

# PLANO CHAIR

## 1.1. Contact Information

Brandes en Meurs industrial design  
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**Brandes**  
en **Meurs** industrial design



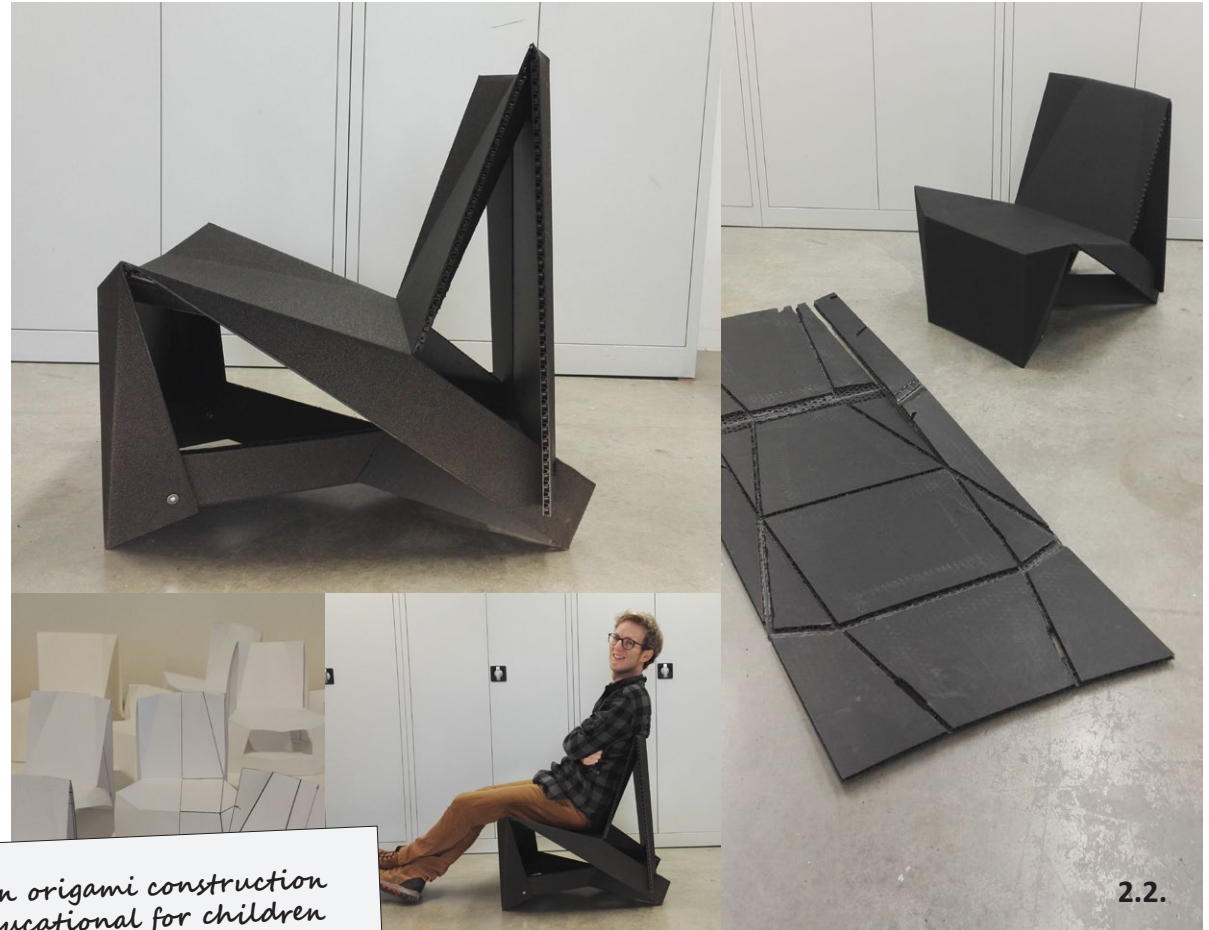
## Product Description and Image

### 2.1. Plano

Plano is a chair made from one single piece of recycled and fully recyclable sheet material. Durable living hinges that are made by cutting into the sheet material allow it to take its final shape. Production is easy and only involves single sided 2.5D milling of a pre produced tri laminate panel. This enables short production runs and endless product variations within each run. One of the difficulties of recycling is the problem of sorting all the different components into separate material flows. We decided that it would be a lot easier if a large proportion, or ideally the whole product, was made of the same material.

Inspired by origami where a uniform flat material is transformed into a complex paper structure, we set out to develop a useful product (chair) that anyone could form from a given rectangular sheet of material. In our search for the best material to do large scale origami we selected a prefabricated polypropylene panel. Polypropylene is perfect for making durable living hinges and it is fully recyclable. The selected panel has a woven top layer, also made from polypropylene, giving the chair a fabric covered appearance. To make full use of the source material we defined a rectangular design that fits exactly within the production size of the prefabricated sheet material. To further reduce waste we minimized offcuts inside the defined rectangle. This process resulted in a product that can be cut from a flat sheet with hardly any lost material. This allows for a short production time without much chip production, meaning low energy consumption and minimal waste.

Although origami is already often used as an inspiration for product design there are not many examples where the final product is still folded from a rectangular flat sheet or where the user gets to experience the folding process. We hope Plano will be seen as an archetypical origami product (technically Kirigami because the material is folded and cut). Furthermore, Plano has potential to be more than just a chair. Plano demonstrates how we can organize affordable small run production of (furniture) products using a 100 % recyclable mono-material, without the need of any extra components. Therefore we hope the design can also become exemplary for Cradle to Cradle thinking.



2.2.

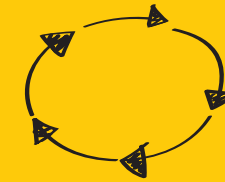
- + Fun origami construction
- + Educational for children and grown-ups
- + Flat storage, hangs on wall
- + Cradle to cradle
- + Near zero % lost material
- + 1 production step between sheet material and finished product
- + Freedom to change parameters for each single product
- + Any production batch size

2.3.

Waste polypropylene

Plano Chair

tri-laminate board with woven finish



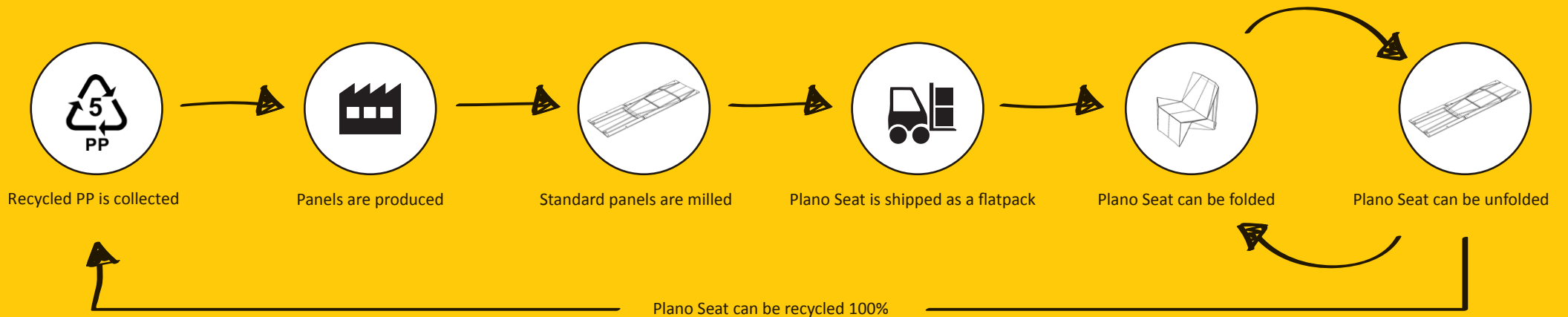
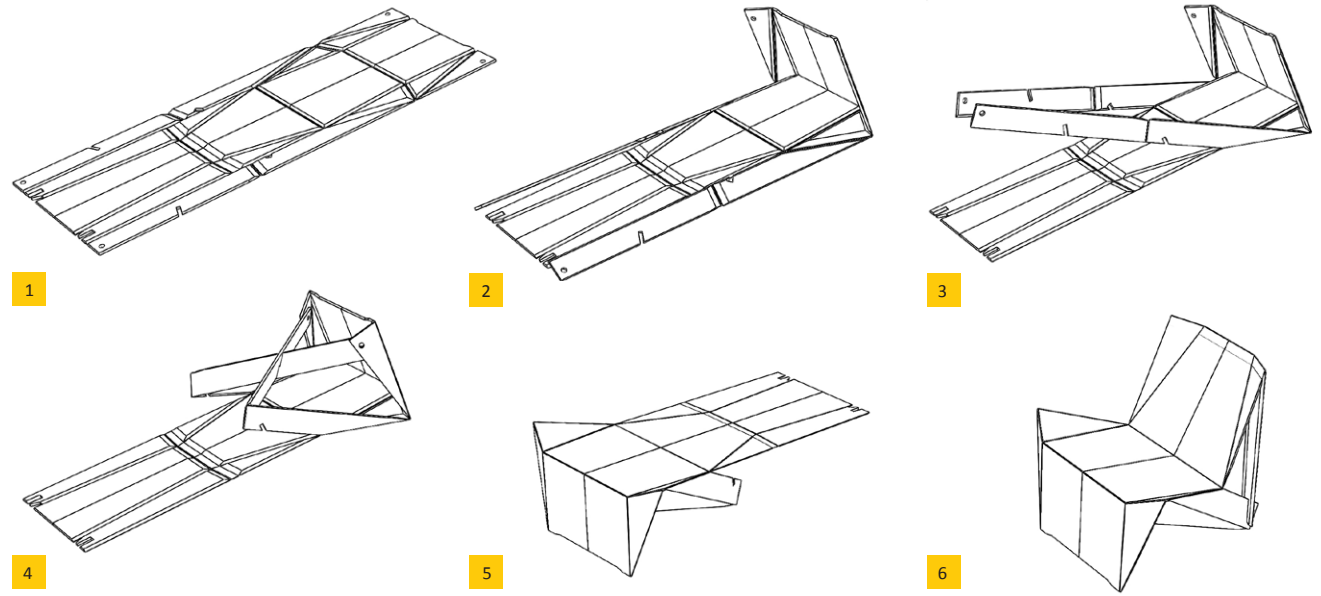
Polypropylene sheets and thread

Thermoformed polypropylene core panel, flat outer layers and woven polypropylene fabric

## Reutilization Cycle and Business Model

### 3.0 Reutilization Cycle & Business Model.

Manufacture of Plano is simple and straightforward. A common milling machine is all that is needed. Therefore production can be fully automated and decentralized. Products will be made near area of distribution, thus eliminating the need for long distance transportation. When Plano's useful life comes to an end it is processed by a dedicated polypropylene recycling facility. An important part of the suppliers growth strategy is the planning of their North American recycling facility based upon the plant in Germany. The plant will work both industrial scrap and surplus material and will be committing itself to an end of life buy-back program for these products. As Plano is made of this material, the service will be able to process the full product.





## Material Selection

### 4.1. Overview

This is a lightweight mono-material board. It is made up of three polypropylene layers. The core layer is shaped into an egg-carton like structure by thermo-forming. After lamination to the outer layers this becomes a light and stable tri-laminate sandwich structure. By adding a fourth layer of woven polypropylene thread the panel looks as if the top surface has a textile finish. This gives our product an upholstered look and feel. All layers are made of the same material and are fully recyclable through one single process.

The material is made in Germany and the United States. The company has a strong focus on green technology. All products are designed for recycling. No adhesives are used. All components are polypropylene based, compatible and made with recycled materials. By strictly controlling the sourcing and processing of recycled materials, the manufacturer is able to produce high-quality products from waste materials that would otherwise be landfilled. The panel is claimed to be low weight (approx. 50% lighter than wood). The material is durable, corrosion, rot and weather resistant, easy to post process and fully recyclable.

### 4.2. Material Reutilization

60% of the product is made from recycled content. We estimate that 1% of the material is lost during its lifetime due to contamination and wear. 99% of the product is therefore considered recyclable. With the material reutilization equation we calculate a reutilization score of 86.

Equation:

Nutrient Reutilization Score = ((% of the product considered recyclable or compostable) \* 2 + (% recycled or rapidly renewable content)) / 3 \* 100

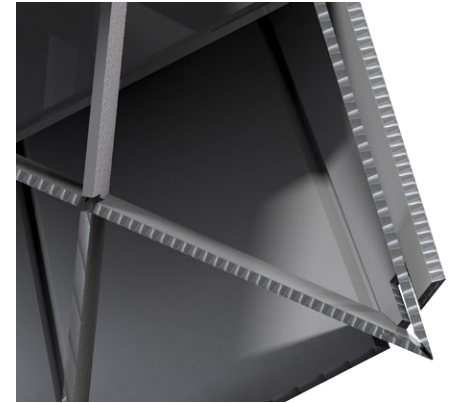
$$(0.99 * 2 + 0.60) / 3 * 100 = 86$$

### 4.3. Material Health

Polypropylene is considered a safe plastic. It is used to make containers for yogurt, margarine, takeout meals, and deli foods and is also found in medicine bottles and bottle caps.

### 4.4. Impact Statement

Structure, moving parts, fixtures and finish are all formed from the same material. Also everything is integrated into one single component made purely of recyclable polypropylene. This simplifies end of life processing and minimizes the chance that any useful material is lost.



**Strong resilient**

- 100% recyclable
- robust and heavy duty
- easy to process
- textile look & feel

