The Elegance of Topology

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… I would therein describe men, if need be, as monsters occupying a place in Time infinitely more important than the restricted one reserved for them in space, a place, on the contrary, prolonged immeasurably since, simultaneously touching widely separated years and the distant periods they have lived through—between which so many days have ranged themselves—they stand like giants immersed in Time.

Marcel Proust, last words of *Time Regained*

The Other Model

In the early summer of 2011, three researchers from the theory laboratory at my Chair met with me at the Monte Verità near Locarno in Switzerland.—[1] We spent three intense days questioning the current state of affairs in landscape architectural theory. The question asked was whether a simple term existed, which was capable of expressing both a poetic and constructive understanding of landscape? In architecture, for instance, the term "tectonics" has helped to establish a general theory of design and construction. A similar term for landscape could help define a structured sense of place and time, and return to a more original intelligence of terrain. Such an all-embracing term capable of expressing the fundamental essence of a landscape with discernment is still lacking.

1 Anette Freytag, Albert Kirchengast, and Dunja Richter joined me on a rainy weekend to examine, challenge, and debate about the state of affairs in landscape theory. Together, we tried to lay down the foundations of a new theoretical position and practical method of designing the contemporary landscape. Was it possible to develop a holistic approach, whether directly or indirectly, through a return to the primacy of aesthetics? Could a better understanding of a place through different benchmarks help to build relationships specific to a given landscape that could escape the banality of normative design? The goal was to establish a deeper understanding of natural and cultural structures within established design traditions.

We tend to refer to landscape in subjective terms, as if it were an amalgamation of things good and bad, beautiful and ugly, without a determined direction. And we agreed that the situation masks an overall absence of choice, method, and purpose regarding the making of a landscape. Agencies today tend to regulate and shape the landscape in such a normative way, that it is often difficult to note any sort of difference from one place to the next.

We come from a long-standing intelligence of terrain, and believe that this tradition could be reinstated with ingenious simplicity. Are we able to rekindle a renewed understanding of site in its physicality, and elegance that could translate back into a sense of design? Modeling tools of unprecedented precision are now able to replicate the physical properties of a site. They show specific aspects of a landscape that cannot be depicted in a plan. Does this mean that these aspects are insignificant, or that the plan in fact seriously limits the range of possible interpretation of a place? The modeling tools rely on large three-dimensional data sets that are unwieldy to decipher and difficult to convert into meaningful workable formats, despite the fact that they are aesthetically pleasing to look at. But does this mean that we should ignore them, and that a valid and workable understanding of landscape can only be based on the use of a plan? Despite the difficulty and challenge that these data sets represent, it is clear that a renewed approach to landscape through such modeling can provide a stronger, well-informed basis for design. In this age of big data, there is a need for a new insightful method that can retrieve the spirit of terrain with elegance. What are the physical aspects that truly matter in design and that so far have eluded the plan? How does one sift through such data sets, in order to touch on the spirit of a landscape? Abstraction has always been the problem with a plan, and the landscape overlay method, which has now become the rule and standard procedure in landscape architecture, cannot design properly because it always confuses deductive analysis with the poetics of place.

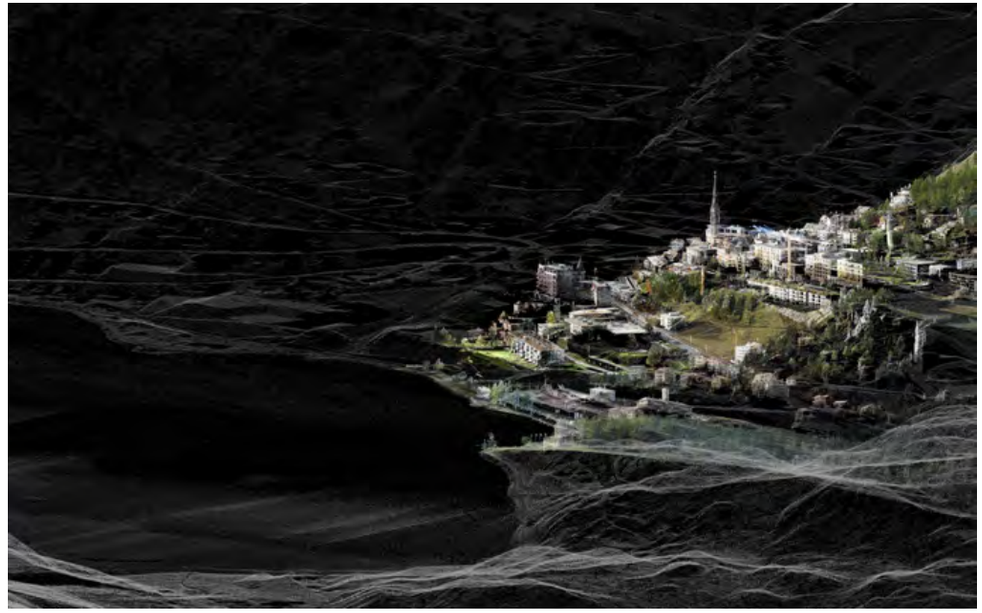
Point-cloud models are unwieldy and the information they deliver—although highly precise topographically—remains partial, virtual, and superficial. These models should in no way be confused with the tangible physical reality of a site, but understood rather like its spirit. They depict many of the physical, material, and temporal qualities of a place that are of vital interest to us. How does one mine these qualities out of a model, and how can it better contribute to design? A point-cloud model resulting from laser scans is fascinating, but of very little use when it is not combined and scaled with other techniques of observation and design. It appears on the computer screen as a pixelated membrane, producing a luminescent ensemble of textures, including details of reliefs, vegetation, and infrastructure. From a topographical point of view, the model is stunningly precise and beautiful in its wafer-thin representation. Landscapes captured in this mode reproduce a pointillistic veil of scintillating electronic point-clouds that look like dew drops minutely covering the entire surface of the land. The models reveal a highly complex assemblage of topography and infrastructure, blending cultural and technical artifacts with natural outcroppings, torrents, and gorges. Beyond the visual fascination the image confers, the features of interest depend on our particular agenda. We can derive a new approach from the models at our disposal, which challenges a certain planimetric status quo in terms of landscape planning and design.

The Other Mind

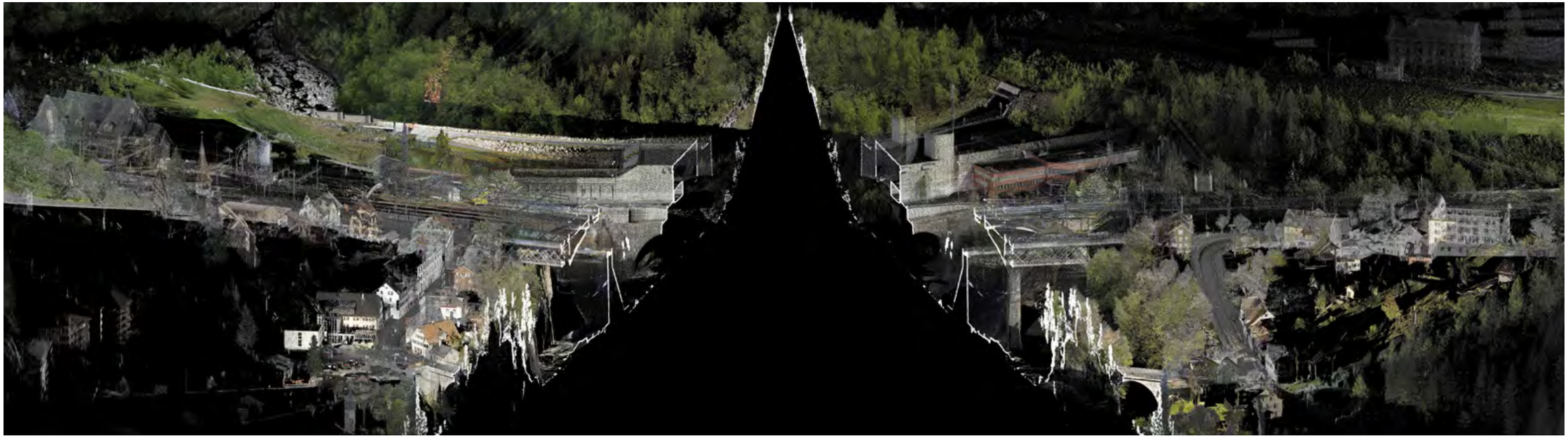
We all agreed on the choice of one term referring to the physical and poetic reality of a landscape, suggesting a sense of wholeness, namely “topology.” Its etymological roots lie in the ancient Greek for place (*topos*), and language (*logos*). Although topology is generally understood as a mathematical construct relating to the continuity and connectivity of surfaces, it can also incorporate a

more general understanding about the genealogy of a constructed landscape. Highly precise electronic models inform us better about the physical interrelation of complex surfaces with forces and changes in the environment. It is not the quantity of data produced by a model that is relevant to topology, but rather the quality and precision of information that can be mined and retrieved from it. The word "elegance" stems from the Latin *elegans,* which finds its roots in *legere* (to pick out or to choose). The elegance of topology could be best defined as the refined art of picking out the essential features of a site. How does one teach such elegance, with or without a model? Topology is about the intelligence of a site perceived, and shaped by society topically. It defines a discerning approach to the physical and natural conditions of a landscape, guided by the technical, ethical, and aesthetic choices. Topology sets the physical, cultural, and temporal reality of a given place through a series of reflected deontic and cognitive choices.

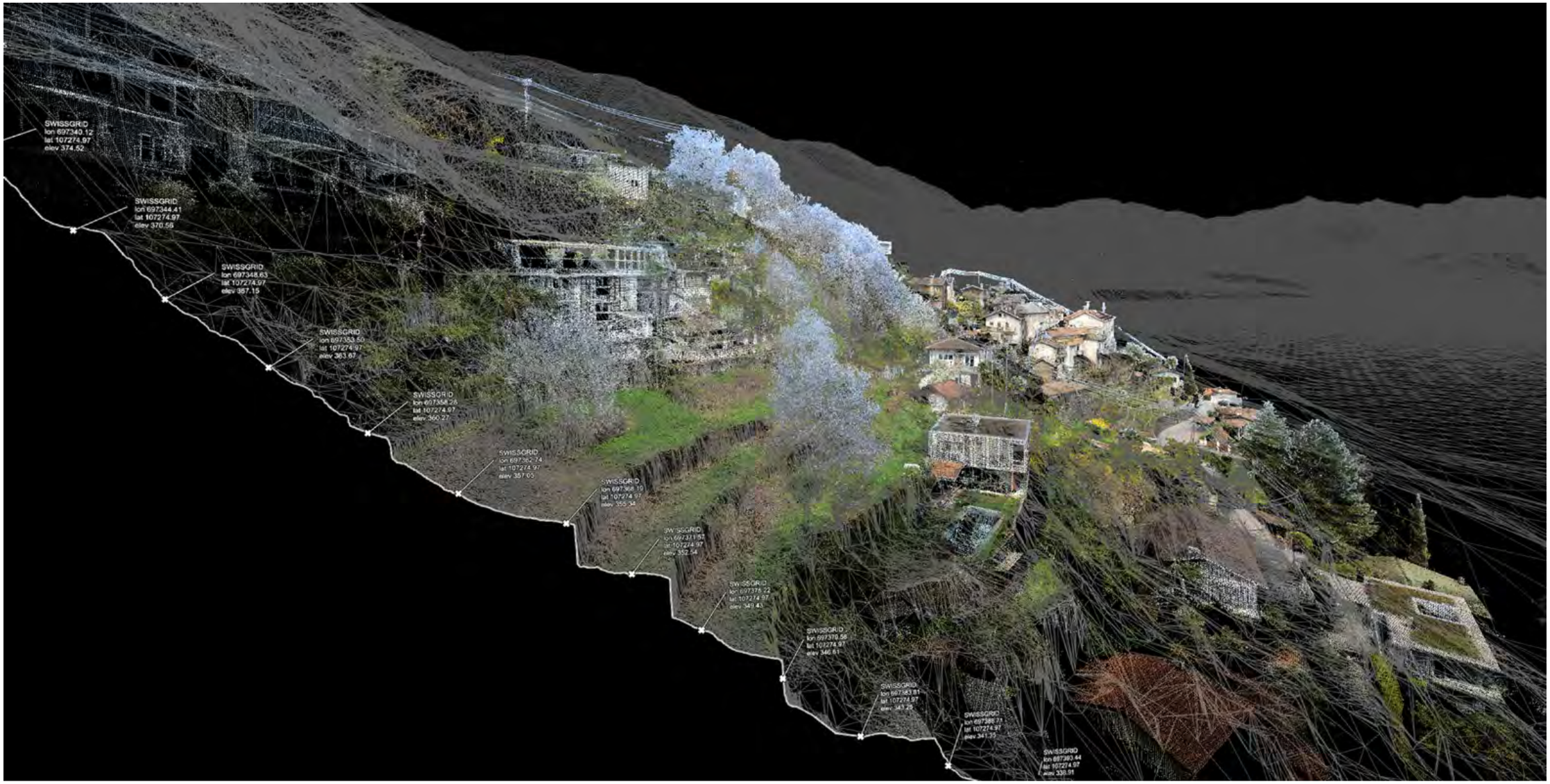
The mapping overlay techniques, developed originally by Ian McHarg and used at present by most agencies around the world, have tended to transform landscape irrevocably into a set of rather abstract and categorical items and zones on a plan. Topology challenges this approach in that it must be local, precise, and culturally specific. The normative overlay system, derived from McHarg's method has tended to considerably reduce and flatten the reality of landscapes as we understand them today. Can the physical model, which can of course supplement many other models and layers, become the canvas of a new approach to design, one that would be much more specific in its understanding and interpretation of place? The elegance of topology could reflect a landscape tradition that is eminently physical, aesthetic, and artistic, and that seems to have been forgotten. It can open a wide range of possibilities across disciplinary fields such as engineering, planning, architecture, and art, by preserving the cultural thread of a place, while discerning key aspects of a given terrain knowledgeably and elegantly.



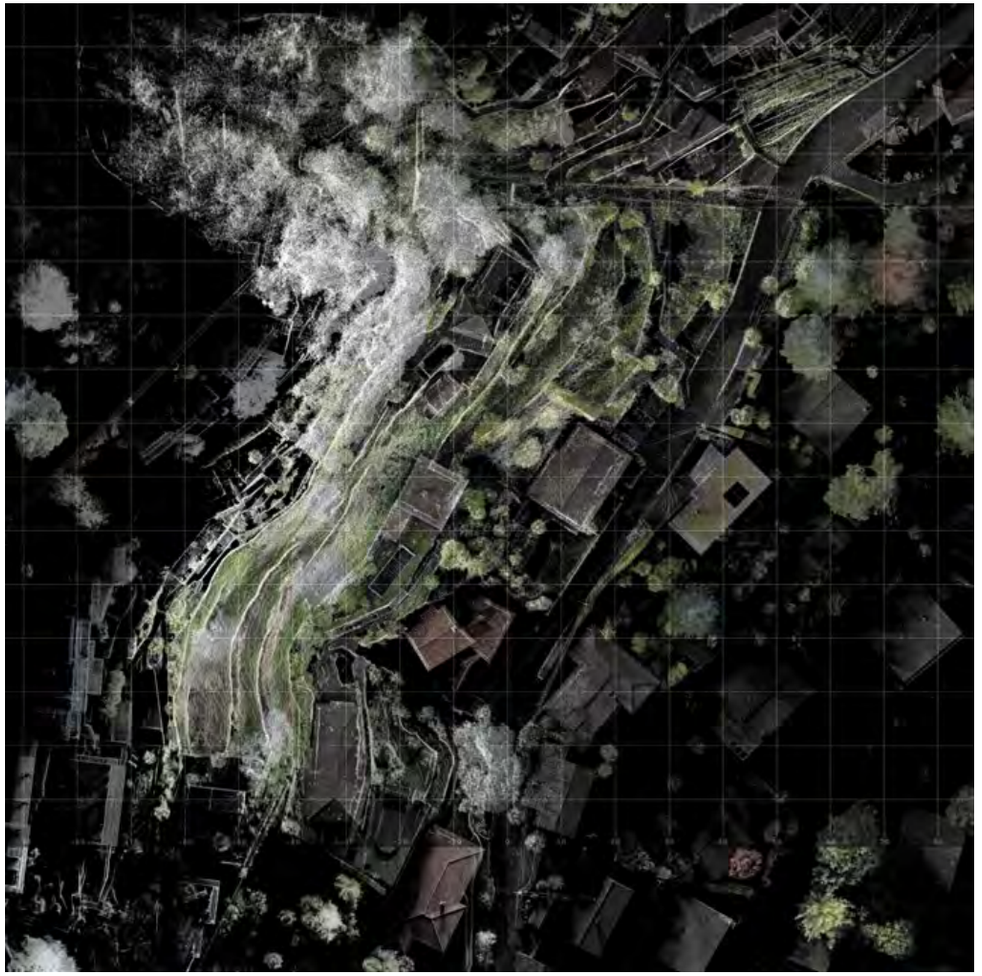
True-color point cloud, St Moritz, Szwitzerland.



Section through true-color point cloud, Göschenen, Switzerland.



Section through true-color point cloud, Brissago, Switzerland.



Plan view of true-color point cloud, Brissago, Switzerland.

Topology must be understood as a holistic approach to a landscape that has always been in the making; a landscape that seems so fragmented and zoned today that we seem to lack an awareness of its past qualities. Topology enables a more general understanding of landscape as a symbolic cultural entity, woven into physical and spatial relationships at the dimension of a territory. Understanding territorial continuity physically helps better identify qualitative priorities in a landscape. Young landscape architects must return to the field, to learn once more how to operate knowledgeably in a landscape. The tendency in recent decades has been to push landscape education towards a higher degree of abstraction and reduction, with an emphasis on communication skills and pattern recognition, rather than physical design skills. This probably has its merits in terms of advocacy and didactics, but has led to a more subjective rather than constructive approach to landscape design, whereby personal impressions, images, and narrations come to play an increasingly important role in describing the existential reality of a site. Consequently, it seems particularly important to return to the concrete physical reality of a site, learning how to identify the character, potential, and inherent qualities of a landscape. Students must strive to gain a better understanding of terrain and foster stronger disciplinary skills before launching into a design. Acquiring skills and proficiency in topology has always been central to the art of landscape architecture. What kind of proficiency is actually needed today? Can we still sketch an idea on a piece of paper, or must our entire design universe be confined to the pixels and vectors of a computer screen? Which ggeneration, if any, works a plan on velum as a palimpsest in the masterful manner of the architect Carlo Scarpa, where every step of the design process transpires through a single sheet of paper? Topology should encapsulate these steps, which assess the physical and temporal reality of a site by consciously weighing a series of decisive choices to avoid applying normative changes blindly.

Topology works as a method of design while maintaining elegance and precision at different scales. Some projects show how it works effectively with regards to large-scale territories. It is effective when applying new techniques intelligently and precisely, particularly in the vicinity of flooding river basins and coastal regions, where the quality and mastery of virtual modeling is of the utmost relevance. We now have the necessary technical know-how to react creatively to such large-scale challenges, and need to improve our constructive approach to landscape in these domains. Topology, understood as a philosophy, but also as a specific intelligence of terrain, will play a major role in the design of landscapes to come. With precise tools and a new attitude towards analysis and design, many of our idiosyncratic habits will be questioned, such as granting the preeminence of program over terrain. To illustrate this point, I can recall the Grands Atelier Project I worked on a decade ago, where the French government decided to embark on a project requiring a flat four-hectare site for an experimental architectural laboratory. They chose a steep hillside for the project, requiring a geologically complicated flattening of the site, which was considerably in excess of the budget. It would have been advisable not to go ahead with such a project on that site, had better knowledge about the terrain and its physical properties been integrated in the program. This lack of understanding about terrain is quite typical of our modern age and has been detrimental to landscape in general, where it is always assumed that a site can be made flat to assume a program.

The Other Foot

Ironically, in light of remarkable developments in landscape modeling, few schools seem to have placed emphasis on topology and a better understanding of what constitutes the physical and cultural basis of landscape design. We are apparently content with a status quo that has prevailed in landscape architecture over the last forty years? How often must we look again at the “brilliant” plans of Tschumi and Koolhaas for the Parc de la Villette competition of the early nineteen-eighties, to reiterate our belief in the preeminence of program over terrain? Both projects at Parc de la Villette approached this very flat site programmatically as if it were a blank sheet of paper. It is indeed convenient to ignore the challenges presented by a given terrain and to pursue a conceptual approach to landscape design, as long as the bulldozer follows and flattens accordingly. But such principles go hand in hand with an absence of discernible aesthetic theory about site topography and locality; in the case of the Parc de la Villette the aesthetic is only in the program. Can anyone talk, let alone teach about the beauty or ugliness of a given place, or are we just seduced by our own concepts independently of a site? We have become disconnected from the sites we supposedly care for, and are unable to formulate a clear opinion about them, because we lack the proper tools and training to do so. These fundamental questions shed a light on the plight of landscape architecture today, which is apparently attempting to save the natural world programmatically without adequate tools or the necessary landscape theory. Many reasons explain such shortcomings, which are bound up with a weakened understanding of the symbolic power of landscapes globally. The waning respect for symbolic value, in favor of programmatic functionalism has greatly affected the credibility and scale of landscape operations worldwide with repercussions that are essentially educational, economic, and social. Large engineering offices have taken over the vast environmental planning and management projects that we should be doing, developing ecosystems services to the detriment of design. Moreover, quantitative methodologies and programs inherent to these services have nothing to do with design and the feeling for place. Topology is first and foremost about understanding the aesthetic substrate of a site, and acting where it matters most in nurturing design. It serves as the basis of a more

immanent understanding of landscape in society. It is about combining the technical and the aesthetic elegantly in a physical conception of place, embracing higher social and cultural values that go with it. A point-cloud model is just the starting point of a set of informed physical choices regarding a site, which enable precise "surgical" interventions into a terrain that are based on a long-standing tradition, where art and technique blend into a single elegant topology. The loss of a sense of the whole in a landscape is not due to the world we inhabit, but rather to the methods we employ. This calls for a renewed attention to terrain, and is only possible if a fundamental change of attitude in society happens, and the blind faith in our current methods of design is challenged.

The schism between an originally shared aesthetic appreciation of landscape and a more subjective and interpretive form of observation can be traced back to the Romantics. The "lakists" saw landscapes as the narcissistic embodiment of individual mystical values. Topology could breed a new generation of "cloudists," capable of founding deeper meaning through an informed understanding of landscape past, present, and future. They should remain wary of whimsical and emotive interpretations of nature, and take distance from assertive scientific analysis aimed at describing and prescribing an entire spectrum of landscape environments. A better understanding of the inherent physical appeal of a given site will be gained through proper methods and tools. Topology is based on the meaning of a terrain, not only technically, but also culturally and symbolically, because it relates to the genealogy of place. This leads to a better understanding of landscape, where subjective interpretation and scientific empiricism are subordinated to the reality of given situation. Models used for topology have the advantage of being eminently physical. They are informative and can be filtered for various design purposes, presenting an undistorted 3D representation of the world, which is geo-tagged. The models themselves have little meaning unless they are combined with other fields of knowledge about a place. They are used by engineers for advanced surveying, and are appreciated for their incredible precision. For engineers, they merely depict an existing situation in high resolution and three dimensions, but for the landscape architect, these models have an inherent aesthetic appeal in addition to the actual terrain information they provide.

Work completed over the past decade on an artificial mound in Sigirino, Switzerland for the AlpTransit Company shows how efficiency and precision in topology help define better solutions and answers to questions of environmental aesthetics and integration. Many of us seek sustainability in our designs; in the case of the Sigirino mound, the 3D point-cloud model enabled a piece of environmental "haute couture," where the project became precisely interwoven and confined to the existing mountainous terrain. Extensive data sets made it possible for the landscape architect to determine the exact contact point between the artificially fabricated mound delineated by a gabion drainage line and the steep rocky slopes of the Monte Ferrino with its rivulets, rubble, and cascades. This understanding of the precise physical reality of a terrain enabled a particular approach, which could be termed "topological elegance," where the entire team of landscape architects, environmentalists, and engineers reached a compromise, and agreed on a common solution.

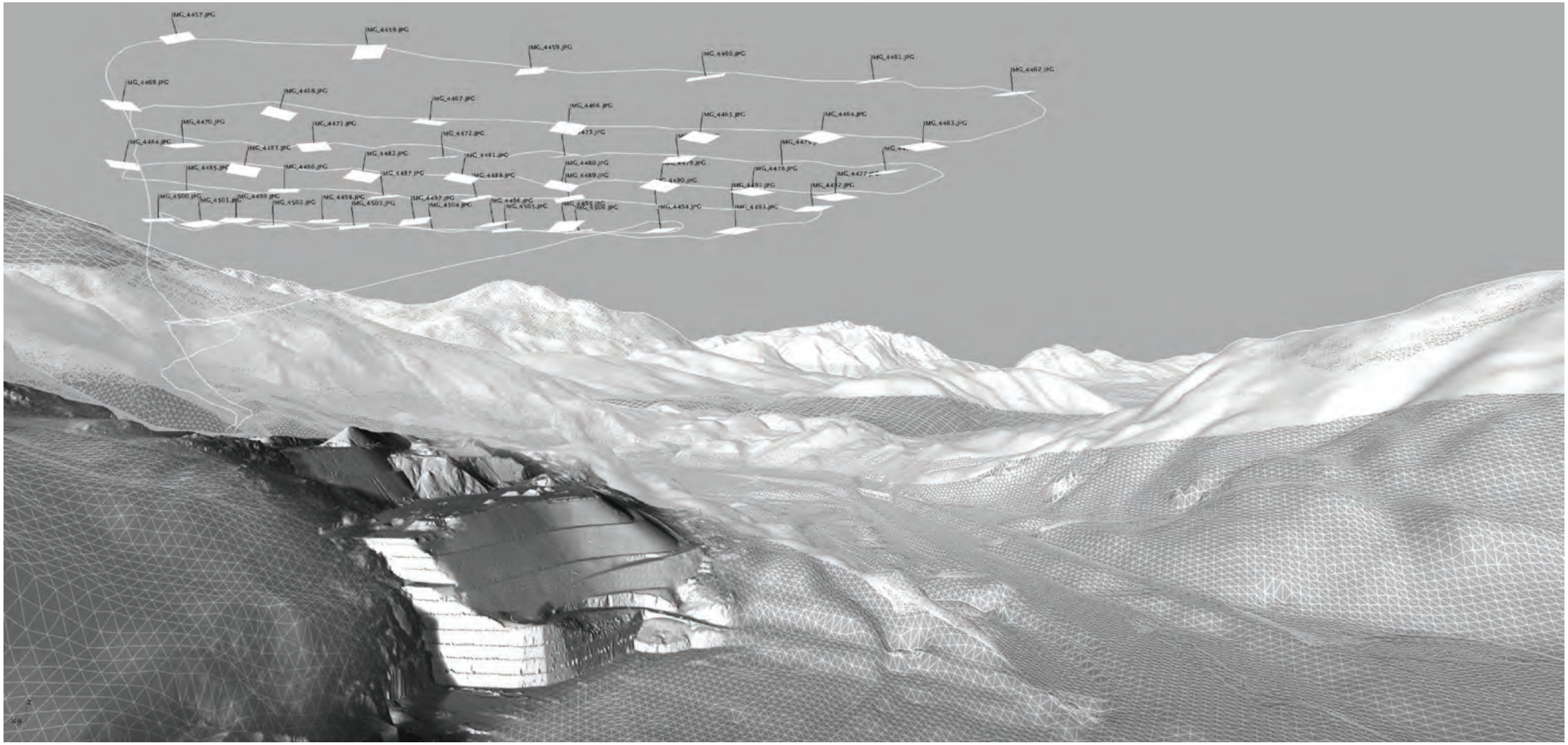
Tools of topology as such do not provide an interpretation of site, but they help assess a given situation very precisely. By focusing on the problem at hand, the situation can be assessed accurately, it is then up to the design team to discuss and determine the appropriate course of action. In the case of the Sigirino mound, verification led to the avoidance of dynamiting mountain rock faces, while linking the project to an existing network of paths and slopes. The form of a landscape project is constantly influenced by the strong physical conditions of a site, and

has to adapt to external conditions. Topology creates a unique design approach that is quite different from the programmatic and analytical methods acclaimed before. Landscape architects can benefit tremendously from surveying and modeling techniques that are usually the privilege of engineers; these can add value to a better design and aesthetic approach to terrain. One can literally visit each rock, each tree, each house on such a point cloud model, placing viewer, the client, the designer at the heart of the landscape and the intended design. We can look at a singular design project as it evolves under a variety of scales and aspects, with a surgical precision that will come to revolutionize the notion of landscape design simulation and participation.

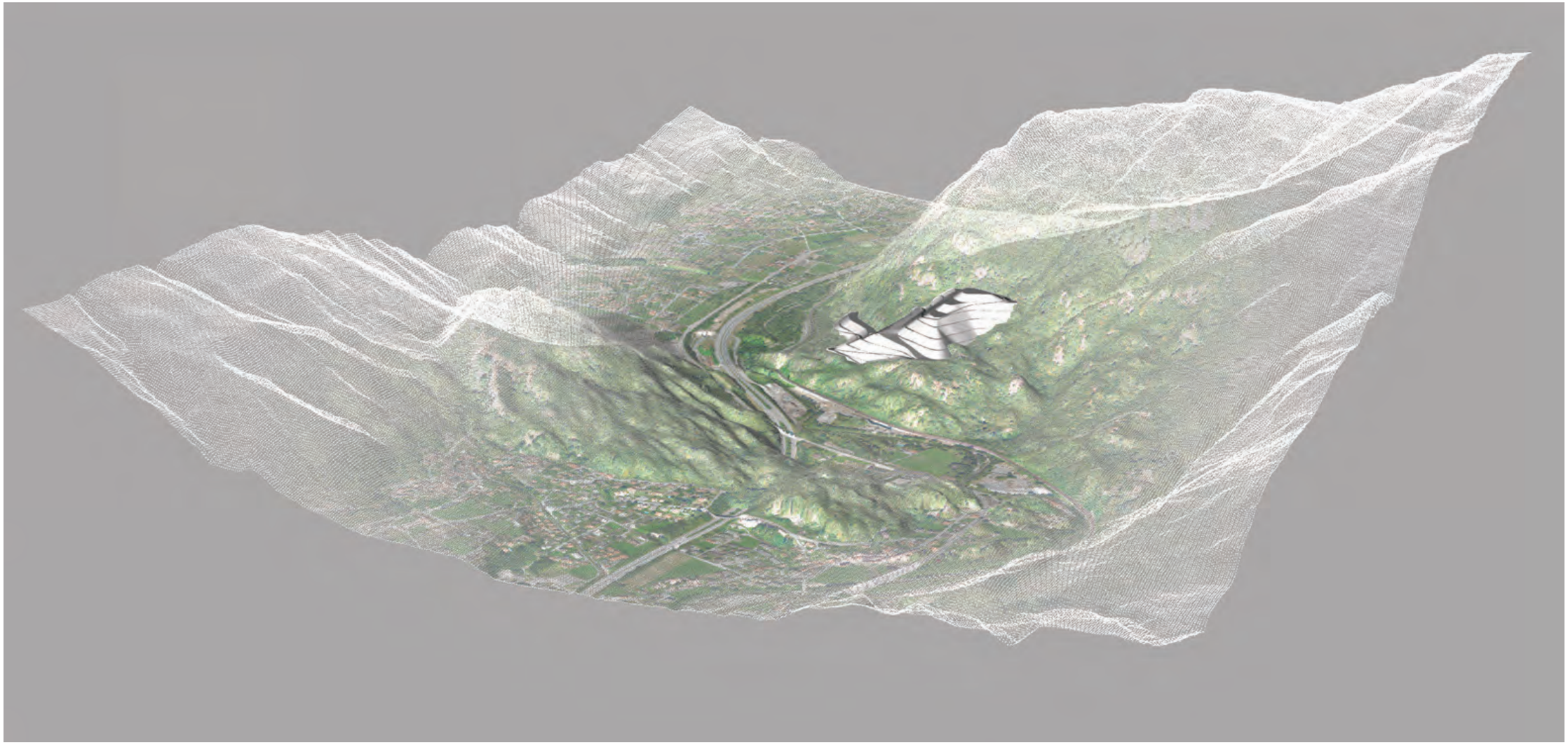
The Other Eye

For centuries, landscapes were considered the product of ideal representations of the world captured within a picture frame. The epitome of such paintings, were the seventeenth-century idealized perspective works by Nicolas Poussin and Claude Lorrain. Earlier perspective studies in the Renaissance focused on building the illusion of pictorial depth through precise proportional triangulation. For this formidable task, the construction of a landscape image always preceded the choice of place. The custom actually goes back to the logic of the *ars topiaria* initiated by the Romans, who drew frescoes illustrating Virgil's *Bucolics* on the walls of their Pompeian atria years before these landscape ideals were ever applied to a garden. To master perspectival illusion in the Renaissance, the rest of the landscape was occluded, while attention was focused on a single point on the horizon. The grand illusion of perspective happened to the detriment of broader aspects in the environment, including the landscape itself, which became seriously distorted around the edges of the picture frame. In Leonardo da Vinci's *Annunciation* or even more so the *Mona Lisa*, the distant landscape warps towards the edge of the frame. (da vinci) We have all grown accustomed to looking at landscapes in a perspectival manner, and it feels almost natural today. However, beautiful landscape vignettes produced by Claude's glass are nothing more than ambient scenery reflected on a dark parabolic mirror. Beyond the immediate charm of this reflection for the beholder, it also stands as the living proof of a tangible perspectival reality. This brings to mind the earlier "Tavoleta" experiment staged by Brunelleschi at the beginning of the fifteenth century, who also used a mirror, which was considered a high-tech product at the time, to reflect a constructed drawing of the Florence Baptistery in perspective. In order to achieve this perspectival epiphany effectively, the beholder needed to literally lie down on his belly at the entrance of the cathedral nave and peek at the Baptistery through a small hole bored in the door on the aforementioned painting. The reflected image confirmed the validity of perspective as an effective mental construct that could be projected onto the world, and the symbolic significance of the observer's prostration in the cathedral nave to attain this revelation was by no means fortuitous. In effect, perspective can detach the subject from the reality of a place for the sake of a projected ideal. Consequently, ideals have had a beautifying but distorting influence upon our gaze over the past five hundred years.

This phenomenon of the idealized gaze could now be counteracted by topology, with an elaborate landscape model preceding any image. This presents a considerable challenge to our conventional way of thinking and designing. The plan, section, and perspective are here to stay, but they can no longer precede the renewed understanding of terrain. If we agree that a model of the existing terrain will supersede the idealized image, it shows the inherent relativity and complexity of landscape transformation. A virtual point cloud terrain model can be applied to landscapes at different scales, viewed relative to several points of view and sets of interest within an overall genealogy of design. The



Drone survey over the Sigirino Depot construction site.



Sigirino Depot project embedded in the digital terrain model.

Visualization of the Sigirino Depot project.

elegance of topology encompasses various landscape forms and artifacts within its present scope, while asserting the potential for possible transformations.

Research in "Landscape Chronology" developed at the Chair shows how past landscape sceneries obtained from photographs and paintings can be effectively embedded into 3D point cloud models. The site of St. Moritz which is consistently documented photographically was chosen as a laboratory for model studies over successive periods of time. Beyond landscape design innovation, these models can also be used to simulate urban growth, and test acoustic phenomena, water, air and snow flow, as well as vegetation over time. Topology is about the primacy of the actual terrain over an idealized vision; and letting a terrain speak in this manner brings something quite new to the discipline. There remains the challenge of how to recover meaning in a landscape with which we have seemingly lost touch. It is precisely the apparent level of abstraction and displacement through the point cloud model that leads to the elegant selection of what matters in a location. In topology, it is the surface of the model in its intricate folds and structure, and not the ideal image that becomes the generative force of design.

French perspective painters were trained by Italian masters, and subsequently influenced the English landscape tradition a century thereafter. The elaborate triangulation behind each picture preceded the setup of the scene and its narrative. Once painted, the scene preceded by several decades the parks and gardens it inspired in England. Think also of Baldassare Lanci's instrument in the Renaissance used for surveying and perspective by Vignola at Villa Lante. The elaborate device was used, quite literally, to project perspective upon an existing hillside. Applied in this instrumental manner, perspective worked perfectly well and gave a majestic illusion of depth in a single direction through the deformation of volumes as they receded from the picture frame into the real space of the garden. The gardens of Vaux le Vicomte, Versailles, and Herrenhausen are perfect examples of further applications of these geometric principles at the scale of a park. The question remains, however, as to how such a perspectival approach employed over the last five hundred years has related back to the rest of the landscape outside of the picture frame, and how this affected the devolution of countless other places. The answer is probably to be found in the grid-like landscape of North America laid out by Thomas Jefferson, or the polder landscapes of North Holland like the Beemster.

The Other Landscape

Picturesque depictions convey meaning to people, both poetically and symbolically, through sets of perspectival conventions, blending optics and mathematics with aesthetics. These meaningful, almost sacred constructs, took centuries of mastery and theory to establish the landscape aesthetic we now revere—such as the great landscapes of Castle Howard, Rousham, and Stowe, and later Central Park and Buttes Chaumont, to name but a few. They show the extraordinary power of idealized landscape perspectives once the mastery of the tools and the theory have been established. The question is not to arraign, nor to replace perspective *per se*, but to understand how it was conceived over time and to reveal the paradox we are part of today. From the point of view of landscape, the perspective system that we have inherited formally prioritizes the image and construct, over the reality of the terrain and model. This is more evident in pseudo-perspectival assemblages, such as photomontages and collages, which emphasize the atmospheric aspects of a landscape of a landscape where an seductive oneiric sense creates scenes that are scarcely believable. Perspective is like a construct that is counterintuitive to normal landscape perception, because it challenges the immediacy of terrain as our gaze pans the land.

The drawing and plan, and even more so the camera image and its multiple derivatives, elude landscape as a whole when it comes to perspective; they provide information about a small scope of terrain that becomes idealized, while the rest remains marginal and ignored. A landscape cannot reduce itself to such a perspectival metonym, or fragment, nor can it cobsist of a set of in-betweens; landscape must encompass a much fuller topological description of the environs. The discrepancy between a perspective image and a site as a whole tends to cripple our apprehension of the world. By entrusting the landscape model with its point clouds, topology yields a renewed sense of the world that subsequently leads towards a renewed sense of aesthetics. When speaking of a model, the cloudist does not brandish the entire spectrum of existing facts about the world, but rather shows an elegant and knowledgeable selection of agents to be considered, shaped, and modified through masterful design. The anticipation of modeling over perspective will bring about a fundamental epistemic shift, whereby the observer will learn to master and appropriate a site in all its *physis*, gaining a deeper sense and conviction about its inherent wholeness, which is both local and specific.

Cultural questions raised by topology are of key importance because they include other forms of knowledge and help cloudists master and differentiate design decisions. They challenge the status quo, but also question the very places that are devoid of such ideals. In this instance, it is the earth itself that "speaks" to us in a meaningful way about all its complexity, history, and structure. The model is not a fac totum, but a measurable constant that refers to distinct points in the world; the cloudist knows that the model and the world will always remain distinct from one another, but through it he will gain a greater mastery and understanding of terrain.

It is precisely this distance between world and subject, that topology questions openly and diachronically. Landscape is the canvas of multiple successive changes, and present-day modeling relates to this culture of change through sets of conventions and signs that eventually enable better choices on the terrain. The point-cloud model shows an abundance of contextual evidence that is at times quite overwhelming, not to say uncomfortable, for most of us who do not master the technique of grading properly. But when it comes to the actual reading and mastering of territorial conditions, topology draws a clear distinction between the tangible reality of a physical terrain model and the evanescent approximation of a photomontage and its eidetic dream. The challenge is to change what has been part of landscape practice over the past decades, presenting a combination of highly abstract programmatic plans, coupled with dreamlike images that simply shortcut any account of the terrain. The established representations of the picturesque relied heavily on an aesthetic theory born from earlier pictorial conventions mastered over previous centuries as an epistemic modality to access the world. The topological model enables the mastery of an entirely different kind of physis, typically non directional and open to a landscape, in its entirety, adding a level of knowledge to a project that will help bridge the gap between terrain and older conventions. In the case of projects like the Sigirino Mound for the AlpTransit Company, the Zimmerman Garden in Brissago, or the River Park at Dordrecht, the images and sections result directly from the mastery of a point-cloud model. Topology learns to master a landscape that is eminently physical and bound to the terrain; it understands first and foremost the rules that apply to a real situation. In that sense, one could oppose the eidetic to the topological, the lakist to the cloudist. The knowledge that topology claims results from local evidence gleaned on-site and considered in all its physical complexity. The new method presents an epistemic challenge, because its mastery necessarily questions the primacy of image over model, and moreover our very own conditioned perspectival sensitivity towards a place. The role reversal between model and image proposed by topology is highly destabilizing, yet very liberating and promising for design; it requires

City and agriculture, Design Studio Dordrecht, The Netherlands.

Urban park, Design Studio Dordrecht, The Netherlands.

Agriculture polder, Design Studio Dordrecht, The Netherlands.

that we question the modalities of aesthetic preconceptions that we have learned to trust for a long time by mastering a physical approach of another kind. Topology can work for landscape architecture in the same way as tectonics did for architecture, mastering the fundamental design aspects of a place through informed modeling and structure. It can can promote new forms of spatial relationships, leading at term to an aesthetic that is not necessarily linked to the ideals of the picturesque, but rather rooted in the gritty reality of today. Topology must first infiltrate the technical and master the elegant enhancement of a landscape *in situ* and *de visu*, before postulating some theory. This mastery is all about returning to the constructive genesis of a place, with a focus on changing physical, temporal, and cultural aspects. Landscape elements can be manipulated physically in such models, or mastered just as they are in all their immanence and purpose. Through topology, design questions and works the model first before reverting to any image. The fact that image follows the model and no longer precedes it harks back to our sedentary origins when the first landscapes were simply drawn with a stick, rope, and chalk directly onto the ambient terrain.

There is a dichotomy between our understanding of landscape in the scientific sense, as a functional normative network of ecological systems, and the existence of a place, as it appears cognitively, poetically, and emotionally for people. Topology operates with elegance at the interface of science and philosophy, combining the reading of layers of history with a mastery of present uses. A point-cloud model offers more holistic truth than a layered plan, although both remain incomplete representations of a world that work in many ways. The difference between topology and palimpsest is essentially epistemic and physical. The palimpsest involves a synthesis of layers, traces, and erasures compressed on the surface of a plan, which are meant to be understood as a two-dimensional representation of different times on the surface of the earth, whereas topology, through a 3D physical model, directly represents

the embodiment of landscape in a much fuller synchronic dimension. Some of our predecessors were already able to operate topologically at a different scale, albeit without reverting to a model, but always keeping the reality of a terrain in check. Lenné worked on a vast but incomplete green ring, embedded in the gritty periphery of Berlin, Olmsted skillfully fought sand dunes behind the Presidio in San Francisco to secure Golden Gate park and the Panhandle, Alphand modeled an idealized landscape with precise contours out of the slums surrounding abandoned gypsum quarries in Paris, and Burle Marx created a previously non-existent beach in Copacabana. Topology is about the mastery of terrain and the creation of timeless landscapes inextricably linked to their respective site, culture, and environment.

The Dordrecht studio, which ran at the ETH in 2011–2012, based its approach on the mastery of highly accurate, virtual terrain models, showing the impact of shifting intertidal waters in the Dutch Delta of South Holland over time. The intertidal zone of Dordrecht, once mastered and modeled, became a virtual laboratory for testing a range of scenarios for high risk flooding. Precise modelling combined with the mastery of terrain grading at ten-centimeter hight intervals made it possible to create simulations of a wide range of landscape futures. The designs were fed directly into the virtual 3D model, which in turn generated new landscapes that merged waterways, urban areas, and agricultural terrain into an entirely new understanding of the Dutch territory. The method, based on the simulation of exact variations in water levels across a very vast territory, helped show possible adaptations to very real flooding threats for South Holland. The use of photomontage was banned in the studio, and students were asked to work on-site directly with sand models in order to remain focused on the physical reality of this sensitive topography—illustrations of the project were generated from the model later only once the landscape had been entirely thought through topologically, mastered

and modeled. Without such precision on the terrain, it would not have been possible to simulate credible flooding scenarios for Dordrecht. Topology is about design in an age of geographic information, where one must master the available tools in order to meet the challenges ahead. This heralds a return to topology, and a better understanding of landscape formation, because although the appearance of a place appears to change, its essential make-up prevails over time. The studio method for Dordrecht showed how precise topological readings could help master the inherent forces at work in a landscape. The elegance of topology relies on the use of powerful indicators that bring a landscape's atavistic qualities to the forefront. In the case of Dordrecht, students mastered the founding blocks of a new Dutch landscape identity that were synonymous with notions of collective effort and trust in the ambient terrain.

The Dordrecht studio was focused on the topological mastery of an extraordinary mosaic of landscape potentials, set within a few meters of sea level. In some cases, the earth was forced to yield to the brute force of water, in others the modulation of terrain would alter its course. River flow and tidal flow shaped sedimentation at specific boundaries that were sometimes designed, sometimes not, which in turn shifted settlement patterns over time. Through the mastery and control of landscape, topology can play a fundamental role in the cultural understanding of this place marked by the memory of past cataclysms such as the St. Elizabeth's Flood of 1421. The patterns of cultivation that were established in polders during the centuries thereafter display the slightest variations in natural sedimentation. This ebb and flow between culture and nature stabilized gradually giving value and purpose to a place that was otherwise in a permanent state of natural flux. Here, the frailty of matter against the power of water is either tangent to the daunting force of flow or nothing. Holland is home to a thousand kinds of flatness, and landscape is its common cultural expression. Landscape, a term that originated in Holland as *Landskip*, is the product of a culture that frames a broader and more meaningful framework of natural signifiers. This topological truth beholds an extraordinary potential and points towards a knowledgeable recovery of terrain in which the sacred meaning of a place is amalgamated with the common banality of ambient circumstances. It shows how people remain in full possession of their land in the face of extreme adversity, turning dejected ordinary moorlands into something collectively remarkable.

The various projects developed in the Dordrecht studio show an elegant set of choices between prosperous agricultural islands, merging from an intertidal wildlife area and a new waterfront city facing the treacherous waters of the Maas. Between the mountain slopes of Switzerland and the moorlands of Holland, we have developed and mastered a range of topologies, adapting the shape of the land to the purpose of radical environmental change, transforming and recreating prosperous communities through a better and more precise feeling for landscape in the fullest sense of the word.