

The making of the pavilion

8

General design and construction considerations

8.1 Introduction

Landscape architectural interventions that are instant and mobile have the ability to breathe new life into city spaces, and assist parks to reprogramme their use and draw new users. The design of these temporary and mobile structures has to take into account their transport, assembly and disassembly, along with their use and programme. Another important consideration is their afterlife, which should be planned with thought. Environmental consciousness is an aspect of contemporary design that ought to be integrated, to an extent, into every project undertaken. Thus, to avoid contributing to the issues created by consumerism-driven design, one should address what will happen to the structure after being dismantled.

The fate of a selection of pavilions constructed in 2015 was determined by Winston (2016), who found that 46% (thirteen) were relocated and 36% (ten) were recycled. One pavilion was made permanent, and the fate of 14% (four) was yet to be determined, being kept in storage until a decision is made (Winston 2016) (see table 1).

This quick overview of the fate of only a handful of temporary pavilions indicates that the majority of structures are utilised after their original objective has been reached. 82% of these were disassembled and either relocated or the parts re-used for other purposes, which makes designing for quick assembly and disassembly important for easy handling and transport.

Furthermore, in order for the pavilion to have a longer lifespan in a rapidly-changing environment, it must be multifunctional and easily adaptable to different site conditions. However, this must also be restricted in order to avoid acontextuality.

These aspects further improve the quality of constructed spaces.

Relocated	Recycled	Undetermined	Remained
Serpentine Gallery Pavilion by SelgasCano	ICD Aggregate Pavilion 2015	Camera Obscura by Mariano Dallago	Shiver House by NEON
Circular Pavilion by Encore Heureux	Eigen Huis & Interieur pavilion by i29	New Horizons Red Pavilion by TAKA, Clancy Moore Architects and Steve Larkin Architects	
Oasis Pavilion for APMAP by OBBA	Around Pavilion by Christiansen and Andersen		
Kiosque pavilions by Ronan and Erwan Bouroullec	Ka300 Pavilion by J Mayer H	France Pavilion for Milan Expo by XTU Architects	
Mpavilion by Amanda Levete	The Temple by Kingston University students	Walden Raft by Elise Morin and Florent Albinet	
Glaze pavilion by Cousins & Cousins	Governor's Island pavilions by Bang Studio and Chinchilla Architects		
Brazil Pavilion for Milan Expo by Studio Arthur Casas and Atelier Marko Brajovic	The ETH Future Pavilion by ETH Zurich		
China Pavilion for Milan Expo by Studio Link-Arc	Pulp Pavilion by Ball-Nogues Studio		
The Hive, Britain Pavilion for Milan Expo, by Wolfgang Buttress and BDP	Breathe, Austria Pavilion for Milan Expo by Klaus K Loenhart and the Breathe team		
UAE Pavilion for Milan Expo by Foster + Partners	Toronto Winter Stations 2015		
COSMO pavilion for MoMA PS1 by Andrés Jaque and Office for Political Innovation			
The Original Dwelling by Atelier van Lieshout			
Yure pavilion by Kengo Kuma			

Table 1: The fate of 28 pavilions erected in 2015 (Winston 2016)

According to Ryan (2011) creating landscapes that are robust relies on the ease of construction. This is accomplished by specifying detailing and materials that are easy to assemble, forgiving and resource-efficient. Ease of assembly is achieved with parts that are easy to handle and connections that are accessible. Forgiving details allow for adjustable fit during assembly. Resource efficiency considers using off-the-shelf parts that are easy to replace and recycle or re-use, as well as taking into account the transport from factory to site.

8.2 Textile pockets

The shortcomings of using a folding pattern to generate a three-dimensional textile canopy that can contain plants, as well as have openings in the pattern for the plants to provide an immersive experience for the user, were encountered in phases 2 and 3.

What followed is the testing of a singular folded textile planting pocket module that can be repeated and applied throughout the canopy. Figure 37 illustrates the resulting origami folding pattern that produces a textile module with four similar pockets. It has the potential to contain plants, and, if no plants are required by the client, it can easily be manipulated mechanically to form a closed canopy if more shade is required. This was tested on a 1:1 scale, using *shweshwe* for the textile body and metal wire for the mountain fold reinforcing. Combining several of these modules proved to be possible by simple joining techniques (in the case of the prototype the metal wires were joined together by bending the ends into hoops), while the opening and closing of the textile canopy was further enabled because of the stiffness of the metal wire.

8.3 Structure

Temporary or instant urban space interventions require easy assembly and disassembly, as well as off-the-shelf materials that are easily replaceable. A modular structural system such as scaffolding can be adapted to different site- and slope conditions. The following precedents illustrate the use of scaffolding in spatial design.

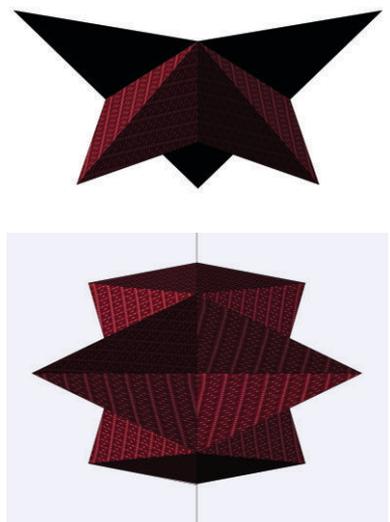


Figure 38: Textile plant pocket module as viewed from below (Author 2016)



Figure 39: Dior Spring/Summer 2014 collection set design (Tododesign 2014)



Figure 40: Dior Spring/Summer 2015 collection set design (Dirand 2015)



Figure 41: Dior Fall/Winter 2015/2016 collection set design (Dior 2015)



Figure 42: Louisiana Hamlet Pavilion, by Selgascano (Selgascano 2015)

Raf Simons has experience in fashion design, furniture design and fine art curation. During his role as Creative Director of Christian Dior, he was also responsible for designing the sets where Dior's couture collections were displayed. These often consisted of simple scaffolding, either used in isolation, or in conjunction with elements such as glass and flowers, where he worked in conjunction with set designers Bureau Betak.

The Dior Spring/Summer 2014 collection was presented in the gardens of the Musée Rodin in Paris. Scaffolding created the formwork of the set, entitled *Paradise on Earth*, which was adorned with an abundance of roses, lilies and tropical fluorescent flowers (figure 38). The flowers and foliage were artificially created with fine, dyed silk, creating a canopy of cascading fabric plants.

The Dior Haute Couture Spring/Summer 2015 collection was presented against a backdrop maze of white scaffolding and soft carpeting (figure 39). Figure 40 illustrates how the Fall/Winter 2015/2016 collection also featured scaffolding used in a visually appealing way. Hieronymus Bosch's *Garden of Earthly Delights* (1503-1515) was the inspiration behind the set design, created in conjunction with Bureau Betak. Referencing the Adam and Eve tale of innocence and temptation, Simons' fashion vision was executed through the gaze of the Flemish and French masters of art and couture craft. Geometrical, glazed panels painted with pointillist dots were placed between the scaffold frameworks to create a structure resembling a "greenhouse-cum-church" (Israel 2015).

A pop-up building in the Louisiana Museum of Modern Art's sculpture garden, designed by José Selgas and Lucía Cano, served as a viewing space for short films as part of the 2015 exhibition called *Africa: Architecture, Culture, Identity* (Stamp 2015). The temporary structure, called the Louisiana Hamlet Pavilion (see figure 41), was designed to be disassembled after the exhibition and then shipped to Nairobi, Kenya, where it now serves as a school (Stamp 2015). It consists of colourful scaffolding components and plastic sheets to allow quick and easy assembly, disassembly and transport. These materials are commonly found,

lightweight, and easy to construct with, yet were used in an artful way.

Pavilion MMM (Miami Many-a-chair Monument) was a temporary pavilion installed at the Miami Cultural Plaza in 2014 by Design With Company (see figure 42). The design consists of chairs purchased at local yard sales, converted into swings and hung from a modular structure made of construction scaffolding members. The strategy makes assembly straightforward, economical, and appropriate based on the installation's temporary existence (Design With Company 2014).

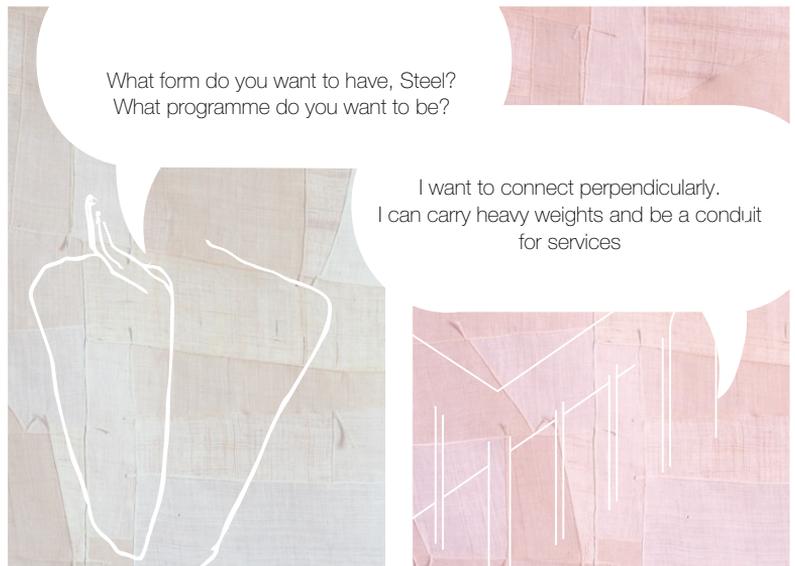


Figure 43: Pavilion MMM (Design With Company 2014)

These precedent studies show how everyday objects can be used in a visually appealing and striking manner. This is in line with the normative positions of post-modernist landscape architects, who believed that landscape architecture is an art form related to the other visual arts, and that landscapes could also serve as a cultural artefact, expressive of contemporary culture and made from modern materials (Schwartz 1993:260). Martha Schwartz states that “nonprecious materials and off-the-shelf items can be used artfully, and with this attitude we can build beautiful landscapes; not only for the rich, who today will no longer pay for fancy materials, but also for the middle class, who can't afford them” (1993:262). Schwartz has an artful approach towards the design of spaces and objects within them, by “making discreet landscape objects and shaping that landscape as an integrated artwork” (1993:262).

In addition, steel will be able to carry the loads and stresses exerted on the structure (see figure 46).

Hollow structural sections have good resistance to loads in multiple directions. Structural tubing thus wants to be columns. They will also be able to accommodate electrical cables for lighting and irrigation pipes if planting is required, further supporting the rationale behind this material choice.





peat moss: 70%



coconut coir: 10%



perlite: 10%

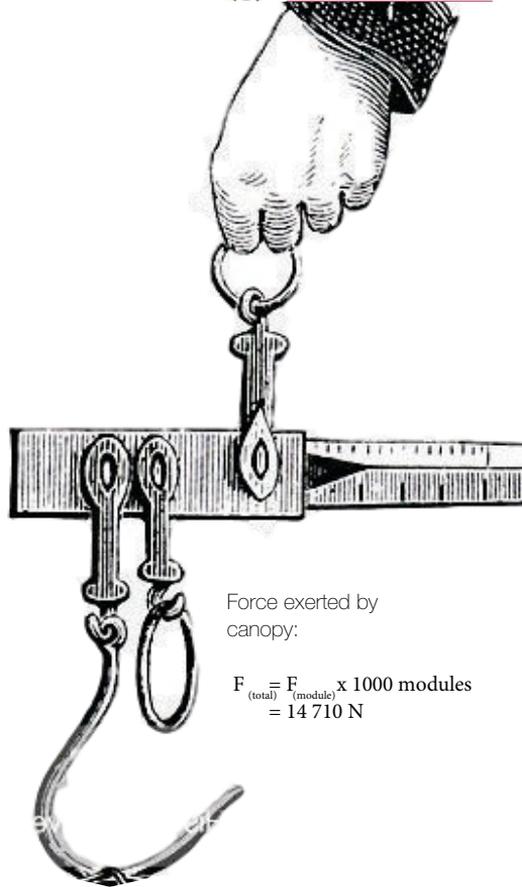


limestone + wetting agent: 10%

170 kg/m³

Figure 44: Planted textile canopy (Author 2016)

Figure 45: Composition and density of PRO-MIX™ HPCC Mycorrhizae



Force exerted by one module:

$$F = m \cdot a$$

$$= (1,5)(9.80665)$$

$$= 14,710 \text{ N}$$

Force exerted by canopy:

$$F_{\text{(total)}} = F_{\text{(module)}} \times 1000 \text{ modules}$$

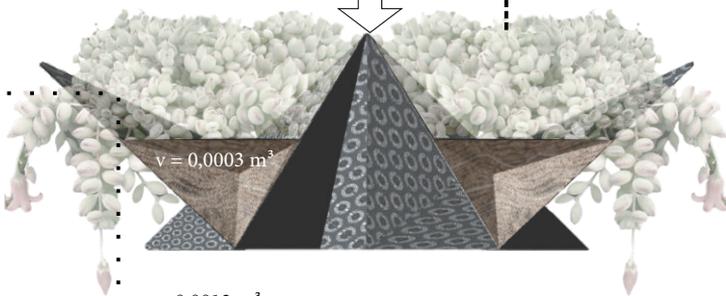
$$= 14\,710 \text{ N}$$

$$a = 9.80665 \text{ m/s}^2$$

$$m = 1,5 \text{ kg (1 + 2 + 3)}$$

1 $m_{\text{(textiles + wires + retained water)}} = 0,500 \text{ kg}$

2 $m_{\text{(plant)}} = 0,150 \text{ kg/plant}$
 $= 0,600\text{-}0,800 \text{ kg}$



$$V_{\text{(total)}} = 0,0012 \text{ m}^3$$

3 $m_{\text{(growth medium)}} = 0,0012 \text{ m}^3 \times 170 \text{ kg/m}^3$
 $= 0,204 \text{ kg}$

Figure 46: Forces exerted by canopy on supporting structure (Author 2016)

8.4 Plant selection



Figure 47: Salvatorpassage hanging plant canopy, by Herzog & De Meuron (Subtilitas 2011)

The use of plants on the overhead plane has the potential to create an immersive and atmospheric experience. The Salvatorpassage of Fünf Höfe in Munich, Germany, by Herzog & De Meuron is the centrepiece of a building complex constructed in the 1990s. It is a glass-enclosed interior space, 19m long, 10m wide and 14m high. A grid suspended under the ceiling like a canopy accommodates a variety of vines and climbing plants, forming a hanging garden up to 10m high (Herzog & De Meuron 2006). The project illustrates how plants can create an immersive user experience. Trailing and cascading plants will be able to be viewed from beneath the textile canopy.

The plant selection was based on criteria related to the site and the desired atmosphere. For canopy plants in sunny positions, its light requirement is a dominating determining factor. Furthermore, it should grow well in a container, and be drought-tolerant. The final criterion is that it must have a sprawling growth form, in order to cascade between the openings in the textile canopy and create an immersive user experience. The same applies to canopy plants that are required in semi-shade, such as in an atrium or between buildings. Refer to figure 50 for the plant palette.



Figure 48: Kimono Forest at Arashiyama Station, by Yasumichi Morita (Author Station, by Yasumichi Morita (Author 2016)

8.5 Lighting

Lighting features also have many possibilities of being integrated into the pavilion design. Yasumichi Morita combined textiles and lighting in a poetic and striking way with the design of an “artificial forest” at Kyoto's Arashiyama Station. Acrylic poles are draped with traditional *yuzen* dyed kimono fabrics, illuminated from within by LED lamps. This ‘kimono forest’ presents commuters with a particularly spectacular view from within trains that are pulling into the station after sunset (Wee 2013). The 2013 *Through Hollow Lands* installation at the Frye Art Museum in Seattle by Lilienthal | Zamora was made with 200 suspended fluorescent lamps (Himede 2013). The result is a striking display using a standard item.

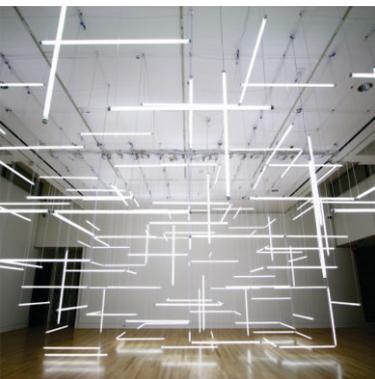
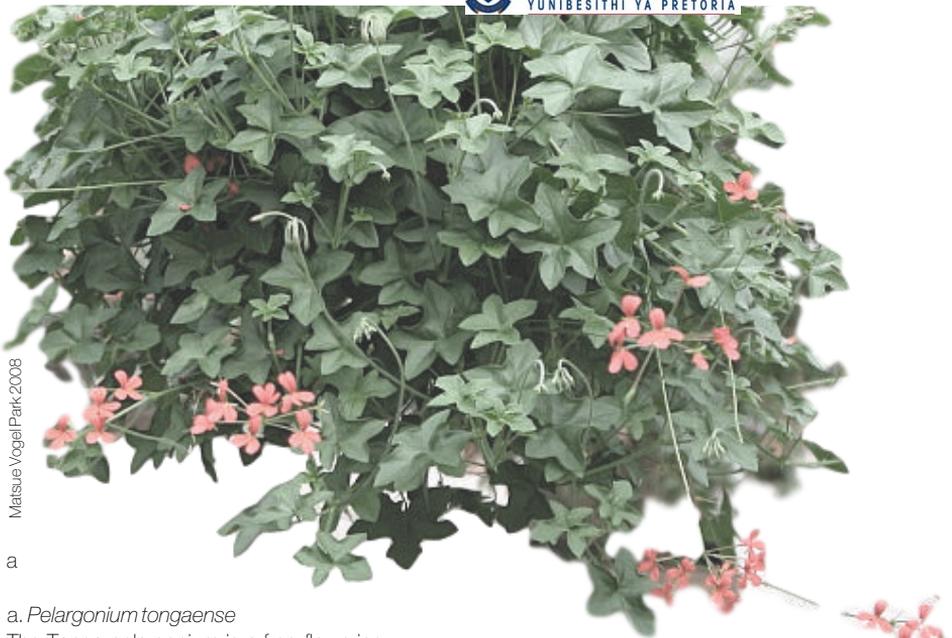


Figure 49: Through Hollow Lands installation by Lilienthal | Zamora (Lilienthal 2012)

These examples show how linear lighting elements can be a continuation of the scaffolding structure.



Matsiwe VogelPark, 2008

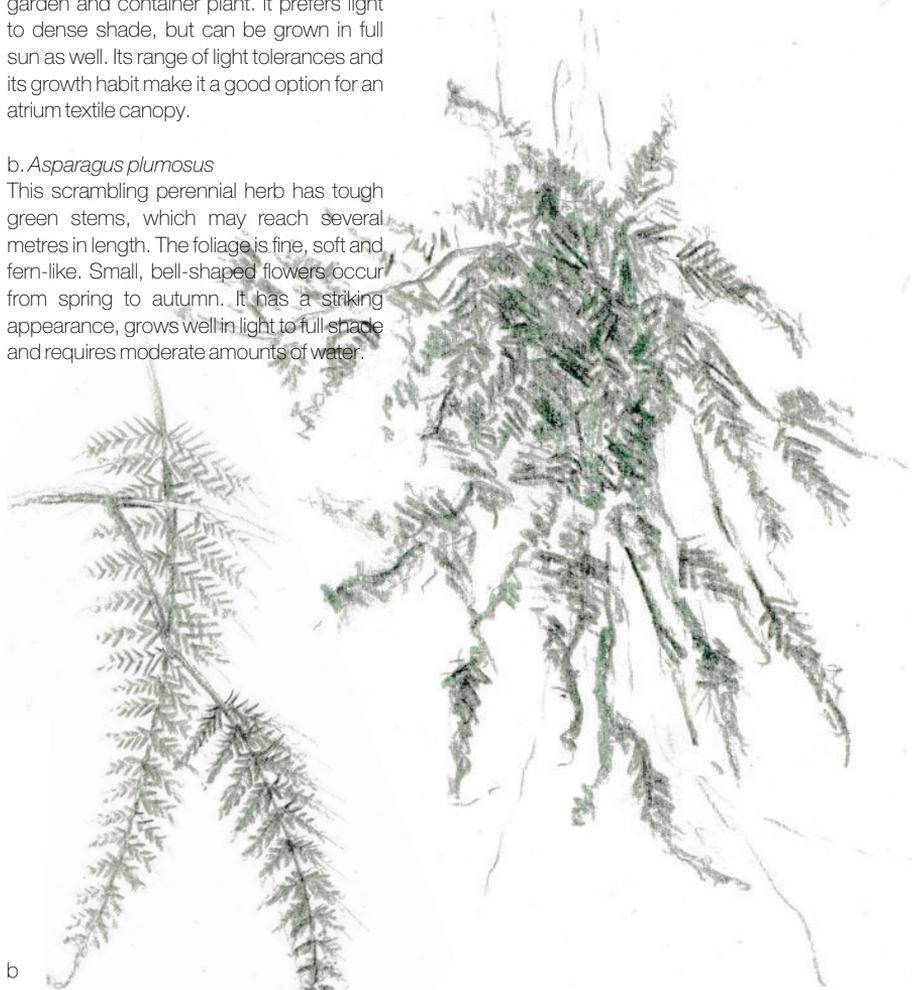
a

a. *Pelargonium tongaense*

The Tonga pelargonium is a free-flowering garden and container plant. It prefers light to dense shade, but can be grown in full sun as well. Its range of light tolerances and its growth habit make it a good option for an atrium textile canopy.

b. *Asparagus plumosus*

This scrambling perennial herb has tough green stems, which may reach several metres in length. The foliage is fine, soft and fern-like. Small, bell-shaped flowers occur from spring to autumn. It has a striking appearance, grows well in light to full shade and requires moderate amounts of water.



b

Figure 50 (continues on p. 74-78: Plant selection (Author 2016)



d

c. *Asparagus densiflorus*

The *Asparagus densiflorus* is a versatile and drought-tolerant plant that grows well in containers. It has trailing branches that can grow up to 1 m long, which will create a mass of green foliage year-round. It can be grown in full-sun, as well as in an atrium space with light shade.

d. *Cotyledon pendens*

This is a much-branched succulent shrublet with dense, curtain-forming, hanging stems up to 600 mm long. They thrive in hanging baskets and containers, and naturally grow in dry cliff faces, making them a good option for the canopy feature. The foliage will create year-round interest, and tubular flowers are a striking sight in winter.



Kvarnblog [S.a.]



e



f

e. *Delosperma tradescantioides*

This cliff-hanging, mat-forming plant with stems up to 1 m long forms loose curtains of foliage, making it ideal to create an immersive experience when walking under the textile canopy. It is also an excellent container plant, and withstands dry periods.

f. *Othonna capensis*

A low-growing, succulent groundcover with a spreading habit. It needs very little care and establishes itself easily in most soils, the proviso being good drainage. These characteristics make it a good choice for a full sun or partial shade textile canopy pavilion.



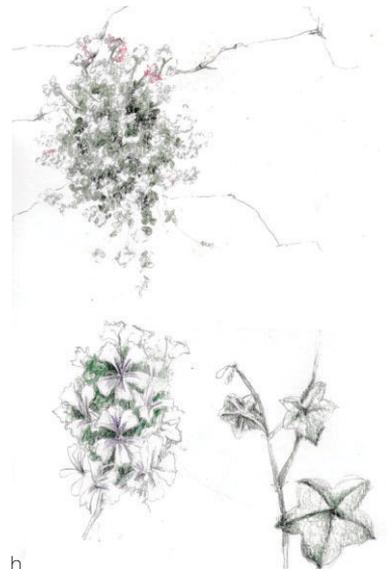
g

g. *Senecio angulatus*

Described as a scrambling and twining herb whose form is a dense tangled shrub 2m tall. Established plants are extremely drought tolerant. Their growth form and drought tolerance will make them well-suited for canopy planting.

h. *Pelargonium peltatum*

This semi-succulent perennial climber has long, straggling shoots, which can reach a height of 2m. It looks striking in hanging baskets and containers, and can grow in full sun or shade. This plant is drought-tolerant.



h



i. *Ceropogia woodii*

The string-of-hearts is usually kept as a hanging pot subject. The small, heart-shaped leaves are a dull pinkish purple below and either green or a variegated silvery-green above. They require light shade and are moderately drought-tolerant.



Fleur 2016

j. *Senecio rowleyanus*

The string-of-pearls is a creeping, perennial, succulent vine that grows in light shade. Its leaves are the size and shape of small peas, growing on trailing stems that are up to 900 mm in length. In summer, trumpet-shaped flower forms clusters of small white flowers. It requires very infrequent watering and a few hours of direct sunlight per day, making it well-suited to an atrium receiving some direct sun.

k. *Chlorophytum comosum*

The hen-and-chickens is a perennial evergreen herb with trailing stems up to 1 m in length. It grows very well in baskets, and its ornamental, gracefully ascending-spreading to recurved leaves in a central rosette make it popular as a house plant. It prefers partial shade and moderate amounts of water.



k

JayJayc 2011

8.6 Textiles as display surfaces and space-definers

Textile panels can serve as vertical space-defining elements that can also be used for exhibition purposes. The 2009 Liceo Ópera exhibition in Barcelona, Spain, by Cadaval & Solà-Morales, was based on the use of simple canvas panels organised in a way that guides the visitor as well as creates a strong spatial experience (Lavinia 2009).

Figures 52 and 53 show removable textile screens made from agricultural shade netting. They can act as space-defining elements to guide users through the space, or act as screens to create more private spaces within the pavilion.



Figure 51: The use of textile panels as vertical space-defining element at the 2009 Liceo Opera House exhibition (Cadaval & Sola-Morales 2009)

8.7 Water

The conceptual approach to the capture of rain water for irrigation of the canopy plants is for surface runoff to be captured and stored in shallow (200mm) containers that form part of the base of the structure (see figure 54).

Preliminary water calculations were based on the general water requirements of succulent plants, but show that this approach will be feasible in the long-term (see appendix C). However, for a short-term application such as in an atrium for an exhibition or in a garden space as a temporary shade structure, there would need to be a connection to municipal water supply.

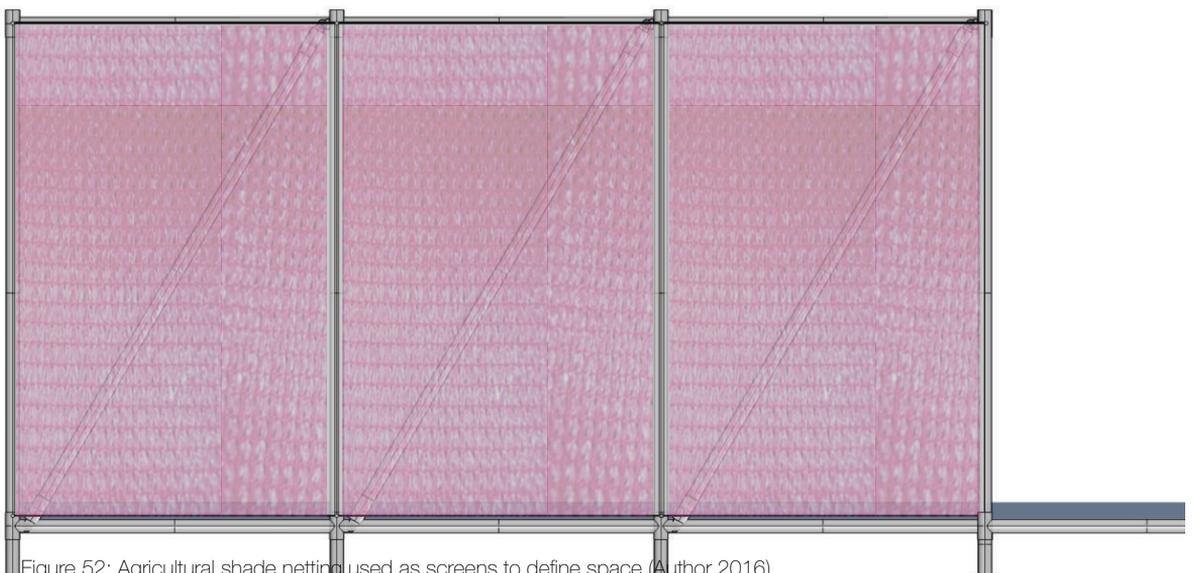


Figure 52: Agricultural shade netting used as screens to define space (Author 2016)

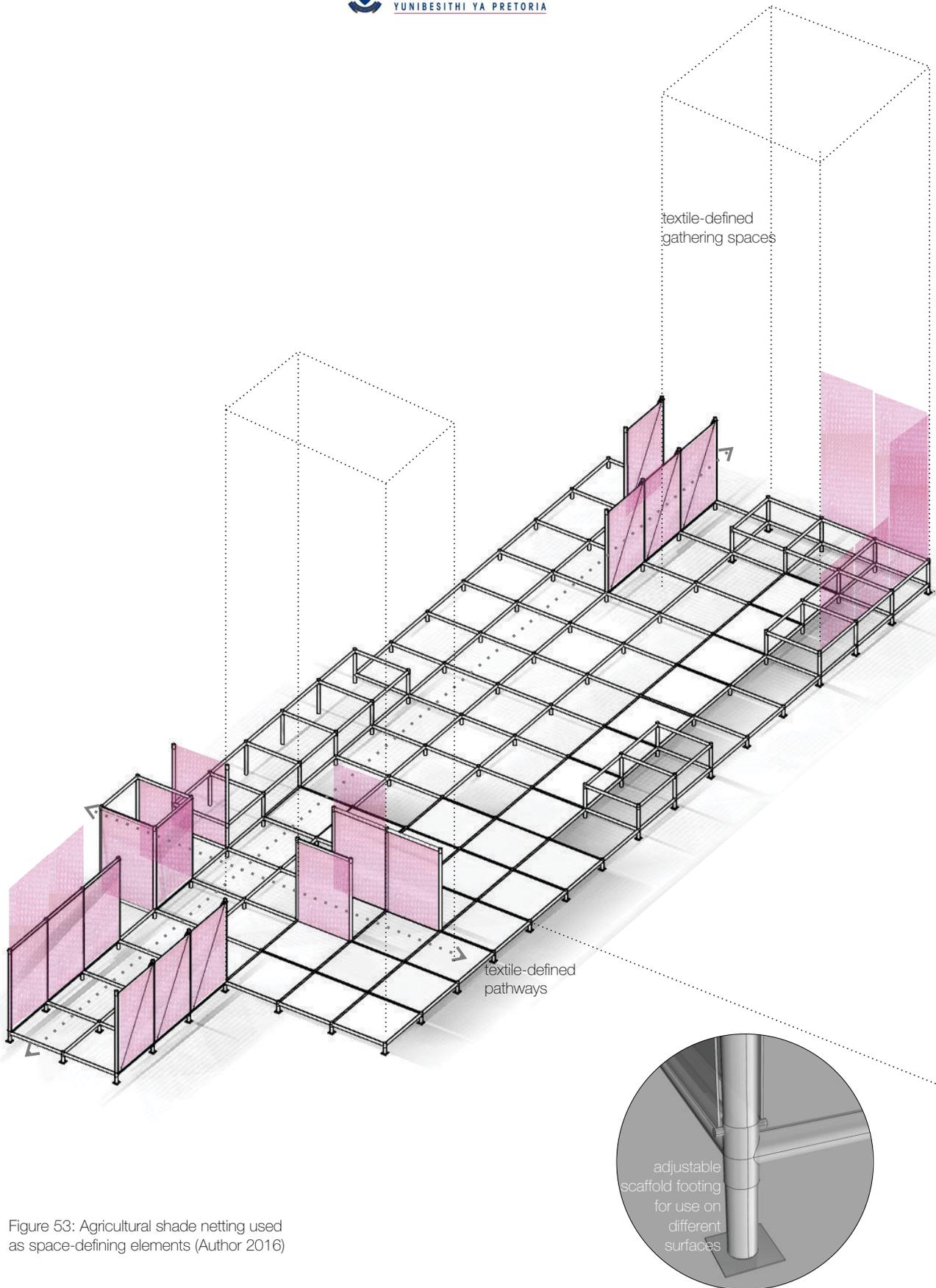
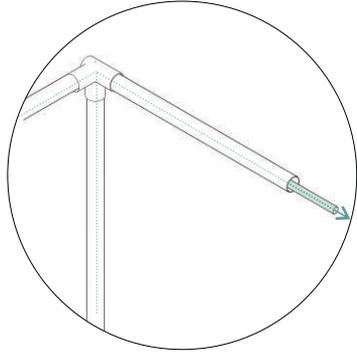


Figure 53: Agricultural shade netting used as space-defining elements (Author 2016)



Scaffold steel hollow sections act as conduits that carry irrigation pipes

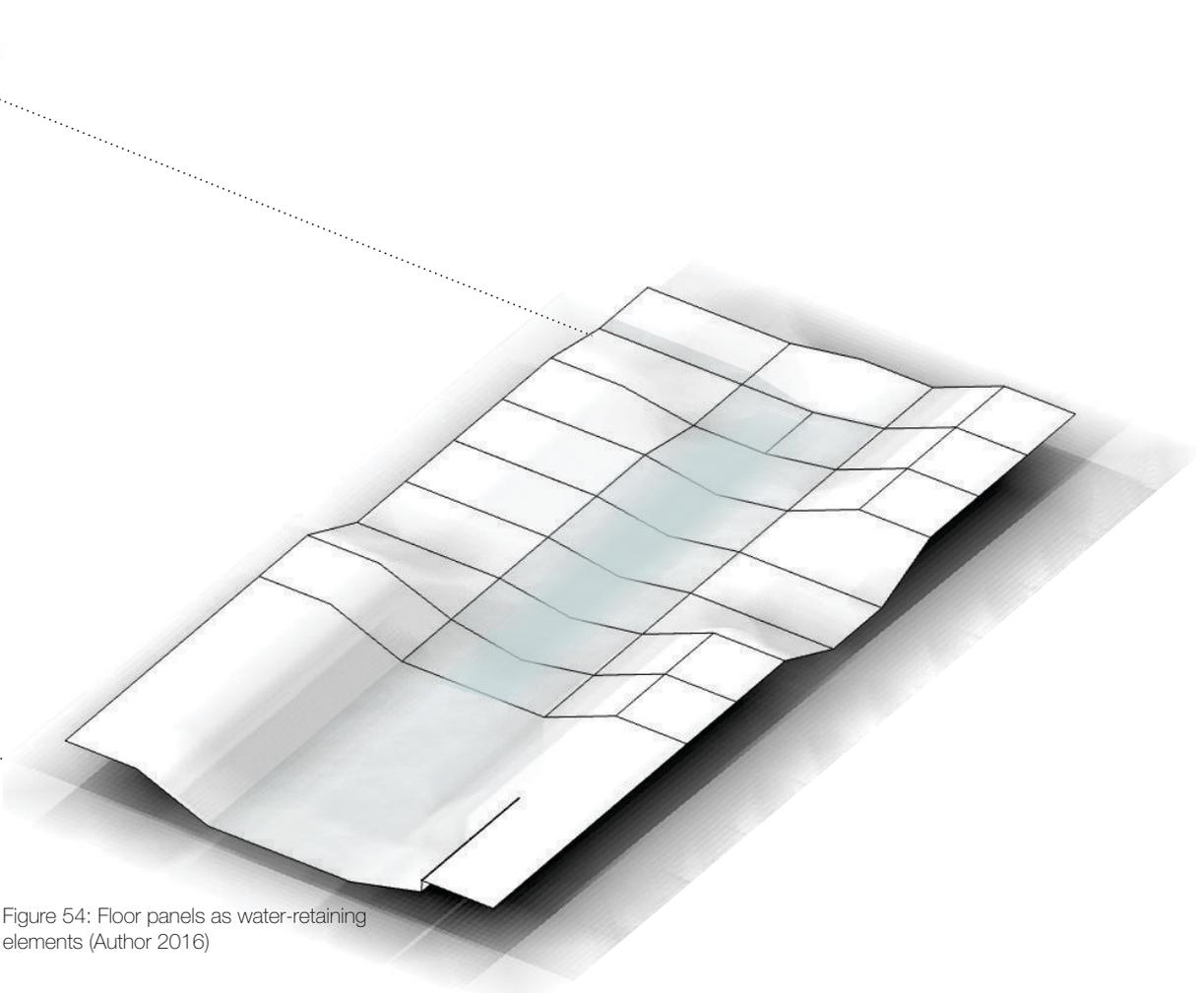


Figure 54: Floor panels as water-retaining elements (Author 2016)



8.8 Seating

Rope, such as mountain-climbing rope, can be simply spanned and attached to the scaffold frame and thus act as different seating elements. The different conformations depend on whether individual or social seating is required (see figures 55 and 56).

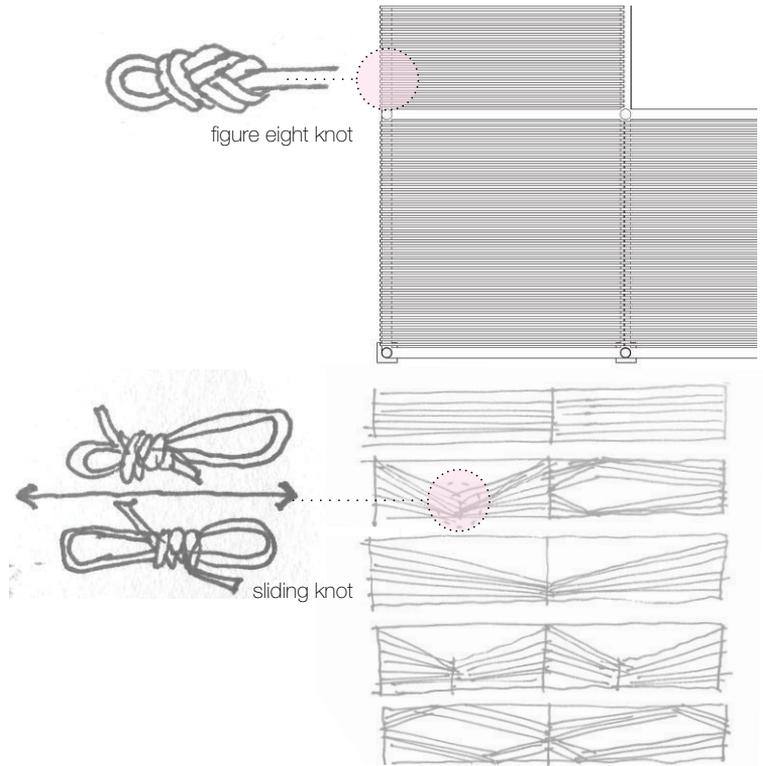


Figure 55: Seating (Author 2016)

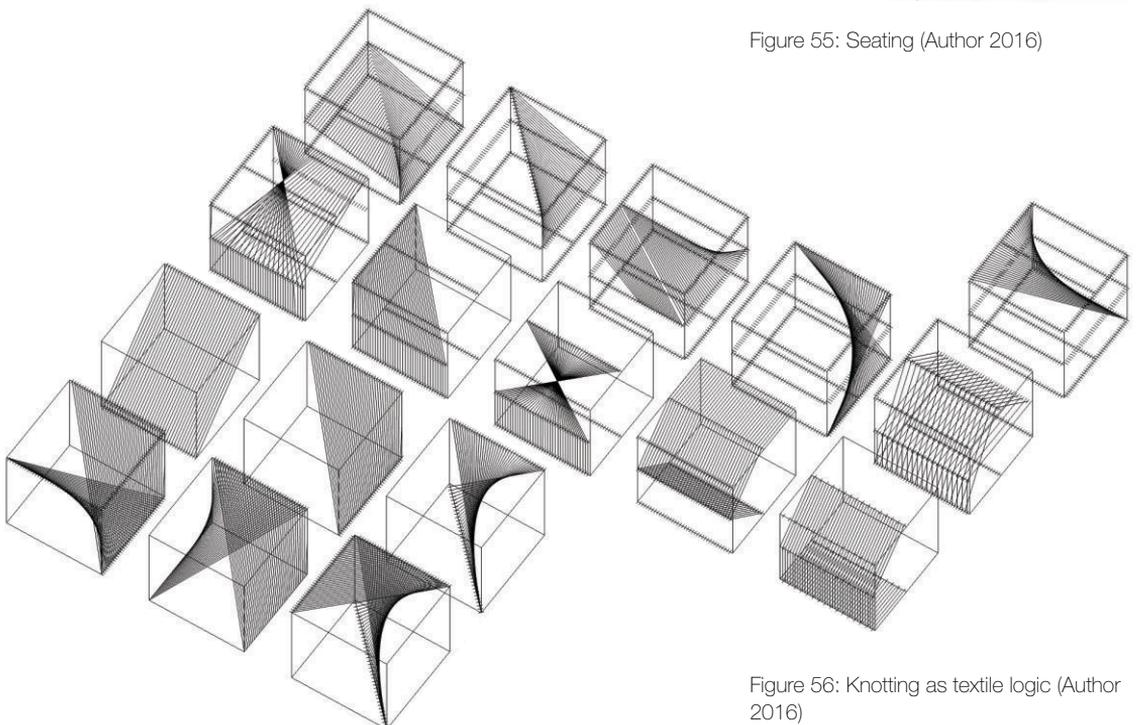


Figure 56: Knotting as textile logic (Author 2016)

8.9 Surface as extension of the landscape

As mentioned in Section 3.1 there is a fundamental difference between buildings and landscapes and that is the application and harvesting of elements that act upon them. Broughton (2012:9) states that “in built landscapes the process of construction is doubled”, as contingent forces constantly manipulate the designed landscape after initial construction has been completed. Where most would consider these elements to be destructive, Broughton (2012:39) claims that textiles have the ability to engage with these elements in a constructive manner: “By strategically utilising materials that can structure contingent environmental forces, landscape architects might configure these forces to work in support of their design intent” (Broughton 2012:39).

Hutton (2013:123) asserts that landscapes are unique in that biological and geological actions have an influence on how landscape architects should construct. “...it is through engagement with geological and biological action and the nonlinear yet powerful relationships between structure and formal expression where landscape tectonics finds its poetics of construction” (Hutton 2013:123) (see figure 57).

Landscapes are dynamic, and this should be harnessed to work with the designed landscape intervention, and not against it. How can the computer software used in the modeling of the pavilion extend beyond pattern and embrace the changing nature of landscapes?

Hansen (2011) states that “performance is a major factor that separates landscape architecture from architecture”, and because of this, effective parametric designs are applied on a landscape in a “performative”, as opposed to “formal” (Hansen 2011) or pattern-based way. Hansen (2011) further points out that parametric design makes visible the often invisible, which reaches its full potential in landscape architecture. “Landscape is defined by...living materials that grow, weather, and decay; and temporal cycles that span hours, days, seasons, and epochs.” These ephemera can be understood, manipulated or emphasised by parametric design.

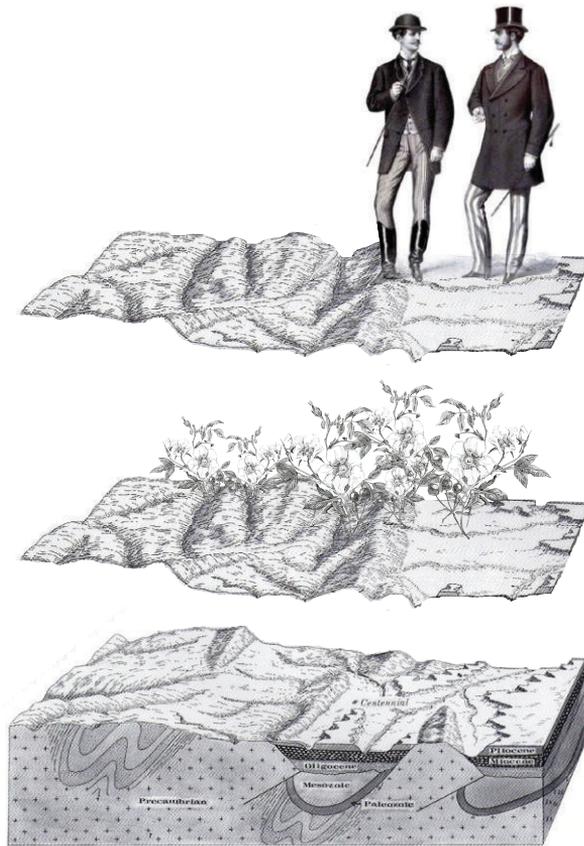


Figure 57: Biological, physical and anthropological forces acting on the landscape (collage by Author 2016)

If the pavilion is permanent, these landscape forces can be made visible. To create openings for plants to established on the ground plane, their size and growth habit can be used as parameters to determine the size of the openings in the surface panels. Seeds embedded within the composite material will germinate after enough water is received, and will grow over time as a visible element of invisible forces: natural (rain and sun), biological (plant growth) and anthropological (human intervention).

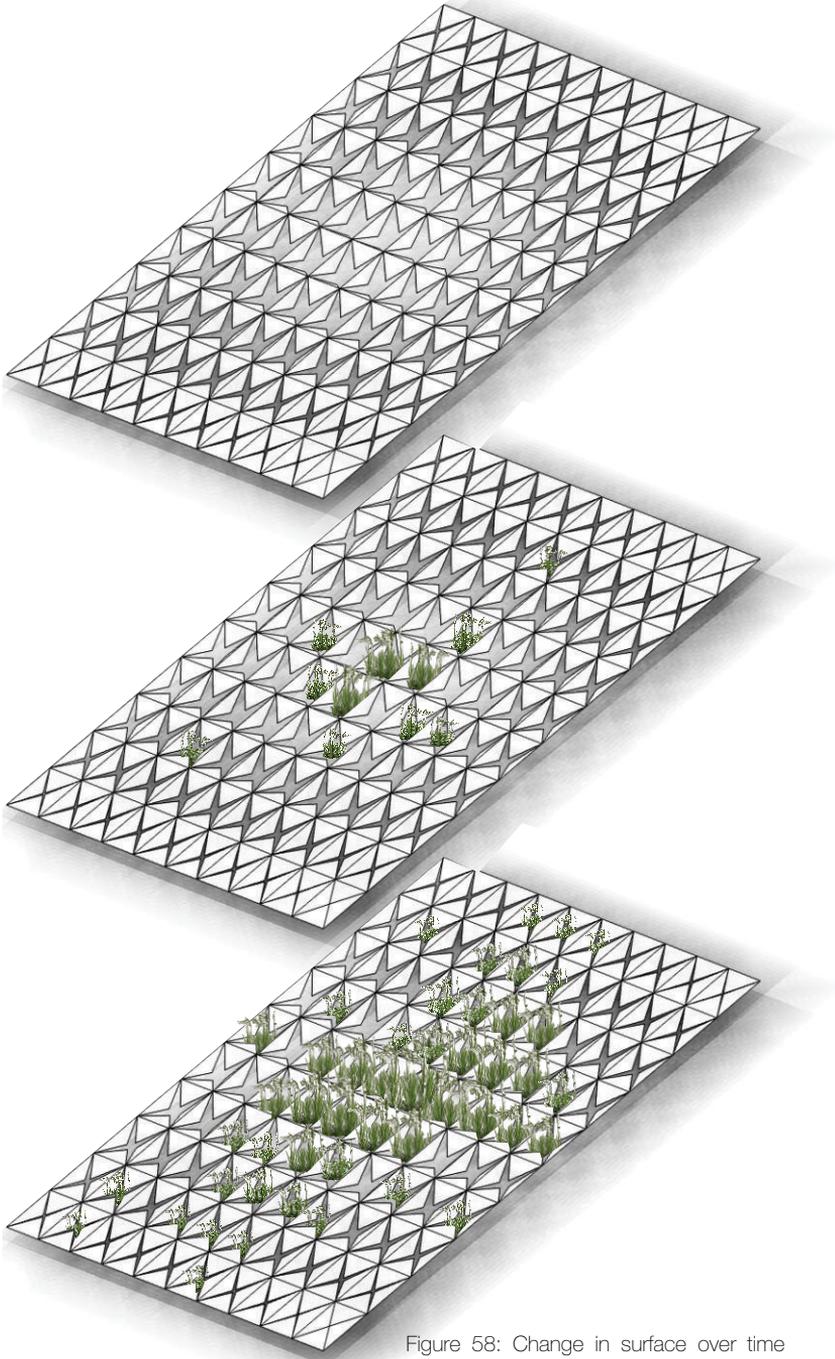


Figure 58: Change in surface over time
(Author 2016)



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