COMPUTATIONAL DESIGN · DIGITAL FABRICATION

Arsenio Andrea Meomartino

Design Engineer at Spentys — I turn 3D body scans into manufacturable, individualised devices: parametric systems in Rhino / Grasshopper, C# and Python, from scan to production file.

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PROFILE

Engineer who designs.
Designer who engineers.

I hold a B.A. in Materials & Nanotechnology Engineering from Politecnico di Milano, an M.A. in Product Design from ELISAVA Barcelona, and an M.C. in Parametric Design and Digital Fabrication from Controlmad.

Currently at **Spentys** in Brussels, I develop patient-specific orthopaedic devices from 3D body scans, automate computational workflows in Grasshopper/Rhino, and design new products from clinical brief to production file.

My edge is the overlap: I can evaluate a material at the molecular level, model it parametrically, and prototype it — then hand over a validated design file to manufacturing.

ACHIEVEMENTS

2024 European Product Design Award 1st Place
Medical Category

EXPERIENCE

Nov 2023 — present
Spentys
Brussels

Design Engineer

- Patient-specific orthoses modelled from 3D scans
- Parametric systems in Grasshopper + custom C# components
- Scan-to-production automation, delivered as web configurators

2024 **Braun Prize Award** 1st Place
Hipcare — Paediatric Hip Orthosis

2023 **SABIC Circul-A-Thon** 1st Place
Circular Economy Innovation

2023 **BASF Forward Award** Semifinalist
Sustainable Materials

Jun — Sep 2023
Lowpoly
Madrid

Industrial Designer

- Computational furniture design (chairs, lamps, tables)
- Recycled / food-waste derived material pellets
- Robotic arm (ABB, KUKA) path automation

Feb — Jun 2023
Freelance
Barcelona

Automotive Designer

- Parametric surface patterns for automotive components

OVERVIEW

01

Hermes & Zeus

Articulated dynamic AFO — full parametric system, scan to print

`100% automated in Grasshopper`

02

AFO

Patient-specific shells, UV-mapped graphics, lattice night splint

`40% automated in Grasshopper`

03

SMO

Supramalleolar orthoses — hindfoot control, ankle left free

`80% automated in Grasshopper`

04

Hipcare

Paediatric hip orthosis — European Product Design Award 2024

`10% automated — hand-modelled`

SELECTED PROJECTS

01 / HERMES & ZEUS

Hermes & Zeus

In production

An articulated dynamic ankle-foot orthosis built as a **system**, not a model: one Grasshopper definition takes a leg scan and returns a print-ready, assembled device — shank, footplate, hinges and straps included.

Parametric System | Scan-to-Production | C# / RhinoCommon | Mesh Processing | Hinge Mechanism

Web Configurator

THE PROBLEM

Every patient gets a different scan, but the device still has to assemble: hinge axes must land on the anatomical joint, the footplate must meet the shank, the straps must clear both. Hand-modelling each one does not scale past a handful of patients.

THE APPROACH

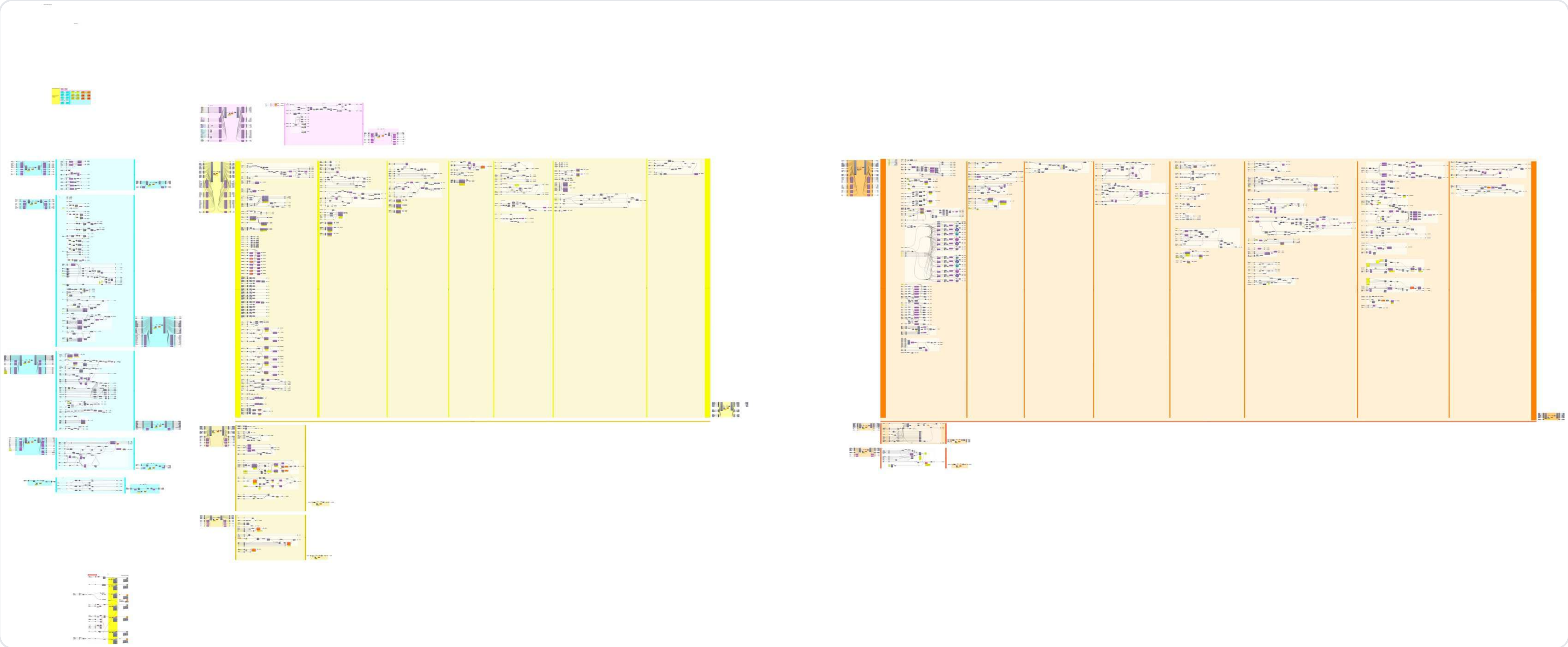
Anatomical landmarks are extracted from the mesh, the base geometry is segmented, remeshed and offset to wall thickness, and every module then rebuilds itself against those references. Where stock components stopped, I wrote custom C# ones — and the whole definition ships as a configurator the team runs without opening Rhino.

HOW IT WAS BUILT

Automated workflow — Grasshopper + ShapeDiver `100%`

No hand-modelling in the loop: a new scan goes in, a valid device comes out.

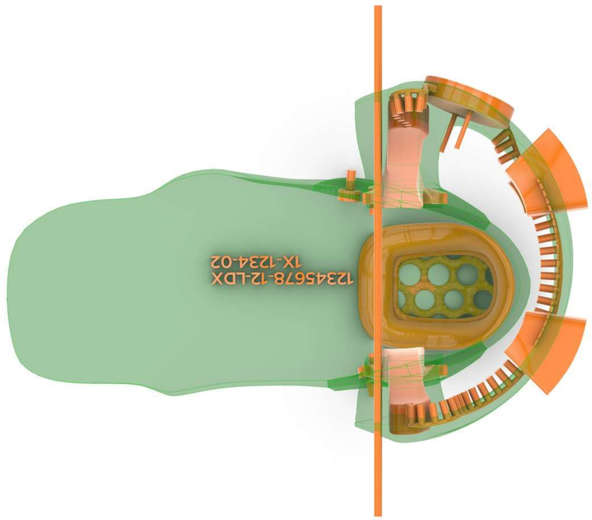
THE DEFINITION



↑ click to zoom — three macro-groups, left to right: landmark extraction & base-mesh preparation, footplate & thickness modules, rivet / anchor positioning.


USER


USER



Technical views straight out of the definition — the assembly, the hinge indexing and the parts as they go to the printer.

TECHNICAL HIGHLIGHTS

Input
3D leg scan (mesh)

Toolchain
Rhino 8 / Grasshopper

Custom components
C# — RhinoCommon

Geometry pipeline
Landmarks → segments → quad remesh → features population → final device

Delivery
ShapeDiver web configurator

Output
Print-ready parts + assembly

> **Why it matters here —** this is the part I care about: not automating a drawing, but building a system that survives contact with real production data and keeps producing valid, manufacturable geometry on inputs nobody has seen yet.

02 / AFO

Pediatric AFO

Product family

A family of ankle-foot orthoses generated from the patient scan — rigid shell, hinged variant and a perforated night splint — where fit, stiffness and *appearance* are parameters of the same model.

Ankle-Foot Orthosis | Scan-to-Device | UV Texture Mapping | Lattice / Perforation | Additive Manufacturing | Mass Customisation

THE PROBLEM

An AFO supports the ankle through the gait cycle — but it is also worn all day, in public, often by children. Devices that fit badly or look clinical get left in the wardrobe, and a device nobody wears treats nobody.

THE APPROACH

The shell rebuilds itself on each scan, and its outer surface then doubles as a design canvas: graphics are UV-mapped onto the double-curved shell without distortion, and openings are placed where stiffness allows. Same geometry, same clinical function, a device the patient picks.

HOW IT WAS BUILT

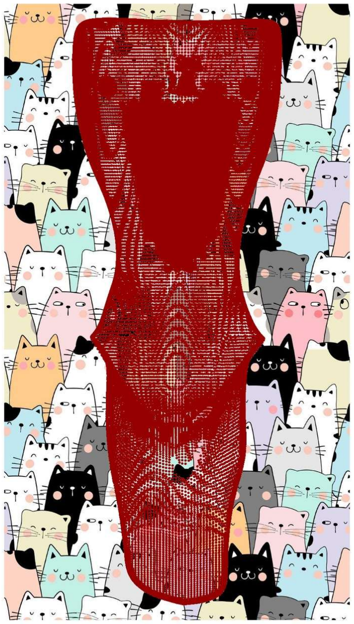
- Automated workflow — Grasshopper `40%`
- Manual modelling `60%`

`The shell and its graphics are modelled by hand; fit, trim lines and patterning are generated.`

VARIANTS

Rigid shell · anterior-panel variant · night splint — worn overnight to hold the ankle in neutral dorsiflexion, perforated to stay breathable and light.

TEXTURE APPLICATION



FLAT ARTWORK → CURVED SHELL

The shell is unrolled to a flat parameter space, the artwork is laid out on it, and the result is mapped back onto the double-curved surface. The print stays continuous across the curvature — no seams, no stretch at the ankle.

It is the same operation a knitted upper needs: a 2D pattern that has to land correctly on a 3D last.

TECHNICAL HIGHLIGHTS

Device	Input	Variants
Ankle-Foot Orthosis (AFO)	**3D lower-leg scan**	**Rigid · anterior shell · night splint**
Surface	Lightweighting	Design tool
UV-mapped graphics, per patient	**Perforation / lattice patterning**	**Grasshopper / Rhino**

03 / SMO

Supramalleolar Orthoses

Product family

A low-profile shell that controls the hindfoot while leaving the ankle free — the smallest device that still does the job, generated per patient.

SMO | Paediatric | Foot & Ankle Geometry | Trim-Line Control | 3D Printed | Parametric Fit

THE PROBLEM

Children with flexible flatfoot or low muscle tone need frontal-plane control of the hindfoot — but a full AFO blocks the ankle they still need to develop. Too much device is its own failure mode.

THE APPROACH

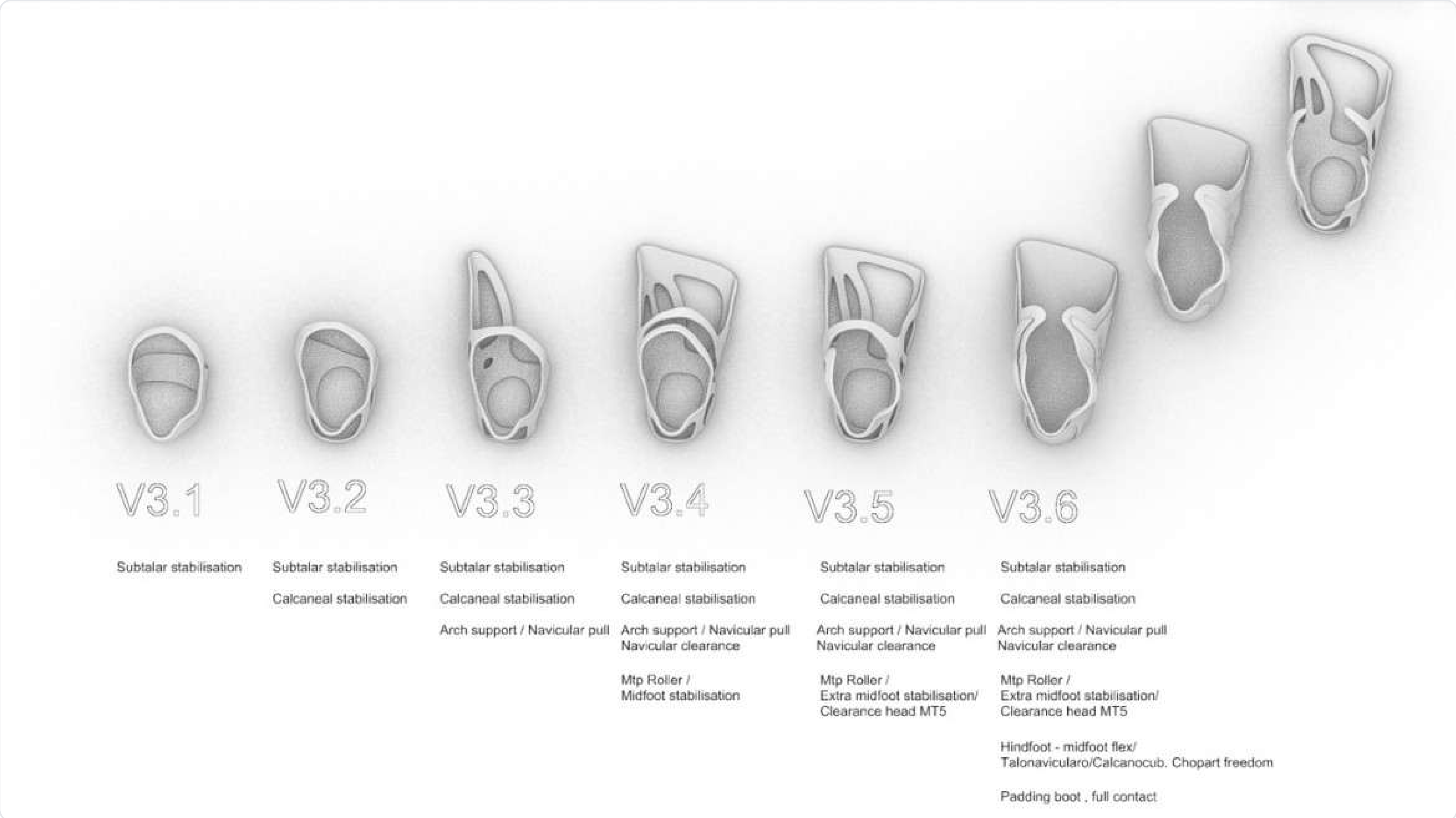
The shell wraps just above the malleoli and stops there. Trim lines, window openings and wall thickness are sliders on a scan-driven model, so a clinician's adjustment is a parameter change — not a remodel.

HOW IT WAS BUILT

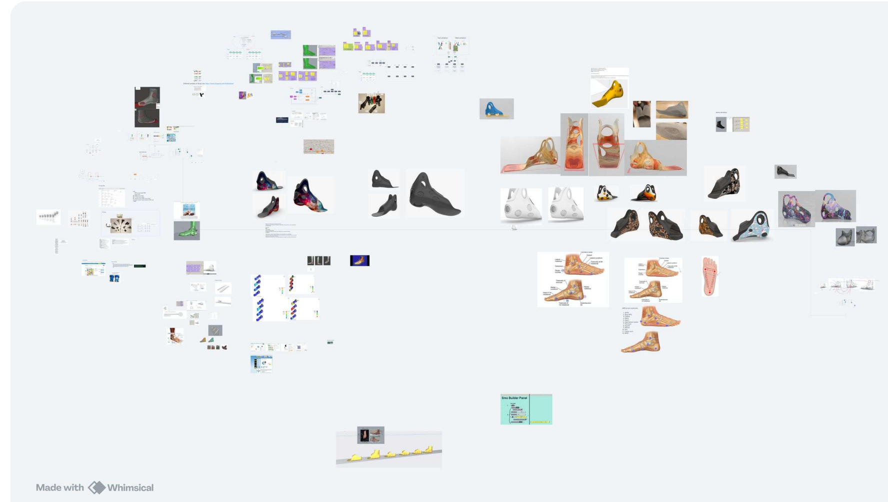
- Automated workflow — Grasshopper 80%
- Manual modelling — Rhino SubD 20%

Mostly generated; the organic shell transitions are refined by hand in SubD.

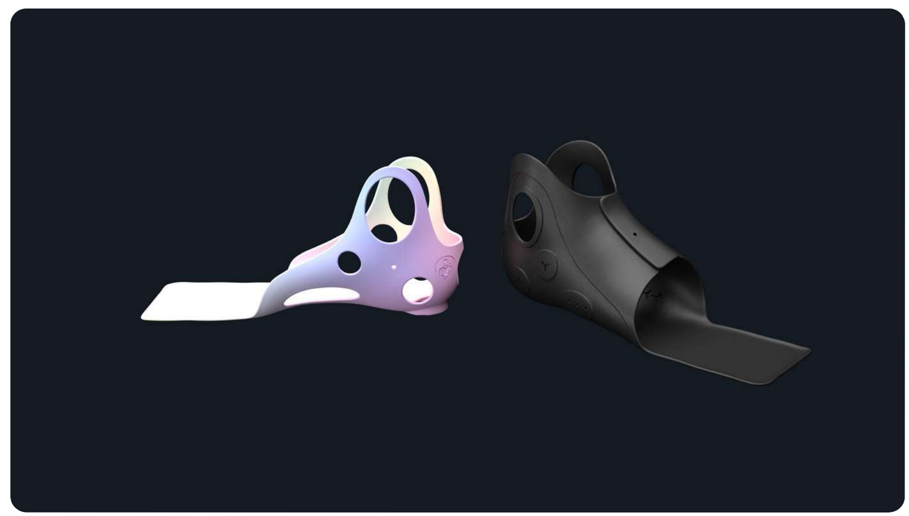
RESEARCH & ITERATION



↑ click to zoom — six generations, each adding exactly one control: subtalar stabilisation, then calcaneal, arch support with navicular pull and clearance, MTP roller and midfoot stabilisation, MT5 head clearance, and finally hindfoot-to-midfoot flex — talonavicular / calcaneocuboid, Chopart freedom — with a full-contact padding boot. Nothing was added that could not be justified biomechanically.



Printed test shells · the research board behind the form — footwear, lasts and gait references.

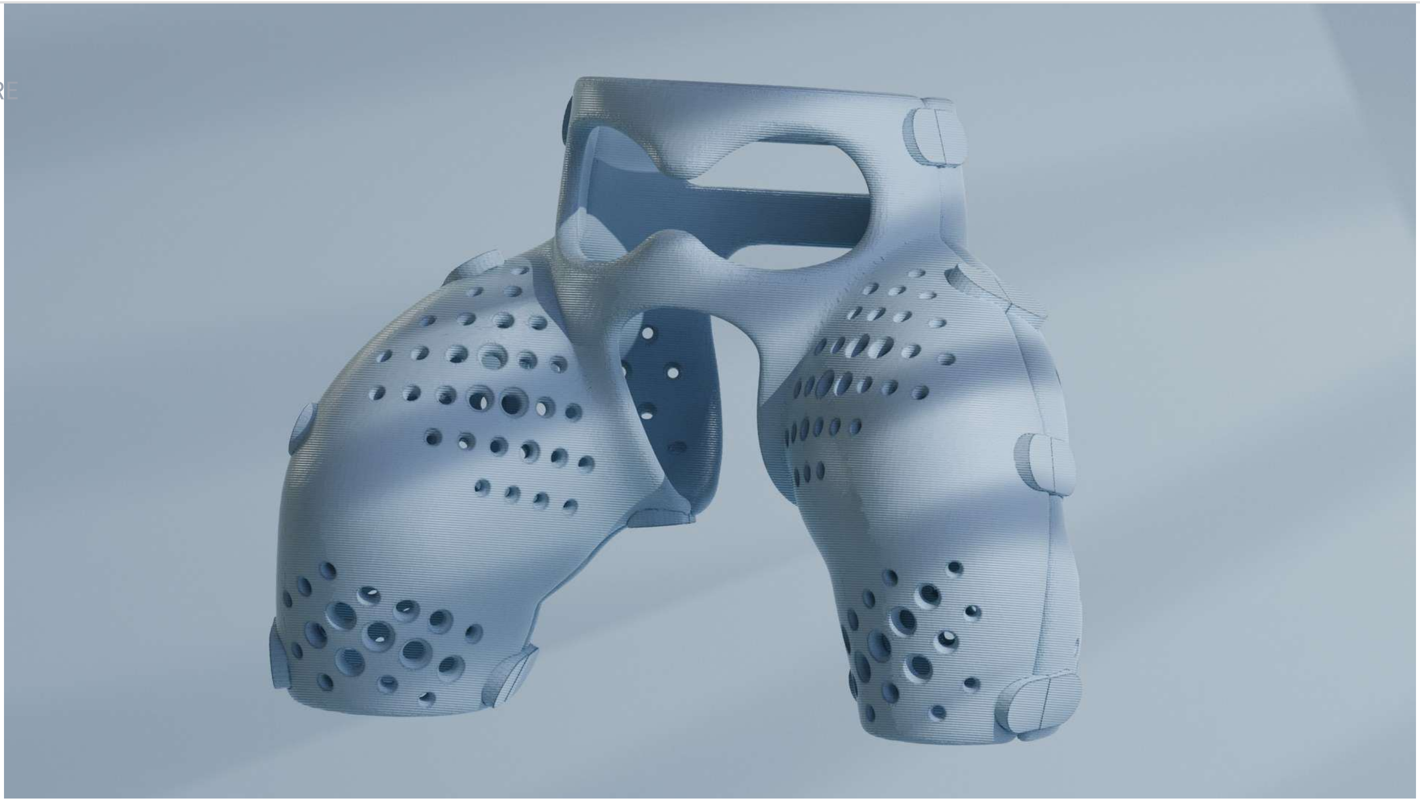


Extended footplate · short shell — same model, different parameters.

TECHNICAL HIGHLIGHTS

Device	Control	Input
Supramalleolar Orthosis (SMO)	**Subtalar, frontal plane**	**3D foot & ankle scan**
Trim height	Parameters	Design tool
Just above the malleoli	**Trim lines · windows · wall thickness**	**Grasshopper / Rhino**

04 / HIPCARE



Hipcare

Award-winning Prototype

Patient-specific 3D-printed orthosis for infants with hip dysplasia (DDH) — a lightweight, parametric alternative to the traditional plaster spica cast.

Paediatric Device | Hip Dysplasia (DDH) | 3D-Printed Orthosis | PLA / Lattice Structures | Parametric Design | Digital Fabrication

THE PROBLEM

Developmental dysplasia of the hip (DDH) affects 1–3% of infants. Treatment requires 3–6 months of continuous immobilisation — currently achieved with heavy plaster spica casts that are painful to fit, prevent diaper changes, and cannot be adjusted as the baby grows.

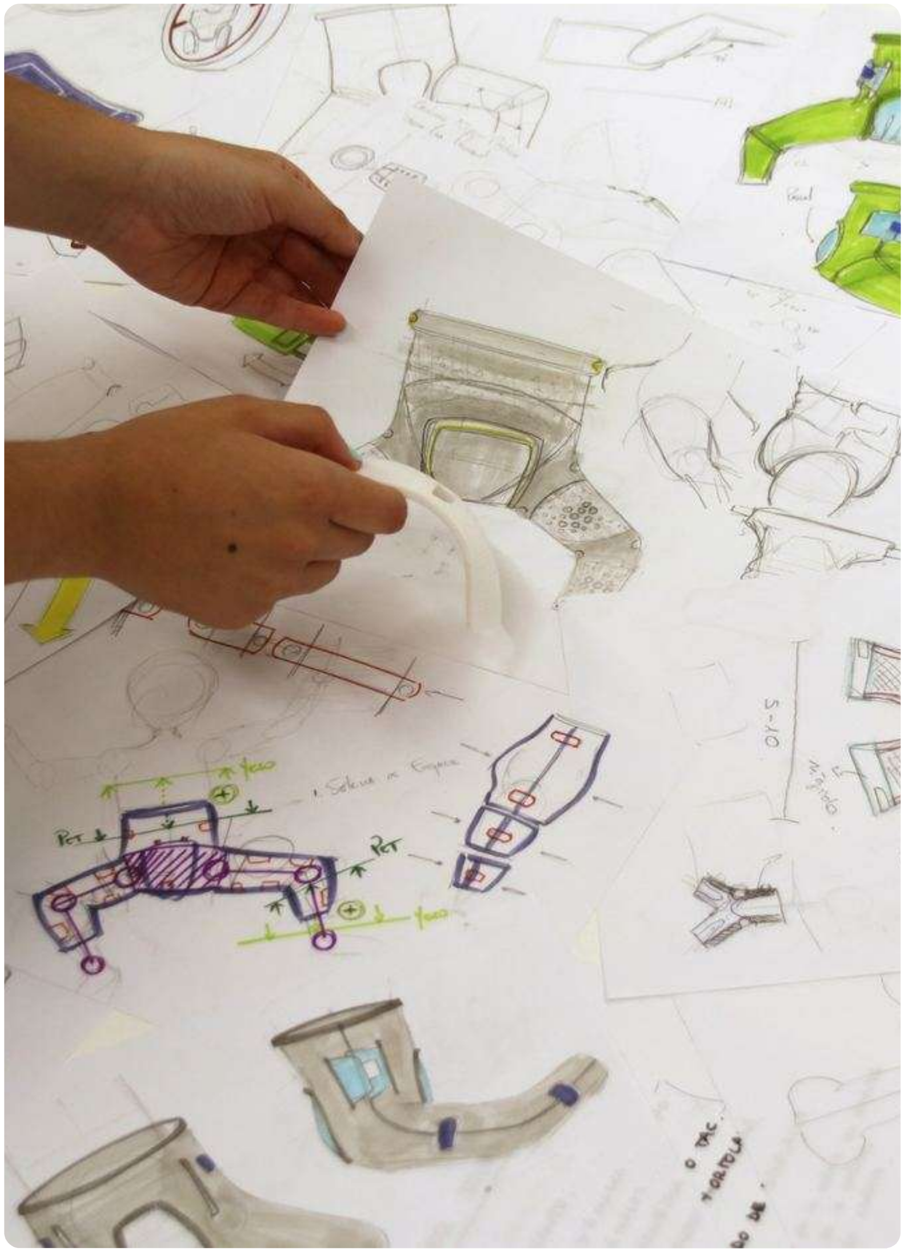
THE SOLUTION

Hipcare is a parametrically designed, patient-specific PLA orthosis with variable-density lattice structures. It is 3D-printed per patient, softened at 50 °C for a precise fit, and features a clip system that allows diaper changes — all without removing the device.

HOW IT WAS BUILT

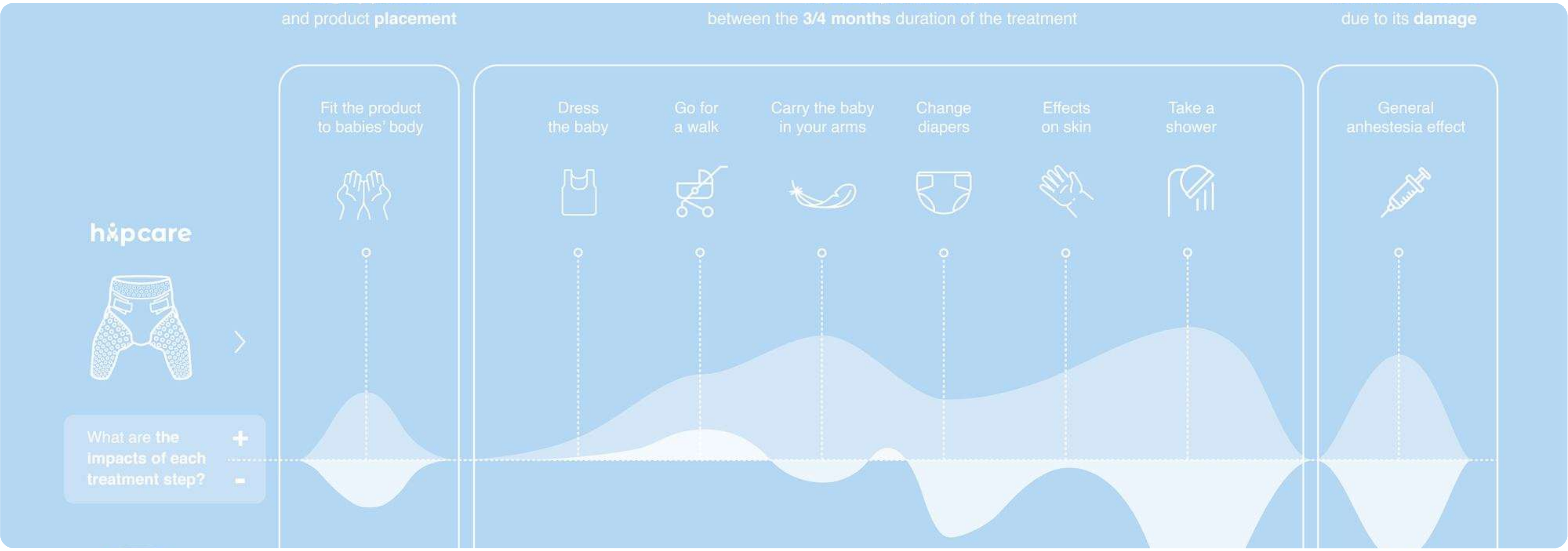
- Automated — lattice pattern in Grasshopper **10%**
- Manual modelling — Maya **90%**

A student project, modelled by hand — the automation is the lattice. Six years later, project 01 is the inverse.




hip care
A design that innovates both the material and the technological process.
HOW?
Combining different densities of lattice structures and the properties of PLA, hipcare controls malleability in order to perfectly fit to the baby's body
WHY?
Compared to other 3D printed solutions, the exact immobilization position of babies' hip is evaluated only during the surgery, so the splint must be adjusted
STEPS
01 3D print a preconfigured splint
02 thermoform at 55ºC during its application
03 rigidity recovered of hipcare once perfectly fit to babies' body
allows malleability


3D Printing is a technology with a growing interest in healthcare, especially in orthopedic surgery. Motivated by this, hipcare is effective and visually friendly with the aim to provide a fair, easy and comfortable treatment.
Upper section of the housing
Slot to facilitate diaper changing
Clips system
Lower section of the housing
hip care


and product placement
between the 3/4 months duration of the treatment
due to its damage
Fit the product
to babies' body
Dress
the baby
Go for
a walk
Carry the baby
in your arms
Change
diapers
Effects
on skin
Take a
shower
General
anhestesia effect
hipcare
What are the
impacts of each
treatment step?
+
-

TECHNICAL HIGHLIGHTS

Material	Fabrication	Compliance ref.
PLA (biocompatible)	**FDM 3D Printing**	**ISO 10993**
Structure	Fitting method	Design tool
Variable-density lattice	**Thermoplastic at 50 °C**	**Grasshopper / Rhino**

WHAT IT REPLACES

TRADITIONAL SPICA CAST

- Heavy plaster — worn 3–6 months continuously
- Fitted under anaesthesia; cannot be adjusted as baby grows
- Prevents normal diaper changes and bathing
- No visual or tactile feedback on skin condition underneath

Hipcare replaces all of this with a single 3D-printed, patient-specific orthosis.

🏆 **European Product Design Award 2024 — 1st Place**

Medical Category — Hipcare paediatric hip dysplasia orthosis

CAPABILITIES

Tools & Expertise

Four years of parametric design and digital fabrication, on top of a materials engineering degree — and the programming to push past what the stock nodes do. I write the components I need, and increasingly I build with AI models in the loop.

PARAMETRIC & COMPUTATIONAL DESIGN

- Rhinoceros 3D — 4 yrs
- Grasshopper — 4 yrs
- Computational geometry
- Design automation
- Mass customisation

PROGRAMMING

- Python
- C# / .NET
- RhinoCommon API
- Custom GH components
- REST APIs / FastAPI
- Git

AI & AGENTIC WORKFLOWS

- AI-assisted development
- LLM tooling & agents
- Claude Code
- MCP integrations
- Prompt engineering

GEOMETRY & SCAN DATA

- Scan-to-CAD
- Mesh processing / remeshing
- Anatomical landmarking
- Lattice & pattern generation
- UV / conformal mapping
- Reverse engineering

SIMULATION & OPTIMISATION

- FEA / structural analysis
- Topology optimisation
- Simulation-driven design
- Material selection (CES / Granta)

DEPLOYMENT

- ShapeDiver — 2 yrs
- Web configurators
- Cloud parametric apps

CAD / 3D MODELLING

- SolidWorks
- PTC Creo
- Autodesk Inventor
- Maya
- Blender

RENDERING & VISUALISATION

- V-Ray
- KeyShot
- Technical visualisation

DIGITAL FABRICATION

- FDM / FFF Printing
- SLA / Resin
- Laser Cutting
- Robotic Arm (ABB, KUKA)
- DfAM

MATERIALS & COMPLIANCE

- Biocompatible materials
- ISO 10993
- ISO 13485
- MDR
- Materials & nanotechnology

DOMAIN

- Orthotics & prosthetics — 3 yrs
- Patient-specific devices
- Medical device development
- Product design

LANGUAGES

- Italian — native
- English — C1
- Spanish — C1
- French — basic

EDUCATION

2023
Controlmad
Madrid

Master Course — Parametric Design & Digital Fabrication

- 350 h · PanelingTools for Rhino certification

2022
ELISAVA — UPF
Barcelona

Master's Degree — Product Design & Development

2021
Politecnico di Milano
Milan

Bachelor's Degree — Materials & Nanotechnology Engineering

Let's work together.

Open to roles in computational design engineering, individualised product development, and scan-to-production systems.

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