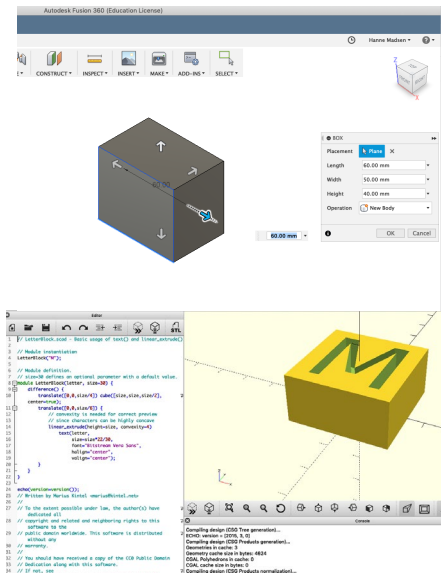
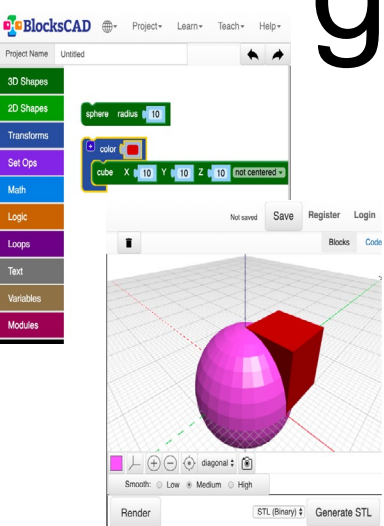
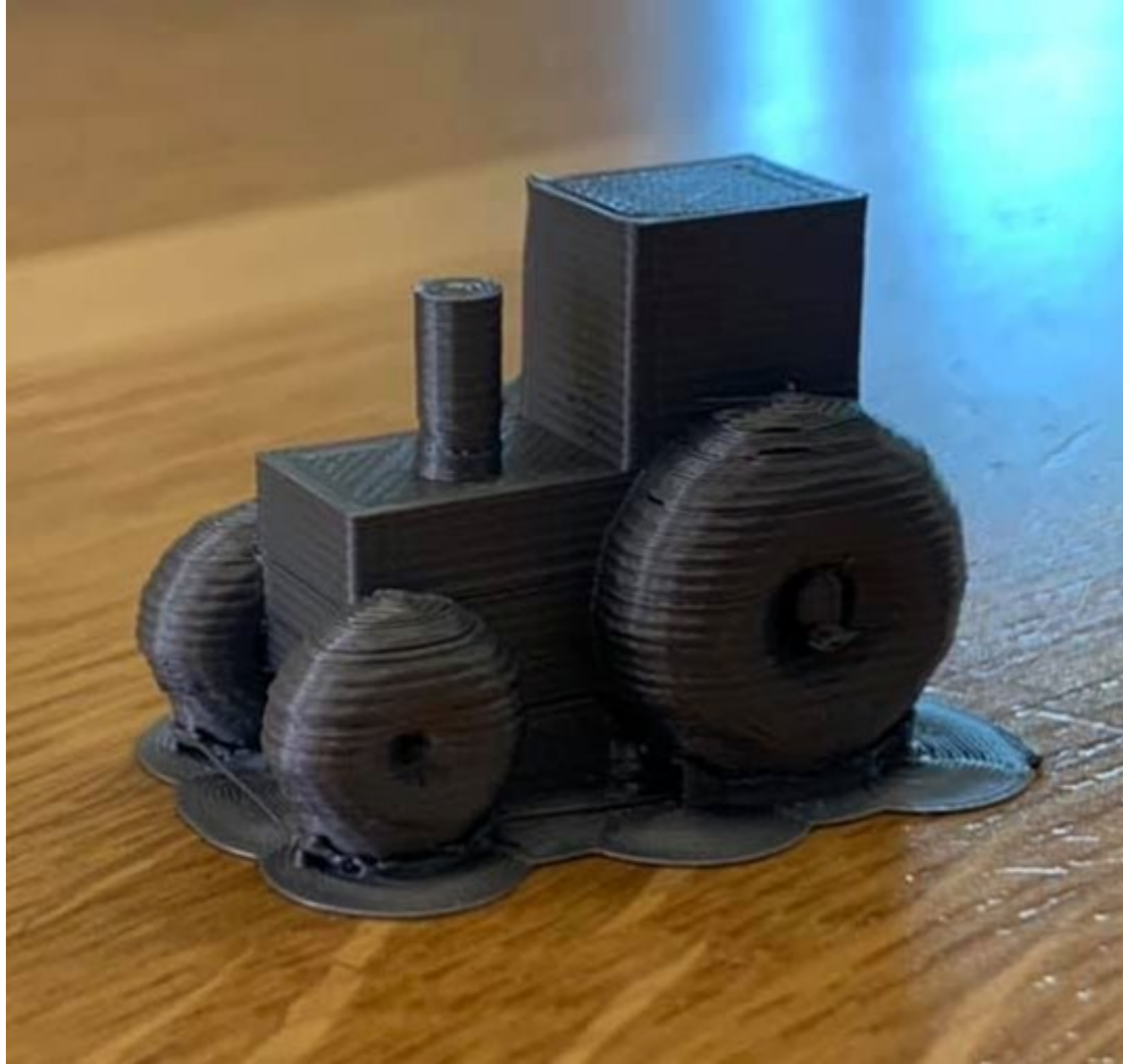


3D-modellering med gratisprogrammer

av Hanne Madsen
Jærmuseet, avd. Vitenfabrikken







Hva kan man bruke 3D-printing til?



Hva kan man bruke 3D-printing til?



Hva kan man bruke 3D-printing til?

Thor, 4 m lang



Hva kan man bruke 3D-printing til?



Hva kan man bruke 3D-printing til?

Hva kan 3D-printing brukes til?

WaterScope/OpenFlexure
Kan kombineres med
webkamera/Raspberry Pi kamera.

Årsak: 1 ut av 10 har IKKE tilgang
til rent drikkevann



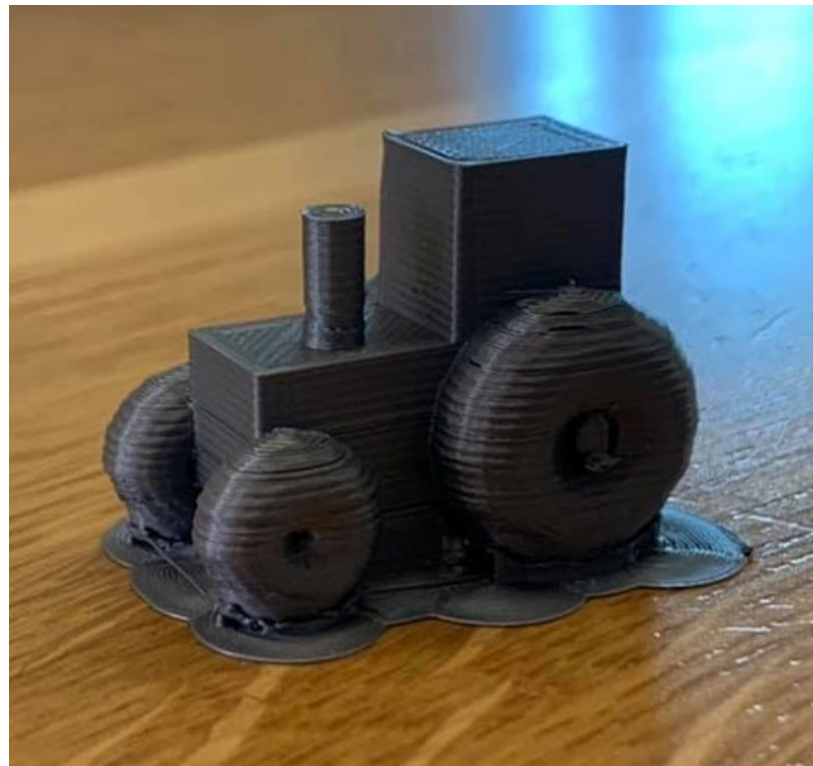
Hjerteklapper

<https://3dprintingindustry.com/news/12-things-we-can-3d-print-in-medicine-right-now-42867/>

3D-skanner

Hvorfor lære 3D-modellering?

- Det er moro å skape
- Mulighet for mange FF (Fantatiske Feil)
- Matematikk som praktisk verktøy (koordinatsystemer, geometri mm.)
- Kan kombineres med programmering
- 3D-modeller kan 3D-printes
- 3D-modeller kan skjæres ut i papp, kartong etc
- 3D-modeller kan brukes virtuelt i spill mm. (eksempel: Minecraft)
- etc.



3D-printeren som ikke er her akkurat nå...

Kjent i maker-miljøet: Det er 3D-printeren som lokker folk inn på skaperverkstedet

3D-modellering er det **kreative** forarbeidet det er til 3D-printingen og det er her matematikken kan komme inn samtidig med skapingen:

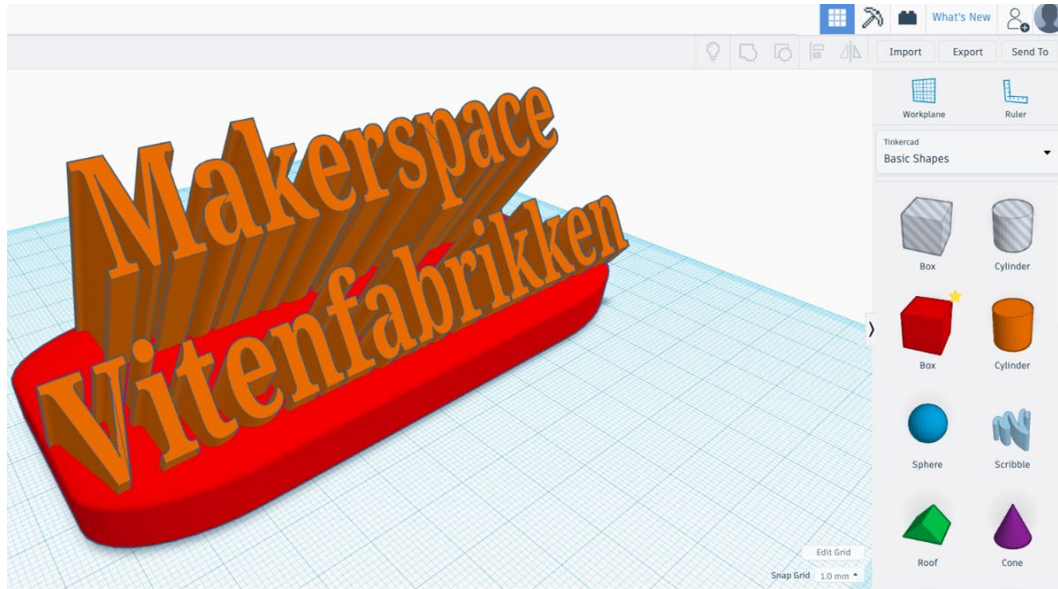
- Design-spiralen
- Form og funksjonsforståelse
- Koordinatsystemer
- 2D- og 3D-former
- Programmering



Diverse plattformer og gratis-programmerne

- iPad:
 - **TinkerCAD**
 - **SculptGL (Sulpt3D og SculptFab)**
- Chromebook:
 - **TinkerCAD**
 - **BlocksCAD**
 - **SculptGL (Sulpt3D og SculptFab)**
- Datamaskin (Windows/MacOS):
 - **Tinkercad**
 - **BlocksCAD**
 - **SculptGL (Sulpt3D og SculptFab)**
 - Sculptris
 - Meshmixer
 - Fusion 360
 - OpenSCAD
 - Blender
 - FreeCAD

TinkerCAD

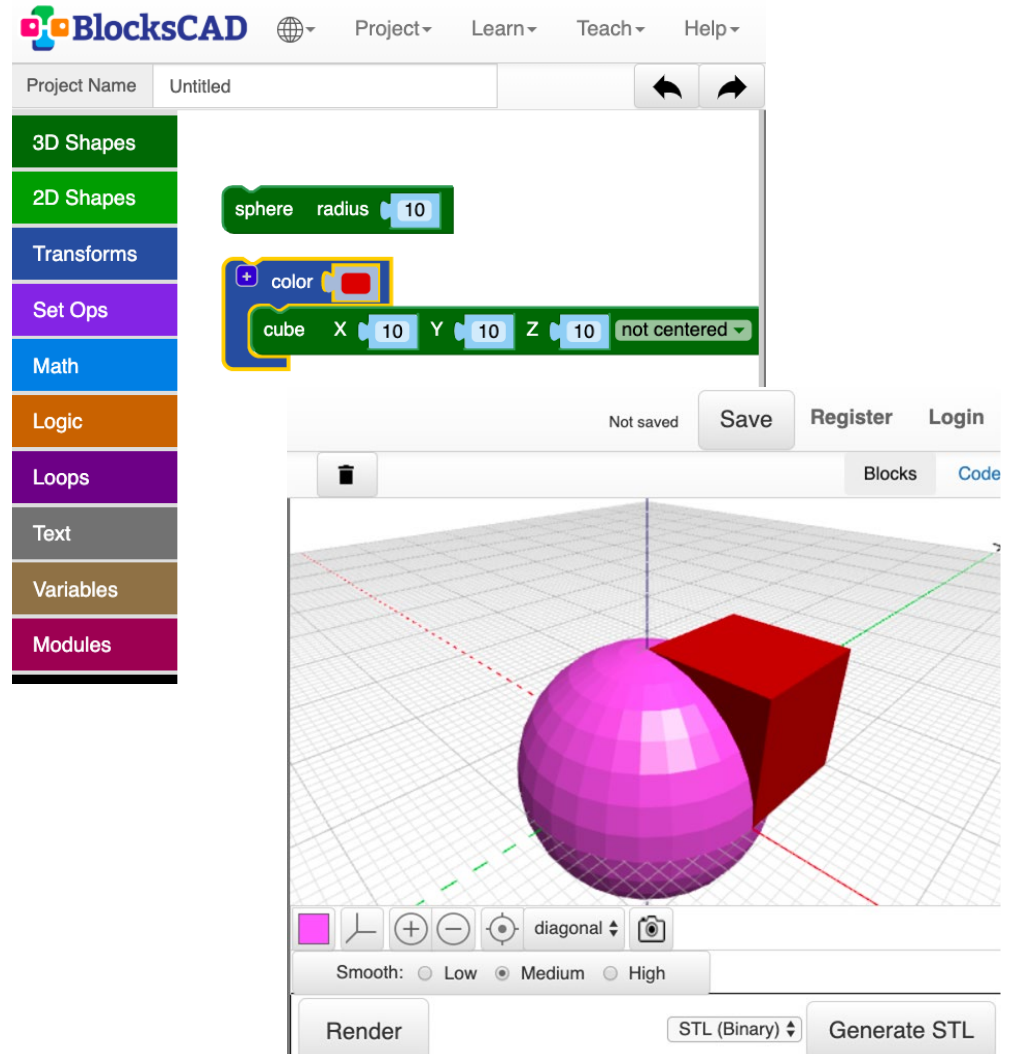


<https://www.tinkercad.com/>

- Nettleser (Chrome anbefales)
- Lav terskel for begynnere
- Litt barnsligt utseende - men med “mye inne bak”
- Produsent: AutoDesk - de samme som bak Fusion 360 (samme brukerkonto)
- Matematikk?
- Integret kopling opp mot elektronikk
- Andre verktøy i Tinkercad
 - Blocks (“Lego”)
 - Bricks (Minecraft).
 - Circuit (elektronikk)
 - Codeblocks (programmering)

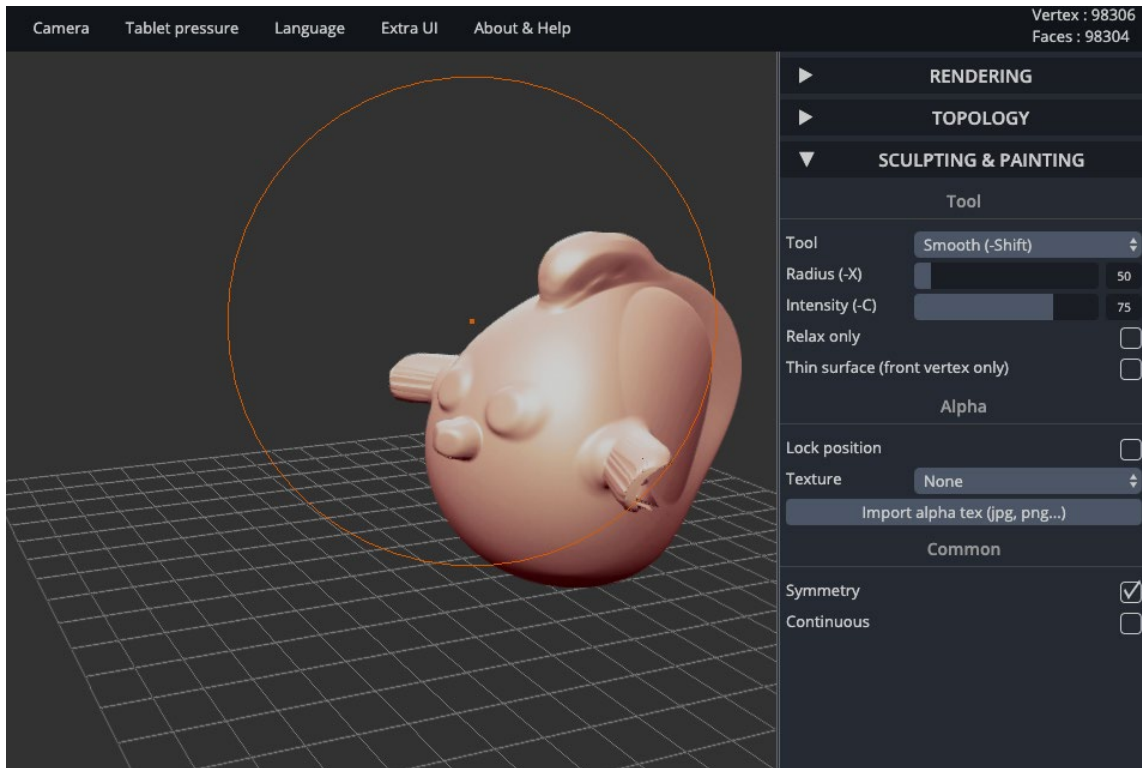
BlocksCAD

- <https://www.blockscad3d.com/>
- Produsent: Utviklet av folk fra Scratch-miljøet på MIT
- Betalingsmodell: Hvis du skal ha innsyn i elevenes prosjekter må det betales for det (\$149/year for 30 studenter)/hele skolen
- Programmering av 3D-modeller
- Kan oversettes til tekstprogrammering med OpenSCAD
- Matematikk?



The screenshot displays the BlocksCAD web application interface. At the top, there is a navigation bar with the logo and menu items: Project, Learn, Teach, and Help. Below this is a project name field set to 'Untitled'. A vertical sidebar on the left contains a list of categories: 3D Shapes, 2D Shapes, Transforms, Set Ops, Math, Logic, Loops, Text, Variables, and Modules. The main workspace is divided into two sections. The upper section is a code editor showing a sequence of blocks: a 'sphere' block with a radius of 10, a 'color' block set to red, and a 'cube' block with X, Y, and Z dimensions of 10, and the 'not centered' option selected. The lower section is a 3D viewer showing a pink sphere and a red cube on a grid. The viewer includes a toolbar with icons for selection, zooming, and rotation, and a 'Smooth' control set to 'Medium'. At the bottom, there are buttons for 'Render', 'STL (Binary)', and 'Generate STL'.

SculptGL



Nettleser: <https://stephaneginier.com/sculptgl/>

“Sculptris i nettleser”

Digital leire

Kunst og håndverk?

Tips: Lagre filen din hver gang du er fornøyd med figuren. OpenGL lagre INGENTING og mister man nettforbindelsen, så mistes alt...

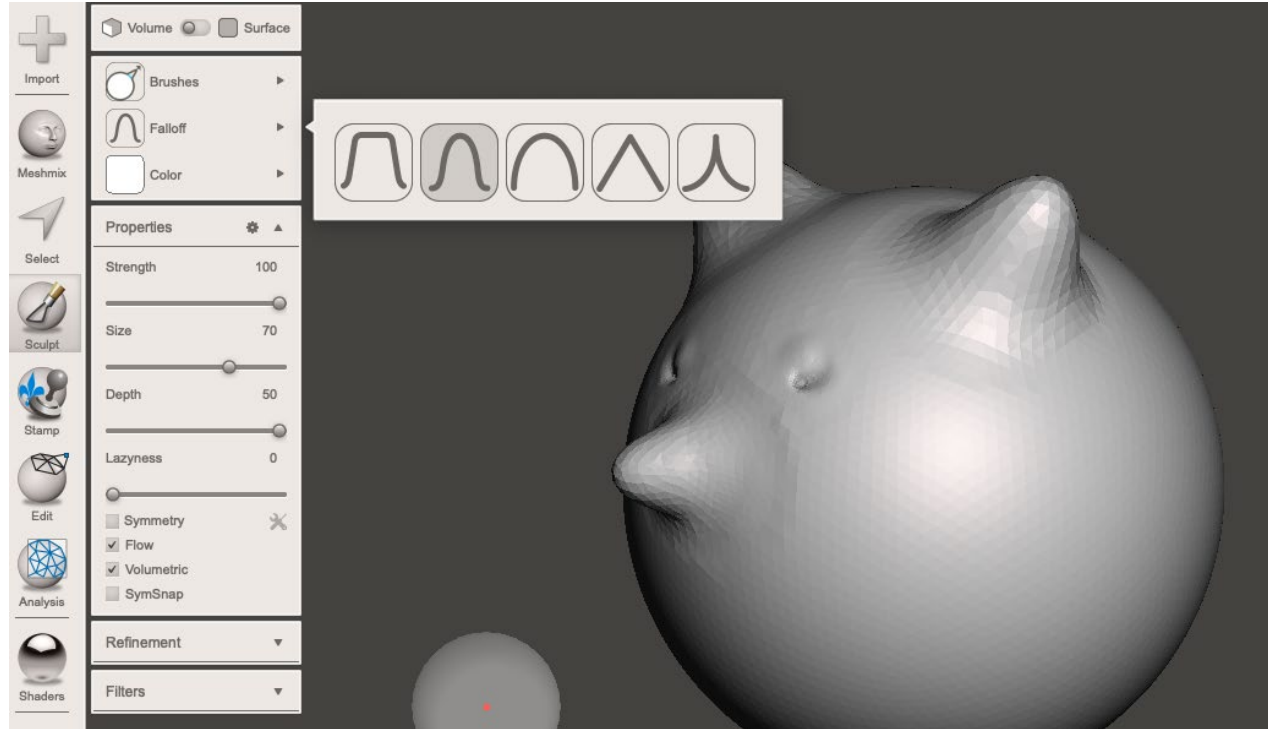
Sculptris

- Digital leire
- Må installeres
- MacOS/Windows
- Kunst og håndverk?

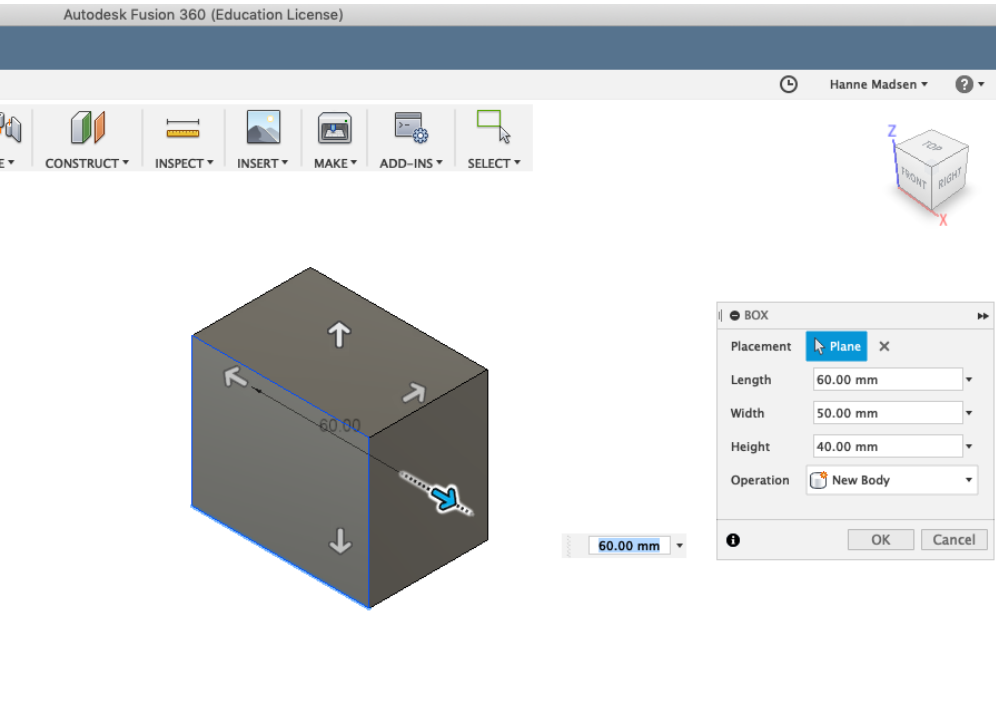


Meshmixer

- Digital leire
- Må installeres
- MacOS/Windows
- Kunst og håndverk?



Fusion 360

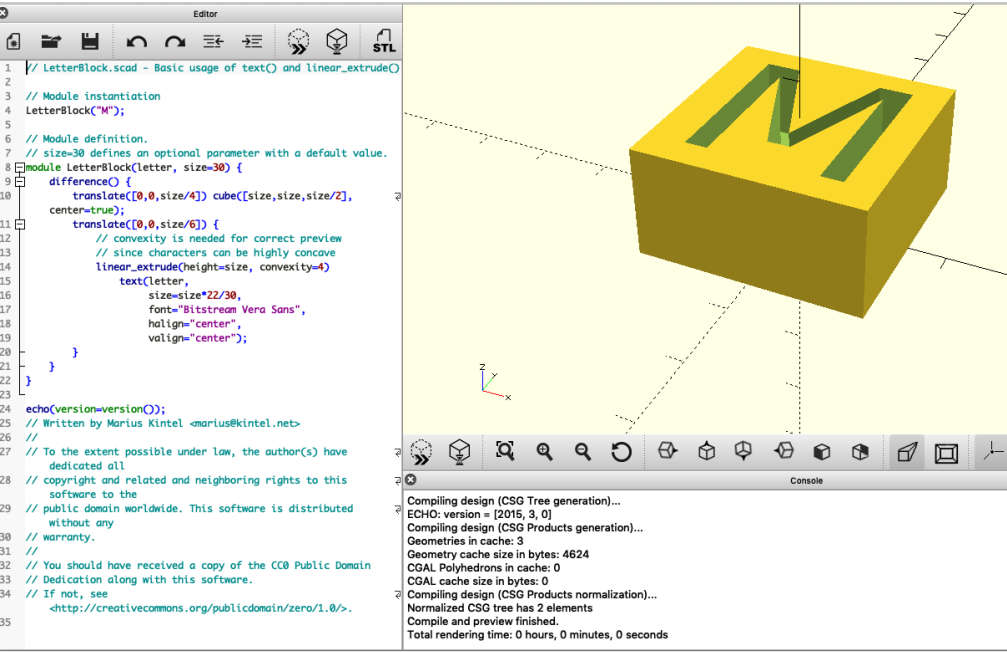


Nedlasting: <https://www.autodesk.com/products/fusion-360/students-teachers-educators> (Tips: Ikke velg 3 mdrs trial)

Produsent: Autodesk (de samme som har TinkerCAD)

Betalingsmodell: At studenter lærer seg deres programvare og tar den knowhow med ut i arbeidslivet

OpenSCAD



```
1 // LetterBlock.scad - Basic usage of text() and linear_extrude()
2
3 // Module instantiation
4 LetterBlock("M");
5
6 // Module definition.
7 // size=30 defines an optional parameter with a default value.
8 module LetterBlock(letter, size=30) {
9     difference() {
10        translate([0,0,size/4]) cube([size,size,size/2],
11        center=true);
12        translate([0,0,size/6]) {
13            // convexity is needed for correct preview
14            // since characters can be highly concave
15            linear_extrude(height=size, convexity=4)
16            text(letter,
17            size=size*22/30,
18            font="Bitstream Vera Sans",
19            halign="center",
20            valign="center");
21        }
22    }
23 }
24
25 echo(version=version());
26 // Written by Marius Kintel <marius@kintel.net>
27 //
28 // To the extent possible under law, the author(s) have
29 // dedicated all
30 // copyright and related and neighboring rights to this
31 // software to the
32 // public domain worldwide. This software is distributed
33 // without any
34 // warranty.
35 //
36 // You should have received a copy of the CC0 Public Domain
37 // Dedication along with this software.
38 // If not, see
39 // <http://creativecommons.org/publicdomain/zero/1.0/>.
40 }
```

Compiling design (CSG Tree generation)...
ECHO: version = [2015, 3, 0]
Compiling design (CSG Products generation)...
Geometries in cache: 3
Geometry cache size in bytes: 4624
CGAL Polyhedrons in cache: 0
CGAL cache size in bytes: 0
Compiling design (CSG Products normalization)...
Normalized CSG tree has 2 elements
Compile and preview finished.
Total rendering time: 0 hours, 0 minutes, 0 seconds

<https://www.openscad.org>

- Operativsystemer: MacOS, Windows, Linus, Raspbian etc.
- Betalingsmodell: Open source-programvare

Online kurser (for lærere og elever)

Gratis

- FutureLearn: Bioprinting
<https://www.futurelearn.com/courses/bioprinting>
- Coursera:
<https://www.coursera.org/courses?query=3d-modelling&>
- EdX: https://www.edx.org/course?search_query=3d-modelling

Betaling

Lynda.com: <https://www.lynda.com/search?q=3D-modelling&f=producttypeid%3a2>

Udemy:
<https://www.udemy.com/courses/search/?src=ukw&q=3d-modelling>