully arranged functional organs, has become, for Wiener as
well as for many biologists, a communications network linked to other networks in all directions,
a ‘pattern.’” Accordingly, Kepes’ and Lynch’s notions of vision embraced, not only a
mechanistic notion of the mind, but also a disembodied, abstracted notion of the corporeality of
vision.

This disembodied vision was not only purportedly objective – able to perceive systematic logics.
It was also closely linked, through cybernetics, with new ways of seeing associated with
emergent technologies. This cybernetic notion of objective, technological viewing, resonant with
modernist conceptions of vision, once again illustrates a theme that would become significant in
later developments of environmental design.

_Scientization: Ecology on the Rise_

The ecological ideologies that would become influential in environmental design were also
highly influenced by cybernetic ideas. One of the early members of the Macy cybernetic
Conferences was ecologist G. Evelyn Hutchinson, whose paper “Circular Causal Systems in
Ecology” modeled the cycling of nutrients through a living ecosystem. Elaborating on

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75 Martin comments primarily on notions of pattern perception that emerged during this period, noting that “Kepes
sees the new landscape made visible by scientific imaging as a communicative topography made up of relational
patterns whose naturally occurring equilibrium can be incorporated into art and architecture, by using the images
themselves as a kind of feedback mechanism.” Reinhold Martin, “The Organizational Complex: Cybernetics, Space,
Hutchison’s approach, his student Howard H.T. Odum continued to integrate cybernetic notions of feedback and communication into ecological models.

H.T. Odum practiced ecosystem modeling: using data in order to create distilled, diagrammatic, manipulable representations of ecosystem activity. With predictability as a priority, his ecosystem models drew from cybernetic theories. In fact, Odum sometimes directly referenced cybernetic diagrams of electrical circuits in order to describe ecosystem dynamics. Peter Taylor identifies H.T. Odum’s philosophy as a sort of “technocratic optimism,” noting how “the new theorists of feedback systems conceived of nature as a machine and, at the same time, acknowledged the purposive and regulatory character of that nature-machine.”

Receiving economic support from the Atomic Energy Commission and a newly emergent National Science Foundation, the collaborative research of H.T. and his brother Eugene emphasized predictability, control, and engineering of natural systems. Well-funded and abundantly published, and authors of what became the primary ecology textbook for more than a decade, Eugene and H.T. would eventually become two of the most influential figures in defining the field of ecology.

The Odums’ work would also be highly influential in the development of environmental design. In fact, even once H.T.’s modeling approaches had fallen out of favor with ecologists, environmental designers continued to lean on the Odum’s texts and models for ecology. In fact, the Odums’ work was useful to environmental designers for many of the same reasons that it became problematic for ecologists. By depicting ecosystems as predictable and therefore controllable, the Odums’ models would enable environmental designers to point to scientific

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77 Hagen, An Entangled Bank, 109-112.
78 Taylor, “Technocratic optimism, H.T. Odum and the partial transformation of ecological metaphor after World War II,” 242-244.
causality as a basis for their design decisions. Meanwhile, the research of scientific ecologists quickly revealed that this very notion of an ecosystem as stable, manipulable, and controllable was highly inaccurate to the vast complexity of ecosystem function. As early as the 1960’s, many scientific ecologists considered the work of H.T. Odum in particular (which was more invested in stability than that of Eugene) to be highly problematic.\(^{79}\)

This would not stop landscape architects from continuing to adopt and adapt Odum-based ecosystem models for management purposes. Indeed, the goal of management made H.T. Odum’s stable ecosystem models particularly useful, despite their increasingly questionable certainties.

Indeed, the priority of management greatly skewed environmental designers’ approaches to ecology. They did not embrace ecology as practiced – an experimental, deliberative, often subjective endeavor. Rather, with management as their goal, they saw in ecology a means to bring new levels of objectivity – and new levels of authority – into their own field. The mantle of science was embraced as a way to support environmental priorities – and as a means for bringing new legitimacy to the landscape architecture discipline overall.

Landscape architects thus incorporated ecological principles into environmental design in ways that were not entirely in line with concurrent practices in scientific ecology. They referenced outmoded ecological ideas in order to project objectivity – and in doing so obscured the fact that this very objectivity was not accurate to the serendipities, imaginaries, and uncertainties inherent in scientific practices. By embracing the mantle of science, landscape architects paradoxically projected a level of certainty that failed to acknowledge the ambiguities inherent in the sciences themselves.

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Ecology as Metonym

The use of outmoded models was one way among several in which environmental designers adopted a peculiar form of ecology in their work. Like many who wrote about environmentalism in the 1960’s-70’s, landscape architects often blurred the lines between ecology as a practice and ecology as an ideology. When landscape architects such as McHarg wrote about ecology, their depictions often bore little resemblance to the practices of their contemporaries conducting research in scientific ecology.⁸⁰

This tendency to broadly interpret ecological ideas could be found not only in the environmental designers’ writings, but in their design practices as well. They often consulted ecological models derived from general principles; took water samples and measured water quality; consulted soil charts; analyzed aerial photographs to estimate the locations of different plant communities; and identified different habitat types. But they rarely questioned the ecological models that they referenced, or conducted scientific experiments. Thus while environmental designers professed to embrace ecology in their projects, they did so in a particular way, often adopting general principles and methods without questioning the scientific discourses from which they arose.⁸¹

Thus we might best understand the highly charged debates between Eckbo and Porterfield, and the broader landscape architectural debate between spatial and ecological methods, as red herrings of sorts. By hyperbolically characterizing the environmental design shift as a radical movement away from art and towards science, such debates obscured significant changes in representational practice that were taking place.

⁸⁰ For example, Susan Herrington describes the influence of Lawrence Henderson’s notion of fitness on McHarg’s ecological philosophy. Notably, Henderson was not an ecologist, nor was his understanding of ecology up to date by the time McHarg began referencing him (Henderson’s book The Fitness of the Environment was published in 1913). Herrington, “The Nature of Ian McHarg’s Science.” It should be recognized here, however, that McHarg was hardly the only one to interpret ecology so broadly.

⁸¹ Ecologists did collaborate on many environmental design projects. However, this involvement did not deter the landscape architects from borrowing and paraphrasing ecological principles in ways that simplified the nuances of scientific practice.
I will now discuss the drawing practices used in three significant environmental design projects. These projects have been selected because, taken from different moments during the field’s early development, they represent notable innovations in the use of the overlay drawing method. Taken together, we can use these projects to track changes in environmental design practices, from the early 1960’s through the mid 1970’s.

Environmental design grew in close association with the institutions, individuals, ideas, and approaches described in the prior chapter. Indeed, there are myriad ways in which the individuals whose work we will discuss – Alexander Manheim, Christopher Alexander, Ian McHarg, and Carl Steinitz – were influenced by the environments described above, and also by each other. McHarg attended the GSD in the postwar Hudnut/Gropius years, studying landscape architecture and planning there from 1946-50. Manheim, Alexander, and Steinitz studied at the GSD and MIT in the early 1960’s, during a period in which both institutions continued to be highly influenced by postwar perspectives. Alexander received the first PhD in architecture from Harvard University in 1964, conducting collaborative research with Manheim at MIT between 1962-64, working on transportation systems and computer science. Manheim was a PhD student in engineering at MIT until 1965, at which point he stayed on as a professor. After studying architecture at MIT, Steinitz stayed on to study Urban Planning and Design with Kevin Lynch at MIT and also conducted research at the GSD during this time – he completed his PhD in 1967.

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82 In a small field, such connections are perhaps inevitable. Nonetheless, a few examples: McHarg and Kevin Lynch both attended a 1958 Rockefeller Conference on Urban Design Criticism; Alexander wrote a piece for Gyorgy Kepes’ *Vision + Value* series; Steinitz referenced the work of both Alexander and Manheim and McHarg in his writing.

83 Gropius was influential in the selection of Josep Lluis Sert, who served as dean at the GSD from 1953-1969. Pearlman, "Joseph Hudnut and the Unlikely Beginnings of Post-Modern Urbanism at the Harvard Bauhaus," 473.
All of the environmental design projects I will discuss used overlay-based mapping. The earliest documented use of overlays in landscape architectural design was by Charles Eliot in the early 1900s.\footnote{Steiner, “Revealing the Genius of Place,” 203-204.} Beginning with the Manheim/Alexander project in the 1960’s, overlay techniques were increasingly common, becoming almost synonymous with rapidly developing environmental design methods. In the early 1980’s, these techniques were used to define the now ubiquitous computer program GIS.\footnote{Killpack, “Computer Mapping, Spatial Analysis, and Landscape Architecture,” 43.}

In what follows, I will touch upon these three influential projects, with a focus on the drawing practices that each employed.\footnote{The authors themselves were not concerned with drawing or the agency of the hand. Despite using hand drawing, Alexander and Manheim’s texts on this project did not refer to the act of drawing itself. It would seem that McHarg almost never discussed drawing. His 1967 piece, “An Ecological Method for Landscape Architecture,” discusses design, but does not mention drawing in relation to design. Steinitz, in contrast, did discuss drawing – but he primarily referenced it as a problematic site of unnecessary labor (more will be said about this shortly).} In the progression from project to project, we will observe transitions: from loose, abstract 1962 explorations of Alexander and Manheim; to more codified and bound drawing methods used in McHarg’s 1967 studio; to a set of 1973 drawings produced by Steinitz with the firm Johnson, Johnson, & Roy that sought to eliminate hand drawing as much as possible. All of these projects were created through some connection to student work. What’s more, all of these projects functioned simultaneously as real-world work, as the basis for academic articles, and as experiments in crafting a new way to design landscapes. Accordingly, each of these projects operated in different moments as client work, academic work, and published case studies.\footnote{These projects also relied heavily on collaboration – among engineers, architects, landscape architects, ecologists, and planners. This was perhaps partly due to interdisciplinary content, partly due to of scale, and partly due to the fact that active collaboration enabled practitioners to more easily meet the demands and desires of bureaucratic, governmental entities. In the earlier years, this was also due to a need for manual labor – for this, students were often recruited, either through studios or as interns. In this environment, authorship is a sticky concept – whether or not an individual was credited in print for their innovation was often a matter of individual benevolence on the part of a given author.}

\footnote{In an effort to strike a balance between accuracy and efficiency, I will mention individual students involved in these works when their names are made available – but I will refer to the drawings primarily in connection with the individuals under whose names they were published and/or filed in archives – Alexander, Manheim, McHarg, and Steinitz. With more time and opportunities to seek out interviewees, this approach could be more diversified, and authorship more fully problematized. Under the current circumstances, however, and given the crediting tendencies}
As for the drawings themselves, they also played several roles. In the context of pedagogical environments, they were educational experiments, opportunities for students to explore innovative approaches to an emergent field. In the context of the client-based projects for which they were drawn, they were analysis and proposal drawings, used to present information on existing landscape conditions and to propose new configurations. In the context of academic exhibition and publishing, the drawings functioned as methodological proposals – models for how environmental design drawing could be done.

As I recount these projects, I will ask: what was the nature of the becoming landscape that emerged through these drawing practices? Where did revelation reside in the environmental design process? And where in these emergent practices did the complex openness of landscape operate?

*The Use of Diagrams in Highway Route Location: An Experiment*  
Christopher Alexander and Marvin L. Manheim (1962)

In the early 1960’s, Christopher Alexander was a PhD candidate in Architecture at Harvard University, working on a dissertation that would eventually be published as *Notes on the Synthesis of Form*. During this time, Alexander conducted collaborative research at MIT with Marvin L. Manheim, a PhD student in engineering at MIT. Both were interested in real-world applications for emergent computer programs. In 1962, Alexander and Manheim jointly published an MIT Research Report entitled *The Use of Diagrams in Highway Route Location: An Experiment*. The project described was funded by the Bureau of Public Roads of the U.S. Department of Commerce and the Massachusetts Department of Public Works. It focused on cross-referencing multiple requirements – such as proximity to existing towns, connections to...
mass transit, minimal disruption of existing development – in order to determine the best location for a planned highway. The overall intent was to experiment with a new methodology for making design decisions in complex circumstances. The method, described in great detail, did indeed propose a new approach: it used numerous overlays in a strategically combinatorial fashion, iteratively cross-referencing and distilling data towards a final solution.

Alexander and Manheim produced a series 26 of plan-based diagrams of the area of a proposed highway. Each of these represented a requirement, illustrating the places to avoid (lightest) and desirable locations (darkest) for each (Figure 4.1). These drawings were then cross-referenced and summarized in nesting series (Figure 4.2). Cross-referencing was achieved by stacking a two or three drawings together, presumably on a light table, then coloring in the darkest areas on a new sheet of paper, resulting in a composite diagram of desirable locations (Figure 4.3). This diagram would then be overlain with other distilled diagrams, and the darkest areas traced again. The process was continued until a single diagram remained (Figure 4.4). According to Alexander and Manheim, the final composite drawing, since it took into account all known requirements, revealed the optimal location for the new stretch of highway – the location with the most desirable qualities and the fewest problems.

Let’s zoom in to discuss one set of overlays – a combination of “Interference During Construction,” “Weather Effects,” and Existing Transportation Systems” (Figure 4.3). Each drawing uses a range of gray tones, with the absence of color signifying the least desirable and black signifying the most desirable location for each requirement. “Weather Effects” (Figure 4.5), for example, uses general washes of gray, outlined colorless areas, and dark gray/black curving forms to illustrate challenges posed by various weather conditions, as influenced by topography. Curving forms darkly color the southeast sides of hills, which are sheltered from prevailing northeast winds, marking them as desirable. Unbroken crosswinds and fog are also represented, again derived from a combination of topographic data and prevailing winds. In
Figure 4.1. All 21 requirements used in Alexander and Manheim’s highway location study. Christopher Alexander and Marvin L. Manheim, *The Use of Diagrams in Highway Route Location: An Experiment* (Cambridge, Mass: School of Engineering, Massachusetts Institute of Technology, 1962), 7.

Figure 4.2. Diagram showing how the 21 requirement drawings were cross-referenced in nested series, eventually resulting in a single location recommendation (diagram “A”, at top). Alexander and Manheim, *The Use of Diagrams in Highway Route Location*, 9.
Figure 4.3. Diagram showing the overlay and distillation process for requirements 6 (Interference During Construction), 17 (Weather Effects), and 24 (Existing Transportation Systems). “6+17+24” shows the overlay image of the three requirements; “G,” at top is the diagram marking the darkest areas seen in the overlay image. Alexander and Manheim, *The Use of Diagrams in Highway Route Location*, 17.

Figure 4.4. Diagram showing the final recommendation for highway location (“A,” top), as well as the two distillation drawings (“B,” “C”) used to determine the final solution. Alexander and Manheim, *The Use of Diagrams in Highway Route Location*, 21.
Figure 4.5. Requirement 17, “Weather Effects,” diagram (above) and base map (below). “This requirement is concerned with the vulnerability of the highway to the effects of weather conditions: floods, snowdrifts on the windward sides of hills, ice on the pavement in the shadows of cuts and underpasses, fog in dips of the road into marshy hollows, unbroken crosswinds, smoke from local conditions, etc.” Alexander and Manheim, *The Use of Diagrams in Highway Route Location*, 68-69.
**Figure 4.6.** Requirement 6, “Interference During Construction.” “In the diagram, main roads, community centers, and railroads are to be avoided (white); secondary roads, commercial and densely populated built-up areas are light grey. Sparsely populated built-up areas are grey, and everything else is desirable. This diagram… also urges perpendicular crossings of roads.” Alexander and Manheim, *The Use of Diagrams in Highway Route Location*, 46-47.

**Figure 4.7.** Requirement 24, “Existing Transportation Systems.” “A highway should not be too far from existing roads and travel patterns, or its purpose is defeated… This requirement expresses the desire to have trip ends close, in terms of access over secondary roads, to the highway. Therefore, areas with high density of trip ends and points of connection to important secondary roads are shown as black in the diagram.” Alexander and Manheim, *The Use of Diagrams in Highway Route Location*, 83.
“Interference during construction” (Figure 4.6), meanwhile, white areas represent “main roads, community centers, and railroads,” areas that would be notably disturbed by construction activities. Populated areas are shown in light gray, and all other areas shown in black. “Existing Transportation Systems” (Figure 4.7) shows high-density areas and important secondary roads in black, highlighting the benefit of locating highways close to dense populations and mass transit.

Alexander and Manheim were mostly silent on the intent behind their drawing methods: at no point did they mention the process of making the drawings themselves. Indeed, the hand-drawn nature of these drawings was not “the point” of their work here. For our purposes, however, the role of hand drawing in this project is significant, for it reveals several characteristics that were to be elided in later environmental design overlay methods. What can we infer from the drawings themselves about the processes of their making? More specifically, what was the nature of the becoming landscape that Alexander and Manheim enacted through their particular actions of drawing?

At a glance, one might assume that these were works of art rather than highly strategic analyses: the representations themselves are loose, general, and highly abstract. Nonetheless, there was clearly research underlying and influencing each of these drawings: prevailing winds, existing developments, mass transit, population density, topography were all taken into account. Furthermore, despite the drawings’ casual appearances, several of their qualities suggest that drawing was a thoughtful process here. Varied textures and shapes were used in different drawings, illustrating that care was taken and craft engaged when marking the page. Some of these choices could only occur with charcoal in hand. Hardness of line, darkness of tone,

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90 Alexander and Manheim, The Use of Diagrams in Highway Route Location, 47.
91 In the absence of first-hand accounts of this, we will primarily have to infer the role of the hand by considering the drawings themselves. There is precedent for this approach in architectural history: see Emmons, “Intimate Circulations - Representing Flow in House and City,” Evans, The Projective Cast: Architecture and its Three Geometries, and Leatherbarrow, “Architecture and its Horizons.”
looseness and density of color, when to outline a form, when to leave it loose: these were
decisions necessarily made in the moment of making.

In each series of drawings, the initial analysis drawings resulted, not from tracing pre-existing
information, but from deducing relationships, and then drawing new forms that revealed them.
The composite diagrams (Figure 4.3, top), also suggest a thoughtful drawing process: as the
designer peered through layers of drawings, they would track the darkest areas and apply layers
of charcoal on a new, abstracted diagram. In these ways, we can find evidence that revelation
took place through drawing and observing together, analytical observation and manual drawing
practiced one inseparable act. In this way, Alexander and Manheim enacted this becoming
landscape through a process that intrinsically, continually, interrelated the actions of eyes and
hand.

One other thing should be highlighted regarding the enactment of the becoming landscape that
occurred in this project. Congruent with prior modernist drawing practices, we see here both
evidence of the designer’s hand and a reliance on the ambiguity of the abstracted diagram. The
drawings’ variability of forms and looseness of line produced a marked openness in the
landscape shown. Outlines were rarely used, and gradient shifts between dark and light often
defied clear categorization. In the looseness of line, evidence of the maker’s hand remained,
further hinting at a process that was not closed – not definitively marked on the page as absolute
– but rather open, accessible in its ambiguity for further interpretation and manipulation.

However precise this project’s cross-referencing structure may have been, the drawings
themselves thus maintained a variability and looseness, an availability and malleability that,
rather than representing something fixed and finished, traced a relational, becoming condition.
What’s more, this openness was directly linked to the way in which the drawings were made:
through sketching by hand, in a process that engaged revelation through making. By inviting and
engaging ambiguity within the drawing practice in this way, Alexander and Manheim enacted a
landscape that, while circumscribed by structure, was nonetheless relationally dynamic, interactive, and open to uncertainty and change.

Was this openness intentional? Alexander’s description of the project’s general intent suggested that it was. In “From a Set of Forces to a Form,” he highlighted the capacity of the overlay approach to facilitate a design process that was responsive to existing natural forces. He described the overlay approach as a “relational method,” one in which the designer should seek to “determine, as abstractly as possible, the physical relation which each individual tendency is seeking.”

This choice of words suggests that there was a clear intent with regards to Alexander and Manheim’s uses of hand drawing. In this quote, Alexander emphasized the need to work abstractly, implying that the openness of drawings was not accidental, but intentional. Further implying intention, he also proposed that landscape forces are capable of “seeking,” thereby hinting at a vitalist belief in the capacity for nonhuman forces to desire. Finally, his use of the term “relational” even further suggests that the overlay method he describes was intended to operate generatively and interactively, between designer and site.

Following this report, Alexander and Manheim each wrote further about their project, each describing their methodology in different terms. Alexander described the method conceptually in the article just referenced, written for Gyorgy Kepes’ *The Man Made Object* (part of his *Vision + Value* series). Manheim described the method in more technical terms in an article for...

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92 Alexander, “From a Set of Forces to Form,” 101. The capacity of the architectural diagram to represent relational conditions has been also described by Hyungmin Pai, who proposes that with the introduction of diagrams, “the visual markings of architectural discourse had moved away from its traditional function as the projection of a physical object. In principle, the diagram should represent concepts and objects external to the building: the movement and activity of its occupants, the flow of air, the angle of sunlight, i.e. the ‘function’ of the building.” Hyungmin Pai, *The Portfolio and the Diagram: Architecture, Discourse, and Modernity in America* (Cambridge, Mass: MIT Press, 2002), 195.

93 Andrew Pickering celebrates this vitalist notion of nonhuman desire, proposing that by seeking to discover what something ‘wants to do,’ environmental designers become uniquely able to “establish a modus vivendi without ever reaching cognitive mastery,” thereby becoming able to engage “the dance of agency without any telos of purification.” Pickering, "The Politics of Theory," 203-204.

an issue of *Design Quarterly*, focusing on computation in design.\(^{95}\) For both, this project was clearly a touchstone for a new way of designing.\(^{96}\) Others wrote about the project as well. Carl Steinitz, Paul Parker, and Lawrie Jordan described it in an article summarizing the history of hand-drawn overlays, noting that it was highly innovative and influential to environmental design methods.\(^{97}\) This mention, along with the prominence of the publications in which Alexander and Manheim wrote, suggests that the highway project was surely known by others in the environmental design field as well. Aptly, then, it is in the context of this first project that we will consider the next one.

**Delaware River Basin II Studio, Poconos Study**

*N. Belanger, M. Clarke, and D. Harper, students, Ian McHarg, instructor (1967)*

By the late 1960’s, the nesting overlay approach described by Alexander and Manheim had been elaborated significantly via the teaching and professional work of Ian L. McHarg. Beginning in 1954, McHarg was chair of the landscape architecture department at the University of Pennsylvania; only three years prior, McHarg had completed studies in landscape architecture and urban planning under Hudnut and Gropius at the GSD. In 1963 McHarg co-founded the Philadelphia-based planning and design firm Wallace McHarg Roberts & Todd.

Throughout the 1960’s, many of McHarg’s studio courses at the University of Pennsylvania served both pedagogical and real-world functions, engaging student work in the service of clients. Through these projects McHarg developed a team-based, data-intensive approach to environmental design. Conducted over several studios throughout the 1960’s, the Delaware

\(^{95}\) Manheim’s later work centered around computer programming for complex design problems, writing: “projects like the route location of a new highway and problems in architecture or city planning are of such complexity that the computer should be employed as a tool for analysis and prediction.” Marvin L. Manheim, “Problem-solving Processes in Planning and Design,” 30.

\(^{96}\) While in later works, Alexander did continue to sometimes use loose diagramming to illustrate his ideas, Manheim’s later work had none of the evidence of the hand that had been apparent in this first project. Manheim’s 1964 publication on this work primarily focused on computer-based numerical and project flow data, rather than focusing on the original hand-drawn items (though it did show them).

\(^{97}\) “As a whole [the Alexander and Manheim] study has had much to offer and it has resulted in one of the rare methodological debates to be found in the design literature.” Carl Steinitz, Paul Parker, and Lawrie Jordan, “Hand-drawn Overlays: Their History and Prospective Uses,” *Landscape Architecture* 66:5 (1976), 448.
River Basin study was one of several studio-based testing grounds for this evolving approach. The Delaware River work was not the most highly published of McHarg’s studies, nor was it the most effective at influencing real-world development. However, in the it was a project through which various overlay methods were developed, tested, and revised—methods that would continue to be used in McHarg’s environmental design work for years to come. As such, the Delaware River Basin studios are particularly useful to an investigation of drawing practices.

Reviewing drawings from the 1967 Delaware River Basin II studio offers some clear illustrations of how the environmental design drawing process changed in the years since Alexander and Manheim’s project. This studio was the second of three closely-related studios conducted between 1967 and 1968, all investigating constraints and opportunities for development throughout the Delaware River Basin, a broad area extending from New York State through Pennsylvania, New Jersey, Maryland, and Delaware. For the 1967 study, groups of 2-4 students were assigned to investigate specific regions within the basin. They produced a series of plan-based analysis drawings of each region, concluding with a drawing showing recommendations for the region’s development. For studio presentation, some of the analysis drawings were accompanied by a series of diagrams traced from other sources, illustrating various ecological principles.

To consider how these studies were drawn, we must zoom in. I will review a handful of drawings out of 21 plan-based drawings describing the Poconos region, produced by students N. Belanger, M. Clarke, and D. Harper. Many characteristics in this set are similar to those of the Alexander and Manheim drawings. Like the 26 requirement drawings of the Alexander and Manheim project, the Poconos study is a set of overlapping and interrelated analysis drawings. As in our first example, this drawing set comprised an iterative and cumulative approach to documenting

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99 For a full listing of drawings in the Poconos set, see Figure 4.8.
landscape. A handful of government maps, charts, and aerial photographs were interpreted and distilled into drawings that illustrated specific characteristics of the site. As I have diagrammed in Figure 4.8, the cross-referencing of these drawings within the project reveals a nested distillation of information similar to that proposed by Alexander and Manheim, with final recommendations resulting from prior comparisons.

How were the Delaware River Basin drawings made? First, students created a template map: an ink-on-mylar tracing of contour lines from a USGS topographic map. Next, they had several duplicate copies made reprographically. Then each of these copies was used as a base drawing for a different interpretive map, into which data traced from other sources was copied. The data itself was collected through a process of tracing, most likely sketched on trace paper before being transferred to the vellum drawing shown. For “Potential Wildlife Distribution” (Figures 4.9, 4.10), students would have placed trace paper over an aerial image, and then outlined different visible patterns on the paper, assigning wildlife categories according to best-guess interpretations of which visible patterns represented which site conditions – dark textured areas for “forest wildlife,” pale smooth areas for “farm wildlife,” and so on. Given the variability of aerial imagery, some estimation and guessing would have been necessary in order to determine which patterns represented which vegetation types.

Much of this process was similar to the process described by Alexander and Manheim. However, this project modified that earlier approach as well: it used multiple base maps and aerials rather than a single base map; multiple colors, rather than black/white; reprographic techniques in providing bases for each analysis sheet; and a web of cross-referencing between drawings, rather than a simple tree-like structure. In these ways, this project used a broader range of data and greater technical detail than the Alexander Manheim study.
Figure 4.8. Diagram showing relationships among drawings in the Poconos set from the Delaware River Basin Studio II. Arrows indicate the transfer of information from one drawing to another (left to right). Produced by the author, reviewing the drawings, their listed sources, and their categories.
Figure 4.9. “Poconos: Potential Wildlife Distribution,” N. Belanger, M. Clarke, and D. Harper, ink and marker on vellum duplicate, Studio Drawings, Delaware River Basin Study II, Instructor Ian L. McHarg, University of Pennsylvania (1967), Ian L. McHarg Collection, Architectural Archives of the University of Pennsylvania.


Figure 4.12. Exhibit photographs, Delaware River Basin Study III, Instructor Ian L. McHarg, University of Pennsylvania (1968), Ian L. McHarg Collection, Architectural Archives of the University of Pennsylvania.
There are other key differences here as well, some of which are particularly relevant to our concern for the enacted landscape. As McHarg and his students refined the overlay process, the work of drawing became increasingly circumscribed by the requirements of categorization and rules of production. As a result, McHarg’s approach introduced increased mechanization of the act of drawing.

Tracing, cross-referencing, delineating, coloring, tracing again: these comprised the essential actions for McHarg’s 1967 studio. When producing diagrams, students simplified fuzzy transitions between patterns into bound, delineated zones, which were then coded and colored according to category: “settled areas,” “forest wildlife,” “farm wildlife,” “ecotone areas,” and “wetland wildlife.” The aerial’s vague edges – between forest and field, for example – were thus translated into clearly edged regions. Though some diagrams required calculation, such as when deriving a slope map from contour lines, more often the primary interpretive action was to decide where to locate a line within a narrow gradient. Sometimes, such as in the case of soil drawings, government maps had already delineated zones, and nothing was required but to re-trace the government map (Figure 4.11). In representations such as these, the creative aspects of drawing involved merely making zones and selecting colors.

This way of drawing was a significant departure from the one practiced by Alexander and Manheim. Drawing in the Alexander and Manheim project was an act of interpretive discovery, one in which interactive relationships were deduced through the acts of creating unbound, texturally and formally complex imagery. In contrast, the McHarg approach increasingly tied the actions of drawing to defined rules of production. Compared to the earlier project, here drawing and revelation operated in greater separation.

In another departure from the Alexander and Manheim approach, drawing under McHarg increasingly became a matter of mass production. There were several related reasons for this. For one, the cross-referencing of drawings in McHarg’s studios seemed to hold a multiplicative
capacity: once created, a drawing would then be used, not only in comparison with other
drawings, as had been done by Alexander and Manheim, but also as source data for new
drawings. “Slope” and “Exposure” drawings, for example, were cross-referenced into a
composite “Slope and Exposure” drawing. Given the introduction of this lateral cross-
referencing, one could produce numerous different interpretive drawings from a handful of
source maps. Figure 4.12, a pair of photographs of a public 1968 exhibit of Delaware River
Basin drawings at the University of Pennsylvania, illustrate this almost endless potential for
iterative re-interpretation.

Figure 4.12 also reveals another way in which mass production became prioritized. The
enormous scale of the Delaware River Basin increasingly inspired massive drawings as well. In
an effort to gain greater detail of information, McHarg had students produce several new
drawings for the 1968 exhibit each measuring over 8 feet tall. The experience of hand drawing
and hand-coloring these drawings prompted rebellion among the students. About this, McHarg
wrote:

I determined to continue the Delaware River Basin Study by examining each of the physiographic
regions. This involved a monumental amount of mapping and induced a mutiny among the
students in the department. The students were correct, the prodigious task of coloring massive
maps was substituting physical labor for learning.\(^{100}\)

What emerged in McHarg’s adaptation of environmental design methods, then, was a
recalibration of the act of drawing within the process of representing landscape. Rather than
involving invention through the skilled work of the hands, drawing began to take a more basic
role. It was increasingly a matter of iterative, cumulative production, repetition with variation –
in short, it became more akin to manual labor.\(^{101}\) McHarg recognized this, and presumably

\(^{100}\) McHarg, *A Quest for Life*, 332.

\(^{101}\) As Mary N. Woods has detailed, tracing *can* be understood as a craft, and especially as a method for training the
architect’s hand – early 19\(^{th}\) century architectural drafting was often practiced this way – though it was to be
replaced by blueprints in the later half of the 19\(^{th}\) century. Mary N. Woods, *From Craft to Profession: The Practice
tracing was more complex than 19\(^{th}\) century architectural tracing – but it was still a largely mechanical process, one
that was easily supplanted by digital methods once computerized visualization became more efficient and
economical. Here we see tracing, incidentally, twice replaced by emerging technologies.
sought to balance later studios in response – though as we will see, this trend was to continue in later environmental design practices nonetheless.

This shift in the significance of drawing was accompanied by an increase in the significance of observation: increasingly, design decisions were made not during the drawing process, with pencil in hand, but rather when viewing drawings after they were made. McHarg himself reinforced this shift in his writings, as can be perceived in his assertion that the integration of ecology in design enabled “the perception of form, an insight to the given form, [and] implication for the made form.” Perception is clearly primary in this description, while making is put into an oddly ambiguous role – it is unclear here whether “made form” is something that the designer should actually produce, or merely imply.

Concurrent to placing new limits on the agency of drawing, McHarg’s approach to environmental design also assigned a different role to ambiguity than had been engaged in the Alexander and Manheim method. Ambiguity was not entirely jettisoned: the very use of the term “potential” in the title of our subject drawing shows an instance of transparency in this regard. And yet McHarg’s studios jettisoned the gradients, nebulous edges, and loose shifts of tone seen in the Alexander and Manheim work, replacing them instead with clearly outlined shapes. The drawing itself – with its generalized categories, lack of overlap, and its implication that animals would say within marked zones – elided ambiguity for the sake of visual clarity and apparent certainty. Within the drawing, ambiguity became quite literally invisible: it operated in the unseen interpretive actions and attitudes of the makers, but left no trace.

This elision of ambiguity is further apparent in the presentation sheet “Wildlife,” (Fig. 4.13), a companion sheet to “Potential Wildlife Distribution.” “Wildlife” details dynamics relevant to “Potential Wildlife Distribution,” presenting ecological models of various relationships that occur among animal species in the wild, including sex and age distributions of wild deer,

Figure 4.13. “Wildlife,” ink on vellum, Studio Drawings, Delaware River Basin Study II, Instructor Ian L. McHarg, University of Pennsylvania (1967), Ian L. McHarg Collection, Architectural Archives of the University of Pennsylvania.

population growth curves, food chains, and interspecies competition and interspersion. These ecological models were traced from source diagrams in scientific texts (Figure 4.14). Despite their apparent relationship, there is an odd gap between these two wildlife-related drawings. The content of the “Wildlife” sheet’s diagrams concerns relationships among different wildlife species – but none of these species are actually listed in the “Potential Wildlife Distribution” drawing. In fact, “Potential Wildlife Distribution” contains no mention whatsoever of specific species – it only refers to habitat types that could be recognized in the aerial image.

Why, then, were these diagrams included? The most likely answer is that the ecological models brought a greater sense of legitimacy to the “Potential Wildlife Distribution” drawing: they implied an understanding of scientific principles and a certainty regarding wildlife dynamics.\(^{103}\)

In McHarg’s uses of ecological diagrams, we thus find a tension between landscape as enacted and landscape as performed. The drawing process for the “Wildlife” page involved selecting diagrams relevant to wildlife from source textbooks, and tracing them onto a new page. Drawing here involved no interpretation, and no revelation – only reproduction. It would seem that the drawings were useful, not as part of a design process, but as a presentation of scientific, objective authority meant to lend legitimacy to the analysis process overall. What’s more, ecology was used here as a marker of authority \textit{without} integrating the principles displayed into the analysis process itself. In these drawings, the designers used imagery to project scientific legitimacy without engaging scientific practices or methods themselves.

\textit{Michigan Natural Environmental Survey: Survey Summary}
\textit{Johnson, Johnson & Roy and Steinitz Rogers (1973)}

By the 1970’s, approaches to environmental design had progressed even further towards mechanization and away from hand-making. The work of Carl Steinitz offers significant evidence of this transition. While completing doctoral research in planning at MIT under Kevin

\(^{103}\) Similar pairings of diagrams, analyses, and proposals are found the work of McHarg’s students during this period, in both studio projects and projects for his “Man and the Environment” course. Various folders, Ian L. McHarg Collection, Architectural Archives of the University of Pennsylvania.
Lynch, Steinitz also contributed to computer-based mapping research at the GSD, contributing to the development of SYMAP, a precursor to GIS.\footnote{Nicholas R. Chrisman, \textit{Charting the Unknown: How Computer Mapping at Harvard Became GIS} (Redlands, Calif: ESRI Press, 2006).} After completing his doctoral work, Steinitz became a professor in landscape architecture at the GSD. Often working with a shifting constellation of researchers and students, Steinitz continued to be a central advocate for new environmental design methods, particularly regarding innovations in computerization. Beginning in the 1960’s, Steinitz’s writings and projects offered a consistent approach and clear polemic regarding the evolving use of computer rendering in environmental design.\footnote{The Steinitz articles cited in this paper, for example, are often cited in discussions on environmental design. Steinitz, “Landscape Resource Analysis: the State of the Art,” and Steinitz, Parker, and Jordan, "Hand-drawn Overlays."} Particularly given his outspoken advocacy for uses of computer rendering in environmental design work, Steinitz’s work is useful to considering 1970’s developments in environmental design drawing practices.

The previously mentioned 1976 article by Carl Steinitz, Paul Parker, and Lawrie Jordan provides a detailed description of how environmental design drawing was changing in the 1970’s. In this text, Steinitz, Parker, and Jordan recounted the history of hand-drawn overlay processes, and noted that computerization was likely in the future. They then described the “hand-drawn data file method,” a hand-drawn overlay process that they believed would provide an efficiency of data production akin to that that would eventually be provided by the computer.\footnote{Steinitz, Parker, and Jordan, “Hand Drawn Overlays,” 449-454.}

The article described the initial test case for the “hand-drawn data file method:” a set of drawings produced in 1973 by Steinitz and Rogers in collaboration with Johnson, Johnson & Roy, a landscape architecture firm based in Ann Arbor, MI.\footnote{Johnson, Johnson & Roy (JJR) was also associated with the GSD – William Johnson received his MLA there. The work referenced here was not characteristic of the work of JJR during this period. Paradoxically, they were best known at this time for spatial design work and an emphasis on exquisite hand-drawn renderings. See Omar Faruque interview, July 3, 2012. We might reasonably assume, then, that the use of overlay processes in this project was led by Steinitz and Rogers.} The project was an environmental survey of the state of Michigan, with a smaller-scale test-study conducted on a portion of land in the
state’s upper peninsula. Its intent was to identify areas of crucial natural value, so that they could be protected in anticipation of future development.\textsuperscript{108} According to the report that contained these drawings, “the system calls for various combinations of data which help to reveal (in a combined map display) the environmental impact implications of each significant construction and use practice required in urban development.”\textsuperscript{109}

These drawings were all created by tracing information from existing data collected from a variety of sources, including the Department of Natural Resources, Great Lakes Basin Library, USDA Soil Conservation Service, State Climatologies, Public Service Commission, and Department of Education. Large-scale series of plan-based diagrams compared development pressures against environmentally sensitive areas. No field visits were made in order to verify data. Their comparison enabled recommendations to be made regarding the best sites for environmental protection and, alternately, for urban development.\textsuperscript{110}

Though Steinitz, Parker, and Jordan proposed that the images from this project represent new innovations in rendering, they did not print them in the article. Indeed, as it turns out, there is little new about the appearance of the drawings themselves. A slide of a project image shows 3-layer overlay images, using basic tonal variation in shades of blue (Figure 4.15). Visually, this method reveals nothing new – its appearance almost exactly matches a much earlier McHarg 1965 highway location study (Figure 4.16).

This similarity is in fact telling – for it is actually what we don’t see in the drawing that is most significant here. The innovations that Steinitz, Parker and Jordan described did not result in visual differences – the “hand-drawn data file method,” rather, was completely focused on

\textsuperscript{109} Ibid.
**Figure 4.15.** JJR Inc. overlay slide, three parameters: “Slopes Bedrock Erodable Soils,” “Wetlands Instable Soils,” “First Order Streams Wildlife Values,” Michigan Natural Environmental Survey, 1973, JJR Inc. Photographic Slides Collection, Bentley Historical Library, University of Michigan.

**Figure 4.16.** Wallace McHarg Roberts & Todd, overlay slide, Highway Route Selection - Route I-95 Between the Delaware and Raritan Rivers, New Jersey, 1965, Ian L. McHarg Collection, Architectural Archives of the University of Pennsylvania.
improving efficiency of production. Rather than making whole drawings for each parameter (each “requirement,” in Alexander and Manheim’s language), the method involved drawing basic units of data on pieces of paper, then Xeroxing the drawings onto transparencies. The transparent “data files” would then be catalogued like computer files. When needed, they would be taken out and stacked with other individual “data files” in order to create an analysis drawing. By breaking the units of each analysis drawing down into even smaller units, the “hand-drawn data file method” created a system which, after initial production, could be used entirely apart from the labor of drawing.

The great advantage of these drawings was that they never needed to be redrawn. The typical environmental design overlay method, as described in this article, was the following:

We usually make a data map as follows: first, we get the data source (usually another map), then we define and make outlines of homogeneous zones and select a color code. Then, we “color it in” just as children do. Finally, on the light table, we pray that we can make sense of it in combination with a limited number of other data maps.\(^{111}\)

“We ‘color it in’ just as children do:” it is telling that the authors likened the act of drawing to the work of a child. The intent of his new drawing method was to eliminate the labor of hand drawing as much as possible, to “flexibly and appropriately use the available data to perform a large number of analyses without the expense of redrawing 200 potential evaluations.”\(^{112}\) The revelatory capacity and skilled craft of drawing were therefore not only devalued, but problematic – a costly form of child’s play.

Here we see a further elaboration of shifts that were partly underway in McHarg’s Delaware River Basin II studio. In this newer approach, the process of drawing had been fully stripped of any revelatory potential – it was understood exclusively in terms of the labor of production. Furthermore, this labor was seen as time-consuming and prohibitively expensive. Correspondingly, the “hand-drawn data file method” further emphasized observation as the

\(^{111}\) Steinitz, Parker, and Jordan, “Hand Drawn Overlays,” 449.
\(^{112}\) Ibid.
primary design act – as the sole locus of revelation within design. As presented by Steinitz, Parker, and Jordan, lingering over a drawing was not an opportunity for realization, but rather a liability. In this iteration of environmental design, the becoming landscape was something rotely produced, economically driven, and decoded through observation. Seeing – analytical, comparative, “objective” seeing – had replaced hand-making as the action through which landscapes were to be understood and realized.

Transitions from Hand to Eye

The shifts in overlay drawing that occurred from the 1960’s through the 1970’s had complex effects. Designer and landscape embraced new levels of complexity – but the potential to engage that complexity through the actions of hand drawing was diminished. This occurred in several ways.

First, by embracing the plan-view diagram as a medium of inquiry, early environmental designers extended a visual language already developed and available through existing governmental and scientific power apparatuses via soils maps, geological surveys, aerial photography, topographic maps, and increasingly, computers. This consistent visual language enabled a centralization of data previously unavailable in the field – and also brought with it tendencies towards comparison, cross-reference, visual clarity, and projected objectivity.

Second, the range of techniques engaged through drawing was iteratively narrowed over time. Alexander and Manheim’s broad strikes, textural variation, loose forms, and varied lineweights – all were progressively constrained in favor of defined lines and precisely edged forms. By the 1970’s, hand-drawing had been constrained to such a degree that it was no longer associated with revelation at all – rather, it was seen as inefficient and costly, an impediment to analyses that relied on vast amounts of data. Through these changes, drawing’s interpretive capacity was reduced, and its mechanized, iterative aspects amplified. This shifted the role of drawing away from revelation and towards manual labor.
Finally, drawing’s capacity to enact ambiguity and uncertainty was decreased, in favor of scientistic – and increasingly technological – projections of objective certainty. Such projections borrowed imagery from scientific texts in order to support analyses that were not necessarily scientific in content or methodology. By the 1970’s, new technologies were similarly invoked as sources of authority, with hand-drawn methods evoking computer-based file management in order to advertise new levels of expediency in the design process. The overlay drawing practices developed through the first decades of environmental design thus increasingly involved limiting the capacity of hand-making to engage revelation, in favor of constraining and fixing landscape conditions and processes. This resulted in a reduced potential for the becoming landscape of design to evolve in ways that were unpredictable, open, or evolving.
CHAPTER 5
CONCLUSION

We have traced shifts in the roles of drawing and designer that occurred through the 1960’s-70’s evolution of environmental design. These shifts involved an iterative reduction in the significance of ambiguity as part of the design process, as well as a privileging of observation over drawing. As a result, the landscape architect’s role changed from creator to laborer and observer. Accordingly, the becoming landscape of the design process began to be enacted, not through explorations of nebulous potentiality, but rather through methods that projected a highly complex, yet precise and defendable, measurability.

Understanding environmental design in these terms provides an counterbalancing narrative to the one that tends to circulate among landscape architecture scholars and practitioners. One aspect of this new narrative highlights the many individuals involved in crafting environmental design methods, thereby resisting a common tendency for landscape architects to canonize Ian L. McHarg as a lone innovator. Another counters a tendency among environmental design innovators to frame their work as an overturning of modernist methods. Comparing these shifts to prior approaches to practice at the GSD and MIT, we can see that environmental design innovators did not forge as clean a break from earlier design methods as they may have claimed. On the contrary, environmental design methods often built upon earlier modernist and cybernetic ambiguities regarding the authority of objectivity, the role of mechanization, and the inchoate nature of creative intuition within design. They also amplified modernist and cybernetic notions of objective vision and cultivations of a scientific self. Environmental design methods expanded on rifts – between making and seeing, and between ideology and practice – that were already embedded in modernist and cybernetic approaches to design.

Yet another aspect of this new narrative problematizes depictions of environmental design as an embrace of scientific method. Upon closer investigation, we see that landscape architects
embraced the scientization of environmental design in order to project an objectivity that was paradoxically inaccurate to the ways in which scientific ecology was practiced. At the same time, this ideological embrace of ecology masked an entirely different shift brought about in the development of environmental design – a shift in the practices of drawing. Environmental design representation methods increasingly entailed a suppression of the revelatory capacity of making, such that by the mid 1970’s, drawing was treated as a labor rather than a generative act.

It is in light of this shift in drawing practices that the 1962 Alexander and Manheim experiment suggests something of an alternate path for environmental design. In contrast to the developments that were to follow, this early project points to a latent potential within the overlay method – in which a becoming landscape might be designed with eyes, hands, materials, and data, all together in simultaneous engagement. The Alexander and Manheim project reminds us that environmental design was, after all, born of a desire to be more responsive to living landscapes. In contrast to modernist notions of individual creativity, environmental design methods enabled the complicated, relational aspects of living landscapes to enter the design process in ways that they had not before. The result was a significant increase in the degree to which the landscape site was invited into the process of becoming that took place in the design studio.

And yet, as this approach was developed – expanded on, defined, systematized, and eventually computerized – it increasingly lost connection with the revelatory capacity that had previously been accessible through actions of drawing by hand within the design process. In this way, environmental design’s incorporation of complexity brought with it a process of simplification as well. Over time, the technocratic aspects of the approach had the effect of reducing the collaborative, creative capacities of landscape and designer alike.

Throughout this historical progression, the landscape architects working to develop environmental design methods grappled with a tension between projecting certainty and
embracing complexity. This tension was problematic – but it was also directly linked to the growth of an environmental ethic and the cultivation of autonomy for the profession. By revealing the tensions underlying such efforts, I have sought to rediscover the generative capacity that lay in some of the early data based methods. In detailing the shifts in practice that occurred over time, I have attempted to reveal some under-investigated, yet significant, aspects of environmental design history. I have also tried to explain how innovative improvements in landscape architectural design process involved losses and compromises – many of which continue to be elided today, in favor of beloved origin stories and triumphant narratives.

**Future Study**

This thesis is an initial foray into understanding 1960’s-70’s developments in the discipline of landscape architecture. Accordingly, much remains to be investigated. The bodily dimensions of design practice have only begun to be explored here. And yet the specificity of practice-oriented research demands a counterbalancing expansiveness as well. As important as the minutiae of drawing are to understanding the workings of landscape architecture, it is equally important to contextualize the work of the profession, complementing a hermetic understanding of the discipline’s workings with a full consideration of landscape architects’ roles within the social dynamics that produce landscapes and urban spaces.

Those larger social dynamics have not been explored in this paper: accordingly, the task of contextualization remains to be tackled in future research and writing. In dissertation work and beyond, I will seek to bring together a deeper understanding of landscape architectural drawing practices with a broader contextualization of landscape architectural practice within the politics and processes of city making.

In particular, I will continue exploring 1960’s-70’s trends through which American landscape architects began perceiving, drawing, and designing systematic landscapes. During this period, an embrace of ecology intersected with the building of urban highway systems and a rise in
computer technology to transform the ways landscape architects understood and represented landscape sites. These changes not only brought transitions in how the profession was practiced, as has been discussed here. They also repositioned the roles of landscape architects within the public negotiations of rebuilding of urban environments.

In summary, this thesis serves as a foray into several areas of research which I will continue to develop going forward: the bodily dimensions of landscape architectural drawing practices; ways in which innovations in science and technology have influenced the development of the field of landscape architecture; and the roles of landscape architects within urban environmental history in the United States, from the postwar through the 1970’s.

**Implications, Ramifications for Design**

In closing, there is a lingering question that still must be addressed. What, after all, is the significance of the hand in the design process? Why does it matter whether or not hands play significant roles in defining the becoming landscape?

Quite simply, power asymmetries underlie both the discounting of tactility and the prioritization of objective vision. Cartesian associations of vision with pure reason have been robustly problematized over the last couple decades, in part due to recognition that such notions of objective vision erode more inclusive conceptions of the body as an integrated, experiential whole. In light of such work, the fact that highly Cartesian approaches to design were advocated as recently as the 1970’s highlights that only a short while ago, landscape architects actively engaged schema resistant to difference and corporeality. There are clear issues regarding

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gender and race here – issues that have not been elaborated in this paper, but that certainly stand to be investigated.

There is a more current issue here as well. This dynamic regarding difference and embodiment would not be quite so concerning if not for a current resurgence of environmental design methods among landscape architects. We are presently in a moment when many of the environmental design methods initiated in the 1960’s-70’s are being actively revisited and extended. Given contemporary landscape urbanist interests in complex data-based systems analysis, it is now particularly important that designers understand: embedded in the drawing practices they engage are historic ways of operating in the world – ways imbued with asymmetries of power. These historic remnants – ways of relating that have been grandfathered into the present through practices defined in the past – they influence the agencies and capacities of designers and landscapes. If designers fail to recognize and reflect upon such relationships, they run the risk of perpetuating myriad inequities, without even realizing that they are doing so.

Developments that occurred in the landscape architectural profession in the 1960’s-70’s are still very much with us today. Therefore, in order for landscape architects to better understand the full ramifications of their design practices, it is essential that we unearth those relational dynamics, presumed agencies, and asymmetries embedded in the ways that we work. Indeed, the becoming landscape enacted in the studio is a proxy for the landscape to be constructed on site – the landscape we represent becomes the landscape we build. In this sense, a significant part of our built environment is highly determined by drawing in the studio – what we draw, and how we draw it. Drawing matters – literally becomes matter – in the world we inhabit.

In that light, I offer this history of landscape architectural practice as a provocation and resource: towards reclaiming an experiential, multi-agentic, revelatory role for drawing within complex, data-driven approaches to design.


Omar Faruque (Professor of Landscape Architecture, California Polytechnic State University San Luis Obispo), interview by Margot Lystra, July 3, 2012.


Roger Osbaldeston (Emeritus Professor of Landscape Architecture, California Polytechnic State University San Luis Obispo), interview by Margot Lystra, June 13, 2012.


Dale Sutliff (Emeritus Professor of Landscape Architecture, California Polytechnic State University San Luis Obispo), email, July 31, 2012.


