THE UNIVERSITY OF QUEENSLAND

AUSTRALIA

Novelty in the Entropic Landscape:
Landscape architecture, gardening and change

Julian Richard Raxworthy

Bachelor of Landscape Architecture (Hons) *RMIT*

Master of Landscape Architecture (Research) *RMIT*

A thesis submitted for the degree of Doctor of Philosophy at

The University of Queensland in 2013

School of Architecture

Abstract

Processes of change in the landscape produce material outcomes, both organic and inorganic, that exhibit the quality of novelty, or specific newness. The idea of change is implicit for landscape architecture, because of its relationship to plants that grow. While recent interest in process in landscape architecture and architecture celebrates change (a body of thought the author labels "The Process Discourse"), such change however is often simulated rather than real. Correspondingly, this dissertation asks, "How can landscape architecture be practiced to allow it to manipulate its materials' inherent capacity for change?"

Three built case studies that were designed and managed over time (The Bordeaux Botanic Garden, France by Catherine Mosbach, Sven-Ingvar Andersson's Garden at Marnas, Sweden and Louis Le Roy's Ecocathedral in the Netherlands) were visited over a 10-year period. Using on-site observations (and participant observation in the case of the Ecocathedral) the case studies are analyzed to determine the mechanisms used to encourage and direct novelty that emerges over time. These projects question, and in turn suggest, practices suited to working with change in the garden and the designed landscape.

Gardening can be considered a 'real-time' cultural means of engaging and manipulating growth in a dynamic, improvisatory relationship with natural processes. This dissertation argues that rather than looking to architectural models of representation, landscape architecture should look to (and reconcile with) gardening for models to produce novel design outcomes that gain qualities rather than lose them over time.

Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my research higher degree candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

I acknowledge that an electronic copy of my thesis must be lodged with the University Library and, subject to the General Award Rules of The University of Queensland, immediately made available for research and study in accordance with the *Copyright Act 1968*.

I acknowledge that copyright of all material contained in my thesis resides with the copyright holder(s) of that material. Where appropriate I have obtained copyright permission from the copyright holder to reproduce material in this thesis.

Publications during candidature

Book Chapter:

Raxworthy, Julian. 2008. “Transgressing Edges and Doing Time: Evolving New Urban Contexts “ In *Landscape: Product/Production: IV European Landscape Biennial*, edited by Jordi Ludevid, 282-293. Barcelona: COAC.

Peer-Reviewed Journal Paper:

Raxworthy, Julian. 2011. “Gardening forms: landscape architecture and gardening in Sven-Ingvar Andersson’s garden at Marnas.” *Journal of Landscape Architecture* (12):6-19.

Peer-Reviewed Conference Paper:

Raxworthy, Julian. 2003. “Landscape Symphonies”: Gardening as a source of landscape architectural practice, engaged with change. Paper read at *PROGRESS: The 20th annual conference of SAHANZ,* 2-5 October 2003, at University of Sydney.

Raxworthy, Julian. 2004. “Writing gardens - gardening drawings: Fung, Brunier and gardening as a model of landscape architectural practice.” *Landscape Review Special Issue: CELA 2004 - Here and there?* no. 9 (1):196-200.

Raxworthy, Julian. 2004. Transactions with chance in the garden. Paper read at *LIMITS: The 21st annual conference of SAHANZ*, 26-29 September 2004, at RMIT University.

Professional Journal Articles:

Raxworthy, Julian. 2004. “Landspace landscapism.” *Architectural Review Australia* (088):24-26.

Raxworthy, Julian. 2006. “Static:Dynamic.” *Architectural Review Australia* (95):102-107.

Publications included in this thesis

Chapter 2 has been developed from Raxworthy, Julian. 2004. “Landspace landscapism.” *Architectural Review Australia* (088):24-26.

Chapter 3 and chapter 5 includes extracts from Raxworthy, Julian. 2008. “Transgressing Edges and Doing Time: Evolving New Urban Contexts “ In *Landscape: Product/Production: IV European Landscape Biennial*, edited by Jordi Ludevid, 282-293. Barcelona: COAC.

Chapter 4 was developed from Raxworthy, Julian. 2011. “Gardening forms: landscape architecture and gardening in Sven-Ingvar Andersson’s garden at Marnas.” *Journal of Landscape Architecture* (12):6-19., of which some extracts remain in the chapter.

Contributions by others to the thesis

No contributions by others.

Statement of parts of the thesis submitted to qualify for the award of another degree

None

Acknowledgements

Over the course of my research, I was supported by a range of institutions and individuals whom I would like to thank: Professor John Macarthur and the University of Queensland for my APA scholarship; Patrick Beale and the University of Western Australia for making me a Research Fellow; Professors John Frazer, Gini Lee, Paul Sanders, and the School of Architecture and Design at the Queensland University of Technology. Thank you to Lachlan Thorn for drawing assistance.

Over an odd and extended candidature, my supervisor Professor John Macarthur held the faith and introduced me to a completely alien realm of scholarly writing, very different to the design thinking I was educated in at RMIT, for which I am thankful. In the last three years, Naomi Stead joined John as my associate supervisor and consistently worked hard on getting me over the line while still keeping an eye on details and staying continually positive about my research even when I was not. Thank you both.

As three case studies form the bulk of this research, there are particular people who allowed me access to sites as well as their time. I would like to thank Beate Andersson for allowing me access to her father's garden at Marnas; Catherine Mosbach for meeting me to discuss her work and then for inviting me to speak at the 4th European Biennale of Landscape Architecture in Barcelona about my research, an invitation opened up five years of international engagement; Louis Le Roy (RIP) and Peter Wouda for being the "one-stop shop" for all things Le Roy, and the Stichting Tijd in Heerenveen for access to the Ecocathedral, and support during my fieldwork there. While it did not end up in my thesis, Valentine Hansen at the Chateau Courances (perhaps the most beautiful garden in the world) gave me access on numerous occasions and answered questions as required—I will publish my writing about Courances elsewhere, I promise!

In an oblique way, the following people introduced me to key ideas that now appear in this thesis, for which I am thankful: Cassandra Chilton and Michael Howards final projects at RMIT concerning weedscapes and landscape maintenance respectively; Brian Davis and Michael Geffel for introducing me to Graham Harman; Kaan Ozgun for introducing me to "Second Law thinking"; and the "green and brown" crew of my final project students at RMIT (Heath Gifford, Jo Henry, Sally Prideaux, George Wright), whose work dealt meaningfully with natural process. Thanks to Karen Burns for her encouragement to continue my critique of the process discourse/landscape urbanism.

Thanks to colleagues and friends for important conversations along the way: Kirsten Bauer, Bernadette Blanchon, Chris Brisbin, Martin Rein-Cano, Sacha Coles, Cate Consandine, Torben Dam, James Davidson, Jamie Dean, Lisa Diedrich, Libby Gallagher, Fiona Harrisson, Rosie Jones, Thierry Kandjee, Martin Kirkwood, Gini Lee, Marian Macken, Rene van Meeuwin, Marc Ramelhaut, Sue-Anne Ware & Ian Weir.

I would like to acknowledge a range of teachers, thinkers and designers in landscape architecture and architecture whom I had the fortunate opportunity to know and who were very influential in my thinking about the landscape, in different ways: Alfred Bernhardt, Graham Fletcher, Malene Hauxner (RIP), Timothy Hill, Louis Le Roy (RIP), John Macarthur, Elizabeth K. Meyer, Chris Razzell, and Richard Weller. I continue to regard Peter Connolly as the greatest thinker in landscape architecture and his role in developing my thinking about landscape is inestimable.

A PhD is a hugely stressful thing and so I would like to thank those closest to me for their support during my candidature: Magriet Deetlefs, James Davidson, Einar Docker, Mungo McCall, Lorraine & Rosie Jones, & Angela Drane. My parents Dorothy and Richard Raxworthy were both alive when this research began and I would have liked it if they could have seen the end of it. Their life long commitment to learning and research was an inspiration to me

Keywords

landscape architecture, design, gardening, change, novelty, plants, maintenance, practice.

Australian and New Zealand Standard Research Classifications (ANZSRC)

ANZSRC code: 120107 Landscape Architecture, 50%
ANZSRC code: 120103, Architectural History and Theory, 25%
ANZSRC code: 120502, History and Theory of the Built Environment (excl. Architecture), 25%

Fields of Research (FoR) Classification

FoR code: 1201 Architecture, 75%
FoR code: 1205 Urban and Regional Planning, 25%

Table of Contents

Table of Figures

Preface

I came to gardening completely by accident.

Having dropped out—of school, of family, and of home—I was offered a lifeline when a family friend offered me some work in her garden. While I was sweeping her yard, she heard a radio advertisement about gardening courses at TAFE and asked me if she could enroll me over the phone with her "new bank card"? I felt like I was living in a void and gardening was no less uninteresting than anything else, so I went along with her plan. Almost thirty years later, after one thing has led to another, I realise that I was saved by the redemptive quality of nature in the garden. Over the years I watched gardening help reconstruct many people from the ground up, as it were; with the time of a garden's processes somewhat of a metronome for our lives. I feel comfort in the knowledge that I am part of this endless thermodynamic transfer: ashes to ashes, dust to dust.

My first contact with a landscape architect was two years after that fateful day, when I had a job interview for the position of landscaper with an inner-city Sydney Council. While she asked me a pragmatic question, I recognised that it was actually conceptual: "If you could only have one tool, what would it be?" My answer, which remains the same today: "A mattock". With two tools on its head—a hoe/adze on one side and an axe/pick on the other—it allows the greatest versatility of operations and a huge return of effect from power. Her question was a conceptual one because it is about agency and propensity: what will you do with it and how will you do it? Again thermodynamic, the mattock is a tool of destruction, construction and cultivation. In nature, disturbance is the start of growth.

Exhibiting classic blue-collar/white-collar disdain we landscapers saw landscape architects as the enemy: they knew nothing and nothing they did was practical. While I was capable of the work, I had a thirst for ideas that frustrated me in the hierarchy of apprenticeship, and I was clearly out of place. On rainy days I was reading *Foucault's Pendulum* while the other tradies were reading *Penthouse*. In the only design subject at the end of my TAFE studies, the brief was for a sculpture garden. I proposed demolishing an ugly existing building and spreading out the rubble as a post-apocalyptic space to exhibit sculpture. The landscape architect critic at the presentation liked the idea for the project and suggested that I study landscape architecture. Two years later, at 23, looking for an escape route from developing back injury, I applied for two courses that did not require an HSC (high-school completion). These offered two different paths reflecting my interests: environmental engineering and landscape architecture. Determined for a change, I resigned and went tramping in New Zealand for three months. Calling my mother from a phone box outside the Dux Deluxe in beautiful, pre-earthquake Christchurch, I asked her to open the envelopes from the universities: I had been accepted into both but chose to move to Melbourne and study landscape architecture. Going to RMIT University allowed me to leave behind my history and reinvent myself, to move from the beautiful but dominating landscape of Sydney to a culture of ideas in Melbourne. It was the second-best decision I ever made, after deciding to take up the offer to study at TAFE.

As a landscaper, I made things, but as a landscape architect all I made was documents. Moving from the outside to the inside was a move from direct engagement to representation. In some sense, I have been frustrated by representations ever since, as much as I have enjoyed making them. I have been frustrated that ideas seem to be enmeshed in impotent, if beautiful, media, while the pragmatism of the world seems to, on the one hand, DO things, but, on the other, resist ideas. This dissertation is an attempt to use real projects as case studies to reconcile these histories and practices, and propose that neither indoor/outdoor, nor design/gardening are poles but can inflect each other in a productive, matter-as-idea way, as Alfred North Whitehead and Gregory Bateson would say.

Chapter 1: Introduction

1.1 Architecture, Landscape Architecture, and Gardening

Over the last twenty years, the disciplines of landscape architecture and architecture have increasingly spilled over into each other, with landscape architecture adopting architectural ideas and architecture developing an interest in landscape. This new disciplinary proximity is most evident in a fascination with change and time,[1] expressed in terms such as "dynamism", "mobility", "process" and "flexibility" that have featured prominently in publishing in both areas since the mid-1990s. This body of thinking and practice I identify as the "Process Discourse". I have coined this term to describe design projects and theory that focus on processes, notably as a source of form. For landscape architecture, an example would be University of Pennsylvania's landscape architecture professor James Corner's edited book *Recovering Landscape* (1999), which includes essays by such architects as Alex Wall, who uses architectural notions of "program" to discuss landscape.[2] Similarly, in architecture, theorist Sanford Kwinter discusses architecture in relation to notions of "dynamism", a condition he describes as a landscape.[3]

The rise of the process discourse has seen the adoption of ecological models of process, and their generalisation into algorithms, which are now incorporated into architectural-design generation process in order to give designs some of the qualities of dynamism that natural systems possess.[4] Architectural genres such as parametricism and datascape work to model dynamic landscape forces in the design-generation process, but do not change when made as actual structures in reality.[5] I argue in this dissertation that by *simulating* change, projects underpinned/informed by the process discourse do not exhibit the key philosophical property of change, which is the spontaneous emergence of novelties.[6] This property is recognised in the language used by the process discourse by terms such as "emergence", but is effectively ignored in the simulatory models of architectural form.

1 As James Gleick argues in *Faster*, this interest in change and dynamism may be the reflection of a broader cultural condition of acceleration, which springs from changes in personal mobility due to new transport and communication modes, notably the Internet. James Gleick, *Faster* (New York: Vintage Books, 2000).

2 Alex Wall, "Programming the Urban Surface," in *Recovering Landscape: Essays in Contemporary Landscape Architecture*, ed. James Corner (New York: Princeton Architectural Press, 1999).

3 Sanford Kwinter, "Landscapes of Change: Boccioni's Strati D'animo as a General Theory of Models," *Assemblage*, no. 19 (1992). This essay was later included in a volume that gathered together all of his writing on this subject, *Architectures of Time* (Cambridge, Massachusetts: The MIT Press, 2002).

4 The development of cybernetics, which is literally the design of self-regulating systems, was modelled after natural systems by those such as Gregory Bateson, who is discussed later in this introduction.

5 In Chapter 2 I argue that the adoption of computer technology introduced a quasi-scientific methodology that lent generated outcomes the legitimacy of transparent scientific fact.

6 Novelty literally means "new", deriving from the French 'nouveau'.

While in architecture, an interest in dynamism requires a fundamental reconsideration of the nature of architectural form—which has traditionally aimed at constancy, permanence, and solidity[7]— I argue in this dissertation that, for landscape architecture, change is an inherent part of the discipline. Indeed, landscape architects regularly operate in environments that manifest significant change. Michael Laurie describes "time" as the fourth dimension of landscape architecture,[8] and, in conceptualising change as a fundamental component, he quotes Brian Hackett, who suggests that what is specific to landscape architecture "is the medium in which we work, the landscape, subject to change and growth, which has existed for millions of years and will doubtless continue to exist".[9] Landscape architects also work with materials that change over time, notably plants, which are the most tangible changing material in the landscape. The fundamental role of plants in landscape architecture was inherited from landscape gardening, from which it developed in the nineteenth century.[10] In his *Introduction to Landscape Architecture*, Laurie notes that landscape architecture has "a difficult title, for the words seem to contradict one another: landscape and architecture, the one dynamic and ever changing, the other static and finite".[11] Correspondingly, it is curious that landscape architecture now looks to architecture for direction on how to engage with change when the means for doing so has a long history in the discipline. By contrast, few contemporary landscape architecture writers or designers are examining gardening in the context of such an interest in change and dynamism.[12]

The difference between landscape architecture, architecture, and gardening lies in how they are practiced, which in turn has implications for how they are able to encourage novelty. Landscape architecture, like architecture, has become an office-based practice that uses drawings to guide later implementation, its role ending soon after construction. Comparatively, gardening is non-representational, and continues to operate in gardens over a long period of time. Gardening is able to work with change and to encourage novelty in real time in a way that landscape architecture and architecture cannot.

In this dissertation I consider how novelty can be encouraged in landscape-architecture projects, examining how the ongoing involvement or provision for change was included in the development of a series of built case-study projects, and how the designers practiced in relation to such change. I argue that by re-uniting landscape architecture with gardening, the discipline may engage with

---

7 Such architecture is now described as 'static', a term that is used derogatively. In this context, 'stasis' means formally unchanging throughout the duration of a project; indeed, historically, this quality of static-ness—a resistance to the pressures and flexibilities of an environment—has been the raison d'etre of the discipline.

8 Brian Hackett quoted by Michael Laurie, *An Introduction to Landscape Architecture*, 2nd ed. (New York: Elsevier, 1986), 9.

9 Ibid., 10.

10 An example of the relationship between landscape architecture and landscape gardening can be demonstrated through Frederick Law Olmsted's use of the English landscape gardens he had visited as a source for his and Calvert Vaux's work at Central Park. At the time, they described their practice as "landscape architecture".

11 Laurie, *An Introduction to Landscape Architecture*, 7.

12 The dominant example of a landscape architect who considers gardening in relationship to change is Gilles Clément, who will be discussed in Chapter 4. Teresa Gali-Izard's excellent *The Same Landscapes* is the premier book of strategies that operate like those I discuss in the dissertation Teresa Galí-Izard, *The Same Landscapes: Ideas and Interpretations*, Land&Scapeseries (Barcelona: Editorial Gustavo Gili, 2006).

change and encourage novelty in a better manner. Thus, the overriding research question of this thesis is: *How can landscape architecture be practiced to allow it to best manipulate its materials' inherent capacity for change?* To answer this question in relation to the introductory arguments above, each chapter answers a related sub-question, which are set out below.

1.2 Structure of the Thesis

Chapter 2 describes the process discourse and considers whether contemporary landscape architectural and architectural approaches to 'process' in design actually produce change. This dissertation arose partly in response to an interest in change that I share with the process discourse, but also from a difference regarding the nature of such change. I argue that it is through the emergence of novelty—understood as concrete uniqueness—that a process can be regarded as producing change or not. This difference provides the structure for the review of the process discourse, dividing discussion of it into two broad categories. In the first category, I discuss projects that simulate change by using design-generation processes in representation to generate form. In the second, I consider performative approaches in the process discourse, which operate in real time, and use physical, rather than representational, practices. In deciding whether change really arises from the process discourse, I argue that for the projects in the first category, the answer is no, while for the second, it is yes.

Chapter 2 is followed by three case-study chapters, the description and analysis of which provide the original research for the dissertation. The proposition that novelty only emerges in the world provides a key criterion for selecting the case studies: that they should be built projects, and that they should have been modified over time. This provides the best means to examine how landscape designers can create novelty through different types of ongoing involvement with a project. This differentiation to the process discourse effectively describes the difference between two landscape practices: landscape architecture as an office practice that uses representations, and gardening as a trade that works directly with materials. The three case studies specifically examine how novelty has arisen due to the catalysing of natural processes, anticipated or manipulated by design or gardening practices, and the research questions focus on this dimension. I have visited the site of each of the case studies a number of times and undertaken different types of research for each, which I outline in the introductions in each case study chapter.

The first case study, which forms Chapter 3, is the Bordeaux Botanical Garden designed by French paysagist Catherine Mosbach. Built in 2000, this conventionally delivered, office-based design project interprets the ecologies of the Aquitaine region. I focus in particular on an area known as "the Environment Gallery", which comprises mounds designed to erode over time, and the perimeter fence, which is made of timber and designed to decompose. My research into the Bordeaux Botanical Garden relies on my photographic documentation of the area during two visits, five years apart, and an interview with Mosbach, who also supplied project documentation drawings

and construction photographs. The related research question for this chapter is: *How can hard landscape materials be detailed to direct their physical transformation over time?*

The second case study, which forms Chapter 4, is the private garden of the Scandinavian modernist landscape architect Sven-Ingvar Andersson, located in Marnas, Sweden. Andersson worked on the garden from the late 1950s until his death in 2007, and created a rigid planting structure of Hawthorn trees that served to define garden 'rooms'. He used pruning over time to train them into different forms, creating distinct spatial effects. During my two visits to the garden, I took photographic documentation and measured the garden rooms, documenting the spacing of the trees. I used this information to produce amended plans of the garden. This chapter's related research question is: *What does gardening add to the spatial and formal development of a planting design?*

The third and final case study, presented in Chapter 5, is an environmental art project from the Netherlands, the Ecocathedral, built by artist Louis Le Roy. Since 1980, Le Roy rearranged recycled paving material in an empty field, building structures that create topography, microclimates and plants. Primarily a construction process, the practices underpinning the Ecocathedral are analogous to gardening, and the site is now a bio-diverse forest. Over four visits (both in summer and winter), I photo-documented the Ecocathedral, and interviewed Le Roy twice. I also worked as a participant observer physically building at the Ecocathedral according to Le Roy's process, when I also produced drawings of selected structures. For this chapter, the related research question is: *How can an unchanging material be arranged to create ecological effects?*

I use a consistent format for each case study: first, the project is described for orientation, and its designer or maker introduced; second, relevant precedents and literature are introduced so as to contextualise the project and; third, the specific novelties of the project are identified and the processes that produced them are analysed in terms of how they were facilitated or directed by the designer or maker. These are linked to observations made on site that reveal how each process played out in actuality, and how it was manipulated in terms of technique or detail. I end each chapter with a discussion of what the case study can tell us about novelty more generally, which links each case study to Chapter 6, on Novelty.

A broader philosophical reflection on novelty that uses the case studies to illustrate a number of different models of novelty, Chapter 6 asks: *How do the kinds of change that characterise landscape projects reconceive the notion of change?* Building on the critique of the process discourse presented in Chapter 2, this chapter argues that the opposition of form and process on the basis of randomness is disingenuous, and that there are degrees of determinism in all processes.

The conclusion, Chapter 7, proposes two approaches to dealing with change that emerge from the case studies and continue from the abstract discussion of novelty in Chapter 6: tendency and feedback. Tendency is an approach to designing that seeks to aim towards an outcome rather than concretely specify it. Instead tendency promotes flexibility in how an outcome will result, exhibiting novelty in the form of specificity rather than contrast. Feedback describes real-time processes,

such as gardening, that allow for a recurrent involvement in the development of projects over time, maximising emergent opportunities.

I briefly consider the implications of the dissertation for contemporary landscape-architecture practice, and ask what the case studies suggest a reformulated landscape architecture that encourages change over time might look like.

When discussing each case study, I seek to tie material, process, and practice to form so as to demonstrate that processes can be manipulated in a designerly fashion to create novel material and spatial outcomes through involvement over time. In so doing, potential methodological contradictions arise; for example, the combination of objective scientific discussion of processes and the subjective discussions of design, experience, and philosophy. It is worth discussing this uncomfortable mix of discourses before continuing onto the introductory arguments of the dissertation, since it informs the way I move between different types of information throughout.

1.3 Methodology

In this section I will outline the methodology of the dissertation in relation to literature about research methodologies. I will focus on case studies and the rationale for using them as well as on models for how an argument can be built using them. While I will discuss specific methods for each case study in the introduction to that case study, I will argue here for observation generally, supported by other methods for triangulation. Finally I will propose that Yin's model of Theory Building describes the use of case studies in developing my argument across the dissertation.

It is difficult to separate "method"[13] and "methodology"[14] since methodology presupposes the methods that are its context, but Hammond and Wellington suggest that methodologies are the consequence of particular questions.[15] This is the same as saying that the methodology is the rationale for the methods arising from the research question. The overall research question of the dissertation, repeated from above, is "How can landscape architecture be practiced to allow it to best manipulate its materials' inherent capacity for change?". This question comprises two foci - practice and material change – both of which are processes. Both of these foci lend themselves to the use of case studies because the answer to the question will only be obtainable through direct observation of processes that happen in time, rather than through documentation. Additionally, because my research arises from a critique of the process discourse on the basis of its use of simulation to understand change, and the proposition that real change cannot be simulated

13 The OED defines *Method* as "a particular procedure for accomplishing or approaching something, especially a systematic or established one" while Hammond and Wellington define "research methods (as the means) through which data are gathered and analysed within a research study" Michael Hammond and Jerry Wellington, *Research Methods: The Key Concepts* (London: Routledge, 2013), 107.

14 Hammond and Wellington define methodology as "the rationale for particular research methods" ibid., 109.

15 Ibid.

and exists uniquely in the world, direct observation of concrete situations, or cases, is the only appropriate method.[16]

Case studies are an appropriate way to research time based processes, as Hammond and Wellington suggest in their book on research method concepts because"(a) particular case or cases (to) explain the "how" and "why" of a phenomenon".[17] Woodside too proposes that case study research (CSR) "achieve(s) a deep understanding of processes and other concept variables, such as participants' self perceptions of their own thinking processes, intentions and contextual influences" which he identifies as "the principal objective of CSR". [18]

The method used for analyzing case studies to answer the research questions was "observation (which) concerns our direct experience of a phenomenon or event",[19] the key value of which is that it "deals with behavior rather than reported behavior".[20] I used photographic documentation as my main method or recording my observations, where photographs generally sought to demonstrate a change event, or a form arising from a process. To emphasise this change, for the Bordeaux and Ecocathedral examples I took photographs during different seasons and also at different intervals to show how an element had changed since a previous photograph. Alongside the photographs I also kept a visual diary which Hammond and Wellington regard as valuable for a researcher as an "'aide-mémoire' for incidents and development of hypotheses during a research project", and which can be "treated as an additional source of documentary data".[21] They also note the increasing use of blogs for this purpose, which I used in the case of the Ecocathedral on Blogger.

Liamputtong's definition of a case study as "an in-depth exploration of a particular context using largely qualitative methods within interpretive enquiry"[22] emphasizes that the treatment of the case is not necessarily neutral but is inherently speculative, concerned as it is with "exploration" and "interpretation". This speculative dimension results from the context that is brought to the study of the case, which provides an explanation rather than a description, since it does not pretend to be objective. An explanation offers "a reason why something has happened often contrasted to a description, which is of what happened", and can be either positivist or interpretivist, where the former is focused on cause and effect, and the latter on interpretation, which seeks to make activity comprehensible.[23]

16 Pranee Liamputtong questions whether the use of case studies comprises a methodology contrasting the view that it cannot be a methodology because "researchers do not collect information using the case study", instead using methods such as interviews or observations. Pranee Liamputtong, *Qualitative Research Methods*, 3rd ed. (Melbourne: Oxford University Press, 2009), 191.

17 Hammond and Wellington, *Research Methods: The Key Concepts*, 16.

18 Arch G. Woodside, *Case Study Research : Theory, Methods and Practice* (Emerald: Bingley, 2010), 1.

19 Hammond and Wellington, *Research Methods: The Key Concepts*, 111.

20 Ibid., 112. Behaviour here is the behavior of a process or system rather than a person, with the exception of the Ecocathedral case study which had a social dimension.

21 Ibid., 51. They also note that "Overly structured observation may end up missing the important in favour of what is more easily recordable".

22 Ibid., 16.

23 Ibid., 75.

The focus on processes and practices in the research questions give two contexts that are brought to the exploration of the case studies. The exploration of processes relies on a scientific context where ecological interpretations are brought to physical evidence of change phenomena found on site through observation. The context for practice is arrived at via a more speculative and propositional interpretation of the change phenomena from the perspective of my own experience in landscape architectural and gardening practice.

In the practice context, the relationship to the observations is closer to that of "participant observation" where "the observer becomes immersed in the everyday life of the institution or environment… It has the considerable advantage of giving the researcher the "whole picture": not only the human activity and interaction but also the location, artifacts, resources, environment and so on".[24] While in the cases of Bordeaux and Marnas this participation was modeled rather than real, I did undertake direct participant observation on the Ecocathedral, which is described in chapter 5.

These two contexts also provide a means of "triangulation", "a term borrowed from surveying which hints at the process of reaching accurate measurement through comparing a set of readings".[25] Woodside argues that triangulation can help develop a "deep understanding" of a case which "usually involves the use of multiple research methods across multiple time periods (also known as) triangulation (including) direct observation within the environments of the case (and) probing by asking case participants for explanations and interpretations of "operational data".[26] Triangulation allows one to "learn the linkages and underlying paths among concept variables identified in a case".[27]

For each of the case studies, as well as my own observations I used other methods to have additional perspectives or to "triangulate" research about my case studies. While I will discuss the details of the other methods used for each case study, I used interviews with the designers on both Bordeaux Botanic Gardens and the Ecocathedral, as well as additional interviews at the Ecocathedral of others involved in building. These interviews took the form of general conversations about ideas relating to change, tended to be conceptual rather than focused on the case studies per se. In terms of triangulation, these allowed me in to compare my own findings with their ideas rather than seeking to find direct causality between their intention and the project outcomes, which would have been appropriate for a more historically focused thesis. On both the Ecocathedral and the Marnas Garden I undertook measured drawings, and for the latter I compared my measured drawings against historic plans and photographs. I also examined construction details for the Bordeaux Botanic Gardens. The purpose of these additional methods was to demonstrate physical change and also to ascertain the designers views of change and the level of deliberation

24 Ibid., 113.
25 Ibid., 145.
26 Woodside, *Case Study Research : Theory, Methods and Practice*, 6.
27 Ibid.

they brought to this concept in their development of the designs. The use of these other methods was not to develop a history of the project but to test my own observations against another source.

Hammond and Wellington note that "a case is literally an example of something (and is) a unit of analysis",[28] which defines the relationship between a case and the research question. In this instance the case study is regarded by Liamputtong as "instrumental" because the case studies are selected to exemplify the emerging issue,[29] where multiple cases are selected because they "may offer more in-depth or multi-faceted insights than having only one case study" but where each case should be researched and treated individually.[30] This means that the case is chosen to exemplify an argument that preceded it, which means that the case study is deductive. The case studies have modified my argument, particularly in terms of scope in the case of the Ecocathedral that allowed me to extend the concepts of the dissertation out of the garden context, and so the cases are also inductive in relation to the overall argument. The relationship of the argument to the case study is thus similar to that of the hypothesis to the experiment.

This model of using multiple cases is developed by Robert Yin and discussed by architectural research methods writer Linda Groat. Groat suggests that case studies have either an explanatory, descriptive or exploratory purpose, the choice of which is "a function of the researchers purpose – or more precisely the nature of the research question – rather than any limitation in the case study strategy".[31] Groat discusses Yin's case study methods and applies his typology to the work of Jane Jacobs, who is also discussed by Yin. Yin's typology analyses four structures for case studies: the Linear-Analytic, where there is a problem statement, literature review, methods and results; Chronological, where there is a narrative sequence, Theory Building, where the sequence of chapters depends on the logic of theory development and; Un-sequenced.[32] Groat classifies Jacob's work as Theory-Building, because of its exploratory and explanatory purposes.

The use of case studies in this dissertation correspond to this Theory Building definition in a number of ways. From a structural perspective, the case studies are arranged in a sequence that develops my theoretical interests and answers developing research questions, each building on the previous. As discussed above, practices and processes are the focus' of the research question, but the order of the cases, sequence of the argumentation and therefore chapters follows a building argument focuses on practices. Building on my critique of representation in chapter 2, the case studies move from highly represented in Bordeux, to the entirely improvised in the Ecocathedral, with Marnas as a balance between designed and built.

The recognition that Theory Building is essentially biased helps remedy a potential issue with case studies identified by Yin and Liamputtong in terms of its conclusiveness. Yin suggests that a

28 Hammond and Wellington, *Research Methods: The Key Concepts*, 16.

29 Liamputtong, *Qualitative Research Methods*, 192.

30 Ibid., 193.

31 Linda Groat, "Case Studies and Combined Strategies," in *Architecural Research Methods*, ed. Linda Groat and David Wang (New York: John Wiley & Sons, 2002), 349.

32 Ibid.

common error in case studies is that they treat each case as an instance of the same experiment, like a respondent in a survey for instance, which Yin calls "sampling". Instead Yin favours an approach he calls "replication" which treats each case study as a separate experiment, which has "a purpose within the overall scope of inquiry".[33] This purpose is the building of the theory and the replication of the models of process and practice in different contexts. Discussing "Internal Validity" in case studies Yin provides a caution relevant to this thesis, that "a case study involves an inference every time an event cannot be directly observed (because) an investigator will "infer" that a particular event resulted from some earlier occurrence based on interview and documentary evidence collected as part of the case study".[34] In the case of this dissertation simple ecology and science and normative landscape practice is used as a "straw man" against which the case study is discussed for the purpose of developing the argument. Since the role of the case study is to "Theory Build" it does not attempt to present the case study in a comprehensive but focused way. As Liamputtong notes,"a case study research project does not intend to 'represent the world' but only the case we are interested in or the case that will make us understand the world better".[35]

1.4 Hybrid Realities

In this dissertation I have adopted a conceptual framework that adds embodied human practice to the physical processes that I discuss in the case studies. This results from an acceptance that the world is full of "'hybrid' realities", because, as Graham Harman notes, discussing Bruno Latour,

> [it is not possible] to point to a term that is purely natural, since our access to the things-in-themselves is never direct. But by the same token there is no point in any of the connections that would be purely constructed or purely political.[36]

Despite this, Latour proposes that modernity has separated three spheres: naturalisation, or the discourse of science; socialisation, or the discourse of social science; and deconstruction, the discourse of discourses.[37]

In attempting to discuss the projects as hybrid realities, I blend all these ways of seeing together so as to "retie the Gordian knot". For example, in Chapter 2, I critique the "naturalisation" of the process discourse, but in each of the case studies, I use science to describe the processes at work. At the same time, I discuss the social dimension of the case studies, such as the response of the Botanical Garden's managers to its change, and the social group, the Stichting Tijd, that has grown up around the Ecocathedral. Latour's characterisation of deconstruction is relevant too, as I critique the role of simulation in the discourse of landscape architecture and architecture. Like Latour, I

33 Ibid., 357.

34 Robert K. Yin, *Case Study Research: Design and Methods*, 4th ed. (Thousand Oaks, California: Sage Publications, 2009), 43.

35 Liamputtong, *Qualitative Research Methods*, 204.

36 Graham Harman, "Bruno Latour, King of Networks (1999)," in *Towards Speculative Realism: Essays and Lectures*, ed. Graham Harman (Winchester, UK: Zero Books, 2010), 75.

37 Ibid., 77.

resist the separation of the world into "hard" (science, economics) and "soft" (popular culture, experience).[38]

Latour uses the term "quasi object",

> which is not quite an object and not quite a subject; or rather it can behave like both of these depending on how you view it. On the one hand they are contextualised by the objects with which they are fused; on the other they have retreated into their own dark inner natures and are never fully measured by the networks in which they are involved at any given moment.[39]

Harman uses the term "object-oriented philosophy" to describe this interest in the autonomous nature of objects, which I have, in turn, interpreted as an interest in specificity and materiality. As such, when I approach processes in the three case studies, I focus primarily on how their concrete material outcomes can be observed specifically on site.

This dynamic relationship between the "network" and the "actor"[40] allows me to link design or conceptual decisions to the material dimension, a method that owes a debt to Reyner Banham. In *Theory and Design in the First Machine Age*, Banham sought to evaluate the International style, comparing functionalism theory to "functionalism as practiced".[41] Banham used a precise discussion of design and detail to do so; in effect, he was using "hard" stuff to discuss "soft" stuff. My discussion of detail in relation to processes operates in a similar way, whereby I link material effects to human processes. Just as Banham forces functionalist ideas to have a material, substantive expression, I allow the experiencing subject to be among the processes that occupy the same space and time that a person does. Correspondingly, I use a similar materialistic account for both the processes and the details so that ecology can be considered in relation to soil, just as it can in relation to a masonry wall stacked by an old man.[42]

The remainder of this chapter will set out the background for the thesis, focusing particularly on the relationship between landscape architecture and gardening. From a disciplinary perspective, the two are obviously historically related; I propose that their link is also a process one, with gardening being both a model for working with change as well as in itself operating ecologically, in process terms.

---

38 Ibid., 80.

39 Ibid. Harman suggests that Latour borrows this term from Michel Serres, the philosopher of science. Latour has written extensively on Serres.

40 Ibid., 68."[Latour] does not propose that science is socially constituted by power relations or figurative linguistic strategies. Instead, Latour's universe is populated with conuntless human and non-human *actors*."

41 Reyner Banham, *Theory and Design in the First Machine Age* (Cambridge, Massachusetts: The MIT Press, 1980), 11.

42 This way of using very specific and temporal description to argue a general point is a stylisation that is used by Graham Harman to demonstrate his point that, while we can discuss frameworks for understanding quasi-objects, we should never lose sight of the real specificity that such systems seek to explain but generalise through theorisation.

1.5 Planning for Plants as Form and Material

Plants are the most changeable material in landscape architecture and provide a way into thinking about change in the discipline. The area in which they are most directly addressed in landscape architecture is in planting design. This has traditionally been dominated by either a neo-Victorian painterly approach focusing on form, colour and texture,[43] or on utilitarian screening or space-forming qualities.[44] A notable exception to these is the modernist reconsideration of plants and the pioneering planting research of James Rose, who studied at the Harvard Graduate School of Design in the 1940s. Along with Dan Kiley and Garrett Eckbo, Rose is widely regarded to have brought modernism to American landscape architecture.[45] Elizabeth Meyer discusses both Rose's and Kiley's work and regards their research into plant material as being equivalent to Clement Greenberg's analysis of modernist painters, "wherein artists sought to exploit the specific properties and logic of their medium".[46] Rose designed a schema that examined plants in terms of the new modernist concepts of form and space, focusing in particular on the quality of transparency.

The work of Rose and his contemporaries is significant for my thesis because it focuses on plants and their unique properties as a material, which I will discuss in more detail in Chapter 3. A material account of landscape architecture offers a vital counterpoint in contrast to the sometimes vague and abstract focus on processes of generation within the process discourse. Considering that the dissertation is concerned with novelty and change, and the landscape modernists do not deal explicitly with growth, I will argue here that discussions of growth and change are implied in any discussion of plant form. Thus, while the landscape modernists might seem a curious inclusion in a discussion of novelty and change, in the dissertation I will argue that their work provides a hinge in the relationship between form, change, and planning in landscape and architecture.

In their desire to develop a modernist sensibility specific to landscape architecture, Eckbo, Kiley and Rose pursued plants not simply as a material but rather as a fundamental way of working, a tectonic, as Gottfried Semper might have called it. For Semper, in his anthropological history of architecture derived from materials and their relation to culture, "each … technical division (e.g. Textiles) has its own domain of forms whose production is the techniques most natural and most ancient task". In proposing that "[the] work [is] a result of the *material* used to produce it, as

43 For example, in the manner of British gardeners Gertrude Jekyll or Vita Sackville-West, or, in Australia, in the work of Edna Walling. This style of planting design, which relies on loose mixes of perrenials (Noël Kingsbury, *The New Perennial Garden* (London: Frances Lincoln, 1996)., has returned in contemporary landscape projects in the work of Piet Oudolf, such as at James Corner Field Operations' High Line in New York, and Peter Zumthor's Serpentine Pavilion from 2011, and is not without sophistication (Piet Oudolf and Noël Kingsbury, *Landscapes in Landscapes / by Piet Oudolf* (New York: Monicelli Press, 2010).

44 R. E Wörle and H. J Wörle, *Designing with Plants* (Basel: Birkhauser, 2008). This book describes this approach as planting to produce "Spatial Structure".

45 M Treib, ed. *Modern Landscape Architecture: A Critical Review* (Cambridge, Massachusetts: The MIT Press, 1993). I assume Treib's reading of this evolution of modern American landscape architecture, though Thomas Church could also be said to have been given this credit.

46 Elizabeth K. Meyer, "Kiley and the Spaces of Landscape Modernism," in *Dan Kiley Landscapes*, ed. Reuben. M. Rainey and Marc Treib (Richmond: William Stout Publishers, 2009), 126. I discuss Greenberg's notion of "medium specificity" and Rosalind Krauss's critique of it in Chapter 2, in relation to landscape urbanism.

well as of the tools and procedures applied",[47] Semper provides a pertinent model for considering plants and gardening since it brings together both the material and processes for its manipulation. Plant form is produced by growth and guided by gardening technique. Correspondingly, while the landscape modernists do not discuss gardening, they do elevate plant growth to a tectonic status unique to landscape architecture, and Semper's model for considering materials as part of a process unites their formal preoccupation with plant form to the action of garden maintenance. Andersson's garden, presented in Chapter 4, uses a tectonic approach to plants, and is discussed in relation to Andersson's gardening techniques that create particular spatial outcomes from plant growth.

1.6 Ecological Processes in the Garden and the Designed Landscape

If Semper's tectonic model can describe plants and unite them with gardening, this recognises that plant growth and gardening are a process. However, Stefan Buczacki notes that "rarely is [ecology] used in relation to gardens and gardening";[48] despite the fact that "the garden is one of the most complex of habitats and can almost defy analysis … it is one to which many of the basic principles of ecology have seldom been applied".[49]

While plant growth is natural, the garden itself is often portrayed as somehow unnatural, or, if not unnatural, then a "third nature".[50] Signs of natural process in gardens and landscapes tend to shift ornamental landscapes into a type, making them "wild gardens", where they represent a particular environmental or ecological ethic or style—for example, "naturalism".[51] Additionally, "the ongoing decline of public landscape maintenance … has initiated a search for 'new' planting styles to help reinvigorate public landscapes"[52] that use natural regeneration or self-organisation in lieu of precise planting design and maintenance so as to provide vegetation in marginal spaces, such as car-parks and infrastructure verges. In areas such as the Ruhr in Germany, regenerating birch is being coopted to provide vegetation for highly designed landscapes. With this developing aesthetic of naturalism comes a recognition that new, hybrid 'cosmopolitan' ecologies are developing in cities,[53] as plants from other places have travelled with people to create 'weed-scapes' that, without privileging pristine wilderness, have undeniable material qualities, to the point that books are now being written

47 Gottfried Semper, *Style in the Technical and Tectonic Arts* (Los Angeles: Getty Publications, 2004), 107.

48 Stefan Buczaki, *Ground Rules for Gardeners: A Practical Guide to Garden Ecology* (London: Collins, 1986), 8.

49 Ibid., 12.

50 John Dixon Hunt, *Greater Perfections: The Practice of Garden Theory* (Thames & Hudson, 2000), 34. Hunt discusses Cicero's model of three types of nature: the first, wilderness, of nature proper; the second, the agricultural landscape; and third, gardens, as third nature. Cultural theorists of gardens tend to get excited by third nature because it celebrates the garden's artificiality, where the natural became a dirty word during postmodernism. However, I would argue that such a polarisation is unnecessary: the garden can be both artificial and ecological at the same time.

51 Keith Wiley, *On the Wildside: Experiments in New Naturalism* (Oregon: Timber Press, 2004).

52 Nigel Dunnett and James Hitchmough, "Introduction to Naturalistic Planting in Urban Landscapes," in *The Dynamic Landscape*, ed. Nigel Dunnett and James Hitchmough (New York: Spon Press, 2004), 1.

53 Crosby called such ecologies "portmanteau biota", so named after a travelling bag of the same name. (Alfred W. Crosby, *Ecological Imperialism: The Biological Expansion of Europe 900-1900* (Cambridge: Cambridge University Press, 1986), 89. These type of ecologies are discussed more recently in Emma Marris, *Rambunctious Garden: Saving Nature in a Post-Wild World* (New York: Bloomsbury, 2011).

to identify weed species in the landscape the way that they might have previously been written for natural landscapes. [54] An early progenitor of this view, Anne Whiston Spirn's book *The Granite Garden* sought to analyse the city as ecology, discussing the soil pavement cracks and urban fauna, for example.[55]

While 'spontaneous vegetation' (as it is called) features in both the Bordeaux botanic gardens and the Ecocathedral, of greater interest is the combination of gardening with such vegetation, which breaks down the boundary between all three natures (wilderness, agriculture, and the garden) through the action of people.[56] The active management of forests in Europe, where horticultural techniques are combined with naturally regenerating vegetation, is perhaps the clearest example of such an interventionist model. Interestingly, such actions make the forest a production space and the discipline 'forestry', like the second landscape of agriculture, rather than being a garden manipulated through gardening.[57] By incorporating the action of gardening with regenerating landscapes, these processes can be combined with the kind of formal precision that Rose aimed for with vegetation, and break down the form/process split that characterises much discussion about spontaneous vegetation.

1.7 Organic and Inorganic: It's All Natural Process

Growth provides the clearest example for understanding how gardens and landscapes can change over time. Throughout this dissertation, the discussion of "organic processes" refers to growth, where novelty arises from the process of ongoing cell division guided by DNA in response to the surrounding environment. While all three case studies involve growth, plant growth is the particular focus of the Marnas case study, because Andersson manipulated plants through gardening to achieve certain desired spatial effects. Organic processes are intrinsically tied to inorganic processes because they deliver effects that facilitate growth, most obviously in thermodynamic terms, by allowing energy transfer into forms available to living things.

Organic processes are not the only type of change that occurs in the case studies; nor is growth their only form of ecological process. With its interest in change and process, these processes are discussed in terms of how a level of specificity results that has levels of novelty that resemble growth but are inorganic. Further to the discussion of plant material, in relation to Semper's notion of the tectonic, architecture too has begun to question the apparent fixity of its construction materials that attempt to encourage change.

54 Peter Del Tredici, *Wild Urban Plants of the Northeast: A Field Guide* (Ithaca: Cornell University Press, 2010).

55 Anne Whiston Spirn, *The Granite Garden: Urban Nature and Human Design* (New York: Basic Books, 1984).

56 Geoffrey Dutton, *Some Branch against the Sky: The Practice and Principles of Marginal Gardening* (Devon: David & Charles, 1997), 10. Dutton suggests that "a Marginal Garden is one minimally differentiated from its surroundings, and so requiring minimal effort to make and keep up; the owner of course being free—and by adding 'adornments'—to increase the difference (and so the input) as desired".

57 Oliver Rackham, *Woodlands* (London: Harper Collins, 2006). & William Mutch, *Tall Trees & Small Woods: How to Grow and Tend Them* (Edinburgh: Mainstream Publishing, 2008).

In Chapter 2, I propose that the development of the process discourse in architecture reflects a desire to overcome the inherent static nature of the building, which I discuss in terms of the use of design-generation processes to imbue architectural form with a sense of movement. Another approach to this problem has been to propose an architecture that dematerialises through the use of ephemeral materials, such as mist, in the case of the Blur building by Diller Scofidio + Renfro,[58] or snow, in the case of the buildings constructed as part of *The Snow Show.*[59] David Gissen critiques the process discourse, describing it as "the emerging vitalist discourse on 'flow'", and, rather, proposes *subnature* whereby "… forms of nature become subnatural when they are envisioned as threatening to inhabitants or to the material formations and ideas that constitute architecture", which are the 'real' natural gritty context for building in contrast to the glossy technology of contemporary sustainability.[60]

For Gissen, the gritty reality of subnatures—composed of dankness, dirt and mud, for example—are a critique of the "comforting forms and dynamic images of nature [that] are often used to reproduce existing forms of power in society".[61] Gissen uses a review of selected architectural theory to demonstrate how the alleviation of these forces has driven architectural language since the nineteenth century.[62] While he discusses contemporary projects that respond to these historical readings, he qualifies his interest by differentiating it from the accounts of weathering from David Leatherbarrow and Mohson Mostafavi,[63] which, he suggests, are "uncritical" because they emphasise the stability of the environment in contrast to the transforming architectural object. They do this, he says, by emphasising the physical transformation of the materiality of the building through weathering and the development of patina rather than "exposing the realities of the external environments". When Gissen proposes that his selection of subnature projects "invert the paradigm of weathering", he does so because "architecture and environment are produced simultaneously".[64] I agree with this latter qualification, and this dissertation examines the interchange between object and environment. Nonetheless, I remain mindful of the physical way this can happen through material exchange between context and object in a way that Leatherbarrow and Mostafavi are also interested in. Ultimately, in few of Gissen's projects does the building itself change, or experience or exercise real effects in relation to the forces he discusses.

Weathering is a chemical transformation, where the mineral material of the building is affected by chemical and hydraulic forces in the atmosphere from the air or from rain. As Gissen notes, the agency or activity of the building surface is limited to patina, to being a registration of the

58 Elizabeth Diller and Ricardo Scofidio, *Blur: The Making of Nothing* (New York: H.N. Abrams, 2002).

59 Lance Fung, ed. *The Snow Show* (London: Thames & Hudson, 2005).

60 David Gissen, *Subnatures: Architectures Other Environments* (New York: Princeton Architectural Press, 2009), 24.

61 Ibid., 25.

62 Gissen's view of subnature is much the same as architectural interpretations of "the Uncanny", to which he also refers (see Anthony Vidler, *The Architectural Uncanny : Essays in the Modern Unhomely* (Cambridge, Massachusetts: The MIT Press, 1992).

63 Mohsen Mostafavi and David Leatherbarrow, *On Weathering: The Life of Buildings in Time* (Cambridge, Massachusetts: MIT Press, 1992).

64 Gissen, *Subnatures: Architectures Other Environments*, 26.

environmental forces,[65] where changes of function or use would be regarded negatively. Stan Allen alludes to the mineral nature of architecture when qualifying the nature of architectural and landscape change, suggesting that "architecture is slower than biology but faster than geology".[66] As a critique of the process discourse, Allen seems to describe architecture's changeability in deliberately non-organic terms when he notes of Also Rossi that "[he] understood urban form as geological: hard and persistent, but capable of accommodating change over time".[67] The commonality of change is clear between the biological and the geological in Allen's discussion, and he obviously sees the two as united by the agency of time and processes of transformation.

Inorganic materials are subject to environmental processes and undergo significant changes that result in important chemical and physical changes, at both the architectural form and the mineral level. In this dissertation, while growth provides a model for change processes, I co-opt this sense of process to discuss inorganic materials too. In relation to the Bordeaux Botanical Gardens, I discuss erosion and deposition processes by examining soil structure, reflecting on how it was influenced through the detailed design of soil 'mounds', exaggerating or amplifying entropic inorganic processes, while for the Ecocathedral, I discuss the way that stacked masonry 'tables' are built without mortar. In both case studies there is a link to growth, which also demonstrates a key aspect of geology, which is that weathering creates growing media or soil. Thus, in both case studies, growth and biodiversity result from inorganic processes.

1.8 Novelty and the Laws of Thermodynamics

Throughout this dissertation, I use the term "novelty" to describe the outcome of a process; novelty is literally its emergent newness, regardless of whether such a process constitutes growth or decay.[68] I discuss novelty in both concrete and abstract terms, which, I argue, are linked because of the implicit role of an observer located in time in any discussion of process.

A concrete approach to novelty is apparent in the previous discussion of the dissertation's methodology, where I discuss a conceptual framework that emphasises material and formal outcomes from change processes. In Chapter 2, which details the process discourse, I suggest that in some cases, form has become a derogatory term, simply denoting the outcome of a process, and understandable only in terms of the process that generated it. In so doing, design as a formal pursuit is set up as a polar opposite to design as a process facilitator. By focusing on the material and formal qualities of particular novel outcomes, I argue in this dissertation that it is unnecessary and counterproductive to separate form and process.

65 In my teaching, I refer to projects that reveal such forces as "interpretation machines".

66 Stan Allen, "From the Biological to the Geological," in *Landform Building*, ed. Stan Allen and Marc McQuade (Zürich: Lars Muller/Princeton University School of Architecture, 2011), 22.

67 Ibid., 36.

68 I recognise that the way we talk about change becomes problematic because it too affects how we see such change process, implying an end that seems to contradict the claims about the processes themselves. In Chapter 6, I discuss the assumptions implicit in words such as "outcome".

The first law of thermodynamics states that energy is not lost but transferred in systems. The world is not made up of closed but open systems and so, as Dilip Kondepudi and Ilya Prigogine suggest, "the biosphere is maintained in non-equilibrium through the flow of energy coming from the sun, and this flow is itself the result of the non-equilibrium situation of our present state of the universe".[69] Such processes are irreversible, exhibiting what Arthur Eddington called the "arrow of time".[70] The second law of thermodynamics describes how in irreversible processes, energy transfer is accompanied by an increase in entropy. Since thermodynamics was developed to describe heat transfer in the steam engine, thermodynamics is an account of the loss of "work" potential, simply demonstrated by the fact that fuel has to continue being put into the engine to produce useable energy. This notion of work is important because while the first law states that no energy is lost, entropy is simply a description of the lack of utility of resultant energy as it changes form in the process of transfer.

Kondepudi and Prigogine note that while the information provided by thermodynamics is general, it "is quite valuable precisely because of its generality".[71] Hannah Arendt describes this generality when she suggests that life is

> a process that everywhere uses up durability, wears it down, makes it disappear, until eventually dead matter, the result of small, single, cyclical, life processes, returns into the over-all gigantic circle of nature herself, where no beginning and no end exist and where all natural things swing in changeless, deathless repetition.[72]

This conception of nature has an ancient lineage,[73] but it also has a scientific description in the laws of thermodynamics, which is reflected in the fact that 'second-law thinking' has become an important part of sustainability discourse.[74]

Considered in relation to the processes discussed in this dissertation, form is the expression of the thermodynamic energy process. It could be argued that the designers of the various case studies utilise thermodynamic processes to achieve certain formal outcomes, and as such, rather than being interested in exergy, or the useable energy in thermodynamics, it is entropy that I am concerned with in this dissertation. Correspondingly, in Chapter 3, thermodynamics is examined in relation to the mounds in the botanical gardens, and in Chapter 6 I argue that novelty is in fact specificity.

---

69 Dilip Kondepudi and Ilya Prigogine, *Modern Thermodynamics: From Heat Engines to Dissipative Structures* (Chichester: John Wiley & Sons, 1998), xi.

70 Ibid.

71 Ibid.

72 Hannah Arendt, *The Human Condition* (Chicago: The University of Chicago Press, 1998), 97.

73 Michel Serres proposes that long before thermodynamics, this sense of constancy and differentiation had been recognised by classical atomist physicists who proposed that "the universe is regulated on the basis of constancy, isonomia… To the degradation of one thing there corresponds the birth somewhere of another. Michel Serres, *The Birth of Physics* (Manchester: Climen Press, 2000), 128.

74 S Stremke, A Van Den Dobbelsteen, and J Koh, "Exergy Landscapes: Exploration of Second-Law Thinking Towards Sustainable Landscape Design," *International Journal of Exergy* 8, no. 2 (2011). Essays such as this focus on reducing energy transfer at a planning scale so as to reduce the loss of useful energy. However, in contrast, I would suggest that while in this specific case such minimisation of energy transfer might be valuable, working with the changing state of energy is an important part of ecological system function, and produces novelty, as I discuss in the dissertation, through processes such as growth and decay

In Chapter 5, I discuss Le Roy's definition of "novelty", which is tied to the growth that emerges from construction acts, and is defined in opposition to design and representation. Le Roy regards novelty as a spontaneous increase in material that exhibits extreme specificity, which is effectively un-representable.[75]

As well as this materialistic account of novelty, in Chapter 6, I consider novelty with reference to Henri Bergson's distinction between "changes by degree" and "changes in kind".[76] The former is simply an expansion, contraction or change of location as the result of the passage of time. I will apply Bergson's critique of difference by degree to the design-generation methods used in simulation by the process discourse discussed in Chapter 2. Bergson proposes that the passage of time, a process that he calls "duration", causes changes in kind to emerge, and thus to transform things completely. Like Bergson before him, Alfred North Whitehead suggests that change over time requires a subject or a mind to appreciate it and so assumes a participant synchronous with its passing.[77]

1.9 The Labour of Life and the Practices of the Gardener

Humans appreciate change across the passage of time, and the change process, but they are also subject to that change. As Arendt notes in *The Human Condition*, "The common characteristic of both the biological process in man and the process of growth and decay in the world, is that they are part of the cyclical movement of nature and therefore endlessly repetitive".[78] Arendt calls this process "labour", which, she says,

> is the activity which corresponds to the biological process of the human body, whose spontaneous growth, metabolism, and eventual decay are bound to the vital necessities produced and fed into the life process by labour. The human condition of labour is life itself.[79]

Arendt later describes how there is little to show for the labouring body apart from ongoing survival and movement toward death, even as the act of labouring to live is our most clear link to the rest of organic life.

Returning to Whitehead and Bergson, novelty is a specificity that arises in time appreciated by a mind. I argue in this dissertation that correspondence between the processes of the world and the processes of the human body experienced by a person suggests a link between human activities and novelty-producing processes in gardening. I propose that gardeners' actions are a mindful

75 This sense of novelty resembles the notion of informational entropy. In communication, a clear message is one that can be understood with the smallest amount of information. However, in information theory, there is also a tendency for messages to gain data and lose recognition.

76 This division is from Deleuze's schematisation of Bergson's thinking in reference to his notion of "duration"; in Gilles Deleuze, *Bergsonism* (New York: Zone Books, 1991).

77 Alfred North Whitehead, *Process and Reality* (New York: Free Press, 1978).

78 Arendt, *The Human Condition*, 98.

79 Ibid., 7.

participation and collaboration with plants and the other elements of the garden, all changing around each other, in the way suggested by Arendt. These actions constitute a practice of gardening.

Michel de Certeau, a French sociologist writing in the 1980s, uses the term "practices" to describe actions that are "multiform and fragmentary, relative to situations and details, insinuated into and concealed within devices whose mode of usage they constitute".[80] De Certeau differentiates between two types of practices, those that are imposed by institutions, which he refers to as a "strategy", and "tactics", which are the individual's means of navigating the "proper" (as he calls it) of authority. De Certeau appropriates this division from the nineteenth-century Prussian military theorist Carl von Clausewitz's influential treatise *On War*.[81] For Clausewitz, "… tactics teaches the use of armed forces in the engagement; strategy, the use of engagements for the object of the war".[82] In further defining the two, Clausewitz uses the analogy of the role of the march:

> A march that is not part of an engagement is thus a tool of strategy, but it is not a matter of strategy exclusively. If a column is ordered to take a route on the near side of a river or a range of hills, that is a strategic measure: it implies that if an engagement has to be fought in the course of the march, one prefers to offer it on the near rather than the far side. If on the other hand a column takes a route along a ridge instead of following the road through a valley, or breaks up into several smaller columns for the sake of convenience, these are tactical measures: they concern the manner in which the forces are to be used in the event of an engagement.[83]

In both de Certeau's and Clausewitz's definitions, strategy is imposed from above, at a greater distance from the action, and attempts to systematise what will happen from a distance, while tactics are made up of localised and specific responses to temporal situations. De Certeau notes of the operation of tactical improvisation that:

> A tactic depends on time—it is always on the watch for opportunities that must be seized "on the wing" and must constantly manipulate events in order to turn them into "opportunities".[84]

This differentiation between tactics and strategy is analogous to the differentiation I present in this dissertation between the prediction and simulation of change in design and the management of change by the gardener operating directly in the garden. Clausewitz differentiates strategy from tactics, respectively, in a gardening analogy appropriate to this thesis:

---

80 Michel de Certeau, *The Practice of Everyday Life* (Berkeley: University of California Press, 1984), xv. While I emphasise the individual in relation to practices, both de Certeau and May (Todd May, *Our Practices, Our Selves: Or What It Means to Be Human* (University Park, Pennsylvania: Penn State Press, 2001), 8.)emphasise their social dimension, for whom practices are "a regularity of behaviour, usually goal-directed, that is socially normatively governed".

81 A recent edition of *A+T* discusses tactics also in relation to von Clausewitz and de Certeau Javier Mozas, "Public Space as a Battlefield," *A+T: Strategy and Tactics in Public Space*, no. 38 (2011). On 22 April 2005, I presented a paper at the IDEA conference entitled "Labour, Tactics: Inside and Out" that, while unpublished, nonetheless dealt with this topic and these authors six years earlier.

82 von Clausewitz, *On War* (New Jersey: Princeton University Press, 1976), 128.

83 Ibid., 130.

84 de Certeau, *The Practice of Everyday Life*, xiv.

> War is not like a field of wheat, which, without regard to the individual stalk, may be mown more or less efficiently depending on the quality of the scythe; it is like a stand of mature trees in which the axe has to be used judiciously according to the characteristics and development of each individual trunk.[85]

The idea of practices as being about labour is important because the physical energy and effort expended in gardening creates the changing outcomes, and is also the kinesthetic background for the collaboration between organisms, the environment and the gardener.[86] The physical ability of the gardener to act is a kind of limitation on the form of the garden; for example, Andersson suggested that when he could no longer hold the clippers, the pruned forms of the hawthorns would revert to being trees.[87] French landscape architect Gilles Clément, in his projects for the Parc Citroen and for the Parc Henri Matisse, explored the concept of "the garden of movement", which involved specific gardening techniques.[88] While neither of these projects are primary case studies in the dissertation, Chapter 4 provides a discussion of Clément's descriptions of gardening as a kinesthetic, haptic experience. For example, he describes the feeling of seed in his hands as he casts it about, his arm moving from side to side.[89] This has a formal outcome because it creates a fan pattern, tied to the experience of his body. This experiential aspect tied to growth is most explicitly discussed in the Ecocathedral case study, and focuses on the experience of the act of doing in time in relation to growth, or the 'zen of building' as Le Roy might call it. Practices are not simply activities but also experiential ways of knowing, which, anthropologist Phillip Descola proposes, are "an organic totality, in which material and conceptual aspects are closely interwoven".[90] This sense of material returns us to Semper's notion of the tectonic and asserts that gardening is a form-making practice with a particular relation to material.

The gardener is the ideal model for Bergson and Whitehead's subject-participant, manipulating changes by kind. Located at the nexus of change, in the moment of it, Whitehead's notion of novelty as a sort of unclassifiable newness, a type of specificity comes to the fore, engaged with in real time by the gardener through the activity of gardening.

1.10 Designing and Gardening

In this dissertation I propose that there is not a binary opposition between desired outcome and a random process, but rather a manipulation of processes that point to an outcome that has certain

85 Clausewitz, *On War*, 153.

86 The same is true of farming, Cicero's second nature.

87 Sven-Ingvar Andersson, "Letter from My Henyard," in *Sven-Ingvar Andersson–Garden Art and Beyond*, ed. Steen Høyer (Copenhagen: Arkitektens Forlag, 2002), 106.

88 While I do not focus on Clément in the dissertation (because there is scant discussion of his gardening practices in English, and his projects have long since changed beyond recognition of this initial technique), as I mentioned in an earlier footnote, he is undoubtedly the pioneer of a gardening-based practice of landscape architecture.

89 Gilles Clément, "The Garden in Movement 2," in *Planetary Gardens: The Landscape Architecture of Gilles Clément*, ed. Alessandro Rocca (Basel: Birkhauser, 2007), 15.

90 Philippe Descola, *In the Society of Nature: A Native Ecology in Amazonia* (Cambridge: Cambridge University Press, 1996), 3.

material, formal or spatial qualities, but that allows and encourages a degree of differentiation, or specificity, in how that is manifest. Correspondingly, design and gardening need not be polarised on the basis of intentionality but rather on their concrete ability to work with change in the world. Because some type of outcome was desired for each of the case-study projects, certain processes related to materials and their change in the environment were selected by their respective designer/gardeners, who predicted they would arrive at an outcome but in an inexact fashion. This gradient between the prescription of outcome and the play of chance is central to my interests in this dissertation. The three case studies all 'transcend the envelope' of the original design or proposition. This means that the novelty that arises is beyond the formal boundary condition of the initial prescription, and yet these processes are also manipulated by design.[91] I specifically chose these case studies for this reason.

In each case study, the focus is on the way the designer has 'worked at a remove'. Unlike conventional practice where a designer specifies an outcome that is then built, in these cases, the designer specifies something that causes a secondary outcome, which can be a change of form of the design itself, or specifies an object that has its own effects. Roel van Gerwen uses the analogy of making a sandcastle with sand that is piled up and erodes away, compared to one where a stick is placed in a position where sand piles up against it. As he notes, "in this analogy placing the stick is less exhausting, gives a less predictable result and is highly dynamic … the main goal is to use the right 'sticks' in order to activate, unravel and manipulate the dormant landscape-forming processes". Van Gerwen calls this the "steering process".[92]

In the case of the Bordeaux Botanical Gardens, the practice of drawing produces construction details that facilitate erosion processes, leading to the erosion of form in the soil mounds. In Andersson's garden, the practice is pruning, leading to the growth and form of the Hawthorns. At the Ecocathedral, construction practices are used to build the tables that cause vegetation growth by creating a microclimate. In all cases, the designer uses a practice to regulate an effect. Since I argue in this dissertation that these processes are regulated in a quite deliberate way, my aim is to examine how specific variables of the regulating process are manipulated by practices to attune the outcome, even while each instance is different.

Considering the activity of the gardener, notions of outcome and proposition are again problematised, as they are in any discussion of process. The proposition that gardeners are better placed than landscape architects to work with growth, conceived of as a constant process of differentiation in kind, begs the question: What is the difference between gardening and landscape architecture?

I propose in this dissertation that the differences between these disciplines arise through the historical professionalisation of gardening, whether considered as previously an amateur hobby

91 Informally and in my teaching, I have used the term "transcend the envelope" to describe this approach.

92 Roel van Gerwen, "Force Fields in the Daily Practice of a Dutch Landscape Architect," in *The Mesh Book: Infrastructure/Landscape*, ed. Julian Raxworthy and Jessica Blood (Melbourne: RMIT Press, 2004), 259.

or a blue-collar trade.[93] The creation of the profession of landscape architecture, to some extent, parallels that of architecture, which was also either a guild-like endeavour or a gentleman's tasteful preoccupation. This change moved both architecture and gardening from a hands-on activity to be one that is primarily based on planning. This primacy of planning elevated the role of drawing, of representation, which became the main production of the discipline. Arguably, it is this historic prioritisation of representation that makes the modelling and simulation involved in the process discourse seem like the natural way to pursue change or process in design. While it would indeed be a novelty to make a building change, this level of literal changeability is rarely seriously pursued, and instead design-generation attempts are made to give some quality of the dynamic to static things. Meanwhile, since actual landscapes do change, following a strictly representational path in landscape architecture overlooks an immediately latent quality.

In all this, the proposition here is not that landscape architecture could or should simply revert to gardening. As I argue in this dissertation, the conjunction of architecture and landscape brings a particular mode of design and way of working, which gives its designed landscapes and gardens a very different sense of proposition than gardening, tied to notions of form and space that result from architecture. These tools are also valuable, and I propose that landscape architecture could have a more rich sense of change if it were merged with the activity of the gardener and located in the real time of growth.

As well as having the same presence in the world, details and gardening are both parts of the practices of the landscape architect, the former in the office, proposing in representation, and the second in the field. While Andersson's garden and the Ecocathedral are explicitly engaged in the real-time practices of gardeners as agents of change, the change that emerges in the more conventionally delivered Bordeaux Botanical Gardens is no less about practices. Throughout the dissertation, practices dominate the discussion, whether critiquing them in relation to the process discourse in Chapter 2, or examining them in the following three chapters. Crucially, throughout the dissertation, a key aim of mine is to reveal how novelty arises from practices—as seen in the case studies—or does not arise, as seen in the process discourse.

Whether referring to the representational practice of designing and detailing in the office, or the physical practice of gardening, practices of any sort are a link of activity that happens in time, through which processes occur, and from which novelty arises. Seen in relation to time, design and gardening are effectively the same thing; both cause and experience effects, separately and together.

93 Martin Hoyles, *The Story of Gardening* (London: Journeyman Press, 1991), 24. Of course, even while I am suggesting that landscape design evolved out of an amateur pursuit, discussing the English landscape gardens, Hoyles notes that "there [was] a marked division of labour between those who did the mental work of design and those who carried out the manual work of construction".

Chapter 2: The Process Discourse

2.1 Introduction

This dissertation is a defense of the role of design in landscape architecture from the scientism of what I call "the process discourse".[94] In the late-twentieth century, the dominant discourse in landscape-architecture theory emphasised the design of processes rather than forms, which I suggest is an interest in change, as I shall demonstrate through highlighting claims made for the dynamism of processes by the process discourse. Processes, it was posited, would lead to formal outcomes that were not prescribed. I argue that while initiated by design-generation processes, the interest in process has become naturalised, and both its history in design generation and its agency to activate real processes in the world has become conflated. This chapter will analyse the process discourse and its flaws, and then go on to explain what could be regarded as an oversight in the logic of the process discourse, which opens up the possibilities for the reinvigoration of landscape architecture that I claim to identify in this dissertation. That oversight is the inability to represent and simulate a process before the process has operated. This oversight demonstrates the difficulty of really engaging with the dynamism of the very processes that the process discourse is interested in. Correspondingly, the key research question for this chapter is: Do contemporary landscape architectural and architectural approaches to 'process' in design actually produce change?

Before outlining the chapter structure and argument, I will define the terms "representation" and "design generation". I this dissertation I argue that the process discourse in landscape architecture is linked to that in architecture. The elevated status of representation, seen as the primary component within academic-design discourse, in design generation has caused the process discourse to develop since postmodernism. Postmodernism, which refers to the period after modernism, was very concerned with representation. David Harvey suggests that, for modernism, "the world could be controlled and rationally ordered if we could only picture and represent it rightly".[95] Postmodernism reacts to modernism's "pre-occupation with the representation of eternal truths", and instead "privileges heterogeneity and difference".[96] In this context, the *Oxford English Dictionary's* definition of "representation" as **"**the action of speaking or acting on behalf of someone or the state of being so represented" becomes relevant. By problematising representation, postmodernism sought to "call into question all the illusions of fixed systems of representation".[97] In academic architectural design practice, the postmodern interest in representation was activated due to the prominence given to the role of drawing in a project; thus, the design process became opened up to be creatively explored as a subject in itself. Since this time, the representation of projects has become independent from the project-delivery process.

94 While I use the term "process discourse" to describe this school of thought, Gissen calls it "flow discourse", a title coined by Antoine Piccon.

95 David Harvey, *The Condition of Postmodernity* (Oxford: Basil Blackwell, 1989), 27.

96 Ibid., 10.

97 Ibid., 51. Harvey quoting Hal Foster.

I have coined the term "design generation" to refer to the process by which designs are created and form is generated. Generally, design generation is complicit with representation because if one cannot represent a design idea, then it cannot be communicated to others. Focusing on representation (which keeps the terms of architecture within a discursive space that is comfortable to academic discourse by freezing the discussion of a design proposition at the design-generation stage) leads to other qualities of the proposed design outcome being ignored, including construction or maintenance. Design generation has become an autonomous subject of architecture. As drawings changed from being representations to being visualisations, so too did their subject change—from being form to process. In so doing, the design-generation process has become the focus of architectural and, more recently, landscape-architectural speculation.

2.2 Chapter Structure

This chapter is divided into three concepts—"Layering", "Algorithm", and "Performance"—which are based around the French Parc de la Villette competition, and the landscape architecture schemes proposed by French-Swiss architect Bernard Tschumi and Office for Metropolitan Architecture (OMA) for the park.[98] I start the discussion of the process discourse with the Parc de la Villette because it is regularly discussed by the process discourse as an important early precedent for design generation, and also because it manifests all three approaches that I argue characterize the process discourse.

The "Layering" section presents a brief history of the process discourse, which will demonstrate that a focus on process resulted from certain representational techniques used in architecture during postmodernism, notably collage and layering.[99] It will then describe Tschumi and OMA's use of layering in their Parc de la Villette entries. Following this, I consider how the use of layering for landscape planning by Ian McHarg at the University of Pennsylvania allowed his students, including James Corner and Anuradha Mathur, to bring the process discourse to landscape architecture by using postmodern readings to reconsider mapping processes,[100] which produced what I call "propositional geography". This section argues that these techniques were initially used as artistic aids informed by the cultural frame of postmodernism, in contrast to those discussed in the following section, which were treated as "natural" or "scientific"—despite being as ostensibly cultural as their predecessors.

The "Algorithm" section returns to the OMA's Parc de la Villette competition entry, arguing that it set a precedent in the development of algorithmic approaches to designing that built on the design-generation strategies introduced in the "Layering" section. Moving from datascape, which spatialised information, to landscape urbanism, which operationalised ecology, I argue that a

98 While Tschumi won the competition, more has been written on the OMA scheme.

99 This partial history will focus on designers and theorists centred around the Architecture Association (AA) in London, including Daniel Libeskind.

100 James Corner, "The Agency of Mapping: Speculation, Critique and Intervention," in *Mappings*, ed. Denis E Cosgrove (London: Reaktion Books, 1999).

machinic approach to ecology has proliferated that treats ecology as a series of relationships that can be algorithmically modelled. Continuing in this vein, I consider computer software, developed by subsequent architectural movements, that focuses on parametric tools and morphogenesis to use ecological models to simulate change. While such models appear to have an objective certainty, I argue that simulation can never predict the novelty that occurs in real time in the world.

In contrast to this discussion on simulation, in "Performance", I discuss projects that operate in real time in relation to how they work with novelty. I divide these projects into those that seek to control performances, such as those using choreography, and those that allow and direct emergent change through tactics and installation. Extending the earlier critique regarding simulation to these performative strategies, I argue in this dissertation that, while such simulations may operate in real time, if they rely on representations to control or limit change, then they are treating real time as if it was a representation. Ending the chapter on this qualification—between simulation and novelty—provides the foundation for the case studies that follow.

2.3 Layering

In this section I will describe the process by which a postmodern artistic practice based on physical collage became merged with a geographic mapping process. I argue that this union was an innovative and valuable one, and saw its outcomes as cultural artifacts and interpretations in contrast to the projects that followed, which will be discussed in the following section. In the context of postmodernism and architecture, the development of collage processes in design generation can be linked to the concept of "deconstruction" proposed by philosopher Jacques Derrida. Deconstruction is a way of thinking that recognises the role of language as a continual, "intertextual" weaving of texts, and as such, Derrida "consider[ed] collage/montage as the primary form of postmodern discourse".[101] Building on the heterogeneity that characterised postmodernism, David Harvey notes that while collage was a modernist technique of artists such as Picasso, it was continued by postmodernist artists, "since different effects out of different times and spaces could be superimposed to create a simultaneous effect".[102] Writing in 1989, Harvey suggests collage had become somewhat ubiquitous and was used across many different discourses and mediums: "collage . . . suffused with a sense of ephemerality and chaos dominates todays practices of architecture and urban design . . . in common with art and philosophy".[103] Derrida's deconstruction thus turned a critique into a proposition, as representations became a tool via collage, the basic operation for which is layering.

The OED defines a "layer" as "a sheet, quantity, or thickness of material, typically one of several, covering a surface or body" and thus layering is a technique whereby images on a transparent medium are overlaid so that information from one image can be seen in relation to another. This allows for cross-referencing and finding relationships between different information for the same

101 Harvey, *The Condition of Postmodernity*, 51.
102 Ibid., 21.
103 Ibid., 98.

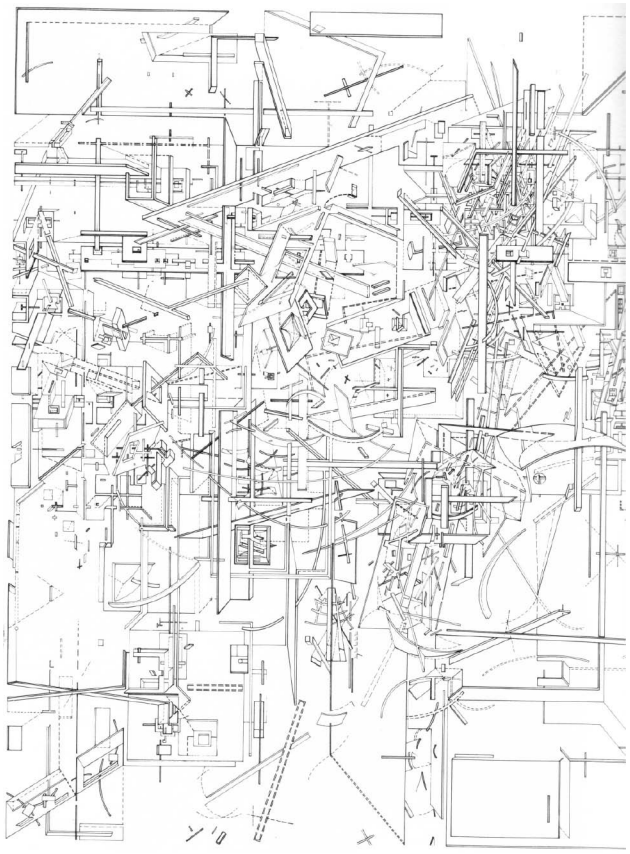

Figure 1. Daniel Libeskind, Little Universe, 1979
This drawing from Daniel Libeskind's Micromegas series exhibits a general sense of "dynamism" through ambiguous spatiality and implied movement through layering.

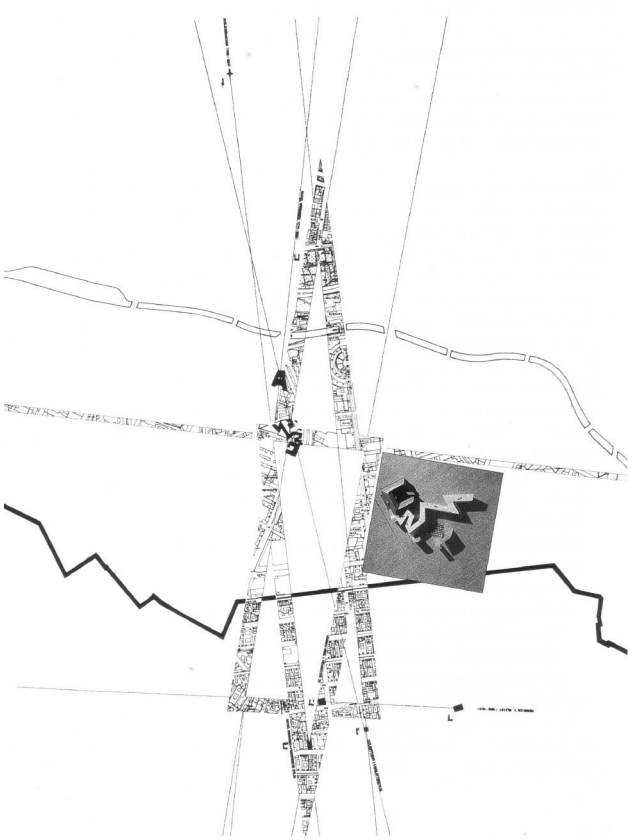

Figure 2. Daniel Libeskind, Drawing for Jewish Museum, Berlin, 1989
Libeskind's design for the Jewish Museum was generated by drawing axes between significant Jewish sites, which sought to bring out otherwise invisible spatial relationships.

physical location. Layering was part of the collage process used in avant-garde architecture in the 1980s, and I would assert that this technique was important for the development of the process discourse. Harvey discusses OMA's use of collage during this period, quoting an exhibition catalogue by Heinrich Klotz who describes the OMA's work as "produce[ing] graphic and architectural work characterised by the collage of fragments of reality and splinters of experience enriched by historical references".104 Meanwhile Corner, who developed McHarg's use of layering, suggests it "involves the superimposition of various independent layers one upon the other to produce heterogeneous and 'thickened' surface", a definition that resonates with Harvey's discussion of postmodernism.105

During the 1980s, Daniel Libeskind created a series of drawings entitled *Chamber Works* for an exhibition at the Architectural Association (AA), which were collected into a volume and published by the AA in 1983.[106] These drawings feature geometric forms that seem to float in single-point perspectival space and are described as "architectural meditations on themes from Heraclitus". As will be discussed in Chapter 6, Heraclitus believed that everything is in flux, and presumably

104 Ibid., 83.

105 Corner, "The Agency of Mapping: Speculation, Critique and Intervention," 235.

106 Daniel Libeskind, *Chamberworks: Architectural Meditations on Themes from Heraclitus / Catalogue of an Exhibition Held at the Architectural Association* (London: AA Publications, 1983).

Libeskind's drawings attempt to exhibit this quality. I argue in this dissertation that attempting to imbue a static drawing with the quality of dynamism is a recurring theme in the process discourse, as exhibited by Libeskind.

Libeskind's drawings exhibit a self-conscious use of layering in the construction of depth, using hierarchy to place things in front and behind other things (Figure 1). From these speculative drawings, Libeskind developed a drawing method that he used in competition projects, including his successful Jewish Museum in Berlin (1989). For this project, he used a drawing to generate the design that linked key sites of Jewish history via axial lines and used them to align a star of David, a section of which was traced to produce the plan of the building (Figure 2). This process operates by creating a specific mapping of invisible relationships at an urban scale and then uses the resultant geometry to define the building's form.

Read metaphorically, this process gives the building a form that arises from conceptually related information, while read literally as a plan form, it avoids formal precedent, exhibiting unusual composition. I would suggest that this latter literal rationale is more defensible than the former since a real perception of these relationships is unlikely without additional interpretation, which indeed has been provided by architectural media. If we read the Jewish Museum drawing in relation to the earlier *Chamber Works* drawings, and in the context of postmodernism, it's clear that the technique for Libeskind is interesting because it produces novel qualities in what are otherwise well-defined types of objects, drawings and buildings respectively. The question of reception is left open and is not necessarily relevant.

His use of a layering process in these two projects indicates that Libeskind was clearly working in a speculative realm, aimed at producing a novelty, but primarily via a drawing. Thus, Libeskind pursued a quality of drawing rather than suggesting a direct relationship to a real dynamic process in the world. Operating in the postmodern period, surrounded by theory, Libeskind pursued these techniques deliberately and abstractly. Despite using the empirical tool of mapping, the reference material itself and the relationships drawn were all cultural, as was the art technique of superimposition. This meant that the data never had an elevated status, and that the relationships drawn did not have scientific weight or seeming transparency. I argue in this dissertation that the self-consciousness that Libeskind brought to these mapping operations has subsequently become lost since the method itself has become an *a priori* generation strategy.

Held at around the same time as Libeskind was completing his *Chamber Works* drawings, the Parc de la Villette competition transformed design-generation techniques and the layering process from being used in the avant-garde to mainstream architectural practice. At 55 hectares, the Parc de la Villette is the second-largest park in Paris, and the competition for its design in 1983 called for a park for the twenty-first century. While the competition was won by Tschumi, though the OMA entry has received equal attention, particularly in the process discourse.[107] In many ways, Tschumi's

107 Considering how influential this scheme was, few realise that the team also included urban theorist Alex Wall (whose writing I refer to later in this chapter), and ENSP Versailles professor Michel Corajoud. This is significant,

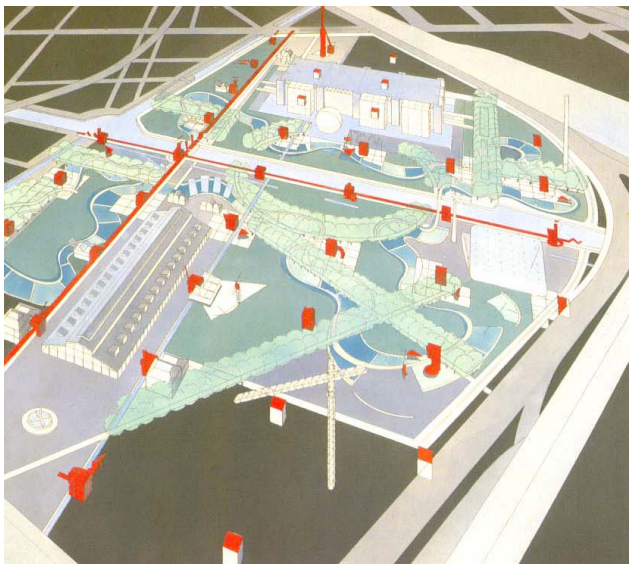

Figure 3. Bernard Tschumi, Plan for Parc de la Villette, Paris, 1985

Tschumi's design for Parc de la Villette used a generational schema composed of "points, lines, surfaces and cinemagraphic strip", each with their own layer.

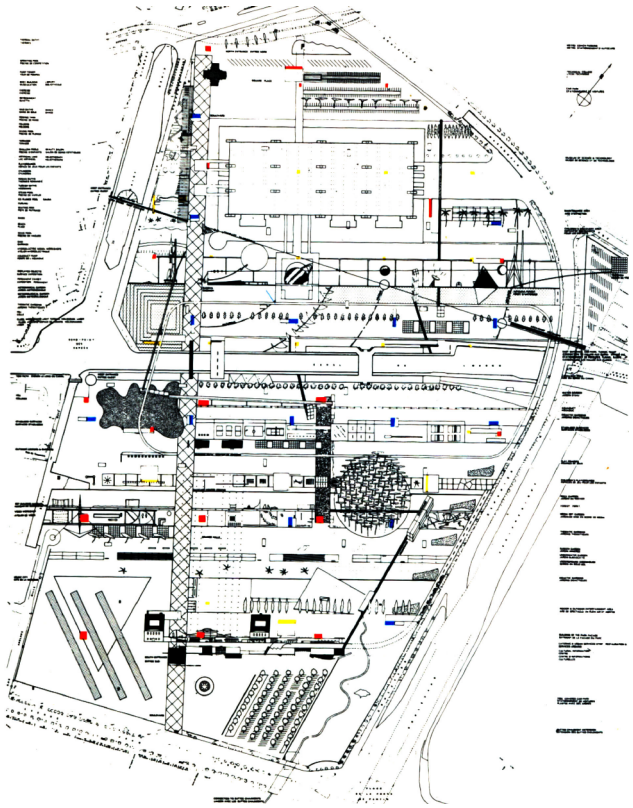

Figure 4. OMA, Proposed plan for Parc de la Villette, Paris, 1985

While not built, the OMA competition entry for Parc de la Villette has been a significant influence on the development of the process discourse, notably in its use of an algorithm and a machinic process of generation.

and the OMA's schemes were similar, both using layering and editing processes to generate their designs and to accommodate all the required program and activity.

In both schemes, each layer had a functional or semiological rationale. Layers were autonomous and represented a particular scenario or model design for a particular factor, considered in isolation of other layers. Tschumi's winning project had a simple schema for describing the generation of his scheme using points, lines, surfaces and the "cinematic promenade",[108] each layer having a type of geometry with a functional rationale (Figure 3). Lines referred to circulation routes that were expressed as direct, logical, desire lines that were given top priority in the editing hierarchy to facilitate movement across the site. The OMA scheme also had a similar layer with virtually the same geometry (Figure 4). The surfaces layer demarcated areas of different materiality and use that directed people's occupation in terms of how they were conducive, or prohibitive to certain uses. The cinematic promenade was a representation of narrative, and curled around the site in a serpentine fashion and included autonomous, themed gardens, in a sequence evocative of film frames. Since the lines were at the top of the hierarchy and were straight, and the curly strip was below it, the lines would cross the strip at odd points in its narrative, a reference to the collage-like film techniques of Sergei Eisenstein. This generational or graphic operation suggested equivalence to a meaning operation that was perceptible in the world, which represents a move toward treating meaning as logical or empirical. In turn,

considering that their student, influential French landscape architect Yves Brunier, went on to work with Koolhaas on projects after being inspired by his la Villette scheme.

108 Simone Brott, *Architecture for a Free Subjectivity: Deleuze and Guattari at the Horizon of the Real* (Farnham: Ashgate Publishing, 2011), 49.

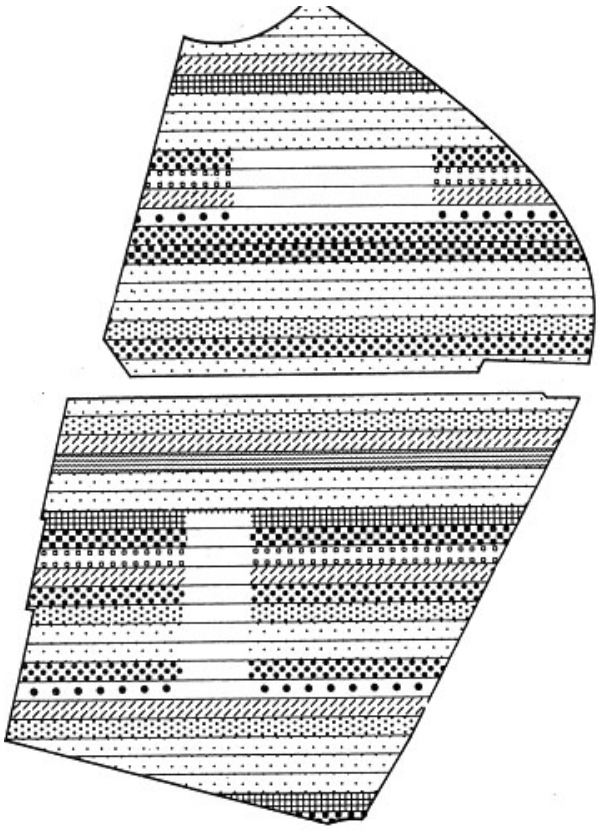

Figure 5. OMA, Diagram for Parc de la Villette bands, 1985

In contrast to Tschumi's band, which was curved, the OMA's bands were linear, each with its own vegetation community.

this lends an instrumentality to architectural meaning in geometry that the process discourse built upon.

While Tschumi's strips with theme gardens were serpentine, the OMA's bands were linear (Figure 5). The layer that OMA designed for the theme gardens was a stack of strips that formed an array across the site that created "horizontal congestion", using the analogy of a skyscraper laid flat on the ground. The bands of 50 metres would be subdivided into increments of 5, 10, 25 or 40 metre dimensions. It was proposed that each of the strips would have a different type of vegetation in it, but because each strip would have such a large edge in common with another strip, there would be great permeability between strips, with plants blending from one theme garden to another.[109] From the perspective of the feedback relationship between container and vegetation, this would have had the effect of a complete blurring of species between one band and another, and an overall gradient across all the bands. Furthermore, because these bands had an accentuated topography, the plants would begin to smooth out the drama of the bands, turning them into dunes. Considered in this way, the proposition of long, thin bands allows for dramatic vegetation change and for the vegetation to change the bands in turn, a strategy that would have created novelty of the kind that this study is interested in. Unlike Tschumi's project, the OMA scheme did not propose a meaning rationale for their use of layers, leaving it simply as a strategy with formal consequences.

The significance of the use of layering and collage at the Parc de la Villette has often been cited by landscape architects in the process discourse, seen as "represent(ing) a conceptual leap in the development of landscape urbanism".[110] This is due to the map becoming propositional rather than simply analytical; "the layers [at Parc de la Villette] are not mappings of an existing site but of the complexity of the *intended* programme for the site".[111] The transformational potential of mapping in landscape architecture arose in the context of post-modernism chronologically after Parc de la Villette because the scheme suggested a way of operationalising analytical environmental planning

109 In ecology, a greater perimeter compared to area makes a wilderness areas more susceptible to weed invasion. Because weed invasion tends to proceed consistently from an edge, if a patch is shaped like a long rectangle, as the strips in OMA's scheme were, the result is more affected edge than pure centre.

110 Charles Waldheim, "Landscape as Urbanism," in *The Landscape Urbanism Reader*, ed. Charles Waldheim (New York: Princeton Architectural Press, 2006), 41.

111 Corner, "The Agency of Mapping: Speculation, Critique and Intervention," 235. My emphasis.

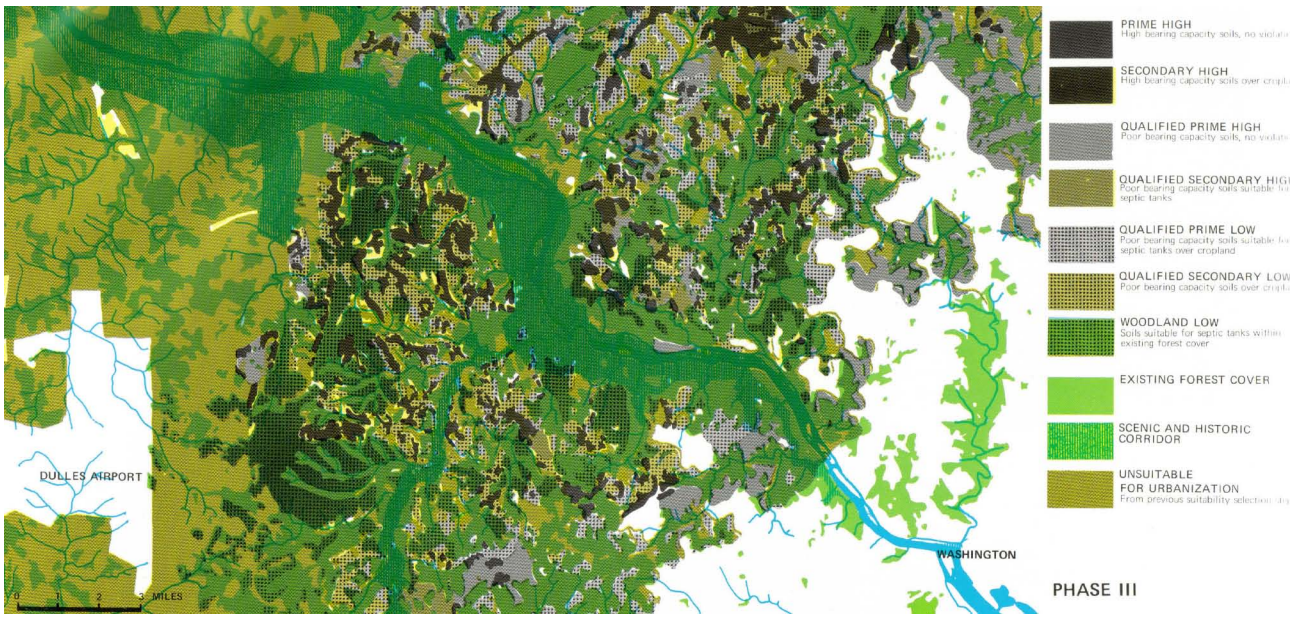

Figure 6. Wallace, McHarg, Roberts and Todd, Urban Suitability Selection Process: Phase III Map for AIA Task Force on the Potomac, 1969

McHarg's overlay mapping technique was used to allocate land-uses on the basis of land suitability, based on geomorphological and soils data.

methods used in landscape architecture. In landscape architecture the dominant method of such planning at the time was Ian Mc Harg's overlay mapping.

A pivotal figure the development of landscape urbanism and the process discourse in landscape architecture, Ian McHarg brought ecology and science into mainstream landscape-architecture practice. While he was operating before postmodernism, his mapping method was transformed by his students Corner and Mathur in the wake of Parc de la Villette competition (the significance of which is noted by Corner in the quote above) and their contribution was immediately influential in the development of landscape urbanism.

McHarg was a Scottish émigré who studied architecture under Walter Gropius and Marcel Breuer at the Harvard Graduate School of Design in the immediate post-war period. Subsequently, he became a professor of landscape architecture at the University of Pennsylvania, at the same time as Louis Kahn and Edmund Bacon, where he was the head of the landscape architecture and regional planning programs. McHarg's major contribution was *Design with Nature*, a seminal text that contained a strong environmental polemic with a practical method showing how environmental information could be incorporated into landscape practice by using overlay mapping (Figure 6). This spawned landscape planning, a sub-discipline of landscape architecture.[112]He was an influential educator who championed the emerging discipline of ecology, and a number of his students went on to undertake pioneering research concerning ecology, including Anne Whiston Spirn, whose book *Granite Garden* was an innovative reconsideration of the city environment in ecological terms,[113] and Lyn Marguilis, who developed the Gaia hypothesis with James Lovelock that the earth could be

112 Ian L Mc Harg, *Design with Nature* (New York: The Natural History Press, 1969).

113 Spirn, *The Granite Garden: Urban Nature and Human Design*.

modelled on a living organism.[114] McHarg's environmentalism was contemporaneous with Rachel Carson's *Silent Spring,* which documented the movement of chemicals into the food chain and also Paul Ehrlich's projections about the catastrophic consequences of population growth.

In an essay on McHarg's science, Susan Herrington notes that while McHarg did not invent the map overlay, "it is consistently attributed to McHarg's ecological method".[115] Herrington cites the use of similar techniques by nineteenth-century epidemiologists and also by American landscape architect Warren Manning in the 1920s. Nonetheless, Herrington concedes that "he certainly championed it as no other individual before him".[116] McHarg's method also influenced Geographic Information Systems (GIS), technology that uses computer mapping linked to a database of information, which he was very enthusiastic about prior to his death. McHarg's use of mapping informed by geographic data ostensibly grounded landscape design decisions, though Herrington is critical of McHarg's assertion that his overlay mapping technique was objective and that its use allowed design to become defensible.

In the context of the process discourse, as well as introducing the map-overlay technique to landscape architecture, McHarg developed the authority of science in landscape architecture; as his student Spirn notes:

> When McHarg calls ecology "not only an explanation but a command" he conflates ecology as a science (a way of describing the world), ecology as a cause (a mandate for moral action), and ecology as an aesthetic (a norm for beauty).[117]

This sense of ecological command is perhaps McHarg's greatest legacy, and even as postmodern critiques of representation sought to distance themselves from this kind of naturalism, the absolute mandate of science in landscape architecture was introduced and, I would argue, remains fundamental to the profession. Indeed, it could be argued that the contemporary relevance of landscape architecture is only guaranteed by its ecological rationale and use of scientific fact. Herrington suggests that McHarg was influential on the development of landscape urbanism which must (paraphrasing Richard Weller), "conjoin the rigor and conviction characterising McHarg's ecological method with the exquisite imagery and theoretical sophistication that defines Corner's work".[118]

In contrast to the process discourse in architecture—which treated design-generation methods as transparent—in the mid-1990s, a self-consciousness about mapping was developing in landscape architecture. Through the filter of postmodernism, James Corner applied a critique of representation

---

114 Margulis was one of the editors of *Ian McHarg: Conversations with Students* (Lynn Margulis, James Corner, and Brian Hawthorne, eds., *Ian Mcharg: Conversations with Students* (New York: Princeton Architecture Press, 2007).)

115 Susan Herrington, "The Nature of Ian Mcharg's Science," *Landscape Journal* 29, no. 1-10 (2010): 6.

116 Ibid.

117 Anne Whiston Spirn, "'Ian Mcharg, Landscape Architecture and Environmentalism: Ideas and Methods in Context," in *Environmentalism in Landscape Architecture*, ed. Michel Conan (Washington DC: Dumbarton Oaks, 2000), 112.

118 Herrington, "The Nature of Ian Mcharg's Science," 8.

to McHarg's mapping operations, effectively bridging the architectural and landscape discourses. Corner brought aspects of design-generation discourse from architecture into the landscape-planning framework established by McHarg.

Corner's essay "The Agency of Mapping" sets forth a critique of the map that allowed it to both become a site for design as well as a tool for working with processes in time. The basis of this critique focused on the map's eidetic quality, that is, their ability to describe something in representation as evocatively as the real.[119] However, the map is not neutral in what it shows, as the comment "the map is not the territory" demonstrates.[120] The selective quality of maps—showing some things and hiding others—was a common critique of the time, made also by Corner, who noted the political effects of maps. When Corner asserted the agency of the map, he chose to utilise this bias through design, reversing this selectivity: "The analogous-abstract character of the map surface means that it is doubly projective: it both captures the projected elements off the ground and projects back a variety of effects through use."[121] As I suggested in the introduction and will further consider in Chapter 6, the word "effect" presupposes a cause. Cause and effect is process terminology, and by describing a map on the basis of use, Corner engenders the map with a sense of time.

This selectivity of the map emphasises that it is the result of a drawing process, since the map is an interpretation of the site by the drawer. The propositional potential of the map is thus also tied to its production by a technique and it is this aspect that Corner uses to bring in discussion of Parc de la Villette's layering technique. However, when he discusses "mapping" he does not focus on drawing technique; rather, he emphasises the curatorial, interpretive technique. In so doing, he refers to the real-time aspect of making maps, and gives the map a sense of process. He then deemphasises this real process after having transferred this quality to other arguments for the map as a tool.

As well as being a landscape-architectural route into design-generation discourse, the sense of the map as simultaneously analytical and propositional opened up a type of mapping enquiry that proved productive to a number of other Penn graduates, including Mathur, Alan Berger, and Charles Waldheim. I refer to this work as "propositional geography" since much of it comprises drawings that hybridise specific maps with other types of drawings in order to focus on readings of particular places or types of landscapes.

Notable among these is *Mississippi Floods*, a book by Mathur and Dilip de Cunha, which aims

to portray a working landscape, [in order to] bring forth from behind the scenes the body of a nation (the expression used by Mark Twain to describe the Mississippi River), the everyday practices that

119 Recalling Jean Baurillard's notion of the simulacra, the copy is more true than the original.

120 Gregory Bateson, *Man and Nature: A Necessary Unity* (London: Fontana, 1979), 37. Bateson suggests that Alfred Korzybski "made [this princple]famous".

121 Corner, "The Agency of Mapping: Speculation, Critique and Intervention," 215.

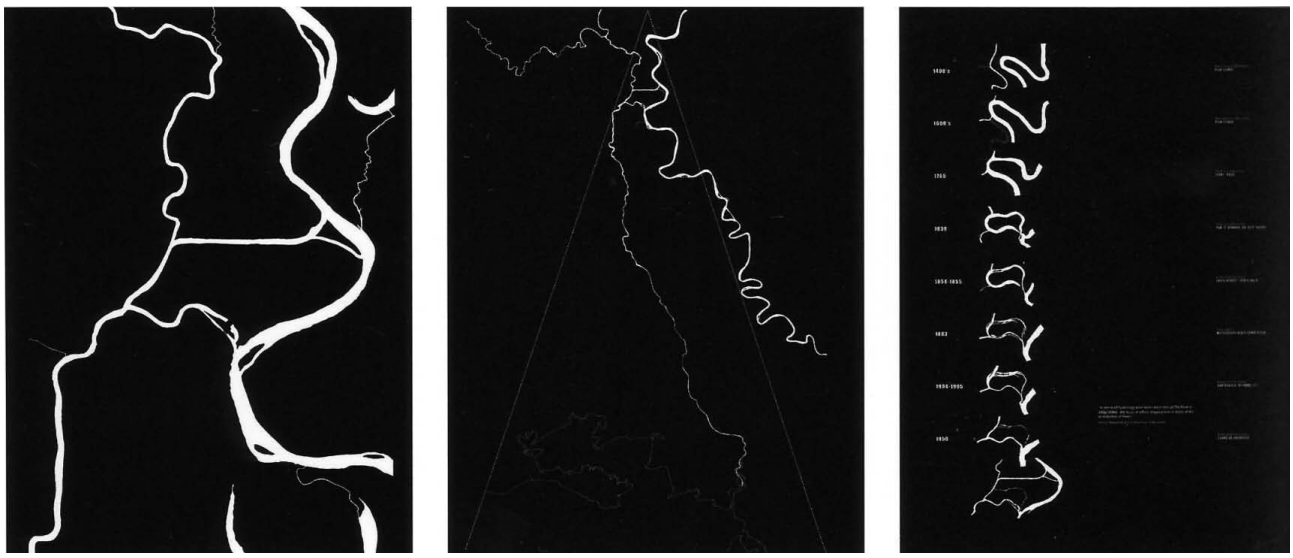

Figure 7. Anu Mathur and Dilip de Cunha, Oxbow Mapping of Mississippi River, 2001
Mathur and de Cunha map changes in the Mississippi River's shape over time due to flooding. This form of speculative mapping is characteristic of "propositional geography".

contribute to the construction of the Lower Mississippi, and, more specifically, the images that play a role in the process of designing this landscape.[122]

The book is based on a trip the pair took in 1996, where they gathered together numerous images of the uses of the river, which they combined with their own mappings to illustrate a thoroughly researched text on the river's dynamics (Figure 7). Mathur and de Cunha sought to "cultivate a critical public" by using "images that are projective rather than descriptive, and (whose) truth lies not merely in what they portray but also in what they leave out", which mirrors Corner's comments on maps.[123]

Corner's original book *Taking Measures Across the American Landscape*,[124] Berger's *Reclaiming the American West*,[125] and *Mississippi Floods* all attempt to map particular processes that form the landscape, notably human processes that have geographic effects. Considering how the critique of maps' selectivity has been turned into a positive attribute, it's unsurprising that the static quality of the map is being used to describe the dynamism of time. This is done through the use of a model of process where form is the result of process, and where to represent a form is also to represent a process. This relationship of form to process is consistent with other parts of the process discourse, particularly approaches that derive architectural form through the modelling of quantitative information using algorithms.

122 Anuradha Mathur and Dillip de Cunha, *Mississippi Floods: Designing a Shifting Landscape* (Yale University Press: New Haven, 2001), 6.

123 Ibid., 8.

124 James Corner and Alex S MacLean, *Taking Measures across the American Landscape* (New Haven: Yale University Press, 1996).

125 Alan Berger, *Reclaiming the American West* (New York: Princeton Architectural Press, 2002).

2.4 Algorithm

In this section, I will discuss the next iteration of the process discourse developed from layering: the algorithm. This is still the dominant design-generation approach and will most likely continue to be so because most computer modelling software is moving towards using algorithms that allow geometry to be associative. In this section, I argue that the self-conscious cultural use of design process has been lost and replaced by an automatist model, driven by the computer. It will be argued that while, on the one hand, this has allowed a flowering of process-based projects to emerge because of the ability to visualise process, on the other, the real agency of the processes is questionable because they simply simulate change.

The *Oxford English Dictionary* says algorithms are "a process or set of rules to be followed in calculations"—formulas into which specific information can be inserted that produce specific, but patterned, relationships. If layering used mapping as both an analogous design-generation process as well as a registration of processes in the world, then the algorithm uses mathematical relationships to capture processes. Like mapping processes, which gain legitimacy by being seemingly quantitative, algorithmic processes gain legitimacy through their use of maths. In effect, visualising an algorithm is to directly visualise relationships between information.[126] Within the process discourse, visualising information as a process has been called "datascape". An early instance of datascape appears in the OMA scheme for Parc de la Villette,[127] and was continued by former OMA employees such as those who formed the architectural practice MVRDV (Winy Maas and Jacob van Rijs), which I will discuss below.

Both Tschumi's and OMA's scheme had a "points" layer as a way of distributing and de-aggregating functional program. Described as "confetti", Koolhaas's system accommodated kiosks, playgrounds, sales kiosks, refreshment bars and picnic areas, distributing them across the site in a number of different point grids, each generated autonomously for each program, which sought to give a desirable frequency for a certain activity. The frequency calculation divides a total area of single program a (such as kiosks) into a certain number of occurrences x (i.e., the number of kiosks) over a certain total area of space A (the area of the park, or subsections of it).

$$\sqrt{\frac{A-a}{x}}$$

Using a mathematical algorithm to distribute form in this way was an important contribution to design-generation methodology, because it suggested that ". . . 'design' should therefore

126 An interest, almost a fetish, in the graphic representation continues to be a precoccupation of the process discourse, and the work of Edward Tufte's has been an important precedent (Edward Tufte, *The Visual Display of Quantitative Information* (Cheshire, Conneticut: Graphics Press, 1983).)

127 Charles Jencks, *The New Paradigm in Architecture: The Language of Post-Modernism* (New Haven: Yale University Press, 2002), 181. Jencks also suggests that OMA's Parc de la Villette competition entry was an important precedent for later datascape projects: "No one knew what the functions of this urban landscape in Paris would be in detail, but the statistics generated a *datascape* [my emphasis] of five different assumptions. A method of functional invention, this became *the* model for many subsequent architects, and it mixed repetition and differentiation at their extremes."

be the proposition of a 'method' that combines architectural specificity with programmatic indeterminacy".[128]

While the plans may have been generated from material that gave them a peculiar non-compositional character, for both schemes the prioritisation of certain geometry in the editing process meant that judgment was required and that in some sense, the outcome was still compositional. It is telling that describing design as compositional had become a negative judgment. This demonstrates a cultural change where a distinction between subjectivity and objectivity had developed. This was symptomatic of an increase in empiricism in architecture. In the pre-digital or the early digital period, real automatism of design generation—where a form could be literally produced by the computer from input data—was not possible, so the computer would be used to effectively simulate an process that exhibited automatism (i.e., using a computer to help pretend what a computer should be able to do). It is only since the advent of animation software, scripting, and parametric tools that real computer-generated form has been possible. The way that OMA used the algorithm set a precedent for these kinds of methods, and is one of the reasons that the un-built project received such prominence. While OMA used an editing process like Tschumi, it retained a sense of non-compositional automatism, while Tschumi's grid, juxtaposed against the serpentine strip, still appeared clearly figurative. Thus, despite the process, the sense that the decisions were driven compositionally makes the outcome seem compositional, which deprioritises the process. In short, OMA's scheme introduced the notion that if a process is used, the outcome should look like it was produced automatically, even if it was a carefully tailored aesthetic that drove the selection of the process itself.

In *Content*, OMA hypothetically lodges a series of patents where "OMA stakes its claim for eternity" of ideas that otherwise would "emerge, inspire and (be) conveniently forgotten".[129] These patents indicate OMA's influence in the developing process discourse, since rather than being for objects, all the patents are for design-generation methods gathered under the title of "Universal Moderniser Patent". The Parc de la Villette's "Social Condenser" from 1982 is the first patent included, with its program distribution algorithm used to "distribute recurrent obligations mathematically across the site in intervals dictated by need".[130]

These patents can be seen as OMA's attempt to claim their own innovation in relation to both their protégés (Maas and van Rijs) who had left OMA to start their own practice, and also to other practices who adopted its methods. Perhaps the most influential of these was MVRDV, who are regarded as the creators of the "datascape". Richard Weller quotes Bart Lootsma on datascaping, who describes it as the "visual representation of all the measurable forces that may influence the work of the architect or even steer and regulate it".[131] On the one hand, Weller critiques datascape

128 Jacques Lucan, ed. *Rem Koolhaas Oma* (New York: Princeton Architectural Press, 1991), 76.

129 Rem Koolhaas, ed. *Content* (Cologne: Taschen, 2004), 73.

130 Ibid.

131 Richard Weller, "An Art of Instrumentality: Thinking through Landscape Urbanism," in *The Landscape Urbanism Reader*, ed. Charles Waldheim (New York: Princeton Architectural Press, 2006), 81.

Figure 8. MVRDV, Metacity/Datatown, 1998
Datascape maps statistical information, and occasionally is used to create three-dimensional visualisations of the information that suggest form.

and the way architects use of data to persuade commercial and bureaucratic forces, because in both, the "subjectivities of the designer can be embedded in seemingly objective data".[132] On the other hand, he suggests that by "deferring a preconceived design outcome, datascaping actively embraces restrictions and regulations", which seems to contradict this critique.[133]

In *Reading MVRDV*, Lootsma writes about MVRDV's datascape approach, describing how they model constraints, such as planning codes (Figure 8), and notes that "no one can deny that the forces the datascapes visualise actually exist", although he is careful to also caution against taking the datscapes literally.[134] Lootsma here is treating the representation as neutral and confusing visualisation, for existence. If the datascape is the visualisation of the effects of forces, then the world as it exists is a visualisation of the forces already. If the datascape makes these forces visible in a different way to the real, then it does so in a less specific way than the real does. If we consider MVRDV's role in the development of the process discourse, it is clear that data is being used to give design a certain defensibility, to give it a numerical definitiveness. Lootsma defends this approach as being an earnest attempt to give voice to decision-making factors in the democratic, capitalist world in such a way that participants can make an informed decision, understanding alternatives. As such, Lootsma defines MVRDV's approach as didactic.

This proposition of the didactic nature of datascape is repeatedly qualified in opposition to misreading its formal nature, which nevertheless ends up being formal because it is the resemblance of the project to the data that causes the method to be discussed as a design technique. Discussing MVRDV's proposal for Metacity Datatown, Lootsma describes a process whereby the visualisations of potential development scenarios are able to be judged. If we consider his earlier proposition—that datascape visualises invisible forces—then we can see that simply spatialising these things places them within the frame of the formal, and asks that we see these forces that otherwise might have a multi-sensory or multifactorial relationship, in formal terms. Lootsma alludes to this when he notes that inhabitants in Datatown may "make political choices on such a scale that they might even become ideological choices".[135] I argue that, at a certain point, quantities become qualities, such as

132 Weller suggests that the way that architects use data in datascape parallels the way that landscape architects use Kevin Lynch–style site planning methods to legitimate site designs.

133 Weller, "An Art of Instrumentality: Thinking through Landscape Urbanism," 81.

134 Bart Lootsma, "What Is (Really) to Be Done?," in *Reading MVRDV*, ed. V Patteeuw (Rotterdam: NAi Publishers, 2003), 31.

135 Ibid., 45.

when Lootsma proposes that the way that MVRDV dislodge architectural language to use quantities is as an "intermediate language between other languages".[136] Lootsma also notes the inherent fascination of quantities at this scale in Maas from MVRDV's recognition that these quantitative models resemble utopias that he too would like to design.

While MVRDV may have used their datscapes to model forces for didactic purposes, in design, MVRDV form a link in a chain of *a priori* use of quantitative models that this I argue has resulted in data modelling becoming a formal language in itself for architecture, removed from the causal relations that govern its selection and processing. This is an aesthetic with the quality of flux and forces measured in time, even though the objects it generates are ostensibly static.

The process discourse in landscape architecture has centred on landscape urbanism, which is largely an architectural creation.[137] Two major books on landscape urbanism demonstrate the primary strands that have comprised it since the term's inception in the late 1990s[138]: Mohsen Mostafavi and Ciro Najle's edited *Landscape Urbanism: A Manual for the Machinic Landscape* and Charles Waldheim's edited *The Landscape Urbanism Reader*.[139] These two strands differ around the way that process is used; the former takes a more design-generational approach to process (as one could imagine from the AA's role in the development of the process discourse, described in the previous "Layering" section), while Waldheim's use of the term is more like a description of a way of thinking, and less about particular formal landscape outcomes.[140]

The addition by datascape of "scape" to "data" demonstrates that landscape has become important to architects, who "use the word landscape more than Americans use the word fuck", as Maas from MVRDV would say.[141] This brings into question what constitutes landscape for landscape

136 Ibid., 35. An example of this might be where water molecules aggregated together in a sea have a quantity that is measurable but begin, at that scale, to have qualities that resemble the sublime.

137 The "Landscape Urbanism" course at the Architectural Association is run by and for architects (previous architectural studies are required) and is not recognised by the Landscape Institute. Similarly, Charles Waldheim trained as an architect originally. This dissertation would argue that landscape urbanism fits more neatly into models of the architectural avant-garde than it does into landscape architecture. Nonetheless, leading American landscape architecture schools, including the University of Pennsylvania and Harvard GSD (where Mostafavi is now dean and Waldheim head of landscape architecture), are seizing on this architectural model of landscape, which this dissertation would argue is to the detriment of the discipline, as it jettisons its traditional bases, for example in plants.

138 The origin of the term "landscape urbanism" is, informally, a hot topic of conjecture: Beth Meyer from University of Virginia suggests that Peter Connolly coined the term in the mid-1990s at RMIT, and, while I did hear it then, I heard it first from Rene van de Velde, who used it to describe the Dutch approach to landscape. I would suggest that Waldheim can claim the title since his conference and academic program at the University of Illinois at Chicago from 1996 used this title.

139 Mohsen Mostafavi and Ciro Najle, eds., *Landscape Urbanism: A Manual for the Machinic Landscape* (London: AA Publications, 2003). & Charles Waldheim, ed. *The Landscape Urbanism Reader* (New York: Princeton Architectural Press, 2006).

140 Of much greater importance for the rethinking of landscape that led to landscape urbanism was Corner's *Recovering Landscape,* which had all the seeds of what was to come but was, at that stage, unbranded. James Corner, ed. *Recovering Landscape : Essays in Contemporary Landscape Architecture* (Sparks, NV: Princeton Architectural Press, 1999).When I talked to James Corner and Anu Mathur at Penn, they were quick to distance themselves from the term "landscape urbanism", which they recognised as being associated with the "Work at Landscape Urbanism" course at the AA. Considering that Mostafavi and Waldheim are both currently at Harvard indicates that this distinction may be dissapearing.

141 This is perhaps the *most* pervasive quote about landscape in architecture, but I have been unable to find its origin.

urbanism. I will discuss three options: landscape as urbanism; landscape as medium; and landscape as simulation of process. I argue in this dissertation that the process character of the landscape, which is sharply opposed to the characterisation of architecture as static, has attracted architects to landscape. Furthermore, for both, there is a fluctuation in how "landscape" is used; alternately seen as a process (whereby "landscape" is a verb), or as an object or substance (whereby "landscape" is a noun).

"Landscape urbanism" conjoins "landscape" to the existing architectural conception of "urbanism". Both the AA and Waldheim versions of landscape urbanism share a sense that urbanism is now a landscape; for example, Waldheim quotes architect Stan Allan, who states that "landscape is not only a formal model of urbanism today, but perhaps more importantly, a model for process".[142] The addition of landscape to urbanism recognises that urbanism, like landscape, is a process, from which the physical urban landscape results, but also that the physical landscape will continue to be dominated by the urban.

If we think of this process character in relation to the urban landscape, then it is the aggregate of both natural and artificial forces. Landscape urbanism has made these two types of process equivalent because it treats ecology as not necessarily about nature but as a series of relationships and communication flows. Taken like this, ecology has been extended to be a way of describing other urban processes, particularly infrastructural ones.[143]Alex Wall's essay in *Recovering Landscape*, entitled "Programming the Urban Surface", contains all the seeds of landscape urbanism and describes the city in terms of a network of processes.[144]

When Wall proposes that because "all things come together on the ground", he suggests that landscape has become a generic surface; a receptacle for everything.[145] In this new formulation, landscape's relation to nature becomes confused. Weller states that "all at once the contemporary city is landscape . . . positioning the city as no longer in dialectic with nature but . . . naturaliz(ing) everything humans make in the world".[146] While the landscape may be a model arising from nature, treated like this, nature becomes simply science, and, to operate in relationship to it is to operate simply instrumentally, as indicated by Weller's title: "An Art of Instrumentality". I propose that this view is in fact a denaturing, since specific natural landscape processes, such as fungal processes, become indistinguishable from artificial processes. Ecology has become an algorithm. Treating ecology like this mistakes representations for the properties of landscapes, which are understood as generic empty containers; cybernetic frameworks drawn from ecology but emptied of their naturalness, organic drive, and specificity.

Wall writes that "*Landscape* . . . evokes the functioning matrix of connective tissue that organizes not only objects but also the dynamic processes and events that move through them"; his use

142 Waldheim, "Landscape as Urbanism," 39.
143 The process discourse is fascinated with infrastructure for its muscularity.
144 Wall, "Programming the Urban Surface."
145 Ibid., 244.
146 Weller, "An Art of Instrumentality: Thinking through Landscape Urbanism," 78.

of "matrix" reveals that systems have an implicit universal geometry of connection.[147] This algorithmic approach seems to characterise the AA's landscape urbanism program as demonstrated in its *Manual for the Machinic Landscape*.[148] Writing nearly ten years prior, Elizabeth Meyer used the term "landscape cyborg" to recognise the machinic and working potential of landscape, which "establishes a continuum within the world of living things . . . it places humans and their actions within the non-human world, breaking down the subject-object relationship of man and nature".[149] Unlike the landscape urbanism definition, Meyer's landscape cyborg is both natural and artificial since it arises from a critique of the binary opposition of the two, and as such does not rely purely on science to describe the relationship.[150] Since her term was coined in the period of post-structuralism, Meyer's sense of knowing landscape recognises that the relationship between the two is really a relationship between domains of knowledge, an approach reminiscent of Michel Foucault in *The Order of Things*, and in the work of Michel Serres.[151]

Turning to landscape as medium, for Ciro Najle, the landscape is a "machinic *medium*" that "segregates domains by installing itself before the physical".[152] Paraphrasing Najle, the landscape segregates because it is the infrastructure or foundation upon which everything rests and as such also precedes that which rests on it. This is an active process because the foundation is an infrastructure, which, while not seeming active, is nonetheless implicated in that which comes after it, which rests on it. This corresponds to a definition of medium in the *Oxford English Dictionary* as "an agency or means of doing something" more than as "the material or form used by an artist, composer, or writer".

"Medium specificity" was the term Clement Greenberg coined when he reformulated modern painting's relationship to the canvas, whereby "the two-dimensional support that defines painting as a medium required its artisans to conquer the drumhead flatness of wall . . . a little fictive space in which so many figurative presences could be placed like actors".[153] Najle's "medium" resembles Greenberg's "medium specificity" because his assertion of the inherent trajectory of its infrastructural nature mirrors Greenberg's rule of medium as its automatism, which is a conception of it as a series of materialist laws. Just as in the previous discussion of landscape as a denatured field, "Greenberg saw Modernism's acknowledgement of its medium as some form of materialist objectivity that this kind of painting shared with contemporary science", a critique that parallels my

147 Wall, "Programming the Urban Surface," 233.

148 Ciro Najle, "System," in *Landscape Urbanism: A Manual for the Machinic Landscape*, ed. Mohsen Mostafavi and Ciro Najle (London: AA Publications, 2003), 63.

149 Elizabeth K Meyer, "Landscape Architecture as Modern *Other* and Post-Modern *Ground*," in *The Culture of Landscape Architecture*, ed. Harriet Edquist and Vanessa Bird (Melbourne: EDGE Publishing Committee, 1994), 26.

150 Meyer's definition is reminiscent of the way that Michel Serres talks about science, as well as Bruno Latour (see the introduction)

151 Michel Foucault, *The Order of Things: An Archaeology of the Human Sciences* (New York: Vintage Books, 1973). & Serres, *The Birth of Physics*. Bruno Latour, discussed in the introduction, builds on the work of Serres in particular.

152 Najle, "Medium," 39. Original emphasis.

153 Rosalind Krauss, *Under Blue Cup* (Cambridge, Massachusetts: MIT Press, 2011), 4.

critique of the scientism of the process discourse, where the painting's material surface "function[s] as an analogue for positivist science's continuous space of fact".[154]

In her recent book, which focuses on the relationship between medium and memory, *Under Blue Cup*, Rosalind Krauss discusses film writer Stanley Cavell's critique of Greenberg's *Modernist Painting*. She quotes Cavell, noting that "modernist art, investigating its own physical basis, searching out its own conditions of existence, rediscovers the fact that that its own existence is not physically assured".[155] She proposes that her model of "the medium is the memory . . . insists on the power of the medium to hold the efforts of the forebears of a specific genre in reserve for the present".[156] This model, and the one I offer in this dissertation, is similar to that which *Art since 1900* proposes exists between what it calls "process art" and medium, which were, according to Richard Serra, about a "logic of materials", or to Robert Morris, an "order of making behavior".[157] *Art since 1900* notes that, for process, "the first imperative . . . was to overcome the traditional oppositions of form and content and of end and means [which could characterise the paranoia of the process discourse]—to reveal the process of the work in the product, indeed *as* the product".[158]

In opposition to Najle's machinic medium, Krauss's proposition of the medium-is-the memory corresponds to Meyer's characterisation of the "figured ground which aims to restore the earth's undulating corporeality".[159] This is a reminder that ground is different to surface;[160] it is imbued with deep time in geomorphological terms, and should not be treated as simply an abstract, mathematical surface. Krauss contrasts "Greenberg's specificity [which] is empirically tied to a physical substance", from her own approach in *Under a Blue Cap*, which is "focused on the rules of the guild".[161] Krauss proposes that material is "a logical support [which] can substitute itself for a physical substance in founding the rules for a medium".[162]

Returning to the definition of landscape as medium, it's clear that for Najle, the medium is a process, and so is both verb and noun. This sense is closer to Greenberg's than Krauss's, the former seeing the process of painting as an empirical relationship to the true nature of the substance—a deployment perhaps, while for the latter, painting is a material act tied to a historically and experientially embedded practice. This qualification mirrors my interest in the relationship between material and practices, rather than simply in isolated processes.

In *Manual for the Machinic Landscape*, Najle's text is followed by student folios; for example, in the "Medium" section, a number of projects feature topographic manipulation based on sensed information from sites that parallel Krauss's characterisation of medium as empirical. In Roxana

154 Hal Foster et al., eds., *Art since 1900* (London: Thames & Hudson, 2004), 441.
155 Krauss, *Under Blue Cup*, 79.
156 Ibid., 127.
157 Foster et al., *Art since 1900*, 534.
158 Ibid., 535.
159 Meyer, "Landscape Architecture as Modern *Other* and Post-Modern *Ground*.", 21
160 I am thinking of here of topological projects like FOA's Yokohama Port Terminal.
161 Krauss, *Under Blue Cup*, 7.
162 Ibid., 17.

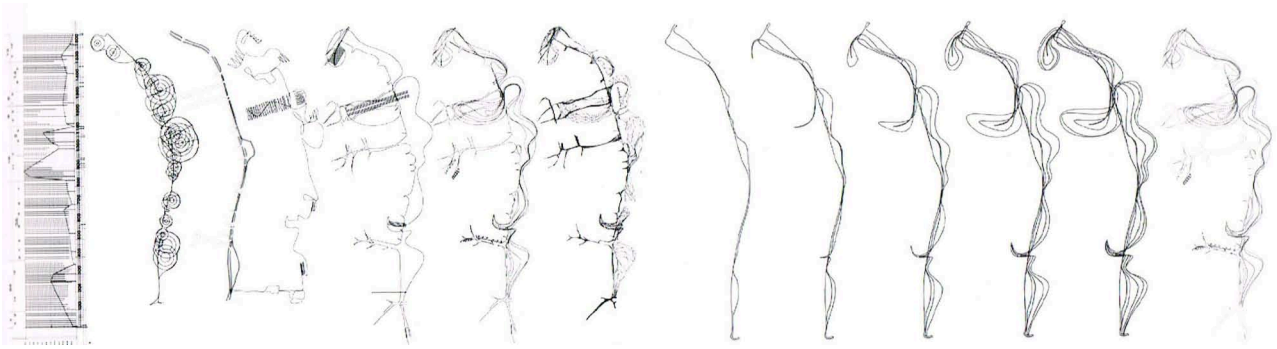

Figure 9. Roxana Scorelli, Urban Excess/River Access project, 2003
Using urban information, the topography is manipulated by "sedimenting" the data, demonstrating how ephemeral information from one field becomes concrete in forming another.

Scorelli's project, the natural process of sedimentation becomes an analogy for the collection of data, mapped and aggregated at the base of roads, which are then graphed to produce a form, which becomes a three-dimensional graph (Figure 9).[163] Here the process of sedimentation, which has a real basis in geographical fluid dynamics, becomes an operational metaphor for design generation. In Jose Parral's project "Art Land", vehicle speeds and view sheds are mapped and then used to manipulate the topography to reorganise roads (Figure 10).[164] In all these examples, the central property of a medium is generic plasticity, with topography treated as topology rather than Meyer's "figured ground".

Having established that Najle's medium of landscape is a closer to modernist account of medium specificity that is inherently empirical, it is unsurprising that student work used to illustrate the section focuses on the metrics of measuring urban processes. This brings us to the third model of landscape, which is landscape as virtual simulation of processes.[165] Driven by its desire to reveal hidden systems, this superficial view of site ignores other systems and concrete site features or specificities, such as property ownership or geographical features, limiting information to that which offers abstract potential with computer modelling.

In the section entitled "Context", Najle demonstrates that landscape urbanism's ecology is quite deliberately denatured, "avoiding the simple opposition between environmental and developmental logics[166] Najle reveals his understanding of ecology when he suggests that landscape urbanism is beyond "mere sustainability" by "enhancing and escalating" natural systems through the use of infrastructure suggesting that these systems, if left to themselves, are incapable of performing their function properly. Additionally, Najle suggests that their "evolution" is not fast enough, needing

163 Mostafavi and Najle, *Landscape Urbanism: A Manual for the Machinic Landscape*, 40-41.

164 Ibid., 48-49.

165 As indicated in my discussion of layering, representation is the most theorised area of landscape urbanism (the best of which is Christopher Hight, "Portraying the Urban Landscape: Landscape in Architectural Criticism and Theory, 1960 - Present," in *Landscape Urbanism: A Manual for the Machinic Landscape*, ed. Mohsen Mostafavi and Ciro Najle (London: AA Publications, 2003).) However, it is not the focus of this dissertation. What I am discussing here is the real relationship between the claims of the representations and the processes they represent, not representation per se, which, this dissertation proposes, rather than being the key to processes, has in fact obstructed a real engagement with processes through practices—this is the rationale for the case studies in this dissertation.

166 Ciro Najle, "Context," ibid., 141.

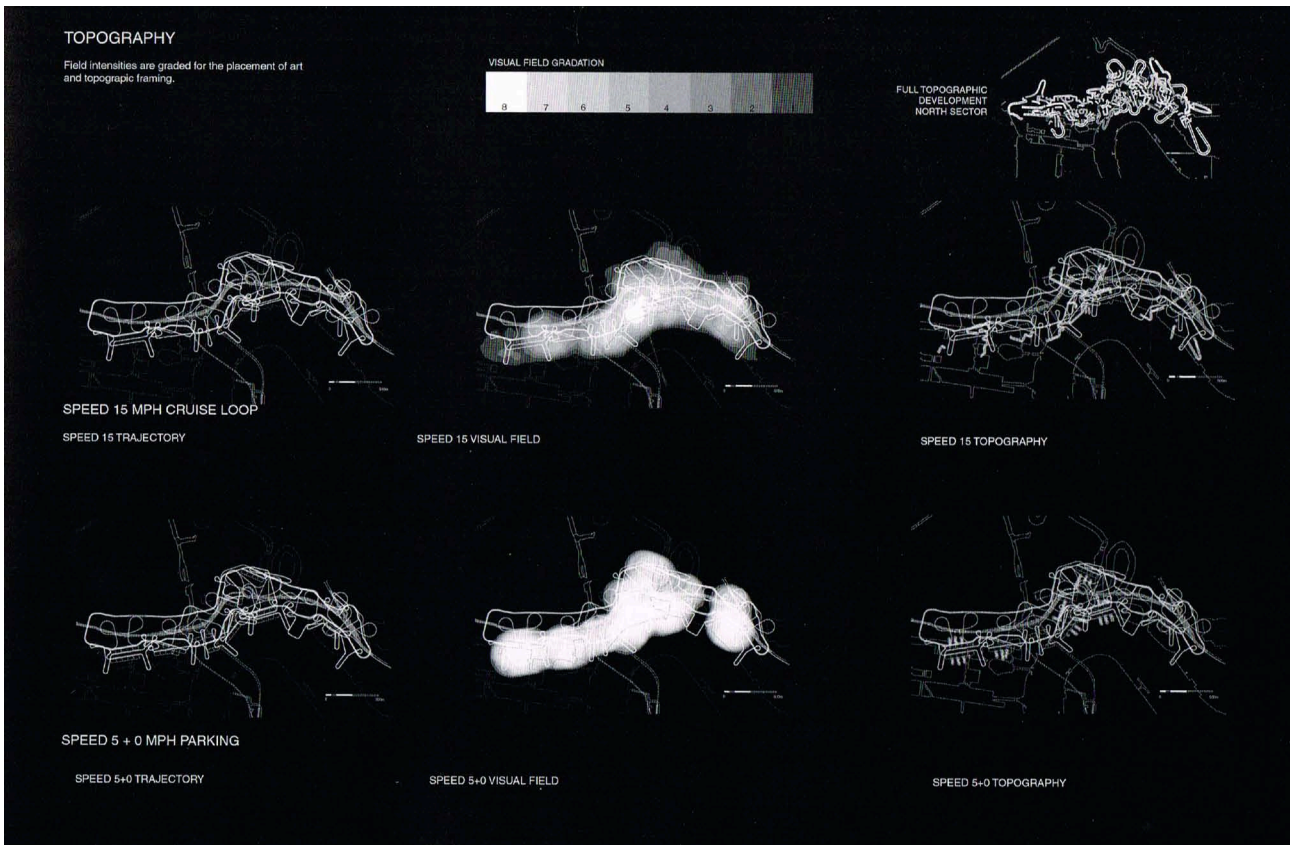

Figure 10. Jose Parral, Artland project, 2003
Taking a datascape approach, Parral, like Scorelli, measures speed of vehicles and uses this information to develop topography.

to be pushed by integrating "the fastest development" with the "highest levels of environmental stress".[167] While it is undoubtedly true that the organic evolves, and systems produce novelty due to stresses, this language reveals a misunderstanding of the length of the cycles of natural systems and shows why the flow properties of human systems are more desirable: because we can see them move. Even while landscape urbanism is obsessed with simulation, it desires the world to resemble its animations rather than recognising the deficiencies in its representations to engage with the slowness or relative speed of natural systems.

Landscape form that results from these mappings tends to then treat the abstract flows of mapped data as sculptural forms. When the geometries become concrete, the lack of understanding of landscape in landscape-architectural terms becomes apparent. This is demonstrated by difficulties with program or use, since propositions have no understanding of landscape types. Street, park, or garden elements are allocated to forms on the basis of their resemblance to the features of the geometry, such as patios allocated to areas, or walls to vertical graphs. Generated by relationships with data, the diverse and complex relationships with populations, politics, and urban dynamics that lead to local public spaces are avoided, leading to potential incongruity of spaces to their locations.[168]

167 Ibid.

168 Even while public space has been problematised and novel types, such as Parc de la Villette or the Highline, have been generated, the logic or precision of strategic location has changed relatively little since the emergence of landscape urbanism.

Continuing with this sense that landscape is a way of working, it's interesting to consider what the implications for practice are for such a view, and how a design proposition is regarded in relation to such simulation processes. In an interview, RUR architect principals Jesse Reiser and Nanako Umemoto were asked how important it is that the forces generating a project be "read and understood" in the final project, to which they suggested:

> it isn't so important for us to show the history of the project as a rational development. . . . The important thing to us would be to have those influences embodied in the project and not simply make them a form of argumentation or description of the process. It doesn't have to be an illustration of those forces . . . at the end it's about the project in terms of its actual effects and not the history of its process.[169]

Implicit in the question and the answer is a recognition that a project's generation is a rationale for it and should be readable in the final outcome. Reiser and Umemoto are quick to note that the effects that the project has in the world are of great significance. Considering that they dissociate the form-generation process from the form as a rationale, the suggestion persists that the form language still has effects, and so the generation is calibrated into it. In the case of RUR, it remains unclear how they literally become dynamic or temporal until later in the interview when they note of a project "the effects of water were directly manipulated" and referred to this as an example of diagrammatic behavior. In this example, it is the nature of the material—water—and its flexibility that make it able to be directly manipulated, and the diagram is unnecessary. In the next sentence, however, they suggest that this diagrammatic behavior is "also carried over into the organisation of other materials like concrete and grass", which they describe as "an indexical relationship between the static form and the flows within it".[170] Whereas water is flexible, here they are using the diagram to figure the grass and concrete and to represent flexibility. This description frames my critique of the process discourse in this dissertation, which is that the majority of projects use processes to give a sense of change and movement, which ends up being an aesthetic quality rather than a tangible effect. Reiser and Umemoto go on to suggest that "if we're talking about transition and the departure from static space, then time becomes a function of spatiality",[171] which is precisely Henri Bergson's critique of scientism. As I will discuss in Chapter 6, Bergson proposes that to map time as movement or change of location is to treat time as space, and argues to treat change as movement rather than novelty, or duration, as he calls it.

In discussing landscape urbanism, I have considered landscape as urbanism, then as medium, and finally as a simulation of process, the latter of which, I propose, is really what landscape is for landscape urbanism. I argue that such process simulations have become ubiquitous because, as landscape and ecology became an analogy for process, ecology has become a denatured container or an algorithm. Moving away from landscape urbanism, ecology-as-algorithm has become a way

169 Jesse Reiser and Nanako Umemoto, "In Conversation with Rur: On Material Logics in Architecture, Landscape and Urbanism " in *Landscape Urbanism: A Manual for the Machinic Landscape* ed. Mohsen Mostafavi and Ciro Najle (London: AA Publications, 2003), 108.

170 Ibid., 109.

171 Ibid., 108.

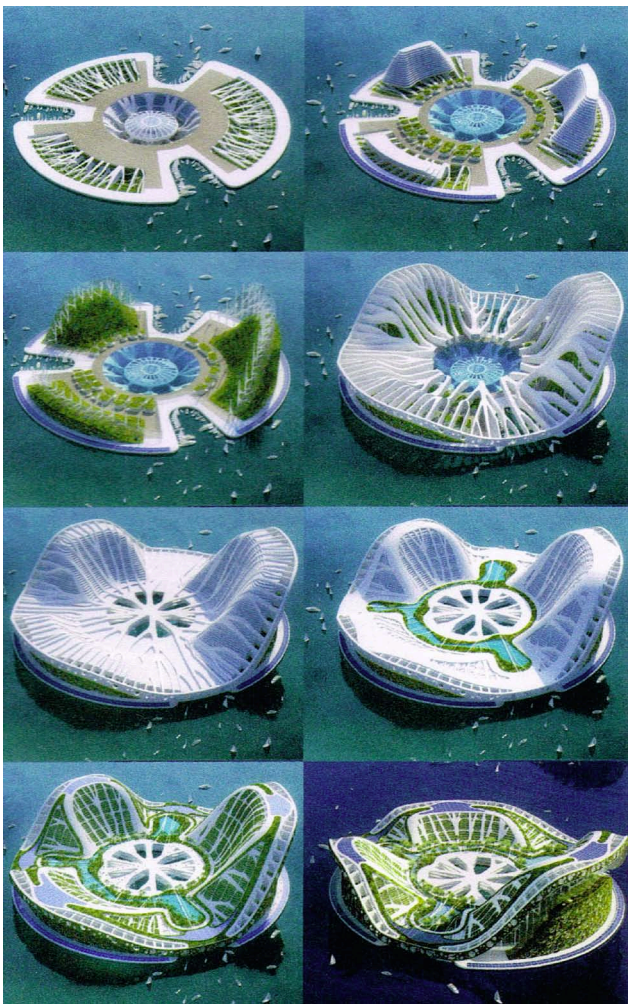

Figure 11. The Why Factory, Giant Water Lilies project, Thailand, 2011

Parametric variables were used to allow the computer model to be modelled iteratively. The opening and closing of a flower was used to develop a changing-roof, solar structure orientated to the light.

of seeing not just systems, but also geometry. In the context of design-generation discourse, process models of geometry systematise geometric relationships in form. I will now discuss two design approaches, parametricism and morphogenesis, where the latter builds on the former. For both approaches, form arises from relationships between data, described via algorithms and visualised using particular software. In this dissertation I argue that, however unconsciously, these approaches fit into the previous discussion about postmodern design-generation practices that linked technique to meaning because they use certain readings of data that have implied value systems. These approaches use the scientific certainty of mathematics to claim naturalness to the tools and the resultant geometry, with an evolutionary rationale in the case of morphogenesis.

The term "parametric" comes from "parameter", which is derived from the Greek *para* (meaning "beside") and *metron* ("measure"). This demonstrates a key feature of the parametric—it concerns the relationship between variables rather than specific numbers, as reflected in the mathematical definition of parameter in the *Oxford English Dictionary* as "a quantity whose value is selected for the particular circumstances and in relation to which other variable quantities may be expressed". Put simply, in the parametric, while positions of elements may change, their relation to other elements stays the same. Such an associative approach[172] to geometry has been extended to describe a way not just a way of designing but also, Patrik Schumacher suggests, as a whole new way of reading the history of architecture.[173] Parametric modelling involves the creation of coded algorithms that direct how the form will result from changes in certain parameters. Multiple elements can be related to each other hierarchically, with different parameters at different levels in the hierarchy so that manipulation at one level can smoothly occur down the hierarchy (Figure 11). In terms of computer modelling,

172 Early drafting software such as AutoCAD used the term "associative" before "parametric" became common. This dissertation would argue that the use of the word "parametric" has resulted from the development of the process discourse.

173 Patrik Schumacher, *The Autopoiesis of Architecture: A New Framework for Architecture* (Chichester: John Wiley and Sons, 2011). Schumacher was one of the founders of the Digital Research Laboratory (DRL) at the AA and works with Zaha Hadid.

parametric modelling was a breakthrough because modelling every single part of a design was no longer required, since once the basic relationships were modelled, broad-brush intuitive actions could allow the whole structure to change. In the construction industry, Building Information Systems (BIM) use parametric methods to allow for materials and construction dimensions to be manipulated simultaneously with overall building form by elements being related to each other. This has been very useful for industry in construction detailing and project documentation.[174]

While the parametric does not have any inherent geometric expression, it has increasingly been treated as a fundamental formal and aesthetic shift for architectural form language. This is demonstrated by Michael Weinstock's suggestion that such parametric approaches represent the "liberation of tectonics from the straightjacket of the orthogonal".[175] In a similar vein, Schumacher notes of the parametric designer that "Their hand would fall off rather than draw straight lines. Is anybody here drawing a triangle, a square, a circle? Ever again? No!"[176] Despite this geometric stylisation, there is more to the parametric; for example, Schumacher notes that "the tools themselves have great potential, but we need to drive these potentials and draw decisive conclusions and give value and direction to the utilisation of these tools". For Schumacher, the parametric is a definitive style, more like design than computer: "That is the difference between a set of techniques and a style, which depends on these techniques, albeit not exclusively, but drives them to a new destiny".[177]

The term "morphogenesis" is defined by the *Oxford English Dictionary* as "the origin and development of morphological characteristics", which refers to the development of an embryo. D'Arcy Wentworth Thompson's *On Growth and Form* was an early work that considered morphogenesis. In it, he sought to demonstrate that "the form of any portion of matter . . . may in all cases alike be described as due to the action of a force",[178] and such forces must be in "conformity with physical and mathematical laws".[179] These forces cause growth and so, while "growth is a somewhat vague matter . . . it deserves to be studied in relation to form".[180] Thompson's account of form and growth was fundamentally parametric, and so it is no surprise that parametric software, combined with algorithmic mathematics, facilitated the modelling of growth.

Morphogenesis has been appropriated by architecture, where architecture is produced through the use of algorithms and where the form literally emerges from the visual modelling of the algorithm. Morphogenesis in architecture uses parametric modelling tools but adds to them an

174 An obvious critique of the parametric in architecture could be similar to the difference between Bergson's difference by degree or kind, because the parametric treats relationships as consistent regardless of scale, which fails to recognise that in design changes in scale can lead to total design reconsideration.

175 Michael Weinstock, "Emergence in Architecture," in *Emergence: Morphogenetic Design Strategies*, ed. Michael Hensel, Achim Menges, and Michael Weinstock (London: Wiley-Academy, 2004), 12.

176 Patrik Schumacher, "Parametricism and the Autopoiesis of Architecture," *Log*, no. 21 (2011).

177 "Parametricism: A New Global Style for Architecture," *Architectural Design* 79, no. 4 (2009): 15. Schumacher refers to it being a "parametric sensibility" as well as a style.

178 D'Arcy Wentworth Thompson, *On Growth and Form* (Cambridge: Cambridge University Press, 1945), 16.

179 Ibid., 15.

180 Ibid.

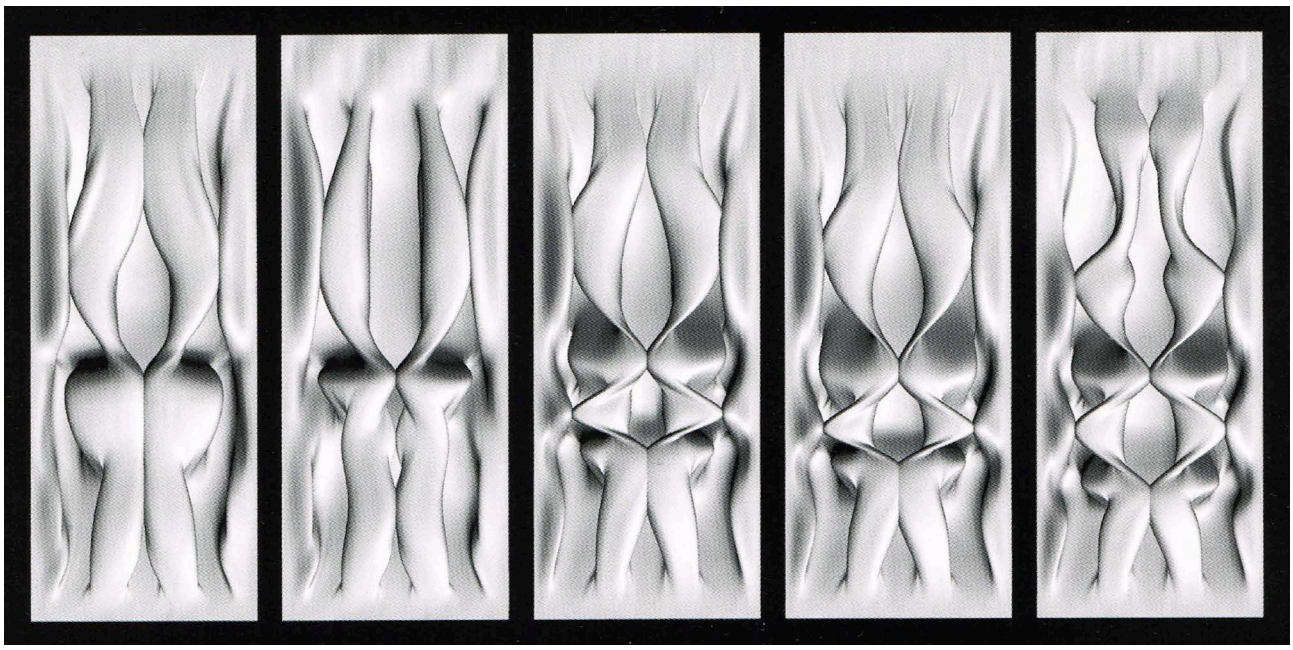

Figure 12. Achim Menges, Landscape Playhouse project, 2004
A surface was generated through digital morphogenesis using an "evolutionary process of local manipulations", shown over five iterations.

evolutionary intention (Figure 12). Key authors and designers interested in morphogenesis are the Emergence and Design Group, from the AA. They use the terms "morphogenesis" and "emergence" interchangeably, despite the former seeming to emphasise form (since it is about morphology), while the latter seems to emphasise process (because it refers to time, since something emerges). Weinstock defines emergence as "the properties of a system that cannot be deduced from its components, something for than the sum of its parts".[181]

It is easy to understand why Weinstock's definition of emergence is useful to architecture, particularly as a way of understanding the natural system context that architecture finds itself in the world as an "explanation of how natural systems have evolved and (been) maintained",[182] but also potentially as a way of describing the urban conditions that develop in cities. Emergence is not simply a way of describing the world, but also provides "a set of models and processes for the creation of artificial systems that are designed to produce forms and complex behaviors, and perhaps real intelligence".[183] Here, Weinstock uses evolution as a rationale for architecture's appropriation of a form language from nature, which, he suggests in his three-pronged rationale of emergence, is already happening but is simply not rigorous enough in the "proliferation of design processes that borrow the appearance of scientific method yet lack their clarity of purpose, mathematical instruments or theoretical integrity".[184] This could be a direct critique of the original design-generation projects from the AA, such as Koolhaas's use of the algorithm at Parc de la Villette that I discussed in the "Layering" section. Weinstock's critique reveals a modernist sensibility, reminiscent of Reyner Banham's review of the integrity of thinking by alleged

181 Weinstock, "Emergence in Architecture," 11.
182 "Morphogenesis and the Mathematics of Emergence," 7.
183 Ibid., 6.
184 "Emergence in Architecture," 12.

"functionalist" architects of the modern movement,[185] particularly when Weinstock proposes morphogenesis in his rationale as enabling "engineering design from a mathematical base".[186]

Weinstock keeps the discussion of architecture firmly on a discussion of morphogenesis in mathematical terms. Since morphogenesis is an evolutionary term, the Darwinian notion of "fit" is used as a descriptor for design, where the best fit is the best design solution. Combined with his suggestion that design generation processes should have scientific rigour, it is clear that morphogenesis seeks to naturalise and de-culture architecture, removing subjective judgment from the inherently judgmental process of design. With the objectivity of the claims made about morphogenesis, emergence, and the parametric disqualified, the rationale for such processes is novel design generation or personal aesthetic and taste predilections.

In his 1972 book *Mind and Nature,* Gregory Bateson talks about "the pattern which connects",[187] which, for him, is the human ability to find patterns. Bateson is regularly used to justify biomimicry, his affiliation to which could be assumed since the book-cover is illustrated with a shell featuring Fibonacci. However, as the title suggests, Bateson was interested in "the parallelism between creative thinking and that vast mental process called *biological evolution*"; instances where we should ask "is this way of looking at the phenomena somehow represented or paralleled within the organisational system of the phenomena themselves?".[188] While humans have evolved to find patterns, and this is part of the same process as the patterns, this ability is, nonetheless, a cultural process. With an interest in psychiatry, Bateson would be more interested in the minds of the protagonists of biomorphism than the natural rationale for what they have produced.

The fact that morphogenesis or emergence is only simulated if it remains computer-based is recognised by parallel research on fabrication, notably at the AA's Design Research Laboratory (DRL). Even when the editors of *Emergence: Morphogenetic Design Strategies* note that "morphogenetic processes for design are not truly evolutionary unless they incorporate iterations of physical modelling", they simply visualise the result of a virtual stage in three dimensions rather than in an image.[189] When they continue "[we cannot] utilise emergence without the inclusion of the self-organising material", they seem to recognise that, for real morphogenesis, the material subject itself, here presumably architecture, must actually change through growth or 'self organisation'. Later in *Emergence*, engineer Chris Wise echoes this when he suggests that rather than being computer-based, he would want the work to be "interactive and instant".[190] Mirroring the argument I put forward in this dissertation—that the gardener is a human participant in a natural process—Wise suggests that the mathematical processes could do with the thought that "the non-rational human brain (brings to) bear".[191]

185 Banham, *Theory and Design in the First Machine Age*. I discussed this in the introduction, where Banham expected functionalist rationales to be expressed in built form.

186 Weinstock, "Emergence in Architecture," 12.

187 Bateson, *Man and Nature: A Necessary Unity*.

188 Ibid., 187.

189 Weinstock, "Morphogenesis and the Mathematics of Emergence," 7.

190 Chris Wise, "Drunk in an Orgy of Technology," ibid., 57.

191 Ibid.

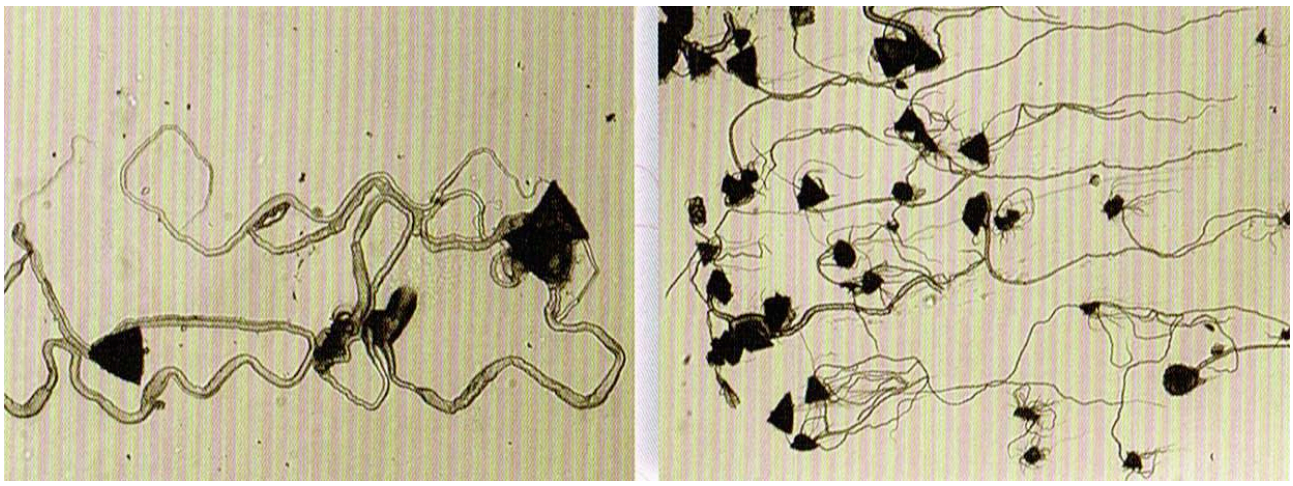

Figure 13. Cronin Group, University of Glasgow, Tubular Architectures, 2009
Inorganic crystal metamorphosis from single crystals to tubular structures that assemble themselves through chemical manipulation.

On the one hand, discussing morphogenesis after landscape urbanism could seem to bring us closer to the subject of the dissertation—change and novelty—however, while the aim is the same for both, I argue that for morphogenesis in architecture, the outcomes are representations of a growth process that is only 'live' in the computer. I will return to this point in detail in Chapter 6, when I will use these precedents from the process discourse to consider what constitutes novelty. Before moving on to real-time projects that involve change in performance rather than simulation, it is worth quickly mentioning an area of morphogenesis that is being considered in the process discourse, which explores literally growing materials called "protocells".

Protocells are "simple chemical models of living cells that possess some of their properties such as metabolism, movement, replication, information, and evolution, but are not necessarily alive" (Figure 13).[192] The rationale for their use in architecture, Hanczyc says, is due to "a clear analogy between synthetic biology and architecture" where

> a system is conceived and then synthesised from the bottom up using modular pieces that assemble or self-assemble into a larger structure which possess functionality and form derived from the structure as a whole but not possessed by the building blocks in themselves.[193]

Protocell architecture is thus parametric. Since my central critique of the process discourse is that since its outcomes are static, it does not engage with real change regardless of its generation, protocell architecture potentially allows architecture to change as the landscape does. However, even when it does, its necessity to have use and static contents leads one to see numerous pragmatic questions, which in turn demonstrate a key difference of landscape to architecture: the context of landscape is change and so all things must in some way respond to it, whereas, for architecture, its use relies on a level of stability to perform, the discipline arguably having developed to buffer such forces.[194]

192 Martin Hanczyc, "Structure and the Synthesis of Life," in *Protocell Architecture*, ed. Neil Spiller and Rachel Armstrong, *Architectural Design* (London: Wiley 2011), 27.

193 Ibid., 57.

194 With Protocell architecture, simple questions like hanging a door that can close demonstrates a level of credibility that is not currently present in this research as architecture.

2.5 Performance

While I have focused on those parts of the process discourse that have been concerned with design generation, there is a stream of the process discourse that resonates with my interest in this dissertation — what I call a "performative" approach. Schemes that use this approach propose and choreograph direct action that produces change, rather than simulating it through design generation. In this section, I will discuss three specific approaches: choreography, installation, and tactics. Choreography is where the subject of design is not an object but an activity happening in time; installation is where something is built that changes over time; and tactics is where a series of actions are proposed that causes something to develop. In discussing each, I will focus on how change as novelty arises, compared to simulation. This section is more succinct than the previous two sections because the case studies that comprise most of the rest of this dissertation demonstrate its points in more depth.

It's pertinent again to start this discussion of choreography with Parc de la Villette, which was also a precedent for the development of performance-based approaches to design in the process discourse. Tschumi wrote in *Event Cities* that "Architecture is as much about the events that take place in spaces as about the spaces themselves".[195] Like the OMA scheme, Tschumi's approach was interested in changing the terms by which "program" or "use" was conceived of, with its "static notions of form and function long favoured by architectural discourse", notably modernism, and to instead replace them by giving "attention to the actions that occur inside and around buildings—to the movement of bodies, to activities, to aspirations".[196] When he talks about movement of bodies in space, Tschumi recalls his design research project undertaken between 1976 and 1981, in which he used a choreographic notational system[197] to describe a fictional encounter between people and space, subsequently published as *The Manhattan Transcripts.*[198] Like the Situationist notion of the *dérive*, where one's aimless wanderings on the basis of their desires are documented after the fact, Tschumi was interested in movement as a type of form, which he then abstracted in design-generation drawings that treated a photograph of a scene as a series of decontextualised, two-dimensional forms.

Event Cities opens with Tschumi's design for a fire-works display at Parc de la Villette, and is accompanied by a quote from Tschumi: "Good architecture must be conceived, erected and burned in vain. The greatest architecture of all is the fireworks."[199] A storyboard that shows the chronological sequence of the fireworks comprises night view, plan, and elevation over time, each calibrated to the other (Figure 14). The plan view shows variations around the actual plan of Parc de

195 Bernard Tschumi, *Event Cities (Praxis)* (Cambridge, Massachusetts: MIT Press, 1994), 13.

196 Ibid.

197 For landscape architecture, an important precedent for a choreographic notational approach was Lawrence Halprin's notational studies that captured peoples uses of spaces over time, informed by the work of his choreographer wife Anna Halprin. (Lawrence Halprin, *The Rsvp Cycles: Creative Processes in the Human Environment* (George Braziller Inc, 1970).). There has been a recent resurgence of interest in Halprin in landscape architecture history circles, which, this dissertation would argue, arises from the process discourse.

198 Bernard Tschumi, *Manhattan Transcripts* (London: Academy Editions, 1981).

199 *Event Cities (Praxis)*, 19.

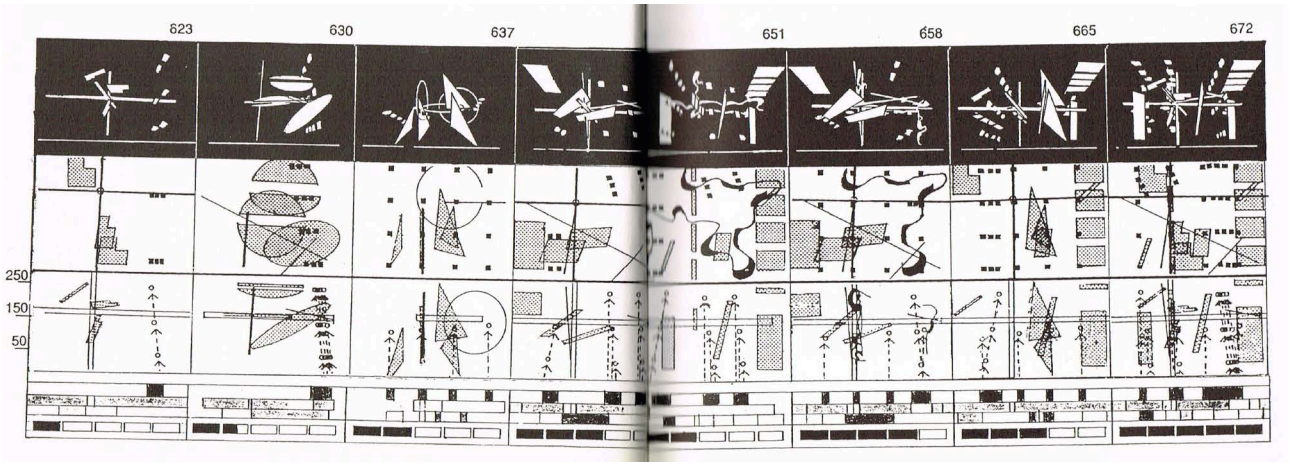

Figure 14. Bernard Tschumi, Parc de la Villette Fireworks, 1992
Tschumi used the same compositional schema for the fireworks as he did for the park, choreographed in real time.

la Villette, moving through the lines, grid, and cinematic strip featured in the design. The use of the plan as the source of the design for the fireworks becomes a documentation of the design-generation process.

While choreographic approaches like this are interested in performance, in terms of change, their approach to time is exactly like an object-based design, because the drawn choreographic process is designed to force the event to resemble the representation, rather than to encourage novelty. Undoubtedly, the effect of the graphic of the plan being created in the sky over time is a dynamic event. This is very different to a drawing, however, because the script specified the sequence, and the opportunities for novelty arose from the effects of the fireworks in the sky and in relation to each other. If not accidental, then these effects do not form a new basis for a transformation of the work, as, for example, if sequenced patterns were used to initiate an improvisational process where the following firework intersected with the effects arising from the last. In a sense, Tschumi's process is one-directional insofar as it radiates from the choreography, rather than feeding back into it. This allows, Bergson would say, difference by degree to occur, as the nature of the environment at that moment causes nuance or qualitative effects that are unpredictable; however, its design seeks to control those effects in order for the initial intention to play out.

While my central critique of the process discourse has been its pursuit of change through simulation, another strand has explored process through the creation of installations. Appropriating the sculptural art form of the installation, notably after the precedent of 1960s' conceptual art and artists, such as Robert Smithson, installation has allowed the otherwise un-built process discourse to build work. Institutional priorities require research output, and for designers with academic affiliations, exhibitions have become popular. The exhibition as a 1:1 outcome satisfies this requirement but without the commitment or long-time frames of the real construction project. Because the installation exists, it can engage with real change forces in the world, and 'sensing' is a common aim of such installations, where the installation registers changes to itself or to the environment.

Figure 15. Atelier d'Architecture Autogérée (AAA), ECOBox/Self-Managed Eco-urban Network, Paris 2001

A transportable kit of parts is the base for an installation that is configured by users according to their needs—it is variously a garden, kitchen or bar, depending on the context.

An example of such an installation is the ECObox, described by its designers Atelier d'architecture autogérée (AAA) as a "Self-Managed Eco-Urban Network" (Figure 15).[200] This project involved placing a kit of parts made from pallets on sites that were derelict or unused, awaiting a new use. Site occupants could put these pallets together to create different uses, including gardens, bars and kitchens.[201] Over a three-year period, "ECOBox's demountable and transportable architecture allowed for a quick reinstallation in a new location and preserved the continuity of the social networks created by the project".[202] Because users can reconfigure the space as required, its form could be regarded as a sensing of the social network. With the advent of Web 2.0 and smart phones, real-time sensing can be linked to maps and other online tools, with such virtual technology being a common adjunct to installations. In some cases, various levels of automation will allow the physical installation to modify due to sensed information.

Because such work is not architecture per se, its starting point is often to 'test' concerns that it might otherwise might be simulated in design-generation processes. Rather than being identified as architectural or landscape architectural projects per se, the commonality them is process. This commonality demonstrates that the subject of landscape architecture discourse had come to be process rather than landscape, discussed earlier. These types of projects are "interpretation machines" (as I referred to them earlier) because, rather than having functional briefs or typological convention, their existence defers to something else that they 'read'. In relation to my earlier discussion of the influence of postmodernism on the development of the process discourse, interpretation (or "interp" as I have heard it referred to by signage designers) as a functional program has become a fundamental part of landscape architecture. It has changed in scope from community and heritage concerns during the heights of postmodernism to ecological sensing during the current period of scientism. With its use of mounds that change over time to interpret the natural landscapes of the Aquitaine region, the Bordeaux Botanical Garden discussed in the next chapter is an example of an installation approach.

According to my Bergson-esque criteria of the creation of differences in kind rather than degree, the installation form of the process discourse comes significantly closer because it monitors real

200 Atelier d'arctiecture autogérée (AAA), "Ecobox/Self-Managed Eco-Urban Network," in *Ecological Urbanism*, ed. Mohsen Mostafavi and Gareth Doherty (Baden, Switzerland: Lars Müller Publishers, 2010).

201 The Urban Physic Garden in London (http://www.physicgarden.org.uk) is another example of this type of garden, which is linked to the process discourse because some of Corner's students at the University of Pennsylvania were involved in its creation and management.

202 (AAA), "Ecobox/Self-Managed Eco-Urban Network," 510.

occurrences and can go through real change itself. In pursuing some form of sensing, calibrated to sense a particular factor, other factors can fall outside the scope of the sensing system. While such installations are not simulations, they comprise "post-factum documentation".[203] By installing after the sensed information, it could be argued, such schemes are not different to the simulations pursued in design generation, and also "spatialise time", as Bergson would say, thus reducing the effects of time to singular changes in location or extent, to quantities.

I will finish this chapter with the most relevant model from the process discourse for the following dissertation: the tactical. In the introduction, I discussed the tactical in relation to practices, differentiating it from the strategic, and drawing on the writing of de Certeau and von Clauswitz. I defined strategy as being imposed from above, at a greater distance from the action, whereas tactics are made up of localised and specific responses to temporal situations. A tactical approach is the closest to the approaches taken in the Marnas and Ecocathedral case studies, where gardening practices are deployed in found situations to have a design effect.

A model project that demonstrates a tactical approach is the TREE CITY scheme for Downsview Park, completed in 2000, by a multi-disciplinary team comprising OMA, the graphic designer Bruce Mau, and Inside/Outside, a hybrid design practice of interior design and garden design.[204] Public parkland of 320 acres on a former military air base in Toronto, the site was intended to be Canada's first urban national park and a "cultural campus". The competition attracted 180 expressions of interest from which five multi-disciplinary teams were invited to submit proposals, which "reprised some of the players of the 1983 Parc de la Villette . . . [but while] the radical claim of the 1980s was to extend architecture into landscape . . . [now it is] the notion of synthetic nature".[205] Julia Czerniak identifies three areas of the brief that competitors needed to focus on: "to inaugurate and structure the transformation of the site while remaining open to change and growth over time"; to "cope with and indulge" the complexity of contemporary ecological thinking, encouraging designers to create "new ecologies"; and to rethink conventional disciplinary scopes and boundaries.[206]

The design developed out of the project's budget limitation and involved a series of operations sequenced over a time frame rather than building a park per se (Figure 16). The scheme used a dot or a tree symbol to represent it and the drawings remained like an information graphic, more like a key to the techniques it proposed. Like the documentation of an installation, with a tactical approach, the drawing is an illustration of the result of the technique or a simulation of what might

203 As Marian Macken would call it, which is literally documentation after the fact, like an "as Built" or measured drawing.

204 Based out of Amsterdam, Petra Blaise has worked with Koolhaas at least since his project for the Kunsthall in Rotterdam, and she collaborated with French landscape architect Yves Brunier on the associated Museumpark prior to his death in 1993.

205 Stan Allen, "Urbanisms in the Plural: The Information Thread," in *Fast-Forward Urbanism*, ed. Dana Cuff and Roger Sherman (New York: Princeton Architectural Press, 2011), 60. Both Tschumi and Koolaas were shortlisted, as was Allen's own entry, when he was a part of Field Operations with James Corner.

206 Julia Czerniak, *Case: Downsview Park, Toronto* (Munich: Prestel Verlag, 2001), 14.

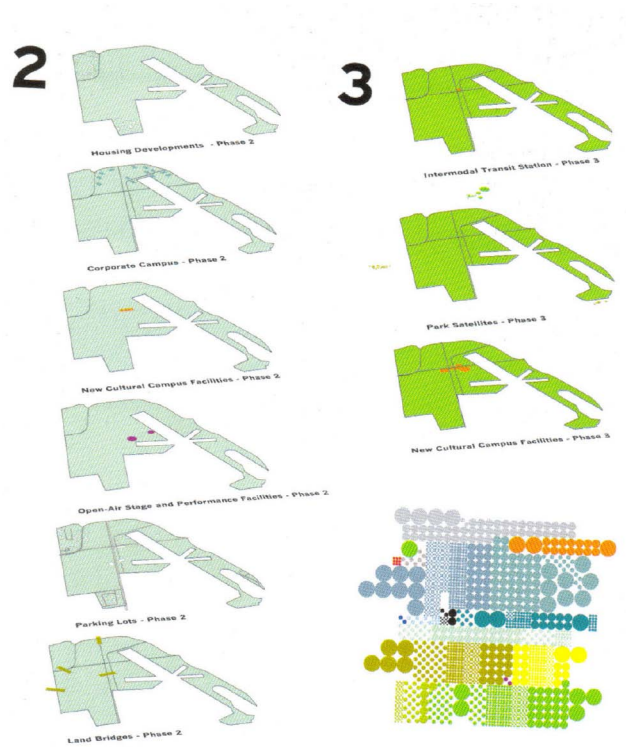

Figure 16. OMA/Inside-Outside/Bruce Mau, Tree City, Downsview Park competition, Toronto, 2001

Rather than implementing a design, tactical agricultural operations were conducted to grow the soil of the park in its initial stages, which was represented by a graphic of aggregating dots over time.

happen in the world. As such, it need not be realistic but rather illustrate the relationship of the various operations.[207]

In the first year of the project, infrastructures were installed from which the park would develop, notably the creation of soil through agricultural processes. Rather than importing soil, the scheme installed a combination of organic material and fine sand that was spread over the site in large quantities, which was cultivated by agricultural machinery. The cultivated soil was graded into what is known as a keyline configuration where trenches are graded along the contour so that rainwater does not run off but percolates into the soil and then adheres to the organic matter.[208] An arboretum rather than a public park might take this approach.

The next stage involved improving the soils further using sacrificial crops. The entire site was first seeded with clover, which was grown on and then ploughed back into the soil, which added nitrogen, the main nutrient required for green plant growth, a key part of photosynthesis. The use of the clover after the cultivation also stabilised the loose soil so that it wouldn't erode before it had a chance to consolidate, since it would have been bulked up and made loose by the cultivation. Ploughing the clover in also adds organic matter to the soil, further enhancing soil structure and nutrient levels. Another green manure crop, barley or wheat, was proposed for the following year, which would provide further structure and organic matter on a larger scale than the smaller clover.

This operational approach was not applied only to the agricultural works but also to the other major park component: the path system. Referred to as 1000 pathways, a system offering "endless excursions", a number of different construction methods were used that give the paths varying levels of permanence and an implicit hierarchy. Major paths were carefully made in a conventional fashion of grouted masonry, but further down the hierarchy, other paths use methods that make surfaces permeable, including pebble pathways, and others that are held in place only by mowing operations. The effect of the paths in relation to the tree clusters produces unexpected encounters

207 In fact,it could be argued that the drawings of this scheme were tactical too, since graphic designer Bruce Mau was a part of the team and the recognisable dot symbol (taken from the use of the circle as a tree symbol) became tactical to the reception and marketing of the scheme.

208 P.A Yeomans, *Water for Every Farm: Using the Keyline Plan* (Katoomba: Second Back Row Press, 1981). This system was invented by an Australian farmer.

with the site where no one route could be taken the same because the paths create a labyrinth that is nonetheless open for intuitive navigation.

The team characterises this approach as "sacrifice and save", where the budget is allocated to these operations rather than architecture, and creates "a medium capable of developing mass with greater economy".[209] This scheme thus uses both a strategic and a tactical approach. It is strategic in its creation of the soil as an infrastructure for growth, but tactical in how it is delivered via agricultural technique.[210] In this respect, it resembles the dynamic between planting design and pruning that we will see in the Marnas garden, and also the dumping of masonry and its arrangement at the Ecocathedral.

2.6 Conclusion

This chapter has demonstrated that an interest in process has become a ubiquitous part of architectural and landscape-architectural discourse in the last twenty years, and now constitutes what I refer to as the "process discourse". From this emerged a series of assumptions about dynamism and change that went on to be the unselfconscious basis for a way of generating design. I propose in this dissertation that this arose from a desire to overcome the static-ness of architecture. I also proposed that rather than being an interest in landscape architecture per se, the growth of interest in 'landscape' in architecture has been to see it as a model for process and ecology that has now become denatured and de-cultured, but that is nonetheless useful in combatting the static.

I have outlined three areas of the process discourse that correspond to three approaches to change: layering, algorithms and performance. In the layering section, I showed how the process discourse began with postmodernism as a cultural interest in collage that was speculatively used (or deliberately misused) to generate design. Building on the projects discussed in the layering section, the algorithm section showed how a similarly speculative use of formulae transformed into allegedly objective design-generation processes with the development of computer software. Thus, the algorithm section negatively answered the chapter's research question—"Do contemporary landscape architectural and architectural approaches to 'process' in design actually produce change?"—by showing that instead, they produce simulations that nonetheless become static themselves when built, because they do not produce novelty. In Chapter 6, I return to the question of novelty and use the process discourse to illustrate Bergson's critique of change as difference by degree, and show that the process discourse "makes time into space", as Bergson would say.

Despite this critique, there have been attempts in the process discourse to engage with change in real terms rather than through simulation or modelling, which I discussed in the final section entitled "Performance". Of the three types I discuss in this section—choreography, installation, and tactics—the latter two feature in the case studies. The next chapter, which considers the Bordeaux

209 Czerniak, *Case: Downsview Park, Toronto*, 76.

210 Since the OMA and Inside Outside are from the Netherlands, this approach is similar to the construction of the Dutch landscape, where agriculture is facilitated by the creation of polders, an interweaving of infrastructure and agriculture.

Botanical Gardens, is an example of installation because it is designed to demonstrate a change process. In the following two chapters, the other two case studies—the Marnas garden and the Ecocathedral—demonstrate a tactical approach, which was used to encourage and engage with emergent novelty.

In leaving the process discourse it is worth acknowledging that while this I have been critical of much of the process discourse, nonetheless both the process discourse and this dissertation ultimately share a common interest, which is the production of novelty. What they disagree on is rather methods for doing so, and it is this difference that provides the foundation for the discussion of the following case studies.

Chapter 3: Case Study 1— Mosbach Paysagistes' Bordeaux Botanical Garden

3.1 Introduction

After a certain period of time, designed landscapes inevitably change from what was initially installed, regardless of the designer's intentions. While plants are expected to change—to grow into maturity—materials that change are generally regarded as a failure, and are detailed to resist change in order to continue performing their function. "Durability" is the ability of a material configuration to resist the entropic potential of forces, including organic processes (such as decomposition) and inorganic processes (such as erosion). In this dissertation I argue that change can also be deliberately designed for, whereby change is regarded as valuable novelty, and it asks "How can hard landscape materials be detailed to direct their physical transformation over time?" To facilitate change is to leave opportunities for physical divergence from what is originally installed or proposed, which will ultimately happen anyway. To have material change in a project there must be a physical "gap" that can accommodate change and this gap must encourage a process of growth or decay. The gap is a space of movement, and the material is the "fuel" for that movement. These are physical design issues, but underlying them are ideological, disciplinary issues concerning how designers see change; but, more, importantly the creative agency of the dynamics of mineral or inorganic materials.

This chapter uses a project by French landscape architect Catherine Mosbach as a case study to investigate how a landscape can be detailed to direct change processes; to produce novel material outcomes. The Bordeaux Botanical Garden, constructed from 2001 to 2004, was designed to actively facilitate change. It does this by using materials that degrade quickly, although at different speeds, and details and configurations were developed to accommodate and regulate physical change, notably an area called the "Environment Gallery". Using soil mounding, the Environment Gallery uses erosion to create change in the mound's form, with resulting growth of indigenous species. I also examine a number of other precedent projects that also use decay or decomposition processes, in order to qualify my interest in the botanic garden. Using photographs taken of the same mounds in the Environment Gallery over 5 years I describe how the Environment Gallery changed between the site visits I made.[211] To support my assertion that the mounds were designed to facilitate change over time I documented the materials' performance and in this chapter compare these against available construction documents showing fixing and preparation to determine how they directed the change process. Where such construction documents are not available, I

211 My visits to the Bordeaux Botanical Garden took place on 1 June 2005 and 1 August 2010. I interviewed Mosbach at a café near her office on 3 June 2005. I do not refer extensively to this interview because Mosbach was not interested in my reading of her project, though later, when she invited me to speak at the IV European Biennial of Landscape Architecture in Barcelona in 2006, she acknowledged that my interpretation was valid and relevant.

speculate on the construction details and methods on the basis of my site observations captured in photographs, and my own construction experience. I model the change I observed by extrapolating geomorphological and ecological processes in relation to these details. These physical changes have social and organizational implications, which become visible according to how the client institution has created allowances for such change by mitigating it, revealing ideological and practical issues that must be addressed if material change is to be incorporated in other public open space contexts.

I will conclude the chapter in relation to the dissertation's central concern of novelty, and propose that novelty arises in the Environment Gallery due to the second law of thermodynamics. I propose erosion as a type of entropy and consider the detailing in terms of how it facilitates and mitigates the increase in entropy. In my thesis introduction, I proposed that working with change over time has implications for landscape architectural practice in relation to the change of the project. Correspondingly, the Bordeaux Botanical Garden is the first case study as it most resembles conventional landscape-architecture practice, and documentation processes are used to deliver it. Because the project was designed and left, unlike the other case studies, the Bordeaux Botanical Garden is useful as an exception to my argument that landscape architects should maintain an involvement in projects, and instead examines how contingencies can be allowed for to accommodate change, even while change is encouraged.

3.2 Project Overview

The city of Bordeaux is located in south-west France, in the region of the Aquitaine, and the department of Garonne, of which it is the capital. The city lies on the Gironde River, where it joins the European Atlantic coast. Bordeaux has been significantly redeveloped in the last ten years, with the installation of a new light rail system and new urban spaces in the historic centre, including the Quays with its mirror by Michel and Claire Corajoud. The Bordeaux Botanical Garden was developed in tandem with a new housing development master-planned by Dominique Perrault, on the right bank of the Gironde, approximately 2km east, upriver from the city centre. In 2000, Catherine Mosbach won an international competition for her design of the Botanical Garden.

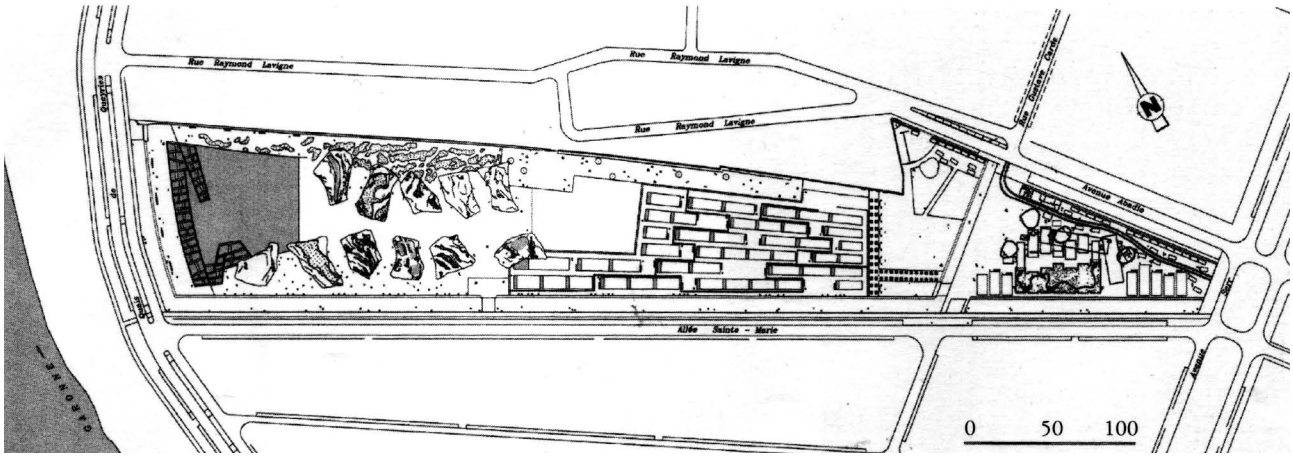

Figure 17. Plan, Jardin Botanique [Botanical Garden], Bordeaux, 2001 (hereafter Bordeaux Botanical Garden)
Plan of the Bordeaux Botanical Garden.

Figure 18. Western entry to the Bordeaux Botanical Garden, 2005
The entry ramp (with gates by Pascal Convert) uses a similar material approach to the 'Environment Gallery', allowing erosion and colonisation, but with a contingent bitumen path to allow continued access.

A graduate of Ecole Nationale Supérieure du Paysage (ENSP) Versailles,[212] Mosbach was one of the editors of the influential French landscape architecture journal *Pages Paysages.*[213] In the plan (Figure 17) there are three main areas to the project, from west to east, sequentially stacked along its length: the Environment Gallery, the Field of Crops (these were completed as Stage One), and the Museum and Greenhouse complex (Stage Two). Stage one was constructed between 2001 and 2002,[214] while the second stage was constructed between 2003 and 2004. Six hundred metres long and one hundred metres wide, the Bordeaux Botanical Garden covers an area of 4.7 hectares, with the greater length extending perpendicular from the Gironde River in an easterly direction. The Bordeaux Botanical Garden was equal first prize winner[215] of the 3rd Rosa Barba European Prize in Landscape Architecture[216] in 2003,[217] and was included in the *Groundswell: Constructing the Modern Landscape* exhibition at the Museum of Modern Art in New York in 2005.[218]

212 The ENSP Versailles is France's premiere landscape architecture school, set in the king's vegetable garden next to the gardens of Versailles. Although established in the nineteenthcentury as a horticulture school, it was modernised in May 1968 by land artist Jacques Simon and landscape architect and planner Michel Corajoud. One of their students, Mosbach is part of a significant generation that also includes Yves Brunier, who collaborated widely with Rem Koolhaas and also Henri Bava from Agency TER in Paris.

213 The French bilingual landscape journal *Pages Paysages* was published by Catherine Mosbach and Marc Claramunt for nine editions over ten years from the early 1990s to the early 2000s when it was taken over by Birkhauser Publishing.

214 Despite the projects complexity, this projects is cheap per square metre compared to Australian projects of a similar level of complexity.

215 The other winner was Paolo L. Bürgi's Cardada lookout in Switzerland.

216 The Rosa Barba Prize is named after the influential Catalan landscape architect (now deceased), regarded as one of the founders of the profession in Barcelona, where public space design has been dominated by architects. The prize is presented as part of the European Landscape Biennial that occurs in Barcelona every two years.

217 Maria Goula et al., "Bordeaux Botanic Garden," in *Only with Nature*, ed. Maria Goula, et al. (Barcelona: Col-legi d'Arquitectes de Catalunya, 2003).

218 Peter Reed, "Bordeaux Botanic Gardens," in *Groundswell: Constructing the Contemporary Landscape*, ed. Peter Reed (New York: The Museum of Modern Art, 2005). There is a very small amount of literature about Mosbach's scheme for the botanic garden, all of which is referred to in this chapter. This literature comprises a number of project descriptions in contemporary landscape architecture collections such as Reed and also *Fieldwork* Landscape Architecture Europe Foundation, ed. *Fieldwork* (Basel: Birkhauser, 2006).. The most thorough discussion is the interview with Mosbach from *Pages Paysages*, referred to later in the chapter—Michel Menu, "From Nature to Culture: Catherine Mosbach in Conversation," *Pages Paysages*, no. 9 (2003). A recent doctoral thesis by Jacqueline Clarke also includes a chapter on the Botanic Garden. Jacqueline Elizabeth Clarke, "Liquid Urbanism: The 21st Century City as Living Waterscape" (University of Auckland, 2012).

Figure 19. Constructed wetland in the Bordeaux Botanical Garden, 2005

On the western edge of the Botanical Garden, adjacent to the Garonne River, is a pool planted with wet-land species.

Figure 20. The 'Environment Gallery' in the Bordeaux Botanical Garden, 2005

In the centre of the Botanical Garden, the Environment Gallery comprises mounds that interpret, and are constructed from, soils of the region.

On its thinner ends, the garden meets the Quais de Queyries on the river at one end and a boulevard at the other, while it has new housing on both its long sides. The Botanical Garden's small size and its housing context makes it feel more like a local park or a community garden than a botanical garden of regional significance. The length of the garden's edge treatment compared to its overall size make the edge seem disproportionately large, and justifies the attention given to the fence in the design. The care with edges and their vertical articulation creates a podium for the project. On the west, south and east boundaries, bitumen pavements are edged by steeply graded swales, from which timber walls emerge from their bases, reaching a height of approximately 1.5 metres (Figure 18). These walls are made with pine logs sawn in different ways, stacked openly with large gaps, and will be discussed in greater depth later. On the rear of the walls, inside the gardens proper, the walls are lower (approximately 80 cm) so that the wall acts as an ornamental "ha-ha"[219], a hybrid fence-wall treatment encircling the garden.

On the river edge, a large, shallow reflective pool occupies the lower fifth of the garden (Figure 19). The pool has a container edge in the form of a band which snakes along its western edge and

219 In both historic French gardens and contemporary French designed landscapes, much attention is given to edge conditions and interfaces, and, despite the English heritage of the 'ha-ha', numerous contemporary projects elaborate this element in great detail. In Parc de Sausset by Michel Corajoud from 1982, Parc Citróen by Gilles Clément and Alain Provost, and Parc de Bercy by Bernard Huet (all from the mid-1990s), ha-ha's or ha-ha-like edge conditions are used to separate the parks from their context, not just for security reasons, but also as a kind of "wrapping" for the project. The ha-ha at Parc Citróen is particularly elaborate, and demonstrates that the basic swale component of the ha-ha on the exterior, together with an extended wall, can be a way of introducing vertical elevation of the edge that can then continue inside the project, where grottoes, architectural elements and elevated and lowered walkways are used to displace the ground and maximise circulation space.

Figure 21. The 'Field of Crops' in the Bordeaux Botanical Garden, 2005

Flood irrigation down channels, regulated through cisterns, is used in the Field of Crops, as it has been historically used throughout the region.

Figure 22. Jourda Architects, Buildings at Bordeaux Botanical Garden, 2010

The administrative and research functions of the Botanical Garden are housed in these concrete buildings.

is broken up into an irregular grid pattern. Inside the grid, different aquatic plants are being grown in containers with different soil mixes, depths, and saturation levels to allow for different wetland plant species and communities to grow. The openness of the pool at the entry establishes a spaciousness or openness in the project that belies its small size.

The pool meets the Environment Gallery and provides a contrasting wetness to the dry quality of its mounds with some of the mounds overlapping into the water, crossing the pool edge. The Environment Gallery comprises a series of soil mounds in two rows that form an axis through the project, and are simulations of the geomorphological strata and soil profiles of the region[220] (Figure 20). The two rows represent the two banks of the Gironde River, the five mounds in the north represent the right bank and are made of clay, gravels and sandstone, while the six in the south represent the left bank, and largely comprise different sorts of sand, with a dune character. Angular concrete paths cross the compacted sand allée between the mounds, and encircle them, offset at a distance from the mounds. The mounds' dryness contrasts sharply to the water body to the west, and the "Field of Crops", to the east, buffered by a turf area. The Environment Gallery will be discussed in greater depth later.

To the east of the Environment Gallery is the "The Field of Crops", the "cultural" part of the design, which comprises forty-nine elevated beds set among grass, in six rows (Figure 21). Some

220 Another precedent for these mounds is "the Island" in Parc Henri Matisse at Lille, implemented ten years earlier by Gilles Clemént, who was director of ENSP Versailles. I will discuss this park as a precedent in the chapter on the Marnas case study rather than here because the island at Lille was not designed to transform but rather to resist change as a reservoir of vegetation.

of the beds are at grade, while others are surrounded by thin steel planters, with open water tanks at the end of each planter. Inside of each planter or bed, the soil has been shaped to make a series of longitudinal trenches, along which are grown agricultural species from the region. These are irrigated by flood inundation from the tank, a method used by farmers in the Aquitaine. Water is re-circulated from the beds back into the tanks at their head, and a cistern system is used to regulate the flooding. Mosbach worked with botanist Patrick Blanc[221] to select species for use in a botanical interpretation system for the area, and all plants have ethnobotanical uses, and can be eaten, used as cut flowers, or have medicinal uses. The Field of Crops is a major part of Mosbach's interpretive agenda but is not an area of focus for the following discussion.

At the rear of the botanic garden complex is a series of administration, storage, museum and research buildings that form a complex of pavilions, each with a blob shape made of shell of sprayed concrete, designed by Jourda architects (Figure 22).

3.2 Precedent Projects

The Bordeaux Botanical Garden is included here because it uses natural processes to change landscape form through material change. In this section, I examine three other projects because they are precedents in using processes to create formal change—the Friedrichshain Courtyards, Berlin, by Gustav Lange[222] (1995–2000); the temporary garden at Schloss Ippenburg by Klahn + Singer + Partner (1999–2001); and the embankments at the Novartis Campus, Basel, by Vogt Landscape Architects (2006). Both the courtyards and the embankments use erosion processes, while the temporary garden uses decomposition processes, and thus I will discuss them first before the garden project below. These projects are discussed as relevant examples rather than being case studies since the first and third projects were completed and had disappeared prior the commencement of this thesis, which precluded my visiting them (since I was unable to visit them before they were gone, or at all, in the case of Novartis).[223] This highlights another difference, which is the use of detail to regulate change, and the incorporation of such detail into the documentation of the project. Like the botanical gardens, these projects are built and then allow the processes to run without subsequent intervention. They will be discussed in terms of how they manipulate detail to regulate the speed of processes, and the novelty that arises from these processes.

In the Friedrichshain Courtyards, Lange placed four blocks of stone in four courtyards (Figure 23) in Friedrichshain, Berlin, each cut into the shape of a perfect cube.[224] The blocks were designed

221 Patrick Blanc is a botanist who has specialised in epiphytic plants and who has become famous as the originator of the green wall, the most prominent of which is at Jean Nouvel's Quai Bramley.

222 Gustav Lange was an influential but enigmatic landscape architectural educator in Germany, whose projects include Mauer Park in Berlin. Lange's courtyards were undertaken prior to the Bourdeaux Botanical Garden but were published in the same edition of *Pages Paysages* as the Botanical Garden was, indicating that even while it is impossible to tell if the earlier project influenced the Botanical Garden, then at least Mosbach, as one of the editors, saw their relevance to each other.

223 As an amusing aside, while in Basel, I sought to visit the project and contacted Novartis to arrange it but was told that if I wasn't in contact with anyone, I could not come as a guest. To this I replied, "But I am in contact with you", and, in a Kafkesque loop, repeated this conversation.

224 Gustav Lange, "Destiny of Stone," *Pages Paysages*, no. 9 (2003).

Figure 23. Gustav Lange, Friedrichshain Courtyards, Berlin, 1995
Cut from limestone ground, these blocks were allowed to degrade via a process of freezing and thawing, creating soil media for colonisation by spontaneous vegetation.

to constantly change, affected by the meteorological processes of the site in relation to their own physical and chemical characteristics. Composed of calcareous material, the rocks were naturally created through a deposition process where water deposited lime onto plants that died and left cavities in the rock over time through the action of pressure, weakening the stone mass. The rock was quarried into cubes using steel cables, then extracted and relocated to site, and an irrigation system was installed to continue the erosion process. This process was accelerated through the action of the water freezing and thawing, and through the plants, such as ferns, colonising the new soil. The novelty produced in this project results from the metamorphosis of the rock to soil. The design has accelerated the process of weathering by exposing a previously subterranean material to the meteorological process. The novel material is the soil that results from the erosion of the limestone, and the plants that colonise it, neither of which were originally specified in the design. Like the mounds in the Environment Gallery that I will later discuss, the novelty that emerges from this design is the changing topographic form and a new vegetation community. The shape of the rock completely transforms from its original design to ultimately becoming a pile of soil. At each stage, the weakenings and material failures that develop direct the formal outcomes, as new erosion lines arise from the changing topography and water movement. The initial use of the perfect cube suggests an experimental condition (or "1" state), which allows any change to be registered against that shape. It's difficult to judge whether the excavation was organised to place fissures in specific locations, which would have directed how the erosion process would occur, but the block could have been orientated on site to determine where, on the uniform paved surface, the erosion and deposition would occur, potentially orientating it to prevailing winds so as to catch wind-borne seeds. As will be shown later, a key difference from this to the Botanical Gardens is that here, the blocks were seen as complete when they had disappeared, and were replaced rather than using the resultant topographic form.

At the Novartis campus, Vogt developed a concept for the park site that closely resembled that of the earlier botanical garden, which was "related to the ancient history of the site, using local

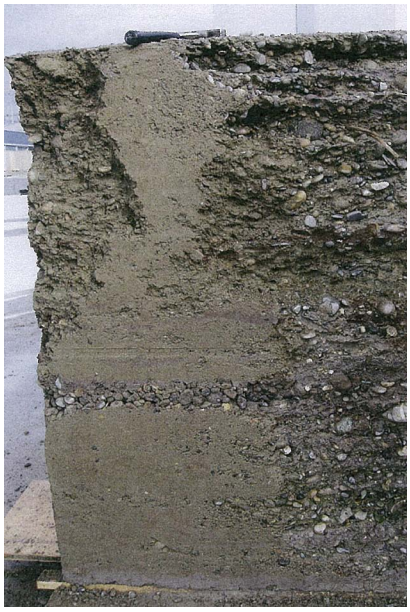

Figure 24. Vogt, Novartis embankment construction, Basel, 2006

Prototype for embankments for the Novartis campus, formed using rammed earth.

Figure 25. Vogt, Novartis embankment construction, Basel, 2006

Constructed rammed earth embankment shaped by workers in-situ.

materials to build a living model of the post-glacial Rhine Valley".[225] This approach of creating "fake geology" has precedents in landscape design history from Renaissance and Baroque grotto's with their simulated stalactites through to the use of Pulhamite in the Victorian period.[226] *Distance & Engagement*, the beautiful book about the design development process undertaken by Vogt for Novartis, is pertinent to this dissertation because it reviews geological processes in design terms. However, as its author Alice Foxley is quick to point out, for a section modelled on Karst, or limestone, "the resulting model does not resemble a natural karst landscape. Instead, the principles of the karst landscape are translated into a hybrid language".[227]This language was developed with an earth-construction contractor to create a series of "artificially eroding" panels, and an embankment entitled "Abandoned Channels". These were made "using stabilized clay and Rhine gravels supplied from the excavation of the subterranean parking structure" (Figure 24). Like the Bordeaux Botanical Gardens, at Novartis these were built up against a form, but unlike them, they were subsequently finished or rusticated physically using a sledge hammer (Figure 25). Because my research commenced prior to its inception, I chose to continue my focus on my existing case study of the Botanical Garden rather than Novartis. The book is also relevant because its section entitled "We Are Geomorphic Agents". The concept of anthropic geology was articulated earlier by Dov Nir, and the period since agriculture has come to be referred to as the "anthropocene" in climate

225 Alice Foxley, *Distance & Engagement: Walking, Thinking and Making Landscape* (Baden, Switzerland: Lars Müller Publishers, 2010), 77.

226 Created by builder James Pulham, "Pulhamite" was a commerical artificial stone which used in rockeries and grottoes in the early 19th century, distinguished by the fact that it "neither shrank nor exfoliated as other concretes of the time were inclined. to do, while at the same time , present(ing) a most convincing stone surface texture".(Eric Robinson, "The Mystery of Pulhamite and an 'Outcrop' in Battersea Park," *Proceedings of the Geologists' Association* 105, no. 2 (1994): 141.)

227 Foxley, *Distance & Engagement: Walking, Thinking and Making Landscape*, 110.

Figure 26. Klahn + Singer, Garden of Babel, Schloss Ippenburg, 2001

For this garden show, hay bales are stacked and left to rot to become topography over time.

change and geological literature, to refer to humans having an impact on the planet like a geological epoch.[228]

For an installation at the garden show at Schloss Ippenburg, Klahn + Singer created what they referred to as a "Garden of Babel" (Figure 26)—the tower-like shape they built using 90 straw bales piled up to six storeys high.[229] The straw bales result from the agricultural harvest of hay, often seen in fields, and were sprayed with grass seed and fertilised. Occasionally watered in summer but never cut, the towers decompose and become growing media, within a year disappearing altogether into piles of hay, growing media and micro-topographies. The main novelty of this project is material, comprising the creation of soil from the decomposing plant material and the new plants that grow from seed initially on the bales and then on the new soil. The topographic form that results is also novel, changing as it does from a series of modules into one mass, from a series of smaller domes to a ridge. This process occurs because of the decomposition of the mounds, which is due to anaerobic composting. Since the piles are on a grass surface, the new topography merges with the ground, forming a new relief in a single surface rather than contrasting with a background. The bales are made of organic material and because they are rolled, the outside receives more air and light, while the interior receives less and holds more water. Additionally, each layer has gaps between them, which may have an effect on density and could be manipulated. Because the bales are circular, open pockets between bales are sinks for water and air. As they are piled on top of each other, the depth of material affects how much water reaches the bottom, where the effect of the soil from below also works up into the piles. In this project, the rate of decomposition is the main formal variable that the

228 Dov Nir, *Man, a Geomorphological Agent: An Introduction to Anthropic Geomorphology* (Dordrecht: Kluwer Academic Publishers, 1983).

229 Landscape Architecture Europe Foundation (LAE), "Garden of Babel," in *Fieldwork: Landscape Architecture Europe*, ed. Landscape Architecture Europe Foundation (LAE) (Basel: Birkhäuser, 2006)..

designers are manipulating. Like the wall at the Botanical Garden, gaps for air and water movement have been strategically aligned to guide the decomposition process.

It is interesting that these examples, like the Botanical Garden that I will describe at length below, use techniques to demonstrate process by making installations, rather than forming normative elements of recognisable landscape typologies. As discussed in Chapter 2, I refer to this approach as "Interpretation Machines", which I will return to in the section of the same name below.

3.4 Interpretation Machines

The Bordeaux Botanical Garden interprets the natural and cultural landscape of the Aquitaine region in which Bordeaux is located. While the focus of the dissertation is not designer's rationale, in this instance, this interpretive dimension helps to understand the terms by which the mounds in the Environment Gallery are developed materially, for example, in the type and order of soil layers and the plant material applied. The interpretive rationale is the reason that the mounds were designed to change and gives the background to Mosbach's approach to designing for change.[230] In chapter 2 I called the creation of such performative installations "Interpretation Machines", aimed at revealing geomorphological and ecological processes, which is similar to that of Mathur and de Cunha, also discussed in chapter 2.

In an interview with Michel Menu about the Botanical Garden, Mosbach discusses the ideas that drove her competition entry for a botanic garden for the twenty-first century. She developed a two -part model that emphasised the garden as an interpretive space, the first part being "a representation of the natural environments in the Aquitaine basin" (the Environment Gallery), and the second, a "representation of the agronomic relationship between people and plants" (the Field of Crops).[231] Mosbach describes the gardens of the Environment Gallery as "meteorites fallen onto the neutral soil of the Aquitaine Basin", which are "ungrounded", referring to their isolated, fabricated soil profiles.

Menu introduces his interview by referring to Mosbach's characterisation of the growing project as its "bushiness", proposing that it constitutes "a specific way of organizing the different spaces of the project, as though echoing the particular reality of the nature that you are seeking to represent".[232] The characterisation of "bushiness" is not simply a description of the material in a static sense but is a quality that results from the processes that Mosbach is representing and attempting to replicate in the museum frame of the botanic garden. While process driven, the formal dimension of the containers holding these relationships do present direct representations of their typical form for the purpose of interpretation. The two areas do have a clear culture/nature dialectic, the

230 Lucy Bullivant, "'Activating Nature': The Magic Realism of Contemporary Landscape Architecture in Europe," *Architectural Design* 77, no. 2 (2007): 85. Bullivant notes that "Mosbach describes her vision as a philosophical rather than an ecological one, using natural flows to draw human movement". This parallels my own conversation with Mosbach where she was unwilling to discuss the ecological dimensions of the Environment Gallery, instead prioritizing the experiential and cultural.

231 Menu, "From Nature to Culture: Catherine Mosbach in Conversation," 60.

232 Ibid.

Environment Gallery having an exaggerated naturalism in its mound forms, and the Field of Crops, an agricultural grid. Despite their naturalism, Mosbach always refers to everything in the Botanical Garden in terms of the garden.

Mosbach highlights how her approach to the botanic garden differs from the conventional, not by simply emphasising the plant but by putting it in the context of a total environment, a milieu of systems, and soils in particular (or "the mineral" as Mosbach describes it) in which the plant develops. Mosbach describes the mounds in the Environment Gallery saying: "these stratigraphy's [sic] are too caricatural [sic] now. I am waiting for all these ingredients to blend with time, through the action of rain and erosion, and for everything to take its place at last and enter into relations with the various elements".[233]

These mounds are effectively pots with erodible edges and are completely artificial. They are not authentic representations of the environments they represent. Instead, they are "process representations", as indicated by Mosbach's description of "rightness" when "everything takes its place". Mosbach's approach to change is focused on demonstrating the dynamic relations at play between various constituents of the total environment. Her suggestion that "Just like when a piece of music has been composed, the melody has to start to play itself, at a remove from us",[234] is reminiscent of the claims of the process discourse and its assertion that the form arises from process. While she acknowledges the composition, like process discourse too, Mosbach underestimates the role of the initial composition because all the potential variations of that melody are established by that initial melody, even in juxtaposition to it. In referring to the initial forms as a caricature, Mosbach seems embarrassed by their formality; however, it is precisely this formality that will determine exactly how the process will proceed to give form to "everything taking its place". The definitiveness of the initial form allows it to direct, not ambiguity. Considering the artificiality of the entire situation, Mosbach's likening to a caricature is revealing because it is exactly that: an exaggerated picture of a frozen moment in a process, demonstrating the catalytic nature of form. By beginning with form, it effectively reverses the form as a result of process argument and instead seems to suggest that process results from form.

While the Menu interview focuses on people's reception of the Botanical Garden, Mosbach positions the changing landscape in terms of unique moments of change that each visitor gets to receive at the moment they visit the garden. These are unique because the garden is changing and is never the same at any one point or incremental viewing of that point, such as when "the garden [is] sly, [and] constantly on the move and seems to lay traps by proposing a new presentation of a new moment that I hadn't imagined".[235]

233 Ibid., 63.
234 Ibid., 64.
235 Ibid., 61.

Mosbach says that "the garden is like a huge, constantly moving canvas, with surprises, unexpected elements".[236] If we consider this description in relation to the two areas—the Environment Gallery and the Field of Crops—then clearly it best describes the former, where the entire form of the mound can change through the action of erosion and growth. For the latter, while growth can occur, it is within the more conventional frame of the garden bed that it does, plants never really transcend the container. Considered this way, 'paradigmatic' change concerns the way that a design allows for change process to affect a boundary condition and change the overall configuration of the design. Returning to the interpretive agenda, while the rationale of the mounds is irrelevant, the fact that their naturalness gives them a flexible edge condition, and the agricultural character of the Field of Crop denies them one, is relevant. In an essay by Mosbach and her *Pages Paysages* co-editor Marc Claramunt entitled "Nature of a Landscape Project", they discuss the relationship between the changeable and the unchangeable when they note that:

> The process of a project may reconcile variables with stable elements, on the one hand, without dissolving contradictions between phenomena or, on the other, without drowning them in a regulating homogeneity which obscures their distinctions.[237]

3.5 Agents of Change

Using Mosbach's proposition of the device of interpretation being primarily a process rather than an artifact, there are three elements in the garden that seem to have been designed to change over time: the timber boundary walls; the mounds in the Environment Gallery; and the entry ramps. These elements change over time because of erosion or decay processes and encourage colonisation or growth. I will introduce these three elements but will only deal with the Environment Gallery in depth because it is the most complex and is specifically discussed by Mosbach as a rhetorical device for her vision of the Botanical Garden as a process.[238] Such discussion will rely on concepts from soil science, ecology and botany, which will be introduced as required. While the longer-term change of the elements will be extrapolated from these concepts, initial indications of such changes were seen between a site visit in 2005 and a subsequent visit in 2010. A key interest in this project for the thesis is how the landscape architects designed and detailed the elements to change and produce novelty over time, so attention will be given to variables that the landscape architect manipulated to facilitate, and, more importantly, regulate such change, and consideration to the novelty produced. The formal configuration of the detail to cause a precise change will be the focus since this demonstrates how design can physically change and produce novelty. Other configurations will be considered that might have produced different results.

236 Ibid.

237 Marc Claramunt and Catherine Mosbach, "Nature of a Landscape Project," ibid., no. 7 (1999).

238 The botanical garden as a type has been examined in depth by many landscape historians. However, it is not a focus for this thesis and so will not be discussed.

Figure 27. Boundary fence, Bordeaux Botanical Garden, 2005

Southern fence showing longitudinal cuts through log and stacking arrangement.

Figure 28. Boundary fence, Bordeaux Botanical Garden, 2005

Fence on western boundary with perpendicular stacking, revealing end grain.

3.5.1 Timber Boundary Walls

There are three timber boundary walls that are made of the same pine material and use a similar construction detail, with the long southern boundary using planks stacked parallel to the length of the wall (Figure 27). The long wall looks as if the planks have been sawn from whole tree trunks and then stacked again in the original order with gaps so that the profile of the trunk remains. The other two walls, located on the thin ends, use short planks stacked perpendicularly, revealing the end grain (Figure 28). There is a relationship between these two orientations because they emulate the grain configuration of a tree or log, treating the whole of the garden as "a tree"[239].

These timber boundary walls are unusual in that they are designed to decay. Together with insect attack, invasion by fungi is one of the main causes of decay in timber, and three factors are acknowledged as encouraging fungal invasion in timber: excessive presence of air; a moisture content of more than 25 percent; and high temperature. The design of these walls facilitates air movement and moisture content, precipitating fungal invasion. The use of spacers between timber slabs creates large gaps through which air easily moves. These gaps also facilitate moisture penetration into the wall and onto the timber surface. Because the timber slabs are laid flat, with their greatest continuous area of surface horizontal, water can collect and penetrate easily. While

239 Such a notion of continuity between the grain or orientation of a material and its larger configuration in a wall is common in stonework, such as where sedimentary rocks like sandstone tend to be quarried and laid in the order that the sediment was laid down.

Figure 29. Boundary fence, Bordeaux Botanical Garden, 2010
Arrangement or bond of wall being distorted due to weathering of planks. This photograph was taken five years after my first visit, as were many of the subsequent photos in this chapter.

Figure 30. Boundary fence, Bordeaux Botanical Garden, 2010
Five years since my first visit, the fence is being invaded by fungus, lichens, mosses and plants.

Figure 31. Boundary fence, Bordeaux Botanical Garden, 2010
Top surface of south wall, as seen on second visit, showing wall collapse, as timbers swell and twist.

Bordeaux is not tropical, it is one of the warmer parts of France. The effect of the temperature would probably be felt more in terms of the deformation of the timber as it dries, which could cause splintering and warping, opening up the cell membrane to further exposure to fungal infection.

Observing the walls after five years, I noticed significant decay and deformation within them. This process of deliberate destruction has manifested itself in weathering, such as warping, delamination of bark, and cracking. Because of the great length and width of the wall slabs, significant twisting has occurred, which contributes to an overall opening up of the structure to further weathering and invasion, and causes the bond of the wall to change as slabs twist over the top of their neighbours (Figure 29). Because the slabs were milled from a single log, the bark was left on the edge and its delamination and decay are the most visible deformation of the timber, with sections of bark beginning to twist and fall off the slabs.

The physical changes have opened up the wall for invasion by other organisms, particularly fungi, lichens, mosses, bacteria and green plants (Figure 30). Where bark has rotted due first to fungal breakdown followed by bacteria, mosses invade the rotted tissue. Where the bark has rotted on a thinner slab, or where bark was present on both sides of

Figure 32. Environment Gallery, Bordeaux Botanical Garden, 2005
Earth mound in the Environment Gallery showing profile with constituent soil layers, collected from road construction sites across the region that resemble the interpreted landscapes of each mound.

the slab, overall decay is more present in the slab. This decay has created growing material for other organisms, which accelerates the penetration deeper into the planks. This effect is due to the general ecological principles of area-to-perimenter configurations, where invasion penetrates uniformly from each edge, with the effect that if two opposite edges are close to each other, the entire element can be invaded. This principle works both at a detailed and a broad territorial scale and is most visible at the western wall where the perpendicular stacking bond is used. As well as organisms growing on the wall using the wall material as a growing media, its construction also facilitates penetration by plants.

With its gaps created by spacers, the overall construction of the wall facilitates its metamorphosis. This openness allows plants to grow through the wall and, as wind passes through the wall, seeds are deposited and wind-borne silt is caught by the structure. Because the wall has these gaps and spacers, the timbers' change of shape also changes the shape of the whole wall, causing the gaps to increase in size and slabs to potentially slip off (Figure 31). If one were to consider the structural failure deliberate, it could be suggested that the aim of the wall was for it to evetually become soil, and its overall form to be a mound. In this process, it would drop in height as the timber decayed and it fell through the grid of spacers. Planks would slide off the top and so its overall form would widen at the base and eventually it would become covered in vegetation.

3.5.2 Earth Mounds

There are eleven earth mounds in the Environment Gallery—five on the north side and six on the south. They represent the range of soils and their attendant plant communities in the Aquitaine region, revealed on the edge in a visible soil profile.

The mounds were constructed by putting down successive layers of material in the order in which they "naturally" occur in the particular part of the Aquitaine region, though their depth does not necessarily reflect the real depths of the constituent soils in their natural profile (Figure 32). The civil contractor who constructed the mounds was a road contractor working throughout the Aquitaine region, and while working on the project, he collected and carefully separated soils from different parts of the region where he was building roads, as well as the different layers in the soil

profile, which were then used in the appropriate mounds in the Environment Gallery. The collected indigenous soils included “sable marin”, or marine sand, and “sable des lands”, or moor sand.

It is interesting to compare the simulated soil in the mounds with the real soil profiles to which they refer. While the mounds in the Environment Gallery utilise the soils from local soil strata, they would operate differently to how they would have in the unexcavated ground. The real parent material of the soils (the rock underlying the soil, from which it has developed through erosion, etc.) is absent, and there would be numerous infiltration barriers for moisture between the layers that would otherwise blend into each other in the ground, and also between the mounds and the existing (dirty, urban) soils beneath them, which would lead to some strata being wetter and more anaerobic than others.

The Environment Gallery both represents a landscape shaped by erosion as well as literally being shaped by erosion as part of the proposition. To erode is to destroy imperceptibly, little by little and, in geology, to gradually wear away. The immediacy of this expression and its geomorphological usage is equivalent because erosion works at scale. This assists the interpretive rhetoric of the project because the same processes that affect the mound do, in reality, affect the geology, the main difference being time frame. In considering the project’s manipulation of erosion, it’s important to remember that “the science of hydrology (water) is inseparably interwoven with geomorphology”,[240] so any discussion about soil is a discussion about the action of water.

Erosion results from the exposure of soil to water and is affected by a range of factors, including the inherent stability of the soil and its stabilisation by vegetation. Erosion can be caused by raindrops that dislodge particles, and also by overland flow that results from water moving across a soil, which is the main agent at these botanic gardens. The erodability of a soil will depend on its angle of repose or the angle at which its inherent structure can support itself. This structure results from a combination of sand, silt and clay, the friction between the relative particle sizes, and also the coherence that results from the cation-exchange capacity, which determines how the particles cohere in the presence of water, with clay particles cohering most. Overland flow occurs when water is directed across a surface at a velocity to break these bonds, and where the water causes erosion that moves a soil past its angle of repose. Overland flow is guided by topography and creates two types of landform: erosion landforms, where the erosion process shapes an existing mass; and deposition landforms, where a new mass is created from the eroded material deposited elsewhere. I will now describe the mound transformation process at length.

Erosion has caused the mounds at the Botanical Gardens to transform and has created both types of landform described above. This process is explained below and accompanies Figure 33, with the number on the diagram corresponding to the following numbers in the explanation:

240 A.N Strahler and A.H Strahler, *Modern Physical Geography* (New York: John Wiley & Sons, 1978), 274.

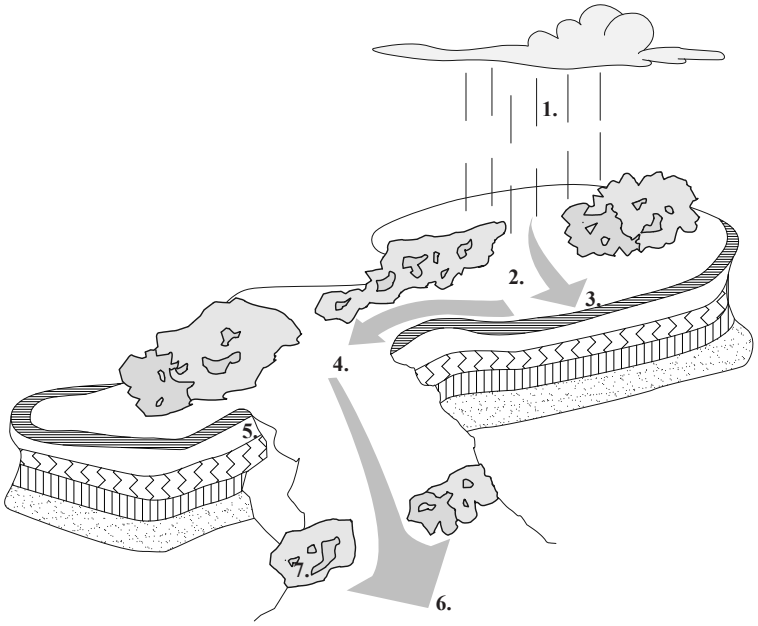

Figure 33. Diagram of mound erosion process, 2011
Model of sequence of transformation of mound in the Environment Gallery due to erosion.

1. Rainfall falls onto the surface of the mound;
2. The water runoff from the rain erodes the soil surface, loosening it where it is not stabilised by vegetation, making it mobile in the water;
3. The solidity of the edge coping and the topographic shape of the surface directs water;
4. Erosion of soil occurs differentially according to the properties of the section of the simulated horizon that it is cutting into;
5. The edge coping collapses at the lowest point where water crosses it;
6. Soil material from the horizons is deposited at the base of mound, creating a deposition landform;
7. Vegetation from the top of the mound colonises the new landform at the base.

The interpretive agenda of the mounds is twofold: each must be a literal model of a soil profile or type that exists naturally, and each must represent the topographic processes that shape these landscapes. According to these terms, the interpretation has failed by the first criteria, and has succeeded by the second, because the first option is a representation while the second is an action. In nature, the first would result from the second over long periods of time. The failure of the soils to erode as they would in nature is the most interesting aspect of the Environment Gallery, confirming the success of such artificial methods in their own terms, without achieving a "correct" naturalism. The most obvious effect of the erosion is the addition of a new topographic form adjacent to the original one, which changes the overall shape of the mound (Figure 34). Since a central interest of this dissertation is to demonstrate that there is greater control and nuance in the use of processes to create forms, I will discuss the range of variables in the construction that have caused the shape of the resultant form, and how they have been, or could be, manipulated to cause particular outcomes. I refer to these

Figure 34. Environment Gallery, Bordeaux Botanical Garden, 2010
Addition of a depositional landform at the base of mounds due to erosion.

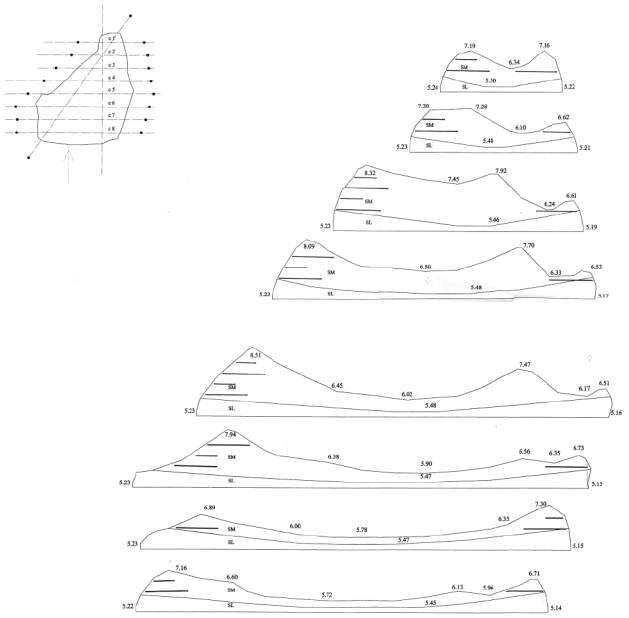

Figure 35. Environment Gallery drawing, 2001
Sectional profiles defining the shape of mounds, anchored to a centre line in a plan, similar to methods of "lofting" in 3D computer modelling software

Figure 36. Environment Gallery, Bordeaux Botanical Garden, 2010
Gravely subsoil from the face overlays the topsoil washed off the top first, inverting soil profile.

as "regulators" because they regulate how the erosion process will occur. I will discuss four regulators:

1. The surface topography can be shaped to direct the water's path that leads to erosion;
2. The soil horizon can be laid down in relation to topography to affect erodability according to the angle of repose;
3. The edge coping of the mound can be designed in such a way that it collapses under certain intensities of water movement over it;
4. Vegetation can be placed to stabilise the surface to affect erosion in relation to the topography.

Topography

The primary agent of directing erosion is the shape of the surface topography, manipulated through the creation of elevated ridges and depressed valleys, similar to what one sees in the geographic broader landscape. This topography was generated through a document, using a series of sectional profiles set out along a longitudinal set-out line anchored to a site location that iteratively defines a surface topography (Figure 35). Traditionally, the method used for documenting topography is the contour plan and the use of sectional profiles represents both the imperative of showing the layers of the horizon but also reflects the use of the profile and path as a tool used in 3D modelling software, which may have been used to model the mounds. The sections build on one another, and, stacked together, can be used to develop a path of water movement in relation to ridges and valleys.

Because the mounds are replicating a natural topography, larger planting occurs on the ridges and grasses in the valleys. This will create

a new topography on the mound, still related to the initial shape of the mound, but accentuated through erosion and deposition processes, making the mound initially more dramatic, until it meets the adjacent ground and then develops an even grade from that ground up the mound, based on the angle of repose of the soil—effectively a ramp.

Horizon

In natural soil profiles, there is a two-way movement of soils, both from the bottom and from the top, though both are generally blended together. From the bottom, weathering of parent material (stone, or the underlying geology), due to movement of water in the water table across the differentially impervious substrate, releases particulates and sands, that may move upward due to hydraulic action in the profile, such as seen when rocks come to the surface in agricultural land. From the top, the movement of water through the profile moves finer particulates down into the profile, especially if there is not a large organic-matter component. While this is a natural process, generally profiles are not inverted, though subsoil is occasionally exposed due to mass weathering. Since the soil profile is simulated and elevated, the erosion process will invert the profile (Figure 36). The topsoil has been washed off first and deposited at the base of the mound. Further, erosion will then move this subsoil to deposit it on top of the previous topsoil, thus inverting the profile. Further, as the edge profile collapses, material from the middle and base of the profile may be deposited on topsoil. Correspondingly, the deposition landform is composed of a novel soil, despite the use of the indigenous soils, because of the effect of the new landform on the blend of the soils. Manipulating the soil horizon in terms of how erodible each layer is, and their sequence, in relation to the surface topography could be used to deliberately engineer the development of novel soil types that would support different vegetation colonisations.

Figure 37. Construction underway at Bordeaux Botanical Garden, 2000

Construction underway at the Garden. In the foreground, one can see the process of creating a mold with soil to back fill the coping against.

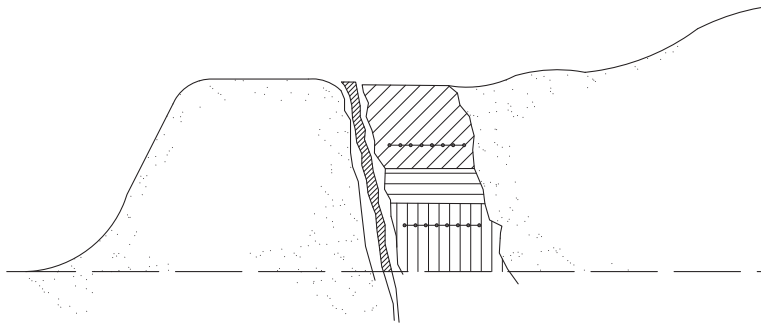

Figure 38. Mound construction detail, Environment Gallery, Bordeaux Botanical Garden, 2011

Construction method used for erecting mound, extrapolated from photograph (Figure 37) and contractor's text in *Pages Paysage*.

Edge Coping

The edges of the mounds, or their "coping" as I refer to it, act as regulating devices for the erosion of the mounds, as well as displaying the soil profile and horizons on the edge.

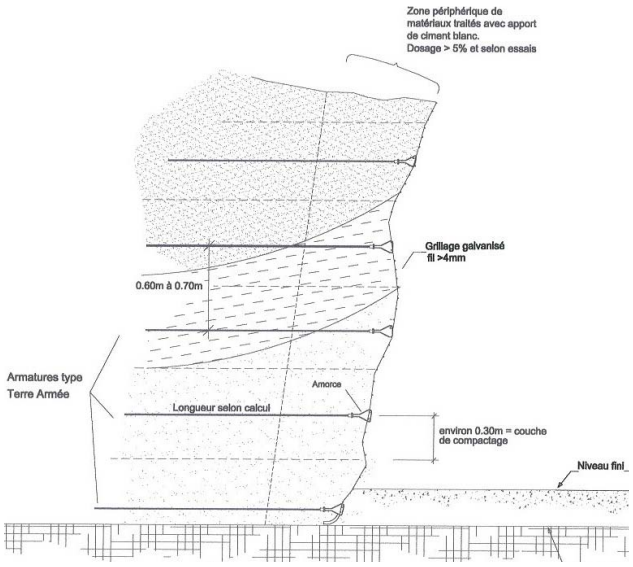

Figure 39. Construction detail, Bordeaux Botanical Garden, 2000

Detail of edge coping construction showing reinforcing, from design development drawings, which contradicts mesh visible in Figure 40.

Figure 40. Environment Gallery, Bordeaux Botanical Garden, 2010

Steel chain-wire fencing laid as a horizontal strip to reinforce the edge coping.

Both of these devices are designed to be more stable by degree than the soil in the mound adjacent to them. The coping is designed to be slightly resistant to the natural processes at play on the top of the mound, or rather, to erode at a different rate to the rest of the mound. In this way, they regulate the process of erosion on the surface and their failure determines where deposition will occur. This ensures that the mound maintains the outline of its original form even as it fails, or rather, that that form has a longer endurance than its contents. In discussing the coping, I am interested in the precision or orchestration of the process of collapse, which concerns the agents of the copings' stabilisation.

Correspondingly, the method of construction is important, and I have extrapolated the construction method from a range of different sources, including my analysis of the site during visits, descriptions from the contractor in the advertorial, and also photographs from the designer's archives (Figure 37);[241] however, contradictions exist between the documentation and what I saw on site. From these sources, it's possible to piece together a construction method (summarised in Figure 38) for the mounds that owes more to sculpture than civil-engineering construction:

1. A temporary berm is built on top of the existing ground on the outside perimeter of the proposed mound;
2. The inside face of the berm is shaped to form a mold for the edge coping and lined with a geotextile;
3. The edge coping is built up in stabilised layers of soil and gravel material, with occasional reinforcing mesh laid across the layers;
4. The soil in the mounds' interior is backfilled against the coping, which acts to form the interior mould and;
5. Once set, the berm is removed back to the geotextile, which is also removed to reveal the finished-edge coping face.

241 Mosbach's office supplied a selection of photographs and drawings from the construction process, though these had no explanation and therefore I have interpreted them myself.

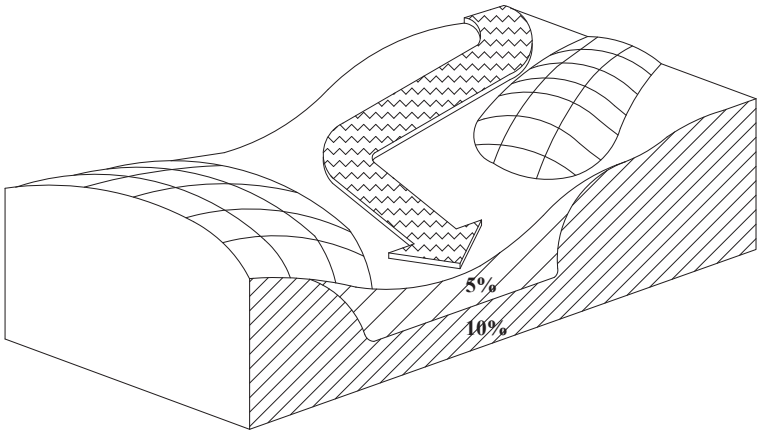

Figure 41. Mound diagram, 2011
The relationship between cement content (%) and surface topography can be manipulated to guide mound collapse, where more cement makes coping more resilient .

The biggest differentiation between my observation on site and the documents supplied concerns the type and location of reinforcing. The drawn detail supplied by the designer shows a reinforcing mesh on the outside of the wall, presumably close to the surface, held in place by soil anchors into the soil behind (Figure 39). On site, however, I observed a horizontal mesh—like a fencing mesh, its edge protruding through the eroded surface of the coping—suggesting horizontal layers of mesh laid down in layers as the coping was built up (Figure 40). This is a sensible solution since it uses the resultant friction from the depth of the protraction into the mound. In terms of the change of the mound, it's clear that the mesh rusts more slowly than the wall is eroding or collapsing, revealing the mesh as it extends past the face. Calibrating the speed of decomposition of the mesh to the collapse of the wall requires considering the time of two different sorts of process. While the wall will erode at one rate due to weathering affected by the soil constitution (discussed below), the reinforcing will oxidise at a different rate because it is dependent on the walls collapse to reveal the steel to air and water. Correspondingly, the reinforcing will always protrude past the wall.

The greatest variable in the rate and nature of the collapse of the mound wall is the constitution of the soils in the wall, in terms of their coherence, notably the percentage of a stabilising agent, such as lime or cement, mixed into the soil, and the gravel mix of particular parts of the horizon. Each layer might have a different percentage of stabiliser, and act differently, depending on how much gravel is included, meaning some layers may be like concrete if they have lots of aggregate-like gravels, while others are more like a biscuit-like sand bed. How they overlay each other and the relationship to the surface topography means that it's possible to imagine designing the mix in relation to areas of the façade to cause failures in different parts at different rates and to guide deposition (Figure 41).

Vegetation

In this project, vegetation and topography interact because vegetation growth stabilises the soil surface and reduces its ability to be eroded where there is vegetation cover. Consequently, vegetated areas will be higher in elevation than those without vegetation. The nature of the vegetation community will also have an effect on the shaping of the surface because of how the plants occupy the soil profile, with trees providing a deeper stabilisation compared to grasses, which will stabilise the surface. The foliage of the plants will also affect the surface because of the effects of organic matter on covering surface and acting as a mulch to reduce particle mobility due to splash and also for the organic matter to increase coherence of particles in the soil. At the same time as it increases

Figure 42. Environment Gallery, Bordeaux Botanical Garden, 2010
A pine tree growing on a mound adjacent to edge may cause edge coping to collapse.

the stability of the surface, large trees on the mounds may fall over since the mounds are operating like pots (Figure 42). The weight and direction of vegetation will put pressure on the edge of the mounds, perhaps leading to a catastrophe where a segment of the edge may fail, ultimately leading to a mass movement of soil to the adjacent surface.

While the designer's intention in relation to interpretation may be to produce a self-regenerating ecology indigenous to the region, the endemic condition of the site is a degraded urban site in the midst of a cosmopolitan flora that would not naturally regenerate, as the designers would prefer, if left alone. Creating an appropriate soil profile and utilising appropriate species does not mean that the situation is ready for regeneration. In the face of cosmopolitan Europe, where plants have been moving around the continent due to human interaction for millennia, this attempt at ecological purity is naïve, since, in purely ecological terms, this is still an artificial approach. As species grow larger, the density of vegetation increases and plants start creating microclimatic effects that affect other species, such as increases in humidity and increased water holding in soils, as plants shade the soil, reducing temperature, and as plants begin to deposit organic material. At this point regeneration may begin, with grasses and annuals beginning first, either sending out stolons, or individual clumps expanding outwards. It is difficult to predict if sexually propagating species, notably trees and shrubs, will regenerate because it depends on a number of interrelated factors—notably, biodiversity, pollination and seed-dispersal agents. To produce seed, plants must be able to be pollinate, which may depend on whether appropriate pollen is available within individual species, and with appropriate genetic diversity.

Figure 43. Environment Gallery, Bordeaux Botanical Garden, 2010
Colonisation of deposition landform by grasses and annuals.

Additionally, pollen must be transferred from one plant to another by an appropriate agent, whether wind, fauna or insect. Once seed is produced, it must also be dispersed. If just one of these factors was not present, the process will fail. Also, if only one species regenerates, perhaps vegetatively, then that species may dominate, and possibly dislocate other species, thus reducing biodiversity. The fact that there are "weeds" in urban situations is because these agents are already present there for those species. A review of the species that have regenerated since the mounds have begun to erode confirms that most plants are grasses and annuals, and largely comprise weed species (Figure 43). Again, this demonstrates the failure of the interpretive dimension in terms of replicating the indigenous situation, but also highlights its success in terms of demonstrating a process.

3.6 Permissible Change

Over time, the area of the mound will increase, as its edges break down and are transgressed. The mounds are surrounded by trafficable sand of the same constitution as the mounds, so that as the mounds break down and move, there is no edge against which they are juxtaposed. In conventional landscape projects, edges provide a mechanism for controlling vegetation and are also a benchmark to appreciate the desired extent of vegetation. Should vegetation encroach too far over an edge, it gets cut back to that edge. In the Bordeaux Botanical Garden example, by surrounding the mounds with similar material, they can "move" without seemingly being out of control. Nonetheless, a further edge is provided as paths set between the mounds in an angular crystalline geometry (Figure 44). These are mostly 1 to 3 metres from the edge of the mounds, and thus a good deal of movement allowed for before the contents of the mound and their expansion intrude upon the functioning of the paths. Regardless, there

Figure 44. Environment Gallery, Bordeaux Botanical Garden, 2010

The gravel base below the mounds and the concrete path are contingencies for the mounds collapse.

Figure 45. Entry ramp, Bordeaux Botanical Garden, 2005

Entry path/ramp with materials that will degrade differently, allowing change but maintaining access.

Figure 46. Environment Gallery, Bordeaux Botanical Garden, 2010
Despite the mounds being deliberately designed to erode, the deposition zone of this mound has been fenced off.

are numerous paths throughout the Garden so they act as a contingent system of circulation should the mounds eventually cross them. In a discussion of the differential endurances, durations and resistances of elements and their materialities, simple relative location of objects plays a part, since the proximity of objects affect each other. Thus, even while a path is relatively static and unchanging, its location in relation to the mounds begins to interact with other time periods or time scales.

A similar strategy is used on the entry ramps (Figure 45), which allow for vegetation but balance this with the necessity of easy access for pedestrian traffic. There are three materials used in the ramps, each with different levels of permeability or resistance to degradation: perpendicular bands of prefabricated concrete slabs, such as stepping stones; a bitumen path as a line running up the ramp between the slabs; and loose, unstabilised aggregate in the gaps between the concrete and the bitumen. In order of durability, the slabs are the most durable and unlikely to degrade much over the life of the project. The bitumen path is durable, but will begin to degrade at the edges within five to ten years, eventually falling away at the edges, making simply a gradient of permeability into the aggregate. The blue metal aggregate surrounding both these is totally permeable, and will allow colonisation of vegetation, and indeed this is already happening. With their different time intervals, different contingencies for long-term performance are embedded in the design, while also directing and encouraging change.

The public landscape is codified with numerous elements that contribute to our sense of its civic-ness and public-ness, including the provision of services such as lighting, seating, circulation and maintenance. Interestingly, this maintenance is vital because it gives the sense that there is control of the landscape, or demonstrates the presence of a public authority. Maintenance is an action rather than an item, and demonstrates a constancy of attention in time. The look of the designed landscape is synonymous with this control, and this control extends into control of detail. A tightly controlled space is a tightly detailed one. This sense of control, both by clients and by landscape architects, will have to be relinquished—or, at least, loosened—to accommodate the types of change processes I am discussing in the urban landscape. An example of this can be seen at the Botanical Garden, where a fence has been erected along one of the mounds where the coping is collapsing, despite the fact that this is a central design idea of the Botanic Garden's interpretive agenda. Clearly, the

Figure 47. Environment Gallery, Bordeaux Botanical Garden, 2010
As the mound has eroded it has become trafficable, and so signage has been installed asking users to keep off.

mound looks out of control or dangerous and has been mitigated to remove a potential public liability or safety issue (Figure 46). In another part, the change of topography has effectively created a ramp that allows easy access to the top of the mounds and so a sign has been erected to prohibit the use of the mound for non-botanical purposes (Figure 47). This demonstrates that, while the mounds are an experiment, they are an experiment of a scientific or botanical, rather than social, nature. When they change form they also engage users and one wonders if this too could have been incorporated into the flexibility of their design, perhaps by using human weight to compact, disperse seed or change runoff.

In a manner similar to contingency, Anita Berrizbeitia proposes that "process-based practices anticipate change from the outset . . . [where] designing is less about permanence and more about anticipating and accommodating growth, evolution and adaptation in the face of unexpected disturbance and new programs and events".[242] While Berrizbeitia advocates process, her language of "anticipation" and "accommodation" still uses a predictive model, and reflects a recognition of change rather an embracing of it and working with it in time, as I discuss in the next two chapters.

Another aspect to this notion of "permissible change" concerns the endurance expected of a piece of landscape construction. From a practice point of view, the expectations that clients and the community have of the building profession is that they produce something that endures. Endurance is the ability to continue existing despite the action and processes of the environment. To endure, landscapes need to be resilient, a quality that is expected of materials. Niall Kirkwood discusses the material resilience of designed landscapes in relation to change in his book *Weathering and Durability in Landscape Architecture*, and notes that:

> the concerns of continuity and change have been ever present (in landscape architecture . . . it is accepted that the materials of landscape architecture, in particular plants, alter, grow, and in some cases die in ways not predicted or desirable . . . Recently, however, built landscape design works have been deteriorating at an alarming rate.[243]

242 Anita Berrizbeitia, "Re-Placing Process," in *Large Parks*, ed. Julia Czerniak and George Hargreaves (New York: Princeton Architectural Press, 2007), 179.

243 Niall Kirkwood, *Weathering and Durability in Landscape Architecture* (New Jersey: John Wiley & Sons, 2004), viii.

While Kirkwood notes the inherent changeability of landscape, he also regards this change as deterioration. Of the kind of materials used at the Bordeaux Botanical Garden, Kirkwood notes that

> Inert landscape materials may be less visibly altered and appear more resilient to physical change during their life cycle; however, they are also altered by cycles of weathering and decay that are in some cases able to be arrested through repair and replacement.

In relation to this, the approach to construction at the Bordeaux Botanical Garden is paradigmatically different, focusing instead on facilitating and directing, rather than avoiding, the forces of time. Kirkwood's approach is based on the reasonable prioritisation of functional performance, predictability for clients, sustainability and diminishing resources. Such an approach is based on maintaining an initial proposition, or, for growth, a particular prediction.

In *On Weathering*, Mostafavi and Leatherbarrow propose the need to

> revise the sense of ending of an architectural project, not to see finishing as the final moment of construction but to see the unending deterioration of a finish that results from weathering, the continuous metamorphosis of the building itself, as part of its beginning(s) and its ever changing "finish".[244]

Using the pithy epithet that "finishing ends construction, weathering constructs finishes", the authors contrast their approach to "maintenance [that] aims at renewal and involves both conservation and replacement", questioning whether "weathering is only subtraction, can it not also *add* and enhance?"[245]

In a similar manner, I suggest in this dissertation that landscape architecture is characterised by a process of continuous transformation, which reconsiders what resilience is. Change is inevitable in the natural landscape. Having consistent and continuous physical state in the face of this change requires constant maintenance and input of energy into the system, since the inherent nature of thermodynamics is to transfer energy and increase disorder. Whereas resilience seeks to resist the second law of thermodynamics by reducing material transformation and the production of novelty, in this dissertation I argue that it is the production of entropy that characterises the landscape, and, further, in evolutionary terms, develops it and the organisms in it. As noted in relation to definitions of change, and as I have shown in relation to the process discourse, there are more options than total control or total surrender to the whims of the process. Instead it is possible to accept and work with the second law process of energy transfer, harnessing the movement of energy to create formal and material outcomes, as is done at the Bordeaux Botanical Garden through the direction of erosion, weathering and decomposition.

244 Mostafavi and Leatherbarrow, *On Weathering: The Life of Buildings in Time*, 16.
245 Ibid., 6.

3.7 Novelty as Entropy

In this dissertation I propose that a key quality of change is the spontaneous creation of novelty by a process. In general, such novelty can result from thermodynamic processes, and the interaction between the laws of thermodynamics, as introduced in Chapter 1. In the case of the Bordeaux Botanical Garden, I am proposing that the novel landforms arising in the Environment Gallery are an expression of the entropy resulting from the energy transfer from the mounds into the environment that accompanies the erosion process.[246] While this argument relies on complex mathematical modelling, discussion of entropy in soils is still largely about principles, since soil systems are open, and quantification of all variables in open systems are impossible.[247] In effect, I am proposing that to design using processes that produce novelty is to deliberately orchestrate entropy.

The first law of thermodynamics states that energy is conserved but that exergy (work energy) in the form of heat is transferred out of a closed system. This change is irreversible. The second law of thermodynamics is, in a sense, a formal explanation of the first law, since it describes the ordering of the energy transfer. The second law states that entropy in an isolated system that is not in equilibrium increases, where entropy is energy that is no longer in a useful form, often described as disorder. Considered in the terms of usable energy, this sense of order is clear; however, when second-law thinking is used to describe other things, the concepts of order and disorder become more like value or aesthetic judgments. Ilya Prigogine & Isabella Stengers note the poetry of emergent entropic difference when they suggest that:

> Nietzsche was one of those who detected the echo of creations and destructions that go far beyond mere conservation and conversion. Indeed only difference, such as difference of temperature or of potential energy can produce differences that are also differences. Energy conservation is merely the destruction of difference together with the creation of another difference. The power of nature is thus concealed by the use of equivalences.[248]

I will now relate the Environment Gallery to the laws of thermodynamics. Considered in relation to the mounds, erosion is the particular form of the general expression of the first law of thermodynamics and is the"natural degradation of soils".[249] In discussing the development of soil peds—the building blocks of soil structure composed of chemical aggregations of clay or silt, water and minerals—Wilding, Smeck and Hall note that "soil formation is basically an energy consuming process".[250] They propose that the additional energy required for this process is transferred into the system from external processes, such as solar radiation, in the form of carbon

246 I am grateful to Prof V.P. Singh for confirming that "my reasoning makes sense" and referring me to references to support this conclusion.

247 P Wilding, N.E Smeck, and G.F Hall, eds., *Pedogenesis and Soil Taxonomy* (New York: Elsevier Science Pub. Co., 1983), 55.

248 I Prigogine and I Stengers, *Order out of Chaos* (London: Fontana, 1984), 111.

249 "Like all things, soils are subject to the second law of thermodynamics . . . and a natural degradation can be expected, the result being diminished soil quality and resilience," W Chesworth, ed. *Encyclopedia of Soil Science* (Dordrecht: Springer, 2008), 205.

250 Wilding, Smeck, and Hall, *Pedogenesis and Soil Taxonomy*, 59.

resulting from photosynthesis of plants, for example, from gravity, or from the transfer of matter from one soil system to another, which is "commonly added to soils by mass movement, wind and precipitation and lost by erosion".[251] Erosion of the mounds at the Botanical Garden, then, is the transfer of energy out of the mound system and into its context on the adjacent surface. Thus, it is an expression of the first law of thermodynamics. For the purpose of understanding the effect of the second law on the Bordeaux Botanical Garden's mounds, the formal and material configuration of the deposition landform is an expression of the entropy exported to the context from the mound through the action of rainfall and overland flow.[252]

That the deposition landform at the base of the mound at the Botanical Garden seems stable, denuded and geometrically simple reflects the third law of thermodynamics, which is that the entropy of a system reduces as the energy reduces. This is a description of how a system reaches equilibrium—although, given that equilibrium is impossible in an open system, it is really only about the appearance of stability. This is a process of moving toward a macrostate of uniformity, and a microstate of maximum disorder; the tenet "order out of chaos" aptly describes this condition. The stability of the macrostate is probabilistic and its simplicity reflects that with an almost infinite number of microstates turning over, the probability of a consistent microstate is high.[253] The stable, unmoving deposited landform has this appearance because almost all of its energy has been transferred to the context, which, for a soil, may refer to a leaching of moisture and nutrient. Artist Robert Smithson famously described the resulting equilibrium state from entropy as a kind of "radical banality"—"a kind of architecture without values or qualities . . . if anything . . . a fact".[254]

If we accept that novelty is produced by encouraging entropy, it's interesting to consider what principles might be used to deliberately do so. Contemporary second-law thinking about issues of sustainability uses the modelling of energy transfer to minimise losses of exergy, proposing that changes of form or state be minimised, since each results in a thermal loss.[255] To encourage entropy would be to allow and direct such transfers or changes of state. If we return to the original Carnot steam engine, which initiated thermodynamics, maximising the surface area of the engine exposed to the external thermal environment would also maximise energy transfer. Here we can see that principles that multiply the number of state changes, or that increase surface areas, increase entropy. In effect, if we increase interaction with other entities and environments, we increase entropy. This could be a description of ecology, which could then be re-described as a science of energy transfer.

---

251 Ibid., 61.

252 "The erosive soil may be transported out of the system, thereby sucking the excess entropy out of the system. We assume that the transportation is realized by processes that are external in relation to the system." Y.M Svirezhev, "Application of Thermodynamic Indices to Agro-Ecosystems. ," in *Handbook of Ecological Indicators for Assessment of Ecosystem Health*, ed. Sven Jørgensen, R Costanza, and F-L Xu (Boca Raton: Taylor & Francis, 2005), 263.

253 This modelling of probability is the same used for the "Infinite Monkey Theorem", that, given enough time a monkey hitting keys on a typewriter at random will come up with the complete works of Shakespeare.

254 Robert Smithson, "Entropy and the New Monuments," in *The Writings of Robert Smithson*, ed. Nancy Holt (New York: New York University Press, 1979), 9.

255 Stremke, Van Den Dobbelsteen, and Koh, "Exergy Landscapes: Exploration of Second-Law Thinking Towards Sustainable Landscape Design."

Considered in relation to Kirkwood's notion of material durability, a novelty-producing strategy is clearly one that encourages rather than limits diverse interactions between materials and their environments.

In a recent essay, Mosbach discusses entropy herself;[256] she reflects on the term "quality of life" and its use as a metric, suggesting that rather than being a static formula, it is really a dynamic relationship in time between an individual subject and the environment, which she calls a "territory of entropy". Mosbach uses the term "performances" to describe the way that the "co-production" between users and situations, which she refers to as a "huge, heterogeneous living factory", transforms resources that are waste in one context to become available again in another, during which time they emerge as a new form through a process of morphogenesis. Writing about "a new materialist practice" in relation to Prigogine and Stengers' notion of matter as "timing in space", Jon Goodbun and Karen Jaschke suggest "we need to find new paradigms for thinking about the unfolding dynamic reality if material processes, and our relationship to those processes".[257] While this notion seems to mirror Mosbach's sense of performance, Goodbun and Jaschke are critical of what they call "notions of flow and throughput", which they suggest are misleading because they such notions imply that something passive is being manipulated by humans, or quasi-alive entities, such as "the market",[258] which seems to resemble Mosbach's notion of one man's waste as another man's treasure, so to speak. In this section, I argue that, as Goodbun and Jaschke suggest, "material flows are never smooth; rather they are convoluted and complex, because matter literally constitutes and embodies economic, political, social and even mental configurations",[259] and that formal novelty results from such timings in space that describe thermodynamic processes.

3.8 Conclusion

As I have shown, the Bordeaux Botanic Garden uses the relationship of inorganic materials and the meteorological environment to create change and stimulate growth. In particular, it uses topography and soil characteristics to direct erosion. In line with the second law of thermodynamics, new soil mixes and novel deposition landforms arise that encourage colonisation. In terms of landscape materials, the Botanical Garden uses variations on conventional constructions methods, such as mortar, and hybridises these with soils to stablise them. In so doing, it builds upon the qualities of soil and the qualities of mortar, effectively changing the quality of cohesion in a soil mix but using cement. This hybridity allows the project to be both speculative or theoretical and pragmatic, facilitated by the didactic nature of the Botanical Garden program.

256 Catherine Mosbach, "Performations," *Architecture and Ideas*, no. 11 (2011): 97.

257 Jon Goodbun and Karin Jaschke, "Architectural and Relational Resources: Towards a New Materialist Practice," *Architectural Design*, no. 218 (2012): 29.. I quote Prigogine about thermodynamics in chapter 1 and again in this section below.

258 Ibid.

259 Ibid.

The fact that this is delivered through the construction documents prior to implementation makes the Botanical Gardens unique among the case studies, which are otherwise all ongoing and non-representational. Since a key argument of the dissertation is that the emerging novelty from processes is best engaged with directly through gardening-like processes, the botanic garden is an important exception that demonstrates that change can be facilitated though conventional project-delivery mechanisms. The gardening-based projects can deal with emerging issues over time whereas the conventional project must predict them and use contingency to factor them in. Correspondingly, while the gardening project can be loose, the conventional project must be precise. This precision can restrict possibilities and extrude the future in a uniform way, while gardening does not just mitigate differences but works with and optimises them into exciting novelty. Nonetheless, the way that paths, edges and configuration have been detailed at the Botanic Garden still allows change while covering contingencies. However, fencing and signage that have been installed indicate that, without the constant presence of the designer, change can be threatening.

The case study demonstrates that an approach can be developed that creates a spatial gradient of control, with parts that are tight and parts that are loose, and considerable opportunities for design and detail negotiating between the two. This can be done by creating details of different endurance and duration, of which the edge-coping and the path are examples at either end of the spectrum. While the focus of the dissertation is on gardening-based processes, it attempts to maintain a strong design-based and formal view of change. The Botanical Garden is important because it avoids polarisations of form and process and instead creates forms to express process and then gives those processes a place in the dynamic formal language of the project.

Chapter 4: Case Study 2— Sven-Ingvar Andersson's Garden in Marnas, Sweden

4.1 Introduction

Figure 48. "The Henyard", Marnas Garden, 1986
Hawthorns pruned into the shape of chickens are collectively called the "Henyard" (in an older photograph by Andersson)

Growth is the unique property of vegetation, a major material used in landscape design. By manipulating plant growth over time, the activity of gardening offers significant formal opportunities to landscape design. While gardening and landscape architecture are historically related, they are practically separate in contemporary landscape-architectural practice, where landscape architecture is seen as a design practice and gardening as a trade or amateur activity. However, the long-term development of gardens and landscapes requires gardening actions to achieve the predicted planting outcome of the initial design. In this dissertation I argue that the separation between landscape architecture and gardening means that landscape architects are unable to optimise emergent qualities that arise from the growth of the garden. Like Tree City, discussed in the section entitled "Performance" in chapter 2, the use of gardening tools and processes have a significant formal and spatial effect but operate in tactical rather than strategic terms.

In this chapter the relationship between gardening and landscape architecture is examined using the case study of Sven-Ingvar Andersson's garden at Marnas, Sweden. I do so because Andersson used his own garden both rhetorically, to speculate on the role of the gardener and aspects of the relationship between gardening techniques and formal design outcomes, and also practically, as a laboratory for testing his own model and projections into the future.[260] The case study demonstrates the opportunities gardening offers for form generation.

260 Andersson continued a lineage of Danish landscape architects who considered gardening and using their own gardens as laboratories, such as G.N. Brandt. Stefan Boris discusses Brandt and his concept of "The Coming Garden": "[Brandt]gave his profession a new dimension by combining academic matter-of factness with a craftsman-like understanding of both nature and the possibilities of the material and the conditions for health and growth of the plants" (Stefan Boris, "Gardens of Situations - Learning from the Modern Danish Landscape," *PhD Working Paper*(2009).)

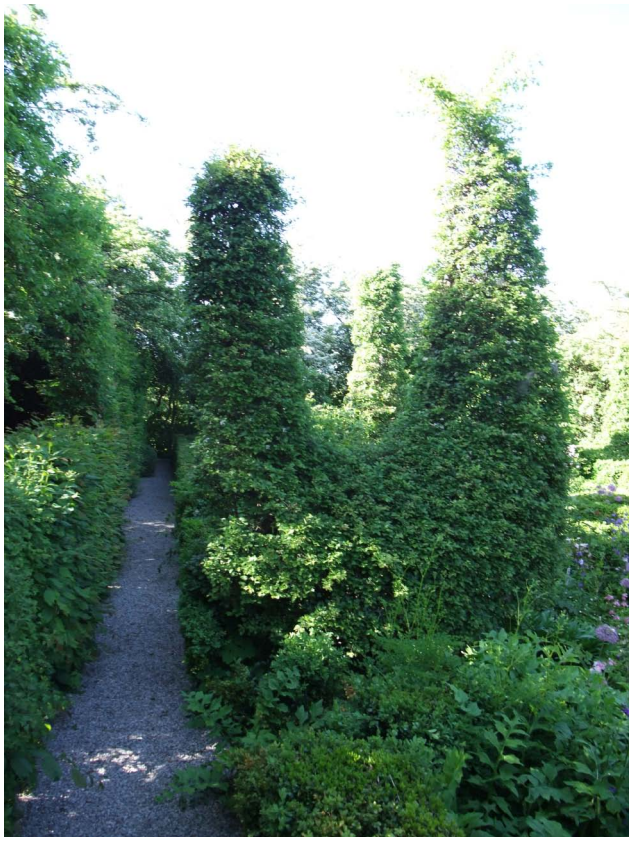

Figure 49. "The Henyard", Marnas Garden, 2010
When I saw, the chickens recently they were fundamentally the same as they were Figure 48, despite Anderssons predictions of their change to "a Hawthorn grove" by his death

Writing about the Marnas garden in *The Language of Landscape*,[261] landscape architect Anne Whiston Spirn focuses on an area called 'the Henyard', where Hawthorn trees have been cut into the shape of hens (Figure 48). When, at the age of forty, Andersson speculated on his garden in the future, he was considering not just his garden but himself as an old man, and was both excited and apprehensive at the time that would pass in between. "A lot can happen before the hen yard becomes a hawthorn grove", he noted, foreseeing a time when he would no longer have the strength to "hold clippers or climb up ladders",[262] and rather, would "sit in a grove of hawthorns with a blanket around [his] legs".[263] In formal terms, Andersson gives the gardener, rather than the designer, the dominant role in form production in the garden. He demonstrates that the production of that form in time arises from the constant or long-term action of the gardener. The transformation of the hens to hawthorns was the primary reason I visited the garden, since the relationship between landscape form, plant biology and gardening activity, and Andersson's writing about it, made it seem relevant to the dissertation.

Christophe Girot notes that during a site visit—which he describes as "Landing"— there is a ". . . moment when a designer reacts to the difference between his or her preconceived idea of a place and the reality that appears during the first steps of a visit".[264] When I visited the Marnas garden I discovered that the hens were still hens and had not become a hawthorn grove as Andersson had predicted earlier (Figure 49). Consequently, the hens could not be used to study the result of Andersson's experiment or his theorising, though, in itself, this lack of change demonstrates how a designer's intentions for a garden and what happens over time can be radically different. Nevertheless, when comparing early photographs of the hens to the site that I visited, I noticed that the adjacent hedged garden rooms are markedly different (Figure 50). Thus, the changes and response of the hawthorns outside the henyard may be a better location to study Andersson's gardening experiment, even though it was initially developed in relation to the Hens.

261 Anne Whiston Spirn, *The Language of Landscape* (New Haven: Yale University Press, 1998). I also mentioned Spirn in Chapter 2.

262 Ibid., 192.

263 Andersson, "Letter from My Henyard," 106.

264 Christophe Girot, "Four Trace Concepts of Landscape Architecture," in *Recovering Landscape: Essays in Contemporary Landscape Architecture*, ed. James Corner (New York: Princeton Architectural Press, 1999), 61.

Figure 50. The Passage, Marnas Garden, 1976
This early photograph shows the hawthorns closely clipped to be ahedge, which have since grown into a diverse range of plant forms.

Correspondingly, I examine the garden rooms rather than the chickens as I had initially planned.

The chapter begins with an introduction to Andersson and his garden. It then goes on to briefly discuss other landscape architects James Rose, Gilles Clément and Pascal Cribier, who had an interest in the form of plants and in gardening respectively.

Following this, planting design is discussed in relation to predicted growth, after which a language of plant biology and pruning is developed. In this dissertation I propose that the form of a given garden embodies a dynamic relationship between the planting design and its subsequent maintenance, where form is generated by manipulating plant morphology. This provides the foundation for the primary contribution of this chapter—my analysis of the garden at Marnas, based on observations I made during two site visits, which is in the section entitled "Pruning Study".[265] This section examines the way that Andersson's garden rooms have been shaped through pruning and speculates on the development from their form. To answer this chapter's research question, "What does gardening add to the spatial and formal development of a planting design?", I needed to compare historic plans of the garden drawn by Andersson with the current condition of the garden as I found it. I focused on three vegetation elements (the hedgerow, the passage, and the hedge), measuring the spacing of the hawthorns. While the spacing's remained the same each element had different qualities that I documented in photographs in relation to the uniform spacing's. Finding that the plan remained the same I then use my training in botany and horticulture to explain the different qualities that have emerged. I looked for scars that showed previous pruning and modelled the maintenance actions in relation to the plant form as I found it. By re-drawing the planting plan of these three elements on the basis of my site measurements I was able to compare and contrast it with these drawings to answer this research question. I end the chapter by returning to Andersson's writing about the chickens and DNA and argue that there

265 This dissertation does not constitute a thorough scholarly treatment of Andersson, his garden at Marnas, or Scandinavian landscape architecture in general. I rely on my own observations and English documents exclusively because I am unable to translate from Danish or Swedish. However, I am aware of the significant body of writing on Andersson and the Marnas garden in those languages. A thorough history of modern to contemporary landscape architecture with an emphasis on Scandinavia is given by the late Malene Hauxner in her three-volume project: Malene Hauxner, *Fantasiens Have: Det Moderne Gennembrud I Havekunsten Og Sporene I Byens Landskab* (Copenhagen: Arkitektens Forlag, 1993); *Open to the Sky: The Second Phase of the Modern Breakthrough 1950-1970. Building and Landscape, Spaces and Works, City Landscape.* (Copenhagen: Arkitektens Forlag/The Danish Architectural Press, 2003); *Fra Naturli Natur Til Supernatur: Europæisk Landskabsarkitektur 1967-2007 Set Fra Danmark* (Risskov: Ikaros Press, 2010).

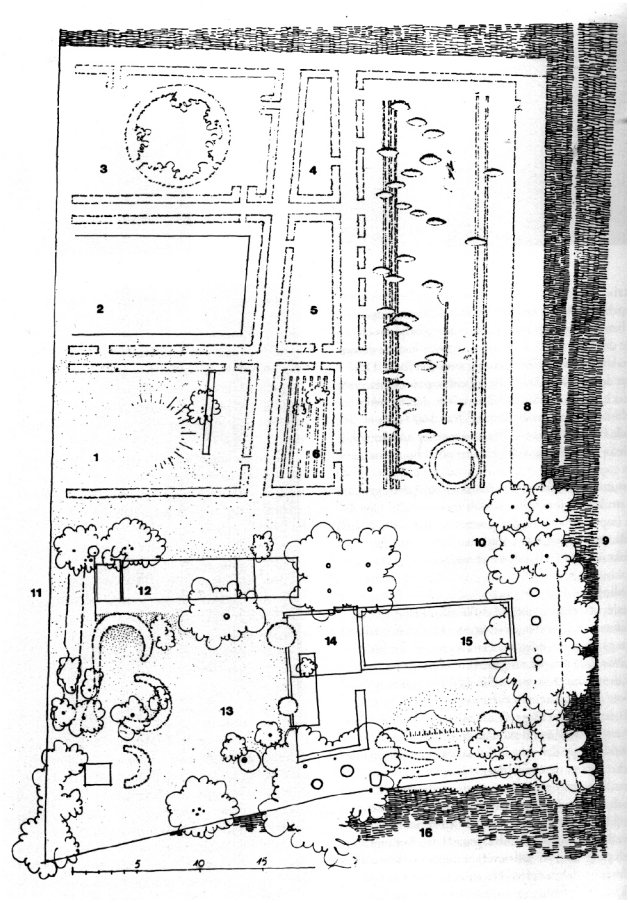

Figure 51. Plan of Marnas Garden, n.d.

As there are more schematic "working" plans of the garden (see Figure 65), this plan was probably drawn after construction to accompany publishing about the garden.

Figure 52. Crataegus monogyna (Common Hawthorn), Marnas, 2010

Characteristic flow and leaf of Common Hawthorn, as seen in the Marnas Garden.

is a dynamic relationship between the novelty that arises from individual genetic expression and the more predictable characteristics of the species, supported by writing about genetics by Jacques Menod.

4.2 Project Overview

Sven-Ingvar Andersson (1927–2007) was a renowned Swedish landscape architect who studied botany and biology at Lund University and landscape architecture at the Swedish University of Agricultural Sciences. Andersson worked as an assistant to Professor C. Th. Sørensen[266] at the Royal Danish Academy of Fine Arts, School of Architecture, Copenhagen, teaching there between 1963 and 1994.[267] Andersson undertook a number of well-known public projects outside Denmark and Sweden, including Karlsplatz in Vienna (1971), and Museumplein in Amsterdam (1992).

Since his death, his garden at Marnas has been carefully maintained by his daughter Beate, who graciously allowed me to visit it in June 2010. Marnas is located approximately 14 km east of Lund in Sweden, an hour from Copenhagen. The garden accompanies the family's holiday house on a lot measuring approximately 30 by 50 metres on Dalbyvägen, a road leading from Södra Sandby, and was built in 1957. Originally set in a purely rural context, the property is now sandwiched between a major road on one side and a bicycle path with adjacent townhouses on the other, with a high-tension power line nearby.

266 Sørensen is regarded as one of the great modernist innovators in Danish landscape architecture, as well as a significant theorist and historian, despite the fact that he was Swedish, like Andersson. His (and Andersson's) use of the ellipse became a characteristic of Scandinavian landscape architecture.

267 Anne-Marie Lund, "Andersson, Sven-Ingvar," ed. Patrick Taylor, *The Oxford Companion to Gardens* (Oxford: Oxford University Press, 2006), <http://www.oxfordreference.com/views/ENTRY.html?subview=Main&entry=t215.e0049>; ibid.

Figure 53. Henyard, Marnas Garden, 2010
This panorama shows the contemporary state of the chicken yard, less controlled than it was in 1986 (see Figure 48).

The garden design can be simply described (Figure 51). The garden is divided in two by a line of buildings, the original house, and a newer guest house. The buildings create a roughly one third, two-thirds division, with the smaller third enclosing a grassed area with a summerhouse. The larger part of the garden comprises a series of garden rooms enclosed with hedges of Common Hawthorn (*Crataegus monogyna)* (Figure 52), and is the focus of this essay. The garden room complex is divided longitudinally in three strips. One of these strips runs continuously along the length of the garden and is generally recognised as the major feature of the garden, the 'Henyard', which comprises hawthorn trees cut into the shape of chickens (Figure 53). The other two strips are divided in three to create an irregular two-by-three grid, with one strip thinner and at an angle. This network of rooms and its use of hedges to define it are spatially complex despite a simple-looking plan. As I discussed in the introduction to this chapter, while I had planned to focus on the henyard, I will discuss these garden rooms in more detail in the section entitled "Pruning Study" instead.

4.3 Precedent Projects

While I use Andersson's garden as a case study because it spans the breach between landscape architecture and gardening, there are other landscape architects who have also worked at this intersection. In the following section I will consider three of them: American landscape architect James Rose, and French paysagistes Gilles Clément and Pascal Cribier.[268] Like Andersson, Rose, Clément and Cribier treat plants and plant form as an important part of landscape design, however, they differ from each other in important ways that clarify the relevance of Andersson as a case study. Rose's interest in plants is in developing a formal account for plant growth that attempts to use the qualities of plant form to shape space, to bring modernist architectural notions of spatial definition into landscape architecture, and to develop equivalent landscape-specific materials to do so. Clément's and Cribier's interest in plants also centres on what I would call "qualities", the unique and difficult to describe material characteristics of plants;[269] however, for them, these result from gardening practices, rather than being specified. I will discuss Rose's plant-form diagrams,

268 I introduced Rose and Clément in Chapter 1, and will introduce Cribier later in this section.

269 When I studied horticulture, the terms *form, texture, colour* and *rhythm* dominated planting design, which I always felt failed to describe the unique qualities that plants had. As a teacher I have avoided using language to deal with plant qualities; rather, following the work of Yves Brunier, using drawing and collage.

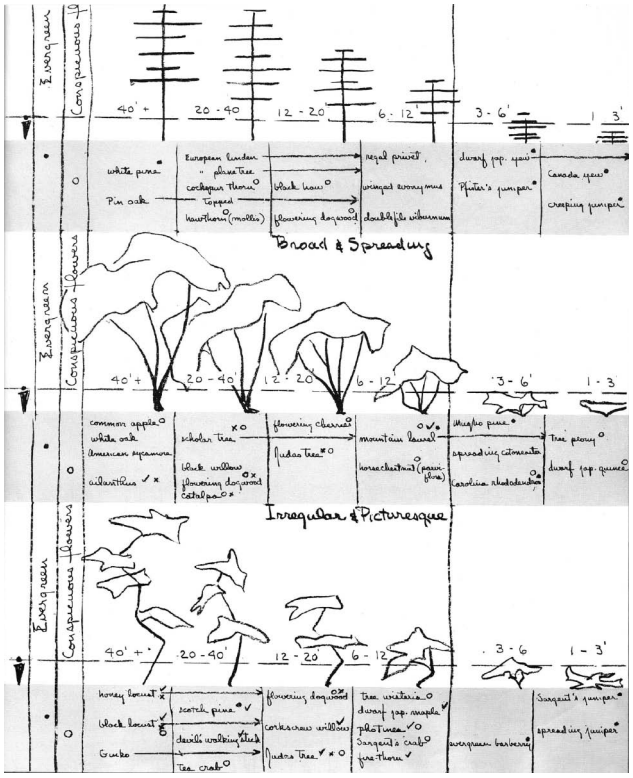

Figure 54. Planting diagram from Creative Gardens, 1958

Rose's diagram groups species into plant morphology types according to shape types.

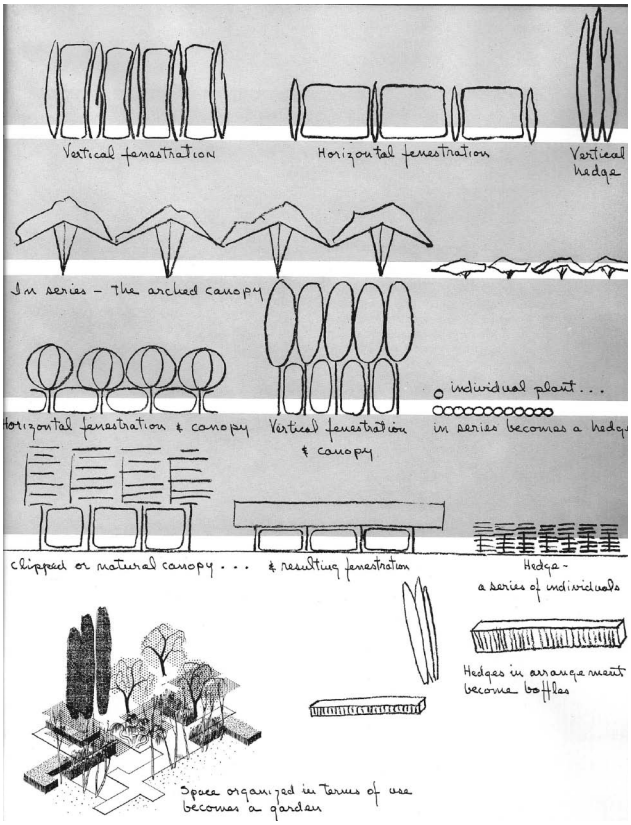

Figure 55. Planting diagram from Creative Gardens, 1958

Following from Figure 53, plant shape types are grouped together to produce aggregate types of transparency.

Clément's project for Parc Henri Matisse, and Cribier's project at Donjon-de-Vez. In the Marnas garden, Andersson brings their different concerns together, sharing an architectonic interest in plant form with Rose, but using the methods and techniques of the gardener operating in time as discussed by Clément. I believe that what is unique to Andersson, and makes Marnas an appropriate case study, is that he did not oppose form and process but used the latter quite deliberately to shape the former.

I will discuss Rose first because, at Marnas, Andersson created an architecture of plant forms that acted together to define space, and was essentially a modernist like Rose, albeit from a later period and within a Danish-modern landscape-architectural tradition. In his book *Creative Gardens*,[270] Rose presents a taxonomy for plants, including organised groups of hand-drawn sketches that show "Plant Forms" (in a chapter of the same name) so as to define their qualities of material transparency. Rose starts with singular plants (Figure 54) and then builds upon them to discuss groups (Figure 55): "the individual plant is a 'specimen'; through spacing it becomes: fenestration; hedges; baffles; tracery; clumps; canopy".[271] Understanding plants by their opacity or transparency was of key interest for Rose, who sought to dislocate two-dimensional composition, focusing on three-dimensional space in a typically modern fashion: "The sense of transparency, and of visibility

270 James Rose, *Creative Gardens* (New York: Reinhold Publishing, 1958). Meyer has also written about Rose's taxonomy of tree forms. Meyer, "Kiley and the Spaces of Landscape Modernism," 126.

271 Rose, *Creative Gardens*, 196.

broken by a succession of planes. If transplanted into terms of outdoor material, would be sufficient in itself to free us from the limitations imposed by the axial system".[272]

Rose creates a typology of tree forms that is broken up into six formal categories: columnar; pendulous or weeping; round or oval; horizontal; broad and spreading; or irregular and picturesque. This division is determined on the basis of the attributes of each plant. Visibility of the branching form and trunk is the major criteria, as manifest by the leaf density that reveals or obscures the branches, and how dominant the green canopy is compared to the trunk. Thus, the types columnar and round or oval are drawn as solid forms, where leaves obscure branches and create a single green mass. Like the lawn, this results from frequent pruning that causes branching. When the leaves are less dominant or less camouflaging than the branch structure, the trees are drawn as predominantly branching based, which includes the types pendulous or weeping and horizontal. The final two types, broad and spreading, and irregular and picturesque, describe species that balance leaves to branching, where a leaf canopy sits among the branching structure.

After developing a species-selection mechanism by growth type and height, in the next table, Rose considers how individuals of these growth types can be aggregated to produce particular enclosure effects, which he also divides into another typology, including clumps, hedges, tracery, broad and spreading, and picturesque. (Andersson does this implicitly when he defines rooms in his plan and the result of maintenance in creating those spaces is evident now.) Viewing Rose's types, the aggregation of species demonstrates how the sense of the individual's transparency is determined in an empirical fashion by the amount of leaf growth and how this obscures the trunk or doesn't, and how this characteristic is enhanced when trees are grouped. While Rose's use of plants converts walls from an interior to an exterior, plants in general contribute qualities due to growth that transcends the clarity of separation and merges qualities (of transparency) and quantities (finite division).

Rose's most important contribution to the discipline of landscape architecture was his highlighting of the important roles of plants: as architectonic form; space shaping; and as a filter through graduating transparency. Andersson's garden at Marnas could be easily deciphered using Rose's taxonomy, and indeed Rose's plant forms seem in tune with Andersson's hawthorns, revealing their mutual modern sensibility for space and form, with the exception of the henyard, which seems more like a postmodern add-on.

As I noted of Rose in Chapter 1, any discussion of plant form implies the growth of that plant, even if this is not articulated. Unless plants are transplanted, they must grow from an immature state to the resultant form of the type that Rose discusses. To do so, they must also have had actions of gardening along the way to encourage them to reach maturity, and, correspondingly, these gardening

272 "Freedom in the Garden," in *Modern Landscape Architecture: A Critical Review*, ed. Marc Treib (Cambridge, Massachusetts: The MIT Press, 1993), 69. As well as operating outside, Rose also pursued this transparency model in his own house in New Jersey, using different types of screen and merging the inside and the outside, a strategy that might have been more appropriate for the tropics than for the cold north east of America. Rose's house is now run by a foundation and able to be visited; see http://www.jamesrosecenter.org

Figure 56. Gilles Clément mowing at Parc Citröen, Paris, 1991

Clément used mowing to influence species mix in this early "Garden of Movement" project.

techniques are also implicit. While Andersson used a similar sense of plant form and of space shaping as Rose, he was also conscious of the role of gardening technique in that shaping process. This sensitivity to gardening technique resembles that of Clément and Cribier.

Clément manipulates mowing to creates hybrid vegetation types in his "garden of movement" projects, such as at Parc Citroen, 1986 (Figure 56), and the Parc Henri Matisse, 1992 (Figure 57).[273] The garden of movement "refers to the physical movement of plant species on the land, which the gardener interprets in his own way", interpretations that comprise maintenance or gardening acts.[274] Geographer Mathew Gandy[275] has written a thorough discussion of Parc Henri Matisse that focuses on spontaneous vegetation[276] in relation to Clément's idea of "du Tiers paysage", or the "third landscape".[277] The "third landscape" refers to landscapes that arise from human land-use but are either derelict or unmanaged, and thus develop cosmopolitan ecologies of 'unnatural' assemblages of species; they can be significant reservoirs for biodiversity. The third landscape and the garden of movement are linked because these derelict spaces allow plants to move, although a significant difference in the garden of movement is the role of the gardener or management.

Mowing paths affects growth of annual and perennial species in the grass mix, in that mown areas lose flowering for a season while un-mown areas flower and produce seeds. Simultaneously, compaction of grass on mown paths favours some plants and not others, so that later, when un-mown, the line of the previous compaction may also be present in what is, and is not growing, and what plants flower at certain times. Subsequent mowing can then adjust around the planting patterns

273 I have visited Parc Citroen twice: once in 1996 and then on 5 June 2005. I visited the Parc Henri Matisse on 15 July 2010. While both of these projects could have been case studies for this dissertation, I chose Marnas for the reasons I describe in this section; namely because it is both strongly formal in its intentions and also strongly controlling in its use of gardening technique.

274 Clément, "The Garden in Movement."

275 Mathew Gandy, "Entropy by Design: Gilles Clément, Parc Henri Matisse and the Limits to Avant-Garde Urbanism," *International Journal of Urban and Regional Research* 37, no. 1 (2012).

276 Spontaneous vegetation is discussed in Chapter 1, but is basically a weed landscape.

277 Clément's version of the third landscape (Gilles Clément, *Manifeste Du Tiers Paysage* (Paris: Éditions Sujet/Objet, 2007).) should be distinguished from Hunt's (Hunt, *Greater Perfections: The Practice of Garden Theory*., 32) landscape historical reading of "third nature", which was discussed in Chapter 1. Clément's description of these landscapes is closer to that of Solà-Morales Rubio's notion of 'Terrain Vague" Ignasi de Solà-Morales Rubio, "Terrain Vague," in *Anyplace*, ed. Cynthia Davidson (Cambridge, Massachusetts: The MIT Press, 1995)., but in landscape terms.

Figure 57. Parc Henri Matisse, Lille, 2010
For another of Gilles Clément's Garden of Movement projects, surrounding Derborence Island, grass is mown to encourage flowers and direct pedestrian traffic (Note also the construction method of island, similar to Bordeaux Botanical Gardens).

that have arisen from the last mowing regime. Species mix and flowering cycles are direct novel outcomes of Clément's "garden of movement" method, as are the resultant access and movement systems that both direct and are directed by the strategy, one type of feedback of the design on its future form. These are all spontaneous vegetation outcomes, whereas I am conceptually more interested in the 'tool' side of the equation—that is the mower and its garden operator—and in the plant form and spatial outcomes, which parallels the use of pruners by Andersson at Marnas.

Clément's "The Garden in Movement" has a step-by-step manual on how to make a garden of movement, which hints at experiential and material aspects of the techniques and tools in gardening.[278] He calls these "Instructions for use" (Figure 58), which immediately emphasises the key role of time since instructions are something used in real time. They do not describe the outcome but steps to get to it, even though the outcome is embedded in the instructions. He gives instructions that direct the reader to the physical sensation of undertaking them:

> Plunge your hands into the oilseed flax . . . make the sweeping gesture of the sower, pushing your arms forward and letting the seeds sift through your fingers. Start again, following the rhythm of your steps, until you have sown all the seeds.[279]

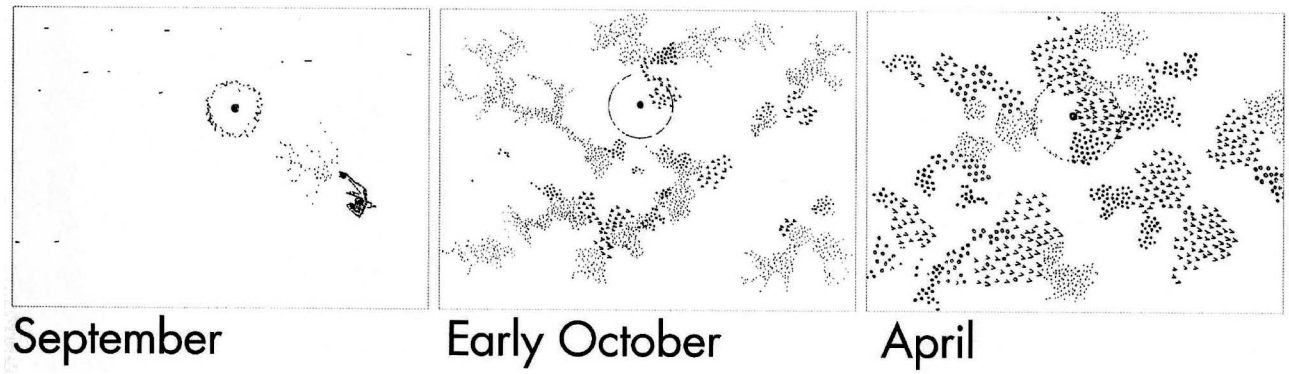

Figure 58. Drawing for The Garden in Movement: A User's Manual, 2007
Over time, the gardener's action of spreading seed will grow into different planting arrangements, but the gardener's physical path sets the trajectory for what will follow.

278 Clément, "The Garden in Movement 2."
279 Ibid.

Clément brings the reader back to the moment through sensation of the flax on the fingers, revealing gardening as a sensual activity. There is no similar appreciation for the labour of mowing; though Pollan understands it when, discussing the lawn, he notes that cutting it requires a "zen approach", presumably describing the boring relentlessness of pushing the lawn mower back and forth.[280] In human labour, the tool of the body has feelings that form part of its utilitarian actions, which also informs how the knowledge is gained. With the movement of arms and the successive rhythm of steps, Clément is describing a field out of which one begins to imagine aggregations of seed at the ends of the rows and a fan-like shape to the field. This links the human movement to an emergent plant form and is not dissimilar to the moving activities, where the performance gives form.[281] In the instructions, Clément also sets out future actions that allow for a feedback relationship with the landscape, since the gardener should "Wait two or three weeks and observe", as the gardener learns via observation and makes action decisions on the basis of emerging conditions, engaging with propensities that are the foundation of the next formal decision. Waiting is a key part of this equation because the plant the gardener reacts to has to grow. Here one imagines that the seed pattern, determined by the kinetic activity of the gardener and the seed's movement through the air, has resulted in clumps of planting. The gardener's action here is to work with that arrangement and push the circulation through the gaps between using the lawn mower. The subsequent acts of the gardener form the boundary by articulating the gap, and simplify the form of the clump to a more recognisable shape or rational path.

This relationship between gardening practice and spatial outcome can be demonstrated in the work of one of Clément's protégé's, Cribier,[282] who also used mowing to affect plant growth, particularly flowering. In his project for Donjon de Vez, flowering seasons and the periodicity a maintenance technique create a flowering display.[283] A fine lawn with horizontal surfaces has invisible zones of flowers throughout, which are concealed by the mowing practice that is rotated in relation to seasonal flowering cycles (Figure 59). This design uses the pattern to engage ecological relationships of the plant material. In this project, Cribier uses two different mowing heights, rotated across different parts of the surface. Since bulbs are planted in the turf, allowing one section of turf to grow tall for a time, bulbs grow unhindered (Figure 60).

Both Clément's and Cribier's projects use gardening techniques to create formal outcomes by engaging plant physiology, and there is a design precision in how this is done. In this sense, Cribier's project is more instructive because even though it simply cuts things off, its timing has impacts on growth cycles with formal (height) and qualitative (colour) effects, as well as the access systems of the paths in the gardens of movement. In fact, mowing creates formal effects in relation to grasses by promoting leaf density and, if stoloniferous, lateral growth. By not allowing

280 Michael Pollan, *Second Nature* (London: Bloomsbury, 2002), 62.

281 This aspect of making a diagram out of the activity reverses the Bergson critique, which I will discuss of making time space, since space emerges concretely from time.

282 Pascal Cribier trained as an artist and architect. In 1990 Cribier's team won the competition for the rehabilitation of the Tuilleries.Marielle Hucliez, *Contemporary Parks and Gardens in France* (Paris: Vilo, 2000).

283 Pascal Cribier, "Blue on Blue," *Pages Paysages*, no. 5 (1995).

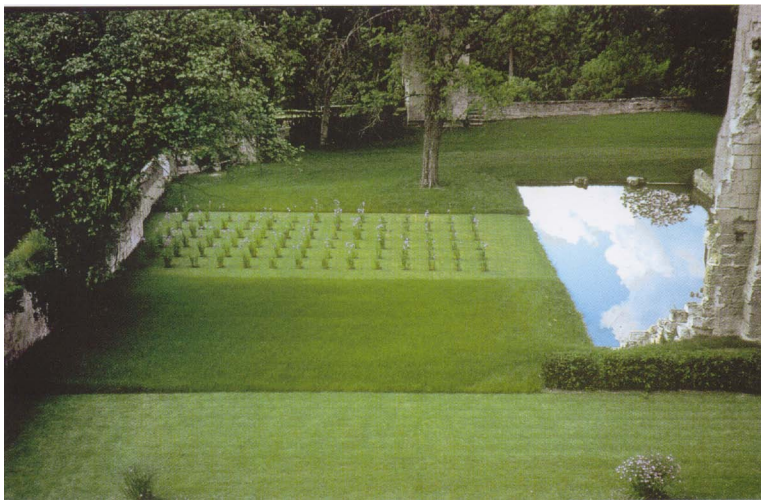

Figure 59. Flower garden, Donjon de Vez, 1990
Pascal Cribier mowed patterns of plants into lawns, by sparing mowing on some patches and cutting others.

Figure 60. Flower garden, Donjon de Vez, 1990
Tulips grow tall and flower, spared from being cut by mowing in relation to flowering times.

flowering, grasses stay focused on leaf development. Mowing is the equivalent to pruning at Andersson's garden at Marnas, but on a different scale, with slightly different morphological action: flowering trees branch in response to pruning whereas grasses re-shoot along a stolon. At a micro-scale, the lawn seen as a material is the result of a small forest, and indeed often has 100% canopy cover, like a rainforest. Its contiguity is a planting, maintenance, and formal decision—organism consistency. Talking about the surface from the perspective of maintenance is to examine the result in terms of the maintenance technique it implies by working back from the form to the morphological agency that caused it.

Danielle Deganais conducted a thorough review of the changes at Parc Citroen over time as an

> in depth study of [a] garden that claim[s] to be based on the principles of ecological science both to better define that science and its place in the process of conception and to analyse more closely the discourses about these gardens as well as their translation into the materiality, the reality, of a given garden.[284]

Demonstrating my earlier point about embodied learning from the act of gardening, Clément notes that the idea of the garden of movement arose from the act of doing it, rather than the project being a test of the idea. Although Deganais' "Garden of Movement" essay has the subheading, "Ecological Rhetoric in Support of Gardening Practice", the maintenance strategies and the gardening techniques remain undiscussed. The effect of mowing seems implicitly related to circulation or the existence or otherwise of vegetation in one spot. In discussing the relationship with gardening, Deganais links mowing to the desire to grow the maximum number of species, linking the garden to ecological notions of biodiversity, which, Clément claims, is increased

284 Danielle Dagenais, "The Garden of Movement: Ecological Rhetoric Tn Support of Gardening Practice," *Studies in the History of Gardens & Designed Landscapes: An International Quarterly* 24, no. 4 (2004): 313.

through his maintenance strategy. Dagenais, like Gandry, focuses on Clément's claims about species richness, Dagenais noting his simulation of natural succession, a link to the third landscape that notes this same process in wasteland sites.[285]

If Rose's (and to some extent Andersson's) vision of the garden is formal, spatial and experiential, and gardening actions are in service of those aims, then this is precisely the problem with the garden for Clément: "Tradition excludes from the garden all those living species, animals or plants, that defy the gardeners control. The advent of ecology overturns this view . . . Yet the garden is made of nature".[286] When Clément proposes that the garden is conventionally an opposition between nature and garden, he polarises form and process, where form seems in his quote to be implicitly about control. When Clément reads gardening as excluding nature and thereby ecology, he converts ecology from being a science to being an ideology.

Reversing Clément's proposition about garden as ecology reveals a truth about nature that Andersson exploits: plants are included in the garden when they can be modified or hybridised by people, pulled into her/his creative oeuvre. Bringing nature into collaboration with people in the garden does not ignore ecology but simply uses it without calling it ecology, referring to it simply as gardening. Stefan Buczacki describes how the garden is an ecological zone, and the gardener its stage manager:

> the garden is indeed an environment of interacting organisms, of which you are, or pretend to be, the most important. It is where life and death continues at all levels and at all times, influenced by and responding to each and every action you take.[287]

Similarly, Pollan recognises that there is a mutual knowing in the garden between nature and the gardener, where gardening is "a painstaking exploration of place; everything that happens in my garden teaches me to know this patch of land better . . . My garden prospers to the extent I grasp these particularities and adapt to them". However, he suggests that this is not so for mowing: "Lawns work on the opposite principle. They rely for their success on the *overcoming* of local conditions."[288] Continuing the reversal of Clément's proposition from above, the mitigation of local conditions is still a reading of place and is also still collaboration with the plant in an ecological manner. As I will argue later, Andersson, in pruning his garden, engages with ecological and physiological mechanisms to achieve his formal results.

This section has introduced other thinkers and projects that share an interest with Andersson in manipulating plant growth through gardening to achieve formal or material results, and whose ideas continue into the Marnas case study. In analysing Clément, I propose that gardening is a shaping process occurring in time that has a sensual dimension as a practice, and where the physical actions cause growth effects. Such a model fits with Andersson's discussion of "holding clippers",

285 Ibid., 323.

286 Clément, "The Garden."

287 Buczaki, *Ground Rules for Gardeners: A Practical Guide to Garden Ecology*, 16.

288 Pollan, *Second Nature*, 69.

and seems to 'embody' Andersson's gardening experience. In considering Rose, I propose that Andersson's interest in plant form had modern parallels that he would also have been aware of. In Rose's work, one sees a language of plant form where gardening is implicit, and, if this is combined with Clément's sense of the work of gardening, one can understand that form and process are not separate but go together to shape space through action, as they do in the Marnas garden.

4.4 Planting and Pruning

Gardens change over time as a result of the dynamic relationship between the predictions made in the initial planting plan and the way that gardening actions modify plant growth to develop particular garden forms. The planting design of the rooms or compartments at Andersson's garden has a rigid and consistent format, but Andersson always assumed that this rigidity allowed for formal variation between the plants due to growth, suggesting more generally that ". . . there are environments that are exciting because they permit a brilliant freedom against the background of a fixed feature in the landscape context or in the pattern of the plan".[289] With this principle in mind, Andersson set out the garden rooms for transformation over time but with the knowledge that "even if it just becomes a big mess, it won't be all bad. My confidence stems from two facts: the simple pattern of the planting and the material, hawthorn."[290] This dynamic between the formal logic of the planting plan and the potentials for change, or lack of it (as I will describe), makes the Marnas garden an appropriate case study for this dissertation. In the following section, I will discuss these two components—planting design and the biology of pruning—to familiarise the reader with background knowledge that will aid in understanding the detailed reading of the Marnas garden that follows.

4.4.1 Planting Design

"Planting design" is a term used to describe the specific part of the landscape design process concerned with how plants will be used in a design. The tool that landscape architecture uses to design with plants is limited to largely architectural methods that work in representation, prior to the implementation of the project, notably the planting plan. A planting plan typically results from a planting design process, which specifies the location of plants. The locations specified are the foundation for subsequent growth. While that growth may take a range of different forms, the locations will not change unless a plant dies and is removed. Planting plans effectively predict growth by the spacing they specify between plants, which includes the physical dimensions of growth in deciding how much space to allow. The planting plan uses predictions of mature size to determine appropriate spacings for plants when they are planted. The predictive model of growth used in the planting plan, which aims for a fixed future mature condition, denies the very thing that makes such an idea unique: growth. A landscape designer tends to see an outcome of growth that varies greatly from the original intention as a catastrophe. Such changes should not only be

289 Andersson, "Letter from My Henyard," 108.

290 Ibid., 107.

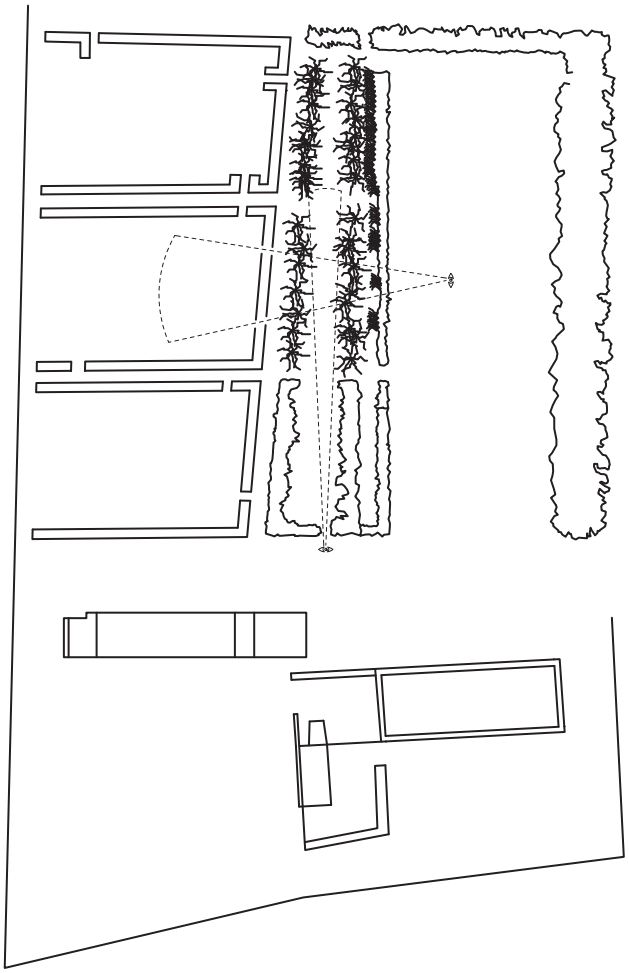

Figure 61. Plan of existing hedges, Marnas, 2010
The original planting plan remains the same but growth and pruning has created differential boundary effects, such as allowing views through compartments.

welcomed as serendipitous (which the *Oxford English Dictionary* defines as "the occurrence and development of events by chance in a happy or beneficial way") but also cultivated through gardening actions, which Andersson sought to balance in his plan when he observed that the garden design has a pattern that can "adapt to whatever serendipitous circumstances are introduced by myself and by time".[291]

There are seven garden rooms at Marnas and each has a hedge enclosing the interior, leaving a passage between hedges that define the adjacent rooms through which circulation through the garden occurs. Andersson described the structure of the garden rooms as ". . . a playground with a differentiated plan. Not with respect to traffic, but spatially."[292] By distinguishing between traffic and space, Andersson acknowledged that while the circulation of the garden may appear simple (and undifferentiated), with clear corridors running between the garden rooms, the spaces that would result would be differentiated because of the variations from growth and his own maintenance.

While his planting design sets out a rigid structure against which change can occur and be registered, its consistency and rigidity also create microclimatic effects. This differentiation is also due to adjacent plants that affect the growth of their neighbours in an ecological way. Plants in the hedges were too closely planted and their growth has had significant effects on both the space and on the plants themselves. While the henyard has a lot of space and the chickens sit among it, the same is not true of the other six garden rooms. Andersson's garden is relatively small, with half of it taken up by the henyard, and the other six compartments have a walkway between each of them, and hedges along each walkway and room edge. While these hedges may have been small at their time of planting, they have become larger and compress the space. In turn, the hedges are shading themselves and their neighbours, which has affected their growth and the resulting shape of the hedges.

291 Ibid.
292 Ibid., 105.

The hedges edge the rooms as interiors and, in so doing, create a space between them that can have some diversity, and while Andersson was inaccurate in his wild predictions for the henyard, his imagination about the way these passage structures would work approximates their current effects:

> In the in-between spaces between the rectangles lie many other possibilities. One immediately experiences them as the garden's negative parts, as the separation between those parts which mean something, as passages from the house out to the attractions and activities. But it could also be just the opposite: all the in-between spaces could be made into enclosed leafy passages. From the rectangles one could peek in at these wonders through openings in the hedges.[293]

By being both defining elements for their enclosing room, and edging elements for the "in-between spaces", the hedges perform multiple spatial functions, and the pruning of a single plant to perform both functions demonstrates how garden maintenance can be used to transcend the planting plan predictions of growth made by location of plants (Figure 61). It's also possible to look at the resulting growth from the density of the initial planting and see the effects that the plants have had on each other.

4.4.2 Biology of Pruning

An innovative aspect of Andersson's discussion of Marnas and the hens is his recognition of the dynamic relationship between plant biology, human action and resultant plant form, such as when he notes, "the hawthorns permit enormous variation, from metre-high closely clipped to the freely growing 20-foot tree" (Figure 62).[294] It is necessary to explain the basic plant morphology that results in plant architecture so that we can understand how a plant can have the divergent range of forms that Andersson mentions. This also provides background knowledge for the discussion of pruning in the three horticultural moments in the garden that I discuss later.

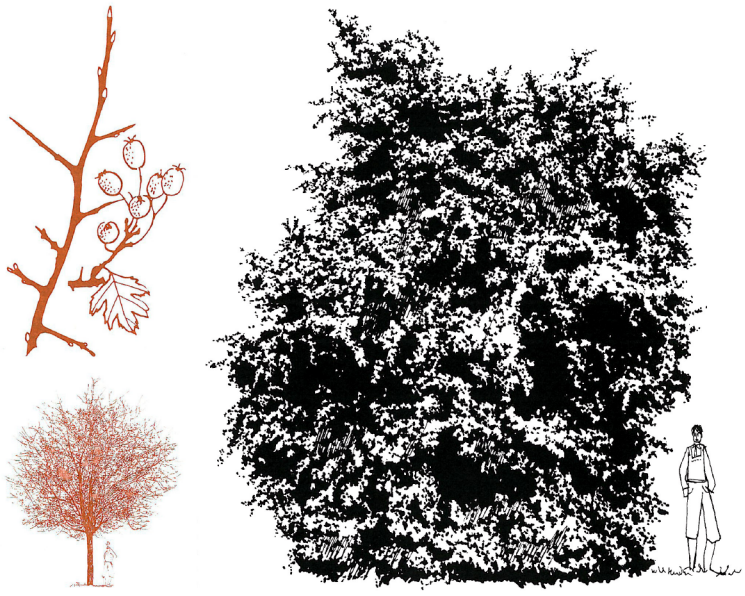

Figure 62. Drawing of Crataegus spp., 1964
As Andersson suggests, hawthorns can take a variety of shapes, as shown in these drawings that show shrub and small tree habits, together with leaf shapes.

The place on plants where cells most actively divide and grow is referred to as the meristem. Growth proceeds continuously from what is termed the apical meristem, located at the top or ends of a shoot. Over time, "the accumulation of apical meristems by the plant and their subsequent activity results in the development of the structural architecture of the plant".[295]

293 Ibid., 107.
294 Ibid.
295 Adrian D. Bell, *Plant Form* (Portland: Timber Press, 2008), 35.

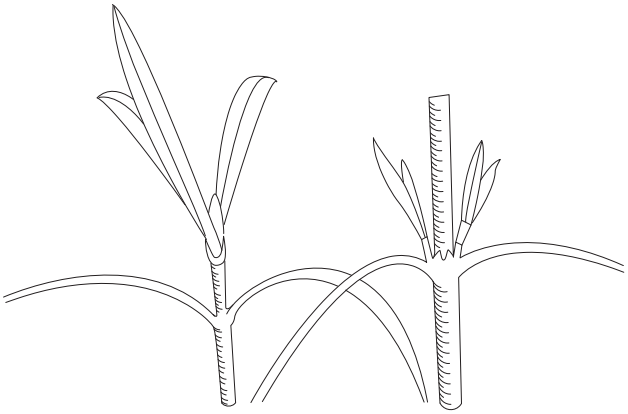

Figure 63. Drawing of axillary buds, 2013
Plant stem on left with terminal bud on left showing apical dominance, while on right, side shoots are emerging from the axil of leaves.

Figure 64. A "Hen", Marnas Garden, 2010
Dense branching of hedge form (here on one of the hens) arises due to promoting side shoots by removing terminal buds through clipping

A plant grows from numerous apical meristems, also referred to as buds, from which shoots emerge that eventually become branches as they become woody, resulting in the plant's form. Bell notes that identification of morphology suggests that the physical characteristics are static; "however, a flowering plant is not a static object. It is a dynamic organism constantly growing and becoming more elaborate" over time.[296] The time dimension in the development of plant architecture is represented in three factors that Bell identifies: bud location, potential, and time of activity. Any intervention that affects these things will affect plant form. These factors can be explained by using pruning as an example. When woody material is removed, the buds located on it that have the potential for growth are also removed. This has a less obvious effect, to do with a phenomenon known as 'apical dominance'. The apical meristem is located at the end of the shoot and produces more growth than the axillary, or side, meristem because of the apical meristem's dominance, which affects the potential of the axillary buds to grow (Figure 63).[297] When a branch is pruned and its apical meristem is removed, the potential of the auxillary meristem to grow increases significantly, along with the possibility of new buds emerging from the cambium tissue surrounding the branch, resulting in greater side branching. This has the effect of a plant becoming 'bushier' when it is pruned (Figure 64).[298] The timing of activity is significant because growth is seasonal, thus it is possible to both remove buds that are about to grow, effectively stunting the plant, as well as potentially unleashing more growth from others that have been latent.

296 Ibid., 258.
297 Ibid., 292.
298 Buczaki, *Ground Rules for Gardeners: A Practical Guide to Garden Ecology*, 183.

In pruning, this process is manipulated by spacing out pruning actions in relation to growth periods and resultant desired growth. Particular pruning tools are used at particular times in relation to the growth period and development of resulting growth, as well as the volume of cutting required. Hedge clippers are used to cut new leaf growth rather than branches, cutting a mass of foliage at one time, resulting in removal of many buds and much branching. Secateurs are used for smaller branches selected individually, as are pruning saws. Like secateurs, pruning saws are used for individually selected, bigger branches. Bigger branches result from choosing not to cut smaller leaves or branches at an earlier stage in order to allow growth to occur. This causes branches to thicken, requiring the use of a different tool and also a change in pruning aims and strategy, from working with a mass of foliage to working with individual branches. The tools used are linked to the times of activity in relation to growth between pruning intervals of particular apical meristems. The pruning tools thus represent moments in the growth story because their selection is the result of timing decisions, and previous guesses about future plant growth. In some cases, this leads to a choice made not to prune at a particular time with the knowledge that at a later time a different tool will be required.[299]

In the case study discussion that follows, the resultant plant form will be analysed as the archaeology of previous growth[300] and gardening moves over time. I will speculate on it by considering the plant morphology factors described above and the form of the plant as it is now. Wörle & Wörle state that "In a garden, a continuous coming into being and passing away can be observed. However, this innate dynamic also poses questions: when is a garden complete?"[301] The form of a garden at any moment is provisional because the garden is always growing. The gardener as observer is always linked to the analysis of a garden because s/he is also maturing while the garden is growing, and s/he and the garden are both at particular, ephemeral states at any given moment. This causes the experience of gardener during a visit to have a great role in subsequent shape of the garden.

4.5 Pruning Study

In his previously mentioned "Letter" Andersson makes an oblique observation about manufactured products in late-1960s society, noting that "our potential for shaping is completely limited to combining finished things to form new wholes".[302] This quote positions the garden as a site of improvisation, unfinished and provisional, a paradigmatic shift from a view that sees the plant in the garden as an object at a point in time to one where the plant's shape at any time is a momentary instance in a continuum of active growth. The state of plants in a garden at any one moment

299 Jones and Cloke characterise the relation between the pruner of the tree and the tree itself as a two-way relationship because "Pruning is not an arbitrary process imposed on the trees. It is an accomplishment which has evolved over a long period of time, where the desire to control the tree is shaped by the biology of the tree". Owain Jones and Paul Cloke, *Tree Cultures: The Place of Trees and Trees in Their Place* (New York: Berg, 2002), 68.

300 The term "prochronism" refers to marks like tree rings or here, bud scars, that indicate the passage of time, formed from the Greek *pro-* ("before") plus *chronos* ("time").

301 Wörle and Wörle, *Designing with Plants*, 64.

302 Andersson, "Letter from My Henyard.", 106

relates to the previous actions of the gardener, made also at a particular instant, and then the subsequent growth of the plants.[303] When the gardener returns, s/he reads this growth in relation to the plants' response and acts again. The pruned plant bears the scars of the previous actions and correspondingly one could speak of a plant's form as a record of those actions, but also, perhaps more importantly for design, as a record of formal decisions. As previously discussed in relation to the developments of buds and timing, it is possible to initiate a trend in the organism that, if left too long, can result in an undesired change of trajectory in the plant's form, which may not be rectifiable in a way that continues the designer's original desires. This difference, however, may also cause the designer to change the design in an interesting, if unexpected, way.

With this in mind, in the following pruning study, I look at the garden as a record of Andersson's gardening actions in response to emerging conditions in the garden, and speculate on what happened at what time, based on the evidence of the subsequent plant growth and the pruning actions on it. The following discussion of three different areas delineates how the rigid planting has been affected by maintenance and growth to demonstrate the role of gardening in giving Andersson his 'differentiated plan' where one plant or planting does multiple spatial things, guided by the action of the gardener, activated by the manipulation of plant biology. The three areas considered (hedgerow, passage and hedge) reflect the progress of the visit from the rear of the site to the henyard, where my discovery in one part was checked against one element, and then tested against the next element found.

4.5.1 The Hedgerow

The planting on the rear boundary of the garden behind the henyard can be described as a hedgerow (Figure 65), which is a manmade structure comprising a "narrow belt of vegetation dominated by a variety of shrubs and trees separating one area of land from another".[304] One component of its Anglo-Saxon etymology, *hega* means *haw*, as in hawthorn, a common plant in hedgerows both in England and in Denmark. The Danish and English presumably share this etymology since the word *hedge* is the same in both languages. Treib discusses the use of the hedge and the hedgerow in Danish landscape architecture, noting that "the wind from the west blows strong and cold

Figure 65. Hedgerow, Marnas Garden, 2010

This panorama-elevation shows the rougher condition of the hedges at the back of the garden, which are clipped on the inside. The Passage is entered from the first opening from the left.

303 Julian Richard Raxworthy, "Landscape Symphonies: Gardening as a Source of Landscape Architectural Practice, Engaged with Change" (paper presented at the PROGRESS, University of Sydney, 2003).

304 W. H. Dowdeswell, *Hedgerows and Verges* (London: Allen & Unwin, 1987), 1.

across Denmark; [something that] created the need for the hedgerow almost from the time of first settlement to comfort the people and protect the soil against erosion".[305]

In general, the planting and pruning process for a hedge can be summarised as follows. After planting, the top shoot or leader would have been removed with secateurs, which would have resulted in the first side branching. After reaching a certain distance from the plant, these side branches would also have been pruned back with secateurs to a visible dormant bud. Once the plants were growing into adjacent plants with too many branches to prune each plant individually, hedge clippers would have been used to work across the whole surface as a formal hedge.[306] Such branching arises from strict early pruning that suppresses the development of leading branches by removing apical meristems and promoting side branching. In a hedge, later pruning then proceeds by removing the apical meristems of these side branches, also causing them to bifurcate. This process continues to create more branching.

While the planting on the rear boundary is planted like a hedge similar to the others in the garden, it has a more naturalistic appearance due to changes in maintenance, from its early clipped state to a later self-regulated, more freely growing, condition. After strict initial pruning, a more informal strategy has been used that would have aimed to control the overall extent of the hedgerow and ensure it remained dense but not totally formally consistent. Andersson anticipated this when he speculated about how high the hedges should be: "It's hard to clip them if they are over a metre and a half, but I would like to enclose the Henyard a bit better, more for my own experience of the space than the need to keep the hens shut in."[307] The bulges in the hedgerow are branches holding leaves, and because they have not elongated into longer bigger branches, it can be inferred that they do occasionally get pruned. When a branch noticeably extended past the front of the hedgerow, it may have been removed with an implement, such as pruning saw rather than hedge clippers, or secateurs that may have taken out the whole large branch and cut it back to the tree.[308] Since this creates an opening for light, the adjacent branches and foliage would grow into this gap. As this type of branch is removed, other bulges come into relief and gain visual dominance. This type of pruning is occasional, perhaps happening every few years, and might also be accompanied by a rough work-over of the hedgerow with hedge clippers to ensure density of leaves and re-branching for the next year. An early diagrammatic plan of the garden from 1960 also includes an elevation of the hedgerow that shows it as a firmly cut hedge, its top line kept level in opposition to the rising level of the topography, (Figure 66) a question that Andersson also considers in his "Letter": "A position has to be taken on whether the tops of the hedges should follow the slope of the terrain

305 Treib. Marc, "Sven-Ingvar Andersson, Who Should Have Come from Hven," in *Tilegnet Sven-Ingvar Andersson*, ed. Høyer Steen, Anne-Marie Lund, and S Møldrup (Copenhagen: Arkitektens Forlag, 1994), 63.

306 Montague Free discusses making a hedge from Hawthorn: "For the first year after they (*Crataegus*) are planted the side shoots should be checked by heading them back. Once this has been done, an all over shearing when the new growth is almost finished, usually in June or July, is sufficient." Montague Free, *Plant Pruning in Pictures: How, When, and Where to Prune and with What Tool.* (New York: Avenel Books, 1961), 46.

307 Andersson, "Letter from My Henyard," 107.

308 Free notes that Hawthorns are one of the species that can be cut savagely back and will return, if one wants to recreate the hedge should it grow too long. Free, *Plant Pruning in Pictures: How, When, and Where to Prune and with What Tool.*, 36.

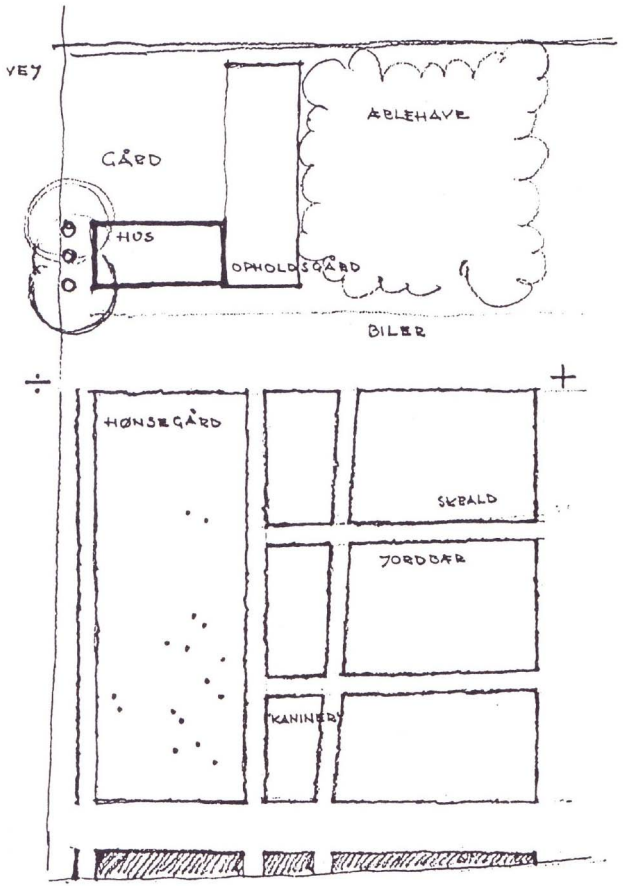

Figure 66. Plan, Marnas Garden, 1960
This early schematic plan (earlier than Figure 51) shows the original intention for the rear hedgerow to be pruned level.

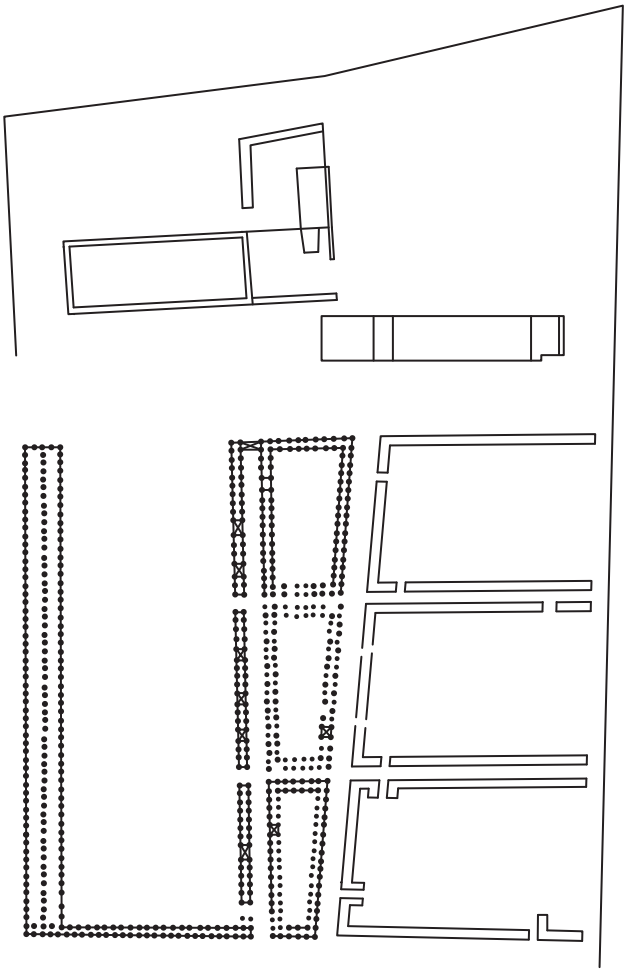

Figure 67. Speculative planting plan, Marnas Garden, 2010
The hedges dividing the garden rooms are all planted at 500mm spacings in double rows, but over time some plants have been removed (indicated with smaller dots) and others added or allowed to grow to fill gaps (indicated with crosses).

or lie in a horizontal plane".[309] The drawing from 1960 suggests a consistency and rigidity to the hedges throughout the garden, which has changed over time (Figure 67); for example, the top the Hedgerow is allowed to grow naturally, probably for pragmatic reasons to do with difficulty of access. This demonstrates that Andersson envisaged maintaining the hedges to a certain height in the long term, or perhaps predicting their growth in the short term.

The side boundary along the Dalby road also takes the hedgerow form but is wider than the back boundary, making it possible to enter it and measure plant spacing (Figure 68). On first viewing, it seemed that the trees were planted in two rows 2 metres apart, with 500 mm spacing along the row; however, moving along the interior of the hedgerow, I discovered that there are in fact three rows 1 metre apart, and that a number of gaps had created clear spaces in the hedgerow, probably because of the death of individuals within the lines. With more space between the rows that line them, this planting strategy creates an impermeable wall element along the outside of the line, but also creates a room inside the hedgerow that is compressed but still accessible. Because the spacing along the length is 500 mm compared to the width between rows being 1 metre, or 2 metre when there is a

309 Andersson, "Letter from My Henyard," 107.

Figure 68. Hedgerow, Marnas Garden, 2010
At the rear of Beatas have, it is possible to get inside the hedgerow and examine planting locations when hawthorns have grown up.

Figure 69. Hedgerow, Marnas Garden, 2010
As the hedgerow has grown long and its edges blurred, it has created a microclimate for climbers and annuals to colonise.

gap, the plantings create a tight allée that emphasise the length of the side of the garden, since the width is greater than the spacing. This is in contrast to the plants along the back boundary, where the trees are 500 mm apart, in two rows also 500 mm apart, in a grid rather than in an allée formation.

On the side boundary where the spacing between rows is 1 metre, some directional or spatial outcome would seem intentional since the space between rows is perceptible, but on the rear boundary this is not the case, since 500 mm is not enough to allow one to enter the hedgerow. While this is the same spacing used on the interior hedges, there the spacing was to create a mass of foliage quickly for hedging, whereas for the back hedgerow there may be an ecological rationale for this spacing. Planting small plants densely causes them to grow tall quickly by stimulating competition between individuals. As they grow, they begin to shade each other, which suppresses side branching and emphasises the top leaders. This might have provoked the hedge to produce a mass of planting quickly. Another reason might have been to allow for the death of individuals, so that if a plant died on the edge, one of the interior plants could grow outwards into the gap.

In terms of evidence of maintenance over time throughout the garden, there is some hierarchy in the hedge because as the trees have grown, some have pushed through to become treelike specimens while others have remained in the shrub layer. In general, it seems that where certain hawthorns have become mature it is because they have ‘slipped through the net’ of regular pruning to get out of the reach of the pruner, “in time it [the hedge] will reach four metre’s height and be completely impenetrable to anything other than sparrows and robins who make their nests there”.[310] This has happened on the side boundary, and here, certain parts of the planting pattern are missing. The density of the planting means that odd individuals have either been shaded out, have died, or are missing, with little effect on the overall planting. Like the hedgerow, the planting has begun to

310 Ibid., 105.

act as a self-regulating ecology. The interior of the hedge looks as if it has not been specifically maintained; rather, the interior effect is caused by pruning on the outside and the result of the ecology of the planting density inside. The idea of pruning the outside of the hedgerow to get an interior effect is interesting, as it creates a chaotic silhouette when light comes through it into the more open interior.

The more casual pruning strategy allows the hedge to become a hedgerow because the relative lack of attention has increased the width and light penetration so that it has a more diverse ecology than the other hedges. Other species have been allowed to colonise in the herb and perennial layer, something that adds to this sense of hedgerow according to its agricultural definition, including climbers, such as ivy, and smaller flowering annuals (Figure 69). This is particularly true on the outside of the hedgerow, which is un-shaded and blurs into the grassed strip behind. While the hedgerow condition of the back hedge was obviously set out in the initial planting plan, it is the gardening actions over time that have caused it to develop both dimensionally and materially. Gardening resulted in material differences of longer and more casual growth in contrast to the strictly pruned hedge. Its formal character is thus the result of changes to the plants as a material that were only possible due to gardening rather than design, happening iteratively over multiple growing seasons.

4.5.2 The Passage

The Marnas garden can be entered from the back through one of two penetrations in the hedgerow immediately adjacent to the henyard, which can be described as a "passage". Inspecting the plan and earlier photographs of the garden, it is difficult to appreciate the network of spaces of which the henyard forms a part. Since each space is enclosed by a hedge, a circulation space develops between the different garden rooms. The way that a single hedge generates by edging one space then defines a spatially autonomous space in such a tight dimension is economical, placing the visitor between the spaces when one walks through, and de-emphasising the long view down the garden by transferring attention to the 2-metre space the hedges creates.

The hedge around the compartments or garden rooms defines the room as an interior, each with its own internal thematic and pruning treatment. Since the compartments are adjacent, these edges define the passage with a different treatment on each side, derived from the treatment of the adjacent compartment. Even while the edges are inconsistent along their length, due to the different pruning regimes, the passage still has a spatial consistency. Proceeding from the rear hedgerow, the henyard edge continues for the whole length of the passage on the left, finally deforming near the end, while on the right, three different compartments each have different hedge treatments.

In general, the passage is formed from multi-trunked hawthorns that arc over the space, the plants having what is commonly called 'sculptural form' because their twisting trunks have been emphasised through pruning and they have few lower leaves. The hedge on the left side, adjacent to the henyard, has two distinctly different sides, the outside sharing this twisted trunk form. These

Figure 70. Beatas have (Beate's Garden), Marnas Garden, 2010
The hawthorns are thinner because they are heavily shaded and gardening has emphasised this form, allowing ivy to use the trunks as support.

hawthorns are multi-trunked with no central leader, which allows them to act together like a palisade wall, with numerous vertical trunks, creating a visually penetrable grill or screen. While each of the three containers to the right also has this configuration of hawthorns, each has different treatments below or around them to distinguish one from another related to their interior condition.

The first compartment along the passage, *Beatas have* (Beate's garden; Figure 70) is most affected by shade because it is behind the rear hedgerow and is thus the sparsest. Initially, it appears at the back to be a separate hedge to the hedgerow, but on inspection this is because some of the plants in the middle of the rows have disappeared, giving it the sense of having a separate enclosing hedge at the back, though it in fact shares this edge with the hedgerow. The hawthorns have very thin and rangy trunks that act as supports for *Hedera helix* to climb up, leaving little trunk visible. In effect, the hawthorn acts as a living climbing structure, and it is interesting that other hawthorns in the passage with the same thin form read entirely different without the climber. The ivy is like a hedge because it provides a surface, though, as it grows, it sags between trunks, giving it a curtain-like feel. This planting has come from the ground where its extent has been pruned by circulation, becoming straggly as it grows. Formally, the initial planting density has been allowed by the gardener to grow in such a way that the resultant growth has caused the form of the plants to change due to shade, a result that could only be caused by gardening actions that allowed for growth rather than prohibiting it due to strict clipping.

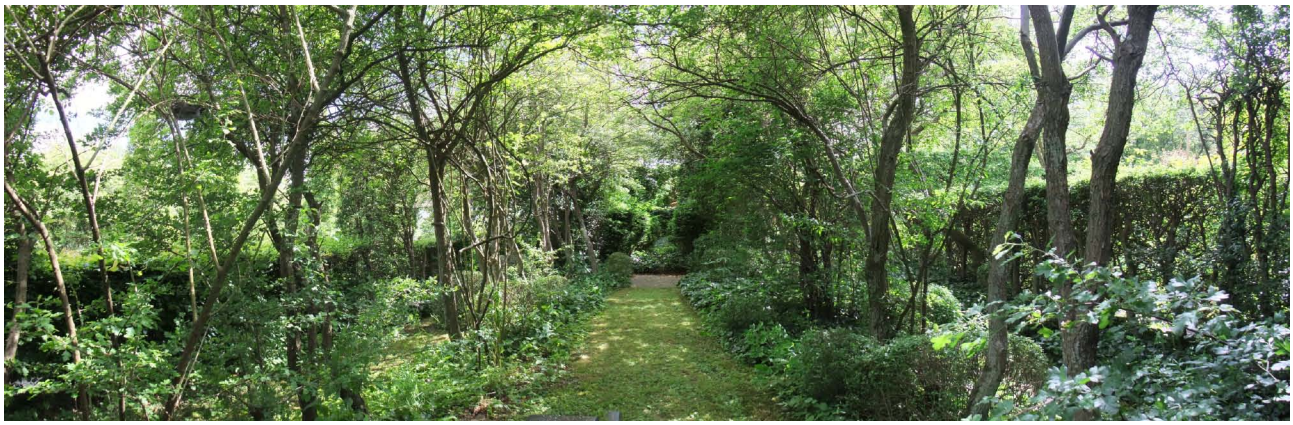

Figure 71. The solgård (Patio), Marnas Garden, 2010
The hedge along the edge of the henyard has been pruned into open trunks to allow views through to the adjacent compartment, the Flower Farm.

The second compartment, the *solgård* ('patio'), has a more open interior without planting at either end (Figure 71). It is a seating area (hence its name), slightly elevated by a step, and has a masonry plinth as a seat. Because the compartment is open in its centre, light penetrates from the interior causing the hawthorns to grow into the compartment, arching from the Passage. The hawthorns have numerous smaller trunks articulating the edge of the compartment, branching horizontally at 2 metres. The height of these hawthorns is opposed to the low height of the opposite hedge along the henyard that allows light and views to come through to the centre of the compartment. Below the hawthorns are smaller balls of privet (*Ligustrum sinense*) in irregular clumps cut into tight balls. While the hawthorns in the first and second compartments have similar forms, the second compartment is more permeable and more defined by the trunks rather than a veil of climber.

This multi-trunked form of the hawthorns has developed as much from the resulting microclimate as it has through pruning intention. Because the hedges are close together they have been casting shade on each other, so the natural inclination of the plants is to grow tall to bring their leaves into the sunshine. However, the plants could have developed single trunks and done this, or at least branched higher up, so they must have been pruned at the base when young in order to remove the central leader and to cause bifurcation from the base. Early photographs (Figure 50) show that initially, all the dividing hedges were pruned the same, as hedges, which would have caused bifurcation of branches, but at some point, these multiple branches must have been allowed to elongate. When the plants were allowed to grow further and to get some length along the trunks, side branching may have been removed at this more mature stage using secateurs. As these trunks grew, selective removal of individual trees must have occurred, since the plant spacing is no longer consistently 500 mm. In general, the pruning would pursue a strategy of retarding the development of small branches to keep leaves above and trunk below. In pruning terms, to prune for sculptural form is to deliberately choose to retain eccentric branch forms and to remove consistent growth, emphasising eccentric plant form emerging in the growth of the plant material over time. Evaluating the relative roles of the initial planting plan and the gardening actions that caused its current state, it's clear that both played a part. By designing the compartment to be slightly larger, the hawthorns would grow into the gap due to phototropism, a desire to grow towards the light, governed by the distribution of the plant hormone auxin, which is responsible for plant growth generally. The reason that the gap was not closed by trees was due in part to their training by pruning into a multi-trunked form without

Figure 72. The blomstergåde (Flower Farm), Marnas Garden, 2010

The hedge surrounding the flower farm includes multiple species and has been allowed over time to close of the passage.

Figure 73. The blomstergåde (Flower Farm), Marnas Garden, 2010

Inside the compartment, smaller hedges have grown together, making a general topiary mass. Note hole in hedge at end, shown from the opposite direction to Figure 74.

developing into a single tree with a large canopy.

The third compartment, *blomstergåde* ('flower farm') is interesting because it demonstrates quite clearly the deformation of the space and view as plants grow together, and as geometries lose their rigorous design form over time. The flower farm is walled by a high hedge comprising different species, including *Celtus spp* and *Fagus spp.* that create a clear-walled interior, with the hedge pruned carefully to be dense and luxuriant. This is in contrast to the other two compartments, which are defined by the form of the plants that has resulted from careful shaping for trunk form and where the canopy foliage has been higher, allowing views through the trunks. The flower farm emphasises foliage rather than trunks and is correspondingly closer in character to the henyard, which is edged by foliage. This change of materiality—from trunks to foliage—affects the passage, which begins to merge into the henyard; the passage becomes a hedge that steps down to address not just the passage but also the henyard. Figure 72 shows how, over time, gardening has caused the end of the hedge to close the passage, varied from the initial planting plan in Figure 66. Inside the compartment, wandering rows of *Buxus sempervirens,* also used to define the circular garden beds in the henyard, have been planted in a false perspective orientated along the length of the compartment. As the *Buxus* have developed, they have grown into each other and this has in turn affected how they were pruned; the lines that initially shaped the hedges disappear into a topiarised mass (Figure 73). The third compartment terminates a long visual through-axis that is cut into the hedge at end of the compartment in the form of a portal, and then continues along the open middle compartment and into the back of the first compartment at the hedgerow. (Figure 74) Without any change to the planting plan configuration of the compartment, the view axis has been created by Andersson repeatedly cutting into the hedge over time. There is evidence that this view line developed over time, rather than in the initial planting plan, because the 1960 (Figure 66) plan shows an enclosing hedge all around both the *solgård* and the *blomstergåde*, while the two ends of the former, and one end of the latter, now have no hedges. With the view gap in the end of the *blomstergåde*, this demonstrates how a major design axis in the garden, the maintenance of a view through all three compartments, has been developed over time with a combination of the removal of individual plants and the use of pruning only possible through gardening.

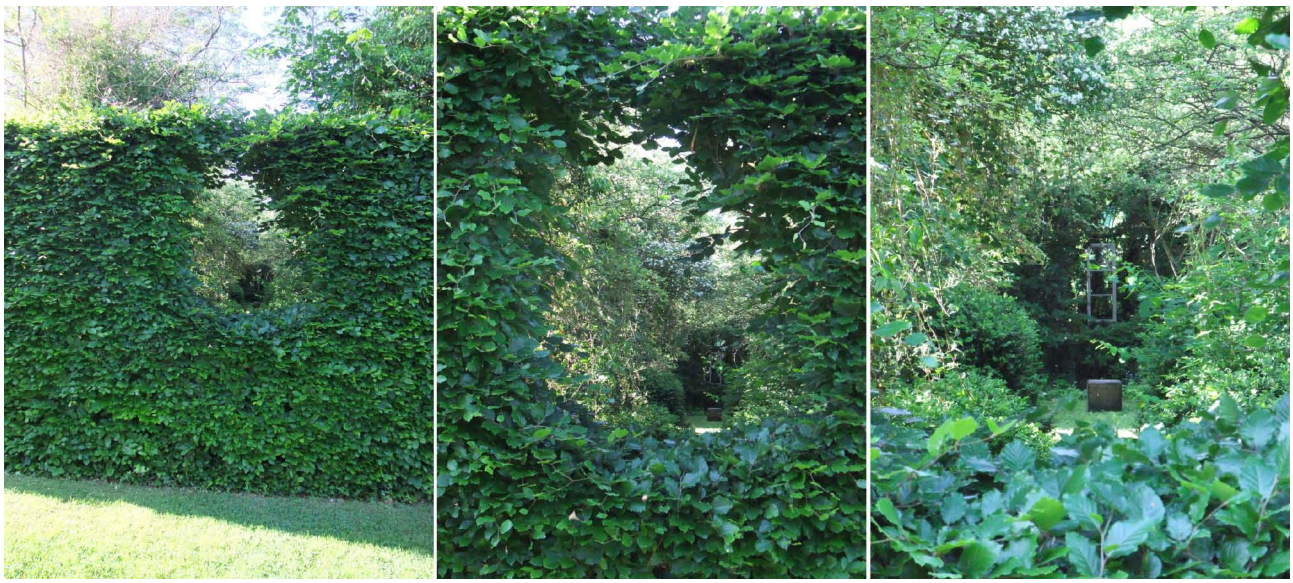

Figure 74. The blomstergåde (Flower Farm), Marnas Garden, 2010
The hedge enclosing the Flower Farm is the tallest in the garden and has been cut to provide a portal, by also manipulating the other two compartments behind it.

4.5.3 The Hedge

Pruning treatments in the Marnas garden differ depending on which side of the plant addresses which space or design relationship, which is in its turn tied to both orientation and to circulation. Hedges are used to edge or wall spaces throughout the garden, most intensely in the henyard, and their surface-pruning treatments are orientated to the space they address. All the garden structure is provided by hedges, and the transformation of the garden spaces over time due to gardening results from their manipulation. Individual plants have multiple spatial effects depending on how different parts of the plant were maintained according to which part of the garden different sides of the plant address. The group of plants that makes up the hedge between the henyard and the passage can be studied to demonstrate how one plant has been cut in multiple ways to serve a number of different spatial functions. The sophistication of Andersson's design is how the plants are used to both provide a spatial role and also material and formal effects to their adjacent spaces. Located between the henyard and the passage, when the hedge addresses the circulation space of the passage, it does so through the transparency of trunks rather than using a wall of vegetation, while on the henyard side, plants have been pruned heavily with clippers for a long time to get lush foliage—a true hedge treatment.

Figure 75. Photograph from Henyard into solgård (Patio) by author.
The hedge along the edge of the henyard has been pruned to allow views into the adjacent compartment, the Patio.

Figure 76. Hedge, Marnas Garden, 2010
Looking from the path into the henyard from the passage, the hedge covers the entry, its carefully trained branching visible in silhouette from outside.

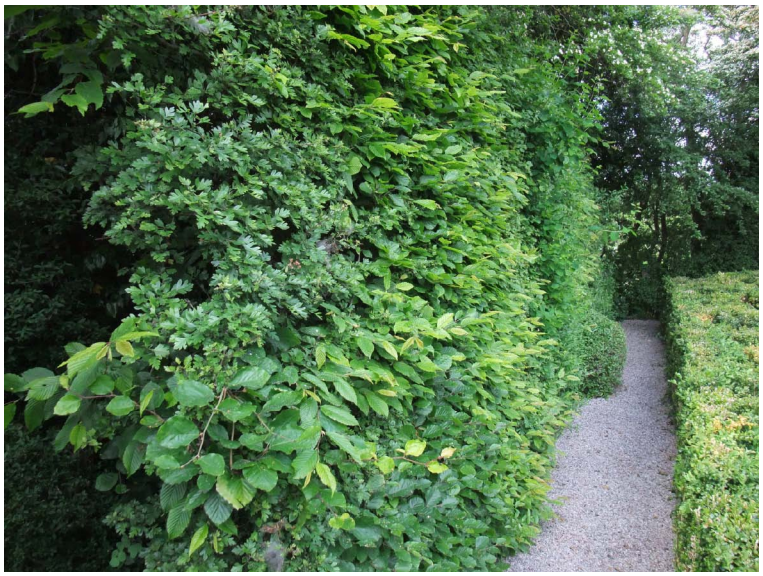

Figure 77. Hedge, Marnas Garden, 2010
The foliage of the hedge on the inside of the henyard is lusher and has been pruned to be dense without revealing branching, with a mix of hawthorn and beech.

The hedge that makes up the edge of the henyard changes its elevation a number of times when seen from the interior of the henyard. From behind the hedgerow it begins as a consistent hedge of hawthorn, and, as one progresses up its length toward the top of the henyard, it gets greener as other species have colonised the hedge. The hawthorn appears to be used primarily when structural shaping by pruning is required while the other species, such as beech, have been incorporated into the hedge to produce softer foliage. The paths that cross between the compartments penetrate the hedge, allowing access into the henyard, so that a third of the way along its length, a stretch of hawthorn has been pruned to create an opening that one walks through, which in turn then steps down to mid-chest height. This pruning manoeuvre catalyses a number of interesting organisational aspects of the hedge and compartment system. At the same time as the hedge steps down, a view from the henyard through the *solgård* compartment and into the far compartment in the furthest third row of garden rooms is possible, each through a step down in the hedges between (Fig. 75). Together with the long view down through this row of compartments discussed above in relation to the *blomstergåde*, these views, indicated with view axes in Figure 61, make the complexity of the spatial organisation visible and are all possible only by modifying the plants' form through pruning without any change in consistency of plant location.

Hedging favours lots of small branches, bearing leaves right at the top of the branch. Each pruning cuts into these leaves and also to the small stems, which produce new denser shoots quickly. Over a long time, some hedge plants can become too woody and may have to be cut back hard to prepare new dense branching, depending on how predisposed a plant is to shoot from latent buds. For the

Figure 78. Hedge, Marnas Garden, 2010
The other side of the same hedge in Fig. 77 along the Passage has less foliage and a more upright form due to microclimate and pruning, demonstrating how a single plant can have multiple forms.

hawthorn, small side branching seems to develop easily from under the bark, even in old branches with lots of small branch growth along heavier structural branching, which provides the overall outline and support for the shape. This type of growth pattern occurs where the hedge hawthorns have been cut and trained to allow for access to the henyard from the path between *Beatas have* and *solgård*. Viewing the hedge where it enters the henyard from this path, the structure of the branching is dominant, with little density of leaves (Figure 76). This results in an intricate view of branching as light comes through the hedge from the henyard; one views the hedge in elevation as one walks along the perpendicular path into the henyard and as a result of the hedge being shaded from this direction. This is a condition of the larger microclimate that results from the planting design decisions, which have affected plant growth and caused visual and spatial effects.

Another section of the hedge between the henyard and the passage further demonstrates the idea that one plant can cause multiple spatial effects due to differences in pruning. Where it faces the henyard, the hedge is lush and covered with leaves, and while it contains segments of other species its structure is still a hawthorn plant from a single 500-mm wide hedge. Pruned with hedge clippers to produce a consistent vegetated surface, none of its branching structure is visible from the inside, which seems continuously green as a result of its orientation to the space, as a background to the overall room structure (Figure 77). On the other side an entirely different result has arisen because of different spatial aspirations, but also because of microclimate and the character of the adjacent space, *Beatas have*. Orientated to the passage, the rear structure of the hedge is visible as a number of vertical branches that have side branching facing toward the light on the other side of the henyard (Figure 78). Since the structure of the passage is branching to create a canopy with arching forms, it is clear that the same branching is having different results for the different orientations. Both types of surface, green hedge and leafless branch structure, are present but the material finish suits the character of each address. Much of the maintenance in the passage would be self-regulating as its shading prohibits too much additional growth away from the trunks that drive upwards to the light. On the other hand, the inside of the henyard is maintained to always have lots of juvenile foliage through constant clipping with hedge clippers, while the passage relies on woodier mature growth. These two different vegetation treatments on the same plant are accompanied by a third, which is the full small tree emerging out of garden where clippers cannot reach.

4.6 Novelty as Trajectory

In Chapter 2, I discussed a range of design-generation approaches from the process discourse that sought to use processes to produce novelty, the form of which was treated simply as an unexpected result rather than deliberate form. I argued that it is unnecessary and disingenuous to treat an interest in processes as incompatible, or even opposed to, an interest in form. In Chapter 3, I discussed the way that the mounds at the Bordeaux Botanical Gardens were detailed to change by controlling certain variables that encouraged certain formal outcomes from the erosion process. In doing so, I argue in this dissertation that rather than novelty being unexpected, the question is instead probabilistic, because there remains a level of predictability in any of the variables manipulated, even while each process outcome is specific.[311] This sense of a limited range of possibilities, rather than complete surprise, corresponds to how Andersson saw the possibilities resulting from the pruning of the hawthorns in Marnas. Correspondingly in this section, I will discuss Andersson's model of novelty, which I call "trend" and "trajectory". Since Andersson discusses DNA, I will also refer to the writing of Jacques Menod about teleonomy, or genetic invariance and morphogenesis, in organisms. This section will also set out the field of possibility that the gardener uses in their practice, which will be discussed in relation to practice in the conclusion.

Recalling Andersson's quote regarding the range of a hawthorn's growth, it is important to note that he goes on to qualify this range of possibility:

> But not beyond those limits which lie in being a hawthorn, which means that every single cell, whether it sits in the roots or in the skin of the fruit has a predetermined number of chromosomes[312] with a particular set of genes, which can vary a little bit and give each plant its unique individuality, yet still ensure similarities in form and mode of meeting external conditions.[313]

Through his responses I described earlier in the chapter, Andersson's pruning catalysed latent genetic potentials. These potentials have developed in response to the environment, or the "external conditions". The external conditions that Andersson refers to would, in a natural situation, comprise both the specific nature of the environment, including climate and soils, but also how the plant responds to disturbance through accident, predation or, in his case, pruning. Even while the species has evolved in response to such external conditions, when Andersson speaks of another limit, that "being a hawthorn", he also recognises a level of continuity or un-changeability, which Nobel-winning biologist Jacques Menod would call "genetic invariance".

311 In the next chapter, I propose a model of novelty as specificity, that comes from Louis Le Roy. Also, in Chapter 6 I will discuss words like "outcome" in relation to models of process and their implied teleology.

312 Chromosomes are long strands of DNA, and are made up of a material called chromatin. Chromatin is a complex of DNA wrapped around proteins called histones. DNA, therefore, chromosomes, encode and direct the development of proteins. While there are highly specific chromosomal responses, which involve both mutation and genetic invariance, additional information persists than is used at the moment of cell division.

313 Spirn, *The Language of Landscape*, 177.

In his book *Chance and Necessity*,[314] Menod is clear that evolution and life has a sense of determinism, or forwardness, and proposes that "objectivity obliges us to recognize the teleonomic character of living organisms, to admit that in their structure and performance they decide on and pursue a purpose".[315] Teleonomy is one of three properties that characterise living beings, the other two being reproductive invariance and autonomous morphogenesis. Teleonomy,[316] or rather "the teleonomic project" as Menod calls it, "consists of the transmission from generation to generation of the invariance content characteristic of the species. All structures, performances and activities contributing to the success of the project will hence be called Teleonomic".[317] Reproductive invariance is the commonality that allows us to distinguish a species and that allows it to reproduce. This reproduction and continuance is the teleonomic project. Conversely, morphogenesis[318] is not solely limited to living organisms since chemistry can exhibit it too, and thus Menod refers to it as a mechanism.[319] He describes the relationship between these things as "genetic invariance [that] expresses and reveals itself only through, and thanks to, the autonomous morphogenesis of the structure that contributes to the teleonomic apparatus".[320]

Herein lies the difference between Menod and Andersson, concerning Andersson's sense of the trees "being a Hawthorn", that is, a question of whether novelty comes from inside the organism, "teleonomy" for Menod, or outside it, "external conditions" for Andersson. This difference could be characterised as coming from two different directions (inside or outside the organism), two different scales (cellular scale or organism scale), and in two different time periods.

For Menod, the creation of globular structures by proteins at a cellular level, governed by chromosomes, "give[s] proof of an autonomous determinism . . . implying a total freedom with respect to external conditions or agents, which are capable of impeding development but not directing it".[321] This is "teleonomic" thinking, from the interior of the organism out to the environment. Similarly, Henri Bergson[322] is critical of seeing the environment—for him the second-rate world of matter and mechanism—as determining the conditions of novelty, since "circumstances are not a mold into which life is inserted and whose form life adopts". He suggests

314 Jacques Menod, *Chance & Necessity* (Glasgow: William Collins & Sons, 1972). It is important to restate here that I am not in any way making a case for intelligent design or a designed direction in evolution, topics which are beyond the scope of this research.

315 Ibid., 31.

316 Teleonomy refers to what appears to be purpose or goal-directdness in an organism that arises from their evolutionary history, and is found because of the application of evolutionary thinking that can analyse an aorganism in these terms. I discuss the notion of "telos" in chapter 6 in more depth in relation to determinism

317 Menod, J. (1972) *Chance & Necessity*, Glasgow: William Collins & Sons. p.26

318 I discussed the notion of morphogenesis in Chapter 2.

319 That morphogenesis is characteristic of both organic and inorganic subjects supports the discussion of novelty in both organic and inorganic media in this dissertation.

320 Menod, J. (1972) *Chance & Necessity*, Glasgow: William Collins & Sons. p.26

321 Menod, J. (1972) *Chance & Necessity*, Glasgow: William Collins & Sons. p.21

322 I will discuss Bergson in depth in Chapter 6.

that "there is no form yet, and life must create a form for itself, suitable to the circumstances which are made for it".[323]

Approaching this from the opposite direction—looking at the effect on chromosomes of the environment—is difficult because the relationship is indirect, when compared to DNA at the cellular level. While mutation arises autonomously from the organism, as Menod notes, the environment can impede it because it can eliminate individuals. For the mutation to continue, however, it has to provide an evolutionary advantage that gets selected over multiple generations. In the first instance, the mutation has to be survivable, even if its role in relation to the environment has not yet been determined. Over time the advantage the mutation gives has to be transmissible between generations and useful to survival.

Thinking about both of these factors in relation to the Marnas garden, one can see that both Menod and Andersson are right: the mutation arises autonomously, even randomly, as both Menod and Bergson would suggest, and was not designed for a purpose. However, once it has become useful, almost accidentally to survival, it will continue to operate efficiently in relation to the environment.[324] Both these operations—outside and in, inside and out—support each other without even necessarily interacting, though they do in causal or probabilistic terms.

Considering this dynamic relationship in terms of novelty, one can say that novelty in the individual over time becomes a trait or generality over time. Here, novelty is again a specificity, but one that is both a form and a process. As a form, the novelty of the individual is its particular response to conditions and disturbance by things such as pruning. As a process, the novelty of the individual, if it survives, is an incremental change in DNA.[325]

4.7 Conclusion

Gardening allows the experiential or perceptual effects in a garden to be cultivated. At Marnas, Sven-Ingar Andersson was able to prune vegetation to allow views through the garden rooms. Because he could return to the garden and adjust vegetation, he could optimise views and other microclimatic effects. I argue in this dissertation that this is only possible where direct personal experience can be fed back into garden maintenance decisions—i.e., through the gardener's own participation. Gardening manipulates microclimatic effects, undertaking actions that will cause growth to develop, which will, in turn, affect later growth. In this sense, gardening is economical because it uses subsequent growth to create forms so that it does not have to directly create them.

323 Bergson, H "Life as Creative Change" from Pearson, K.A & Mullarkey, J (eds) (2002), *Henri Bergson: Key Writings*, London: Continuum, p.195.

324 This model evolution was theorised by Stephen Jay Gould who called characteristics that suited current survival but did not arise for that purpose "exaptations"; however Dawkins has been critical of the existence of such non-adaptive genetic tendencies.

325 Its important to note that because of the way that natural selection occurs over time, through lots of blind alleys, any sense of real directionality is only possible in retrospect, as discussed in Richard Dawkins, *The Ancestor's Tale* (Boston: Houghton Mifflin, 2004).

By examining Andersson's garden, it is possible to see how gardening actions develop the initial planting plan into a related but different garden. This brings into question the relationship between gardening and landscape architecture. Gardening is a time-based engagement with the landscape that is practically impossible for landscape architects to pursue from an office-based practice. Landscape-architecture practice is only economically viable when it works in representation and at scales that specifically avoid engagement with the particularities of the real landscape that develops over time, because, to do so would take too long and would in effect be gardening. In the next chapter, I argue that this is precisely the reason why Louis Le Roy advocates building rather than designing at the Ecocathedral.

Andersson is important to the current study because he resisted polarising form and process, and indeed, demonstrated how processes can be undertaken with specific formal effects in mind, such as his garden rooms, and yet still be serendipitous, in how specific growth renders these rooms with particular microclimates and effects. As an activity that optimises emergent characteristics from growth, gardening is linked to design definitions of accuracy—an important concept for design where being specific about form is the celebrated aim of design. Growth can be predicted, but with varying levels of accuracy that bring into question precision and tolerance for deviation from initial formal intentions. Accuracy for plant forms cannot be measured in terms of absolute form, but instead by general trends and outline dimensions, where a plant may be smaller or larger than intended, for example, but still have the general rough form. In Chapter 6, I will discuss "tendency" as a way of balancing this dynamic, in terms of novelty. At Marnas, Andersson suggests a sensible and useful balance between prediction and novelty in the design and in his discussion of the hawthorn's chromosomes.

Chapter 5: Case Study 3— Louis Le Roy's Ecocathedral, the Netherlands

5.1 Introduction

The concept of gardening as an activity is tied to the garden as a place. In turn, the garden as a place is defined by the cultivation of plant growth through the activity of gardening. If a relationship between growth and the gardener defines the garden, then it is possible to imagine a gardening practice where the gardener does not work directly with plants, but undertakes non-gardening actions that have gardening effects. In the final case study, presented here, the definition of gardening is expanded by examining the Ecocathedral in Mildam in the Netherlands, initiated by Louis Le Roy in the late 1980s. The Ecocathedral comprises a series of brick structures made from recycled paving. Arranged into platforms, they have been built over time and have converted a grazing paddock that was a monoculture into a bio-diverse forest. Le Roy described his

> wild garden in Mildam as a foundation for an "Ecocathedral", an environmental, landscaped or urban structure that is able to develop towards its natural peak form, endlessly in time and space, and based on cooperation between people, plants and animals.[326]

In the project overview section of this chapter, I introduce Le Roy and his work in Heerenveen and then at the Ecocathedral. I then describe the project in terms of its different stages and changes in the type and manner of construction, in order to orientate the discussions that follow. Following this, I discuss relevant precedents from art, since Le Roy was an artist, which involve improvised construction using found materials and that transform either themselves or their contexts over time.

In the section entitled "Building as Gardening", I compare the activity at the Ecocathedral with definitions of gardening, and consider whether improvised building can be considered as gardening. While the role of gardening was obvious in the Marnas garden—since Andersson worked with plants and used conventional gardening techniques—at the Ecocathedral, Le Roy worked with inorganic materials and used techniques such as piling masonry that would not typically be called gardening. Nevertheless, I argue that it can be considered as gardening both through its operation as an activity over time, as well as through its cultivation of organic effects.

The basis of this chapter is the evidence I gained from a number of visits and interviews, as well as participant observation from working on site. In 2005 I visited Mildam twice, first in the summer, and then in winter, when I first interviewed Le Roy and was shown around the site by a botanist.[327] I then began planning a more substantial visit for 2007 with the help of the Stichting Tijd (Time

326 Esther Boukema and Philippe V. McIntyre, eds., *Louis G. Le Roy: Nature Culture Fusion* (Rotterdam: NAi Uitgevers, 2002), 12.

327 I visited the Ecocathedral on 1 July 2005, 10 January 2006, and worked there between 6–18 June 2007. I interviewed Louis Le Roy on 10 January 2006 and 7 June 2007, which I draw upon generally in my discussion of

Figure 79. Louis Le Roy at his house, 2007
Louis in his house in Orangewoud, surrounded by his coloured glass collection, while I was interviewing him.

Foundation), a non-profit local organisation established to continue Le Roy's work after this death. This was a two-week visit during which time I worked both at the Ecocathedral and the Kennedylaan building, and interviewed Le Roy on two further occasions. The opportunity to work at the Ecocathedral and build my own structure revealed a range of dimensions to the project that I had suspected but that could only be confirmed by working as an active participant rather than studying the project abstractly, This is because, as I was told by members of the Sticting Tijd, "bouwwerk geen gebouw zijnde": to work at the Ecocathedral is to "build but with no intention".

In the section entitled "Mind the Gap", I describe the building process that Le Roy and his followers use—both in terms of managing the site and for the detailed construction of the structures. As evidence for this I use my own training that was given to me on site by teachers at the Stichting Tijd, which I wrote about in a blog I kept at the time after work. The construction techniques are the key to both the subjective process of building at the Ecocathedral and to its ecological effects. In this section, I attempt to answer the following question: How can an un-changing material be arranged to create ecological effects, such as an increase in biodiversity? By comparing photographs taken in winter, when the constructions are exposed with their physical characteristics visible, to that in summer, when they are covered in growth, it is possible to see how the former related to the latter. Drawing on sources in landscape ecology and meteorology I model the performance of the brickwork in terms of the creation of microclimate, and the properties of the constructions as elaborate ecological niches. The growth arising from these techniques affects site access, which then influences future structures, so, quite literally, the whole site form arises from the individual act of using a technique.

When I refer to the building-as-gardening process as being subjective, this is a reference to Le Roy's concept of the Ecocathedral as demonstrating the productivity of the individual, and as a critique of capitalist division of labour. In the section entitled "Building Zen", I introduce Le Roy's argument for this way of working and then reflect on the realities of this experience from my time working at the Ecocathedral.

his ideas. I worked at the Kennedylaan in Heerenveen on 6 June and visited Le Roy's other project in Groningen on 28 September 2006.

Figure 80. The Kennedylaan, Heerenveen, 1973
An early project of Le Roy's was in a traffic island, which was abandoned, but has recently been reactivated according to Le Roy's principles.

Figure 81. Louis Le Roy at work, Belgium, 1971
Le Roy (characteristically bending over with shovel) working with students arranging masonry and rubble on a project by Belgian architect Lucien Kroll

Le Roy regards the building at the Ecocathedral as producing more novelty[328] than design could, because design works via representation at scale and seeks to control effects, whereas the construction at the Ecocathedral directly engages ecological relationships. In the final section of the chapter entitled "Extreme Specificity", I discuss Le Roy's notion of specificity as a way of understanding novelty, which he argues through his collection of coloured glass.

5.2 Project Description

Louis Guillaume Le Roy (1932–2012) (Figure 79) was a Friesian artist from the city of Heerenveen, in the north of the Netherlands, near Groningen. Le Roy studied art at the Royal Academy of Art in The Hague and was an art teacher at the local high school in Heerenveen. An early project was on left-over land set among local housing in Heerenveen on the Kennedylaan (Figure 80). Here the local community, organised by Le Roy, built landscape elements, such as paths and walls, and planted plants among them in something akin to community gardens. The Kennedylaan is a traffic island running along the centre of a street in a housing area, and is about 15 metres wide. It is divided into four strips, filled with mature trees that line a path among elevated terraces that Le Roy worked on in the early 1970s. While he walked off the job after an acrimonious dispute in the 1970s, the Stichting Tijd has recently begun working with the Council again, who are keen to continue with Kennedylaan according to its original intentions, in light of Le Roy's work at the Ecocathedral.[329] Utilising ad-hoc construction, Le Roy worked in a similar manner with Belgian

328 Though I have used the term "novelty" throughout, it is worth noting that of the three designers discussed in this dissertation's case studies, only Le Roy used the term explictly.

329 Peter Wouda, 2007. The relationship between the Kennedylaan and the Ecocathedral was described by Peter Wouda as such: "the Kennedylaan is a playground, the place where you had your trainer wheels on, while Mildam was where the serious work happens". Wouda told me this on the first day that I was working, by way of explaining why I was at the Kennedylaan rather than at the Ecocathedral.

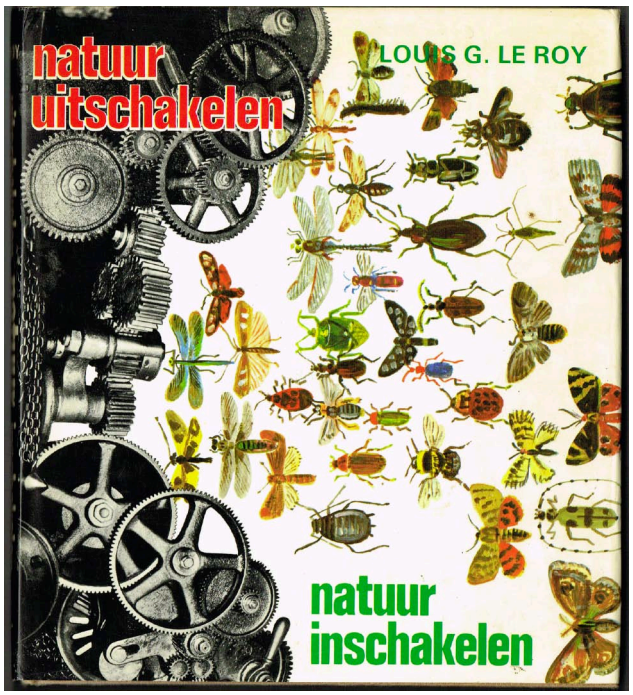

Figure 82. Louis Le Roy, Nature Uitschlackien/ Inschlaken, 1973

Translated as "turning nature on and off", Le Roy laid out his principles for the kind of practice used later at the Ecocathedral.

Figure 83. Mildam property, 1973

Prior to the Ecocathedral, in the 1970s, Le Roy's studio sat on agricultural land that was simply being left to regenerate, helped along by his later constructions.

architect Lucien Kroll (Figure 81).[330] In the early 1980s, Le Roy commenced his most significant project, the Ecocathedral, on a piece of agricultural land that he had purchased in Mildam, near the Dutch royal gardens at Orangewoud. He published a book entitled *Nature Uitschlackien/Inschlaken* (Figure 82) that summarised his work to date, though the development of the Ecocathedral over time is what best exemplifies his ideas.[331]

In the 1960s, the Ecocathedral was an empty field. Le Roy invited the local council to dump paving waste material comprising bricks, paving modules and sand (which I will discuss in depth later in chapter) onto the site, and set about arranging and stacking the material by hand, working outward from the stockpiles where the material was dumped. Le Roy made structures that resembled ruins and comprised complexes of paths, towers, walls, and "tables". The "table" is the term used by Le Roy and the Stichting Tijd to describe the basic construction unit at the Ecocathedral, essentially a terrace with a wall around it, which often formed the foundation for later structures, as well as facilitating ecological activity, just as a table facilitates other activities in the house or workplace.

330 Wolfgang Pehnt, ed. *Lucien Kroll: Projets Et Réalisations-Projekte Und Bauten* (Teufen: Editions Arthur Niggli S.A, 1987).

331 Le Roy's book title translates as "Nature Connected, Nature Disconnected" *Louis Le Roy, Natuur Uitschakelen, Natuur Inschakelen (Deventer: Ankh-Hermes BV, 1973)*. The only book dedicated to the Ecocathedral in English is a collection of quotes by Le Roy, with essays Boukema and McIntyre, *Louis G. Le Roy: Nature Culture Fusion*. A biography of Le Roy in French is published by ENSP Versailles: Anne Demerlé-Got, Lucien Kroll, and Michel Racine, "Louis-Guillaume Le Roy (Nè En 1924)," in *Créateurs De Jardins Et De Paysages En France De La Renaissance Au Xxi Siècle*, ed. Michel Racine (Arles: Actes Sud/ENSP, 2002). Other writing about Le Roy and the Ecocathedral includes: Lucien Kroll, "Grounds Cathedraux De Verdure," *Techniques et architecture*, no. 407 (1993)., Gerrit Confurius, "Louis Le Roy Und Seine Lustigen Streiche = Louis Le Roy and His Pranks," *Daidalos* 03/1996, no. 59 (1996). & Jan Woudstra, "The Eco-Cathedral: Louis Le Roy's Expression of a "Free Landscape Architecture"," *Gartenkunst* 20, no. 1 (2008). The Sticting Tijd occasionally publishes books in small runs (in Dutch) that contain an idiosyncratic range of reponses to the project.

Figure 84. Louis Le Roy, Staging plans of the Ecocathedral, n.d.
Le Roy drew these plans to explain the sequence of construction at the Ecocathedral, and are the only plans in the possession of the Stichting Tijd.

The Ecocathedral was an ongoing project for Le Roy, which he worked on with different levels of intensity from the 1980s onwards. Time lapses between construction stints meant that vegetation growth occurred, which influenced subsequent constructions, potentially causing previous constructions to be abandoned, or the shape of the constructions to change. The growth of vegetation also affected trucks' access to the site to dump stockpiles. The constructions worked from stockpile locations (which could be described as "go" points"), while vegetation formed blocks or constraints ("stop" points) that together governed the shape and extent of the Ecocathedral. Over time, the flat empty field in Mildam has become a topographically complex, bio-diverse forest of faked ruins.

Describing the Ecocathedral in terms of plan organisation is difficult because it was built in-situ rather than planned, and further, Le Roy was adamant that representation and planning was antithetical to the idea of the Ecocathedral, as I will later discuss. A series of schematic maps exist that were drawn by Le Roy that explain the stages of the Ecocathedral's development from his initial site occupation in the 1970s until the late 1990s. I shall use these to explain the stages in order and introduce the key types of construction that accompany each stage as an orientation to the site.

The cabin is the oldest part of the Ecocathedral and was Le Roy's studio before he commenced work on the Ecocathedral. An illustration of it in his book from 1973[332] shows what the site looked like before the Ecocathedral began changing it (Figure 83). Figure 84 shows the first three stages from Le Roy's drawings (labelled in the figure I, II & III), the first indicating that the site initially comprised simply an open field and a patch of forest, while the second shows the addition of the

332 Le Roy, *Natuur Uitschakelen, Natuur Inschakelen*.

Figure 85. Landscaping, Mildam, 2006

Prior to the commencement of the Ecocathedral, in the 1980s, Le Roy constructed terraces with mortar, more like a garden than his subsequent work on site.

Figure 86. Landscaping, Mildam, by author

As part of the early landscaping, Le Roy lined a pool near his studio, one of the few excavations on site, from winter 2006 visit.

cabin (Figure 83) and what appears to be conventional landscaping around the cabin, together with re-growing vegetation on the boundaries, presumably spontaneously arising from the removal of grazing. In the third staging, drawings in red seem to indicate what might be the first stockpile of dumped material from which the construction began.

Figure 87. Table, Ecocathedral, 2006

An ornamental table built in the 1980s, before the pinnacles. Note the facing using the underneath of large square pavers.

Figure 88. Tower, Ecocathedral, 2006

One of the early towers from 1980s.

Figure 89. Pinnacles, Ecocathedral, 2006
The dramatic Pinnacles built in the 1990s. Note the inverted concrete road divider used to build a cantilever.

In the 1980s, Le Roy began working on the Ecocathedral in earnest, presumably from this first stockpile. These early works were features rather than the tables as units of biodiversity that they became later. Le Roy's fourth drawing (labelled IV in Figure 84) shows deployment for construction that is setting up the areas for further work. Near the cabin, bricks were used to form small walls to edge terraces (Figure 85) and also to line ponds that revealed the ground water (Figure 86), the works resembling landscaping treatments. This was the period when Le Roy was working at the Kennedylaan, and, like there, he used mortar and took less care with the coursing of the bricks. Toward the end of this period (but still represented in plan labelled IV in Figure 84), Le Roy began building larger structures or towers, which used a table approach but with a more monolithic, architectonic form, including long walls (Figure 87) and a pair of towers (Figure 88). These structures took more care with selections of modules and their pattern, and shifted to what might be called a ruin (like a Mayan ruin) approach, whereas the structures were less like landscaping and more like follies.

The final, fifth drawing by Le Roy shows the final stage of the Ecocathedral as it was when I visited it (labeled V in Figure 84), without the "Skyscraper" having commenced. Two types of construction characterise this final period of working: the Pinnacles and the Tables. The most

Figure 90. Pinnacles, Ecocathedral, 2007
The pinnacles form part of a complex artificial topography.

Figure 91. Table, Ecocathedral, 2006
A table in winter 2006 showing the structure forming a terrace or topography without vegetation.

Figure 92. Table, Ecocathedral, 2007
Tables covered in spontaneous vegetation, taken in summer 2007.

dramatic elements are the pinnacles (Figure 89), which are architectonic, with the same care in details as the towers, including a cantilevered level in the far corner of the site. Rather than standing alone they form part of a topographic complex with many different paved levels like a megastructure (Figure 90), both following the scale of the previous towers and being like foundations for the Tables. The 1990s also initiated the table as the Ecocathedral's basic unit; these are larger areas and more like terraces and use the walls to create topography (Figure 91) and induce spontaneous vegetation (Figure 92). They range in height and some resemble tower-like elements but still create surface relief more than architectural form. The tables are the building block of the project but they are less visible because of the many circulation routes, so are visible from the edge. The tables are the focus of my following discussion of the Ecocathedral.

Figure 93. Skyscraper, Ecocathedral, 2005
The masonry dump that is going to be "the skyscraper" in summer 2005.

Figure 94. Skyscraper, Ecocathedral, 2005
Care has gone into forming the base of "the skyscraper" in summer 2005.

Figure 95. Steps, Ecocathedral, 2006
Steps off the entry drive into the forest, built by a neighbour in winter 2006.

Figure 96. Entry gate, Ecocathedral, 2006
Warning on entry gate that visitors enter at own risk in winter 2006.

Though the area that would later become the "Skyscraper" was not built at the time Le Roy drew his maps, there was already an opening that probably provided access for trucks in the previous stages. At the end of the entry road, the skyscraper is currently an amorphous dump of masonry (Figure 93), despite Le Roy's initial, careful efforts to shape its base foundation where the pile meets the forest (Figure 94). Efforts I saw in this area in 2007 seem ephemeral compared to the mess of bricks. Le Roy envisaged that the last part of the Ecocathedral would take 100 years to gain the height of a skyscraper, a task he allocated to me and others in 2007, as I will later discuss. Because Le Roy gained notoriety and sought ways to continue his project, others have independently begun working on the site such as a neighbour who has built an elegant path into the forest along the entry drive (Figure 95). Le Roy insisted that visitors are welcome although, as the sign of the gate notes, they enter at their own risk (Figure 96).

Many local people have become involved in the Ecocathedral and have built sections of it in ways that are quite different, particularly in quality, to Le Roy's own beautiful constructions. Because he wished the project to keep going, as indicated by the use of "cathedral" in the title (which are built over hundreds of years), he encouraged the development of a Time Foundation that would continue his work and also explore its implications for ideas about ecology and change. The foundation allows the Ecocathedral to keep being built after his death and has also been engaged by the council to return to Kennedylaan for a 100-year contract.

5.3 Precedents

The Ecocathedral is unlike the other two case studies both because a landscape architect did not undertake it and because it does not correspond to an easily recognisable typology, which begs the question: what is the Ecocathedral? Le Roy was an artist so discussion of his work in relation to the work of other artists is relevant, but also clearly demonstrates that the Ecocathedral is very different from other precedents because, while Le Roy's work shares interests in site specificity and in performance, his instrumental engagement with growth and ecology are more like landscape

architecture. As such, the following will discuss a number of precedents from art that together describe Le Roy's approach, although the dissertation proposes that his approach was unique and instead uses these partial resemblances to reflect on their differences to Le Roy's work. In this process, his work is considered as art in relation to site specific art, building but primarily performance. Perhaps more than any of the other case studies, the Ecocathedral demonstrates the performative approach discussed in chapter 2 because it is almost entirely tactical, its form resulting from construction decisions. I ultimately propose that Le Roy is a gardener and that the Ecocathedral is a garden.

Piet Vollaard locates Le Roy's work within the Situationist oeuvre, comparing him to Constant Nieuwenhuys and his project *New Babylon.*[333] Le Roy would have no doubt agreed with Constant's statement that "We require adventure" in his "A Different City for a Different Life",[334] and that the modern city was bereft of environments for people to play in. Their political approaches were also similar, with Le Roy eschewing the emphasis in capitalism of the financial value of time and Constant advocating more leisure time. Vollaard also notes that Constant's sense of the creative potential of the interaction between humans and the environment paralleled Le Roy's; however, the two were fundamentally different because "Constant used artificial, spatial structures for this while Le Roy concentrated on the natural environment."[335] This is not entirely true because Le Roy was really interested in an integrated cultural and natural environment where humans did human things in the reactive context of nature. Probably a core difference between the two is that while Le Roy would have embraced the spontaneous nature of a city of Situationist leisure, it's likely that Le Roy's protestant notion of the therapeutic value of work, albeit useless work like the Ecocathedral, would have been too prescribed for the Situationists. A final similarity between New Babylon and the Ecocathedral is that they are both infrastructures of activity, though Constant's would finish first while Le Roy's would emerge over time.

An example from Le Roy's teaching is instructive of his approach to art practice in relation to time. Peter Wouda told me that Le Roy used to give his art students at the local high-school a small card to do a drawing on at the start of each class, which he would collect at the end, a practice he continued through their whole education.[336] At their last class, as they were about to graduate, Le Roy would hand the pile of cards back to the students and they could see how they had developed over the year. In this example, the individual card is not important, but the trend over the series is. Recalling Constant, the card is the infrastructure but the activity is the outcome. If Constant deferred from the ground, leaving it open for possibility but ultimately ignored in favour of the aerial infrastructure, Le Roy's practice was firmly engaged with it, the specificity of the site conditions or the drawing on the card.

333 Piet Vollaard, "Time-Based Architecture in Mildam," in *Louis G. Le Roy: Nature Culture Fusion*, ed. Esther Boukema and Philippe V. McIntyre (Rotterdam: NAi Uitgevers, 2002).

334 Constant, "A Different City for a Different Life," in *Guy Debord and the Situationist International: Texts and Documents*, ed. Tom McDonough (Cambridge, Massachusetts: The MIT Press, 1959), 95.

335 Vollaard, "Time-Based Architecture in Mildam," 21.

336 Wouda.

Figure 97. Gordon Matta-Clark, Conical Intersect, 1977
Matta-Clark at work cutting a hole through a building for an art project, whose direct action resembles Le Roy's.

Considering other artists, the criteria of site-specific response and physical labour, particularly construction (or destruction, rather), parallels the work of Gordon Matta-Clark. Matta-Clark modified existing houses by cutting circular geometry into them. Speaking of one of his projects, *Conical Intersect* (Figure 97), Matta-Clark noted

> I cannot separate how intimately linked the work is with the process as a form of theater in which both the working activity and the structural changes to and within the building are the performance. . .Tackling a whole building, even with power tools and helpers is as strenuous an action as any dance or team sport.[337]

While both Matta-Clark and Le Roy reacted to existing objects and performed the labour on them themselves, for Le Roy, the labour itself was the subject, making it more like a performance, whereas for Matta-Clark, though he did the construction, which was documented, the final result was the focus. While he was engaged with the particularity of the building, Matta-Clark ultimately was juxtaposing an ideal form, and the interest was in that discrepancy. In Richard Long's site-specific performances, he walks a line in the landscape and documents it, but he too errs on the side of juxtaposing the abstract on the real. Both these markings could be seen as registrations but do not take their lead primarily from site, treating it as an 'other', or a foil, to the perfect abstraction.

While performance art may emphasise the action of the performance itself, Le Roy's performances produced ecological effect at a distance. The substance of the work, the brick, caused an effect through the creation of microclimate, a technique used in an environmental artwork from 1980, Betty Beaumont's *Ocean Landmark Project*. Beaumont's work was concerned with ocean habitat loss and so she produced an underwater artwork composed of 17,000 brick-like modules made of coal ash to help create a new reef (Figures 98 and 99), now "a thriving 150-foot long ecosystem colonised by vegetation and fish".[338] There are numerous similarities between the *Ocean Landmark Project* and the Ecocathedral, including the selection of the brick form for its gaps with their attendant encouragement of biodiversity, as well as the form of the reef as a long mound, like the tables as the Ecocathedral.

337 ICC_Antwerp, "Interview with Gordon Matta-Clark, Antwerp (1977)," in *Gordon Matta-Clark*, ed. Corinne Diserens (London: Phaidon, 2003), 189.

338 Barbara C. Matilsky, *Fragile Ecologies: Contemporary Artists' Interpretations and Solutions* (New York: Rizzoli, 1992).

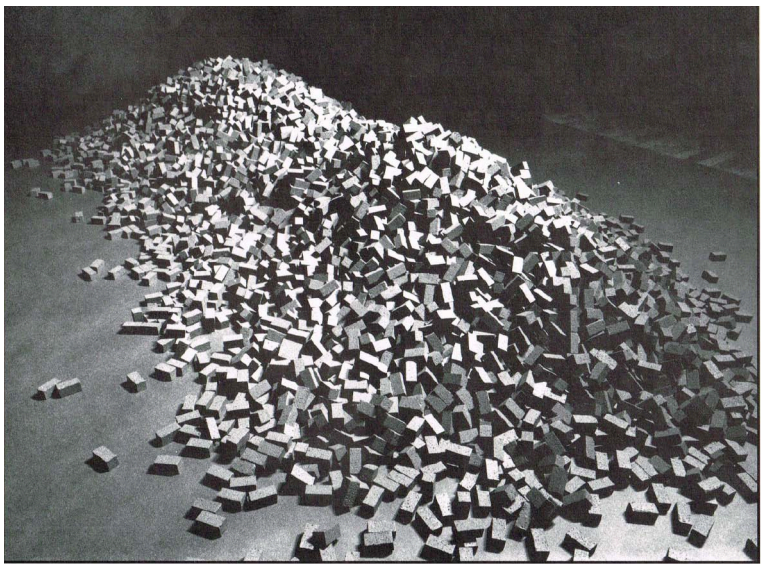

Figure 98. Betty Beaumont, Ocean Landmark Installation: The Object, 1980
Exhibition installation of project, showing submerged brick pile as it would appear on ocean bed.

Figure 99. Betty Beaumont, Ocean Landmark Project, 1980
Brick pile on ocean floor acts as a reef and becomes a fish breeding ground.

In many respects, Beaumont's project also resembles Robert Smithson's *Spiral Jetty* (1970), which might also seem to be a relevant precedent for the Ecocathedral. Smithson's spiral made of basalt boulders in a salt lake resembles Le Roy's constructions in both material and natural-process terms. The jetty has subsequently been covered by salt "which was the only attribute that Smithson . . . did not manipulate directly".[339] The relationship between the jetty and its crust where "the salt is not quite the jetty, but rather a species of patina" is similar to the way that the bricks at both the Ecocathedral and *The Ocean Landmark Project* operate by providing an indirect framework for another form to grow using natural process. Comparing all three though, while Beaumont's and Le Roy's structures encouraged biodiversity, the same cannot be said of the jetty, since salt water is effectively sterile.

While the mechanism of creating ecological effects at a distance and using masonry[340] is similar to the Ecocathedral, neither the *Ocean Landmark Project* nor *Spiral Jetty* involves the artist in an ongoing way. While Beaumont's and Smithson's projects managed the implementation of their projects, Le Roy's project is first and foremost a physical activity. Consequently, projects that involve construction by the artist and reflect labour may be the best precedents for Le Roy's work.

Perhaps the best precedents for the Ecocathedral are the follies built obsessively by non- or outsider artists, such as Watts Towers in Los Angeles, or another precedent that was "greatly admired" by Le Roy—the Palais Idéal by Ferdinand Cheval (Figure 100). The Palais was an elaborate folly that had numerous different types of architecture, such as Hindu, and was in this respect like an Exposition

339 Jennifer L Roberts, "The Taste of Time: Salt and *Spiral Jetty*," in *Robert Smithson*, ed. Eugenie Tsai (Los Angeles: MOCA, 2004), 97.

340 There are also similarities in both with the use of dumping locations to generate overall form.

Figure 100. Ferdinand Cheval, Palais Idéal, 1879
East Façade of the Postman Cheval's "Ideal Palace", a work of outsider art that took 33 years.

of the period. Cheval was a postman in France who began building the Palais after famously tripping on a stone:

> My foot had stumbled against a stone which almost made me fall: I wanted to know what it was. It was a stumbling block of such an unusual shape that I put in my pocket to admire it at my leisure. The next day I went back to the same place and found others that were even more beautiful. I thought: since nature wants to do the sculpture, I'll do the masonry and the architecture.[341]

The last point that "since nature wants to do sculpture, I'll do the masonry" clearly parallels Le Roy's proposition that he does culture and leaves nature to do nature. Piet Vollaard notes the similarity between Le Roy and Cheval in terms of their piling of stones and their interest in "free energy". He distinguishes between the two because "the realisation of the Palais Idéal was a goal for Cheval whereas the Ecocathedral is simply a way for Le Roy to test his theory in practice".[342] While it is true that Cheval had a goal, as a 'monument to obstinacy' (as it is often called), by his estimation, it took 9,000 days or 65,000 hours and was for him primarily "(proof) of what willpower can achieve",[343] a position not dissimilar to Le Roy's. And while Le Roy's rhetoric is focused on the process or practice, he too has goals in mind—his desire to have the work continued, and the goal of the skyscraper. In the following quote, one sees a definitive goal among the seeming focus on practice:

> I once said to a local alderman that I was working for the year 3000 and he split his sides laughing. He said that he hadn't even got around to thinking of the year 2000! He took a quick look at my lands and said: "You must be almost finished". I replied, "No, I've only just started." He then asked, "How high is it going to be?" To which I said "about 200 metres".[344]

Considering all the artistic approaches listed above—Situationist, site-specific, performative—it is really Beaucamp's action that is closest to Le Roy's because it releases 'free energy'. Le Roy used

341 Ferdinand Cheval, "Ferdinand Cheval / Le Facteur Cheval (1836 / 1924)," http://www.facteurcheval.com/en/history/postman.html.

342 Vollaard, "Time-Based Architecture in Mildam," 20.

343 Mary Blume, "The Postman Who Delivered a Palace," The New York Times. , http://www.nytimes.com/2007/05/03/arts/03iht-blume.1.5546120.html?_r=0.

344 Boukema and McIntyre, *Louis G. Le Roy: Nature Culture Fusion*, 12. While Le Roy's estimation is clearly provocative, he mentioned this number to me a number of times, and so it leads one to wonder how he came up with it. The actual potential height could be estimated, for the sake of the exercise, by measuring the area of the foundation and then extrapolating the unmortared batters upwards til they intersected, in which case it would be unlikely to get more than 50 metres high.

the term ‘free energy’ regularly; it refers to thermodynamic free energy, or the energy available for work.[345] The free energy is the total energy minus the entropy, which is regarded as useless, and is also known as exergy, as I discussed in Chapter 3. I believe Le Roy used the term incorrectly because I would argue that the Ecocathedral has no useless energy. Its aim is to distribute energy throughout the system, and as such catalyses what would have previously been regarded as entropy, in effect encouraging transfer outside the system. Thus, like the Ecocathedral, the *Ocean Landmark Project*, creates growth and diversity through the simple act of placing bricks. However, it doesn’t feature performance, which, combined with the ecological productivity that Le Roy referred to as free energy, would describe gardening.

The Ecocathedral is more like gardening than building. Gardening is defined by the Oxford English Dictionary as “the activity of tending and cultivating a garden” and while this definition might not seem to be immediately relevant to the Ecocathedral, it does set out parameters for understanding what takes place there. Like gardening, the Ecocathedral is a continuous activity, iterative and reactive, not aimed at completion but rather comprising an ongoing relationship to the garden, where growth results. The only differentiation is material because bricks are inorganic, and this does not matter because if growth is the desired outcome, the nature of the material that causes that response is irrelevant: water is inorganic but watering causes growth and is part of gardening.

There are some key differences between Le Roy’s approach to gardening and the conventional “tending and cultivation” of the garden, that are discussed by Vincent van Rossem. In the context of the period’s environmental movement, he places Le Roy’s book as a treatise on wild gardening, noting that

> One can treat Le Roy’s book as a gardening manual . . . his approach to the environment is extremely practical . . . anyone can experiment with nature in his own garden, and decide for himself whether to switch it off or on [which refers to the title of Le Roy’s book].[346]

Rossem is right when he distinguishes Le Roy’s approach from conventional gardening practice, which is “a labour of Sisyphus”[347] (van Rossem quoting Le Roy), forever stopping the actions of nature to maintain an organised image of it. While this is an important qualification, since Le Roy does none of these interventionist acts at the Ecocathedral, I would still propose that the iterative quality—the responsiveness to emerging conditions in the site and the emphasis on growth—are a better description of gardening than defining it based on activities such as weeding or fertilising.

345 Free energy is exergy, or the available energy for work as governed by the First Law of Thermodynamics. However, since the first law states that energy is conserved, while its path is irreversible as it is transferred, it memains available if it can be used. Since first-law energy is always conserved, it is evident that free energy is an expendable, second-law kind of energy that can perform work within finite amounts of time.

346 Vincent van Rossem, “Change Your Thinking, Change Your Gardening,” in *Louis G. Le Roy: Nature Culture Fusion*, ed. Esther Boukema and Philippe V. McIntyre (Rotterdam: NAi Uitgevers, 2002), 76.

347 Sisyphus was a king of Ephyra (now known as Corinth) punished by being compelled to roll an immense boulder up a hill, only to watch it roll back down, and to repeat this action forever.

5.4 Mind the Gap

5.4.1 Ecocathedral Construction

Figure 101. Kennedylaan, Heerenveen, 2007
A characteristic stockpile, with a mix of sand and soil and pavers that requires sorting by hand.

The Ecocathedral is constructed exclusively from recycled materials. They derive from urban demolitions in Heerenveen, and are provided by the Council. The location of groupings of constructions (which I refer to as "complexes") depends on the trucks being able to access the site, which is dictated by both the location of the previous structures and the growth of vegetation in terms of how they block access. Construction has retreated toward the gate as the number of possible paths has diminished because of the complexes and the regenerating vegetation. A construction happens as close as possible to where dumping occurs in order to minimise transport since the work is un-mechanised, relying on individuals' labour. This is mostly undertaken by hand rather than by wheelbarrows. Ultimately, the dumping location is the major design decision of the project since it all works from there.

The stockpile is the foundation of the project in both a topographic and building sense. The Netherlands is very flat, so the significance of the Ecocathedral creating topographic relief cannot be discounted. Stockpile location and type of received material is the major determining factor for construction at the Ecocathedral. It is deposited by dump trucks in great piles on the edges of the construction zone, and is then sorted or graded into different types of material. The grading sorts half bricks, which are for filling behind walls, and the different types of full modules used for the walls. Sorting usually occurs via throwing bricks from the stockpile, so the bricks are thrown as close as possible to where they will be used. Hands

Figure 102. Kennedylaan, Heerenveen, 2007
A table being constructed showing the use of different modules for different courses, in close proximity to the stockpile (in Figure 101).

Figure 103. Bricks at Kennedylaan, Heerenveen, 2007
Peter Wouda demonstrating two common bricks, notably the 200 x 150 x 100mm module on right.

do the sorting work because the piles include the fill, and the mix of bricks and fines does not surrender well to the shovel (Figure 101). The sorting activity deforms the geometry of the tipping process and reforms it into the table form, centrifugally from the stack, and a logical way to map the project might be from stack locations.

Piles are not always dealt with immediately and so they may get submerged under a mound of clean fill. As it rains, the soil moves in among the bricks, and the mix blends into a mound of material, which can get colonised by vegetation if left too long, since both the finished table and the stockpile function in exactly the same way, in terms of habitat. Because the Ecocathedral is a volunteer activity, stockpiles are the default treatment for the project, rather than the tables, since activity is sporadic. Meanwhile, some of the work undertaken at Kennedylaan has been uncovering and using twenty-year-old piles.

The materials in the particular truck that creates the stockpile determine what the adjacent constructions are made of (Figure 102). The material used at both the Kennedylaan and the Ecocathedral mostly comprises demolished pavements and so in effect Le Roy and others have adapted what was a surface or horizontal module to suit a walling or vertical use. Generally, a 300 x 150 x 100mm (Figure 103) brick has been used, although the more recent constructions are composed of smaller units, similar to a normal English brick. Concrete drainage and traffic control units also found in the rubble are used for cornices, headers and row details. The recycled materials are screened for structural integrity, consistency and cleanness, with the unsatisfactory units, and those that cannot be separated into units because the mortar used was too strong, used as fill. While the walls are made of brick, other modules, like pavers, have other uses. The most common paver is the 300 x 300 x 45mm

Figure 104. Pavers at Kennedylaan, Heerenveen, 2007
Often 300 x 300 x 45mm pavers are used as a cap or to tie across brick courses.

Figure 105. Table, Ecocathedral, 2007
A table construction in progress, with poor masonry units infilling the centre.

paver, which is used as the main pedestrian pavement material. Because it is flat and large it can bond across as double-brick wall-brick pavers, covering a lot of space with little risk of overturning (Figure 104). Special materials, such as curved kerb segments, are kept at the side and are further transported beyond the immediate stockpile and are used as details, either as a trip at the base of the tables, or as a coping on the top, sometimes flipped vertically. The nature of the construction is dictated by the kind of material that is being dumped, with the Pinnacles concealing a pile of 390 massive kerb blocks. These pavers and others give a very local connection because they can still be seen in the streets of Heerenveen, and I noticed different modules from the Ecocathedral in the street as I rode around Heerenveen on

Figure 106. Table, Ecocathedral, 2006
A wide table acting as a topography rather than an object.

Figure 107. Table, Ecocathedral, 2006
A thin table showing how different sized tables allow different types of plants to grow.

Figure 108. Table, Ecocathedral, 2007
An elevation of a table showing bonding pattern using bricks and flat pavers.

my bike. The Ecocathedral could be seen as a history of Dutch paving.

As already noted, the basic module of the Ecocathedral is the table (Figure 105). This description is appropriate both formally and metaphorically. Formally, the tables look like tables because they are generally rectangular and about the height of a table, allowing them to be climbed or sat on, within reach of people. Metaphorically, the table is something that facilitates other activities; an object that one puts something on. This definition describes the tables at the Ecocathedral because first and foremost they are foundations for other things—new landforms that will be colonised by vegetation. Consequently, while they are shaped like tables, their top surface is open, and so they are actually small retaining walls, often not covered or fully backfilled.

There are ranges of different constructions that change the basic table proportion of a greater surface than base, where those that have more surface than height seem like tables, while those that have more height than surface seem like towers. Some tables are so large that they seem like simply steps up a level, becoming foundations for further tables (Figure 106). As discussed in the project description, earlier tables tended to have more wall than surface and are read as objects, some towers or long walls, with these proportions generally precluding colonisation (Figure 107).

Figure 109. Table, Ecocathedral, 2007
Table walls use bricks stacked perpendicular to the face on a batter, with pavers crossing to tie them together, and backfilled with broken modules to hold the wall up. Sand is finally dumped over the top of the whole interior.

All tables are built as large as possible to accommodate future change, of an unknown nature, at a later date. Correspondingly, the most important characteristic is that these forms do not preclude future possibilities. This fits with their status as “tables”. Because they are infrastructural, they are generic in terms of both construction and aesthetics. In terms of construction, the aim is to make a large, battered masonry platform that has thick walls and consistent fill. A consistent rectangle allows maximum possibility for future potential.

The initial location is determined by the stockpile and this sets up centre that the generally straight walls are attached to, either enclosing it or running from it. This tends to be a straight segment as long as possible but is also a balance of the material and the further expected dumping in that location.

Bricks are laid in a header bond, their ends facing outwards so that the walls are deep, often with two rows of header course, tied together with the flat paving modules, interspersed between a number of header courses to tie the wall together (Figire 108). The walls occasionally run a course in the opposite direction but are not precise about the keying in of courses because movement is not discouraged by the construction method. No mortar is used in the courses or concrete in the foundations, and gaps are deliberately left between bricks "for nature", as I will discuss later.

The walls have an ornamental face on the front but gain their structural width by simple piling behind. The cavity behind the walls is filled with half bricks and poor-quality units, as well as large pieces of mortared mass masonry (Figure 109). The dumped fill is also shovelled over the mixed rubble behind the wall to begin the soil-building process. In the Netherlands, because paving is laid on sand rather than concrete, much sand is also dumped with the masonry. The filling process behind this wall occurs at the same rate as building so that the wall rests somewhat against the masonry fill. The relatively steep batter all the way around the table allows it to shift over time inward and, as it does so, becomes more structurally stable. The looseness in the construction and the batter allows it to get stronger rather than looser over time as it organically settles into a stable base.

5.4.2 Ecological Performance of Tables and Gaps

By Le Roy's own admission, the project at Kennedylaan and the one at the Ecocathedral differ in a small but significant way that indicates the full incorporation of ecological process into the constructions and that moves them from the community-garden paradigm into a much deeper operation as an ecological laboratory. Both projects are constructed from recycled building materials and neither are designed but instead emerge from the process of arranging the recycled masonry elements. While the earlier Kennedylaan project used cement mortar, at the Ecocathedral, the constructions are stacked dry. This absence of mortar allows what Le Roy described as "a space for nature", a literal and metaphorical description, because the open joints allow for growth and the movement of soils and fauna. This allows plants to colonise the tables, the main source of plant material at Mildam rather than planting, though visitors occasionally introduce plants into the Ecocathedral.

I discussed "spontaneous vegetation" in Chapter 1; however, such vegetation has been used for a long time in the Netherlands where it is simply referred to as "nature". Spirn discusses the "Urban Wilds" in the Bos Park in Amsterdam as a precedent for other "experimental" parks, such as the Buitenhof in Delft, where, "instead of the regarding the site and landscaping it with new trees, the city left the vegetation which established itself during construction and permitted natural succession

to take its course".[348] For Spirn, this approach to public landscapes reduces maintenance costs, and brings derelict spaces—such as Clément's *tiers paysage* and de Sola Morales's *terrain vague* that I discussed earlier—into cities' municipal green space regimes. Of these derelict spaces, Spirn notes that "the Dutch have found that a more diverse plant community with fewer undesirable plant species development more readily on infertile soils".[349] Marris calls these vegetation communities "novel ecosystems [that] are defined by anthropogenic change but are not under active human management" and are "as you might expect . . . more common than intact ecosystems".[350] At both the Ecocathedral and these derelict sites, it is the physical characteristics of the urban soils and the debris on them that causes vegetation to establish itself through colonisation and succession processes.

Buchanan describes succession as "the slow, orderly progression of changes in [vegetation] community composition during development of vegetation in any area, from initial colonisation to the attainment of the climax".[351] Buchanan discusses a number of different types of succession that explain how one type of plant can succeed over another over time, as each generation adapts the environment making it more suitable to the next "colonizer", "a plant or animal which successfully invades and becomes established in a bare area".[352] Primary succession is what occurs on a bare area without soil as soil is being formed on sand, mud or rock, which is what happens at the Ecocathedral immediately after construction. Secondary succession follows primary succession, when the process of "autogenic succession" is underway, and where plants have deposited organic matter as they have colonised and decomposed. This enriches the soil, which then becomes a growing media for seeds. Succession continues to the "climax state", which could be defined as a stage when succession has slowed, until disrupted by disturbance, which recommences the succession process.[353] During the primary stage of succession, colonisers are referred to as "pioneers" and, while suited to the initial environment, may make it more suitable for the following species than themselves.[354] Climax species following in the succession order often inhibit the

348 Spirn, *The Granite Garden: Urban Nature and Human Design*, 196.

349 Ibid., 197.

350 Marris, *Rambunctious Garden: Saving Nature in a Post-Wild World*, 114.. While Marris' book advocates for accepting, even engineering, ecosystems, which she calls "designer ecosystems", Clive Hamilton is critical of Marris' "promethean" approach that manipulates ecosystems for human ends without appreciating the complex interconnections. In this case, Hamilton suggests such a view fails to recognise the value of biodiversity in remnant ecosytems.

351 Robin A Buchanan, *Bush Regeneration: Recovering Australian Landscapes* (Sydney: TAFE NSW, 1989), 53. I refer to Buchanan because I studied Bush Regeneration with her at Ryde TAFE and learnt these terms in that course. It is ironic that I am writing in a positive light about those very same things—weedscapes—that we were being instructed in the removal of back then; however, as Del Tredici asks: "Can we put the invasive species back in the box or are we looking at a future in which nature as we know it becomes a cultivated entity?"Peter Del Tredici, "The Role of Horticulture in a Changing World," in *Botanical Progress, Horticultural Innovation and Cultural Change*, ed. Michel Conan and John W Kress (Washington, D.C.: Dumbarton Oaks, 2007), 260.

352 Buchanan, *Bush Regeneration: Recovering Australian Landscapes*, 35. It's interesting to compare succession and colonisation in these two quotes, where the former is "slow" and "orderly", while the latter is an "invader". This reveals an inherent bias toward indigenous plants that had to be tempered later when native plants like *Pittosporum undulatum* and *Omalanthus parvifolius* began to expand their distribution into nutrient rich environments alongside the weeds.

353 Molles, *Ecology: Concepts and Applications* (Boston: WCB/McGraw Hill, 1999), 383.

354 Ibid., 391.

growth of pioneers, and because they are longer living, establish the stable order of climax. It is worth noting that climax is not a real reflection of the state of ecological systems because "ecosystems are not static but constantly change in response to disturbance, environmental change and their own internal dynamics".[355]

For each type of succession, the process involves deposition and creation of soil and the introduction of plants. Soil is either deposited via erosion or by wind, and then can build autogenically, as discussed above. Plants colonise by either vegetative—where plants spread into new areas or where pieces of plant material break off and are deposited physically to the new growing site—or sexual means, where seeds are deposited via wind or mechanic means, such as by other species, like animals or insects. At the Ecocathedral, while the sand from the paving is an initial growing media, the gap, as a catching or filtration mechanism, is the main tool in succession.

The gap is interesting because it demonstrates that ecological effect arises from construction technique, not from design strategy or planting design. The constructions at the Ecocathedral result not from a design strategy or vision developed prior to the construction process, but during the construction process. I will discuss the philosophical aspects of Le Roy's vision of the construction process but will focus here on ecological issues. The construction process results from the continuous use of a single technique, which is stacking bricks. In stacking bricks, there are only two variables, which is the bond or the pattern of the stack, and the gap between bricks. This gap is fundamental to the ecological performance of the tables, and, indeed, also operates at the scale of configuring the tables in relationship to each other. As such, it is from the technique itself that the diversity of the Ecocathedral, both spatially and in terms of species' richness, arises.

The ecological effect arises from the creation of microclimates that have different temperature and moisture conditions than the broader regional macroclimate, as well as the literal shape of the edge as a boundary. In the following section, I will define microclimate and edge physiology from an environmental perspective and then look at how the tables and gaps perform in those terms. In effect, I am arguing that the current state of the site, with its diversity and its spontaneous vegetation, has resulted from properties of the tables and their construction.

The tables create microclimates at a range of different scales by creating different types of gaps, because microclimate is a "climatic variation on a scale of a few kilometers, meters, or even centimeters, usually measured over short periods of time".[356] In *Boundary Layer Climates*, Oke notes "the Atmosphere is characterised by phenomena whose space and time scales cover a very wide range" where the biggest variation occurs in the lowest part of the troposphere (the bottom 10 kilometres of the atmosphere) within what he calls *the boundary later*, which extends 1 to 2 kilometres up during the day and less than 100 metres at night and variations in time occur at

355 Ibid., 383.

356 "Macroclimate and microclimate are usually substantially different. Because many organisms live out their lives in very small areas during periods of time ranging from days to a few months, macroclimate may be less important than microclimate. Microclimate is influenced by landscape features such as altitude, aspect, vegetation, colour of the ground and the presence of boulders and burrows" ibid., 85.

intervals of 1 day.[357] Below this, Oke refers to a *turbulent surface layer* that extends to 50 metres high with variations occurring in seconds, but averaging out in longer than ten-minute intervals, and finally closest to the ground are two other layers the *roughness* layer, which is two or three times the height or spacing of the elements in it, and the *laminar boundary layer*, which refers is in contact with the surface of objects and is 2–3millimetres thick. When discussing the effect of the tables and their gaps, I am referring to the roughness layer where "flow is highly irregular being strongly affected by the nature of the individual roughness features (e. g. blades of grass, trees, buildings, etc)".[358] Oke's definitions show in the roughness layer all objects, regardless of size, can have significant effects, and thus it is possible to discuss both the gap in the joints in the table and the table as a whole in terms of microclimates, which we might regard as nested.

The gaps and the tables create edges. In *Land Mosaics*, Forman discusses edge morphology and the *edge effect*, which "refers to the high population density and diversity of species in the outer portion or edge of a patch or other spatial element".[359] Providing a link to Oke's sense of the fluctuating climate of the edge, Forman suggests "sun and wind are overriding controls on edge microclimate"[360] through their manipulation of temperature and its regulating effects on moisture levels through evaporation from soils, desiccation of plants due to wind, evapotranspiration in plants, and photosynthesis. While primarily describing the dynamics of the edges of forests, which apply to the effects of the tables at their site scale, Forman also proposes that "tiny gaps, clearings, clumps and objects create microheterogeneity within a spatial element [that] also contain edges, called interior or inner edges as in mathematics" that are "structurally similar to exterior edges, except that they tend to be less developed and more ephemeral".[361] Later, Forman proposes that a fractal model can be used to understand the imbrication of edges in edges, which, I would propose, also applies to the tables and their edges in the Ecocathedral.[362]

Forman uses the cell membrane as a model for understanding the morphology of edges and their physiology or effect, modelling what crosses the cell membrane, where and how. He proposes five functions of a landscape edge: habitat, filter, conduit, source, and sink. These could all apply to the tables and the gaps, but I will focus on their habitat and filter roles. Forman notes that increasing the quantity of edge (or *boundary length*) is used by wildlife managers to increase game populations; in summary, he notes, "the edge effect reflects the habitat function of a boundary".[363] After discussing the microheterogeneity of edges, he proposes that landscape edges can be measured as fractal dimensions, noting their property of "self-similarity", which could describe the relationship

357 T.R Oke, *Boundary Layer Climates*, 2nd ed. (Routledge: London, 1987), 5.

358 Ibid., 6.

359 Richard T.T. Forman, *Land Mosaics: The Ecology of Landscapes and Regions* (Cambridge: Cambridge University Press, 1995), 85.

360 Ibid., 87.

361 Ibid., 97.

362 J. M. Halley et al., "Uses and Abuses of Fractal Methodology in Ecology," *Ecology Letters*, no. 7 (2004). Note, however, the ubiquitous use of fractal descriptions in geometry and urge caution because there needs to be a scalar shift of magnitude to prove it, though perhaps the difference of scale between the bricks and the overall ecology of the edge of the Ecocathedral might be enough of a jump.

363 Forman, *Land Mosaics: The Ecology of Landscapes and Regions*, 99.

between the overall table as an edge and its joints as microclimates or micro ecologies. Noting the permeability of the cell membrane, the edge is also described by Forman as a filter, where "boundaries affect the rates of movements and flows between ecosystems".[364] He describes how seeds, wood, and heat move across boundaries by vectors such as wind, water, flying animals, humans and machines via processes such as mass flow or locomotion. Drawing on membrane theory, he states that "a history of abundant fluxes produces a richly textured or heterogeneously structured membrane", suggesting that "an anatomically diverse landscape boundary is more permeable to more objects".[365] Here, again, we see that the complexity of the edge of the tables could easily be described as a filter, with air and water movement easily crossing the walls through the gaps. The colonisation of the tables by vegetation demonstrates that they already act as filters that can catch seed. The anatomy of these gaps exhibit what Forman calls the "funnel effect" where objects are channeled through a lobe or gap.

5.5 Building Zen

5.5.1 Ecocathedral as an Activity

Including the Ecocathedral as a case study here suggests that it is a design project; in fact, the Ecocathedral is an activity that has effects. If one thinks of the claims of the process discourse about form being the result of process, this clearly describes the Ecocathedral. However, while the Ecocathedral is an artefact, it is primarily the record of an activity. As I will discuss later, its formal qualities result from the predilections of the person undertaking that activity. Treating the Ecocathedral as an activity is underlain by a number of related concepts articulated by Le Roy regarding human agency, specificity, and the productivity of time and nature. The Ecocathedral is both, and simultaneously highly theoretical and highly practical. I will quickly introduce and discuss these three aspects and direct the reader to the respective sections where they are dealt with in this chapter, before focusing on the activity itself here.

The Ecocathedral can be regarded first as an activity because its emphasis has always been on the doing of it rather than the result of it. As I will discuss in relation to my own experiences there, this is not as straightforward as Le Roy proposed, but nonetheless his position is interesting and not hypocritical. There are three arguments that Le Roy made about this activity: the real capability of people; the necessity of the unplanned; and the productivity and specificity of the collaboration of humans and nature in time. Underlying all three is a critique of capitalist society.

Le Roy argued that due to a combination of technology and capitalism, human beings have become detached from their bodies' physical capabilities. The division of labour has segmented people into trades and office workers, with tradespeople working physically and office workers not using their bodies to the limit of their physical capabilities. Further, for physical workers, machines have amplified human potential, which distances workers from their real physical capabilities. Human

364 Ibid., 100.

365 Ibid.

bodies have strength and capabilities that can only be understood through real physical labour undertaken without the help of other people or tools. The activity of building at the Ecocathedral then is didactic because it shows people what they are really capable of. Starting with simply materials, the action of people using their bodies produces something tangible: a section of an endless construction. Part of the promise of the Ecocathedral was that people might gain an appreciation of their abilities, which could potentially be revelatory. Because there is no set result to building at the Ecocathedral, the emphasis while doing the work is on the experience of the body itself in labour. The focus on labour is also compounded because structures cannot generally be completed in one session and because others may well work on the structures in between visits. Added to this, colonisation by nature means that the structures never look complete, which further transfers attention to the process. In terms of increasing obesity in Western civilisation, using human energy to create something like the Ecocathedral is also a fitness activity. The Netherlands is a Protestant society with an attendant work ethic, so Le Roy also believed that hard work is good for one, and that there has been a loss of appreciation for its value in society.

As a critique of capitalist society, the Ecocathedral also has implications that emphasise the physical and psychological aspects of the activity. The capitalist adage that "time is money" has made money seem to be a key quality of time. Le Roy's argument is that the allocation of financial value to time is an abstraction entirely removed from the reality of time, which is experience. Because the Ecocathedral is effectively useless in financial terms, the activity of making it is wasted time. But by being wasted, in fact, the real value and productivity of the body doing something is revealed and valued in finite terms of direct labour producing a direct outcome. As such, the valueless-ness of the activity is seen to enhance the sense of bodily experience of the Ecocathedral because the labour itself, rather than a financial reward, becomes its focus.

This sense of the useless-ness of the Ecocathedral is also a critique of state planning. In the Netherlands, a document known as the "Bestemmingsplan" dictates the use of every square metre of the country. For Le Roy, this level of spatial control, together with the valuing of time as money, has caused a total abstraction from both the body and also the natural processes of the world. This critique is accompanied by another, which is more political, and concerns the right of people to have access to places where they can express themselves through activities that are outside the financial system. The Ecocathedral is doubly important in this sense because it is both independent from the financial systems and its spatial controls at the same time as allowing a focus back onto people's physical capabilities. Arguably, the first is vital for the second. As the Stichting Tijd has developed beyond Le Roy's own positions, members have developed a proposed modification to the Bestemmingsplan that would make "the Ecocathedral Process" a statutory land-use for left-over spaces at the margin of other well-defined uses. For the writers of this amendment in the Stichting, despite being a land-use plan, the Bestemmingsplan treats these uses not as activities that happen in time, but as objects. Correspondingly, the Ecocathedral inserts a process into a document that is supposed to be about processes but isn't.

Figure 110. Tower, Ecocathedral, 2006
Le Roy's construction methods are precise and make thoughtful use of found modules, which give them the feel of foundations or fortifications.

Figure 111. Ad-hoc constructions, Ecocathedral, 2007
More recent constructions by others tend to conform to a "community participation" aesthetic, less like masses than ornament, more like mosaics.

As well as being a critique of the over-determining of land by planning processes, the Ecocathedral operates as a critique of capitalist notions of productivity in general. Le Roy argues that the Ecocathedral is much more productive in real terms precisely because it is unplanned. This point overlaps with points in the next chapter regarding the role of form and also novelty, but I discuss it here because central to Le Roy's prioritisation of the Ecocathedral as an activity is the notion that the activity of building produces more than design or planning can. As I have explained, the construction method that Le Roy used causes ecologies to develop, but it is the technique itself, more than the resultant forms, that do this, since the gaps in the walls result from how the bricks are laid. Considering that the technique of laying the bricks accompanies the activity of building, the experience of building has an ecological effect. For Le Roy, this is economic in so far as the return in terms of biodiversity outcomes from labour is economical, with more than simply the walls themselves arising. Because this productivity is tied to the technique rather than the configuration of the walls to form the structures, the Ecocathedral is a critique of design.

Despite being the result of an activity, the project is generally discovered by people via photography. Photography transforms the constructions from being the result of the activity to having primacy as form in their own right, and so my drawings were an attempt to recognise that regardless of the process, they still had formal qualities. Le Roy's constructions are carefully and beautifully made, themselves elegant constructions. They are characterised by precise batters, dimensions and spatial effects, and thoughtful use of different modules to provide detail (Figure

Figure 112. Ad-hoc constructions, Ecocathedral, 2007
Many people who just visit the Ecocathedral empathetically build these quick cairns that quickly disappear.

110). The constructions that came later than these original structures often seem crude and ugly (Figure 111). When I asked Le Roy about his own constructions compared to those that followed, he said that there were no formal principles, but his were a certain way because that was "how he liked to do it". Correspondingly, their level of artisanship was the result of his own preferences during the time he was building them and correspondingly were no better or worse than any other person building there because the act of building was important. Looking at one frail and ugly pile on site, which I suggested was not sturdily made, he told me that it wouldn't last (Figure 112). His response further qualifies the role of technique at the Ecocathedral. As well as being a demonstration of the productivity of human labour and as a method of increasing biodiversity, its aesthetic and formal qualities result in greater endurance. This equates performance with beauty and is reminiscent of arguments used to value vernacular building as architecture. It was further suggested by other members of the Stichting Tijd that the ability of each person to contribute their own formal language was vital because the ability to be creative at the Ecocathedral was a key rationale for it. This locates the Ecocathedral in a participatory paradigm and indeed much of the work post Le Roy looks familiar in this sense, with use of mosaics and ornamentation beyond the structural as Le Roy was largely focused on.

5.5.2 Experience of Building at the Ecocathedral

Having determined that the Ecocathedral was regarded by Le Roy and the Stichting Tijd as primarily an activity, it is logical to discuss the activity further in relation to my experience of it. This experience revealed aspects of the Ecocathedral as a subjective process that has implications for its formal and ecological functioning. Relying on my own experience, I will attempt to describe what I did in relation to what it clarified for me about the Ecocathedral. Working at the Ecocathedral begins with an orientation, generally held at the Kennedylaan, led by experienced builders from the Stichting, which involves no design intention but simply the introduction to key tasks and skills. I will discuss this orientation first since it focuses on the activity, and then discuss what I built, and what this reveals about the role of design intention to repetitive activity. As this discussion progresses, certain contradictions between the rhetoric of seemingly directionless building and latent psychological desires for proposition will be revealed.

Figure 113. Kennedylaan, Heerenveen, 2007
Peter Wouda building a wall on my first day building at the Kenendylaan.

Figure 114. Kennedylaan, Heerenveen, 2007
Thomas Richard and my "vandalism" of Wouda's wall; an exploration of how subsequent work can redirect an existing structure.

While it is unnecessary to detail my entire time at the Ecocathedral, describing the first day is relevant because it demonstrates the issues that become immediately apparent through the process of building, compared to describing, structures. Peter Wouda from the Stichting orientated me and my fellow volunteer Thomas Richard, and suggested that "What we do is just start work and take it from there." He noted that the basis of the project is sorting, and beginners were generally encouraged to start there. I began sifting through the mixture of clean fill and masonry, but Wouda came across and said "It's faster this way". He bent over the pile and began throwing bricks backwards through his legs like a dog digging: half bricks inside the table that was coming up and full ones to the side for use in building the face. Wouda suggested not worrying about productivity, and suggested we enjoy and use all the time available. The emphasis on sorting is so as to create useable material for later—not necessarily for yourself, but for the next person working on the site. Sorting is in effect a task of somewhat selflessly providing community infrastructure. Because the focus is on the work and not the structure, the nature of the work itself is less important; nevertheless, Wouda noted that most people want to build something visible. This became obvious as we began building, and it refuted some of the selflessness of the infrastructural work.

During the orientation, Thomas and I worked from an existing wall alignment that comprised two tables immaculately built by Wouda. One was almost complete and 1.5 metres high; it was almost perfectly formed (Figure 113) except for one poorly stacked corner. After our initial sorting, we moved onto constructing the wall by observing the detail of the complete table. Continuing the configuration of the table would produce an elegant treatment but at a certain point we introduced a tangential design that put a ramp into the platform. We started to prepare the foundations for

a corner and wall return to start to close the table, and spent some time trying to use a large, ugly chunk of glued-together rubble but could not make it work (Figure 114). This act changed the direction of the construction and re-cast the existing work. It was in no small part an act of rebellion, resulting from our own desire to quickly make a mark. Because the overall structure would not be significantly affected in the time we had, a smaller embedded construction would allow us to see a result, which seemed a natural desire but antithetical to the description of the Ecocathedral as a process without a defined object apart from human activity.

Turning the corner to start the ramp, we attempted to undertake a corner detail that mimicked the one opposite us and were confronted by a lack of material, which brought us back to sorting and assessing the constitution of the stock-pile. In examining the required modules, it was obvious that a sense of the constituency of the stockpile must first be ascertained to make an informed decision about which construction methods to pursue, which is like gambling on what is buried. This meant additional labour uncovering material in the hope that it would be the right material; if it were, it would reduce the time required for us to visibly produce something. In terms of learning from the act of building, this realisation re-cast our initial sense that sorting was creating material for others to get an outcome from and instead made it an exercise in determining palette.

A program seems to be in place where most volunteers at the Ecocathedral work there for one morning a week. Later we were joined by another volunteer who told us what he was doing. His own system was based around alternating colour arrangements of the bricks, working between red and black. He admired the corner we had made and suggested ways to use brick chips and the angles on the large kerb modules to create the batter on the wall. We had been pursuing a stepping back of the courses rather than an angling of the wall. After this, he resumed his own section and began to take the bricks that we had separated earlier. (As noted before, one may separate rocks for a day for their self, but if they do not get to use them, then someone else will.) We worked quietly in parallel and I made an important realisation about the nature of the process, which is that there is a reservoir of experience but not a set guidebook. At a certain point, the other volunteer walked over and said to me: “Ah! You have an imagining, a design in your head”, suggesting that there is a certain point in the process where the construction starts to have a clear form, moving forward.

At the Ecocathedral, responding to what has happened since one’s last visit is very important. In your absence, people may have intervened and changed what you have done, and you have to deal with their changes. Indeed, what one does in this space is deal with change from one visit to another, whether that be the change of the construction or one’s own change in temperament that affects what they will do next time. Thus, both the volunteer and the construction are changed by time.

When Wouda returned to review our work later, he was clearly disappointed that we deviated from his original design. Nonetheless, because he realised that the focus is on the activity, he said “Just go ahead”. This also reveals an unspoken rule, which is that one should continue with the apparent trajectory, and since Wouda’s foundation was clear, it was logical that we should have followed

Figure 115. Skyscraper foundation, Ecocathedral, 2007
The foundation for Le Roy's skyscraper that Thomas Richard and I were supposed be working on.

it. Moreover, since its appearance was elegant, we also should have followed its construction language. Because the work is a process, we did not demolish what we had accomplished since demolition is antithetical to the whole project. Because the artefact doesn't matter, our constructions still perform the same ecological function regardless, perhaps even better than those that are very tightly constructed. In this sense, there is no going back and one, or someone else, is committed to what has come before.

After our orientation at the Kennedylaan, we visited Le Roy to be briefed on the work we were going to perform at the Ecocathedral. Despite not working there or visiting the site in a number of years, Le Roy was still well acquainted with what was happening where. Le Roy planned for Thomas, another volunteer Occa, and I to work on the foundation for a skyscraper that he envisaged as being 200 metres high in the year 3000, with each of us coming up from one side until we met in the middle (Figure 115). While this relates to Le Roy's characterisation of the Ecocathedral in terms of being like a cathedral, built by many hands over a period longer than one person's life, it seems at odds with a number of the Ecocathedral's other agendas. While Le Roy's structures like the pinnacles have monolithic presence, they do not necessarily perform ecologically in the same way as the tables, and so setting the skyscraper as an ambition undermines some of Le Roy's argument about the significance of the tables as producers of novelty. Additionally,

Figure 116. Step construction, Ecocathedral, 2007
My step construction at the Ecocathedral.

with its emphasis on a final form, the assertion of the skyscraper undermines some aspects of the performative dimensions of work at the Ecocathedral. Considering that the emphasis is on the building, not the artefact, setting such a goal deemphasises the process. Such a goal also resembles design, which Le Roy specifically told me on numerous occasions was not what the project was about.

In the work that followed, I chose not to work on the skyscraper but instead to focus on making landform since I found myself more interested in the objects when they made up a surface, which nonetheless had some architectonic quality. Thomas and I were both told that we could "make our own form" but then, with the skyscraper, it must be in a certain location or meeting another place, so instead we chose to pursue smaller projects that we used to improve our technique. Thomas chose to make paving, while I worked on a platform and some steps down from it (Figure 116). Both sites were at the entry, and arose from a subtext of clearing space from the stock pile for more trucks to deliver at the middle, where our dedicated sites were supposed to be.

Without a design, building at the Ecocathedral first involves considering what one should do. Le Roy's work is so beautifully made and has such potent intention that determining the scope and nature of the construction first involves either engaging with or separating from his methods. One is very much aware of their limited time, which affects the scope of the proposed design if one wishes to see it finished. This is interesting because it seems antithetical to the whole idea of the Ecocathedral, which is about ongoing work rather than a finished object. Yet, one naturally wants to see something result from their actions. This difference results from the fact that I was a visitor rather than a local and could not complete something I started over a long time frame. In relation to Le Roy's notion of the Ecocathedral as a bodily experience, it's clear that this dimension is easier for locals than visitors who have a specific time limit thus restricting the outcome, making it less about experience and more about an artefact.

With only a week available, I chose to build a set of steps as a critique of the architectural-ness of the constructions, rejecting Le Roy's desires for me to start work on his proposed skyscraper. (Nevertheless, I was also interested in this idea that the Ecocathedral is about building "foundations", and in retrospect, for a research method, should have built something that I could later have evaluated in terms of its catalytic effects or otherwise.)

Clearly, building a staircase involves a grade change, which was a reading of the existing site and a relationship to other existing constructions. I chose a location near the site entry, off the elevated road into the site. Somewhat provocatively, I was inspired by a construction not by Le Roy, but rather by a neighbour who had built a lovely staircase down into a section of open forest of trees (Figure 95). I chose a spot opposite, since I wanted to allow access to the bottom of the skyscraper, revealing the beautiful walling of the foundation rather than emerging onto its surface among a mess of masonry (Figure 108). In so doing, I was engaging a way of understanding site as facilitating existing relationships, rather than building an object per se. Each builder effectively constructs according to their mental model, or interpretation of the Ecocathedral, a dimension of the

Ecocathedral that allows the project to engage multiple people and to develop over time rather than simply continuing Le Roy's vision.

Perhaps the most critical dimension that governs what one does at the Ecocathedral is the location of existing stockpiles. Generally, these are partly buried or covered with vegetation, and there are stockpiles everywhere, which have been partly used, and the most consistent and elegant modules are used first. More than any other aspect, the proximity of a stockpile guides decisions about what to do, and where the construction will happen, since it is difficult to move a stockpile without equipment. Moving a stockpile involves manually throwing modules from one place to another, one at a time—a very time-consuming activity. Even without this, the method I used involved much throwing of bricks because I chose to sort the existing stockpile into different modules as required—for walls, risers or treads—by throwing them to just near to where the steps would be built so that I could access them while I was building. This was intended as a labour-saving process,[366] but when I discussed this with Wouda—who had been building at the Ecocathedral for many years—he made the point that each person has their own method and that there is no right one. My own method developed from my experience of working as a landscaper and a builder's labourer where small time-saving economies allow for easier work.[367] By contrast, Wouda is a white-collar worker and, as such, his reasons for working at the Ecocathedral are different to mine. In a sense, first cynically and then respectfully, I began to realise that the Ecocathedral was about white-collar workers, or office workers, working like blue-collar workers (i.e., like labourers) for recreation. This surprised me but was another similarity to gardening, where the physical work in the garden is itself therapeutic.

5.6 Novelty as Extreme Specificity

While I have read the other case studies in this dissertation in terms of how they produce novelty, Le Roy is the most explicit in referring to the Ecocathedral as producing newness, both in his writing and in his interviews with me. In this section, I will discuss Le Roy's notion of novelty, which is tied to the growth that emerges from the construction acts, and is defined in opposition to design and representation. Le Roy's notion of novelty is that the combination of locale and action produce a novelty that is not only quantitative (which he, of course, does, as explained earlier), but is also qualitatively new. This is to say that part of its volume is its specificity: there is not just more "stuff" but all of it is different. In this section, I propose that for the Ecocathedral, and for Le Roy, novelty is specificity.

366 Interestingly, building from a set of steps from a stockpile forced me to break a fundamental rule of construction, which is to build from the bottom up. Working from a stockpile like this means working out and down rather than the other way around.

367 I was taught this quickly on building sites where logical inefficiencies of labour like facing the barrow away from the direction of travel could lead one to be described as "Irish".

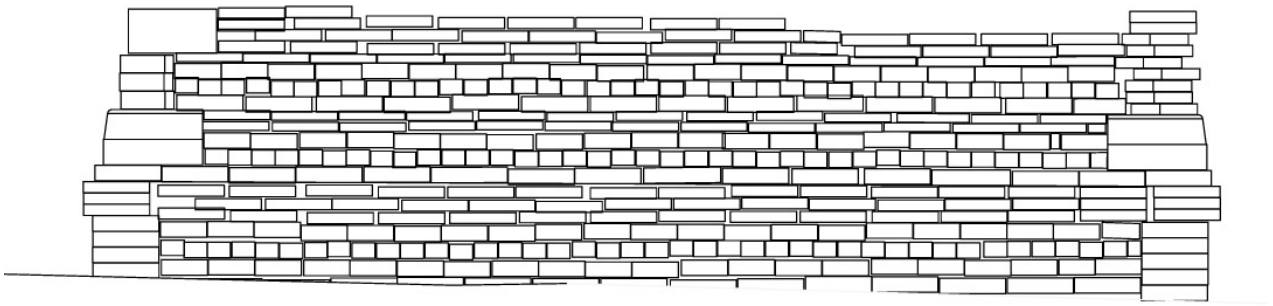

Figure 117. Elevation of table, 2007
Measured drawing of table built by Peter Wouda at the Kennedylaan.

Unsurprisingly, site specificity is a key concern of landscape architecture, and arguably could be its *raison d'etre*, though, as Kahn and Burns note, "architectural theory[368] has become ever-more dissociated from the consideration of physical conditions, veering toward a progressively abstract array of concerns".[369] Kahn and Burns provide a useful way for describing the work on site that the gardener and the builder at the Ecocathedral does, which they call "site thinking" that, "as a form of knowing . . . is concretely situated, more interactive than abstract, and less concerned with the semantic content of knowledge than with a concern for relationships among knowers and known".[370] Berrizbeitia also suggests that the concerns of the process discourse need to be reconciled with the fine site readings that can characterise landscape architecture:

> The shift from composition to process has facilitated the incorporation of complexity in design, but it has also given less visibility to issues that, in spite of new methods, remain at the core of the discipline, such as maintaining and expressing the qualities of place and its cultural meaning.[371]

Burns and Kahn's notion of knower and known, or between the person experiencing the site and the site's nature is one that Christophe Girot suggests is a component of French landscape architecture;[372] as one of his "trace concepts of landscape architecture", he proposes the concept of *landing*, which I discussed in Chapters 1 and 4.[373] Together with Girot's three other trace concepts, of grounding, finding, and founding, these strategies are essentially about mitigating what surveyors would call "misclose" or a discrepancy between the survey and the site. Girot, like many others writing about site in landscape architecture, treats site as a "problem" for design, an issue designers need to deal with to close their distance from place.

368 Although they mention architecture here, *Site Matters* also features landscape architects and discussion of landscape in architecture. As I discuss in the chapter on the process discourse, as process has become a dominant interest in landscape architecture theory, it has become dislocated from site.

369 Carol J Burns and Andrea Kahn, "Why Site Matters," in *Site Matters: Design Concepts, Histories and Strategies*, ed. Carol J Burns and Andrea Kahn (New York: Routledge, 2005), ix.

370 Ibid., xv.

371 Berrizbeitia, "Re-Placing Process," 196.

372 While Le Roy is a Dutch citizen, he comes from a French Hugenot background and is thus claimed by the French as their own in the compendium of French landscape architecture. Demerlé-Got, Kroll, and Racine, "Louis-Guillaume Le Roy (Nè En 1924).".

373 Girot, "Four Trace Concepts of Landscape Architecture," 61.

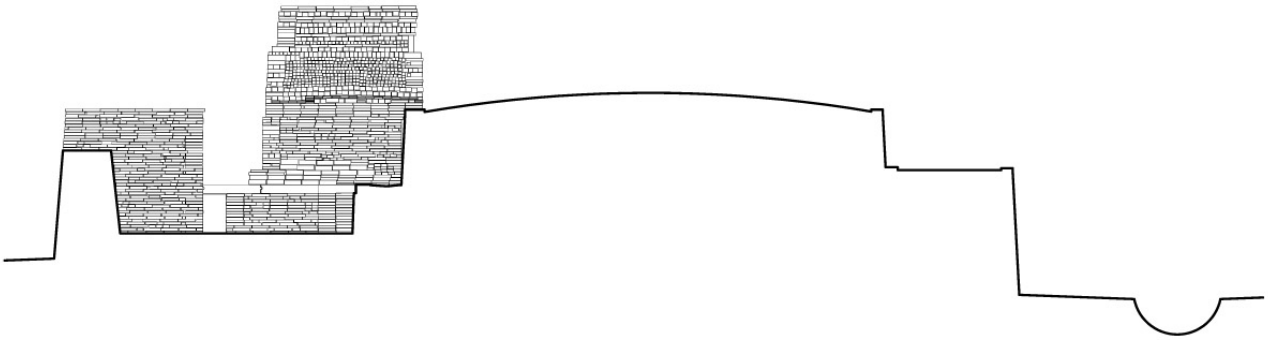

Figure 118. Section elevation of pinnacles, 2007
Measured drawing the artificial topography of the "pinnacles" at the Ecocathedral.

This distancing appears too in Burns and Kahn when they discuss the designer's relationship to site, where "the relational condition of the site derives from uninterrupted exchange between the real and the representational, the extrinsic and the intrinsic, the world and the world-as-known".[374] This is effectively a fight with the distancing nature of representation, which Le Roy seeks to mitigate via direct construction practice at the Ecocathedral. In relation to Le Roy, Burns and Kahn, and Girot demonstrate the importance of site and seek strategies to engage with it in representation, whereas Le Roy advocates a direct involvement that is non-representational and engages such site qualities in a real sense, and brings out aspects of a site's potential that would be impossible in representation.

Le Roy's sense of specificity is informational and, for him, reality is seemingly a question of resolution:

> We are all too quickly inclined qualify the reality around us as "chaotic". Take for example my collection of glass. I will never succeed in knowing what it really looks like. The closer I get to all that glass, the more information will be passed on to my cerebral system. The further away I am from it, the better I can survey the extent of my collection, but at the same time the amount of information will be proportionately smaller.[375]

While recognising the difficulty of comprehending the full breadth of a detailed reality, Le Roy clearly advocates immersion in information rather than its simplification. He notes that "observation is a complex event that takes place more effectively the more ready we are to make time and space available to it".[376] In effect, this is a preference for observation over representation and Le Roy made this point to me when I attempted to produce measured drawings of some of the constructions observed during my time at the Ecocathedral (Figures 117 and 118). When I showed these drawings to Le Roy, he suggested that they were a waste of time since the Ecocathedral is about the act of building; he argued that there is no place for drawing there since the task iss direct,

374 Burns and Kahn, "Why Site Matters," xv.
375 Boukema and McIntyre, *Louis G. Le Roy: Nature Culture Fusion*, 14.
376 Ibid.

Figure 119. Glass Collection, Orangewoud, n.d.
Peter Wouda took numerous photographs of Le Roy's glass collection at his house, which Le Roy used to illustrate his ideas about specificity.

not representational. That is to say, it is a waste of time to try to draw something (or duplicate it) that is easier simply to build. Further, he argued that the constructions would take too long to draw accurately because they were extremely specific insofar as they have enormous variation resulting from them being the output of an activity. Because of this, their inherent economy would be lost to the drawing act, which is ultimately about simplification. The economy Le Roy talked about was the level of ecological outcome compared to labour, discussed earlier; in contrast, a drawing demarcates areas—it does not produce lots of specificities, but, in fact, attempts to shoot them down as aberrations. Le Roy argued that this level of specificity was only possible directly and would never be possible in representation; or, rather, it would be wasteful to attempt it through a drawing, arguing in effect that one should "just do it".

Representation gains its economy by being scalar. Each change of scale saves time by removing detail so that designers can allocate their time to a bigger area or other things. This change of scale is possible due to interpolation or generalisation. In this process, certain things are prioritised while other things are unrepresented. As much as designers want accuracy, what they really desire is a precise ignorance. In comparison to this, the gardener or builder at the Ecocathedral deals with all the complexity around them at their own scale and makes decisions on the basis of what is in front of them. They make evaluations on the basis of the potentials in their immediate milieu in terms of materials or forms to react to. Because the work is unplanned, the economy is in the decision about maximum gain from minimum input.

As well as being a critique of design, or rather an emphasising of the qualities of proximity, Le Roy's project also considers this specificity as temporal and experiential, and because Le Roy worked with the found substance of site, this highly theoretical reading is embedded in a person's material engagement with site. This principle of specificity was also demonstrated at Le Roy's

Figure 120. Glass Collection, Orangewoud, n.d
Further photographs of Le Roy's glass collection.

house through his glass collection, which is also a feature in *Nature Culture Fusion*.[377] Along the wall-sized windows of his house, Le Roy had a stacked series of coloured-glass vases. Through these, kaleidoscopic light enters the space and light is reflected from vase to vase. To confirm his point to me, Le Roy, during our interview, got up from his chair and moved around to twist the vases to specifically bounce one beam of light from one vase to another. In discussing the difference between drawing and building, he argued that it would be impossible to draw the movement of light he was describing because it was so specific and situational—it was easier to "just do it". Tuning the light beams, he muttered "I do this every day but I just can't seem to get it right."

The glass pieces are modules like the paving units that form the foundation of the project. For both, any construction will be modular, and because the builder must work with the modules that are found, the qualities may not be exactly of one's choosing if it were designed. One must work with what is at hand. As Le Roy combined the glass pieces together and considered the new light effect, he noted "Now this is a new thing", and with the next, "And again a new thing." He suggested that the final assemblage is a new creative product that transcends the modules that make it up, even as those modules give it its qualities. As the assemblages are piled over each other three dimensionally, they become a precinct and a colony, like the Ecocathedral, but made up of densities of light rather than plants.

5.7 Conclusion

At the Ecocathedral, the freedom to act that one experiences is tied to processes, but is very different to the way that the process discourse (discussed in Chapter 2) typically deals with processes. In representation, processes are tools to catalyse systems that are distant from the designer, in order to incorporate them into the control of design. This is only ever possible to a limited degree due to the selectivity of representation—and thus one has to 'fight' with the representation. Conversely, at the Ecocathedral, the level of freedom is the problem, since the

377 Ibid.

site is ‘in one’s face’, unavoidable, constantly present. At the same time, due to the laws of thermodynamics, one’s actions, such as the piling of bricks, can have effects on things like vegetation that one is not directly working with.

This chapter has proposed that Le Roy’s way of working (which was called ‘working at a remove’ in chapter 1) can be considered gardening because it encourages growth, and because it is practiced like gardening. In Chapter 4, I proposed that gardening was a way of operating like a designer in real time, making formal decisions on site on the basis of found conditions that have emerged over time since one’s last visit. This definition links both Marnas and the Ecocathedral, differentiating them only on the basis of the media they use, plants in the former, and masonry in the latter. The use of inorganic material in the Ecocathedral is a link to the Bordeaux Botanical Garden, as is their creation of soil conditions for subsequent colonisation by pioneering plants during succession.

As a contribution to the thesis’ discussion of novelty, at the Ecocathedral, novelty is growth, just as it is at Marnas but it gains an additional dimension due to the way it harnesses ‘free energy’. Because energy is tied to its use, the use of much energy is lost as it is transferred out of one system into another; however, at the Ecocathedral, this is captured by growth, literally demonstrating the first law that energy is retained. Thinking of the gardener again, this transfer is from the labour of the individual and emerges again in plant growth. Additionally, since the labour is embodied and improvisational, this thermodynamic transfer it highly situational and specific. In the next chapter, I will build on this definition of novelty as specificity.

Chapter 6: Novelty

6.1 Introduction

Throughout the thesis I have used the term "novelty" to describe the changes in the case studies. This chapter discusses process and novelty, considering the terms first and then relating them to findings of the case studies. In this dissertation I have argued that in any discussion of process, the notion of an outcome is problematic but is nonetheless implicit. This chapter aims to reunite the poles of determinism and process so as to support my overall conclusion that by engaging with landscape change, design precision (in formal terms) is combined with natural process, and, more broadly, that separating design form and process is unnecessary, impossible, and disingenuous. Consequently, the research question for this chapter is: How do the kinds of change that characterise landscape projects and practices reconceive the notion of change?

In this dissertation, I have proposed that novelty is the quality and quantity that arises from a process.[378] The term derives from the Latin *novus*, meaning "new", the root of the French "nouveau", and describes something that is "young, fresh or newly made or created" (*Oxford English Dictionary*). I suggest that this quality emerges from the change process and, more generally, from the passage of time. Seeking novelty as an outcome from processes is found within the process discourse, however I have suggested that it arises from a real-time engagement with change, modelled on the way that the gardener works in time, rather than pursing it through representation. In developing a definition of novelty specific to this dissertation, I emphasise novelty as specificity, in material terms, at particular moments in time. As such, I propose that by practicing alongside processes, as the gardener does, results in a less clear demarcation between process and result, since the process is inseparable from the result at any moment. The result is the operation of the process, and the process is the manipulation of the result in real time.

In this chapter, I draw on Henri Bergson's thinking on change to discuss two different but related ideas.[379] The first is that change is unique and impossible to simulate, which is Bergson's critique of mechanism, which I in turn apply to the process discourse in the section entitled "Making Time, Space". The second is Bergson's notion of "duration", which neatly describes the way that I have proposed the gardener works. While I refer to Bergson, as well as other philosophers, such as Heraclitus and Alfred North Whitehead, it is important to note that my interest lies in change rather than in these authors. I do not claim to be contributing anything to the study of these philosophers;

378 Although it is only of anecdotal significance, it is worth noting that I discovered this particular usage of the word novelty in the book *The Invisible Landscape: Mind, Hallucinogens, and the I Ching*. The McKennas referred to Alfred North Whitehead and his notion of novelty as a way of describing emergent ideas and information during the psychedelic experience. While this work is largely speculative, the sense that they used novelty resonated with my characterisation of novel outcomes from processes. Dennis McKenna and McKenna Terrence, *The Invisible Landscape: Mind, Hallucinogens, and the I Ching* (New York: HarperCollins, 1994).

379 Both Sanford Kwinter and Elizabeth Grosz have considered Bergson in more depth than I do here in terms of his understanding of change. Kwinter, *Architectures of Time*. & Elizabeth Grosz, *Time Travels: Feminism, Nature, Power.* (Crows Nest: Allen & Unwin, 2005).

rather, I refer their thinking on change in order to understand how the case studies here can reconceive of the idea of change for landscape architecture.

I start the chapter by reviewing the terminology used to discuss process and change, focusing on the relationship between process descriptions and their outcomes. This reflects both their level of predetermination and the location of an implied observer, a dynamic that continues throughout the chapter. This is critical to how I have discussed practice in relationship to the ongoing development of the case studies.

I then go on to explain Bergson's critique of mechanistic views of change that reduce time to space by treating change as simply change in location or change in size. Bergson calls this understanding of change "difference by degree". I propose that this dominant description of change used by the process discourse results from the use of representations to capture change. Instead of difference by degree, Bergson proposes that change is characterised by "differences in kind", where unique changes emerge in the present. Bergson's discussion of difference by degree and the relationship of the subject is used as a critique of the process discourse, against which I propose the gardener as a model for a practice more able to engage with differences in kind.

I continue by contrasting two models of process that characterise two different and generally opposing views on process and design. The first, randomness—or "stochastic" process—emphasises articulation of process and de-emphasises form of an outcome. The second, determinism, characterises design, which is about precision, and prioritises formal outcome, with process being a means to an end. Arguments against determinism centre on its teleological character, where pre-determination in processes suggest an end at the beginning. Starting with stochastic processes, I look at different models of probability and then discuss Whitehead and Bergson in terms of the uniqueness of change, produced by a process that Bergson describes as duration. I then consider determinism, focusing on design and tendency, which, I argue, are inherent to any definition of a process. Throughout this section, I consider the case studies in relation to all the terms used, without seeking to polarise them, but rather to acknowledge elements of both in all the projects.

6.2 Process Language

In this section I examine what is implied by specific terminology used to discuss processes, and then consider how the case studies illustrate these terms. Each case study will also be discussed in relation to what it suggests in relation to determinism or randomness, which will be discussed in more depth later in the chapter.

Change is where something becomes different. Three implied parameters arising from this statement are of interest to this discussion of change: process, the becoming; result, the difference; and time, the context of the processes action and the outcomes prior and later condition. The interdependent and contradictory terms of "process" and "result" are of particular interest here. To be a process at all, something needs to have an observable effect, which is the result or the change.

But change and process are also contradictory because processes seem ongoing while, by definition, the word "result" seems frozen in time. This interdependency and contradiction opens up many other issues around the question of intentionality, which is fundamental to any notion of design.

Process is implied in the above definition because something moves from one state to another in the process of becoming. *Process* involves action or steps toward an end condition, where one step follows another chronologically over time. Because processes happen in time, they are regarded as inherently *dynamic*, characterised by constant change, activity, or progress, as compared to things that do not change, which are often referred to as *static*. A design regarded as static by the process discourse is synonymous with it being uninteresting, and the pursuit of dynamism as an aim results from this critique, as I discussed in Chapter 2. One could think of a process as a machine in a factory, which receives an input, undertakes an operation on it, and then produces an output that is the same object but is different to the state it was in when it was inputted.[380] This describes a single step of the process, or an *iteration*, however most processes continue, and therefore the identification of an input or output becomes problematic, as does using a mechanical definition, however convenient. The constant turnover of iterations of a process reflects the *recursive* nature of processes, their repetitiveness. Indeed, the recursiveness of a process is what allows it to be recognised as such. While it is recursive, its consistency does not produce the same results because the process is general and the inputs are specific. Instead, it can be identified because it produces recognisable types of change with different inputs into the process. This characteristic has caused processes to be referred to as *algorithmic*, whereby general mathematical or rule-driven models set out the operation of the process, and specificity occurs because particular inputs enter the process, where they are treated generally, but emerge specifically. This was also discussed in Chapter 2. While process can be used to describe or, perhaps, add up to change, change is a description of a quality of processes generally; it is the very thing by which one can judge that a process has occurred, as I will discuss later in relation to Bergson's notion of "duration".

I have described the processes within all of the case studies, each with their own inputs and outputs, which I called "novelties". For the Bordeaux Botanical Garden, I described two processes; the first is the erosion process where the forms of the mounds change, and the second is the decomposition process of the perimeter walls. These processes are inherently dynamic, though they start with a static object in both cases. For Andersson's Marnas garden, the process was growth, mediated by gardening, and is continuously dynamic, despite the rigidity of the planting plan shaping the rooms. While in these examples, the materials as inputs and outputs change, in the Ecocathedral, the process of construction is dynamic, as is its context. In itself, it is a ruin that is fundamentally static, and the input, bricks, and output, growth or biodiversity are different. Processes tend to be described around the poles of randomness (or stochastic process) and determinism, which I will discuss in the next section in relation to the case studies.

380 I use this description for convenience, even as I acknowledge that I have critiqued this way of describing a process, and will apply Bergson's critique of mechanism in the next section.

Time is the context for process and provides a metric for the range of intermediate states that something moves through as it changes. However, without change, it is impossible to know that time has passed, since people look to change to judge the process of time because change is material. While the medium of time seems like an appropriate analogy, it is in fact the base materiality of change that makes it useful to judge time, which is immaterial. Yet the material found in the present is static at that moment. It is because we are sentient we perceive the progress of time and so we look to that static quality of materiality as a marker of time and process. But time is abstract compared to this immediate physical presence. This disjunction allows change and process to be simultaneously abstract and concrete, and disciplines with very different aims, such as science and philosophy, to both be concerned with it. This important notion will be referred to later in relation to Bergson's notion of duration, in terms of the progress from the virtual to the actual. Time and change are not easy to separate because, as J. P. Priestley notes:

> Time cannot be reduced to mere change. It is true that without change in some form or other, there would be no Time . . . For Time as we know it, we need both change and not-change, some things moving and others apparently keeping still, the stream flowing and its banks motionless. If everything is changing, including oneself, how can one know that anything is changing? There could be no standard of comparison, no point of reference.[381]

Priestley is asking for a datum, a fixed point from which to judge change and thereby discern time, which, I argued in discussing Bergson's critique of mechanism, is effectively an observer. Priestley is asking for a recognisable initial state in a process against which the following state can be judged. In terms of the case studies, each has a different type of datum: for Bordeaux, it is the path toward which the erosion of the paths leads; for Marnas, it is the nature of the definition of the rooms, which are the benchmark; and for the Ecocathedral, it is the tables themselves, around which, and in which, vegetation grows. Priestley's discussion contains a tension between time as a unit of measurement and change as constant transformation. This fluctuation characterises all discussions of process and change; the fluctuation between process as an abstract or universal system and change as absolute material specificity.

The most basic description of a process' result is *end*, which is tied to notions of determinism, due to the notion of *telos* and its relationship to intentionality. This intentionality is associated with God and is called intelligent design; the notion that nature was designed by God. For an "end", the watcher is waiting for the process to be complete and there is only a single iteration, indicated by the finality of the word "end". In the popular value system of process, speaking of a process as having an end is treating the process as static because the inherent nature of a process should seem to be ongoing. The result as an end makes the process less relevant, typified by the expression "the end justifies the means", and instead emphasises the form of the end. The intentionality of end is clear, and indeed, intention and end are synonymous. This quality of finality is also latent in terms that feature the binary opposition of *in* and *out*, such as *outcome*, or *output*, which also suggests the process is a single stage or iteration. Perhaps the main difference between "outcome" and

381 J.B Priestly, *Man and Time* (London: Aldus Books Limited, 1964), 64.

“end” is that while both imply a process before them—with “end” implying it through termination and “outcome” through a transition between in and out—“outcome” suggests that the process is a machine, the word having emerged after industrialisation.

Result is the clearest term, and has a mathematical or algebraic dimension to it, the process if not machinic then perhaps notational or diagrammatic. While still indicating a point after a processes turnover, it also refers to the process because it suggests that it is best known by the process rather than itself, since it “results” from the process (perhaps opposite to “end justifies the means” example used earlier). If “result” seems to be the next term after “outcome” in a line where “end” is the most final, then the term *iteration* seems to completely downplay the result in favour of the process, which is why, in the process discourse, it tends to be used to describe a frozen moment in a process. However, if extracted from the process, at this point it is still effectively an end, which was my critique of the process discourse—that designers in the area of morphogenesis, particularly, built an iteration of the process and claimed it was dynamic, despite the fact that it had been frozen it at one point. If one conceives of the watcher in relation to iteration, the watcher’s concern is to the turnover of the process itself, and the result is more of an indicator of the stage of the process and not onto the qualities of the result itself. The watcher is in front of the process in the present, continuous with it, as Le Roy was at the Ecocathedral while he was building. Another common process term, *provisional*—which means currently existing but potentially being changed later—describes the qualities of the process result or iteration. Something is provisional because of greater certainty than the result is that the process will continue and the watcher’s attention with it. The result is here now but soon gone and replaced by another, each result an occasion of the processes repetition or recursion. This is like Andersson’s relationship to his garden, where the pruning creates a form at a moment, but is then subsumed into later growth. “Provisional” is a good way to understand the result that the gardener is interested in and produces. Related to “provisional”, *contingent* is another term that emphasises the temporary nature of the result, and it means existing only under current circumstance and subject to change. “Contingent” also recognises that the result is provisional but, whereas “provisional” still emphasises the result even as it also recognises that the process is turning over, “contingent” holds a link firmly back to the operation of the process. In a contingent result, as one tweaks the process, they modify the result, which is thus parametric.

Clearly, I am interested in the emphasis on form that terms such as “end” suggest, but I am also interested in how processes give such ends a uniqueness that dislodges such determinism but keeps a level of deliberateness in the outcome. Correspondingly, I would not consider these case studies in terms of “ends”, though I would qualify how the other terms were used. Perhaps the Ecocathedral has the most clear result or end because of its materiality; its form is only the beginning of another process of growth. The pruning at Marnas might seem like a result though perhaps it is more like an iteration since growth will emerge from the sites of the cuts. Bordeaux, on the other hand, is not clearly a result or an iteration, perhaps until it reaches thermodynamic equilibrium. For Bordeaux, the forms of the mounds can only be judged to be provisional or contingent.

6.3 Making Time Space

In this section I will outline Bergson's argument against mechanistic views of time. Starting with this supports my own critique of the process discourse in relation to its claims about novelty. Bergson's critique implies the two central apparent contradictions that this chapter seeks to address—the contradiction between form and process (where the process discourse makes a form out of the representation of a process) and a fixed or changing observer. Once introduced, these ideas will be developed throughout the chapter, moving towards a duration-based model of novelty with a dynamic participant/observer in the second half.

Bergson proposes that mechanisms treat time as if it were space, since "science cannot deal with time and motion except on condition of first eliminating the qualitative dimension of time, duration, and of motion".[382] Because science treats time as a quantity, it removes the particularity of time and therefore defers the qualities to their location, thus time becomes space. Space is homogenous and measurable, because the terms that describe it generalise its specificity, while duration is "heterogeneous, continuous and with no analogy to number".[383] Because each moment is unique, duration is heterogeneous because no one thing is the same as any other thing. Deleuze characterises two types of change in Bergson's writing about duration. The first, *difference by degree*, corresponds to Bergson's critique of mechanism and its spatialising of time, while the second, *difference in kind*, refers to the effect of duration. Because mechanisms describe time via spatialising it through the description of motion in a two-dimensional way, change becomes a difference in degree. This is because change is represented in terms of location or physical extent: for example, over a passage of time, X moved from point A to point B; or its size changed, it grew from X cubic metres to Y cubic metres. As I have discussed above, this treats time as a quantitative phenomena. There is no paradigmatic change in the object. Alternatively, duration produces differences in kind, which means that a thing is fundamentally different at every moment than it was before. Changes resulting from duration are "virtual, insofar as (they are) actualized, (and) in the course of being actualized . . . are inseparable from the movement of their actualization".[384] Deleuze also uses the term "alteration" to describe this process of differentiation by kind as a way to describe the differentiation process in contrast to differences in kind, which are characterised as metrical. Whereas differences by degree can be measured in a process of addition or subtraction (i.e., things are less or more of what they already were), things that are different in kind are altered in "a virtual qualitative multiplicity, like the run of Achilles that is divided into steps but which changes qualitatively each time it divided",[385] since, as Bergson says, "life does not proceed by the association and addition of elements but by dissociation and division".[386]

382 Henri Bergson, "The Idea of Duration," in *Henri Bergson: Key Writings*, ed. K.A Pearson and J Mullarkey (London: Continuum, 2002), 66.

383 Ibid., 68.

384 Deleuze, *Bergsonism*, 43.

385 Ibid.

386 Bergson, "Life as Creative Change," 197.

In terms of the relationship between form and process, an example of "making time into space" is where datascape attempts to spatialise statistical information. Datascape treats time as difference by degree both in terms of the statistics it uses as well as how they are mapped onto the city. Because statistics are selective, they only capture specific criteria, which means that changes in those statistics is literally by degree: simply an increase in the same criteria. Additionally, statistics give general number to qualitative and temporal phenomena and changes, and thereby dislodge them from their specific circumstances. Further, by treating circumstances as locational, a difference between one location and another that exists in terms of statistical magnitude represents a change where none has or ever will literally exist. Although I am critical of the ability of datascape to capture the dynamic factors it seeks to describe, I recognise that the creation of a correspondence between epidemiological information and urban location by Saint Simon that led to an improvement in public health and the creation of sewer systems in nineteenth-century Paris, was effectively an early instance of datascape.[387]

When Bergson speaks of the virtual and the actual, he implies what I call a "temporal observer" in relation to "the arrow of time".[388] This observer is implied because without such an observer, any sort of registration is impossible. In the case of the actual, the observer is looking back and noting a change of some sort, while in relation to the actual, the observer is in the present of duration, 'with' the changes of kind that are happening. This notion of the implied observer is important because Bergson's critique of mechanism assumes that the observer is only looking back along 'the arrow' that has already passed, and this is my critique of the process discourse. I would argue that even when looking forwards, the process discourse is looking backwards because it presupposes a uniform system for recording change, which is pulling differences in kind into the expected frameworks of differences by degree.

The Ecocathedral is perhaps the best example of operating in the actualising frame of duration, and in relation to differences in kind. This is primarily because it is an improvisatory practice that works with what it finds at hand.[389] It is completely dictated by the conditions surrounding it and the predilections of the builder and their subjective state at that moment, from which novelty arises. While differences in kind arise from it, it is not completely random—masonry is used throughout and certain building methods are consistently used, even while these are inflected by the builder. In this dissertation, I am not arguing that there is no level of predictability but rather that the response to conditions is from an actualising perspective.

387 (Paul Rabinow, *French Modern : Norms and Forms of the Social Environment* (Cambridge, Massachusetts: The MIT Press, 1989).)

388 Physicist Arthur Eddington famously coined this term to describe the irreversibility of time, particularly in relation to the second law of thermodynamics. (Prigogine and Stengers, *Order out of Chaos*, 8.)

389 Like Lévi-Strauss' *bricoleur.*

6.4 Randomness, Determinism, and Probability

A common way of dividing processes is into those that are *deterministic*, where there is no randomness and where the output is always the same from an initial starting point, and those that are *stochastic*, where varying levels of randomness and indeterminacy are present and where there are probable but not definite outcomes. Each of these versions of the description of process and its outcome has a bias toward either the process or the outcome that implies a value judgment about form. On the one hand, if one is primarily interested in process, then one tends to be interested in its operation and to downplay the process' result, the word "result" indicating its inseparable relationship to the process. On the other hand, if one is interested in outcome, then the process is downplayed and instead, the form of the "outcome", a word that implies finality, is emphasised.

The division between deterministic and stochastic processes centres around intentionality or *teleology*, the sense that there is a defined and consistent result (an end or *telos*).[390] As I discussed in Chapter 2, the contemporary interest in processes is in their nature as autonomous, unpredictable production; however, a sense of a process' direction is fundamental to almost all definitions of process, including the stochastic, its root being *stokhos*, "to aim". Logically, randomness and determinism seem opposed to each other, the one precluding the other, because something cannot be random if it is previously determined. This is only a Platonic question because, in the world, nothing is truly identical, even as things exhibit degrees of similarity. Correspondingly, nothing is truly exact; rather, there are tolerances of exactitude. Similarly, nothing is truly random because any terms of differentiation are a form of ordering. Instead, randomness and determinancy are both qualities of things in the world, and instead, what people do when they describe things is to describe levels of gradation between these two terms.

I will start this section by defining stochastic processes and then move onto deterministic processes, using the case studies to illustrate these definitions. By taking this route—from the apparently random to the determined—I will demonstrate that the two are not opposed but are, in fact, a graduation, with different levels of each present at all times. I will discuss stochastic process' operation in relation to time and probability, which I will also define. Probabilistic notions of chance are interesting because they rely on quantification of possibility to demonstrate randomness. This could seem like a contradiction, which is the position taken by the model of Humean chance that regards probability as deterministic. This model suggests that there is a possibility that a condition may arise however this cannot be predicted at all, and instead argues for the specificity of things in time. Whitehead also discussed this and, after introducing his notion of the actual occasion, I will use Bergson's notion of duration, which describes gardening, to end this section.

Statistician Emanuel Parzen discusses the definition of "stochastic", which, in the seventeenth century, meant "to conjecture, to aim at a mark", but has now come to mean, "pertaining to chance". He defines stochastic processes as

390 It is important to state categorically that I am not making an argument for intelligent design, the discussion of which is beyond the scope of this research

> "the dynamic" part of probability theory, in which one studies a collection of random variables from the point of view of their interdependence and limiting behavior . . . One is observing a stochastic process whenever one examines a process developing in time in a manner controlled by probabilistic laws.[391]

Later, he qualifies this when he describes a stochastic process as the development, over time, of "random phenomena, defined as empirical phenomenon obey[ing] probabilistic (rather than deterministic) laws".[392] Parzen gives the most basic mathematical description as: "A stochastic process is a collection (X (t), t ε T) of random values". A random value is a function (a relationship between an input variable and an output, defined by a formula or an algorithm) on a sample space. In the above equation, "T" is the sample space (which could be anything, including time) while the symbol "ε" denotes that the random variable in the first part of the equation "X(t)" belongs to.

Interestingly, and seemingly contradictorily, another way of stating the previous definition would be that a stochastic process is a deterministic function (the algorithm) with a random input, making the output unpredictable. As I will discuss later, this qualification reveals the core of difference between determinism and stochastic process, because determinism assumes that with the same input, outcomes will be the same, whereas stochastic processes allow for the changing relationship of the variable to the selection set that compounds to make the progression irreversible.[393]

Determinism is based on the notion that everything is determined by external causes, which ultimately control an "end". Design is inherently deterministic. Like the word "determine",[394] "design" has a similar Latin root, with the prefix *de* meaning "to complete". All definitions of design emphasise such completeness, or rather a design's "purposefulness", "intention", or, more pertinently, "aim", which implies an outcome. A further definition of design is "an end in view, a goal" (*Oxford English Dictionary*). What's more, because design is about a future, as determinism is, design could be a definition of determinism itself, since both have the sense that the future is prefigured already, regardless of the passage of time. Contemporary architectural historian Adrian Forty tracks the link between design and representation in pre-twentieth-century ideas, quoting Vasari from 1568, who suggested that design was '"nothing but a visual expression of the concept which one has in the intellect".[395] The drawing is thus a physical stand-in for a conceptual form, where, in a Platonic fashion, it is the idea that is perfect and the manifest reality that must be made to match it. In a determinist discourse of cause and effect, or ends justifying means, all processes are mechanisms for satisfying the end as closely as possible. In this sense, in determinism and in design, innovation exists prior to the end or thing, which is why in design, a built outcome is sometimes referred to as a realisation.

---

391 Emanuel Parzen, *Stochastic Processes* (Oakland, California: Society for Industrial and Applied Mathematics, 1999), xvii.

392 Ibid., 7. He mentions Hagstroem (1940) as a discussion of the origin of the term.

393 This quality of stochastic processes makes them useful for describing the irreversibility of the second law of thermodynamics.

394 Oxford online: *de-* 'completely' + *terminare* 'terminate'.

395 Adrian Forty, *Words and Buildings: A Vocabulary of Modern Architecture* (London: Thames and Hudson, 2000), 136.

While both the Bordeaux and the Marnas gardens are conventional designs insofar as they are built from drawings, it could be argued that Marnas is more deterministic in a design sense. If determinism describes a knowledge of an end, Bordeaux is more definite because the drawings document what was built. However, because the construction was documented to change and the change was not specified, I would argue it has been left open in terms of its end. In contrast, the drawings of the Marnas garden do not specify exactly what was built, since they represent a prediction of the size that trees will be when they are fully grown, which is effectively an end. From my discussion of the Marnas garden, it is clear that while this may have been predicted, Andersson modified the design with his gardening actions from the predicted scenario.

Cause-and-effect process models are fundamental to determinism, with the nature of the cause spawning numerous definitions of determinism. While historically the cause has been seen as logos[396] or god, Tony Flew describes a "scientifically oriented determinism, with no predestination overtones" in the following quotation from nineteenth-century French scientist P.S. de Laplace who proposed that:

> we ought to regard the present state of the universe as the effect of its previous state and the cause of the one which is to follow [where] an intelligence knowing at a given instant of time all the forces operating in the universe would be able to comprehend the motions of the largest bodies of the universe and those of the smallest atoms in a single formula—provided that it was sufficient to submit all these to analysis. To it nothing would be uncertain and the future would be present to its eyes as much as the past.[397]

In this quote, one can see the movement of "an intelligence", which might once have been God, become "a formula". Flew argues that in such a view, everything is inevitable and that we and the universe are "helpless products of ultimately blind forces which have made us what we are". Henri Bergson notes that any review of a process after its completion seems to point directly to an end, all the effects naturally leading from causes that seem easily visible after so that "it will explain the present as much as the present explains it; and even more it must be viewed as an end as much, and more than, a result".[398] This gives the sense that an end is latent in the present, a possibility that is waiting to be manifest. This is different to probability because when one regards something as being more likely than others, they begin to imbue teleology onto things. Writing about Bergson, Deleuze is critical of this notion of the possible that "appears when, instead of grasping each existent in its novelty, the whole of existence is related to a preformed element, from which everything is supposed to emerge by simple "realization".[399]

---

396 I discuss Heraclitus later in this section, who, despite his belief in flux, "introduced [an] immanent conception of divine intellegence with his use of the term *logos* (originally meaning word, speech, or thought) to signify the rational principle governing the cosmos. All things are in constant flux, and yet are fundamentally related and ordered through the universal Logos" Richard Tarnas, *The Passion of the Western Mind* (New York: Ballantine, 1991), 45.

397 Tony Flew, *An Introduction to Western Philosophy: Ideas and Argument from Plato to Popper* (New York: Thames and Hudson, 1971), 238.

398 Bergson, "Life as Creative Change," 192.

399 Deleuze, *Bergsonism*, 20.

Despite the teleological implications of determinism, namely, that there is intentionality to the way that systems progress, many scientists, particularly during the late 1950s to the 1970s, spoke of the laws of physics and genetics as having an *effective* determinism. For example, Erwin Schrödinger speaks of "accepted statistical explanations of [physics and chemistry that] if not strictly deterministic [are] at any rate statistic-deterministic".[400] Prigogine and Stengers note that for dynamic systems described by physics "the basic characteristics of trajectories are *lawfulness, determinism* and *reversibility*". They go on to quote Bergson that "Everything is given, but everything is possible"[401] in duration, which I will discuss soon. Tarnas describes this way of thinking about the world as "the Cartesian program of mechanistic analysis [that proposed] that the universe as a whole could be regarded as a machine . . . Ruled by statistical determinisms [and] subject [to] the domain of probability theory".[402] Such a mechanistic view of the world is not just used in physics, but also biology, where genetics allows for difference also to become mechanistically described, as I noted in Chapter 4 when I quoted Menod in relation to Andersson: "All teleonomic structures and performances can be regarded as corresponding to a certain quantity of information which must be transferred for these structures to be realized and their performances accomplished."[403] These definitions are close to Bergson's description of mechanism, which demonstrate that the search for probabilistic definitions of randomness is inherently deterministic.

"Probabilities" describe how propositions are more or less probable. Mellor discusses three types of probability: chances, epistemic probabilities, and credences. He writes,

> Chances are real features of the world [smokers have more chance of getting lung cancer than non-smokers] . . . Epistemic probabilities measure how far a hypothesis conforms or disconfirms a hypothesis [astronomical data makes it very probable that our universe had a beginning] [and] credences measure how strongly we believe a proposition [I think it will probably rain tonight].[404]

For Mellor, "the role of chance in modern physics is hard to over-state [since] theories of microphysics now ascribe chances to (propositions about) almost all small-scale events".[405] Since I have been observing physical evidence of change in relation to the case studies, chance is the best probability model for understanding the phenomena discussed. At the same time, as I speculate on the way that certain elements or techniques direct processes toward certain outcomes I am using epistemic probabilities.

Discussing probability, Mellor notes that while

400 Schrödinger . Erwin, *What Is Life?: The Physical Aspect of the Living Cell with Mind and Matter and Autobiographical Sketches* (Cambridge: Cambridge, 1992), 86.

401 Prigogine and Stengers, *Order out of Chaos*, 60. It should be noted that this view of dynamic systems is not the same for thermodynamic systems because they are not closed systems, and are goverend by the irreversibility of the second law.

402 Tarnas, *The Passion of the Western Mind*, 332.

403 Menod, *Chance & Necessity*, 25.

404 D.H Mellor, *Probability: A Philosophical Introduction* (Oxon: Routledge, 2005), 7.

405 Ibid., 9.

> probability comes by degrees . . . this does not entail that all probabilities have numerical values, since they might be comparable without being quantitative . . . they might be greater or less than each other without fixing by how much they are greater or less.[406]

This description is clearly relevant to Bergson's notions of difference. On the one hand, Mellor suggests that difference is indeed a matter of degree, but on the other, by recognising difference as qualitative, it also allows for a degree of variation. This notion of variation reveals that determinism could be read as a degree of probability. Mellor's characterisation of quantitative difference also supports the thesis that I have developed in this dissertation, which is that novelty emerges not as difference as contrast but as graduation, as specificity.

In line with their thesis in *Order out of Chaos*, Prigogine and Stengers take an emergent view of probability that they oppose to the "subjective interpretation [of probability that] corresponds to the situation where individual trajectories are not known", where probability thus "arises from our ignorance".[407] Instead, they propose "another objective description: probability arises as a result of an alternative description of dynamics, a non-local description which arises in strongly unstable dynamical systems".[408] A feature of complex systems is that, at a detailed level, local conditions can seem to be disordered, which are "local trajectories" that they call subjective and seemingly unintelligible; however, at a global scale, an order emerges from these fine-grain interactions, which they characterise as objective probability.[409] The difference between these two is reminiscent of Mellor's point about the necessity of clearly defining a proposition. As the proposition becomes more and more specific, it becomes more unpredictable. However, while its statement is general, probabilities become more certain.[410]

In Chapter 3 I discussed the erosion of the mounds at the Bordeaux Botanical Garden in relation to entropy. Prigogine and Stengers' difference between local trajectories and global systems mirrors the way that entropy creates unpredictable form at the scale of eroding soil particles at what I called in that chapter the "micro scale", while, at the "macro scale", they came to a stable state that resembles equilibrium.[411] In terms of how the mounds were designed, as I noted in Chapter 3, the design of the surface topography and edge coping leads will cause erosion to occur and to be deposited in a general area, which can be regulated through the design. This is the global order, or the "non-local" description. In terms of its local trajectory, the resultant erosion cannot be predicted, which is its specificity, rather than simply a subjectivity.[412]

---

406 Ibid., 16.

407 Prigogine and Stengers, *Order out of Chaos*, 274. This point is similar to Mellor's characterisation of credences.

408 Ibid.

409 Roger Lewin, *Complexity: Life at the Edge of Chaos* (London: Phoenix, 1993).

410 Returning to Mellor's distinction between "chance" and "epistemic probabilities", one could argue that as propositions become more specific they become more like chances, more clearly empirical, but with lower probability, whereas when they are more general they become more like epistemic probabilities, or hunches.

411 Interestingly, Heraclitus also says "In change is rest"(Heraclitus, *The Fragments of the Work of Heraclitus of Ephesus on Nature*, trans. G. T. W. Patrick (Baltimore: N. Murray, 1889), 105.)

412 Its important to remember that this formal unpredictability is only interesting because hard landscapes are generally designed to resist such change, and that their highly detailed edges would normally be expected to remain the same and thus be completely predictable. I made this point in Chapter 3.

On the one hand, the use of models for stochastic processes seem to celebrate randomness, but on the other, those same probability models have been used to ultimately demonstrate that order arises out of chaos, which could be seen as a kind of determinism. Schrödinger suggests that "orderliness" is produced by "the 'statistical mechanism' which produces 'order from disorder'… which is followed in Nature and which conveys an understanding of the great line of natural events, in the first place of their irreversibility".[413] This demonstrates that such views are about denying the teleological, not denying pattern or order, and coming to terms with thermodynamics.

For some rationalists, such probabilities are as teleological as determinism is. Mellor discusses the Humean view of causation, which suggests that causation does not link singular causes to singular effects: "effects need not be made inevitable by any 'necessary connections' between them and their causes, nor by any 'causal powers' which those causes connect". Mellor suggests that for those who subscribe to Humean chance, causes need to simply be "sufficient" for the effect. Using the example of the coin toss, all that is required is the coin, the air, and the landing surface. Similarly for Humeans, Mellor suggests that causes "necessary" for effects are presupposed by the fact that "all it takes to make tossing a coin a necessary cause of its landing in the circumstances (e.g. where coins only move if they are tossed) *only* tossed coins land".[414] In this model of causality, there is no probability, simply common-sense possibility since, for the Humeans, Mellor suggests, probabilities or frequencies are treated as "occult": the chance is the same every time and measurement of frequency simply retroactively describes and cannot affect the possibility of subsequent chances.

It's interesting to note that there are definitions of determinism that resemble Humean chance, such as those used by classical Stoic philosophers. Discussing Stoic philosophy and determinism, Bobzien notes that: "the cause and effect are relative to each other and inseparable: a cause is not a particular thing but that thing *in so far as it produces an effect*".[415] For the Stoics, cause and effect was a two-directional process, where the both the cause and the effect were physical and the process of change was immaterial. It was two-directional because both the cause and the effect were tied to each other. For each other, at a particular moment, one is in a position of sustenance (sustaining something/being sustained by something) while the other is in a position of change (changing something/being changed by something).[416] The cutting action itself was immaterial, operated in a different, entirely "incorporeal", sphere until it has concretised into the effected state, when it is physical. This inter-directionality arises because it was not simply the change that required a cause, but also the sustenance: there had to be a cause to keep things the same. The Stoics believed that the world comprised two principles, the active and the passive, where the passive was an "unqualified" matter, and the active was "god", "the cause of the world". Both were seen as physical, but the active animates the world. The only difference in this description of a cause-and-

413 Erwin, *What Is Life?: The Physical Aspect of the Living Cell with Mind and Matter and Autobiographical Sketches*, 81.

414 Mellor, *Probability: A Philosophical Introduction*, 36. Interestingly this way of discussing causality is very similar to that of the Stoic's, except they used the same logic to discuss determinism, as I will discuss later.

415 Susanne Bobzien, *Determinsm and Freedom in Stoic Philosophy* (Oxford: Oxford University Press, 1998), 19. Original emphasis.

416 Ibid.

effect relationship to Humean chance is that the Stoics believed that God animated the processes. As such, determinism is revealed as different to probability only in terms of sentience in relation to what is driving the process, and therefore knows its outcome.

The Humean view of causation treats everything that is possible as ultimately specific. Such a view treats the world as flux, insofar as nothing is fixed. The notion of the world as flux has been attributed to the pre-Socratic Ionian philosopher Heraclitus of Ephesius who, as Karl Popper notes, "was the philosopher who discovered change".[417] Heraclitus believed that that "the most beautiful kosmos is a pile of things poured out at random".[418] The description of *kosmos* as "poured" suggests water and, indeed, Heraclitus used water analogies as the main way to describe change and its passage in time, notably his famous dictum "into the same river you could not step twice, for other [and still other] waters are flowing".[419] Water is also suggested in the word *flux*, which means the process of flowing, that Heraclitus also used: "Everything is in flux and nothing is at rest."[420] Water is the archetypal analogy for change because it has physical presence, but, because it is a liquid, it is constantly in movement. In the gradient of determinism and randomness, both the water analogy and the notion of flux have aspects of consistency and difference. In Heraclitus' discussion of the river there is stability and change in the model: it's still identifiably the same river, but the material of it is different. Here we see that Heraclitus is really talking about not absolute differentiation but specificity. Within the container of the river, the water is different. Heracitus' term *flux* is a useful one because it contains both difference and repetition, an inherent rhythm. It's a probabilistic term because the periodicity of the flux may change but there will always be a return a rhythm of some sort.

In Chapter 2, I discussed how an involvement in process was not seen by the process discourse as deterministic because its emphasis was on the machinic operation of the process, whereas an interest in outcome was seen as deterministic because it constitutes a focus on ends rather than means. Analysing the Heraclitus' river dictum in this context, one can understand it in both ways. In terms of process, water has flowed along the river and its passage could be described in process terms, in terms of the path of the river, perhaps its velocity. This would be an algorithmic or, as I have discussed from Bergson, a *mechanistic* description, which acknowledges that while the water is different, the parameters are not necessarily so. In terms of form, the substance of the change, its literal materiality and novelty, which is its form, could be the focus. In Bergson's terms, which I will return to later in the chapter, the river is in a constant state of actualisation. If one judges the river by its own physicality then it is not the same because, as Heraclitus notes, the water is different in it. For this pole, the process is irrelevant because our interest in it is relative to ourselves, at the moment of its engagement. Heraclitus referred to constant change as *strife*,[421] and

417 Karl Popper, "The Open Society and Its Enemies Volume One: The Spell of Plato," (Sydney: Routledge, 2000), 8.

418 Richard D McKirahan, *Philosophy before Socrates: An Introduction with Texts and Commentary* (Indianapolis: Hackett Publishing Company, 1994), 122.

419 Heraclitus, *The Fragments of the Work of Heraclitus of Ephesus on Nature*, 94.

420 Popper, "The Open Society and Its Enemies Volume One: The Spell of Plato," 8.

421 "By strife all things arise and are used" (Heraclitus, *The Fragments of the Work of Heraclitus of Ephesus on Nature*, 99.)

this term gives an emotive dimension to the moment, appropriate because such an interest in the immediacy of flux emphasises the analytical subject. An interest in a temporal material aesthetic of flux is a characteristic of the process discourse; however, the experiential dimension of a moment in the process' outcome is de-emphasised, I would argue, because of the scientism of the process discourse that emphases objective empirical information. This is despite the fact that an observer is implicit in any description of a process that is otherwise continuous in time.[422] Heraclitus' interest in flux is being amongst its flow, not looking down at its process from above; "'whatever seeing and hearing I particularly honor' that is, the visible above the invisible".[423] Heraclitus' characterisation of the river in relation to a person stepping over it evokes a much more existential and involved participant, whereby the process is not designed and deployed but rather, where the participant accompanies it and knows it through direct observation and involvement. This type of relationship to process is closer to that of the gardener, which I have been developing in this thesis.

Alfred North Whitehead was also interested in the specificity of what arises in time and the relationship of a subject to it. A philosopher of science in the early-twentieth century, he discussed novelty in his book *Process and Reality*.[424] His interest in novelty is as the highly specific outcome at a highly specific moment in time in processes: "'creativity' is the principle of *novelty.* An actual occasion is a novel entity diverse from any entity in the 'many' which it unifies."[425] This description of novelty sees it both as a material thing as well as a moment in time, the two simultaneous because its physical state is determined at a moment. Whitehead's description corresponds with Heraclitus' dictum about the river. The "many" is the field of similarities that the novel entity will join when its newness or its novelty becomes recognisable, resembling other existing things, when it becomes an instance of a more general classification rather than as a material uniqueness at a temporal moment.

When Whitehead says that "Becoming is a creative advance into novelty",[426] he demonstrates the key role that novelty plays to the concept of change, tied as it is to the concept of *becoming*. As I shall show, this is a term that Bergson also uses, although actualising is really what he is referring to. While Whitehead is interested in the principle of creativity and becoming, which both refer to the process by which novelty is produced, he is less interested in the process as a mechanism than in the specificity of the outcome as a unique material thing. Whitehead says:

422 This is the divide between scientists and philosophers of science, where the former assume this observer, while the latter (such as Whitehead, who I shall discuss later in this chapter) make much of the mind-matter progression. Bergson, Whitehead and Bateson all logically assume that any appreciation of pheneomena or the measure of it involves the mind, which is also a physical thing in the world. It is a reconciliation of these two poles that Latour attempts. Harman pursues this even further when he argues both for a reconsideration of the phenomenology of the basis of actual phenomena, as well as asserting the autonomy of objects in the world, apart from their appreciation. Interestingly, Mosbach and Claramunt argue for a view that acknowlegdes the subjective reading of place and its scientific reading simultaneously.

423 Heraclitus, *The Fragments of the Work of Heraclitus of Ephesus on Nature*, 87.

424 Whitehead, *Process and Reality*.

425 Ibid., 21.

426 Ibid., 28.

> the loci of the "unison of becoming" are only determinable in terms of the actual happenings of the world. But the conditions which they satisfy are expressed in terms of measurements derived from the qualification of actualities by the systematic character of the extensive continuum.[427]

This latter part of the quote mirrors Bergson's critique of mechanism and mine of the process discourse. In the process of choosing a single measure to describe change, we deprive it of its uniqueness.

Whitehead's model of novelty effectively merges Mellor's discussion of the Humean view with Heraclitus' sense of the ever-different river. Quoting Whitehead, Shaviro notes in *Without Criteria* that "the new is one of the fundamental concepts that 'are incapable of analysis in terms of factors more far-reaching than themselves'".[428] Discussing Le Roy's notion of novelty as a specificity in Chapter 5, I discussed his critique of design and his positioning of building practice as uniquely productive, because of its ability to engage with and produce the particular at a moment. Similarly, Shaviro notes that "for Whitehead, the final cause is the 'decision' by means of which an actual entity becomes what it is".[429] This decision could be Le Roy's decision at the Ecocathedral, where one brick is placed as a response to a latent situation, which then makes it the source of action guiding future transformation. Even while a decision made directly in response to a found condition is a kind of uniqueness, it can also be seen as the making of an end, even among a process. Le Roy's approach is simple and instructive in this context: all he does is place one brick and then another. He is a catalyst but separate from the effects that arise from his actions. The simplicity of choosing a brick, finding a location, and placing it limits the claims about his agency in relation to effects and allows them to be unique, affected but unguided. And at the same time, the way that the brick is laid is decisive and, in a sense, final. Again, Shaviro provides a useful qualification for the relationship between a deterministic decision and an open effect:

> The point is that "decided" conditions are never such as to banish freedom. They only qualify it. There is always a contingency left open for immediate decision. This contingency, this opening, is the point of every entity's self-determining activity; its creative self actualization or "self-production".[430]

Heraclitus and Whitehead articulate the notion that the present is a particular emergent newness, which corresponds to Bergson's notion of duration, as discussed by Deleuze in his book *Bergsonism*. Bergson's model of duration advances his critique of mechanism by presenting a model for how "differences in kind" emerge from the passage of time. Bergson's notion of duration is pure change happening in current time; as Deleuze says, "a becoming that endures, a change that is a substance itself".[431] Endurance here suggests something fixed that endures against change;

427 Ibid., 128.

428 Steven Shaviro, *Without Criteria: Kant, Whitehead, Deleuze and Aesthetics* (Cambridge, Massachusetts: The MIT Press, 2012), 71.

429 Ibid., 89.

430 Ibid.

431 Deleuze, *Bergsonism*, 37.

however, Deleuze is really talking about continuous change, and, in some senses, persistence, so endurance is continuation. It could even be regarded as contiguous because the same thing transforms while staying the same thing. Things persist also because changes continue changing but are not reversible, as thermodynamics reminds us. This sense that change is the materiality of novelty arising from landscape processes is relevant to how I have discussed the case studies.

From Bergson, Deleuze breaks down the process of duration in time, looking at the transition of the past into the present in consciousness as the action of either recollection or perception, respectively, both of which have engagements with matter in different ways. From the discussion of differences in kind, Deleuze describes perception as being part of the virtual. The present is virtual because it is not an object and, in the process of actualising, is never complete—otherwise it would be the past. For Deleuze, "the present is not; rather it is pure becoming, always outside itself. It is not but it acts. Its proper element is not being but the active, being useful."[432] Differences in kind can result in matter, so out of the process of actualising, matter can be produced, but as soon as it is, it is the past. Because consciousness is engaged with the world as it is actualising, it uses perception to engage with matter. This matter has resulted from earlier differentiations in kind, so is actual rather than virtual, having ceased actualising. It is perceived as material to be brought into the virtual process of actualising. While it is in the process of actualising, new differences in kind, which can be matter, are highly specific, "actual occasions", as Whitehead would say.

The difference between the virtual and the actual can be defined in relationship to matter. The nature of the virtual is to produce, to be in motion, which is antithetical to matter. Conversely, the actual is entirely without movement, its nature to be fixed, describable, and complete—entirely matter. The difference between these two things, despite their relationship, is a difference in kind. Compared to the virtual present, acting "the past on the other hand, has ceased to be useful or to act. But it has not ceased to be. Useless and inactive, impassive, it IS, in the full sense of the word".[433] Other than through memory, we tend to understand change by tracing it via matter from the past, however, as Deleuze notes "Duration is virtual. It is actualized according to divergent lines; but these lines do not form a whole on their own account, and do not resemble what they actualized."[434]

Despite knowing from Bergson's own critique that using a path to describe time spatialises and freezes it, these lines suggest a diagram that shows how the two, duration and matter, relate to each other, in relation to the respective actions of perception and recollection. This diagram would resemble the prow of a boat and the waves behind it. At the front of the prow in the present, differences in kind, are specificities being produced in the virtual process of actualising. Behind the prow, the wake represents the past. This V-shape, with the point of the prow in the present, and the wide wake describes the amount of matter at each point. Deleuze notes that "duration is the most contracted degree of matter, matter the most expanded degree of duration".[435] Duration is contracted

432 Ibid., 55.
433 Ibid.
434 Ibid., 105.
435 Ibid., 93.

because of the specificity of its selection for use by the process of perception, rolled into action. While Bergson is cynical about the notion of possibility, the pointed prow of duration is pointed because it has reduced its range of choices of material to what it is actualising. When Deleuze talks about matter being the expanded degree of duration, he is referring to the matter that results from the process of differentiation.

Using the boats prow analogy, the waves widening out are the expansion of matter in the wake of duration. While the first expanding wave is matter, its outside edge, where it meets the rest of the sea, is space, the whole wave being the schema. This expansion out of matter is reminiscent of Whitehead's notion of the actual occurrence joining the many: as the novel material joins the other matter of the world, it loses some of its specificity and blends with the world in the background. Recalling Bergson's discussion of space, it is through matter that space gains its dimensions. So, in considering space in relation to matter, Deleuze notes "space is not matter or extension, but the schema of matter, that is, the representation of the limit where the movement of expansion would come to an end".[436] In this model, novelty is the moment of action actualising, of decisions made that cause material consequences, immediately perceived and then returned to the actualising process.

Considering the case studies in relation to duration and this model of the ships prow, as I have been suggesting, the most important factor is the relationship of the designer or gardener as protagonist in relation to the emerging novelty. For the Bordeaux Botanical Garden, change is virtual insofar as the designer is operating well before the change occurs, but the design itself is being actualised. Bergson's critique of difference by degree seems to best describe the way the designer necessarily conceives of change. Looking forward and designing for change, inevitably the designer can only work with prediction, and therefore the most probable cause-and-effect relationships can be relied on. This is particularly true for the manipulation of erosion at the botanic garden. Because the erosion is literally a change in location or a change in extent, these are differences by degree, and the critique of mechanism applies. Other issues, such as the ability to climb the mounds, that have had to be subsequently mitigated are more like differences in kind, ironically. The Ecocathedral could be regarded as pure duration. Without a plan, responding purely to circumstances and entirely an activity, construction at the Ecocathedral is virtual because it is ongoing, in a state of actualisation, and focused on the moment. As I alluded to earlier in relation to Humean chance, the Ecocathedral is highly specific but because it is focused on the static object of the brick, it is ambivalent about change. If one thinks about the actualised as a record of the past, the configuration is a record of the decisions made during the construction stage. Finally, the Marnas garden is a strictly determined design project, which, even more than Bordeaux, locks down spaces into constrained room. Its tight planting design is founded on change by degree because it relies upon growth to join up the individual plants into a single wall structure. At the same time, Andersson's engagement with the garden changes to one that is like duration because he makes constant decisions from emergent trends as he gardens. I end this discussion of the case studies in relation

436 Ibid., 87.

to duration with the Marnas garden because it treads the most interesting line between duration and determinism, and suggests a model for practicing that I shall discuss in the conclusion.

6.5 Conclusion

This chapter has considered process terms and then used the case studies to develop and illustrate them. A central contention of mine in this dissertation is that a range of assumptions are embedded in the language used to discuss processes in design, which have real effects on the results of processes. Some of these are contradictory, as I have demonstrated, such as the suggestion that unless the operation of a process is autonomous, its outcome is deterministic. I have demonstrated that to a certain degree, even in the language and the way we think about processes generally, processes always exhibit a certain degree of determinism. By considering the relationship of determinism and randomness I have sought to break down the polarisation between form and process by concentrating on the property of novelty that results from a processes operation and is found in the result. I have characterised this novelty as not total unpredictability but as specificity.

By reviewing the language of processes, I have shown that the position of an observer is implicit within it. This protagonist is analogous to the designer or gardener, and their temporal location to the processes brings into question the relationship between prediction and action. Henri Bergson's idea of duration has provided a useful model for understanding how novelty emerges in time, with its notion of an actualising present, which both builds on what has existed but does so in a highly specific way that makes the outcome very particular. Leading up to the concluding chapter, I have proposed that the ability to act in this way is a crucial feedback process that the gardener can undertake in support, and also creative transformation of the original design proposition.

Chapter 7: Conclusion

7.1 Introduction

The personal context described in the preface provided the impetus for this dissertation's overarching research question—*How can landscape architecture best be practiced to allow it to manipulate its materials' inherent capacity for change?* While the fact that landscapes change and people change with them constitutes the most exciting thing about landscape architecture, most of its practical methods do not genuinely engage with such change. Though the dissertation began with a critique of the process discourse, it nevertheless has a key interest in change and critiques landscape architects' typical responses to change. Thus, the process discourse shares certain interests that I have expressed in this dissertation. This shared interest arises from an emphatic belief in the novelty resulting from processes but also in a formal conception of design. The case studies I focused on revealed these two interests, and thus the dissertation proposes a renewed landscape practice that combines the use of 'tendencies' in the design stage with an 'ongoing feedback' relationship with the developing landscape, through a gardening-like practice. After defining 'tendency' and 'feedback', this conclusion will extend the previous chapter's discussion of novelty that proposed a gradated, or perhaps reciprocal, relationship between determinism and randomness. I will then end the chapter by looking at the case studies in relation to each other, and propose that the Bordeaux Botanical Garden evidences tendencies, the Ecocathedral feedback, and Sven-Ingar Andersson's Marnas garden both.

Recognising that landscape and people change equates to the recognition that both also continue. The landscape is both people- and place-dynamic, but static at any given moment, which, I propose, is analogous to the dynamic between design and gardening. In Chapter 1, I discussed Arendt's notion of labour, distinguished from "work and its product, the human artefact, (which) bestows a measure of permanence and durability upon the futility of mortal life and the fleeting character of human time".[437] This could be an exact description of the purpose of architecture, but, as I argue in this dissertation, gardens grow in a dynamic relationship with human life and the measure of human time. The desire for a garden to have an 'artefact' character is tied to architecture and its representation in plan. At the same time, a garden's life-span is related to the endurance of the plants that comprise it, which occupy the same temporal and spatial continuum that humans do, and that affects them and also the landscape.[438]

When Philip Descola investigated Achuar gardens in the Ecuadorean Amazon, he discovered repeating patterns of trees in what would otherwise appear to be a virgin forest.[439] Comparing these arrangements of trees with current Achuar gardens, Descola noted that the Achuar people cleared by using slash-and-burn techniques around these trees and planted further trees, effectively re-

437 Arendt, *The Human Condition*, 8.

438 Michael Marder, *Plant-Thinking: A Philosophy of Vegetal Life* (New York: Columbia University Press, 2013).

439 Descola, *In the Society of Nature: A Native Ecology in Amazonia*.

occupying older, abandoned gardens, and planting trees that would later provide the foundation for further gardens. Seen in this way, the Amazon is actually one enormous garden. This example demonstrates how the form of the garden as an artefact starts from tendencies in the existing site that are partially cleared (or "cleaned" as the Achuar people call it[440]), and used to make a proposition for the future. This proposition is then guided through gardening acts that feedback into the garden's shape as it grows. If one adopts a real-time feedback relationship with processes, such as that of the gardener, the distinction between the process and its outcome is useless, since the process is not representational. Because novelty is produced by processes and exhibits a degree of the processes' unpredictability, it is still connected to the process. However, because the novelty has qualities that are desired autonomously of the process, emphasising it allows a formal understanding of process that is design-like. I propose that developing a dynamic, but intentional, relationship between novelty in process results and process operation allows for a level of design-like deliberation. Ultimately, the activity of gardening is what allows a garden's form to persist, as well as a relationship between the gardener's desires for the future and their precise actions with what results in the present.

7.2 Tendency

Tendency is a way of thinking about the design process that recognises that design is a form-making process inherently tied to a prediction of an end,[441] or later state, but where novelty is encouraged to develop over time. The sense in which I use tendency here seeks to balance predetermination and the potential to novelty, and can be described using the analogy of a gift. When one gives a gift, one makes a choice based on knowledge of the receiver's tastes—what they "tend" to like. However, one also hopes to surprise the receiver, and this surprise makes the gift "novel". So, embedded in the gift is both predictability and surprise. Importantly, the gift must be selected before it is given. It is predictive, and, like a design, its reception and its effects cannot be truly judged until after it has left the hands of the gift-giver.[442] Tendency is deterministic, but if the determinism occurs just in initiation, then it is less like determinism and more like a hunch. In initiation, a decision is made, a process started with its initial parameters set, and then the process is left to run its course. The end is in sight but not clearly focused.

The Bordeaux Botanical Garden case study in Chapter 3 provided a useful example of how tendency might work in a design project. Since the project was documented for construction, change had to be anticipated in how it was planned and detailed. Considering tendency as levels of precision, the gross tendency of the mounds was to erode; however, the way that the topography was developed, and particularly how the edge coping was detailed, fine-tuned this tendency, with factors that I discussed, such as soil mix and the reinforcement detailing being the variables used to regulate it. As I noted in Chapter 6, in using tendency to describe how change is accommodated in

440 This is *limpiar* in Spanish.

441 According to the definition of design I gave in Chapter 6.

442 This characteristic is similar to that of Arendt's notion of "action", where speech is ephemeral but can have physical consequences that shape history.

the pre-construction design stage, the built form of the mound was provisional, since it would begin to change almost immediately. In terms of planning the Environment Gallery's layout, the use of a gravel surface around the mounds allows them to change their form by blending in, and the creation of paths between the mounds with a significant gap ensures that functions like trafficability are maintained. As noted in Chapter 6, this is a "contingent" approach.

In considering the relationship between tendency and novelty, a key issue is accuracy, because complete (i.e., 100 percent) accuracy could be seen as determinism, whereas no (i.e., 0 percent) accuracy could be regarded as random. Tendency would allow a certain degree of inaccuracy, but would still be roughly in a range of desired outcome. Qualifying tendency in the percentage terms discussed above defeats the purpose of proposing it as a design strategy, since it is about approximation. Bergson's critique of mechanism seems to equate tendency with differentiation by degree, as a shift rather than a major change. Deleuze quotes Bergson:

> The Elan Vital was able to use matter to create an instrument of freedom, "to make a machine which should triumph over mechanism", to use the determinism of nature to pass through the meshes of the net which this very determinism has spread.[443]

Bergson's definition of tendency is linked to the process of constant actualisation, such as when he notes that "vital properties are never entirely realized, though always on the way to becoming so; then are not so much states, as tendencies".[444] This definition of tendency looks more like a vector: continuing the overall direction but then turning off in one way or another as differences emerge but still with its overall directionality. In the same quote Bergson notes that "sometimes [it] even remounts the slope and seems to turn back on its original direction".[445] This turn could be like a catastrophe or a programmed major event, like puberty, which Bergson discusses. These major changes are latent and irreversible but are not necessarily linear, instead seeming to step the organism up to another level. Bergson notes,

> a change like puberty is in the course of preparation at the very instant from birth and even before birth, and the aging up to that crisis consists, in part at least, of this gradual preparation.[446]

Here, Bergson is using a different formal analogy, while once describing the tendency as a line that then becomes a path as it turns up the slope, it now has a sense of gradation to it. As he continues discussing the aging process, Bergson notes "what is old is the insensible, infinitely graduated, continuance of the change of form".[447]

Tendency allows for form as well as process to be pursued in landscape design. From the Bordeaux example, I argue that tendency provides a way of specifying landscape form using representations

443 Deleuze, *Bergsonism*, 105.
444 Bergson, "The Endurance of Life," 178.
445 Ibid., 179.
446 Ibid., 181.
447 Ibid.

during the design stage, where the built design is nonetheless seen as provisional. Here, change is designed and desired, but change is recognised as being specifically different to the initial prediction used in the design stage. Allowances are made in the way that such forms are detailed to capitalise on interactions between the material and the rest of the organic and inorganic environment to encourage and direct such change, thus leaving, as Louis Le Roy would say, literally "a gap for nature". Taking a tendency approach, functions are maintained by considering multiple scenarios and embedding multi-purpose contingent elements that allow for the variation that may occur over time. Since a tendency approach welcomes change, it needs to consider cultural and institutional aesthetic preferences about "orderliness". Importantly for my thesis, using tendency and contingent solutions can never accommodate all possible scenarios, and nor would it want to; so, as I will discuss next, tendency needs to be accompanied by feedback. Tendency is a generous and expectant approach; it 'makes a stab in the dark' but also welcomes the distinctiveness that the world brings to things.

7.3 Feedback

Feedback is a continuing, real-time involvement in a process, and I use it here as a model for how a gardener works. Stochastic processes exhibit the property of feedback. It is when the output of the process is fed back into another iteration of the process as an input. The easiest way to describe feedback is to give the example of feedback at a live-music performance.[448] Imagine a band is playing on stage and they have amplifiers that project sound outward, in front of which are microphones to broadcast the sound out to the audience. However, a speaker is behind the amplifier and so when the microphone picks up the sound from the amplifier, it also picks up the same sound from the speaker. As the sound repeatedly loops in and out, its distortion or feedback increases. This additional sound, generated by the process, is referred to as feedback. Importantly, feedback is a key differentiation between the approach to process found within the process discourse and that recommended by this dissertation. Because the process discourse operates/functions through (or relies on) representation and simulation, it does not allow for an ongoing feedback role in the process.

Mathematician Norbert Wiener describes feedback in his book on cybernetics, a discipline concerned with the design of control systems to govern processes. A key quality of cybernetic processes is their cumulative or iterative quality, even while they are built on the relatively stable foundation of the algorithm; this accumulation is the feedback process. Wiener calls this first level of predictability "First Order Programming", which is about rules and a frozen system, with a single iteration, which could describe the mechanistic approach of the process discourse. The model of feedback that Wiener uses is initially simple; it involves an input, the effector, output and feedback, where the output is returned to the input stage:

448 When I talk about feedback here I am using the technical term that resembles the phenomenon between a microphone and a speaker, however activities like gardening resemble this phenomenon because an output becomes an input. Correspondingly I use feedback and feed back interchangeably.

> The simplest control systems are linear: the output of the effector is a linear expression of the input, and when we add inputs we also add outputs . . . the output is read by some apparatus equally linear. This reading is simply subtracted from the input.[449]

"Second Order Programming" describes its cumulative feedback operation over time, which is unpredictable because, as Wiener writes,

> we are directed in time, and our relation to the future is different to our relation with the past. All our questions are conditioned by this asymmetry, and all our answers to these questions are equally conditioned by it.[450]

Using Wiener's model of feedback, one can see how unpredictable it becomes at the Ecocathedral because there is enormous difference between the tables as they are left (as an output) and as they are found when construction restarts. As the site and the builder also change, the input is also different. At the Ecocathedral, the builder's ability to optimise these found potentials by redirecting their actions makes a feedback valuable. Since growth affects access at the Ecocathedral, stockpiles arrive and the builders have different capabilities (ranging in levels of fitness, experience, and interest in the project), and thus the potentials are very specific and un-representable. Referring to Wiener's definition, one might make parallels with the technique and the algorithm, but here the feedback relationship is different at the Ecocathedral too because the builder learns, so it is not only the input and output that changes, but the algorithm also develops.

7.4 Practicing Now for the Future

So, how would one define a landscape architecture practice that merges tendency in the design stage of a landscape and a feedback role over time through gardening? Sven-Ingvar Andersson's Marnas garden provides a useful model for such practice, what it offers, and how these two aspects interact. In his design, Andersson proposed a strong formal vision of the garden rooms through the rigid planting plan that used the Hawthorns to define them. In deciding the spacing of the plants, he was working with their tendencies of growth in terms of how they would eventually define a hedge. In turn, the tendencies of the plants in the hedge would tend to produce a general spatial quality. As the garden grew, Andersson returned regularly to undertake gardening operations that fed back into the growth of the hawthorns, by working with the growth forms that had arisen. While a conventional approach to maintenance at the design stage would have kept clipping back to maintain a strict hedge surface, Andersson's feedback approach allowed growth variations to develop and then catalysed these, which improved the planting plan with a rich spatial and experiential quality. In considering tendency and feedback together at Marnas, it's clear that the both the rigidity of the initial design and the subsequent gardening actions were needed in order to give the space its current qualities.

449 Norbert Wiener, *Cybernetics or Control and Communication in the Animal and the Machine* (Cambridge, Massachussetts: The MIT Press, 1967), 98.

450 Ibid., 33.

7.5 Conclusion

Feedback into the growth or decay of a landscape allows the landscape architect to have a positive, creative role in its development, rather than a negative, mitigating view of change, which is encompassed in the notion of "maintenance". This is the way that gardening has always operated, and, I argue, that it is to gardening that landscape architecture should turn to for a model and, more practically, for techniques with which to creatively optimise change and emergent conditions in the landscape. In turn, landscape architecture can also offer a level of formal, material, and aesthetic understanding to gardening that can bring ad-hoc gardening decisions into a larger conceptual and design vision. I surmise that the biggest challenge to landscape architecture in creating a feedback relationship with projects is that it requires a socio-political change, crossing class and financial boundaries to work outside more, either directly labouring or interacting more collaboratively with garden and landscape tradespeople. This is a significant shift but one that would be rewarded with a practice more engaged with the uniqueness of its medium: its capacity to change.

In discussing growth, erosion, and human labour, I have sought to place landscape architecture back into its original context of relentless, irreversible thermodynamic exchange, and separate it from the solipsistic world of representation that it is so firmly ensconced in at present. Even while its disciplinary terrain is proving fertile to others, landscape architecture currently lacks a richness that will be regained if the approaches described in this dissertation are embraced. Landscape architecture will become a creative discipline that benefits from the reality of its materials: living and dying, reborn again.

Bibliography

(AAA), Atelier d'arctiecture autogérée. 2010. "ECObox/Self-Managed Eco-Urban Network." In *Ecological Urbanism*, edited by Mohsen Mostafavi and Gareth Doherty, 510-511. Baden, Switzerland: Lars Müller Publishers.

(LAE), Landscape Architecture Europe Foundation. 2006. "Garden of Babel." In *Fieldwork: Landscape Architecture Europe*, edited by Landscape Architecture Europe Foundation (LAE), 88-91. Basel: Birkhäuser.

Ackerman, Ben, and Ofri Gilan. 2000. "Interview with Eduard Bru." *Kerb* (10):53-55.

Allen, Stan. 2000. *Practice : architecture, technique, and representation*. Sydney: G+B Arts International.

Allen, Stan. 2011. "From the Biological to the Geological." In *Landform building*, edited by Stan Allen and Marc McQuade, 20-37. Zürich: Lars Muller/Princeton University School of Architecture.

Allen, Stan. 2011. "Urbanisms in the Plural: The Information Thread." In *Fast-Forward Urbanism*, edited by Dana Cuff and Roger Sherman, 36-61. New York: Princeton Architectural Press.

Andersson, Sven-Ingvar. 2002. "Letter from my Henyard." In *Sven-Ingvar Andersson–Garden Art and Beyond*, edited by Steen Høyer, 105-108. Copenhagen: Arkitektens Forlag.

Andersson, Thorbjorn. 1997. "Appearances and beyond: time and change in Swedish landscape architecture." *Studies in the History of Gardens and Designed Landscapes* no. 17 (4):278-295.

Angelil, Marc, and A Klingmann. 1999. "Hybrid Morpologies: Infrastructure, Architecture, Landscape." *Daidalos* (73):16-25.

Appleton, Jay. "Some thoughts on the geology of the Picturesque." *Journal of Garden History* no. 6 (3):271-290.

Arendt, Hannah. 1998. *The Human Condition*. Chicago: The University of Chicago Press.

ASLA. 2004. Landscape Architecture Body of Knowledge Study Report. Washington DC: American Society of Landscape Architects, Canadian Society of Landscape Architects, Council of Educators in Landscape Architecture, Council of Landscape Architectural Registration Boards and Landscape Architectural Accreditation Board.

Auricoste, Isabelle. 1996. "The Manner of Yves Brunier." In *Yves Brunier: Paysagiste*, edited by Michel Jacques. Basel: Birkhauser.

Aymonino, Aldo, and Valerio Paolo Mosco. 2004. *Contemporary Public Space: Un-volumetric Architecture*. Milano: Skira.

Banham, Reyner. 1980. *Theory and Design in the First Machine Age*. Cambridge, Massachusetts: The MIT Press.

Barcells, Conxita, and Josepa Bru. 2002. *Alongside: boundaries, borders & frontiers*. SA, Barcelona: Gustavo Gili.

Baridon, Michel. 2003. "The cultural foundations of contemporary French landscape architecture." *Studies in the History of Gardens and Designed Landscapes* no. 23 (4):310-328.

Barnes, T.J, and J.S Duncan. 1992. *Writing worlds : discourse, text, and metaphor in the representation of landscape*. London: Routledge.

Barnett, Rod. 1997. "Gardens without Meaning." *Landscape Review* no. 3 (2):22-42.

Bateson, Gregory. 1979. *Man and Nature: A necessary unity*. London: Fontana.

Bateson, Gregory. 2000. *Steps to an ecology of mind*. Chicago: University of Chicago Press.

Beardsley, John. 1996. “Entropy and the new landscapes.” In *Hargreaves Associates: landscape works*, edited by Steven Hanson. Tokyo: Process: Architecture.

Beardsley, John. 1998. *Earthworks and beyond : contemporary art in the landscape*. New York: Abbeville Press.

Beck, Thomas E. 2002. “gardens as a ‘third nature’: the ancient roots of a renaissance idea.” *Studies in the History of Gardens and Designed Landscapes* no. 22 (4):327-335.

Bell, Adrian D. 2008. *Plant Form*. Portland: Timber Press.

Belmunt i Chiva, Jordi, Alfred Fernandez de la Reguera, Enric Battle i Durany, and Maria Goula. 2006. *Only with Nature*. Barcelona: Col legi d’Architectes de Catalunya.

Berger, Alan. 2002. *Reclaiming the American West*. New York: Princeton Architectural Press.

Bergson, Henri. 2002. “The Idea of Duration.” In *Henri Bergson: Key Writings*, edited by K.A Pearson and J Mullarkey. London: Continuum.

Bergson, Henri. 2002. “Life as Creative Change.” In *Henri Bergson: Key Writings*, edited by K.A Pearson and J Mullarkey. London: Continuum.

Bergson, Henri. 2002. “The Endurance of Life.” In *Henri Bergson: Key Writings*, edited by K.A Pearson and J Mullarkey. London: Continuum.

Berrizbeitia, Anita. 2007. “Re-Placing Process.” In *Large Parks*, edited by Julia Czerniak and George Hargreaves, 174-197. New York: Princeton Architectural Press.

Betsky, Aaron. 2002. *Landscapers: building with the land*. London: Thames and Hudson.

Blaisse, Petra. 1996. “A personnal(sic) impression.” In *Yves Brunier: Paysagiste*, edited by Michel Jacques. Basel: Birkhauser.

Blanc, Patrick. 1999. “Plant Being.” *Pages Paysages* (7):96-102.

Blume, Mary. 2013. *The postman who delivered a palace*. The New York Times. 2007 [cited 3rd January 2013]. Available from http://www.nytimes.com/2007/05/03/arts/03iht-blume.1.5546120.html?_r=0.

Bobzien, Susanne. 1998. *Determinsm and Freedom in Stoic Philosophy*. Oxford: Oxford University Press.

Boettger, S. 2002. *Earthworks : art and the landscape of the sixties*. Lawrence: University of California Press.

Bois, Yve-Alain, and Rosalind Krauss. 1997. *Formless: A User’s Guide*. New York: Zone Books.

Boris, Stefan. 2009. Gardens of Situations - Learning from the Modern Danish Landscape. *PhD Working Paper*.

Born, Megan, Helene Furján, and Lily Jencks. 2012. *Dirt*. Vol. 2. Cambridge, Massachusetts: MIT Press.

Boukema, Esther, and Philippe V. McIntyre. 2002. *Louis G. Le Roy: Nature Culture Fusion*. Rotterdam: NAi Uitgevers.

Bourdon, D. 1995. *Designing the earth : the human impulse to shape nature*. New York: H.N. Abrams.

Brand, Stewart. 1994. *How buildings learn: what happens after they’re built*. New York: Penguin Books USA.

Bronowski, J. 1958. *Science and Human Values*. Harmondsworth, Middlesex: Penguin Books.

Brouwer, Joke, Arjan Mulder, and Susan Charlton. 2003. *Information is Alive*. Rotterdam: V2_ Publishing/NAI Publishers.

Brouwer, Joke , and V2_0rganisation. 2000. *Machine Times*. Rotterdam: NAI Publishers/V2_ Organisatie2000.

Brown, Brenda, Terry Harkness, and Doug Johnston. 1998. *Landscape Journal Special Issue - Eco-Revelatory Design: Nature Constructed / Nature Revealed*. Wisconsin: University of Wisconsin Press.

Bruel, Anne-Sylvie. , and Christophe Delmar. 1997. "Sand Traps." *Pages Paysages* (6):154-159.

Brunsden, D, and J.C Doornkamp. 1975. *The unquiet landscape*. Bloomington: Indiana University Press.

Buchanan, Robin A. 1989. *Bush Regeneration: Recovering Australian Landscapes*. Sydney: TAFE Student Learning Publications.

Buczaki, Stefan. 1986. *Ground Rules for Gardeners: A practical guide to garden ecology*. London: Collins.

Bullivant, Lucy. 2007. "'Activating Nature': The Magic Realism of Contemporary Landscape Architecture in Europe." *Architectural Design* no. 77 (2):76-87.

Burns, Carol J, and Andrea Kahn. 2005. "Why Site Matters." In *Site Matters: Design concepts, histories and strategies*, edited by Carol J Burns and Andrea Kahn, vii-xxix. New York: Routledge.

Cache, Bernard. 1995. *Earth moves : the furnishing of territories*. Cambridge, Massachusetts: The MIT Press.

Catalunya, Collegi d'Arquitectes de. 2000. *Remaking landscapes: landscape architecture in Europe, 1994-1999*. Barcelona: Fundación Caja de Arquitectos.

Cecilia, Fernando Márquez, and Richard Levene. 2003. *MVRDV 1991 - 2002*, *El Croquis*. Madrid: El Croquis SL.

Certeau, Michel de. 1984. *The practice of everyday life*. Berkeley and Los Angeles, California: University of California Press.

Chapman, T. 1998. "Beneath the sod." *Architects' journal* no. 208 (24).

Chauvel, Gabriel. 1995. "The Richness of Poor Soils." *Pages Paysages* (5):6-11.

Chemetoff, Alexandre. 2009. *Visits: Town and Territory - Architecture in Dialogue*. Basel: Birkhauser.

Chesworth, W. 2008. *Encyclopedia of soil science*. Dordrecht: Springer.

Cheval, Ferdinand. 2013. *Ferdinand Cheval / le Facteur Cheval (1836 / 1924)* 2012 [cited 3rd January 2013]. Available from http://www.facteurcheval.com/en/history/postman.html.

Claramunt, Marc, and Catherine Mosbach. 1999. "Nature of a Landscape Project." *Pages Paysages* (7):54-63.

Clarke, Jacqueline Elizabeth. 2012. *Liquid Urbanism: The 21st Century City as Living Waterscape*, University of Auckland, Auckland.

Clausewitz, Carl von. 1976. *On war*. Translated by Michael Eliot Howard and Peter Paret. New Jersey: Princeton University Press.

Clement, Gilles. 1999. "The Field." *Pages Paysages* (7):150-159.

Clément, Gilles. 2007. *Manifeste du Tiers paysage*. Paris: Éditions Sujet/Objet.

Clément, Gilles. 2007. "The Garden." In *Planetary Gardens: The Landscape Architecture of Gilles Clément*, edited by Alessandro Rocca, 43. Basel: Birkhauser.

Clément, Gilles. 2007. "The Garden in Movement." In *Planetary Gardens: The Landscape Architecture of Gilles Clément*, edited by Alessandro Rocca, 13. Basel: Birkhauser.

Clément, Gilles. 2007. "The Garden in Movement 2." In *Planetary Gardens: The Landscape Architecture of Gilles Clément*, edited by Alessandro Rocca, 15. Basel: Birkhauser.

Coignet, Philippe. 2003. "On Specificity." *Studies in the History of Gardens and Designed Landscapes* no. 23 (4):340-347.

Coignet, Philippe. 2003. "The Revealing Process in Contemporary French Landscape Architecture." *Studies in the History of Gardens and Designed Landscapes* no. 23 (2):93-130.

Colvin, Brenda. 1947. *Land and Landscape*. London: John Murray Press.

Conan, Michel. "Landscape Metaphors and Metamorphosis of Time." In. Washington, D.C: Dumbarton Oaks Research Library and Collection.

Conan, Michel B. 2000. *Environmentalism in landscape architecture*. Washington, D.C: Dumbarton Oaks Research Library and Collection.

Confurius, Gerrit. 1996. "Louis Le Roy und seine lustigen Streiche = Louis Le Roy and his pranks." *Daidalos* no. 03/1996 (59):116-121.

Constant. 1959. "A Different City for a Different Life." In *Guy Debord and the Situationist International: Texts and Documents*, edited by Tom McDonough, 95-101. Cambridge, Massachusetts: The MIT Press.

Cook, Robert E. 2000. "Do Landscapes Learn? Ecologys "New Paradigm" and Design in Landscape Architecture." In *Environmentalism in landscape architecture*, edited by Michel Conan, 115-132. Washington, D.C: Dumbarton Oaks Research Library and Collection.

Cooper, P. 2001. *Living Sculpture*. London: Mitchell Beazley.

Corner, James. 1989. A discourse on theory and the hermeneutic landscape. Paper read at CELA.

Corner, James. 1992. "Representation and landscape drawing and marking in the landscape medium." *Word and Image* no. 8 (3).

Corner, James. 1996. *Taking measures across the American landscape*. New Haven, Conn.: Yale University Press.

Corner, James. 1999. "The Agency of Mapping: Speculation, Critique and Intervention." In *Mappings*, edited by Denis E Cosgrove, 213-252. London: Reaktion Books.

Corner, James. 1999. *Recovering landscape : essays in contemporary landscape architecture*. Sparks, NV: Princeton Architectural Press.

Corner, James. 1999. "Recovering Landscape as a Critical Cultural Practice." In *Recovering Landscape*, edited by James Corner. New York: Princeton Architectural Press.

Corner, James. 1999. "Eidetic operations and New Landscapes." In *Recovering Landscape*, edited by James Corner. New York: Princeton Architectural Press.

Corner, James. 1999. "The Agency of Mapping: Speculation, Intervention and Critique." In *Mappings*, edited by Dennis Cosgrove, 213-252. London: Reaktion Books.

Corner, James. 2003. "Landscape Urbanism." In *Landscape Urbanism: A Manual for the Machinic Landscape*, edited by Mohsen Mostafavi and Ciro Najle. London: AA Publications.

Corner, James, and Alex S MacLean. 1996. *Taking Measures Across the American Landscape*. New Haven: Yale University Press.

Cosgrove, Dennis, and S Daniels. 1988. *The Iconography of landscape : essays on the symbolic representation, design, and use of past environments*. Cambridge, England: Cambridge University Press.

Cribier, Pascal. 1995. "Blue on Blue." *Pages Paysages* (5):24-29.

Cribier, Pascal. 1997. "Working with the Elements." *Pages Paysages* (6):50-55.

Criperay, Gerard, and Rene Loyau. 1992. "Drawing-up an Eco-balance-sheet." *Pages Paysages* (4):38-42.

Crosby, Alfred W. *Ecological Imperialism: The Biological Expansion of Europe 900-1900*. Cambridge: Cambridge University Press, 1986.

Czerniak, Julia. 2001. *CASE: Downsview Park, Toronto*. Munich: Prestel Verlag.

Dagenais, Danielle. 2004. "The Garden of Movement: Ecological Rhetoric in Support of Garden Practice." *Studies in the History of Gardens and Designed Landscapes* no. 24 (4):313-340.

Dagenais, Danielle. 2005. "Corrections." *Studies in the History of Gardens & Designed Landscapes: An International Quarterly* no. 25 (1):86.

Daskalakis, Georgia, Charles Waldheim, and Jason Young. 2001. *stalking Detroit*. Barcelona: ACTAR.

Daval, Agnes. 1999. "Cushons and Climbers." *Pages Paysages* (7):123-125.

Dawkins, Richard. 2004. *The Ancestor's Tale*. Boston: Houghton Mifflin.

Dee, Catherine. 2012. *To Design Landscape: Art, Nature & Utility*. London: Routledge.

de Certeau, Michel. 1984. *The Practice of Everyday Life*. Berkeley: University of California Press.

de Courtois, Stephanie. 2003. *Le Potager du roi: The Kings Vegetable Garden*: Actes Sud: Ecole Superieure du Paysage.

de Solà-Morales Rubio, Ignasi. 1996. "Terrain Vague." *Kerb* (3):4-12.

de Solà-Morales Rubio, Ignasi. 1997. *Differences : topographies of contemporary architecture*. Cambridge, Massachusetts: The MIT Press.

Debord, Guy. 1994. *The society of the spectacle*. New York: Zone Books.

Del Tredici, Peter. 2007. "The Role of Horticulture in a Changing World." In *Botanical Progress, Horticultural Innovation and Cultural Change*, edited by Michel Conan and John W Kress, 259-264. Washington, D.C.: Dumbarton Oaks.

Del Tredici, Peter. 2010. *Wild Urban Plants of the Northeast: A Field Guide*. Ithaca: Cornell University Press.

DeLanda, Manuel. 1997. *A thousand years of nonlinear history*. New York: Zone Books.

Deleuze, Gilles. 1991. *Bergsonism*. New York: Zone Books.

Demerlé-Got, Anne, Lucien Kroll, and Michel Racine. 2002. "Louis-Guillaume Le Roy (Nè en 1924)." In *Créateurs de Jardins et de Paysages en France de la Renaissance au XXI Siècle*, edited by Michel Racine, 253-256. Arles: Actes Sud/ENSP.

Descola, Philippe. 1996. *In the society of nature: a native ecology in Amazonia*. Cambridge: Cambridge University Press.

Diller, Elizabeth, and Ricardo Scorfidio. 2002. *Blur: The Making of Nothing*. New York: H.N. Abrams.

Diserens, Corinne. 2003. *Gordon Matta-Clark*. Edited by Corinne Diserens. London: Phaidon.

Dixon Hunt, John. 2000. *Greater Perfections: the Practice of Garden Theory*: Thames & Hudson.

Dowdeswell, W. H. 1987. *Hedgerows and Verges*. London: Allen & Unwin.

Dunnett, Nigel, and James Hitchmough. 2004. "Introduction to naturalistic planting in urban landscapes." In *The Dynamic Landscape*, edited by Nigel Dunnett and James Hitchmough, 1-22. New York: Spon Press.

Dutton, Geoffrey. 1997. *Some branch against the sky: the practice and principles of marginal gardening*. Devon: David & Charles.

Eco, Umberto. 1988. *The Aesthetics of Thomas Aquinas*. Cambridge, Massachusetts: Harvard University Press.

Edelman, Bernard. 1992. "The eye of the law: Nature and copyright." *Pages Paysages* (4):14-22.

Edquist, H, and V Bird. 1994. *The culture of landscape architecture*. Melbourne: Edge Publishing.

Elkins, James. 1993. "On the conceptual analysis of gardens." *Journal of Garden History* no. 13 (4):189-198.

Elstgeest, Tanja. 2002. "Nature, Art & the City." In *The Public Garden*, edited by Anne-Mie Devolder, 141-146. Rotterdam: NAi Uitgevers/Publishers.

Engler, Mira. 1995. "Waste Landscapes: Permissible Metaphors in Landscape Architecture." *Landscape Journal* no. 14 (1):11-25.

Envo, Claude. 1995. "Moods." *Pages Paysages* (5):104-111.

Erwin, Schrödinger . 1992. *What is Life?: The Physical Aspect of the Living Cell with Mind and Matter and Autobiographical Sketches*. Cambridge: Cambridge.

Fagone, V. 1996. *Art in nature*. Milano: Mazzotta.

Farina, A. 1998. *Principles and methods in landscape ecology*. New York: Chapman & Hall.

Figureau, Claude. 1999. "First Come the Mosses." *Pages Paysages* (7):34-42.

Finger, Marten. 1995. "The landscape of Moment." *Kerb* (2):42-43.

Flew, Tony. 1971. *An Introduction to Western Philosophy: Ideas and Argument from Plato to Popper*. New York: Thames and Hudson.

FOA. 1995. "Exploiting foreignness (a conversation with Farshid Moussavi and Alejandro Zaera)." *El croquis* no. 5 (Spanish architecture).

Focillon, Henri. 1992. *The Life of Forms in Art*. New York: Zone Books.

Forman, Richard T.T. 1995. *Land Mosaics: The ecology of landscapes and regions*. Cambridge: Cambridge University Press.

Forty, Adrian. 2000. *Words and Buildings: A Vocabulary of Modern Architecture*. London: Thames and Hudson.

Foster, H. 1983. *The Anti-Aesthetic : Essays on Postmodern Culture*. Seattle: Bay Press.

Foster, Hal, Rosalind Krauss, Yves-Alain Bois, and Benjamin Buchloh. 2004. *art since 1900*. London: Thames & Hudson.

Foucault, Michel. 1973. *The Order of Things: An Archaeology of the Human Sciences*. New York: Vintage Books.

Foundation, Landscape Architecture Europe. 2006. *Fieldwork*. Basel: Birkhauser.

Foxley, Alice. 2010. *Distance & Engagement: Walking, thinking and making landscape*. Baden, Switzerland: Lars Müller Publishers.

France, Robert. 2000. "Smoky Mirrors and Unreflected Vampires: From Eco-Revetation to Eco-Relevance in Landscape Design,." *Harvard Design Journal* no. 10:36-40.

Free, Montague. 1961. *Plant Pruning in Pictures: How, when, and where to prune and with what tool.* New York: Avenel Books.

Fromageau, Jerome. 1992. "The rights of the landscape." *Pages Paysages* (4):46-48.

Fung, Lance. 2005. *The Snow Show*. London: Thames & Hudson.

Fung, Stanislaus. 1998. "Mutuality and the Cultures of Landscape Architecture." In *Recovering Landscape*, edited by James Corner. Sparks, NV: Princeton Architectural Press.

Fung, Stanislaus. 1998. "The interdisciplinary prospects of reading Yuan ye." *Studies in the History of Gardens and Designed Landscapes*.

Fung, Stanislaus. 1999. "Here and there in Yuan ye." *Studies in the History of Gardens and Designed Landscapes* no. 19 (1):36-46.

Galí-Izard, Teresa. 2006. *The same landscapes: Ideas and interpretations*, *Land&ScapeSeries*. Barcelona: Editorial Gustavo Gili.

Gandy, Mathew. 2012. "Entropy by design: Gilles Clément, Parc Henri Matisse and the Limits to Avant-garde Urbanism." *International Journal of Urban and Regional Research* no. 37 (1):259-278.

Gastil, Raymond W, and Zoe Ryan. 2004. *Open: New Designs for Public Space*. New York: Van Alen Institute.

Gausa, Manuel. 1997. "Landscape and architecture, fresh shoots." *Quaderns* (217):50-54.

Gerritsen, Henk. 2008. *Essay on Gardening*. Amsterdam: Architectura & Natura Press.

Geuze, Adrian. 1995. "Moving Beyond Darwin." In *Modern Park Design : Recent Trends*, edited by M Knuijt, H Ophius and P van Saane. Bussum: Thoth.

Geuze, Adrian. 2000. "Introduction: Void Totem Contemplation." In *West 8*, edited by Linda Molinari. Milano: Skira editore S.p.A.

Girot, Christophe. 1999. "Towards a general theory of landscape." *Topos: European landscape magazine* (28).

Girot, Christophe. 1999. "Four Trace Concepts of Landscape Architecture." In *Recovering landscape : essays in contemporary landscape architecture*, edited by James Corner, 59-69. New York: Princeton Architectural Press.

Gissen, David. 2009. *Subnatures: architectures other environments*. New York: Princeton Architectural Press.

Gleick, James. 2000. *Faster*. New York: Vintage Books.

Goula, Maria, Jordi Bellmunt i Chiva, Alfredo Fernández de la Reguera, and Enric Batlle i Durany. 2003. "Bordeax Botanic Garden." In *Only with Nature*, edited by Maria Goula, Jordi Bellmunt i Chiva, Alfredo Fernández de la Reguera and Enric Batlle i Durany, 304-307. Barcelona: Col-legi d'Arquitectes de Catalunya.

Groat, Linda. "Case Studies and Combined Strategies." In *Architecural Research Methods*, edited by Linda Groat and David Wang, 341-74. New York: John Wiley & Sons, 2002.

Groening, Gert, and Joachim Wolschke-Bulmahn. 1989. “Changes in the philosophy of garden architecture in the 20th century and their impact upon the social and spatial environment.” *Journal of Garden History* no. 9 (2):53-71.

Grosz, Elizabeth. 2005. *Time Travels: Feminism, Nature, Power.* Crows Nest: Allen & Unwin.

Guattari, Felix. 1995. *Chaosmosis: an ethico-aesthetic paradigm*. Sydney: Power Publications.

Hacking, Ian. 1990. *The taming of chance*. Cambridge, England: Cambridge University Press.

Halprin, Lawrence. 1969. *the RSVP Cycles: Creative Processes in the Human Environment*. New York: Georges Bralilier, Inc.

Hamblyn, Richard. 2001. *The Invention of Clouds*. New York: Farrar, Straus & Giroux.

Hammond, Michael, and Jerry Wellington. *Research Methods: The Key Concepts*. London: Routledge, 2013.

Hanczyc, Martin. 2011. “Structure and the Synthesis of Life.” In *Protocell Architecture*, edited by Neil Spiller and Rachel Armstrong, 26-33. London: Wiley

Harman, Graham. 2005. *Guerrilla Metaphysics: Phenomenology and the Carpentry of Things*. Chicago: Open Court.

Harman, Graham. 2009. *Towards Speculative Realism*. Winchester: Zero Books.

Harman, Graham. 2010. “Bruno Latour, King of Networks (1999).” In *Towards Speculative Realism: Essays and Lectures*, edited by Graham Harman, 67-92. Winchester, UK: Zero Books.

Harvey, David. 1989. *The condition of postmodernity*. Oxford: Basil Blackwell.

Hauxner, Malene. 1993. *Fantasiens Have: Det moderne gennembrud i havekunsten og sporene i byens landskab*. Copenhagen: Arkitektens Forlag.

Hauxner, Malene. 2003. *Open to the Sky: The second phase of the modern breakthrough 1950-1970. Building and landscape, spaces and works, city landscape.* Copenhagen: Arkitektens Forlag/The Danish Architectural Press.

Hauxner, Malene. 2010. *Fra naturli natur til Supernatur: Europæisk Landskabsarkitektur 1967-2007 set fra Danmark*. Risskov: Ikaros Press.

Hazlett, T.C. 1988. *Land form designs*. Mesa, Ariz: PDA Publishers.

Heidegger, M. 1994. “Building Dwelling Thinking.” In *Basic Writings : Martin Heidegger*, edited by D.F Krell. London: Routledge.

Helms, Karin. 2006. “The Pioneers: Michel Corajoud - learning from Jacques Simon; Reynir Vilhalmsson - learning from Georg Boye.” In *Fieldwork*, edited by Landscape Architecture Europe Foundation. Basel: Birkhauser.

Hensel, Michael, Achim Menges, and Michael Weinstock. 2004. *Emergence: Morphogenetic Design Strategies*, *Architectural Design*. London: Wiley-Academy.

Heraclitus. 1889. *The fragments of the work of Heraclitus of Ephesus on nature*. Translated by G. T. W. Patrick. Baltimore: N. Murray.

Hermitte, Marc-Angele. 1992. “The law of the land.” *Pages Paysages* (4):10-14.

Herrington, Susan. 2010. “The Nature of Ian McHarg’s Science.” *Landscape Journal* no. 29 (1-10).

Hight, Christopher. 2003. “Portraying the Urban Landscape: Landscape in Architectural Criticism and Theory, 1960 - Present.” In *Landscape Urbanism: A Manual for the Machinic Landscape*, edited by Mohsen Mostafavi and Ciro Najle, 22-38. London: AA Publications.

Hobhouse, Penelope. 1992. *Plants in Garden History*. London: Pavilion.

Holt, Nancy. 1979. *The Writings of Robert Smithson*. New York: New York University Press.

Holton, Gerald. 1965. "Science and the Deallegorization of Motion." In *The Nature and Art of Motion*, edited by Gyorgy Kepes. New York: Georges Bralilier, Inc.

Howett, Catherine. "Ecological Values in Twentieth-Century Landscape Design: A History and Hermeneutics." *Landscape Journal* (80-98).

Howett, Catherine. 1990. *Abstracting the Landscape: the artistry of landscape architect AE Bye*. Philadelphia: Pennsylvania State University Press.

Hoyles, Martin. 1991. *The Story of Gardening*. London: Journeyman Press.

Hubbard, H.V, and T Kimball. 1917. *An Introduction to the Study of Landscape Design*. New York: Macmillan.

Hucliez, Marielle. 2000. *Contemporary parks and gardens in France*. Paris: Vilo International.

Hunt, John Dixon. 2000. *Greater Perfections: the Practice of Garden Theory*. London: Thames and Hudson.

Hunt, John Dixon, and Peter Willis. 1988. *The Genius of Place*. Massachusetts: The MIT Press.

ICC_Antwerp. 2003. "Interview with Gordon Matta-Clark, Antwerp (1977)." In *Gordon Matta-Clark*, edited by Corinne Diserens, 187-190. London: Phaidon.

Jackson, J.B. 1984. *Discovering the Vernacular Landscape*. New Haven, Conn.: Yale University Press.

Jacobs, Peter. 2000. "Playing with Time." *Studies in the History of Gardens and Designed Landscapes* no. 20 (4):325-340.

Jacques, Michel. 1996. *Yves Brunier: landscape architect, paysagiste*. Basel: Birkhauser.

Jellicoe, G, and S Jellicoe. 1965. *The Landscape of Man*. New York: Thames and Hudson.

Jencks, Charles. 1987. *The Language of Post-Modern Architecture*. London: Academy Editions.

Jencks, Charles. 1993. *Architecture today*. London: Academy Editions.

Jencks, Charles. 1997. "Landform architecture: emergent in the nineties." *Architectural design* no. v.67 (9-10).

Jencks, Charles. 2002. *The New Paradigm in Architecture: The Language of Post-Modernism*. New Haven: Yale University Press.

Jensen, J. 1990. *Siftings*. Baltimore: John Hopkins University Press.

Jones, Louisa. 2006. "Gilles Clément revisited: biology, art and ecology. A reply to Danielle Dagenais." *Studies in the History of Gardens & Designed Landscapes: An International Quarterly* no. 26 (3):249-252.

Jones, Owain, and Paul Cloke. 2002. *Tree Cultures: The Place of Trees and Trees in Their Place*. New York: Berg.

Kahn, Andrea. 1991. *Drawing/building/text: essays in architectural theory*. New York: Princeton Architectural Press.

Kastner, J, and B Wallis. 1998. *Land and environmental art*. London: Phaidon Press.

Keeney, Gavin. 2000. *On the nature of things: contemporary American landscape architecture*. Boston: Birkhauser.

Kepes, Gyorgy. 1965. *Structure in Art and in Science*, *Vision + Value Series*. New York: Georges Bralilier, Inc.

Kepes, Gyorgy. 1965. *The Nature and Art of Motion*, *Vision + Value Series*. New York: Georges Bralilier, Inc.

Kienast, Dieter. 1997. *Kienast : Gärten = gardens*. Basel: Birkhauser.

Kienast, Dieter. 2002. *Kienast Vogt, parks and cemeteries*. Boston: Birkhauser.

Kingsbury, Noël. 1996. *The New Perennial Garden*. London: Frances Lincoln.

Kinnard, Judith. 1998. "The Bricoleur and the Weaver: Contexturing the City." *Harvard Design Journal* (Civitas).

Kirkwood, Niall. 2004. *Weathering and Durability in Landscape Architecture*. New Jersey: John Wiley & Sons.

Klanten, Robert, and Lukas Feireiss. 2011. *Utopia Forever: Visions of Architecture and Urbanism*. Vol. Gestalten. Berlin.

Knuijt, M, H Ophius, and P van Saane. 1995. *Modern Park Design : Recent Trends*. Bussum: Thoth.

Koekebakker, Olof. 2003. *Westergasfabriek Culture Park*. Rotterdam: NAI Publishers.

Koolhaas, Rem , Bruce Mau, and Jennifer Sigler. 1998. *SMLXL*. New York: The Monacelli Press.

Koolhaas, Rem, and Brendan McGetrick. 2004. *Content*. Koln: Taschen GmbH.

Korp, M. 1997. *Sacred art of the earth : ancient and contemporary earthworks*. New York: Continuum.

Krauss, Rosalind. 1983. "Sculpture in the expanded field." In *The Anti-Aesthetic : Essays on Postmodern Culture*, edited by Hal Foster. Seattle: The MIT Press.

Krauss, Rosalind. 2011. *Under Blue Cup*. Cambridge, Massachusetts: MIT Press.

Krog, Steven R. 1992. "Whither the Garden?" In *Denatured Visions: Landscape and Culture in the 20th Century*, edited by Stuart Wrede and William H Adams, 94-105. New York: Museum of Modern Art.

Kroll, Lucien. 1993. "Grounds cathedraux de verdure." *Techniques et architecture* (407):102 - 103.

Kwasniak, Arlene J. 1996. "A. Framework for How Laws and Legal Policies Shape Landscapes." *Landscape Journal* no. 15 (2):153-162.

Kwinter, Sanford. 1992. "Landscapes of Change: Boccioni's Strati d'animo as a General Theory of Models." *Assemblage* (19):50-65.

Kwinter, Sanford. 2002. *Architectures of Time*. Cambridge, Massachusetts: The MIT Press.

Lange, Gustav. 1996. "The spaces in between." In *Open Spaces : The City*, edited by Maria Aubock and Andrea Cejka, 82-87. Vienna: PlanBOX.

Lange, Gustav. 2002. "Destiny of Stone." *Pages Paysages* (9):36-41.

Larkin, Graham. 2000. "On the advantages of Nietzsche for garden history." *Studies in the History of Gardens and Designed Landscapes* no. 20 (1):1-6.

Latour, Bruno. 1993. *We have never been modern*. Cambridge, Massachusetts: Harvard University Press.

Laurie, Michael. 1986. *An Introduction to Landscape Architecture*. 2nd ed. New York: Elsevier.

Le Dantec, Denise, and Jean-Pierre Le Dantec. 1990. *Reading the French Garden: Story & History*. Boston: The MIT Press.

Le Roy, Louis. 1973. *Natuur uitschakelen, natuur inschakelen*. Deventer: Ankh-Hermes BV.

Leatherbarrow, David. 1999. "Leveling the Land." In *Recovering landscape : essays in contemporary landscape architecture*, edited by James Corner. Sparks, NV: Princeton Architectural Press.

Leatherbarrow, David. 2000. *Uncommon Ground: Architecture, Technology, and Topography*. Cambridge, Massachusetts.

Leatherbarrow, David. 2009. *Architecture Oriented Otherwise* New York: Princeton Architectural Press.

Leenhardt, J, and M Audouy. 2000. *Michel Corajoud, paysagiste*. Paris/Versailles: Hartmann/ENSP Edition.

Lefebvre, H. 1991. *The Production of Space*. Oxford: Blackwell.

Lewin, Roger. 1993. *Complexity: Life at the Edge of Chaos*. London: Phoenix.

Liamputtong, Pranee. *Qualitative Research Methods*. 3rd ed. Melbourne: Oxford University Press, 2009.

Libeskind, Daniel. 1983. *chamberworks: architectural meditations on themes from Heraclitus / catalogue of an exhibition held at the Architectural Association*. London: AA Publications.

Libeskind, Daniel. 1991. *Countersign*. Vol. 16, *Architectural Monographs*. London: Academy Editions.

Lootsma, Bart. 2003. "What is (really) to be Done?" In *Reading MVRDV*, edited by V Patteeuw. Rotterdam: NAi Publishers.

Lovelock, J. 1991. *Gaia*. Sydney: Allen & Unwin.

Lucan, Jacques. 1991. *Rem Koolhaas OMA*. New York: Princeton Architectural Press.

Lund, Anne-Marie. 2006. Andersson, Sven-Ingvar. In *The Oxford Companion to Gardens*, edited by Patrick Taylor. Oxford: Oxford University Press.

Lupton, E. 1993. "Visual Dictionary." In *The ABC's of ABC: The Bauhaus and Design Theory*, edited by E Lupton and J Abbott Miller, 22-33. London: Thames and Hudson.

Lynch, Kevin, and Garry Hack. 1983. *Site Planning*. 3rd ed. Massachusetts: The MIT Press.

Marc, Treib. 1994. "Sven-Ingvar Andersson, who should have come from Hven." In *Tilegnet Sven-Ingvar Andersson*, edited by Høyer Steen, Anne-Marie Lund and S Møldrup, 62-77. Copenhagen: Arkitektens Forlag.

Marder, Michael. 2013. *Plant-Thinking: A Philosophy of Vegetal Life*. New York: Columbia University Press.

Margulis, Lynn, James Corner, and Brian Hawthorne. 2007. *Ian McHarg: Conversations with Students*. New York: Princeton Architecture Press.

Mark, Dorrian, and Gillian Rose. 2003. *Deterritorialisations... Revisioning Landscapes and Politics*. London: Black Dog Publishing.

Marot, Sebastian. 1997. "The Return of Landscape." In *Desvigne & Dalnoky*, edited by Pierluigi Nicolin, 6-10. New York: Whitney Museum of Art.

Marot, Sebastian. 1999. "The Reclaiming of Sites." In *Recovering landscape : essays in contemporary landscape architecture*, edited by James Corner, 45-59. New York: Princeton Architectural Press.

Marot, Sebastian. 2003. *Sub-Urbanism and the Art of Memory*. London: AA Publications.

Marriage, Thierry. *The World of André le Nôtre*. Philadelphia: University of Pennsylvania Press.

Marris, Emma. 2011. *Rambunctious Garden: Saving Nature in a Post-Wild World*. New York: Bloomsbury.

Massumi, Brian. 2002. *Parables for the Virtual: Movement, Affect, Sensation*. Durham & London: Duke University Press.

Mathur, Anuradha, and Dilip da Cunha. 2001. *Mississippi floods: designing a shifting landscape*. New Haven, Conn.: Yale University Press.

Mathur, A , and D da Cunha. 1998. "Soil that New York rejected and re-collects." *Landscape journal* (special issue).

Mathur, Anuradha, and Dillip de Cunha. 2001. *Mississippi Floods: designing a shifting landscape*. Yale University Press: New Haven.

Matilsky, Barbara C. 1992. *Fragile Ecologies: Contemporary Artists' Interpretations and Solutions*. New York: Rizzoli.

May, Todd. 2001. *Our practices, our selves, or, What it means to be hurnan*. Philadelphia: Pennsylvania State University Press.

Mc Harg, Ian L. 1969. *Design with Nature*. New York: The Natural History Press.

Mc Harg, Ian L. 2002. "An Ecological Method (1967)." In *Theory in landscape architecture: a reader*, edited by Simon Swaffield. Philadelphia: University of Pennsylvania Press.

McKenna, Dennis, and McKenna Terrence. 1994. *The Invisible Landscape: Mind, Hallucinogens, and the I Ching*. New York: HarperCollins.

McKirahan, Richard D. 1994. *Philosophy Before Socrates: An Introduction with Texts and Commentary*. Indianapolis: Hackett Publishing Company.

Mellor, D.H. 2005. *Probability: a philosophical introduction*. Oxon: Routledge.

Mellor, David R. "Art exhibit focuses on mowing patterns." *Grounds Maintenance* no. 35 (9):p10.

Menod, Jacques. 1972. *Chance & Necessity*. Glasgow: William Collins & Sons.

Menu, Michel. 2003. "From Nature to Culture: Catherine Mosbach in Conversation." *Pages Paysages* (9):60-69.

Meyer, Elizabeth K. 1991. "The public park as avant-garde (landscape) architecture: a comparative interpretation of two Parisian parks, Parc de la Villette (1983-1990) and Parc des Buttes-Chaumont (1864-1867)." *Landscape Journal* no. 10 (1).

Meyer, Elizabeth K. 1994. "Landscape Architecture as Modern *Other* and Post-Modern *Ground*." In *The Culture of Landscape Architecture*, edited by Harriet Edquist and Vanessa Bird, 13-34. Melbourne: EDGE Publishing Committee.

Meyer, Elizabeth K. 2000. "The Post-Earth Day Conundrum: Translating Environmental Values into Landscape Design." In *Environmentalism in landscape architecture*, edited by Michel B Conan. Washington, D.C: Dumbarton Oaks Research Library and Collection.

Meyer, Elizabeth K. 2004. "Site Citations: The Grounds of Modern Landscape Architecture." In *Site Matters*, edited by Andrea Kahn and Carol J. Burns, 92-129. New York: Routledge.

Meyer, Elizabeth K. 2009. "Kiley and the Spaces of Landscape Modernism." In *Dan Kiley Landscapes*, edited by Reuben. M. Rainey and Marc Treib. Richmond: William Stout Publishers.

Michelis, Marco De. 1991. "The Green Revolution: Leberecht Migge and the Reform of the Garden in Modernist Germany." In *The Architecture of Western Gardens: A design history from*

the Renaissance to the present day, edited by Monique Mosser and Georges Teyssot, 373-387. Cambridge, Massachusetts: The MIT Press.

Mollie, Caroline. 2007. *Des arbres dans la ville: L'urbanisme végétal*. Paris: Actes Sude Cité Verte.

Molles. 1999. *Ecology: Concepts and applications*. Boston: WCB/McGraw Hill.

Monod, Jacques. 1972 *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology* St James Place, London: Collins.

Mosbach, Catherine. 2006. "Behind the Scenery." In *Only with Nature*, edited by Jordi Belmunt i Chiva, Alfred Fernandez de la Reguera, Enric Battle i Durany and Maria Goula. Barcelona: Col legi d'Architectes de Catalunya.

Mosbach, Catherine. 2011. "Performations." *Architecture and ideas* (11):96 - 120.

Mosser, Monique , and Georges Teyssot. 1991. *The Architecture of Western gardens: A design history from the Renaissance to the present day*. Cambridge, Massachusetts: The MIT Press.

Mostafavi, Mohsen, and Gareth Doherty. 2010. *Ecological Urbanism*. Baden, Switzerland: Lars Müller Publishers.

Mostafavi, Mohsen, and David Leatherbarrow. 1992. *On weathering: the life of buildings in time*. Cambridge, Massachusetts: MIT Press.

Mostafavi, Mohsen, and Ciro Najle. 2003. *Landscape Urbanism: A Manual for the Machinic Landscape*. London: AA Publications.

Mozingo, Louise A. 1995. "The Aesthetics of Ecological Design: Seeing Science as Culture." *Landscape Journal*:46-59.

Mutch, William. 2008. *Tall Trees & Small Woods: How to Grow and Tend Them*. Edinburgh: Mainstream Publishing.

Nadenicek, Daniel J, and Catherine M. Hastings. 2000. "Enviornmental Rhetoric, Enviornmental Sophism : the Words and Work of Landscape Architecture." In *Environmentalism in landscape architecture*, edited by Michel B Conan. Washington, D.C: Dumbarton Oaks Research Library and Collection.

Najle, Ciro. 2003. "Medium." In *Landscape Urbanism: A Manual for the Machinic Landscape*, edited by Mohsen Mostafavi and Ciro Najle, 39. London: AA Publications.

Najle, Ciro. 2003. "System." In *Landscape Urbanism: A Manual for the Machinic Landscape*, edited by Mohsen Mostafavi and Ciro Najle, 63. London: AA Publications.

Najle, Ciro. 2003. "Context." In *Landscape Urbanism: A Manual for the Machinic Landscape*, edited by Mohsen Mostafavi and Ciro Najle, 141. London: AA Publications.

Nassauer, Joan Iverson. 1995. "Messy Ecosystems, Orderly Frames." *Landscape Journal* no. 14 (2):161-170.

Nir, Dov. *Man, a Geomorphological Agent: An Introduction to Anthropic Geomorphology*. Dordrecht: Kluwer Academic Publishers, 1983.

Nolan, Billy. 1999. *9 + 1 Young Dutch Landscape Architects*. Rotterdam: NAi Uitgevers/Publishers.

Oakes, B. 1995. *Sculpting with the environment: a natural dialogue*. New York: Van Nostrand Reinhold.

Oke, T.R. 1987. *Boundary Layer Climates*. 2nd ed. Routledge: London.

Oudolf, Piet, and Noël Kingsbury. 2010. *Landscapes in Landscapes / by Piet Oudolf*. New York: Monicelli Press.

Owens, Craig. 1983. “The Discourse of Others : Feminists and Postmodernism.” In *The Anti-Aesthetic : Essays on Postmodern Culture*, edited by H Foster. Seattle: Bay Press.

Parzen, Emanuel. 1999. *Stochastic Processes*. Oakland, California: Society for Industrial and Applied Mathematics.

Pehnt, Wolfgang. 1987. *Lucien Kroll: Projets et Réalisations-Projekte und Bauten*. Teufen: Editions Arthur Niggli S.A.

Picon, Antoine, and Alessandra Ponte. 2003. *Architecture and the Sciences*. New York: Princeton Architectural Press.

Pollan, Michael. 1991. *Second Nature: A Gardener’s Education*. London: Bloomsbury Publishing.

Pope, Albert. 1996. *Ladders*. New York: Princeton Architectural Press.

Popper, Karl. 2000. “The Open Society and Its Enemies Volume One: The Spell of Plato.” In. Sydney: Routledge.

Priestly, J.B. 1964. *Man and Time*. London: Aldus Books Limited.

Prigogine, I, and I Stengers. 1984. *Order out of Chaos*. London: Fontana.

Rabinow, Paul. 1989. *French modern : norms and forms of the social environment*. Cambridge, Massachusetts: The MIT Press.

Racine, Michel. 2002. *Créatuers de jardins et de paysages en France du XIX siècle au XXI siècle*. Versailles: Actes Sud: École Nationale Supérieure du Paysage.

Rackham, Oliver. 2006. *Woodlands*. London: Harper Collins.

Raquejo, T. 1998. *Land art*. Madrid: Nerea.

Reed, Peter. 2005. “Bordeaux Botanic Gardens.” In *Groundswell: constructing the contemporary landscape*, edited by Peter Reed, 84-89. New York: The Museum of Modern Art.

Reed, Peter. 2005. *Groundswell: Constructing the contemporary landscape*. New York: MoMA.

Reiser, Jesse, and Nanako Umemoto. 2003. “In Conversation with RUR: On material logics in architecture, landscape and urbanism “ In *Landscape Urbanism: A Manual for the Machinic Landscape* edited by Mohsen Mostafavi and Ciro Najle. London: AA Publications.

Repton, H. 1969. *An Enquiry into the Changes of Taste in Landscape Gardening*. Westmead: Gregg International. Original edition, 1806.

Richardson, Kurt, and Paul Cilliers. 2001. “What Is Complexity Science? A View from Different Directions.” *Emergence* no. 3 (1):5-22.

Roberts, Jennifer L. 2004. “The Taste of Time: Salt and *Spiral Jetty*.” In *Robert Smithson*, edited by Eugenie Tsai. Los Angeles: MOCA.

Robinson, Eric. “The Mystery of Pulhamite and an ‘Outcrop’ in Battersea Park.” *Proceedings of the Geologists’ Association* 105, no. 2 (1994): 141–43.

Rocca, Alessandro. 2007. *Planetary Gardens: The Landscape Architecture of Gilles Clément*. Basel: Birkhauser.

Rocca, Alessandro. 2007. *Planetary Gardens: The Landscape Architecture of Gilles Clément*. Basel: Birkhauser.

Rose, James. 1938. “(1993) Freedom in the garden.” In *Modern landscape architecture: a critical review*, edited by Mark Treib. Cambridge, Massachusetts: The MIT Press.

Rose, James. 1958. *Creative Gardens*. New York: Reinhold Publishing.

Rose, James. 1993. “Freedom in the garden.” In *Modern landscape architecture: a critical review*, edited by Marc Treib. Cambridge, Massachusetts: The MIT Press.

Rowe, C. 1983. *The Mathematics of the Ideal Villa and Other Essays*. Boston: The MIT Press.

Russell, Bertrand. 1948. *History of Western Philosophy*. London: George Allen and Unwin Ltd.

Schröder, Thies. 2001. *Changes in scenery: contemporary landscape architecture in Europe*. Basel: Birkhäuser.

Schröder, Thies, and V Hertlein. 2002. *Making Spaces: Contemporary German LA*. Basel: Birkhäuser.

Schumacher, Patrik. 2009. “Parametricism: A New Global Style for Architecture.” *Architectural Design* no. 79 (4):15-23.

Schumacher, Patrik. 2011. “Parametricism And the Autopoiesis Of Architecture.” *Log* (21).

Schumacher, Patrik. 2011. *The Autopoiesis of Architecture: A New Framework for Architecture*. Chichester: John Wiley and Sons.

Semper, Gottfried. 2004. *Style in the Technical and Tectonic Arts*. Los Angeles: Getty Publications.

Sens, Jeanne-Marie, and Hubert Tonka. 2007. *Gilles Clément: Le Jardin en Mouvement de la Vallé au Jardin Planétaire*. Saint-Herblain: Le Govic S.A.

Serres, Michel. 2000. *The Birth of Physics*. Manchester: Climen Press.

Shane, Grahame. 2003. “The Emergence of “Landscape Urbanism”: Reflections on Stalking Detroit.” *Harvard Design Journal* no. 19:1-8.

Shapiro, Gary. 1995. *Earthwards: Robert Smithson and art after Babel*. Berkeley: University of California Press.

Shaviro, Steven. 2012. *Without Criteria: Kant, Whitehead, Deleuze and Aesthetics*. Cambridge, Massachusetts: The MIT Press.

Shepheard, Paul. 1997. *The cultivated wildemess, or, What is landscape?* Cambridge, Massachusetts: The MIT Press.

Sijmons, Dirk , and H+N+S Landscape Architects. 2002. *=Landscape*. Amsterdam: Architectura &: Natura Press.

Simon, Jacques. 1964. *L’art de connaitre les arbres*. Paris: Hachette.

Simonds, John Ormsbee. 1998. *Landscape architecture : a manual of site planning and design*. 3rd ed. New York: McGraw-Hill.

Site, Factuer Cheval Official. *Postman Cheval’s Ideal Palace - Facade East*. Available from http://www.facteurcheval.com/tl_files/contenu/photos/facade-est.jpg.

Smithson, Robert. 1979. “Entropy and the New Monuments.” In *The Writings of Robert Smithson*, edited by Nancy Holt. New York: New York University Press.

Sonfist, A. 1983. *Art in the land : a critical anthology of environmental art*. New York: Dutton.

Sorkin, Michael. 1993. *Local Codes*. Cambridge, Massachusetts: The MIT Press.

Spiller, Neil, and Rachel Armstrong. 2011. *Protocell Architecture*. London: Wiley

Spirn, Anne Whiston. 1984. *The Granite Garden: Urban Nature and Human Design*. New York: Basic Books.

Spirn, Anne Whiston. 1994. “Texts, Landscapes and Life.” In *Tilegnet : Sven-Ingvar Andersson*, edited by Steen Hoyer. Denmark: Architektens Forlag.

Spirn, Anne Whiston. 1998. *The Language of Landscape*. New Haven: Yale University Press.

Spirn, Anne Whiston. 2000. "'Ian McHarg, Landscape Architecture and Environmentalism: Ideas and Methods in Context." In *Environmentalism in Landscape Architecture*, edited by Michel Conan. Washington DC: Dumbarton Oaks.

Spirn, Anne Whiston. 2000. "The Authority of Nature: Conflict and Confusion in Landscape Architecture." In *Environmentalism in landscape architecture*, edited by Michel Conan, 249-261. Washington, D.C: Dumbarton Oaks Research Library and Collection.

Starobinski, Jean. 2003. *Action and reaction : the life and adventures of a couple*. New York: Zone Books.

Steen, Høyer, Anne-Marie Lund, and S Møldrup. 1994. *Tilegnet Sven-Ingvar Andersson*. Copenhagen: Arkitektens Forlag.

Steinitz, Carl. 1979. Defensible Processes for Regional Landscape Design. In *Landscape Architecture Technical Information Series*. Cambridge, Massachusetts: Harvard University.

Stephensen, Lulu Salto. 1997. "The Danish landscape and landscape gardening: on the visualization of the aesthetic potential for nature in cultivation in the Twentieth Century." *Studies in the History of Gardens and Designed Landscapes* no. 17 (4):295-310.

Strahler, A.N , and A.H Strahler. 1978. *Modern Physical Geography*. New York: John Wiley & Sons.

Stremke, S, A Van Den Dobbelsteen, and J Koh. 2011. "Exergy landscapes: exploration of second-law thinking towards sustainable landscape design." *International Journal of Exergy* no. 8 (2):148 - 174.

Svirezhev, Y.M. 2005. "Application of Thermodynamic Indices to Agro-Ecosystems. ." In *Handbook of ecological indicators for assessment of ecosystem health*, edited by Sven Jørgensen, R Costanza and F-L Xu, 249-275. Boca Raton: Taylor & Francis.

Tarnas, Richard. 1991. *The Passion of the Western Mind*. New York: Ballantine.

Taylor, William. 1998. "The cultivation of reason: functionalism and the management of nature." *Studies in the History of Gardens and Designed Landscapes* no. 18 (2):120-145.

ter Meulen, Alice G B. 1995. *Representing Time in Natural Language*. Cambridge, Massachusetts: The MIT Press.

Teyssot, Georges. 1991. "The Eclectic Garden and the Imitation of Nature." In *The Architecture of Western Gardens: A design history from the Renaissance to the present day*, edited by Monique Mosser and Georges Teyssot, 359-373. Cambridge, Massachusetts: The MIT Press.

Thompson, D'Arcy Wentworth. 1945. *On Growth and Form*. Cambridge: Cambridge University Press.

Thompson, George F, and Frederick R Steiner. 1997. *Ecological design and planning*. New York: John Wiley.

Thompson, lan H. 1999. *Ecology, community and delight: sources of values in landscape architecture*. London: E & FN Spon.

Tiberghien, G.A. 1995. *Land art*. New York: Princeton Architectural Press.

Tiberghien, Gilles A. 2004. "Form & Projet." *Studies in the History of Gardens and Designed Landscapes* no. 24 (4):298-304.

Tonka, Hubert. 1996. "Attitude Yves Brunier." In *Yves Brunier: Paysagiste*, edited by Michel Jacques. Basel: Birkhauser.

Treib, M. 1993. *Modern landscape architecture: a critical review*. Cambridge, Massachusetts: The MIT Press.

Treib, Marc. 1994. “Sven-Ingvar Andersson, who should have come from Hven.” In *Tilegnet : Sven-Ingvar Andersson*, edited by Steen Hoyer. Denmark: Architektens Forlag.

Tschumi, Bernard. 1981. *Manhattan Transcripts*. London: Academy Editions.

Tschumi, Bernard. 1994. *Event Cities (Praxis)*. Cambridge, Massachusetts: MIT Press.

Tufte, Edward. 1983. *The visual display of quantitative information*. Cheshire, Conneticut: Graphics Press.

van Gerwen, Roel. 2004. “Force Fields in the Daily Practice of a Dutch Landscape Architect.” In *The MESH Book: Infrastructure/Landscape*, edited by Julian Raxworthy and Jessica Blood, 238-257. Melbourne: RMIT Press.

van Rossem, Vincent. 2002. “Change your thinking, change your gardening.” In *Louis G. Le Roy: Nature Culture Fusion*, edited by Esther Boukema and Philippe V. McIntyre, 74-81. Rotterdam: NAi Uitgevers.

Verin, Helene. 1991. “Technology in the Park: Engineers and Gardeners in Seventeenth-Century France.” In *The Architecture of Western Gardens: A design history from the Renaissance to the present day*, edited by Monique Mosser and Georges Teyssot, 135-147. Cambridge, Massachusetts: The MIT Press.

Vidler, Anthony. 1992. *The architectural uncanny : essays in the modern unhomely*. Cambridge, Massachusetts: The MIT Press.

Vigny, Annette. 1998. *Latitude Nord - Nouveaux paysages urbains*. Versailles: Actes Sud: École Nationale Supérieure du Paysage.

Vogt, Günther. 2006. *Miniature and Panorama: Vogt Landscape Architects Projects 2000-2006*. Mars Müller Publishers: Zurich.

Vollaard, P. 2002. “Time-based architecture in Mildam: Louis le Roy’s Ecocathedral (CA 1970-3000).” In *Nature Culture Fusion*, edited by Louis G le Roy. Rotterdam: NAi Uitgevers/Publishers.

Vroom, Meto J. 2006. *Lexicon of garden and landscape architecture*. Basel: Birkhauser.

Waldheim, Charles. 2006. “Landscape as Urbanism.” In *The Landscape Urbanism Reader*, edited by Charles Waldheim, 35-54. New York: Princeton Architectural Press.

Waldheim, Charles. 2006. *The Landscape Urbanism Reader*. New York: Princeton Architectural Press.

Wall, Alex. 1999. “Programming the Urban Surface.” In *Recovering Landscape: Essays in Contemporary Landscape Architecture*, edited by James Corner, 233-250. New York: Princeton Architectural Press.

Watson, L. 1986. *Earthworks: ideas on the edge of natural history*. London: Hodder and Stoughton.

Watts, Alan. 1976. *Nature, Man & Woman*. London: Abacus.

Waugh, Alexander. 1999. *Time*. London: Headline.

Weilacher, Udo. 1996. *Between landscape architecture and land art*. Basel: Birkhäuser.

Weinstock, Michael. 2004. “Morphogenesis and the Mathematics of Emergence.” In *Emergence: Morphogenetic Design Strategies*, edited by Michael Hensel, Achim Menges and Michael Weinstock, 10-17. London: Wiley-Academy.

Weinstock, Michael. 2004. “Emergence in Architecture.” In *Emergence: Morphogenetic Design Strategies*, edited by Michael Hensel, Achim Menges and Michael Weinstock, 6-9. London: Wiley-Academy.

Westcott, Geoff. 1992. “Reserve Management: The Fourth ‘R’ of Local Governement.” *Australian Parks and Recreation* (Spring):41-46.

Whitehead, Alfred North. 1978. *Process and Reality*. New York: Free Press.

Wiener, Norbert. 1967. *Cybernetics or Control and Communication in the Animal and the Machine*. Cambridge, Massachussetts: The MIT Press.

Wigley, Mark. 1993. *The Architecture of Deconstruction: Derrida’s Haunt*. Cambridge, Massachusetts: The MIT Press.

Wilding, P, N.E Smeck, and G.F Hall. 1983. *Pedogenesis and soil taxonomy*. New York: Elsevier Science Pub. Co.

Wiley, Keith. 2004. *On the wild side: experiments in the new naturalism*. Portland, Oregon: Timber Press.

Wirz, Heinz. 2001. *Eaux, strates, horizons: Agency Ter*. Lucerne: Quart Editions.

Wise, Chris. 2004. “Drunk in an Orgy of Technology.” In *Emergence: Morphogenetic Design Strategies*, edited by Michael Hensel, Achim Menges and Michael Weinstock. London: Wiley-Academy.

Wörle, R. E, and H. J Wörle. 2008. *Designing with Plants*. Basel: Birkhauser.

Worpole, Ken. 2002. “Urban Parks in Europe: topology and geometry, economics and aesthetics.” In *The Public Garden*, edited by Anne-Mie Devolder, 156-161. Rotterdam: NAi Uitgevers/ Publishers.

Wouda, Peter. 2007. Conversation at Kennedylaan (6th June, 2007). Heerenveen.

Woudstra, Jan. 2008. “The Eco-cathedral: Louis Le Roy’s expression of a “free landscape architecture”.” *Gartenkunst* no. 20 (1):185-202.

Yates, Frances A. 1979. *The Occult Philosophy in the Elizabethan Age*. London: Routledge.

Yeomans, P.A. 1981. *Water for Every Farm: Using the Keyline Plan*. Katoomba: Second Back Row Press.

Yin, Robert K. *Case Study Research: Design and Methods*. 4th ed. Thousand Oaks, California: Sage Publications, 2009.

Zobel, R.W Jr. 1995. “The Representation of Experience in Architectural Design.” *Presence: Teleoperators and Virtual Environments* no. 4 (3 Summer).