



3D Food Printing

Why, Who, How, When?

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Internship period of ± 5 months at TNO
Only public information & internet research is presented

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Why food printing?

- More food produced efficiently converting alternative ingredients such as proteins from algae, beet tops, or even insects in tasty products that are not only good for health but also for the environment
- Fully customizable nutrition (Personalized Food): products that exactly fit the needs and preferences of individuals
- Create a fresh and healthy dish waiting for you when you get home
- Freedom in design, make products that can not be made: 3D shape, composition (ingredients and mutual relationship), structure, texture and taste

Who wants printed food?



Printing materials



Which materials can we print more?

Printing techniques

What are currently the printing techniques for food printing?

- Fused Deposition Modeling (FDM)
- Selective Laser Sintering (SLS)
- Powder Bed Printing

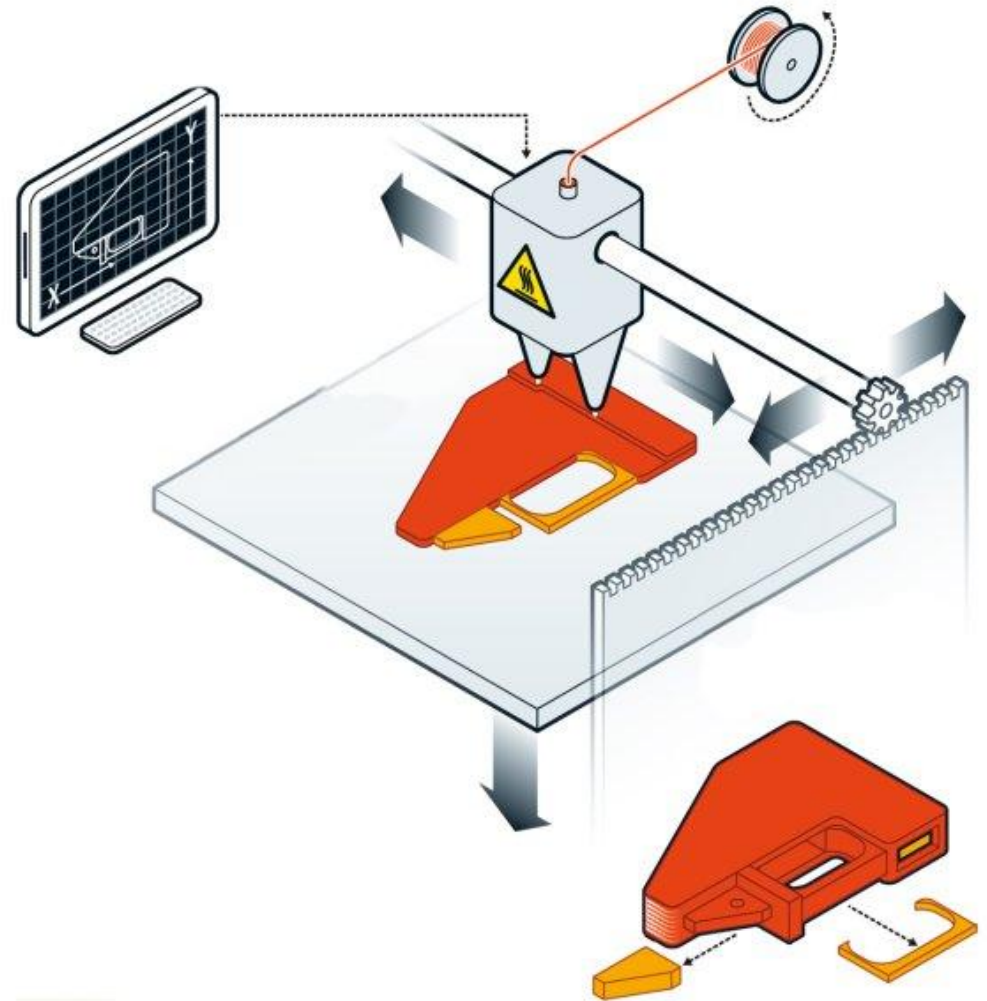
FDM

Advantages

- Easy to control
- Possibility to change extruder
- Accurate

Disadvantages

- Support is needed for some prints
- Not so fast



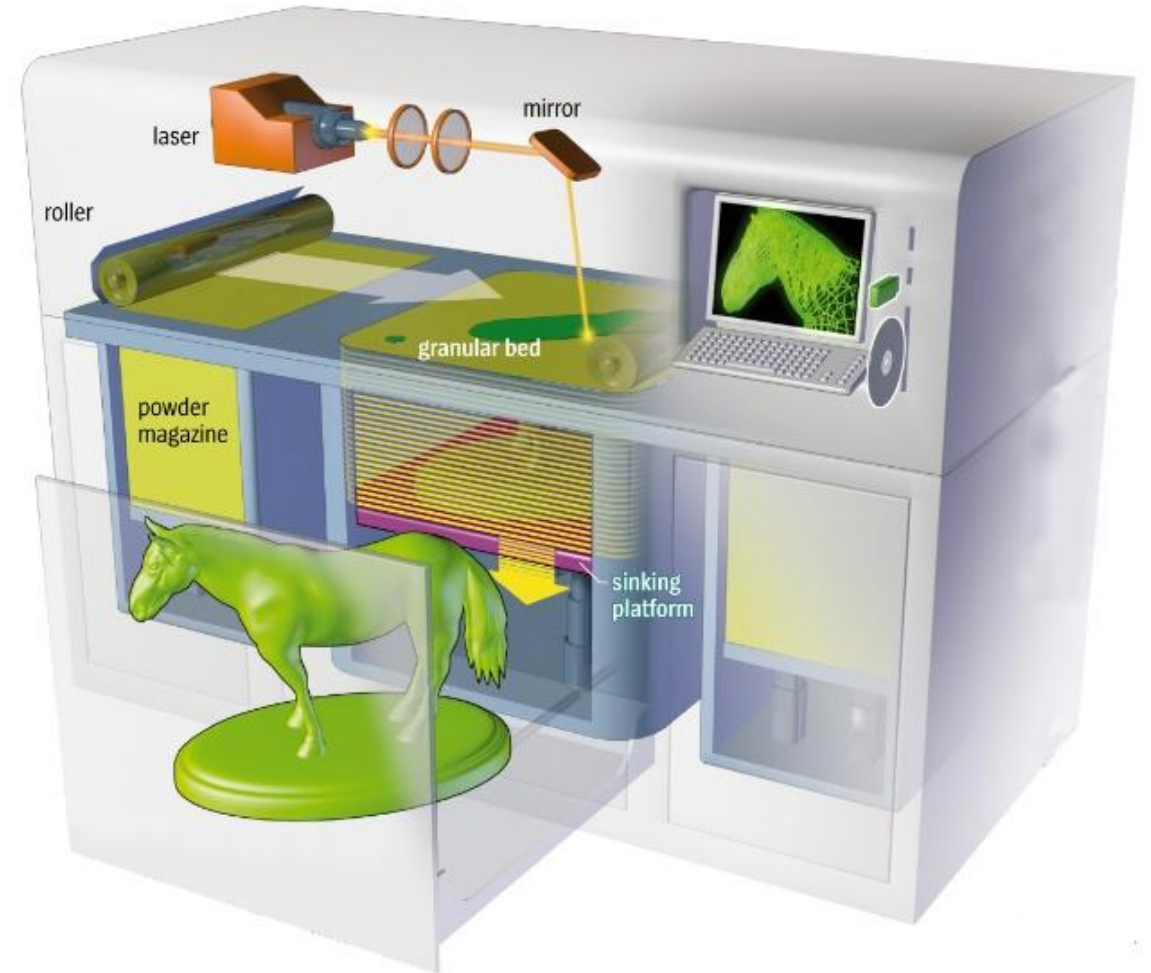
SLS

Advantages

- Multiple objects at the same time
- No support needed
- Accurate
- Use of different powders

Disadvantages

- Expensive machine
- Large machine



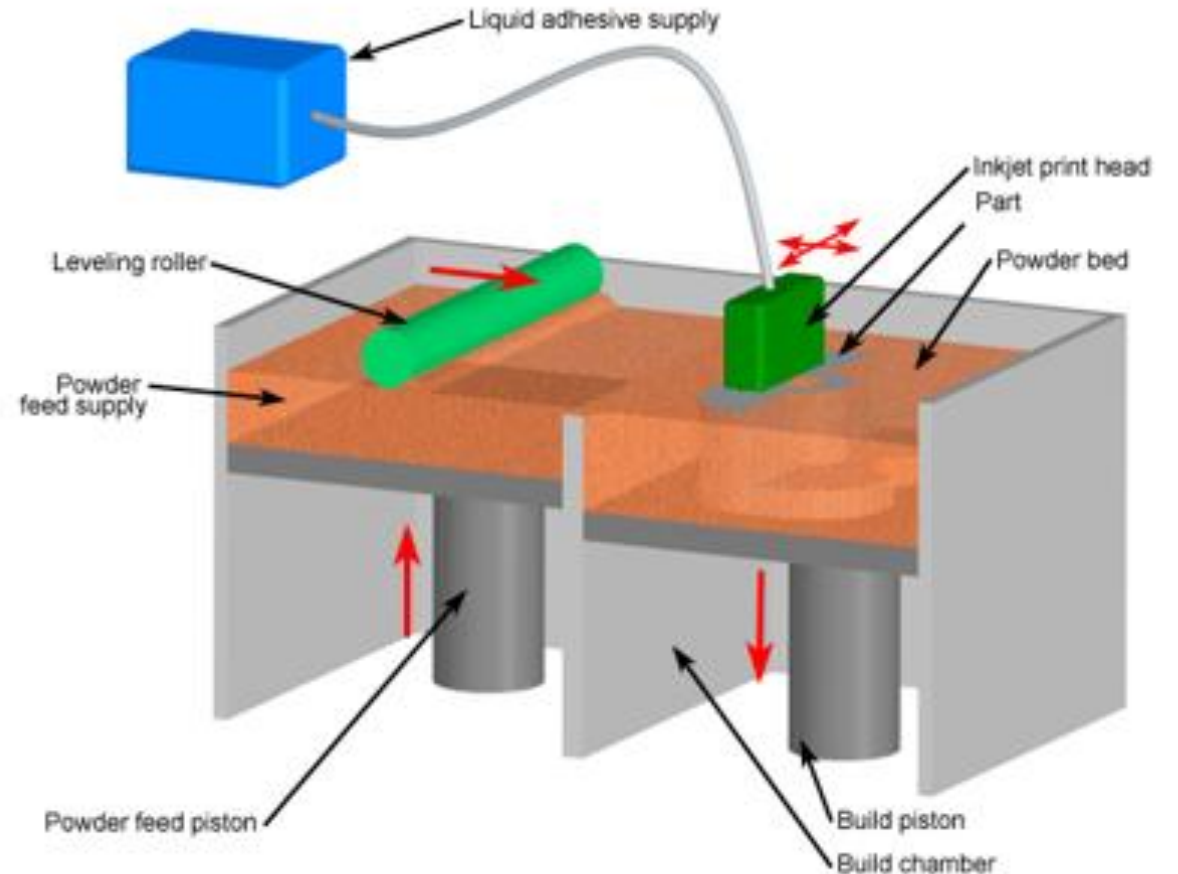
Powder Bed Printing

Advantages

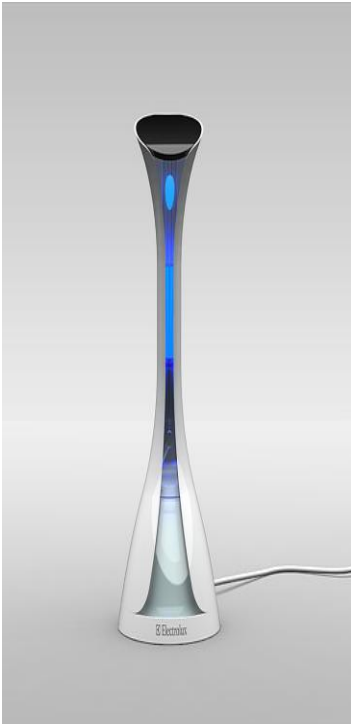
- Multiple objects at the same time
- No support needed
- Accurate
- Use of different powders

Disadvantages

- Objects very fragile
- Large machine



Concepts by other people



Electrolux

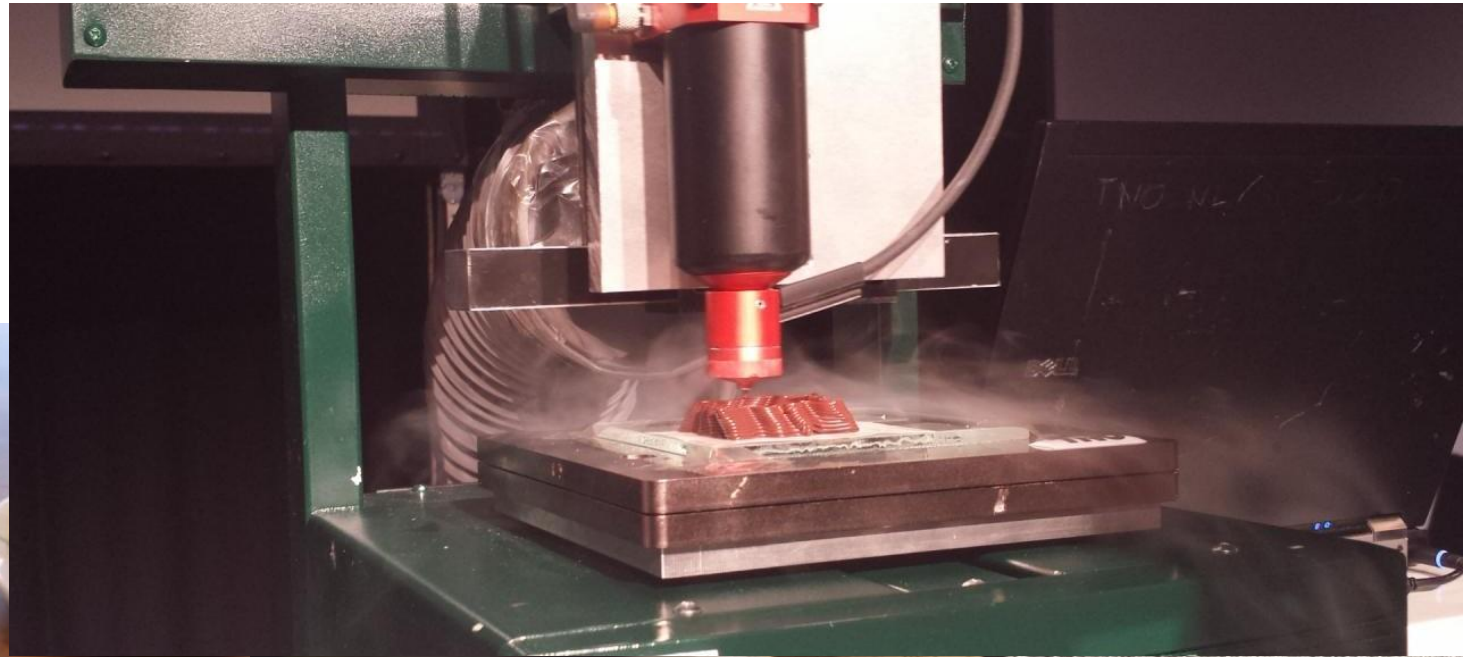


MIT



Philips

Research at TNO Eindhoven





500
The existence of the first cocoa beverage.



1502 **1615**
Columbus is given cocoa bears. *Chocolate is introduced in France.*



1777 **1875**
The first chocolate factory. *The first milk chocolate.*

400 AD
The Mayans grow cocoa in Yucatán, Mexico.

900
King Quetzalcoatl is worshipped as the 'God of cocoa.'

1528
Cortés introduces cocoa to the Spanish court.

1720
Cocoa botanically classified.

1847
First commercial chocolate bar.

2013
First complex 3D printed chocolate concept for gastronomy.

One week experiment at Michelin star Restaurant De Molen



Conclusions

Printing food is good for several target groups and the environment

It is possible to print with lots of ingredients

Making new products, healthy, tasty and nice to see

It is too slow now for large amounts

More research is needed

Credits: [TNO](#) (Kjeld van Bommel, Peter Brier), fooddesigner [Marijn](#)

[Roovers](#) chefkok [Wouter van Laarhoven](#)