

## CULTIVATED SUSTAINABLE PRODUCT AND SPATIAL DESIGN

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### ABSTRACT

Wood is one of the most widely spread building and manufacturing materials, which has been used from antiquity till nowadays. There are many examples for the application of timber in contemporary design, however, some of the most attractive ones are those related to the development of sustainable design. Growing product and spatial design by modelling construction and shape during plant growth is a method experimented in for a long time. In contemporary design these explorations are motivated and justified not by the desire to rule over nature, but by the ambition to take care for it and use resources in a sustainable manner.

**Key words:** sustainable design, cultivated design, eco-friendly design, growing design.

### INTRODUCTION

It is hard to imagine the progress of humankind without the presence and the usage of wood. Together with stone, wood is the earliest material that man started to use for his benefit. He used it as a weapon for his defense, for hunting, for building a shelter, for making the first household utensils. He also used it as a source of fire, warmth and light, for protection and for cooking of his food. Throughout all history of mankind wood has been the basic material in different areas of human activity. One of the most sustainable and significant applications of this material could be seen in architecture and the building of the material living environment of people.

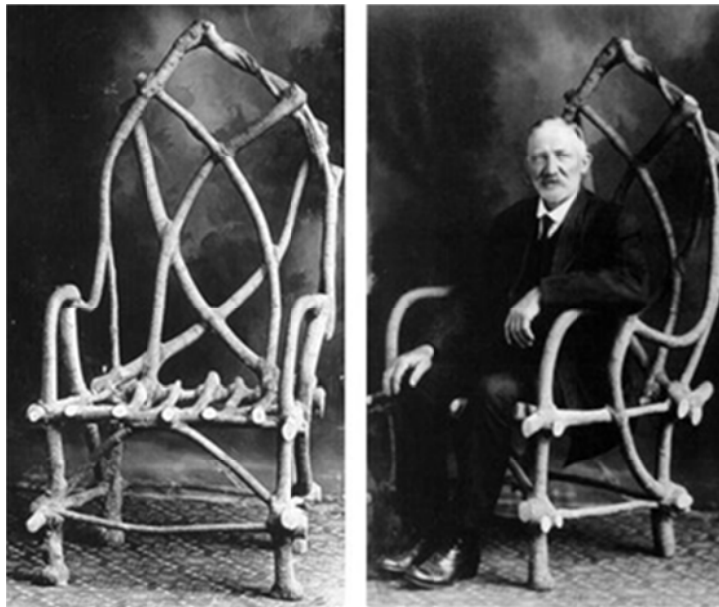
### METHODOLOGY

The way of using the wood has undergone different changes, mostly related to the abilities and the processing tools that people possessed. Starting from the usage of timber the way it was provided by nature – broken branches or fallen trees, through the manual primitive tools for processing, to the more sophisticated instruments and mechanized tools up to the latest technologies. All of

them are tied to the exploitation of wood from wild or regulated forests. Since the dawn of wood processing people have sought and selected parts of naturally grown trees and shrubs that could be used with minimum processing for one or another function. This has largely been determined by the modest tools they possessed and also the effort that they put into the obtaining and the processing of material on one hand and on the other – the closeness to nature and the opportunity to use natural resources. With the development of industry people started treating nature as an inexhaustible resource, which only goal was to serve the well-being of man, meeting his needs. We've built a culture that aims at subduing the nature and its laws in the service of man. The attempts to shape the natural flora, fauna and landscape according to the needs, the desires, the fashion, etc. are widely spread. This aspiration is reflected in the attitude towards the different plant species. It is no longer expressed solely in the selection, improvement, harmonizing and shaping of the plants but extends to a qualitative change of their structure in the process of their growth.

One of the earliest successful attempts in that direction is the chair made by John Krubsack, a banker from Wisconsin, USA

(image 1)  
(<http://www.atlasobscura.com/places/chair-grew>).

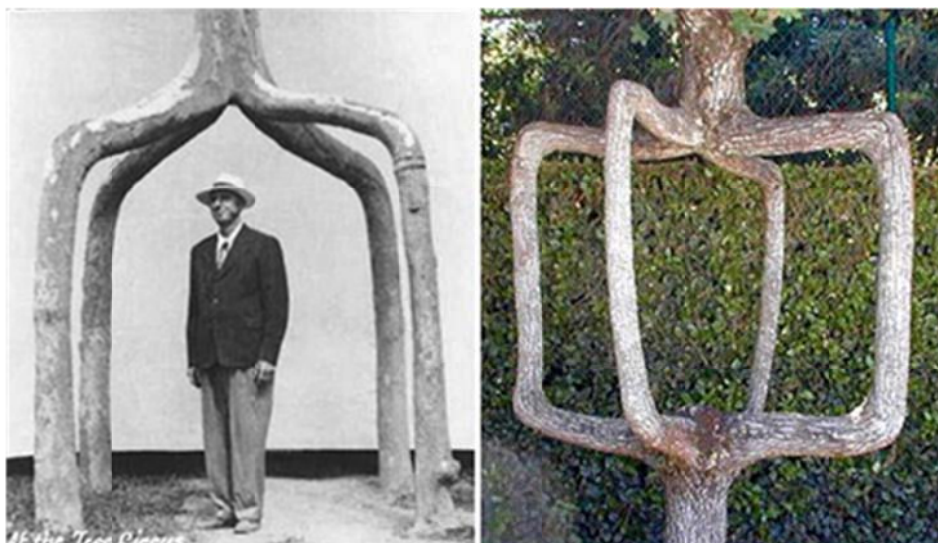


**Image 1: The chair made by John Krubsack**

The cultivation of this piece of furniture made out of boxwood took about fifteen years and was finally finished in 1918. That was probably the first time when a product with such a complex construction and shape was produced. Its unique shape and linkages were achieved by managing the growth of the plant.

„The Circus Trees“ probably is the most popular project on a large scale. Nowadays it is known mostly as the “Gardens of

Gilroy”, California, USA. Its designer is Axel Erlandson, a farmer from California, who studied the growing of tree species. He noticed that trees have the ability to graft naturally either by their branches or trunks (<https://www.gilroygardens.org/circus-trees/a-circus-tree-story>). Thus in 1925. Erlandson started shaping trees, grafting them into one another to the purpose of producing an art effect.



**Image 2: Axel Erlandson and “Four-Legged Giant”**

His first artefact was the “Four-Legged Giant” – four trees that were planted and grown in such a way that when they reached two meters height they might graft into one single tree (image 2).

From 1925 till 1963 he has grown eighty living sculptural installations (forty of them exist up to now). They demonstrate the abilities of this technology (images 3 – 4).



**Image 3 – 4: The Circus Trees of Axel Erlandson**

Although these and other such attempts dating from the beginning and the middle of the 20th century, provoked by the desire to subdue nature, were considered to be the first, there are far deeper traditions in this respect. It has been known that in ancient Egypt people shaped the branches of ornamental shrubs and trees. For many centuries in South East Asia people have built living

bridges that connected the opposite sides of rivers or precipices (image 5).

They were built by growing and weaving of trunks of wild vines. There is evidence that such bridges were used even in 12th century. The oldest preserved and functioning such bridge is more than 500 years old (<http://binscorner.com>).



**Image 5: Double Decker Living Root Bridge**

Experiments for modeling the shape of plants in the process of their cultivation are not limited only to trees and bushes. Many attempts have been made for modeling the fruits of some plants. They serve different purposes related to both aesthetic and functional aspects. What's common for them is that the result there is visible and completed in a much shorter time. There are interesting examples in the production of gourds. As each fruit of the gourd is unique in respect of size and shape, it's hard to incorporate this material in some kind of manufacture. Attempts have been made to mold the material in the process of growing, so that the result could be predictable and the shape could be known and to some extent unified (image 6 – 7) ([http://andrewmowbray.com/section/359035\\_Modular\\_Lagenaria\\_Gourds.html](http://andrewmowbray.com/section/359035_Modular_Lagenaria_Gourds.html)).



**Image 6: Harvested Gourds in Acrylic Forms**



**Image 7: Modular Lagenaria Gourds**

There are transparent plastic molds which are fixed around the young fruit and thus in the process of growth mold the product into the desired shape. In this way uniform elements are produced. They could be turned into a constructive module which could be used for building different structures and manufacturing of various functional products. A similar approach using plaster molds instead is implemented in the production of gourd pipes, bottles and pieces of decorative and souvenir value. The same method is applied in the cultivation of the so-called square watermelons. Growing up in cubic forms, and acquiring the respective shape, they are much more convenient and compact for storage and transportation. And probably much easier to be cut.

The Chinese company Fruit Mould creates molds that give the regular fruits and vegetables all kinds of bizarre shapes – square watermelons, cucumber stars, pears in the form of Buddha. These decorative fruits and vegetables became very popular in China and now are widely spread in the supermarkets there (<http://www.viralno.bg/stranna-forma-plodove/>).

In order to counteract the aspiration of the past to subject nature to the human needs and desires and thus prove man's supremacy over it, today the designers turn to the idea of molding the plants in the process of their growth with the purpose of preserving the natural resources and protecting the biodiversity. The English designer Gavin Munro says: "It's our goal to fully redefine the way wood has been used as a material". His desire is to develop a method for the furniture industry, that should replace the traditional one, which includes processes such as cutting trees, loading and sawing of logs, cutting them into planks and then gluing, cutting, etc. All that generates a huge amount

of industrial and environmental waste while using a lot of energy.

**RESULTS**

Munro and his team in Full Grown have grown hundreds of willows, patiently waiting for the right time to harvest the crop of furniture. As a result of his research in applied botany and shaping trees Munro develops a technology that uses the methods

of grafting. By attaching the branches to special molds the plants are “cheated” to form different products like chairs, tables, lamps, frames. In this way we get a unique and long lasting product, more durable because there are no fittings and seams. Besides this technology provides for mass production of unique products (images 8 – 11).



**Image 8: Botanical Illustration of the 1st Edition Nelson Chair**



**Image 9: Full Grown Chair**



**Image 10: A row of Nelson Chairs**



**Image 11: Full Grown Table**

The different kinds of wood define different characteristics of the process – a period of growing and specific approaches for organizing the manufacture. Depending on the type of material it requires a different amount of time. For example, for a willow you need 3–4 years and for a beech – 6–7

years. Although at first sight this process may seem laborious and slow, in fact it is incomparably faster and more efficient than the standard one where the timber is grown for 50-60 years, and the obtaining of raw materials and furniture requires special con-

ditions and costly equipment (<http://fullgrown.co.uk/>).

In this method the cost of material and energy input for the production are minimized and there is no need for additional fittings. The shape is achieved entirely by controlling the growth of the tree, with minimal finishing, designed to provide ergonomic comfort and to emphasize the structure of both the material and product.



**Image 12:** „Chair Farm” of Werner Aisslinger

The work of the designer here is to point growing bamboo stalks in the desired direction through a specially designed mold. The cultivation of bamboo furniture gives much faster results than other kinds of wood, even if it be fast-growing tree species. Furthermore, the content of silicates in the stems of the bamboo gives the furniture an exceptional strength – close to and even competing that of steel. At the same time the hollow stalk of bamboo contributes to the smaller mass of products.

Analyzing the method of construction of furniture by shaping the plant we observe an analogy with the technology of 3D printing. As the three-dimensional printer lays down successive layers of a certain material

Besides the different kinds of trees, the designers also experiment with other faster growing plants. For example, the bamboo, with its elasticity, strength and rapid growth is used in the project "Chair Farm" of Werner Aisslinger for making sitting furniture (<http://www.dezeen.com/2012/04/16/chair-farm-by-werner-aisslinger-at-ventura-lambrate/>). In this case there is no need to perform grafting and pruning (image 12 – 13).



**Image 13:** Finished product – a naturally grown chair

until the object is completely finished, so in modern method of cultivated design the products are constructed by overlay, and not by removal as it is in the industrial production.

In this way the wastage in production could be minimized. There is another similarity to 3D printing and that's the potential to produce shapes and constructive joints that could not be achieved by standard methods.

## **CONCLUSION**

The technology for cultivation of wood products and furniture is almost entirely waste-free, nature friendly and preserving biodiversity. The production processes are

minimized and there are no additional inorganic materials and surface coatings that could hinder the recycling of the timber or its utilization as an energy source or food biomass after the product is out of use. This technology can be defined as sustainable, efficient and eco-friendly. It can be seen as a positive example and a good direction for the development of sustainable product design.

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