LANDFORM BUILDINGS AND THE FUTURE OF CONSTRUCTED TOPOGRAPHIES

RENÉ C. DAVIDS
Department of Architecture, College of Environmental Design, University of California, Berkeley, USA

ABSTRACT
Innovative technologies, advanced design methodologies, and an increasing demand for improved building performance prompted by widespread concern for degradation of the natural environment have provoked a reconsideration of architecture’s traditional relationship to the ground. In the past, building construction was adjusted as necessary to accommodate challenging terrain, but using advanced modelling technology, contemporary architects now design landform buildings, or landscrapers, which simulate naturally occurring topographic features, including artificial mountains, dramatic geological formations, excavations deep into the earth, vegetated roofs, and landscaped promenades at high elevations walked upon or over. By merging the ground plane and built fabric, new construction can be better integrated with environmentally sensitive sites and reduce resource consumption. Rather than merely follow topographic contours or occupy a given site, landform buildings can provide its replacement. This paper will examine how landform buildings utilize properties usually associated with the natural environment such as continuity with surrounding topography, weathering, contextual integration above and below ground, and programmatic indeterminacy to achieve unique expressions of local, regional, or national identity, improving their surroundings, enhancing their experiential potential and advancing architectural practice.

Keywords: landform building, landform, topography, landscape architecture, constructed landscape, landscaper, environmental architecture, sustainable architecture.

1 INTRODUCTION
In their analysis of what they referred to as the International Style, Henry-Russell Hitchcock and Philip Johnson reinforced historic distinctions between architecture and landscape design, arguing that the natural conditions of the site constitute a pristine entity best left untouched by architects and invoking the myth of the “natural” landscape as the ideal setting for modern buildings: “As far as possible, the original beauties of the site should be preserved. Mere open spaces are not enough for repose; something of the ease and grace of untouched nature is needed as well” [1]. While he did not design underground buildings, the architect Frank Lloyd Wright defined organic architecture as the reinterpretation of nature’s principles resulting in more natural forms that better integrated buildings with their surroundings; his Falling Water house (1939) in Mill Run, Pennsylvania is the most celebrated example. Similarly, the work of Alvar Aalto and Elissa Aalto adapted buildings, such as the Säynätsalo Town Hall (1952) to the regional landscape of Finland. In his seminal work Architecture Without Architects, Bernard Rudofsky wrote: “The untutored builders in space and time demonstrate an admirable talent for fitting their buildings into the natural surroundings … Instead of trying to ‘conquer’ nature, as we do, they welcome the vagaries of climate and the challenge of topography … to fit their buildings in”; he could hardly have imagined that rather than fit architecture into the land, some contemporary architects would seek to construct buildings that emerged as topographic replacements [2]. The Earthworks sculpture movement that emerged in the 1960s and gained in popularity and influence throughout the following decade expanded the boundaries of what could be considered sculpture in terms of scale and materials, eventually exerting a strong influence on the environmental arts. Green roofs, artificial mountains, geological forms carved into the earth
or emerging from it, buildings walked upon and over, are increasingly prominent in contemporary architecture [3, p. 20].

New technologies and design techniques as well as a demand for enhanced environmental performance have provoked a reconsideration of architecture’s traditional relationship to the ground. Some of today’s most innovative buildings no longer merely occupy a given site but rather reconstruct the site itself [3, p. 40]. In his book, *Landscrapers: Building with the Land*, critic Aaron Betsky heralded the unfolding of land as the excavation of a visionary and buried utopia [4]. In *Groundwork, Between Landscape and Architecture*, Diana Balmori and Joel Sanders attributed the new way of thinking and working since the turn of the 21st century to “a more nuanced understanding of the complex interplay between human nature and technology” [5, pp. 30–31] that rejects “the false dichotomy between buildings and landscapes” [5, p. 8]. Architects Stan Allen and Mark McQuade examined the many ways in which landscape effects are manifest in architecture today, not as cross disciplinary phenomena involving architects working on the landscape but as “new design techniques, formal strategies, and technical problems within architecture itself” [3, p. 30]. Historian Richard Ingersoll believed a palpable fear that the biosphere was in mortal danger led architects to treat their buildings as landscapes by returning them to the earth and using local materials [6].

A related advantage of buildings which merge with their sites is that substantial energy savings are possible. In a typical above-ground construction, energy is wasted by cycles of heating and cooling, but by reducing heat transfer to and from their surroundings, earth-sheltered buildings require less energy to maintain comfortable living conditions as unwanted infiltration losses are practically eliminated in earth-covered construction [7]. Underground or semi-underground dwellings have provided shelter for millennia in challenging landscapes and climates, often in the form of intricate networks of subterranean dwellings, and more recently for utilitarian buildings such as carparks and shopping malls [8]. Current efforts to reduce energy consumption and the amount of land used for building are motivated by popular concern regarding excessive use of non-renewable raw materials and fossil fuels and the increasing pace of deforestation to clear land for agriculture have increased the focus on the role buildings might play in addressing environmental challenges [9]. As opposed to typical green roofs installed at high elevations, the surfaces of landform buildings can create a physical continuity with their surroundings, making them directly accessible to the public, as well as provide opportunities to incorporate recreational or functional enhancements [10].

2 LANDFORM BUILDINGS

For many contemporary architects, the landscape is no longer a soothing naturalistic background for geometrically pristine buildings [11] but a landscape/architecture hybrid that effectively blends the natural and the synthetic [5, p. 31]. The most important influence on the development of landform buildings has been the availability of new digital technologies that allowed architects to explore the design of fluid organic forms and engineers to calculate complicated stresses while simulating the effects of active forces on natural forms. The Yokohama International Port Terminal designed by the Foreign Office of Architecture (FOA) (2002) is one of the first and probably the most influential landform building to make use of the new technologies, a realization of an architecture invested with landscape techniques operative at the scale of a building (Fig. 1). Yokohama is nothing if not a constructed landscape: the terminal lacks the traditional vertical building walls, substituting a formal language of warped and folded surfaces that suggests an abstract cave-like geology with fluid exterior and interior boundaries, an artificial topography built on a perfectly proportioned podium that could sit anywhere [12].
Arguably one of the most important tasks of landscape architecture design and by extension landform buildings is to highlight the natural features of a site, a difficult task, as buildings that aim to merge with or replace the landscape forfeit opportunities to establish their identity through subtle contrasts and counterpoint. The Olympic Sculpture Park in Seattle, Washington (2007) by architects Weiss/Manfredi exploits the 40-ft drop in elevation from the top of the site to the water’s edge to re-establish the original slope, removed by the installation of transportation infrastructure. The main pedestrian route through the site begins at an exhibition pavilion that integrates with the contours of the park and descends zig zagging as each segment of the path opens to different views of the highways, the Olympic Mountains, the city, port, and a newly created beach, successfully merging architecture, infrastructure, and landscape, with the notable exception of the gallery interior which is not influenced by landscape architecture design [13].

Architect Toyo Ito’s Grin Grin Central Park (2005) built on a manmade island in Hakata Bay off the coast of Fukuoka, Japan consists of three greenhouse pavilions with a continuous rippling roof structure of undulating ellipses that appear to be lagoons surrounded by grass. Pedestrian walkways snaking above and below the roof structure create an artificial topography that provides a counterpoint to the flatness of the artificial island. While Toyo Ito’s building by being submerged into the ground integrates well with its surrounding landscape, other landform buildings are less successful. Historian William Curtis wrote that Peter Eisenman’s City of Culture in Galicia, Spain (2014), promoted for its topographical sensitivity, is an ungainly mass with little relationship to its surroundings that required the complete decapitation of Monte Gaias and the removal of millions of cubic metres of soil from the mountaintop to construct a profile suggestive of rolling hills [14]. Situated on an informal hillside neighbourhood in Medellín, Colombia, the Biblioteca de España (2007) represents a much more successful attempt to merge with the hillside topography. Designed by Colombian architect Giancarlo Mazzanti, the library consists of three interconnected buildings that resemble strange geological monoliths on a hillside platform, each with a different program – library, auditorium, training rooms – covered with dark stone tiles, and perforated with numerous small windows so that they shine like beacons at night [15]. Both Eisenman’s City of Culture and the Biblioteca España resemble landforms at a distance, an illusion that disappears on closer inspection. A more easily recognizable landform from far
and near is the Oslo Opera House (2007) situated on Oslo’s harbourfront, designed by Snøhetta in the form of an iceberg, although its interior is not in any way suggestive of an iceberg [16] (Fig. 2).

![Oslo Opera, Snøhetta Architects. (Source: Author.)](image)

A more abstract version of a natural form is the Mountain Dwellings project in the Ørestad district of Copenhagen, Denmark (2008) designed by the Bjarke Ingels Group (BIG) in collaboration with JDS Architects (Fig. 3). Stepped dwellings slope towards an adjacent suburb with roof gardens and terraces oriented towards the sun. Built over a parking structure, the apartments can be reached individually by car as if they were suburban houses while pedestrians use an inclined elevator. Two exterior steel stairs also ascend, merge, then climb higher, offering expanded city views, an experience that might be available in a natural setting [17]. While the parking arrangement is spatially spectacular, the building itself is more reminiscent of the clusters of dwellings built on hillsides all along the Mediterranean coast than a mountain.

At the opposite end of the spectrum is the Vanke Centre Horizontal Skyscraper (2009) in Shenzhen, China designed by Steven Holl Architects for a real estate company which while built over a landscaped garden, itself bears no resemblance to a landscape, artificial or otherwise. The building contains compartmentalized programs, including apartments, a hotel, and the head offices of Vanke, grouped together in a linear bar raised on eight white glass columns, so that the ground floor is at the same height as the third floor of most typical commercial buildings, leaving a minimal footprint on the landscape of large-planted mounds, sunken gardens, courtyards, and ponds. While small portions of the program are below grade level and help to give the ground plane its strong presence, the building does not merge with the landscape and has no interior features within that are inspired by it [19]. As was sometimes the case with early Modernist works, the Vanke Centre exemplifies a landscape architecture that does not compete with the buildings but is complementary to the extent that the design would be incomplete without it. By not merging with its surroundings, the Vanke Centre illustrates the difficulty in defining landform buildings as such, and the narrow
expressive range available for landscape practice to inform landform architecture. In many cases the landform is a formal imitation or abstraction of a landscape rather than an attempt to integrate the architecture with nature, thus reinforcing rather than overcoming what Sanders and Balmori describe as the false dichotomy between buildings and landscapes.

3 EXPANDING THE SYNTAX

Among the many essays focused on the relationships between architecture and landscape, one by historian Marc Treib identifies three types: structures that merge, oppose, or synthesize the natural and the man made, yielding a perceptual ambiguity between the identities of each, the precise nature of which is dynamic, seeming to fluctuate under differing environmental or temporal conditions [20]. A linear graphic of possible construction to natural site relationships might indicate merger or synthesis, at least as an aspiration, at one end and opposition at the other. Perhaps the Vanke Centre could be considered a fourth category as it establishes a relationship of affinity and simultaneous distinction between building and an artificial topography.

Within Treib’s classification, landform buildings would qualify as structures aiming to merge architecture and landscape, as the default paradigm for landform buildings tend to be natural features such as mounds, hills, and mountains which, if hollowed out, could conceivably become interiors, but exclusive focus on these most conspicuous forms misses the complexity and diversity of other landscapes. Architect Tadao Ando’s Chichu Art Museum at Naoshima Island in Japan (2004) has a small although powerful presence on the site’s surface as it was built mostly underground to avoid interfering with the beauty of the Naoshima landscape (Fig. 4). It was also a manifestation of Ando’s desire to return to what he perceives as the origin of architecture and contemplate light from the realm of darkness.

Figure 3: Mountain Dwellings, Bjarke Ingels Group. (Source: Author.)
with the exclusive use of natural light to illuminate many of the exhibits. The unimposing entrance, just a gash on the hill, leads to a passage that opens to a square courtyard with a view of the sky, planted with long grasses that sway gently in the breeze. A more surprising feature is the concrete passageway leading to the museum’s interior that is surrounded by walls tilted at an angle of 6°, according to Ando, “to give visitors the feeling that they are going into the earth, perhaps to its very centre” [21]. A light channel below the massive concrete walls gives the eerie impression that they are floating. The overall structure of the museum consists of an entrance and a gallery wing – the former a square structure and the latter a triangular sunken court – connected by a trench-like channel [22]. The restaurant at the end of the gallery tour offers the museum’s only conventional relationship to the exterior, with magnificent views of Naoshima’s landscape through a large vertical window. An aerial photograph of the museum shows the geometric shapes of the courtyards and skylights as sculptures in the landscape, appearing disconnected from each other on the surface but linked underground.

![Aerial Photograph of Chichu Art Museum](Image)

**Figure 4:** Chichu Art Museum, Tadao Ando Architects. (*Source: Mitsuo Matsuoko.*)

The museum was intended to be visited with light as a guide. Ando elaborates that his desire to navigate the relationship between light and dark comes from a personal drive: “I have been looking for my own ‘matrix of space’, which in my imagination is an obscure place like a cave surrounded by thick, heavy walls of earth, or a space in the darkness lit only with a dim ray of light” [23].

As historian David Leatherbarrow points out, architecture offers more permanent imagery than landscape. Unlike the fixed, geometrically precise apertures of the Chichu Museum, the seasonal cycles of blooming trees, leaves changing colours, and barren branches are familiar
spectacles, but in architecture changes of surface colours or textures are seen as problematic, suggestive of deterioration and a compromise of its fundamental role as protection from the elements. An architecture that could be identified as merging with the landscape might use materials that reflect passing of time through processes of decay such as corrosion and oxidation, or the integration of natural phenomena such as water and vegetation, all effects that unless carefully controlled can compromise a building’s useful life, but do not necessarily preclude realization [24]. Carlo Scarpa’s Querini Sempalia in Venice famously allows water from the canal to flood the building during high tide and light reflected from the water’s surface onto its walls and ceilings produces the sort of dramatic change in atmosphere typically associated with landscapes rather than buildings. For Scarpa, water was an unsettling force – a medium mediating between the solidity of the earth and the ever-changing sky. Water is at once reliable and volatile: present like the earth, but in constant flux like the sky. An aqueous quality pervades Querini Stampalia as the floor that wraps up the sides of the wall undermines the sense of solid ground, situating the space within the rhythmic ebb and flow of the tide. While great care is usually taken in architectural design to ensure that no water penetrates a building’s protective envelope, water’s presence in the landscape generates renewal rather than destruction and Querini Sempalia exists as a sturdy kind of tidepool [25]. The studio by architects Herzog and de Meuron for Swiss Painter Rémy Zaugg in Mulhouse, France allows rainwater mixed with mineral deposits from the building’s roof to wash down over its concrete walls, staining them to create a record of the process and as they accumulate, a beautiful abstract painting [26].

4 CASE STUDIES
The more interesting and potent examples of buildings as landscapes are those that find multiple ways to derive inspiration from it. The landscape around Barcelona, Spain has traditionally been regarded as symbolic of its distinctive regional and cultural identity and independence, a focal point for the nation of Catalonia, as well as a source of inspiration for some of its buildings. Located roughly 60 km southwest of Barcelona, the multi-peak mountain range of Montserrat and its extensive honeycomb of caves became the symbol par excellence of the Catalan homeland, exerting an intellectual influence on artists and architects through the Renaixença, a cultural movement promoted by its influential bourgeoisie during the last quarter of the nineteenth century: “Catalan mentality was forged in the mountains. We cannot overlook the fact that the human and spiritual resources of this country were to be found in mountainous areas and that the creators of the historical Catalan personality were all mountain men” [27]. In 1900, when industrialist Eusebi Güell commissioned architect Antoni Gaudí, both of whom were Catalan nationalists and devout Catholics, to design a residential suburb on the slopes of the Muntanya Pelada, they drew inspiration from the intricate caves and serrated profiles of the Montserrat mountain peaks [28]. The new development, named Park Güell, was to consist of 60 triangular plots of land for residential buildings that would take advantage of favourable sun orientation and splendid views of the city and sea. As work on the park commenced, prehistoric fossils were found in the numerous small caves during the initial excavation, which later became associated with biblical cataclysms, supporting the notion of scared ground for the new centre of Catalan culture [29, p. 161]. After the development failed to attract buyers and only two houses were built, it became a municipal park in 1923.

The main access to Park Güell leads to a hypostyle hall that was intended to be a market for its residents, with 86 Doric columns supporting a large esplanade situated directly above them that were also used to collect rainwater channelled into a cistern below the market for use in the park. The space between the columns is spanned by domes partitioned with
spherical caps. Like a hybrid between an Hellenic temple and a vast cavern, the hall’s dark interior contrasts with the expansive open esplanade above it surrounded by a combination of balustrades and benches covered in mosaics [30]. At the summit of the Park Güell hill, negotiated using grotto-like bridges and viaducts surfaced or studded with various rough stones suggestive of the mountain caves of Montserrat, are three rustic stone crosses representing Calvary or Golgotha, the place where Christ was crucified, and within it is a large cavern where iron ore was once mined. The park’s paved surfaces as well as its eccentric roof profiles can also be perceived as interpretations of the Montserrat mountain peaks, eroded by wind and rain. The fourth viaduct is perhaps the most evocative of this style, its concave wall set into the ground in the form of an ocean wave supported with inclined buttressing columns, creating a space that suggests a perforated tunnel straddling the interior and the earth’s surface (Fig. 5). Gaudi’s reverence for the subterranean was influenced by the nineteenth century preoccupation with grottoes, as well as the Catholic revival’s fascination with hermit caves [29, p. 147]. Park Güell’s bridges resemble both sacred grottoes and primitive buildings, influences apparent in the rough, startlingly archaic stonework applied to the columns [29, p. 147]. For some, Gaudi’s architecture was a whimsical variant of Art Nouveau; for Nikolaus Pevsner, it was an eccentric Pyrenean interpretation of Medieval and Baroque buildings [31]. Filmmaker Alfred Hitchcock described the park as having “a strange biological plasticity [that] turns structures into malleable masses as in some Gulliverian dream of vegetable or animal elements grown to monumental size” [32]. Beyond its intellectual origins and surreal appearance, Park Güell is like a topographical promenade that winds in and out of the earth, revealing surprising textures and creating formal spectacles up and down the slopes of Muntanya Pelada.

Figure 5: Montserrat Caves (left); and Park Güell Arcade (right). (Source: Author.)

A related conceptual voyage featuring excavated areas is the Igualada Cemetery (1994) designed by Enric Miralles and Carme Pinós, the winning design of a competition held in 1985 for a site on the perimeter of the town of Igualada, 65 km west of Barcelona and 20 km west of Montserrat. Situated between an industrial zone and the growing areas surrounding the town, the cemetery is located on a downward sloping site that meets Riera d’Ódena, a stream bordering its east and north sides. After the paved oval entry, a double wall with modular concrete panels creates unique shade patterns to the northeast and hides two unfinished subterranean buildings: a biopsy laboratory that features an imposing, sinuous, curvilinear wall, and a triangular funeral chapel. The triangular form of the chapel has two of its corners truncated to allow access for vehicle parking during funerals. The chapel interior is spare, and lighting is limited to linear incisions in the ceiling, producing a mysterious effect (Fig. 6). While nineteenth and twentieth century Spanish cemeteries such as the Cementerio de la Almudena in Madrid and the previous Igualada Cemetery feature centrally located chapels, the new nearly hidden Igualada Cemetery chapel suggests a return to early Christian catacombs buried in the earth.
South of the chapel is an abstract sculpture composed of Corten steel poles resembling the crosses of Calvary at the entrance to a processional pathway. The exterior path of wooden planks embedded in the ground surrounding the main portion of the cemetery is lined with concrete retaining walls containing *loculi*, individual mausoleum-like burial chambers common in Latin countries, capped by a cantilevered half-vault forms that obstruct views of the surrounding landscape; the excavated path is what Dennis Dollens terms a “first-degree boundary”, the threshold between a created and existing landscape [33]. The walls resemble the land art sculpture Double Negative (1969), built by earthwork artist Michael Heizer in the Moapa Valley on Mormon Mesa in Utah. The form of the half-vaults is reinforced by the canopies of trees planted on the pathway, creating the appearance of a cylindrical space leading to an oval-shaped terminal plaza that dramatically reveals the sky, surrounded by gabion walls faced with cast iron partitions covering the entrances to family mausoleums that metaphorically represent the final journey into the earth [34]. The metaphors of permanence are represented by excavations into the ground, the gabion stones, the modular concrete paving and niches, tangible, earthly materials juxtaposed with the ever-present reminders of death and of the fragility of human life [35]. Perhaps it was this juxtaposition that led Miralles and Pinós to choose the assertively industrial materials rather than fabricated rock formations as Gaudi had done at Park Güell. The architects did not want to express the perfection implied by machine manufacturing in their work but to mark the effects of the passing of time with aged concrete, rusted Corten steel, cracked wooden railway ties set into the ground, and the assortment of rough stones collected in the gabion walls. These textures, together with the underground spaces, cavern-like passages between levels, sloped walls, and general spatial dynamism are similar both to Park Güell and the Montserrat caves. Miralles and Pinós
certainly admired Park Güell and Gaudi’s creative manipulation of water, shadows, and movement, as well as his notion of a completely permeable earth and transparent ground. All three architects – Gaudí, Miralles and Pinós – understood that incorporating geological elements into architecture was essential when merging buildings with excavated ground [36].

5 CONCLUSION
While typical landform building are contrived to resemble hollowed out landscape features such as mounds, hills, and mountains, even when successful on its own terms, this approach misses other opportunities to enhance the architectural experience by employing attributes primarily identified with the natural environment such as visible traces of passing time, integration with larger spatial constructs, interconnections above and below ground, programmatic indeterminacy, and the unique, site-specific expressions of local, regional, or national identity. Rather than merely occupy a given plot of earth, innovative landform buildings can provide its replacement, merging ground plane and built fabric, to provide opportunities for recovery of the space typically occupied by buildings alone, as well as reductions in resource consumption. The work of Gaudí and Miralles/Pinos shows that landform buildings can be fully integrated with the landscape without necessarily mimicking its appearance, and the incorporation of a larger range of attributes characteristic of landscape practice can produce a richer, more diversified architectural experience.

REFERENCES


[28] Viotti Fernandes, L., Gaudi and the establishment of Catalan cultural identity. [https://www.academia.edu/39357533/Gaud%C3%AD_and_the_Establishment_of_Catalan_Cultural_Identity](https://www.academia.edu/39357533/Gaud%C3%AD_and_the_Establishment_of_Catalan_Cultural_Identity).


