INSTRUMENTS OF DESIGN:
ON SURVEYING AND DESIGNING SITE-SPECIFIC MATERIAL

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"Our deepest hope as humans lies in technology; but our deepest trust lies in nature. These forces are like tectonic plates grinding inexorably into each other in one long, slow collision."[1]
  —W. Brian Arthur

Design is not just what it looks and feels like; design is how it works.[2] This was the design mantra of the late Steve Jobs, which resulted in the beautifully crafted mp3 players and mobile phones we are so familiar with today. Of course, one cannot compare these gadgets with the design of our environment, but the message is clear nonetheless: good, functional design is also aesthetically pleasing. So why, then, do we so often consider the fringes of our cities and landscapes ugly? Can we say that they do not work properly on a functional level? Should we call this *bad* design?

There is a schism between two entities: On the one side there are the paper drawings of the designer, and on the other, the material reality in the landscape.[3] This article will take a closer look at the potential connection between them and propose new tools and methods to close the gap between the designer's work in the studio and the found material outside. I suggest that the potential for reconciliation lies in design instruments, be it for the purpose of surveying, designing or producing new landscapes, and that a renewed connection will have profound impacts on any final design. Take, for instance, computer-aided architectural design, which quickly altered the way landscapes were drawn. Suddenly it became possible to draw complex shapes and curves quite easily. Beginning with the professional responsibility to designed landscapes, this article will explore both the materials and instruments of design from an operative perspective in order to propose a new design approach for contemporary landscape architecture.

1 W. Brian Arthur, *The Nature of Technology: What it Is and How it Evolves* (New York: Free Press, 2009), 11.
2 Rob Walker, "The Guts of a New Machine," *New York Times*, November 30, 2003, accessed January 15, 2015, http://www.nytimes.com/2003 /11/30/magazine/the-guts-of-a-new-machine.html.
3 Brian Davis, "Landscape and Instruments," *Landscape Journal*, vol. 32, no. 2 (January 1, 2013), 293–308.

Landscape Architecture

Let's start at the beginning. The formation of the profession of land-scape architecture was prompted by questions of urban expansion that arose in the middle of the nineteenth century, thus rooting it in the urban and infrastructural arts.[4] However, from that point forward, landscape architecture seems to have retreated into the residual space left over by architecture, infrastructure and ecology. While the work of landscape architects began to be connoted only with horticulture, I would argue that their disciplinary skills could greatly benefit large-scale city planning today. Practices in civil and environmental engineering are now dominating the shape of the territory by applying their expertise to the political structures of urban and landscape planning. However, these data-driven disciplines seem to be unable to cope with this fundamental question: How does the territory exist both functionally and aesthetically, for people?[5] If we want to approach the territory in these terms, we have to come to a new understanding of the value of landscape; how landscape is perceived. The conventional understanding of elements within the landscape deals with dwelling and transportation either as objects in the form of architecture or as systems in the form of infrastructure. They are considered technical, only to be dealt with by technicians. But by situating these things in the territory there is an interest in shifting from a strictly functional approach toward an aesthetic performance. Cities and infra-structures modify, measure, situate and utilize the landscape; they suggest and evoke something beyond mere practical functionality.[6] They are, in short, what constitutes the domain of landscape architecture.

Surveying

How can we liberate the territory from this paralyzing grip of normative practices, which once constituted the domain of landscape architecture? With the ever-increasing specialization of the sciences

4   Charles Waldheim traces the origins of the profes-sional identity of landscape architecture in his article "Landscape as Architecture," published in *Landscape Architecture's Core?*, Harvard Design Magazine 36 (Cambridge: MA: Harvard Univer-sity, 2013), 116–123. Particularly striking are Waldheim's findings on the role of the landscape architect during the formation of the discipline: "The landscape architect was originally conceived as a professional responsible for divining the shape of the city itself, rather than pastoral exceptions to it" (Waldheim, *Landscape Architecture's Core?*, 119).

5   Christophe Girot, Anette Freytag, Albert Kirchen-gast, Suzanne Krizenecky and Dunja Richter, *Topologie – Topology*, Pamphlet 15 (Zurich: gta Verlag, 2013).

6   Vittorio Gregotti, "Territory and Architecture," *Architectural Design Profile* 59, no. 5–6 (1985), 28–34.

throughout the twentieth century, new disciplines such as ecology, transportation planning, economy and public administration began to intrude on the role of the landscape architect as an ultimately form-defining entity. In order to reclaim this responsibility from these pro-fessions and reincorporate it into the realm of landscape architecture, we must first redefine the material tools of the landscape architect. This excerpt by Vittorio Gregotti can be read as a seminal text for the landscape architect's approach to the material of a particular site:

> Nature, in this sense, is not seen as an indifferent, inscrutable force or a divine cycle of creation, but rather as a collection of material things whose reasons and relations [landscape-] architecture has the task of revealing. We must therefore modify, redouble, measure, situate, and utilize the landscape in order to know and meet the environment as a geographical totality of concrete things which are inseparable from their historical organization. This can only be done if we abandon the sociological or ecological or adminis-trative notion of the environment as an imprisoned element and think of it instead as material for architecture. It should be made clear that this idea of the environment is not a system in which [landscape-] architecture is dissolved, but is on the contrary a load-bearing material for the [landscape-] architectural project, enabling new planning principles and methods to accommodate the spirit of the specific terrain.[7]

According to Gregotti, the formal expression of a landscape should emerge from the elements in the landscape directly, to accommodate the spirit of the specific terrain. These materials of design have to be dealt with not in terms of space or program, but in terms of their function and aesthetic.[8]

7   Gregotti, "Territory and Architecture," 28–34.

8   It may seem paradoxical to talk about aesthetics when discussing these pragmatic entities. While the pragmatic may be exclusively concerned with the practical, traditionally opposed to aesthetics and seen as something purpose-less, landscape [infrastructural] projects often operate on a very large scale and evoke sublime experiences that must be confronted in terms of design. The aesthetics of the territory is defined by two moments: The first moment presents an ungraspable image of terror that relates not so much to reason as to instinct and intuition. Here, the incomprehensible, first overwhelm-ing moment of the power of scale, forms a new aesthetic embedded in the comprehension of the territory. After this ecstatic moment, the second moment answers formal questions in

This approach presents the following problem: How do we capture the load-bearing material for a landscape architectural project and how do we work with it inside the studio? Without referring to any specific material, I will discuss the tools and instruments that lead the designer to the initial selection of particular materials and finally to a design. My intent, here, is not only to elaborate on the importance of the instruments that are used in the design process, but also to emphasize that, because each site is distinct, successful design must respond to a site's specific features. In this way, each and every project will be based on its own collection of material and with its own internal logic. And the tools that are used to capture this material will, consequently, also determine what will be captured of the site. It is impossible to design a landscape without a thorough knowledge of these instruments—they measure the geometry of the land, observe and describe physical features, and what is more, they help to conceive the spirit of the particular terrain. This document accesses what field instruments can measure, what they can reveal, and how they can influence the course of landscape architecture as a whole.

For the purposes of this investigation, I will distinguish between three phases within the design process of a landscape architectural project: 1) Surveying, 2) Designing, and 3) Producing. Because of my limited experience, for the purposes of this article I will discuss only phases 1 and 2. However, the concepts and methods outlined below could easily be applied to phase 3 as well. For each phase the choice of the instrument, and the related medium that it produces, will heavily determine its possible outcome. Let's have a look at the designing and surveying phases.

Tool-Specific Output

Landscape architects work with various media during the design phase in order to reach a design proposal. Pen, paper, computer-aided drawings, photos—they all fulfill the purpose of visualizing

relation to functionality. Aesthetic experience emerges not from valuing outdated concepts of beauty, such as proportion and order, but rather from the appreciation earned by comprehending the territory. Now it is not the function, but the expression of this function, that makes it architecture—and that, paradoxically, also renders it beautiful.

something that does not yet exist. Ultimately, the illustration of ideas through media is subject to the character of the chosen medium, just as the written word is subject to the content of print; spatial organization defines the content of landscape architectural drawings. Before an idea is built, the media, each with its own specific characteristics, processes it. The design process usually begins with a plan drawing that illustrates the spatial organization. From here, a new proposal is drawn up in the attempts to likewise describe a new organization. It becomes apparent that only certain site characteristics will translate through the media, therefore making the choice of the notation instrument a first creative decision. This leads, in the choice of a plan for instance, to a flat copy of the reality, which is limited in terms of a three-dimensional organization, and can only give a rough estimate of the complicated whole. A photo would be better suited to notate a reality in three dimensions; however, it lacks the plan's precise measurement of site.

Technology as Chemical Process

We have established that instruments can only output specific characteristics within their separate domains. In order to address the question, "What can these new surveying and drawing instruments reveal?" we must first understand how they operate and come into being. Just as erosion and sedimentation are entropic by nature, so, too, are instruments technological by nature, each equipped with its own set of properties. In *The Nature of Technology*, W. Brian Arthur states that the core of technology relies on the exploitation of natural phenomena by instruments, in which existing technologies are combined to generate new ones.[9] This was certainly the case before the digital revolution. However, the understanding of technological development as a linear (mechanical) process has recently been rivalled by an emerging view of technology as a chemical process. As such, a vast pool of technological possibilities could be endlessly combined and reconfigured toward new purposes.[10] For the landscape architect, this means that the careful creation of survey- and design instruments plays an essential part in capturing and manipulating

9 Arthur, *The Nature of Technology*, 24.
10 Arthur, *The Nature of Technology*, 25.

the materials of design. A faulty selection and combination of technologies into a set of design instruments can drastically hinder the designer from making a valid, site-specific intervention.

Design Innovation

The technological nature of instruments applies to all phases of design, and innovation is reached through technology. Arthur explains how technological innovation comes into being:

> In fact, we can see that innovation has two main themes. One is this constant finding or putting together of new solutions out of existing toolboxes of pieces and practices. The other is industries constantly combining their practices and processes with functionalities drawn from newly arriving toolboxes—new domains.[11]

This makes me think of terrestrial laser scanning. For a long time, measuring landscape form and producing measured documents, such as sections and topographical maps with contour lines, now considered conventions in the practice of the landscape architect, have belonged to the domain of the surveying industry. Recent design practices have incorporated the functionalities of the survey into the design process, pushing for innovation that is drawn from toolboxes outside their own domain, thus allowing for unforeseen possibilities, in terms of design.[12]

If we look at the technological innovation of devices and practices within landscape architecture, we can attribute almost all of the developments to functionalities that are drawn from newly arriving toolboxes, that is to say, by borrowing technology from other domains. According to Arthur, this is just one way to innovate. The other possibility is to put new solutions together out of existing toolboxes. If we think of the designer who is working within a specific medium to produce designs, the importance of using what I will call "valid instruments"

11 Arthur, *The Nature of Technology*, 164.
12 For example, the landscape architecture office Atelier Girot heavily relies on photogrammetric and laser scanner surveys during the design process. Some of the firm's work, including some videos demoing the process, can be found on the office website: Girot.ch.

becomes evident. Using valid instruments means selecting the right instrument for the right purpose instead of employing biased instruments that output properties of space in a medium that is not suited to fulfilling one's stated goal. For example, one could argue that using a single photograph for taking precise measurements is not constructive, or that the administrative system of land use, which projects landform into two-dimensional, functional layers, is not effective in making the territory both functional and aesthetically pleasing for people.

This is where innovation comes in. In addition to selecting valid instruments, taking an innovative approach to the design process means configuring new solutions out of existing toolboxes and drawing on functions from domains that lie beyond landscape architectural design.

Hybridization

The sand box interface that was developed at the Chair of Landscape Architecture of Professor Christophe Girot set the goal of quickly sampling and evaluating both the normative and the poetic properties of several landscape topologies.[13] It combined physical sand-modelling techniques with real-time digital analysis to develop precise landscape structures. Its purpose was to combine tangible, analog sand-modelling techniques with digital analysis so as to incorporate the designer's intuition and a few pragmatic restrains. The sand box represents technology from the domain of landscape architecture; the scanner that of the computer gaming industry. These techniques were then combined within the computer, thus completing the setup. Whenever the sand in the box was remodelled, it was simultaneously digitized into a 3D model, its slope, water level and topology analyzed, and the results thus displayed to the designer within only a few seconds. Information that would otherwise have been difficult to grasp in the sand box, such as precise water levels or grading, was made available via the digital screen. In this way, the validity of the tool is proven by its use. The fact that the chosen site was small in scale, while still including varying water levels, made the

13 Ilmar Hurkxkens and Georg Munkel, "Speculative Precision: Combining Haptic Terrain Modelling with Real-Time Digital Analysis for Landscape Design," in *Wissen, Peer-Reviewed Proceedings of Digital* *Landscape Architecture 2014 at ETH Zurich*, eds. Ulrike Hayek, Pia Fricker and Erich Buhmann (Berlin/ Offenbach: Herbert Wichmann Verlag, 2014), 399–405.

chosen design instrument a perfect match. On a larger site the sand box might not have had the preferred resolution. Alternatively, if one did not have the need for digital elevation models or contour lines, the process of digitalization could be skipped altogether.

Site-Specificity

The Topology project developed by the Chair of Professor Christophe Girot tries to recover landscape architecture as a discipline that integrates the physical, scientific and poetic properties of a particular site into a single, meaningful whole.[14] It searches for a new intelligence of terrain by encompassing its continuity and complexity. Here the specificity of a particular site becomes the driving force for design. Reaching an understanding of site through drawings, texts or point clouds reveals that the subject, namely all of the elements on the site, will pass through several mediums and instruments of notation. We have already established that these instruments are not innocent; each specific technology yields a unique design. The first decision within the design process starts here, by choosing the instrument and the medium with which the design will be developed. The instrument will then reveal the design materials of the landscape architectural project.[15]

The explosion of [digital] tools, now making new technologies readily available to the landscape architect, calls into question the role of the notational instrument, both in its ability to describe existing sites and in envisioning new ones. The designer's choice of media during the design process will heavily influence the output.[16] And just as drawing is a craft in and of itself, so, too, is choosing the right instrument to collect the materials of design a practice. Specific sites require specific tools for specific purposes. The designer has to choose, rather intuitively, from an ever-expanding media toolbox which iterative

[14] The Chair of Landscape Architecture of Professor Christophe Girot reopened the debate on the forming of landscape with the symposium *Topologie: Zur Gestaltung der gegenwärtigen Landschaft* in October 2012 (with project lead Anette Freytag). The term "topology" refers to the position of the chair: Landscape architecture should be strengthened as an integrative discipline with a deep- rooted tradition in shaping and preserving nature. The lectures of the symposium can be retrieved at the following link: http://www.multimedia .ethz.ch/conferences/2012/topologie; Girot et al., *Topologie – Topology*, Pamphlet 15, 8.

[15] Gregotti, *Territory and Architecture*, 28–34.

[16] Marshall MacLuhan, *The Medium Is the Message* (Corte Madera: Gingko Press, 2005), 8.

combination of tools may produce the preferred vision. But we should not stop here. If we agree that the work of the architect is a visionary one, then we could also argue that the architect's task is not only to choose an instrument but also to develop new instruments, through either the combination of various existing technologies or the adoption of technologies from outside the domain of landscape architecture (see Technology as Chemical Process). The development of design instruments now marks the first act of every design project.

Funkiness

One should not be afraid of developing a design through various technologies or mediums. Using multiple tools and techniques increases the possibility of reaching a moment of uncertainty, an exception to the rule. In "Exploration: Creativity, Understanding and Idea," Hille von Seggern describes a creative moment as depending on the skilful interaction of ratio, intuition and intellect, as something that happens when intuition merges with comprehension to yield progress.[17] The pragmatic operation of instruments and materials of design is mostly a matter of ratio. However, their respective selection is an act of creativity. As such, intuition also plays a large role, which, in turn, is fed by a designer's experience and intellect. Seggern outlines intuitive practices in two ways: one drives new practices through a leap in technique (examples are the work of the Situationists and Salvador Dalí's Paranoiac Critical Method), and the other deals with history in the genius loci tradition, as a harmonic extension of the history of a place (as outlined in Christophe Girot's essay "Four Trace Concepts").[18] Without going too deeply into the role of creativity in design, Arthur aptly describes the limitations of design instruments:

> Architects who domain their design work digitally can produce variations of their ideas almost instantaneously and compute material

17 Hille von Seggern, "Exploration: Creativity, Understanding and Idea," in *Creating Knowledge: Innovation Strategies for Designing Urban Landscapes*, eds. Hille von Seggern, Julia Werner and Lucia Grosse-Bächle (Berlin: Jovis, 2008), 69.

18 Simon Sadler, *The Situationist City* (Cambridge, Mass.: MIT Press, 1998); Rem Koolhaas, *Delirious New York: A Retroactive Manifesto for Manhattan* (New York: Monacelli Press, 1994), 237; Christophe Girot, "Four Trace Concepts in Landscape Architecture," in *Recovering Landscape: Essays in Contemporary Landscape Architecture*, ed. James Corner (New York, Princeton Architectural Press, 1999), 59–67.

costs automatically as the act of designing takes place. But the digital domain imposes its own subtle biases on what can be accomplished. Only the quantifiable aspects of the real world can be mapped into the digital world and worked on successfully there. And so, digital architecture can easily yield geometric surfaces that arch and swoop in nice mathematical curves, but as the architectural critic Paul Goldberger says, it has "little patience for funkiness, for casualness, for incompleteness." Surfaces are quantifiable; funkiness is not. Or, I should say, funkiness is not yet quantifiable. If ever it is—if ever you can move a slider on a screen to yield the degree of funkiness you want—then the domain would extend. But for the moment that is not possible. What cannot be accomplished in a world becomes that world's limitation.[19]

If we take this statement to heart, it would seem that the only way landscape architecture may regain its territory from architecture, infrastructure and ecology, is to drastically expand its disciplinary tools and techniques—to incorporate the spirit of place into its design vocabulary. Hence, intuition and creativity might even become a quantifiable administrative instrument.

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So how *does* landscape function, how does it evolve? Ground that has been physically altered in connection with the development of contemporary civilization now exceeds untouched surfaces around the globe.[20] Land levelling, trenching and embankment building, concurrent with the construction of cities, partially define what we refer to as the Anthropocene, a geological era in which human activities are significantly redefining earth's ecosystems.[21] In this process, landscape,

19 Arthur, *The Nature of Technology*, 84.

20 Peter Vitousek, Harold Mooney, Jane Lubchenco and Jerry Milillo, "Human Domination of Earth's Ecosystems," *Science*, vol. 277, no. 5325 (1997), 494–499.

21 Jane Hutton, "Substance and Structure I: The Material Culture of Landscape Architecture," *Landscape Architecture's Core?*, Harvard Design Magazine 36 (Cambridge, MA: GSD Harvard University, 2013), 116–123.

22 Pierre Bélanger, "Landscape Infrastructure: Urbanism Beyond Engineering," *Infrastructure, Sustainability and Design*, eds. Spiro Pollalis et al. (London: Routledge, 2012), 276–315.

23 On May 1, 2014 the Federal Council of Switzerland set in force a revised Law on Spatial Planning (RPG). First introduced in 1979, the law regulates the separation of the built-up area from the non-built-up area while paying attention to both their natural conditions as well as social and economic

architecture and infrastructure have become more and more entangled, forming nearly a single, large artifact that slowly but surely consolidates the increasing complexity of our environment into a continuous whole.[22] The apparent inevitability of this man-made landscape heavily challenges contemporary feelings of nostalgia for "Nature" in its wildest state, illustrated by the countless laws on natural preservation.[23] Robert Smithson demonstrates the irreversibility of our environment in his consideration of a sand box:

> Picture in your mind's eye the sand box divided in half with black sand on one side and white sand on the other. We take a child and have him run hundreds of times clockwise in the box until the sand gets mixed and begins to turn grey; after that we have him run anticlockwise, but the result will not be a restoration of the original division but a greater degree of greyness and an increase of entropy.[24]

Today, landscapes consist of fields of activity that are heavily modified and transformed by infrastructural projects. Under these circumstances, the child will continue to run in circles until we teach it to build sandcastles. In selecting a design instrument for the task at hand, we have, already, discriminated between possible outcomes; the choice becomes a design decision in and of itself. Developing valid instruments for specific sites allows us to be more connected to the local features of a landscape, and as a result, also speaks to our intuition in rendering a valid response.

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needs. The latest revision dramatically alters the provincial system of the colonization, forcing the cantons to compensate for new building zones by excluding predetermined zones from being built upon. It aims to protect the landscape by directing residential development inward to create compact settlements, and by preventing cultivated land from being fragmented into smaller parts. In doing so, the law recognizes landscape not only as a means of agricultural or ecological produc-

tion, but for the first time in Switzerland also as a precious commodity for human living. More information is available at the following link: "Bundesgesetz über die Raumplanung," accessed January 15, 2015, http://www.admin.ch/opc /de/classified-compilation/19790171/index.html.

24 Robert Smithson, *Robert Smithson: the Collected Writings*, ed. Jack D. Flam (Berkeley: University of California Press, 1996), 74.