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RECLAIMING PLANT ARCHITECTURE

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Plants take root in the earth and grow from there. A building does the same, growing out of its plan. But the analogy goes even further since the plant is also an architectural program. Analyzing the case of the water treatment plant in Los Angeles, USA, this text explores the multiple and unexpected relationships between plants and architecture and, even, the architecture of plants.

Architecture was once a plant. By this I do not only refer to the grasslands and savannas that sheltered early *homo sapiens* or the trees used in the construction of so-called primitive huts. Nor do I refer only to the logic of wood and vegetal construction that is embedded in the forms and figures of Egyptian and Greek temples and that serve as protagonists in the prevailing narratives of the evolution of Western building. Rather, I also refer to the more limited and specific plants that importantly, although often without

credit or name, structure the modern professional practice of architecture.

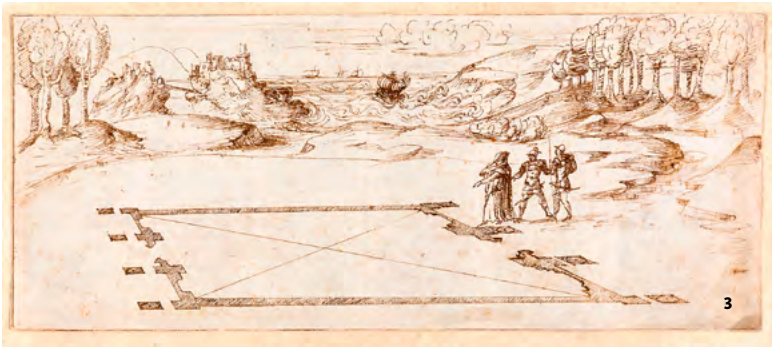
When the shape of architectural practice started to emerge in the fifteenth century, one of the first signs was instructions directing architects to begin with the plan and to introduce the plan to the ground – plans were often literally drawn directly into the soil.[1] For early modern architects, new buildings and living organisms, like young trees and seedlings, were implanted in the earth because that was where they were understood to grow and propagate. By the time, in other words, that the Latin word *planta* (a sprout, shoot or twig) had become *pianta* (the architectural plan in the writings of Alberti and also the common modern Italian word for living flora), architecture did not only use plants as building material or represent them, but was itself a plant.[2]

This identification between plant life and architecture, however, required a simultaneous and radical cleavage as living things embedded in the ground were removed, often brutally through the totalizing and sudden clearing of a site, when a planned building took root. In other words, the emergence of the concept of the architectural plan – the a priori image of what a completed building will do to the surface of the earth in anticipation of its construction – is predicated on the multiple forms of abstraction that interpolated into what we now call the discipline of architecture: not only the hierarchy that privileges architecture – structures that are planned – over buildings – structures that occur – but also one that elevates certain life forms over others, with humans clearly at the top and plants at the bottom. Once severed from the projective act of planning, plants were no longer associated with beginnings, but with the abject dirt of the ground.

Examining the many and varied effects of this aporia embedded within the architectural plant has much to contribute to the increasing efforts to understand

1 Jardines de Hokkaido en la Planta de Recuperación de Agua Donald C. Tillman- Hokkaido's garden at the Donald C. Tillman Water Reclamation Plant. ©Sylvia Lavin.

2 DMJM, Planta de Recuperación de Agua Donald C. Tillman, 1984. DMJM, Donald C. Tillman Water Reclamation Plant, 1984. ©Sylvia Lavin



3 Círculo de la familia Sangallo, Ilustración para Vitruvio, *Libro III*, Capítulo 2, c. 1540-1560. Lápiz y tinta marrón oscura sobre papel verjurado, 150×250 mm. Cortesía de Drawing Matter. Circle of the Sangallo Family, Illustration to Vitruvius *Book III*, Chapter 2, c. 1540–1560. Pen and dark brown ink on laid paper, 150 × 250 mm. Courtesy of Drawing Matter. Public Domain

4 Giovanni Battista Piranesi, *Vista del Templo Octogonal de Minerva Medica*, 1764. Giovanni Battista Piranesi, *View of the Octagonal Temple of Minerva Medica*, 1764. Public Domain

architecture's role in the creation of the current state of the environment, as well as in identifying what role architecture might play in the design of its future. For example, during the mid-19th century, the interface between plants and architecture shifted from the ground plan to the buildings and systems that carried out industrial processes.[3] Just as oxygen was by then widely understood to be generated by plants through the process of photosynthesis, coal, steel, electricity, and eventually water were also all generated by architectural plants. Manufactured resources were subsequently turned into consumer goods in places called factories, a term that initially referred to sites of commodity exchange in 'foreign' places. Plants, in other words, were site specific, while factories deterritorialized matter, increasingly in the service of colonial expansion.

Although the two words ultimately became almost interchangeable in common speech, factories became the object of much more architectural interest, demonstrated through the often highly elaborated drawings made by architects. These drawings, like the structures themselves, were often designed to spectacularize the deracination and mobilization of materials that made it possible for consumer goods to travel. Plants, conversely, like the organisms removed to produce the plan, rarely received much consideration from architects and were more likely to be photographed and documented while active, rather than drawn in advance.[4] Tied as they were to local ground and to yielding products not yet ready for direct consumption, plants were little tended to by architects, left to the equally abject category of infrastructure and mechanical systems of representation until well into the 20th century.

Architectural historians are actively working to shift attention away from architectural authorship and towards the study of climate change, yet the risk of confirming the human subject as privileged within and central to the built environment remains.[5] Strategies that address non-human actors and conceive of non-sentient lifeforms as active historical agents have demonstrated enormous potential to reduce this risk, for both historians and architects as well. More, however, can be done to bring plants to bear on these developments,

both because of the specific role environmental humanists have identified that plants play in the forms of image production that are essential to architectural practice, as well as the fact that plants are important building materials.[6] To this end, it is most provocative to ask not what architects did to plants, but if and how plants used their points of contact with architects – through architectural drawings and the ways in which architects adapted plant-based models of resource processing – to increase their own chances of survival.[7]

Plants of various kinds frequently sprout up in architectural drawings in ways that accustomed architects and patrons to seeing them in unexpected places, and therefore reduced the risk of their removal. Piranesi's drawings, for example, did much to "naturalize" the idea that plants could live in ruins, turning the Temple of Minerva into a romantic habitat rather than a terrain that needed to be rid of invasive intruders. During the mid-19th century, trees used their capacity to process oxygen to establish vast new forests in cities and alongside the industrial machinery that first put them at risk.[8] Indeed, the oldest surviving photograph depicts not only the arrival of modern urbanization, but provides evidence of the fact that trees were among the earliest metropolitan inhabitants. While their capacity to be mechanically productive was most important to their survival during the 19th century, after World War II, the capacity of plants to process data and calculate paths of survival and structural efficiency, ones that relied less on industrialized maintenance systems than on renewable energy and adaptive responses like the sun or branching, became more essential.[9] Today, whole trees are an advanced building technology not only because they are sustainable but because they are pre-engineered.[10] Exploring these most recent but least studied and information-based chapter in the history of plant architecture could redirect the ways in which architects intersect with the environment by suggesting new modes of collaboration between them.

On the one hand, the history of plant architecture can be described in broad strokes according to the intersections among epistemic, ecological, and socio-political conditions at various stages of modernization. On the other, the dynamic exchanges between these factors are most visible in the context of specific plant forms read in relation to the precise historical shaping of their growth. During the 1970s in Southern California, for example, extreme environmental challenges, pervasive media and cultural attention,

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and the development of urban ecology by way of information processing systems all converged. The UCLA Urban Simulation Lab, which was founded in the late 1960s, the publication of both Barry Commoner's *The Closing Circle* and Reyner Banham's *Los Angeles: The Architecture of Four Ecologies* in 1971, as well as Roman Polanski's *Chinatown* of 1974, all focused on LA as a case study of the social and economic impact of environmental change. The broadly ecological discourses such artifacts provoked and reflected constitute the cultural context in which the Environmental Protection Agency (EPA) Clean Water Act of 1972 was received by architects and translated into new ways of planting buildings, processing resources, and calculating the 'nature' of design.[11]

While the lack of water and the politics of its importation and distribution in the city are well known problems, the polluting effects of too much wastewater was the first water-related issue in Los Angeles to run afoul of the EPA. The city was dumping more raw sewage into the ocean than new Federal laws permitted. This led to the proposal to add a new water reclamation plant to the city's grossly over-taxed water infrastructure that would reduce the amount of dumping in the ocean by cleaning sewage enough that it could be put back into the earth via agriculture.[12] Donald Tillman, a Cal Tech educated, World War II Navy vet who was appointed city engineer in 1972, worked for a decade to win almost seventy million dollars from the EPA to build the wastewater treatment plant that would eventually bear his name.[13] He sought to include the most advanced available purification technologies as well as research activities with the goal of eventually finding ways of returning reclaimed sewage into the groundwater for direct human consumption.

The fundamental purpose of the plant, in other words, was less to diminish the causes of environmental degradation than it was to facilitate further urban development. As a result, Tillman understood that the plant would need to do more than purify water: it would also need to convince Angelinos that reclaimed water was clean enough to enter the human food chain and mitigate the odor effects of human waste it would off-gas into the rapidly densifying San Fernando Valley. Tillman's solution was to add to the extensive territory required for the water reclamation process a Japanese aroma garden irrigated with reclaimed water as proof of concept, as well as a visitor's center designed not by city engineers but by an architect. At significant extra cost to the city, the plant was to be simultaneously dramatic enough to attract visitors – despite its difficult-to-find location inside a military base – exuberant enough in its techno-aesthetic to build confidence in novel environmental technologies, and pacifying enough to ease anxiety about the need for humans to consume their own waste.[14] The result was an unprecedented effort to harness the resources of the military, industrial, academic complex in order to mobilize architecture to mediate the ecological impact of unsustainable

development and mitigate the kinds of human behaviors now understood to drive climate change.

Anthony Lumsden, head designer at Daniel, Mann, Johnson & Mendenhall (DMJM), a Los Angeles-based corporate architecture firm founded in 1946, considered The Tillman Water Reclamation Plant his best work.[15] Although the engineering press had reservations about the "fancy design [that] was used to win federal and community acceptance," the architectural press immediately acclaimed the poured-in-place and precast concrete structure that was sheathed by an aluminum and glass membrane, projected asymmetrically on one side, and hovered within an artificial lake (N/A, 1984).[16] Visitors approach the long, narrow building through an open-air barrel vaulted portico and move into a viewing tube delimited on one side by a curved glass skin that turns towards the lake. In what critics described as a rare use of "metaphor" in Lumsden's work, exposed spokes on the interior suggest a cascade and the water wheels that once powered American industry. Stepped concrete planters, fountains, and irregularly placed terraces on the exterior of this tube lead to a sunken "blind," eye level with the lake's surface.

The material and non-directional organization of this area link the project both to what has been called the "environmental" logic of Kevin Roche's Oakland Museum, for which Lumsden served as project architect, as well as to environmental fountains designed by Lawrence Halprin in Seattle and Portland.[17] At the end of the tube, long concrete paths and bridges lead to a viewing platform elevated above the administration and laboratory wing at the building's rear, offering an unobstructed view of the reclamation plant beyond. There, a field of variously earth-toned rectangular pools framed by an extensive network of brightly colored pipes are carefully monitored by humans to assure that the combined effects of gravity, sun, and water animation work to support microbial life as it

5 Planta de Recuperación de Agua Donald C. Tillman, diseñada por DMJM, *en Start Trek: The Next Generation* (1987) como el escenario de Rubicun III, un planeta caracterizado por abundantes atmósferas superficiales a base de agua, nitrógeno y oxígeno, y la capacidad de soportar vida vegetal y animal a base de carbono, incluida una especie humanoide alegre, amante del sexo libre, llamada Edo.
The Donald C. Tillman Water Reclamation Plant, designed by DMJM, in *Start Trek: The Next Generation* (1987) as the setting of Rubicun III, a planet characterized by abundant surface water, nitrogen and oxygen-based atmospheres, and the ability to support carbon-based plant and animal life, including a joyful, free-sex loving, humanoid species, called Edo.
© Paramount Television

6 DMJM, Planta de Recuperación de Agua Donald C. Tillman, 1984. DMJM, Donald C. Tillman Water Reclamation Plant, 1984. Photo: Sylvia Lavin. ©Sylvia Lavin.

7 DMJM, Planta de Recuperación de Agua Donald C. Tillman, 1984. DMJM, Donald C. Tillman Water Reclamation Plant, 1984. ©Sylvia Lavin

gradually consumes human waste. The plant, in effect, is a botanical garden for protozoa.

A second rounded terrace looks over the formal garden designed by Hokkaido (born Koichi Kawana), who immigrated to the US in the early 1950s.[18] Kawana became well known for using native species and local horticulturalists to produce traditional Japanese gardens, an approach linked to a broad effort to promote reconciliation between the US and Japan by creating images of Japanese culture as contemplative, respectful of nature, and non-invasive. Kawana taught these ideas at the UCLA extension program for adult education, where he developed a large following, including Tillman, who conceived of the garden at the reclamation plant with Kawana in mind. Fed by a waterfall of effluent, Kawana's scheme emphasized not only the manufacture of meticulously shaped bonsai, earthworks, and rock formations, but also the various states of animation into which water could be composed.

Dominated by the large artificial lake, a 'chisen' wet-stroll garden takes visitors through agitated waterfalls, still ponds, and tranquilly moving streams, all made of effluent. The Garden of Water and Fragrance culminates in a traditional Shoin Building and teahouse from which visitors look back over the lake to the futuristic administration building. The combination of garden, plant, and infrastructure was celebrated by architectural critics for "enabling plant life to dominate an otherwise totally industrial site," and reversing expectation by presenting the "man-made serving the natural."[19] Mass media too, at least initially, confirmed the notion that the extraordinary convergence of environmental protection regulations with LA's efforts to increase the quality of public buildings had generated a model for an ecotopian future in which technology and emergent lifeforms would happily co-exist. Shortly after the plant opened, *Star Trek: The Next Generation* used the plant as a film set for Rubicun III, a Class M planet characterized by abundant surface water, nitrogen and oxygen-based atmospheres, and the ability to support carbon-based plant and animal life, including a joyful, free-sex loving, humanoid species, called Edo.[20]

While DMJM had done many publicly funded and infrastructural projects prior to 1972, the plant was one of

a small group of projects that constituted a significant shift in Lumsden's work. By the early 1970s, Lumsden started to insist that traditional forms of modern design driven by the repetitive logics of industrial production were inadequate to "environmental criteria [that] are much more complex than those used to develop filing cabinet office structures."[21] For Lumsden, the survival of architecture depended not on its reduction to minimal expense and construction logics, but rather on its capacity to "fit" its environment. Fitness, in his view, depended on the ability of the architect to shape buildings in relation to the often heterogenous conditions that constituted an environment and that a building would not only engage but alter.

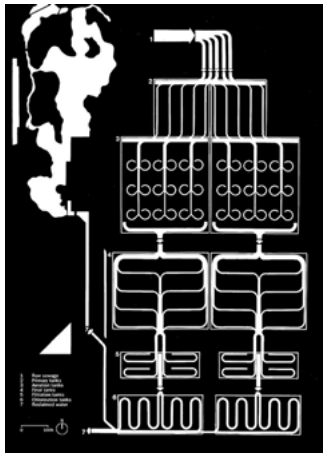
Lumsden first began to pursue this idea by developing what he called stressed skins: exterior surfaces in which windows are conceived not as holes but as parts of a continuous membrane with minimal mullions, independent both of plan and internal structure, and therefore able respond to non-directional forces outside a building.[22] The ability of the skin to adapt to these often variable conditions enabled the architect, according to Lumsden, to produce complex sections that better reflected the diverse programs increasingly needed by contemporary buildings than typical stacked plates. Prioritizing environmental criteria over standardization combined with the technical capacity to produce stressed skin enclosures and the socio-political desire for complex sections generated the possibility of what Lumsden called the "mutation effect": a release from geometric, structural, and visual norms that enabled a building to grow into and hence fit its environment. The result was towers with varying spandrel heights on different elevations allowing unobstructed views on one side but restricting heat gain on another; split level sections permitting diverse programming; and building shapes that undulate or protrude to maximize space use in irregular sites. For Lumsden, the process towards these adaptations begins with the collection of environmental data derived through systematic analysis, but he also acknowledged that it is not "easy for the mind to develop form from information."[23] As a result, he argued that the mutation effect could never result from an a priori plan, but instead resulted from the randomizing action of human intuition on an otherwise impersonal flow of information.

Initially, Lumsden explored these ideas in the context of urban towers, but in the early 1970s, a few non-urban projects shifted his attention to landscape-oriented buildings. In that context, the stressed skin, complex section, and mutation effect resulted in what can be called a new theory of plant architecture, or what Lumsden called the "extrusion aesthetic."[24] Lumsden conceived of projects like the unbuilt Lugano Convention Center as a collection of tubes terraced together at various heights and lengths to take advantage of different aspects of the site. The tubes are covered by skins that are not only independent from load bearing walls but that allow the enclosures they produce internally to graft together

and hence generate the spatial variations necessary to accommodate programs that ranged from small but numerous hotel rooms to large but singular convention spaces, transportation infrastructure, and shops. Furthermore, the infinite extendibility of the tubes was conceived of by Lumsden as a means of making a building easily adaptive to changes in circumstance. While the surfaces themselves are modular in their construction, and while the tubes are consistent in their cylindrical geometry, the building as a whole has no front or back, no formal sense of completion or closure, but rather operates as a coordinated set of elements that extend along the landscape until stopped by the limits of the site, budget, and time.

Although today extrusion is generally considered to be a reductive design technique that relies on minimal intelligence and creativity, extrusion as deployed by Lumsden is better understood as a way of mobilizing the kinds of information that a plant processes as it seeks to fit in its environment: how to grow roots towards water; how to push leaves towards the sun; how to run different programs in winter and summer; how to activate responses when threatened. Not only are the data needed by plants and buildings that seek environmental fit parallel in this schema, but the way in which the processing occurs, the kinds of intelligence and creativity that are deployed, are parallel as well. Neither plants nor extrusion architecture rely on conscious intention or creative will alone, but also rely on other forms of knowhow, like running photosynthesis or using intuition. In Lumsden's work, extrusion, in other words, did not operate as an industrial process rooted in mechanical repetition, but rather as an information-driven process that could coordinate multiple material systems, support various lifeforms, and make the best use of available resources. The result, according to Lumsden, was an aesthetic of fit generated not without human agency, but as the result of the cooperation of multiple forms of intelligence.[25]

Lumsden designed several extruded buildings during the early 1970s and continued to incorporate certain aspects of their logic into the early 1980s, including his design for a BEST Products Showroom made for the exhibition at MoMA in 1980 (The Museum of Modern Art, 1979). The Tillman plant, however, is the most significant example to have been built and is something of an anomaly in the DMJM oeuvre: the result of a unique convergence of environmental concerns, federal regulations, US-Japanese relations, an engineer with unusual aesthetic proclivities, theories of plant biology, information discourses, and an architect working to understand the role of his creative energy in a large corporate setting. Because of this inimitable confluence, it is not surprising that the extrusion aesthetic never gained wide influence. Given the fact that the Tillman plant was not primarily conceived of as a means of ameliorating the environment but was instead, quite to the contrary, built in order to facilitate the urban growth that had caused the negative environmental



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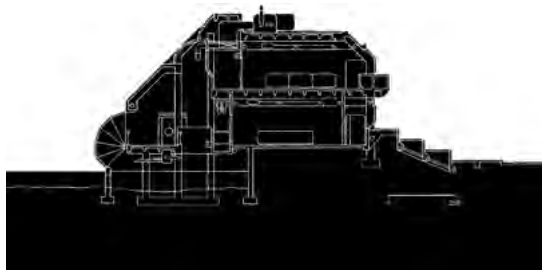

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consequences that needed to be remediated, it is surprising that a project the effect of which was to harness solar and human energy to support a vast territory of plant life was realized at all.

If the media environment can be said to have its own form of intelligence, they were the first to recognize this strategic bait-and-switch. Shifting rapidly away from reveling in the ecotopia initially promised by the plant, films shot at the Tillman plant began instead to expose its role as a staging ground for the globally coordinated effort of governments and corporations to expand development. As large sums of Japanese money began to flow into LA during the 1980s, the garden of water and fragrance became the film home of evil ninja warriors and ravenous corporations. Soon, the garden and its reclaimed water were left out of most films shot at the plant altogether, and only the building remained, the HQ first of Japanese, then Russian, and eventually just generically non-American but technologically-advanced invading entities. By the 1990s, the architectural community had lost track of the plant, turned off both by the human shit smell it exuded and by the environmental and economic forms of exploitation by then deeply associated with conglomerate firms like DMJM.[26]

But not everything takes root the first time it is planted, and vulnerable seedlings are particularly dependent on the receptivity of their environment. In 1972, a series of things came together, from specific people and emerging technologies to regulations and biota, to produce an architectural potentiality that perhaps can only now flourish. Deflating the centrality of human intentionality in historical developments is an important goal of environmental humanists, the consequences of which works in two directions. Not only is what Lumsden consciously intended not the primary criteria by which to understand the Tillman plant, but the fact that he was not even fully aware of the potentials embedded within the conditions of possibility that shaped his actions neither necessarily negates their historical impact nor diminishes their value today.

8 Diagrama de procesamiento de agua, Planta de Recuperación de Agua Donald C. Tillman Donald C. Tillman Water Reclamation Plant water processing diagram. Fuente / *Source:* LUMSDEN, A.J. *Selected and Current Works*. Images Pub. Group, 1997.

9 Corte transversal Planta de Recuperación de Agua Donald C. Tillman Cross section of Donald C. Tillman Water Reclamation Plant. Fuente / *Source:* LUMSDEN, A.J. *Selected and Current Works*. Images Pub. Group, 1997.

Plants did not make their way into any of Lumsden's drawings of the plant, but they were and continue to be the primary recipients of the water it generates. Plant behavior triggered the use of sustainable solar energy as the fuel for the technologies of reclamation at the plant, just as it continues to drive large numbers of volunteers who meticulously tend the garden and environmental scientists who take care of the microbial flora that also labor there. And today, plant-thinking may be that which is bringing the attention of contemporary architects to the plant as they not only seek ideas about how to improve architectural fit, but also as they begin to realize that the survival of life in its many forms will depend on plants as much as on plans.[27] Lumsden (1985:30) intuited as much when he argued that "a tree ... has no intention of relating to beauty, of being artistic. The tree ... wasn't made for man." **ARQ**

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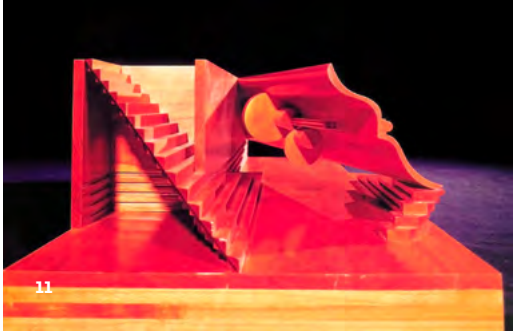

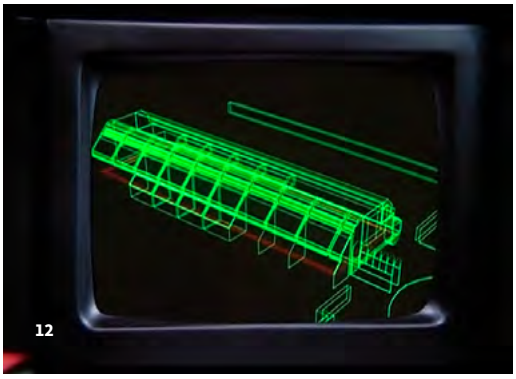

10 Anthony Lumdsen. Centro de Convenciones, Lugano, Suiza, 1972 (no construido).Anthony Lumdsen. Convention Center, Lugano, Switzerland, 1972 (unbuilt). Fuente / *Source:* Lugano Ii Convention Image collection.

11 Anthony Lumdsen, BEST Sala de exposición de productos, 1980 (unbuilt). Anthony Lumdsen, BEST Products Showroom, 1980 (unbuilt). Fuente / *Source:* LUMSDEN, A.J . Selected and Current Works. Images Pub. Group, 1997.

12 Dibujo computacional de la Planta de Recuperación de Agua Donald C. Tillman en Knight Rider, 1986. A computer drawing of the Donald C. Tillman Water Reclamation Plant in Knight Rider, 1986. Fuente / *Source:* LUMSDEN, A.J . Selected and Current Works. Images Pub. Group, 1997.

Notas / *Notes*

1 Vitruvius also had much to say about how to plant a building on the ground, but my emphasis here is on the early modern period when such antique practices were translated into the system of drawn plans, sections, and elevations that are still in general use by architects today.

2 While using the term 'plant' to refer to an entire building goes back to at least the thirteenth century, it is only during the fifteenth century that the unified and three-dimensional structure of the architectural plant is separated into the plan(t), as an abstract plane, which is further separated from the planes of sections and elevations. For an introduction to this broad subject, see Saalman (1959). An early Italian edition of Alberti's *De Re Adificatoria* uses the word *pianta* several times, particularly when the discussion is concerned with dimensions (Alberti, 1546:148, 151).

3 Haussman's transformation of Paris, both in relation to the planting of trees on Boulevards and also in relation to his use of lungs and other biological systems as metaphors for the city are the best-known example of this phenomenon. It is also interesting to note that this aspect of the Haussmannization of Paris became of particular interest to scholars during the 1970s. See for example Saalman (1971).

4 The invention of photography pulled images into this logic as they too came to be understood as the result of industrial procedures acting directly through and on materials. For the relation between photography and other image media and photosynthesis see Uhlin, (2016), Zylinska, (2017), Peters, (2015), Nickel (2012), Despard & Gallagher (2018).

5 Louise Hornsby has noted this as a problem in the reception of Olafur Eliasson's work. See Hornsby (2017). David Gissen and Daniel Barber are among those working on the environmentalization of architectural history. Additional evidence of this reorientation of the field includes the project Histories of Architecture and/ for the Environment by the Canadian Centre for Architecture, the establishment of the Architecture and the Environment subgroup within the European Architectural History Network, and the Buell Center's recent call for proposals for new courses on the environmental history of architecture.

6 Some particularly provocative texts from this point of view include Kohn (2013), Marder et al (2013), Jones & Cloke (2002). See also: Borasi, Amemiya & Beyer (2010).

7 On the specific question of intentionality, see Marder (2012).

8 On the history of urban forests, see Dümpelmann (2019), Dean (2009).

9 On the parallel between trees and computers, see Hidalgo (2016:62).

10 On the impact of using wood as building material, see Oliver et al (2014).

11 Banham's book was harshly criticized by Peter Plagens for what he considered Banham's irresponsibly idealized view of the ecological impact of automobibles. See Plagens (1972). Peter Kamnitzer joined the faculty of UCLA's School of Architecture and Urban Planning in 1965 where, along with working at NASA, he developed digital design tools for simulating urban conditions in order to study the impact of buildings on their environments. Kamnitzer and Anthony Lumsden were on the same UCLA faculty for over two decades. On Lumsden, see note 15. More broadly on the environmental history of LA and architectural responses to environmental issues in the early 1970s, see Deverell & Hise (2005), Martin (2004), Borasi et al (2007).

12 On the Tillman Plant, see City of Los Angeles (1990), N/A (1986:18-19), Moiraghi (1995), N/A (1994:82-83).

13 The plant was initially called the Sepulveda Reclamation Plant and intended to provide upstream relief for the over-taxed Hyperion Water Treatment Plant, in operation since the 1950s. The plant was designed to "grow" over time and increase both its capacity and the degree of amelioration it could offer water.

14 On funding sources, escalating costs, delays and tensions between the city and Federal Agencies, see: N/A, (1980); Nichols (1987); Smith (1977).

15 See the interview with Lumsden in Lumsden (1985:30). For overviews of Lumsden's work with DMJM, see Daniel, Mann, Johnson & Mendenhall (1977). For an analysis of the plant in relation to the structure of that firm, see Cayer (2018:163-169). For overviews of Lumsden's work more specifically, see Lumsden (1975) and Dobney & Lumsden (1997).

16 Conversely, Leon Whiteson, then the architecture critic for the *LA Times*, who eventually wrote the introduction to Lumsden's monograph, went so far as to credit the Tillman Plant with sparking an improvement in the overall quality of public and civic buildings in Los Angeles (Whiteson, 1989).

17 The stepped concrete water features recall Halprin's Ira Keller Fountain (Portland, 1970) and Freeway Park (Seattle 1976). On Halprin, see Helphand (2017). On the Oakland Museum, see Pelkonen et al, (2011). Lumsden also worked on the Urban Nucleus at Santa Monica Mountain Park along with Cesar Pelli, which won a *Progressive Architecture* award in 1966 , and has, more recently, been referred to as a model of what a low-impact building-as-infrastructure, might be (Fisher, 2009:96).

18 On gardens in the US and the despite fact that the garden won a *Progressive Architecture* design award in 1972, there is relatively little literature on Kawana. For the basic outlines of his biography, see Tobar (1990). For Kawana's own writing, see N/A (1977) and N/A (1990). For overviews of Japanese gardens in the US, see Sawyers et al (1990) and Brown & Cobb (2013). For studies of other Kawana projects see Bunting (2002). For specific discussions of the landscape of sewage, see Barletta & Weber (1986), and Clemons (1998).

19 See "L'eau dans tous ses estats," 82: "Paraodix réussi: dans un site hautement industriel, ce son les minéraux et végétaux qui dominent." My translation. See also Peter Papademitriou's comments on the Honor Award given to the project from *Architecture California* 8, no. 2 (1986): 18.

20 That the peace-loving species were given their original Tokyoite names suggests the persistence of complex relations between the United States and Japan, particularly on the west coast, until long after World War Two.

21 See the interview with Lumsden in Lumsden (1985:29).

22 See Lumsden's comments in Lumsden (1976:73).

23 As cited by Giovanini, 15-16, within a description of Lumsden's views on intuition and mutation particularly in the context of teaching.

24 Esther McCoy was especially interested in this group of project and organized her discussion of them around Lumsden's concepts of extrusion and mutation. See McCoy (1975).

25 Hidalgo has argued that trees are computers. Here I use his argument in reverse; that Lumsden's extrusion buildings are trees.

26 In 1996, it was even used as a stand-in for the Bio-dome in a satiric film directed by Jason Bloom.

27 In October 2019, the Tillman Plant will receive a 25-year award from the AIA/LA.

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