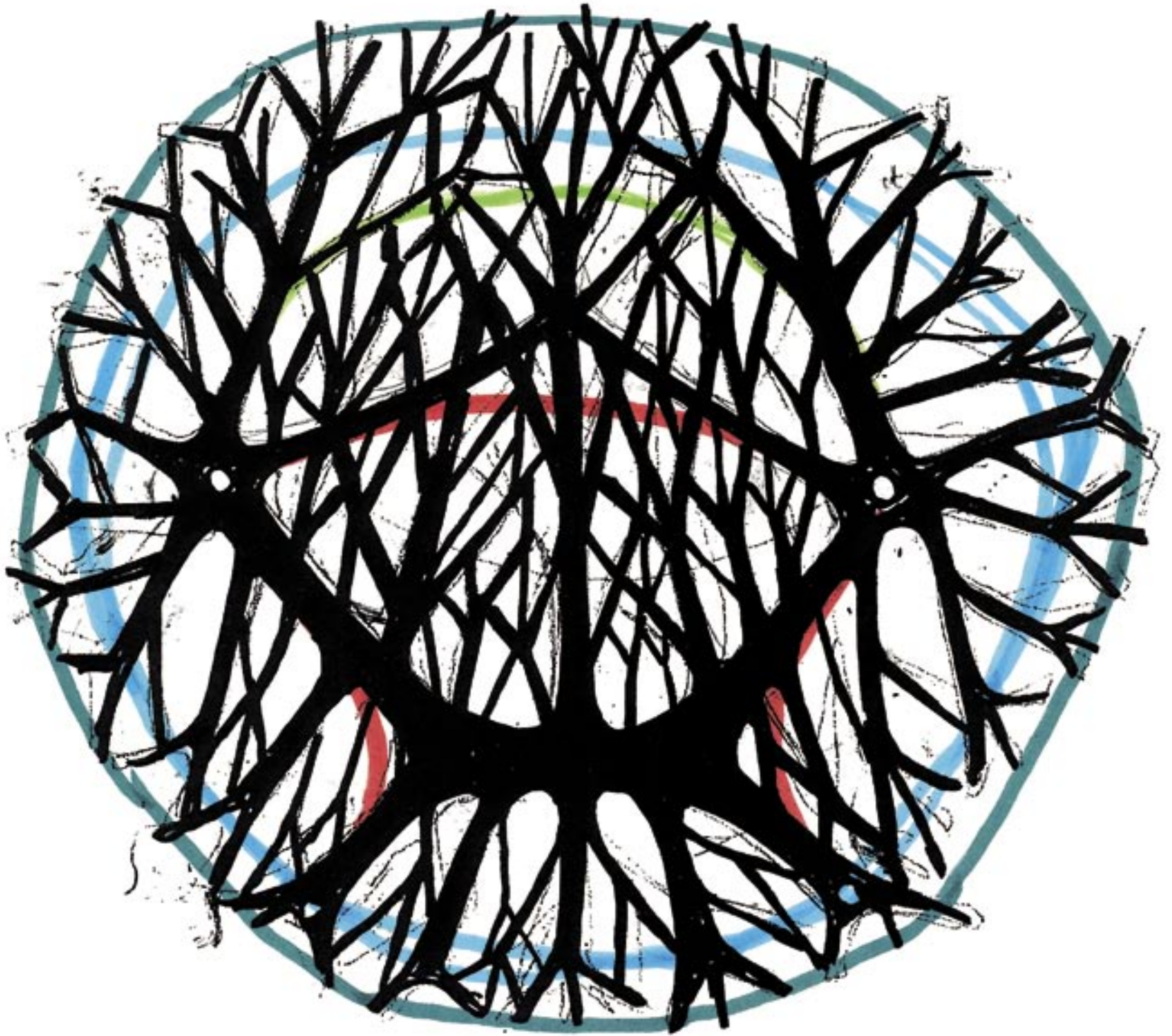


Vegetal
Ronan & Erwan Bouroullec



vitra.

Nature: Image or Model?

Rolf Fehlbaum

Each project at Vitra starts with the hope that something new will result: new in function or new in expression; ideally both.

The new becomes possible because new sensitivities arise (driven by issues our society has to deal with), new needs appear and new techniques allow realizations that were not possible previously. The project is considered successful when these new questions are addressed in a way that makes sense practically and, at the same time, when it also satisfies our visual and tactile senses.

Sometimes it is difficult to find the right form/function balance, since an undiscovered inner contradiction in the project misleads us. One always hopes that in the course of the long and exacting trial and error process required in the development of a product any contradiction will dissolve thanks to some new and surprising turn of events. Well, that happened several times during the four years the Bouroullecs and Vitra worked together on *Vegetal*.

The project for *Vegetal* was triggered by the experience of developing *Algues*, the extraordinary plastic branches with which the Bouroullecs create most unexpected structures, almost artificial representations of nature. Could a chair be made in the same spirit? Can nature teach us anything in the making of objects, and can we infuse the pleasure that nature gives us into an industrially made object?

In the 1940s an American gardener, Axel Erlandson, experimented with small trees by inosculating them, and created living chairs and architectural sculptures. At the same time Charles and Ray Eames and Eero Saarinen designed chairs, the parts of which were organically shaped. They were inspired by Alvar Aalto's organic plywood furniture from the 1930s, but they went a step further, shaping the plywood three-dimensionally. A different inspiration from nature can be seen in the work of Hector Guimard from the years around 1900: in his cast-iron Parisian Metro entrances and some furniture vegetal motifs and constructive elements freely intermingle. At about the same time arms and legs grew from the seats of Antoni Gaudí's chairs for Casa Calvet. Some forty years earlier Michael Thonet had experimented with solid wood, bending it in a way that feels completely 'natural'. His Chair No. 14 became the most successful chair of all times.

Ronan and Erwan Bouroullec are interested in another aspect of nature: nature's growing process. In this respect they are close to Axel Erlandson. Their first drawings and models for *Vegetal* show a structure that grows from four branches into a network of twigs, which create a basket. The twigs support the body of the user and the openings among them allow transparency and space for the legs of a second chair to be stacked on top.

Most nature-inspired furniture has been made from natural materials (with the exception of Guimard), but, from the beginning, the Bouroullec project was designed with plastic in mind, an 'unnatural' man-made material. A chair of these characteristics could only be made of plastic if it was meant to be mass-produced. Would plastic and the idea of using nature as a model create one of these inner contradictions that tend to destroy a project's course and meaning? The Bouroullecs' *Algues* had dealt successfully with this issue. It soon became clear that the chair had to move away from their all too naturalistic first approach.

Obviously, injection-moulding plastic technology would be the right technical choice for creating such a complex structure at a reasonable price. Furthermore, the advantage of using plastic means that the chair can be used both inside and outside. Plastic well processed can result in a chair that is very robust and durable. The challenge was to use nature as a model to create an object that was comfortable and could be manufactured at a reasonable price. Injection moulding depends on the constructive intelligence underlying the design of the mould. The challenge was to build a mould that could produce these branches and the basket of twigs in one shot. Injecting a normal shell-chair is now easy, but this is not a shell, it is a three-dimensional structure of which every element has to be formed in such a way that it can be taken out from the mould.

The project evolved and grew considerably thanks to these realistic criteria. It became more abstract; the twigs became flat in order to offer comfort, and the network more dense for the same reason. The chairs had to be stackable. Stacking requirements added to the complexity. Vitra's very demanding criteria of stability and safety had to be met, and so on.

The Bouroullecs tested different approaches in numerous drawings, some of them recalling the graphic work of the American artist Terry Winters, who is also interested in the construction principles of nature. The most promising proposals were then converted into three-dimensional models. The dialogue between the designers and Vitra's technicians, particularly the CAD specialist Thomas Bieling, continued for months and months. The front legs became part of the seating 'basket', while the back legs had to be inserted. The voids of the 'basket' are not set in an ornamental way as for decoration, they are the free spaces that remain after the construction of the reduced network of twigs needed for the support and comfort of the user. As the twigs became flat, so they needed ribs or nerves on the underside to provide strength: another construction principle borrowed from nature, like the structure of a leaf.

If, today, the chair looks effortlessly 'natural', this is the result of a lot of hard work: it can be likened to a circus act, seemingly so easy, but in need of much attentive preparation. Egon Bräuning, who has been head of Vitra's product development for decades, says this was technically the most demanding chair Vitra has ever made. It is certainly one of the most complex in the history of furniture design.

The Bouroullecs are not the only designers who create objects inspired by nature. Nature has been an inspiration for designers, architects and artists on many occasions in history and seems particularly relevant today. In most cases, nature's formal appearances are reproduced, often as ornament. The Bouroullecs' approach is specific, though. They are far more interested in nature's principles of growth.

But, of course, contrary to natural evolution which knows no designer (unless you disbelieve Darwin's theory), the fact that they are designers means that they create something different from nature: artificial nature.

January 2009.

Growing a Chair

Ronan & Erwan Bouroullec

The initial intuition was that of a chair which would sprout up like a plant. A vegetal chair, its branches gently curving to form the seat and back. It comes from this fascination we have for various types of old furniture, which is plant-inspired. Garden chairs of English origin, structured in boughs of cast iron, for example; various items formed using real branches; or even those armchairs designed in the United States during the first half of the last century, using bushes whose growth had been restricted until they took on the form of a chair. Objects which, in short, take us back to a time when forms were perhaps a little bulkier, less sleek or smooth than nowadays. There was therefore, from the outset, a desire to create an original structure, based on a complex and narrative form of construction. Coupled with an inclination for highly advanced techniques, such as plastic injection moulding, which opens the way to mass distribution.

The initial designs show a chair that has the fluidity and uniform elegance of a plant: a great unity of form whilst at the same time being, in essence, untamed [fig. 4].

They immediately appealed to Rolf Fehlbaum, but their complexity posed the question of industrial feasibility. This led to the start of close collaboration with the team led by Egon Bräuning, head of the development department, which was to last almost four years.

The main issue was to follow the realistic geometry of a chair, whilst at the same time using the principles of plant-like branching as a construction model [figs. 2, 3, 5]. What we felt was possible in order to maintain the integrity of our proposed design was approached in stages, whilst asking questions about its compatibility with the manufacturing process. Take *Algues* for example, developed by Vitra in 2004 [fig. 1]. Its branching form was shown to be particularly suited to the requirements of plastic injection moulding. This process consists of injecting the liquid material, under very high pressure, into a steel mould [fig. 26]. Just like the sap in a tree trunk, it has to circulate evenly inside all the branches of the mould, congeal and then solidify—and all in less than two minutes, at the end of which the piece is extracted. The major difficulty with this process resides in the alchemy which has to take place between the material, how quickly it moves, the fall in its temperature and its method of solidification. In other words, there is a certain number of uncertainties to grasp, given that the result must be perfectly uniform.

One of the important stages in the process consisted in transforming the branch sections, circular at the outset, into a T-profile [figs. 5, 12, 20, 21]. This solution gives better structural qualities whilst at the same time meeting the demands of injection fluidity. As luck would have it, it turned out that this solution reinforced the plant-like aspect of the whole piece.

Throughout the entire duration of the project, the only way of conducting an in-depth study into industrial feasibility was to

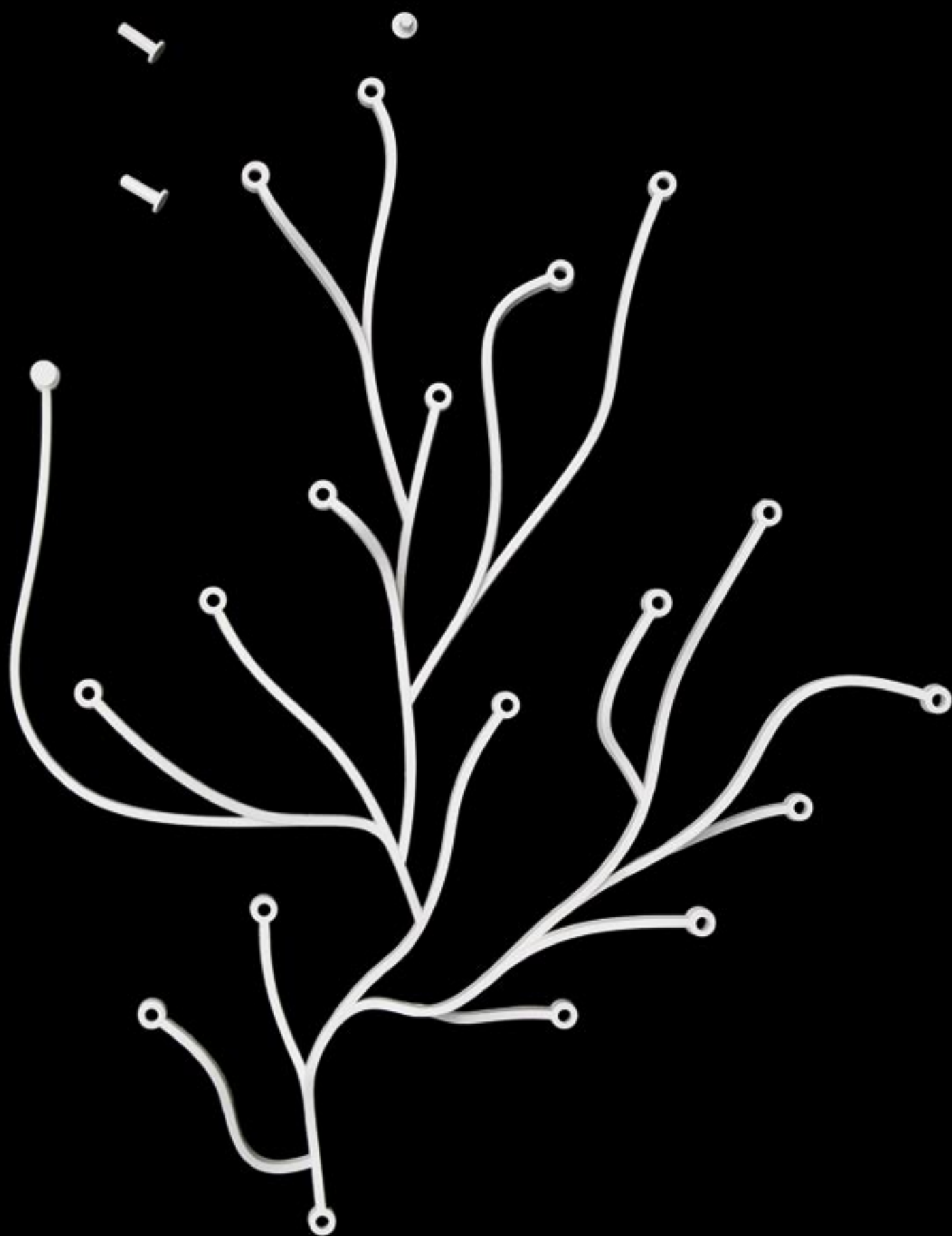
represent the chair by means of our virtual modelling software, that is, an orthonormal digital script, which represents an obstacle to the refined chaos of the organic. Resorting to this working method, which consists of moving on from a drawing to three-dimensional representation, is unrelenting. Here, we found a subterfuge: having produced drawings by hand on large sheets of paper on a 1:1 scale, these two-dimensional designs were projected onto the surface of a shell [figs. 11, 14, 15, 16]. On the seat and the back, this worked fairly well, as the drawing of the branches does not move too much. Instead, there was serious distortion on the slope of the armrests. Like an anamorphosis. The distortion of the design, when applied to the form in three dimensions, was a real surprise. The branches had to be redesigned. But the real difficulty lay in retaining their spontaneous aspect. The great ambiguity of this project was to make the very sophisticated technique demanded by plastic injection moulding cohabit with a necessary poetry that can only be obtained through the sensitivity of drawing by hand [figs. 7, 8].

Plastic chairs usually fall within two distinct groups: either the shell is fixed to the base, or the entire chair is moulded in a single piece. In the case of *Vegetal*, the solution adopted was different. For better stability, the front legs are linked to the shell. In a certain way this causes them to be much more in line with the design of the chair. At the back, the legs are glued on. These are two separate parts. Then there was the issue of successfully incorporating them in a way that is fluid, but also structured. It was decided to branch out the circular sections of the legs to make them match up with the T-profile sections of the seat, the objective being to retain the suggestion of an organic development [fig. 21].

As well as the two- and three-dimensional design drawings, throughout the duration of the work process, models have enabled the changes made to be visualized spatially. This part of the work was, on the one hand, carried out on very precise models, manufactured by Vitra [figs. 17, 18, 20, 21, 22, 23], and, on the other, on items modelled by us, more sensitively [figs. 9, 10, 12, 13]. During the past year, when the process was speeding up, we were designing directly on to the models provided by Vitra, in order to perfect the position of each branch and the accuracy of its curve [fig. 19].

Vegetal could not have existed without the technical sophistication of modern software, in the same way that it could not have moved on from the finesse intrinsic to the stages of design drawing by hand. It is the close association of these two processes that has been so special. The complexity of its form, which must be uniform as a tree or a flower would be, has continuously forced us to rethink the whole thing in respect of each detail: one might say, this chair has been redesigned a thousand times.

Interview with Constance Rubini, January 2009.



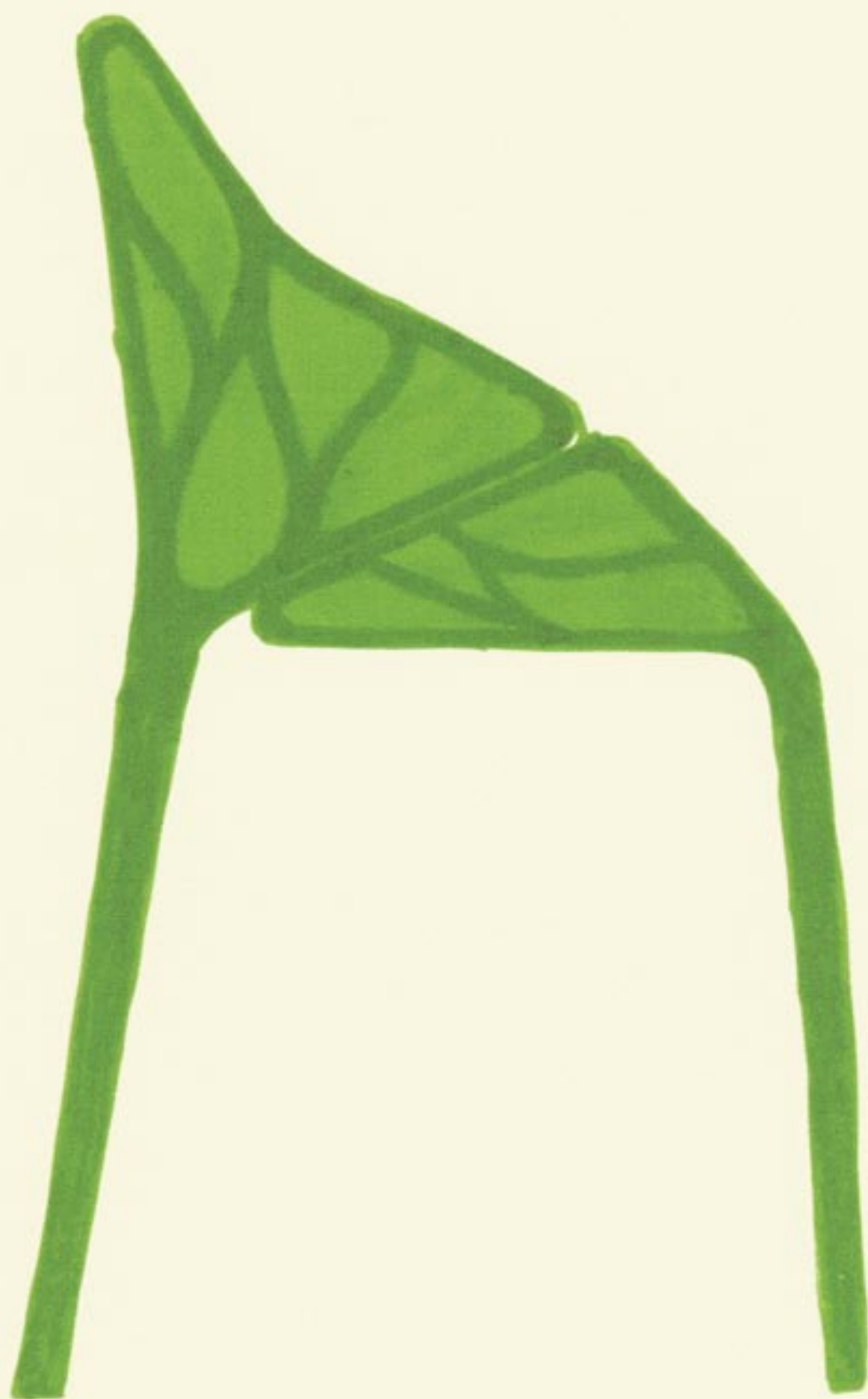
1

Algue, module in injected polyamide.
Vitra, 2004.



2

Drawing in felt-tip pen and pencil,
October 2005.
Study drawing.



3

Drawing in felt-tip pen,
October 2005.

Study drawing showing the image
of a transparent leaf.



4

Drawing in felt-tip pen,
October 2005.

First study drawing presented
to Vitra marking the birth of the project.



5

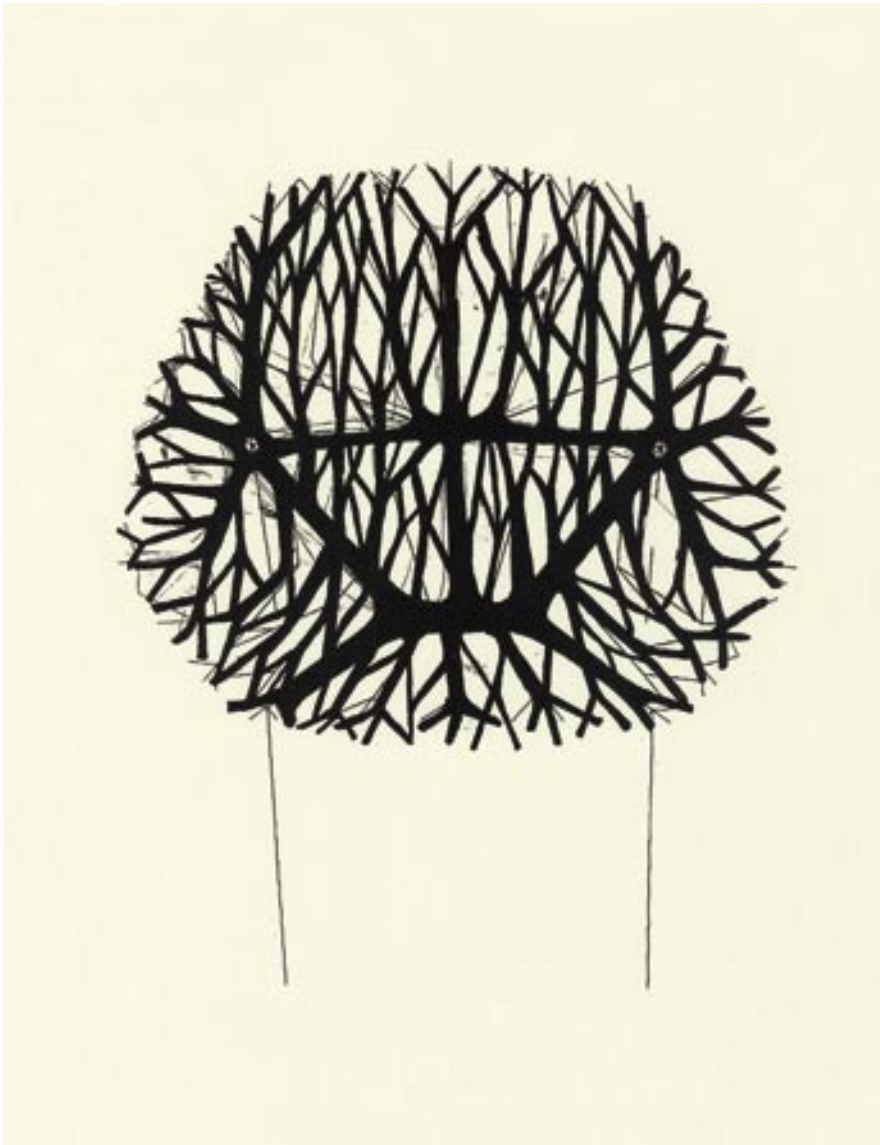
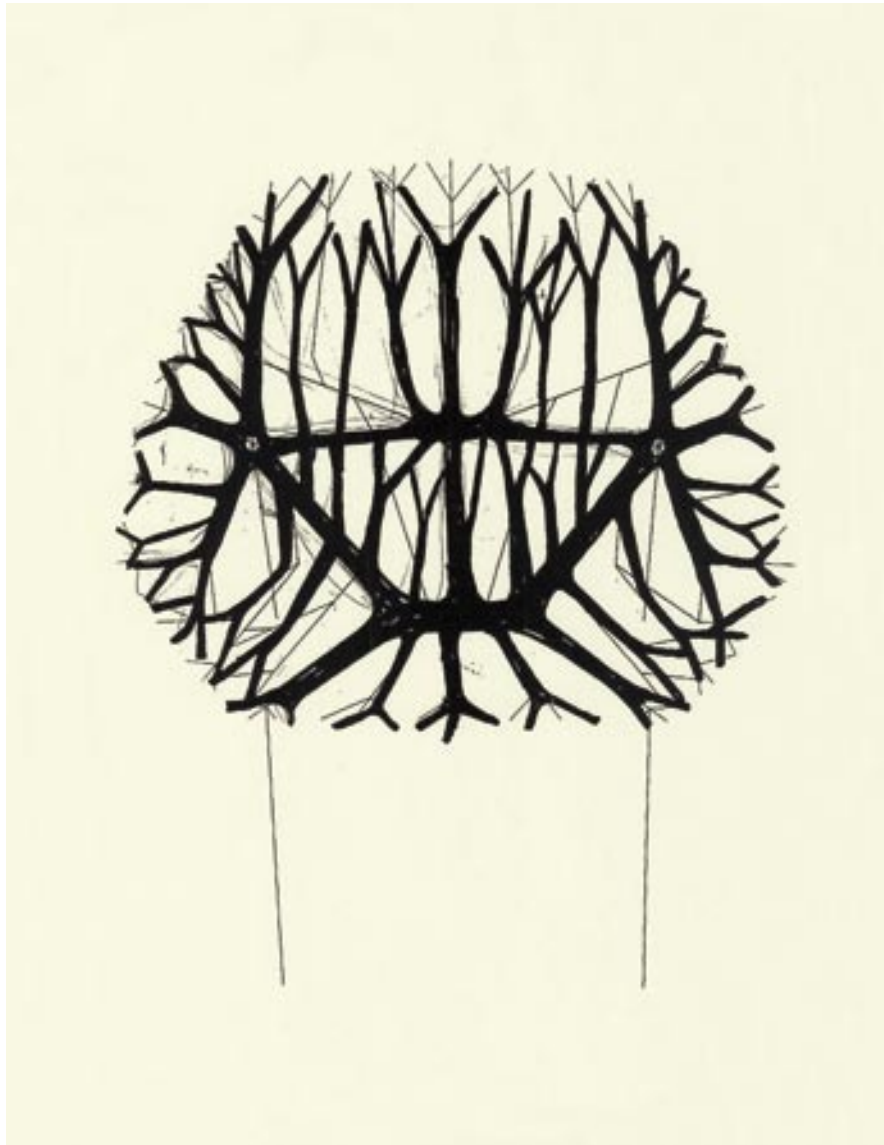
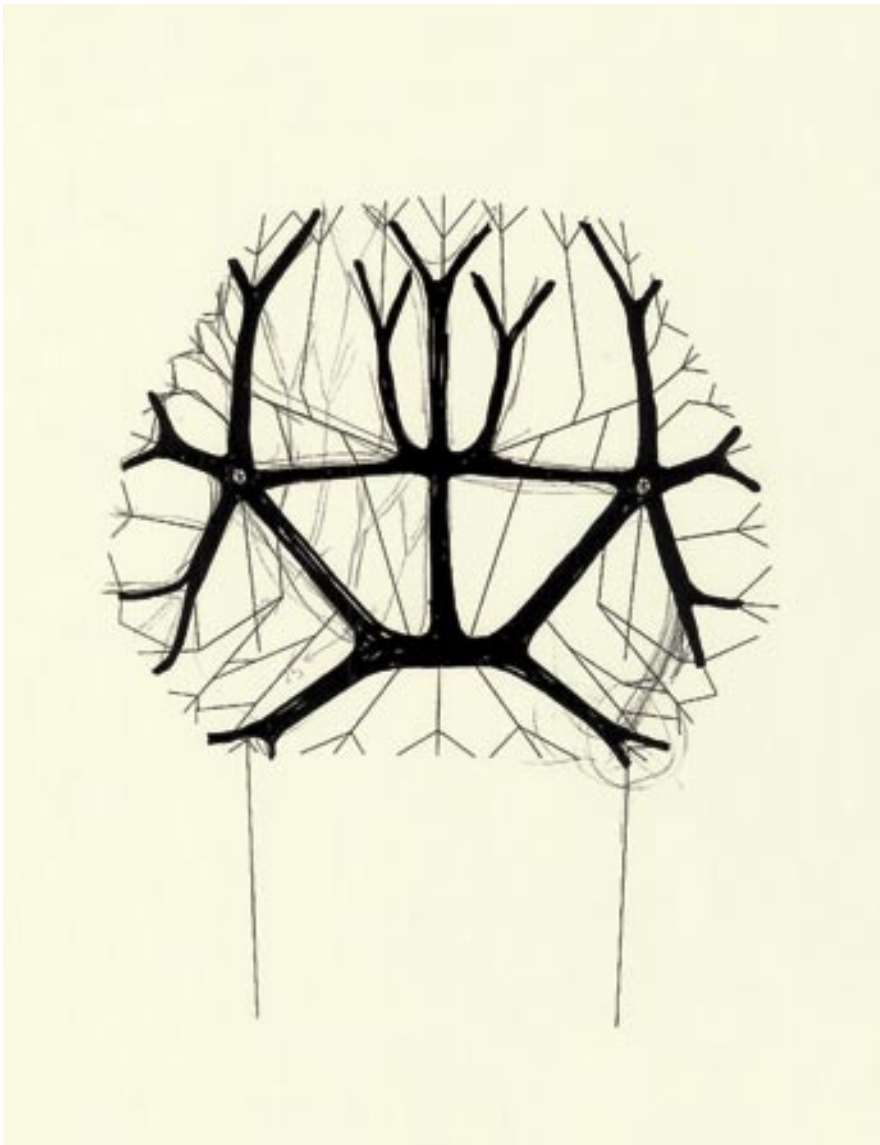
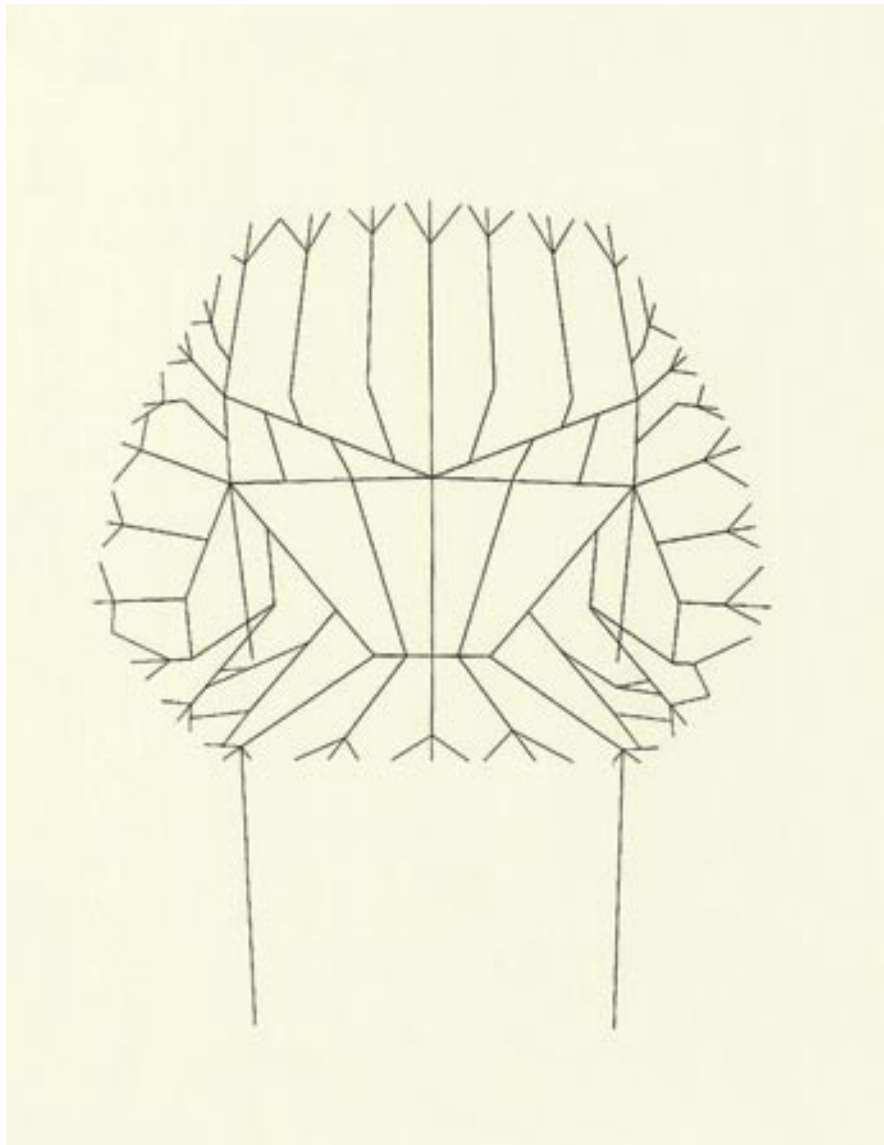
Stereolithographic model, scale 1:5,
November 2005.

The first three-dimensional model
made from a three-dimensional data file.



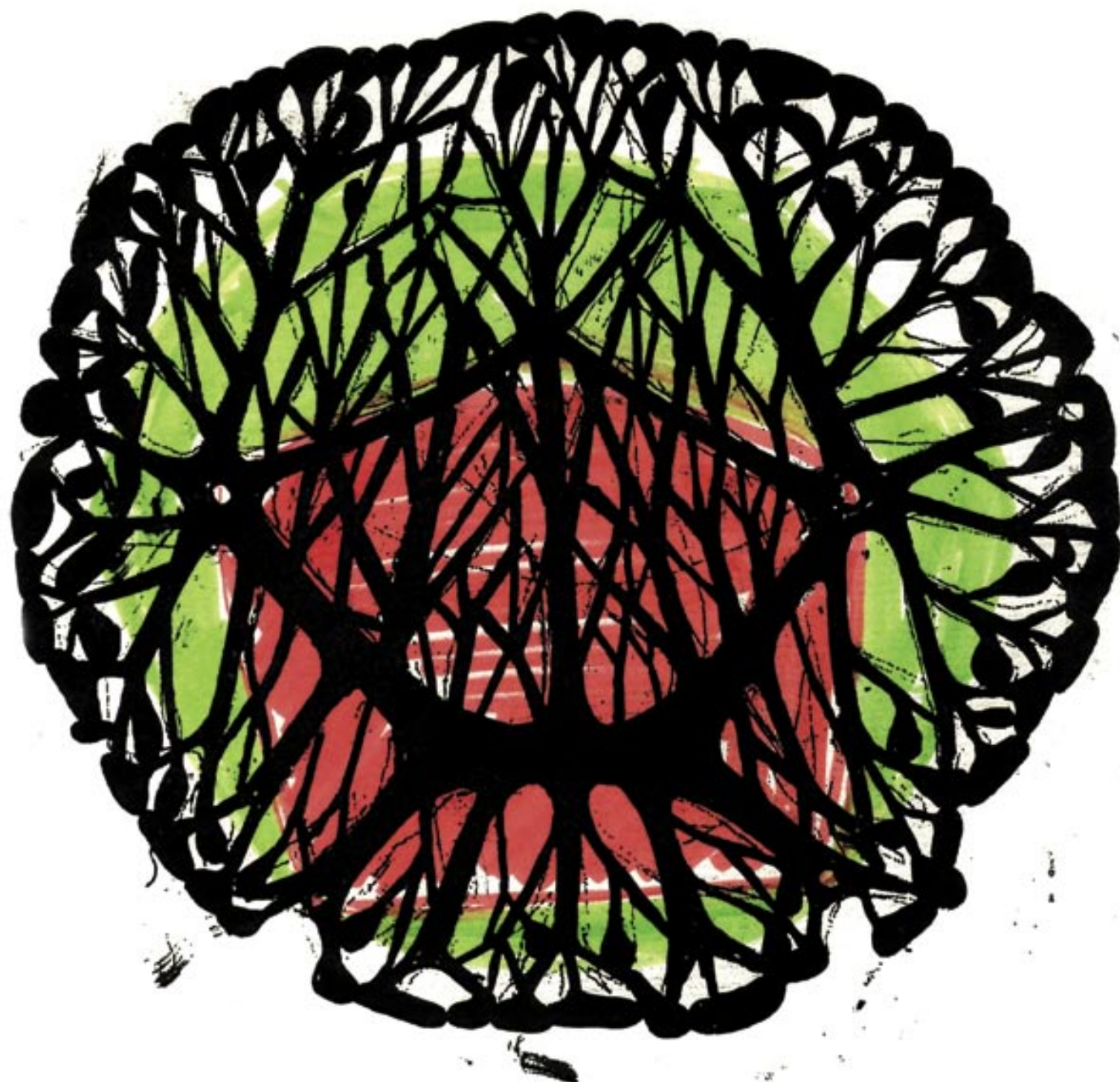
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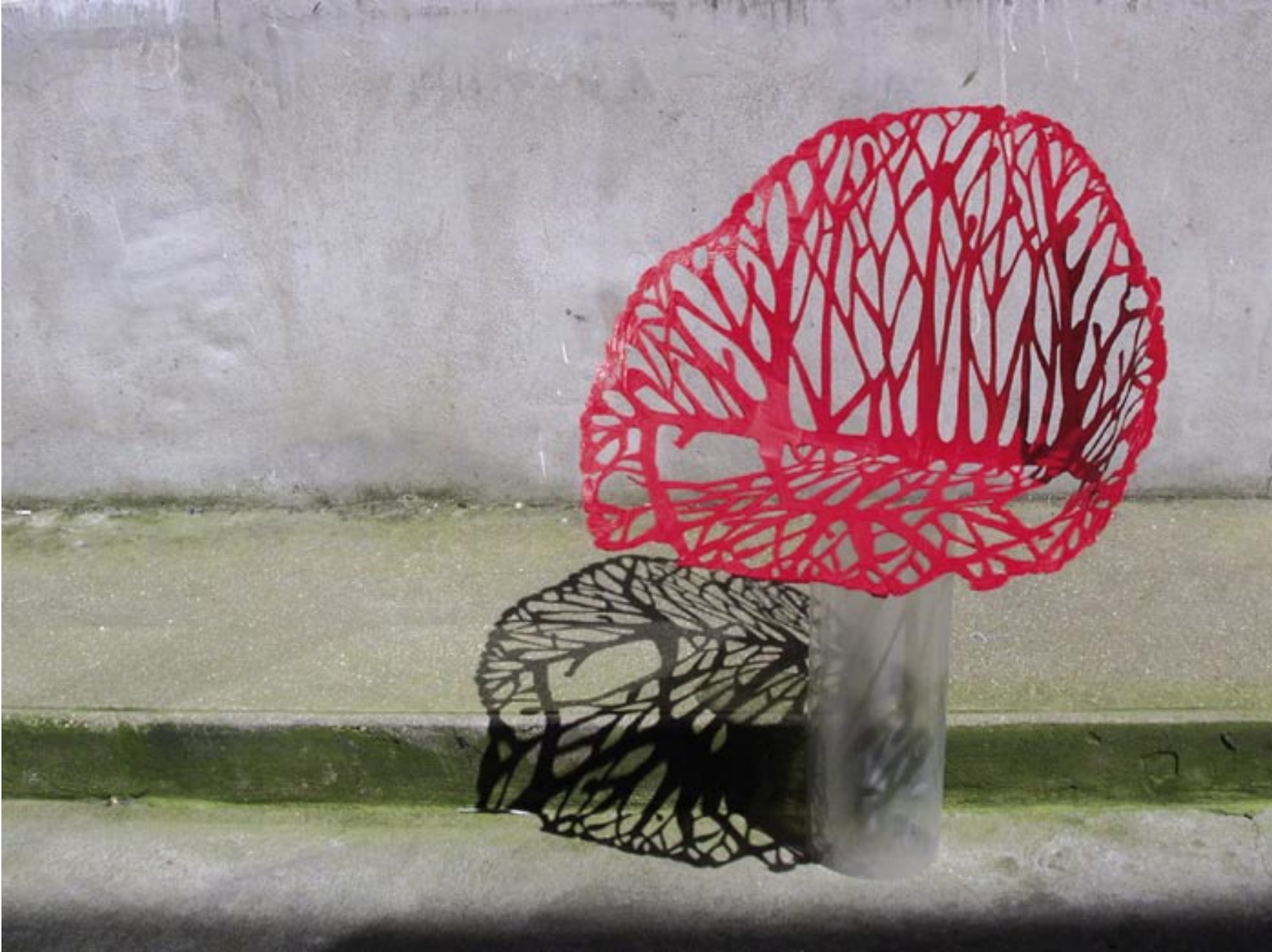
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Drawings in felt-tip pen
on digital print-off and photocopies,
November 2005.
Study for the placement
of the main and secondary branches.



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Drawing in felt-tip pen on photocopy,
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Study to find the principle for linking
the branches to the lines of the chair.



9

Model in glued paper, scale 1:1,

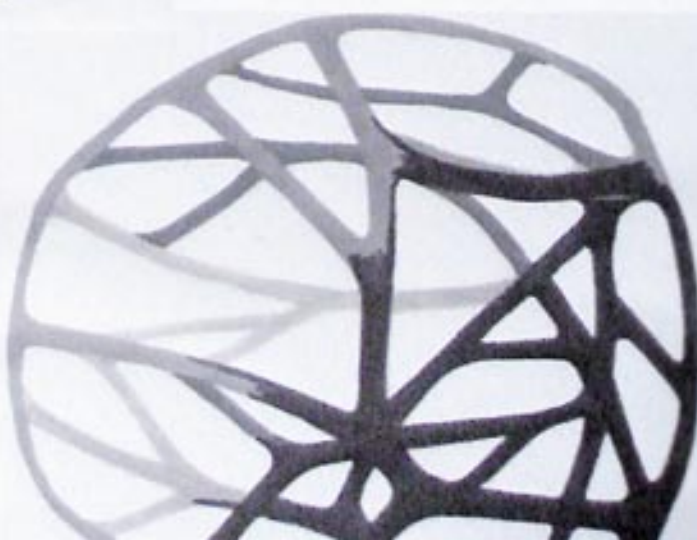
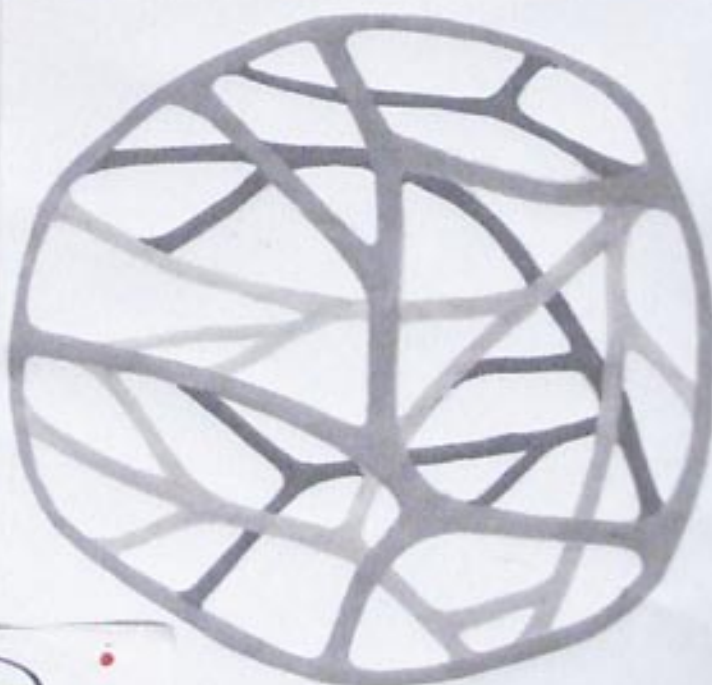
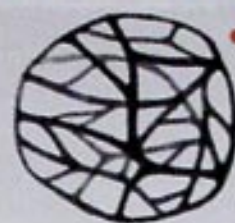
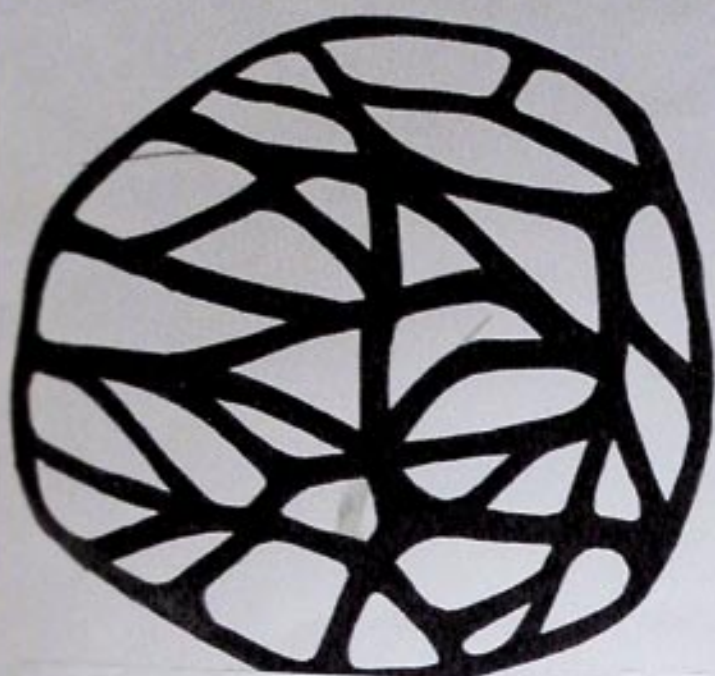
April 2006.

First test at actual size.



10

Shadow of a model,
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II

*Drawings in felt-tip pen on paper
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December 2006.*

*Hundreds of stages were necessary
to design a balanced structure.*



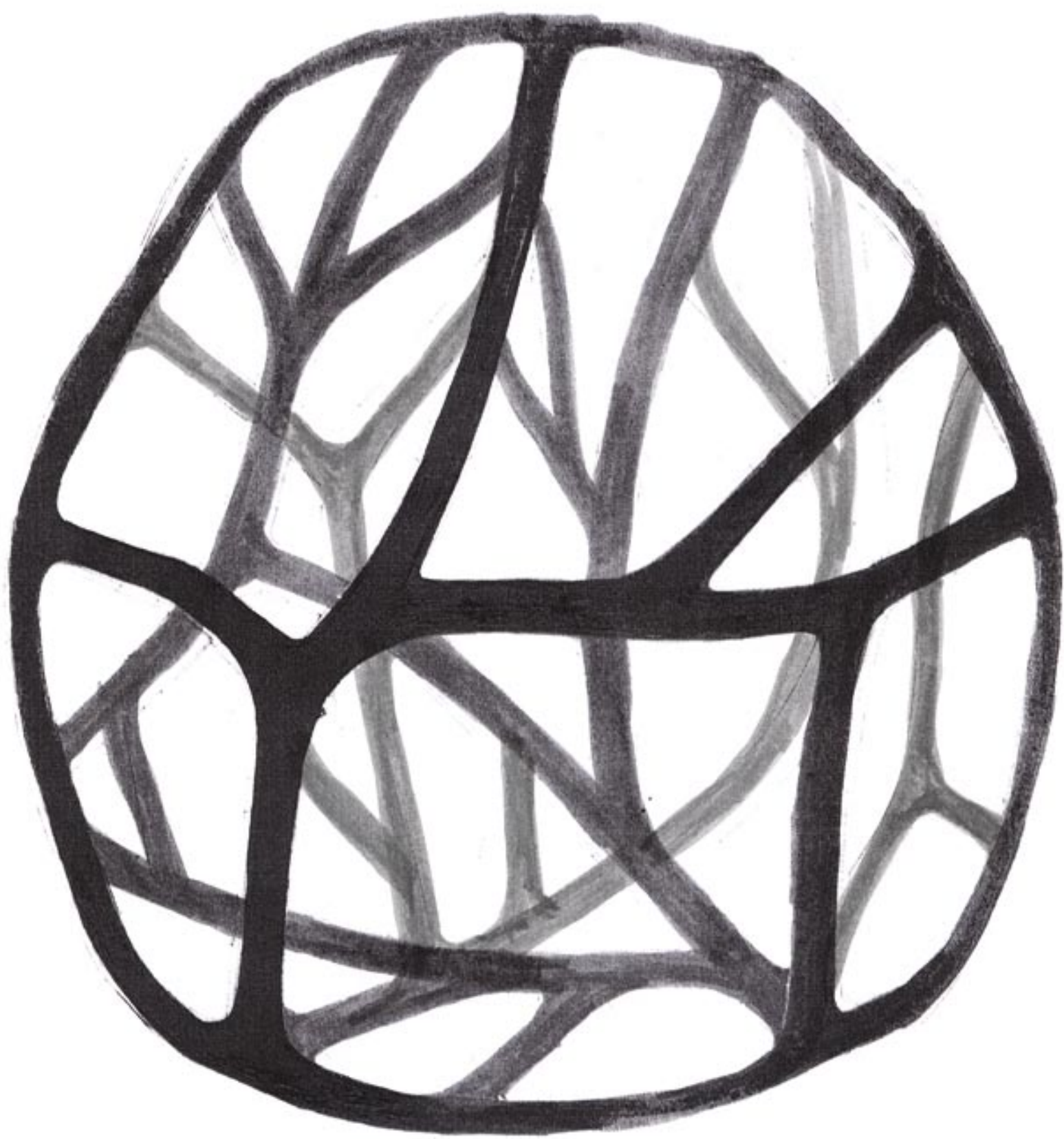
12

Model in glued paper
and polyethylene foam, scale 1:1,
October 2006.
Ronan and Erwan Bouroullec.



Model in wood, pvc sheet
and polyurethane resin,
December 2006.

First models for testing the comfort
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and density of the branches.



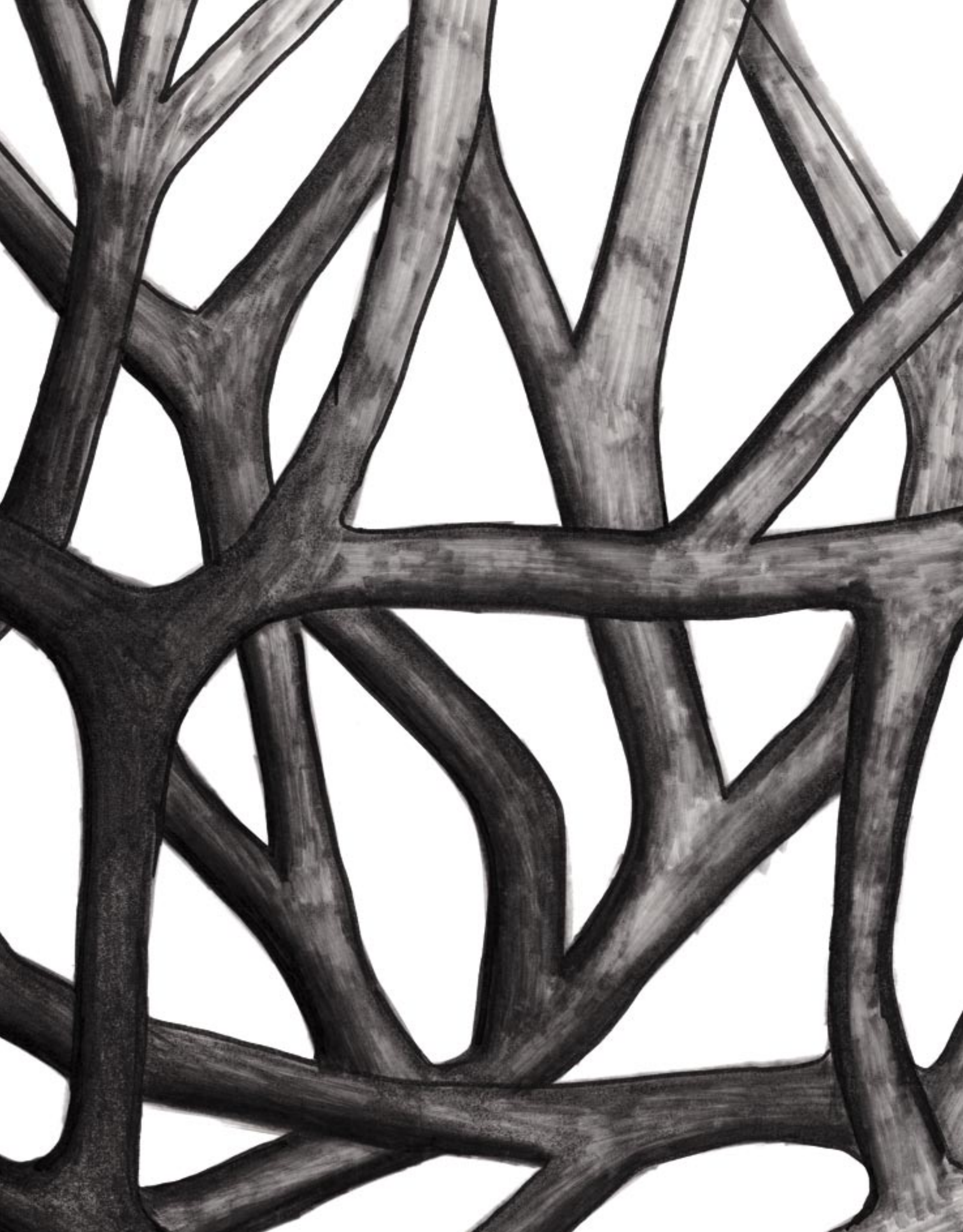
14

Drawing in felt-tip pen, scale 1:1,
December 2006.
A search for arborescence.



15

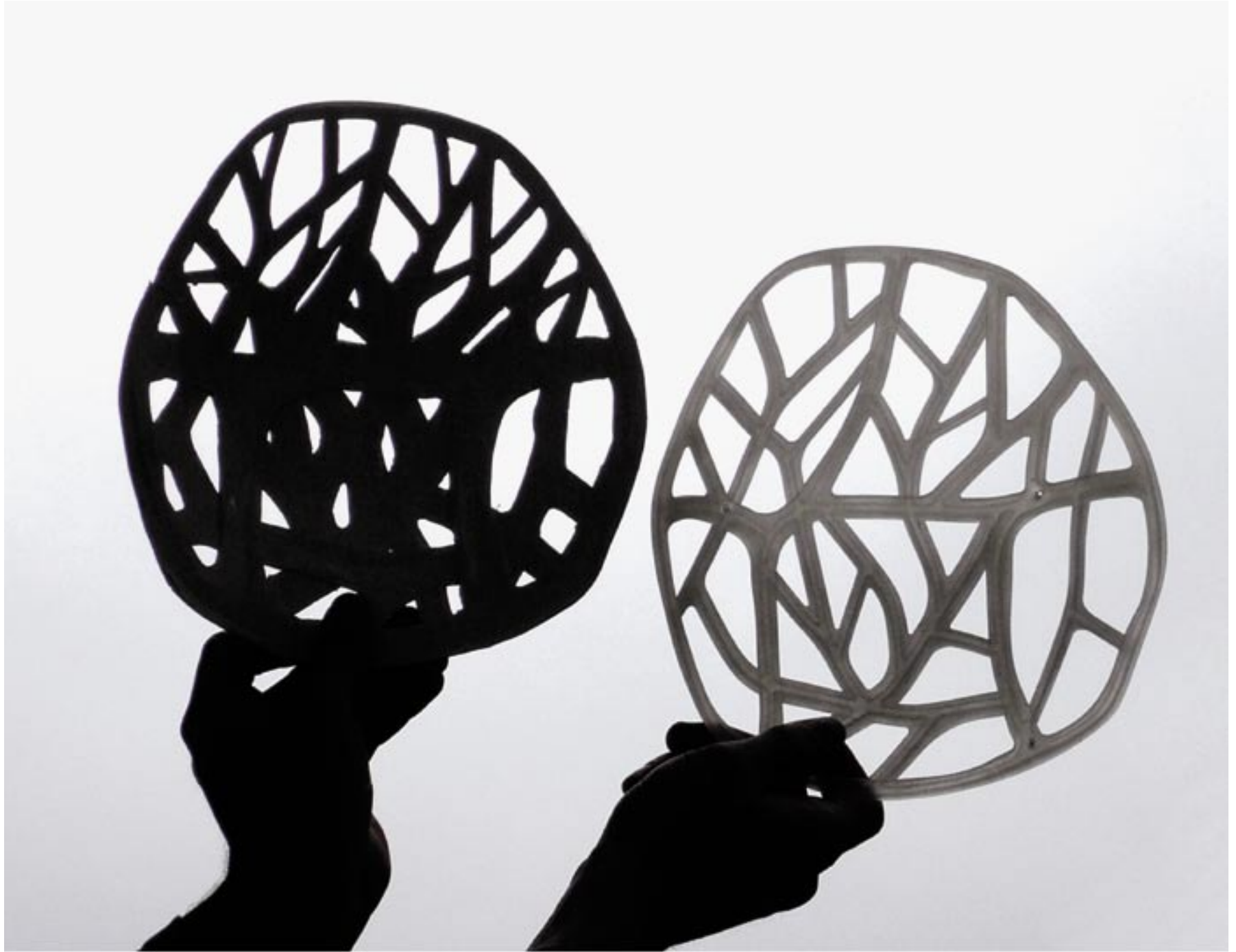
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16

Drawing in felt-tip pen,
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Study of the interlacing of the branches.



17

Stereolithographic models,

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Models enabling the appearance to be compared
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18

Stereolithographic model, scale 1:5,
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19

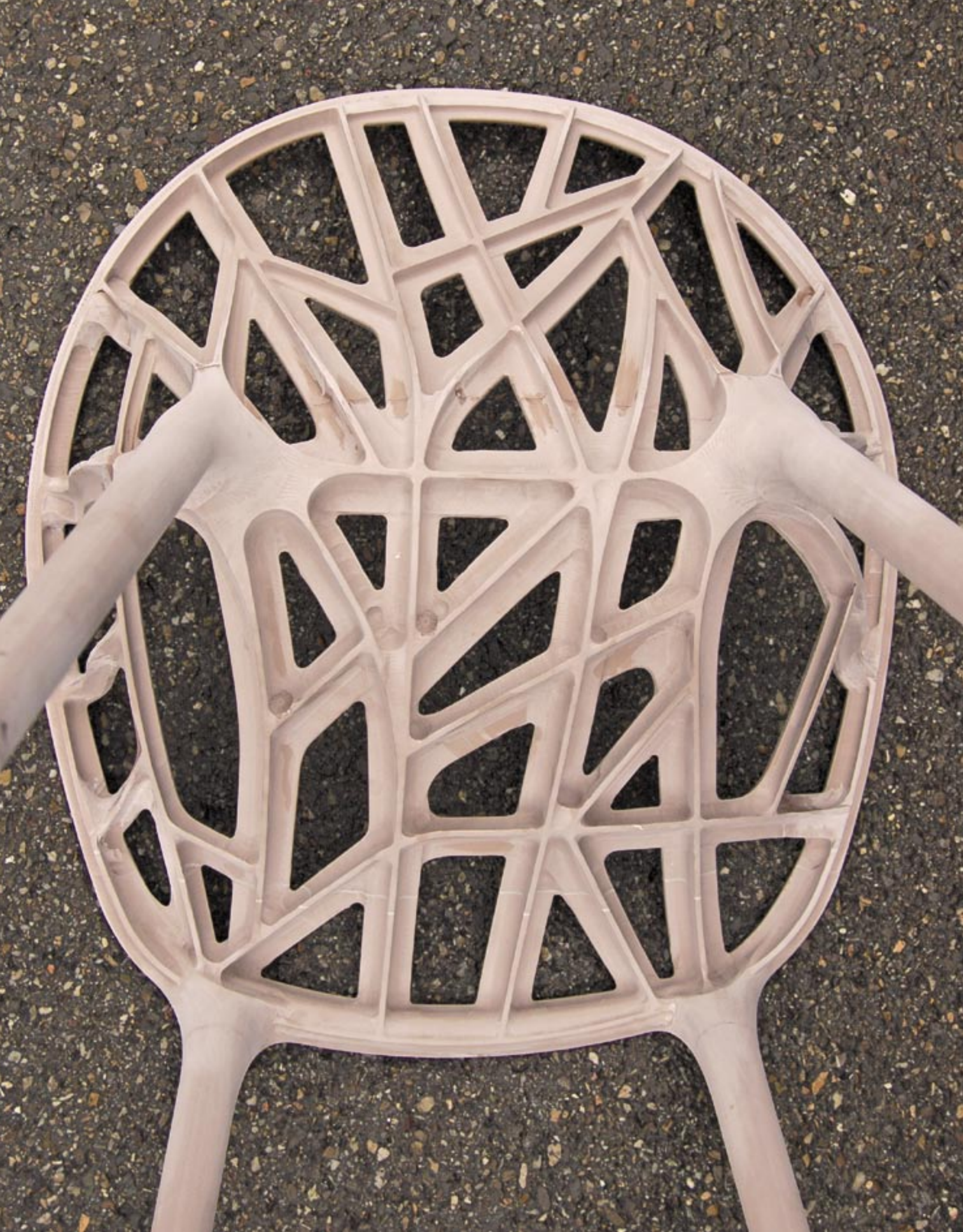
Polystyrene model, digital machining, scale 1:1,
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Model used for testing the comfort of the seat.
Final adjustment to the painting
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20

Model in high-density polyurethane foam,
digital machining, scale 1:1,
January 2008.
Model for checking the ribs
and the final details.



21

Model in high density polyurethane foam,
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Model enabling the balance
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22

Mould in high density polyurethane foam,
digital machining, scale 1:1,
March 2008.

Mould made by Vitra for producing
models in vacuum-cast resin.

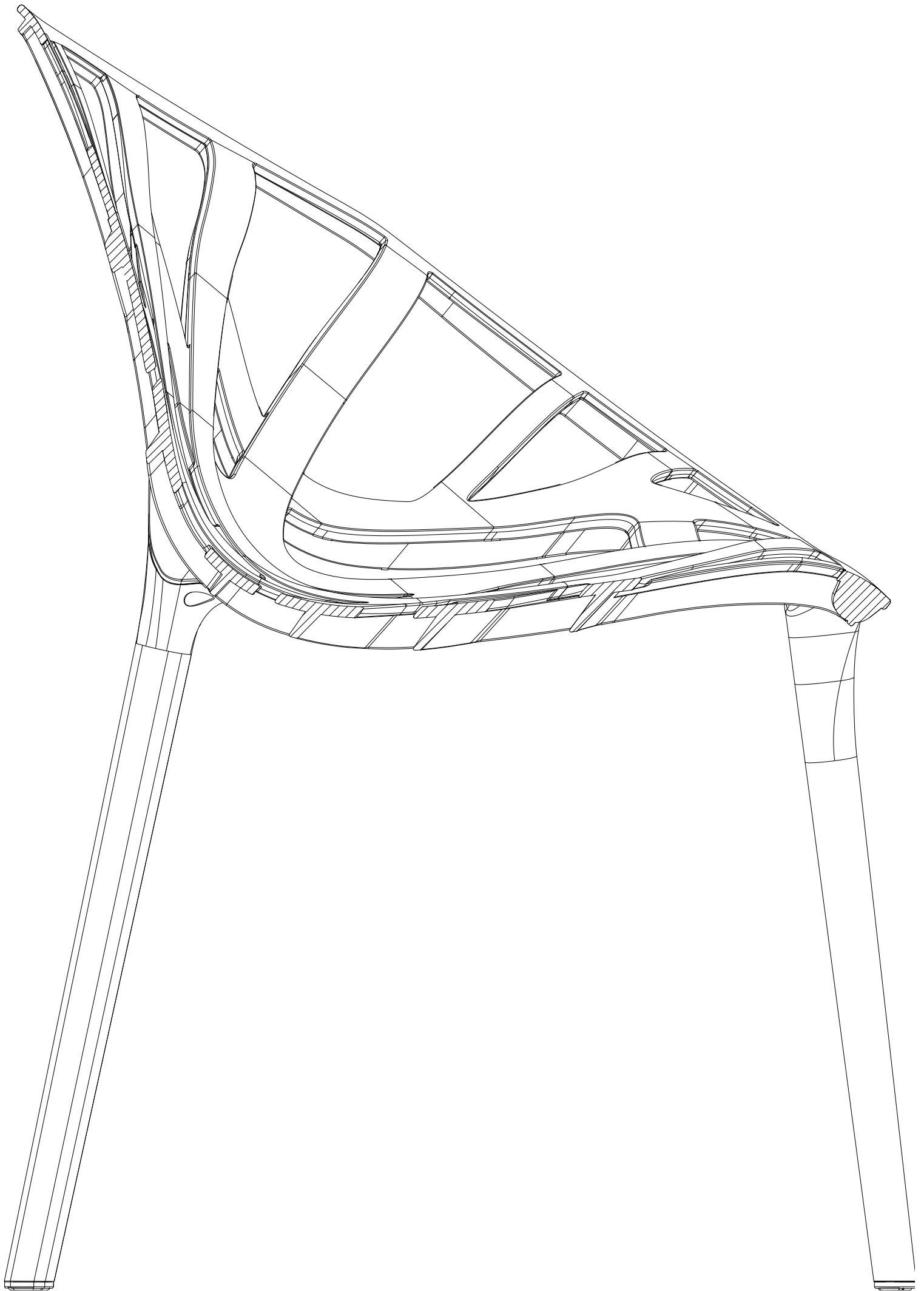


23

Painted model, vacuum-cast resin,

May 2008.

Analysis of the final details.

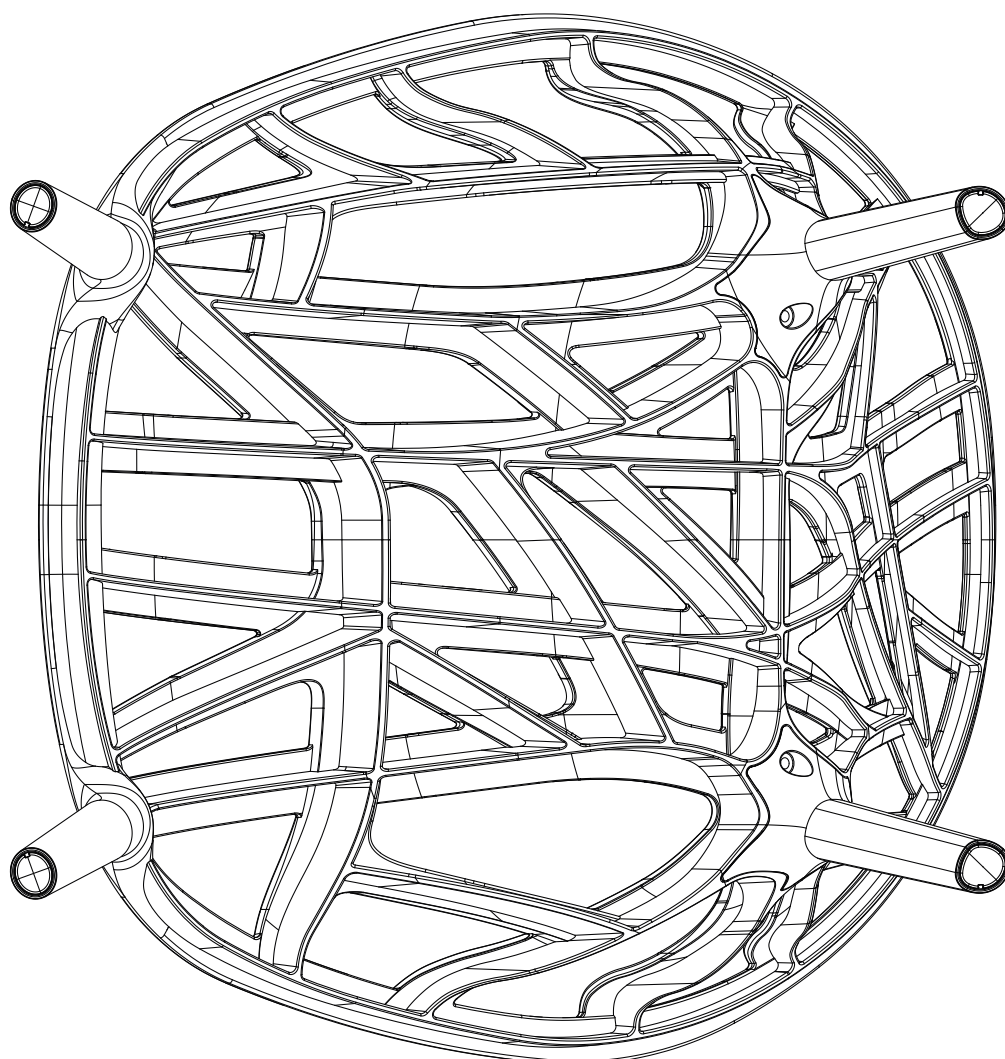
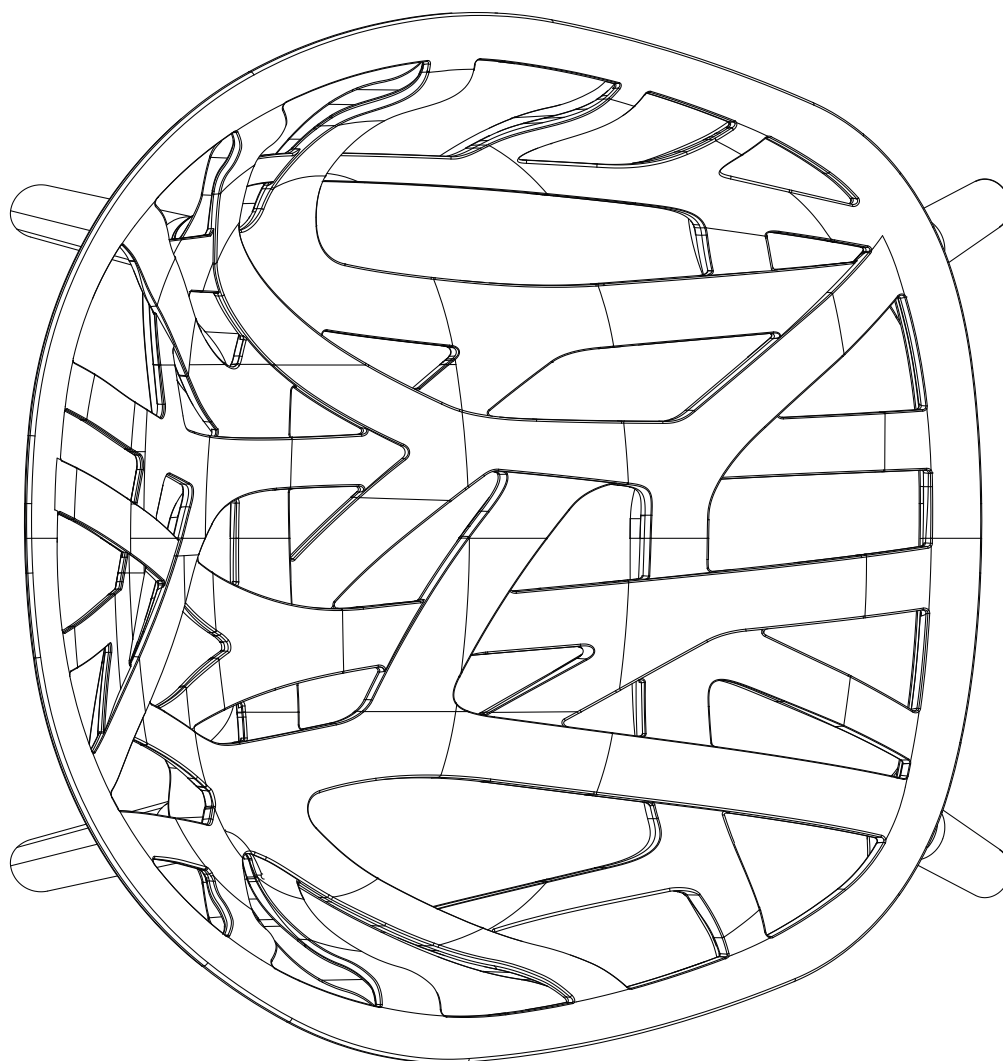


24

Technical drawing, final version,

July 2008.

Transverse section.

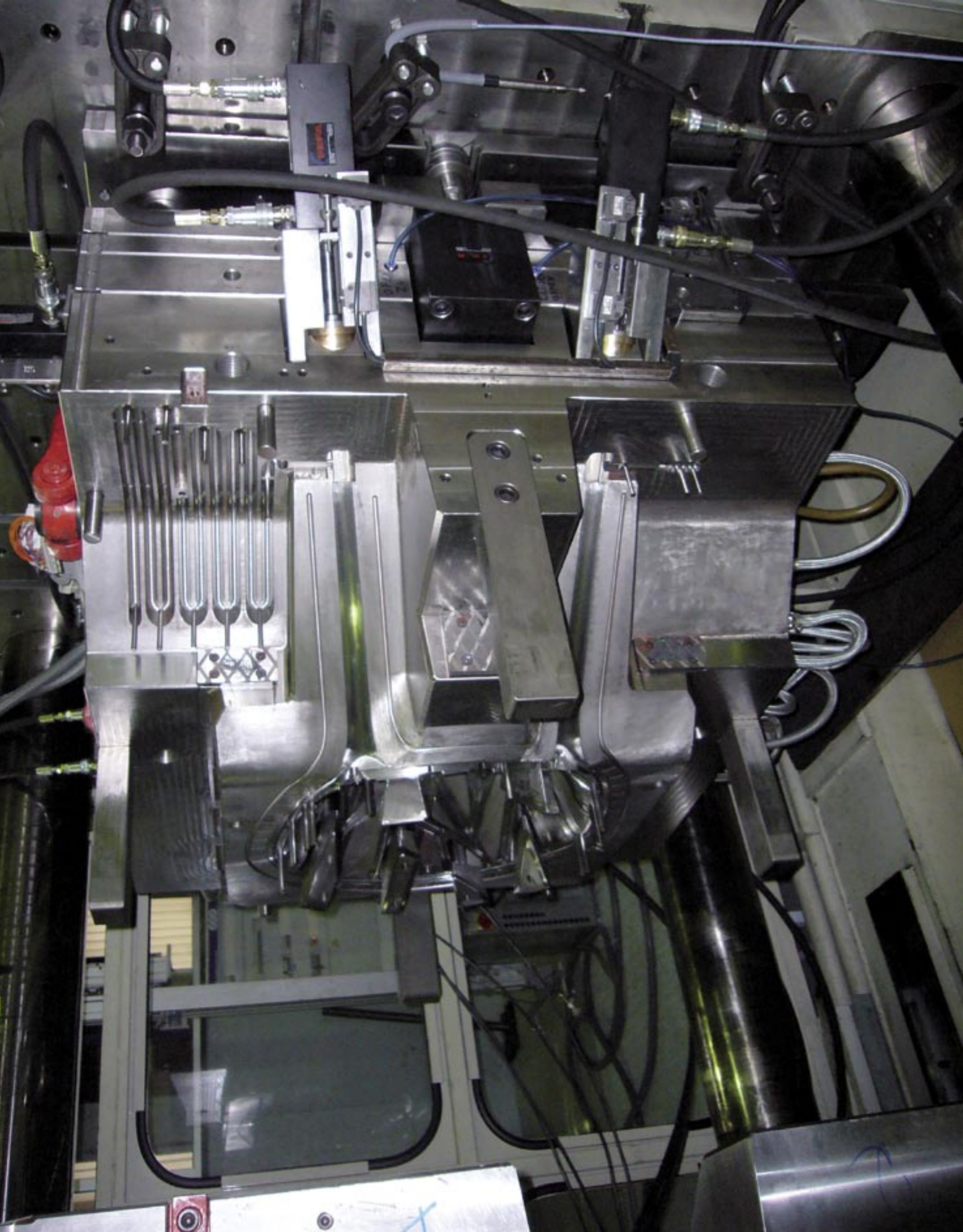


25

Technical drawing, final version,

July 2008.

View from above and below.



Injection mould installed in the press, steel,
September 2008.

Principal mould measuring $115 \times 142 \times 109$ cm
and weighing 14 tonnes.



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Prototype in polyamide,
November 2008.

Chair resulting from the first injection tests.



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29

Final pieces, stacked,
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30
Full range of colours for Vegetal,
November 2008.

Vegetal

Ronan & Erwan Bouroullec



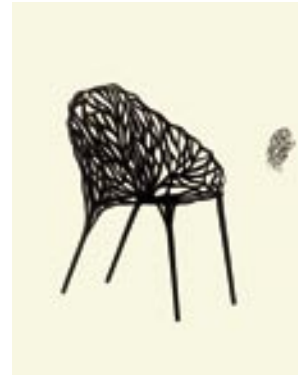
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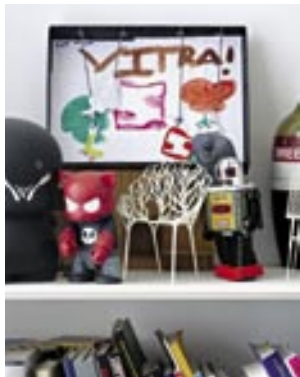
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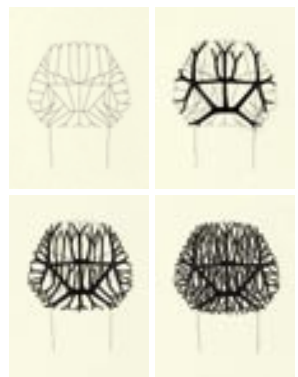
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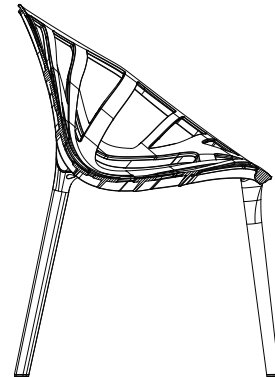
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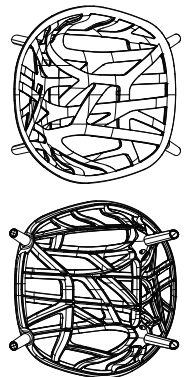
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