3D printing as mass production technology

Creating a beautiful and green world

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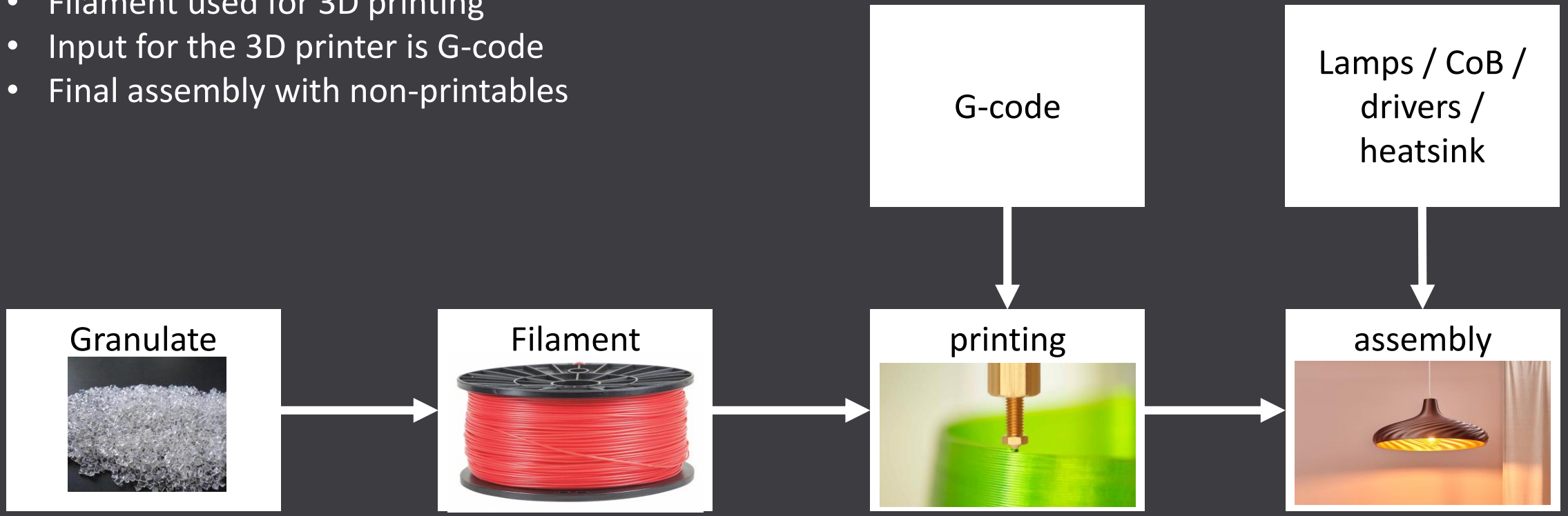
- Why do we print
- What do we print
- How did we organize
- What are our challenges

3D printing as mass manufacturing technology: a short intro

We use 3D printing as mass manufacturing technology

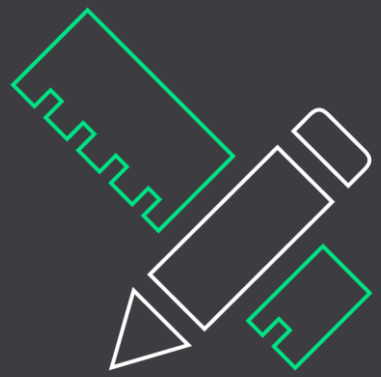
- Create filament from plastic granulate
- Filament used for 3D printing
- Input for the 3D printer is G-code
- Final assembly with non-printables



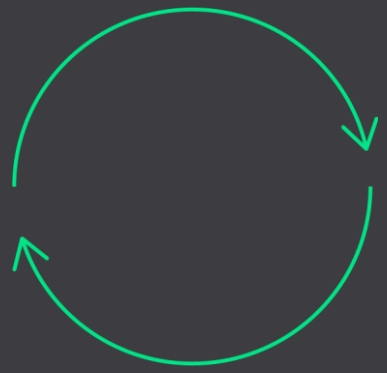
Why do we print | we want to create a beautiful and green world

Beautiful: mass customization and tailored designs

Green: 3D printing technology is a sustainable production technology



Tailored design
for everyone



Sustainable &
Circular by default

Tailored design for everyone

3D printing is enabling mass customization: every individual can create his/her own luminaire

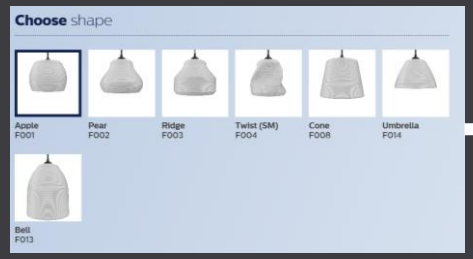
- Shape and Dimensions
- Color
- Texture
- Light technical specs

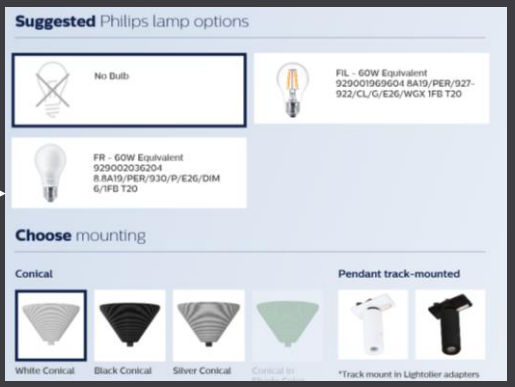
Enabler: No tooling needed

- No tooling investment
- No tooling leadtime

Customer journey: 2 examples

1) Via website





Choose shape

Choose color

Choose texture (or logo)

Choose light technical specs

2) Bespoke design process: We design together with you a luminaire

- Shape & dimensions
- Color
- Textures
- Specs

Case Albert Heijn
Decorative pendants in a wide range of shapes and colors

Albert Hein: largest supermarket in Netherlands. Albert Hein is owned by Ahold Delhaize who also owns US groceries Stop & Shop, Giant, Food Lion and Hannaford

A nice atmosphere in the fresh food area in 3 months with specially designed, tested and produced decorative pendants.

Flexibility in store format: shades easily replaced without any waste.

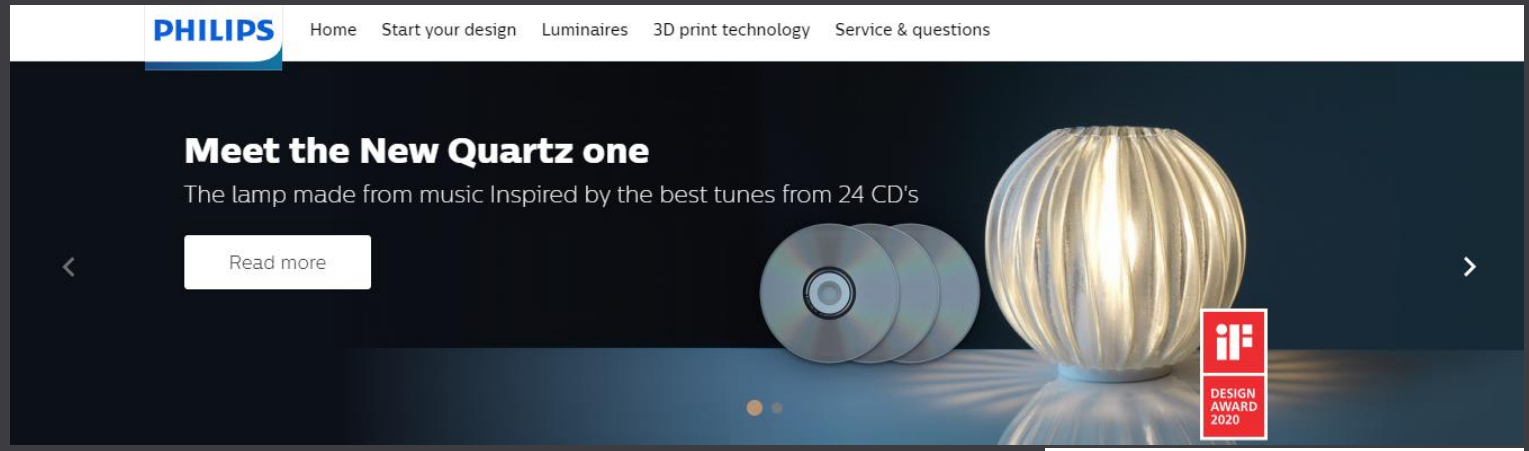
Our sustainability promise

Support the circular economy – benefits 3D Printing

On demand avoiding waste
in transportation, surplus of stock and unused materials

Contribute to a circular economy
moving to recycled materials
no screws and other smalls parts

Reduce emissions
by local production
lightweight materials



When you buy this Quartz table lamp you reduce CD waste & contribute to a cleaner world

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This translates in a carbon footprint reduction over full life

Carbon footprint reduction:

- **Material supply and manufacturing: 3D can save up to 75%**
- **Transport: 3D can save up to 28%**
- **Use phase: on par**
- **End-of-life: 3D can save up to 27%**

The total depends on the luminaire type

Impact Assessment Carbon footprint IPCC 2013 GWP 100

Projector: 24% carbon footprint reduction

3D Printed VS Metal

Downlight: 75% carbon footprint reduction

3D Printed VS Alu die cast

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3D products: standard series
Products for US, Europe and Asia

decorative	functional	Consumer

RD E27 Pendants

BA-L Pendant low & midbay

TT/GreenSpace downlight

Pendants

SC Accent spot

PM Highbay

20kLm

MS Projector

Table lamps

- **Technology is optimized for printing “round” shapes**
- **Rectangular products we can do but pushes the technology to the edge**

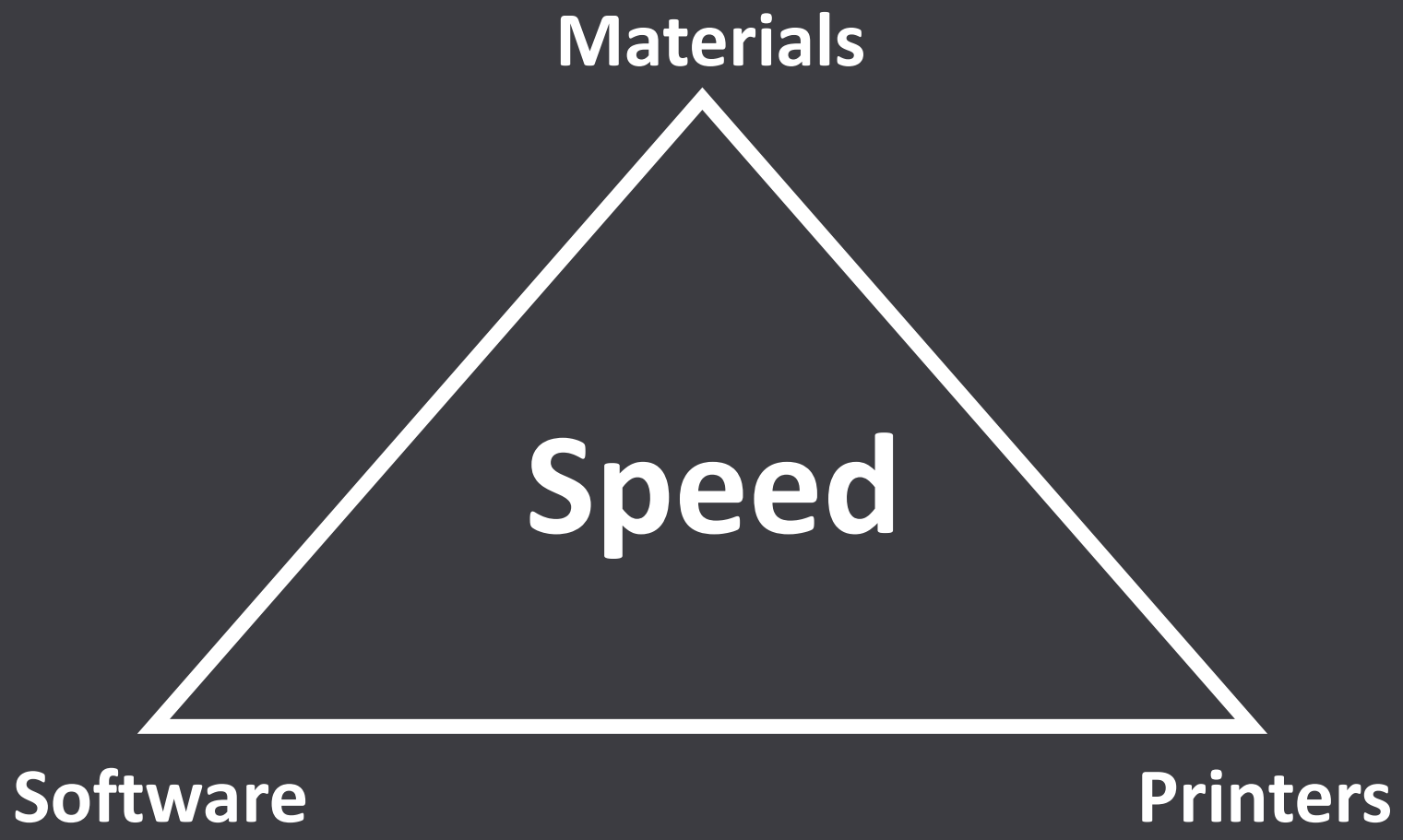
Case Praxis
Functional High Bays
tailored to customer needs

Praxis installs more than 3,600 3D-printed LED luminaires in 30 stores

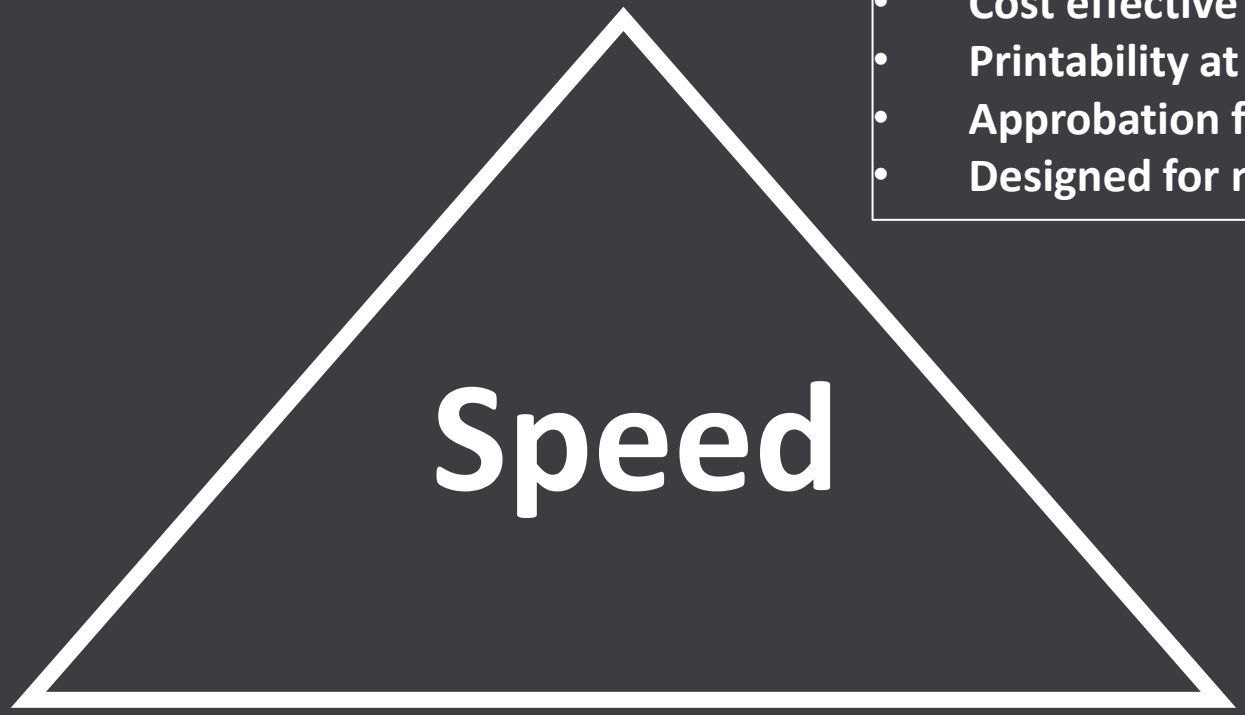
Unique Praxis design

Easy to install

Platform to print on economical scale: ensure printing at speed



Platform to print on economical scale



Print with mainstream materials
- Cost effective
- Printability at high speed
- Approbation for global use
- Designed for mass customization

Print with mainstream printers
- Enable mainstream materials
- Boost Speed

Optimize printing with dedicated software
- Printer software: printers must always print
- Create optimal G-codes: speed

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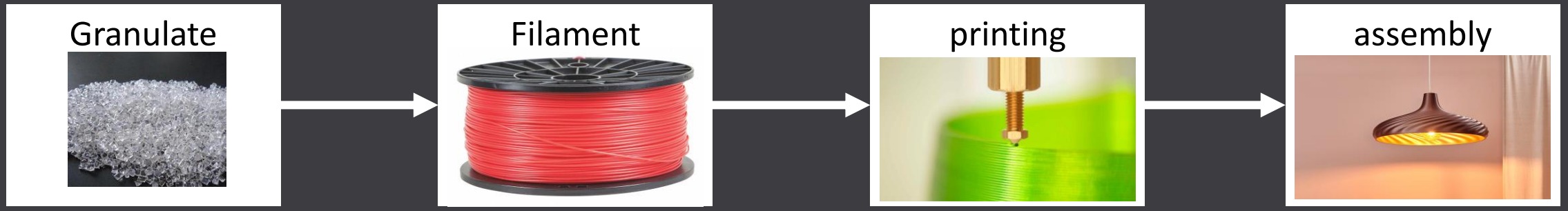
Next challenges

- Now we only print housings and optical components
  - Next step is to print metal parts, especially heatsinks: need for low cost accurate printing of metals. This would enhance the design freedom of luminaires

- Peripherals of the printer: we need to print continuously and effectively
  - Auto change of filaments
  - Automatic quality control



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Summary

- 3D printing is a mass production technology for luminaires
  - 3D printing enables mass customization
  - 3D printing is a sustainable production method
- We now print plastics, next challenge is metal
- The key is speed: continuous and efficiently printing
- To achieve continuous printing, also the peripherals need to be optimized


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