A 3D CAD model of a mechanical part, possibly a bracket or a component of a machine. The model is rendered in a semi-transparent grey color, revealing internal features such as a central channel, a circular hole, and a complex internal structure. The model is shown within a 3D coordinate system, with dashed lines representing the axes and a red line indicating a specific direction or feature. The text "3D Drucker – was nun?" is overlaid on the model in a large, bold, blue font.

3D Drucker – was nun?

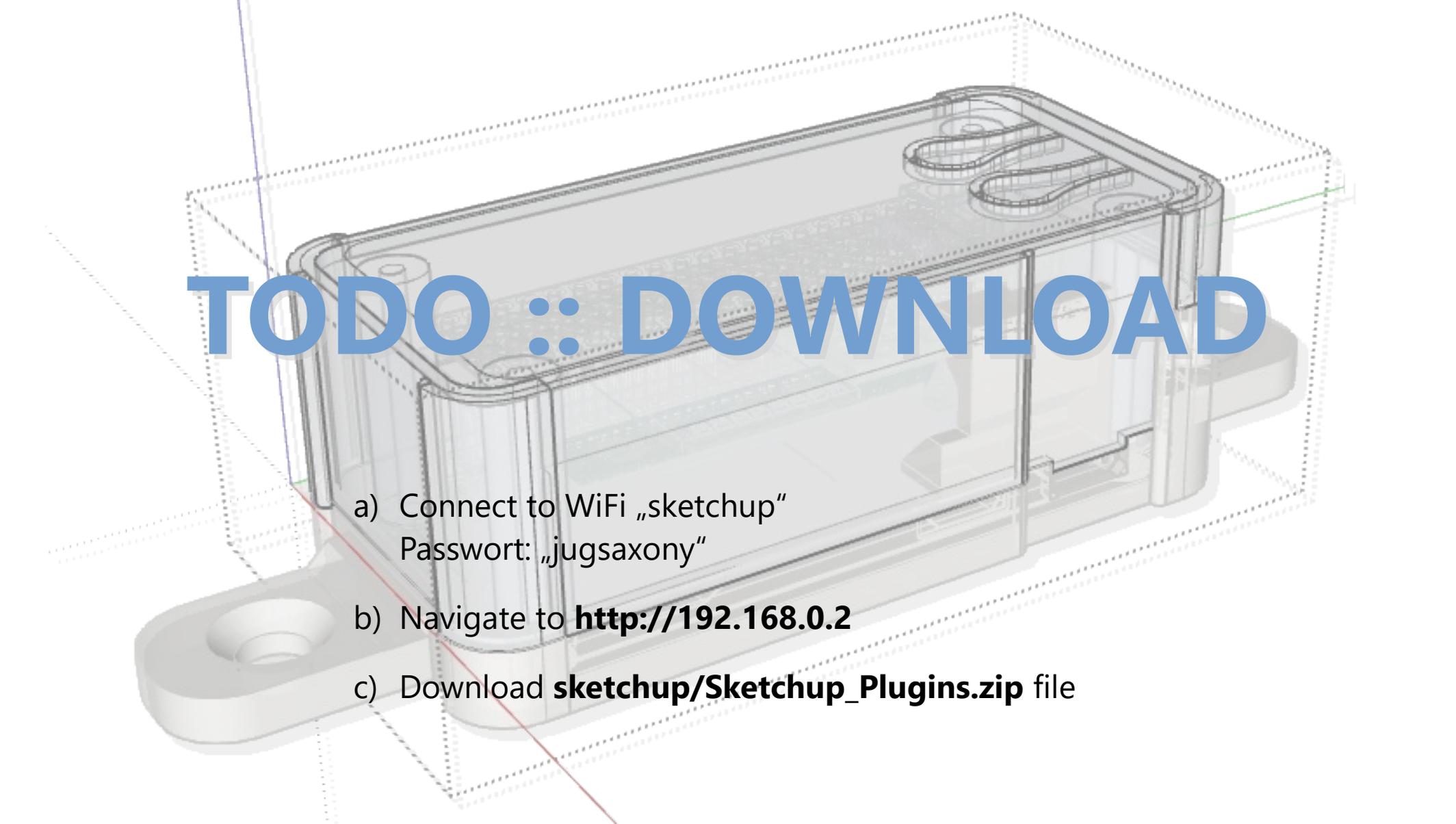
Eine Einführung in die Welt der 3D Modellierung mit
Sketchup

nebel.tobias@gmail.com

Agenda

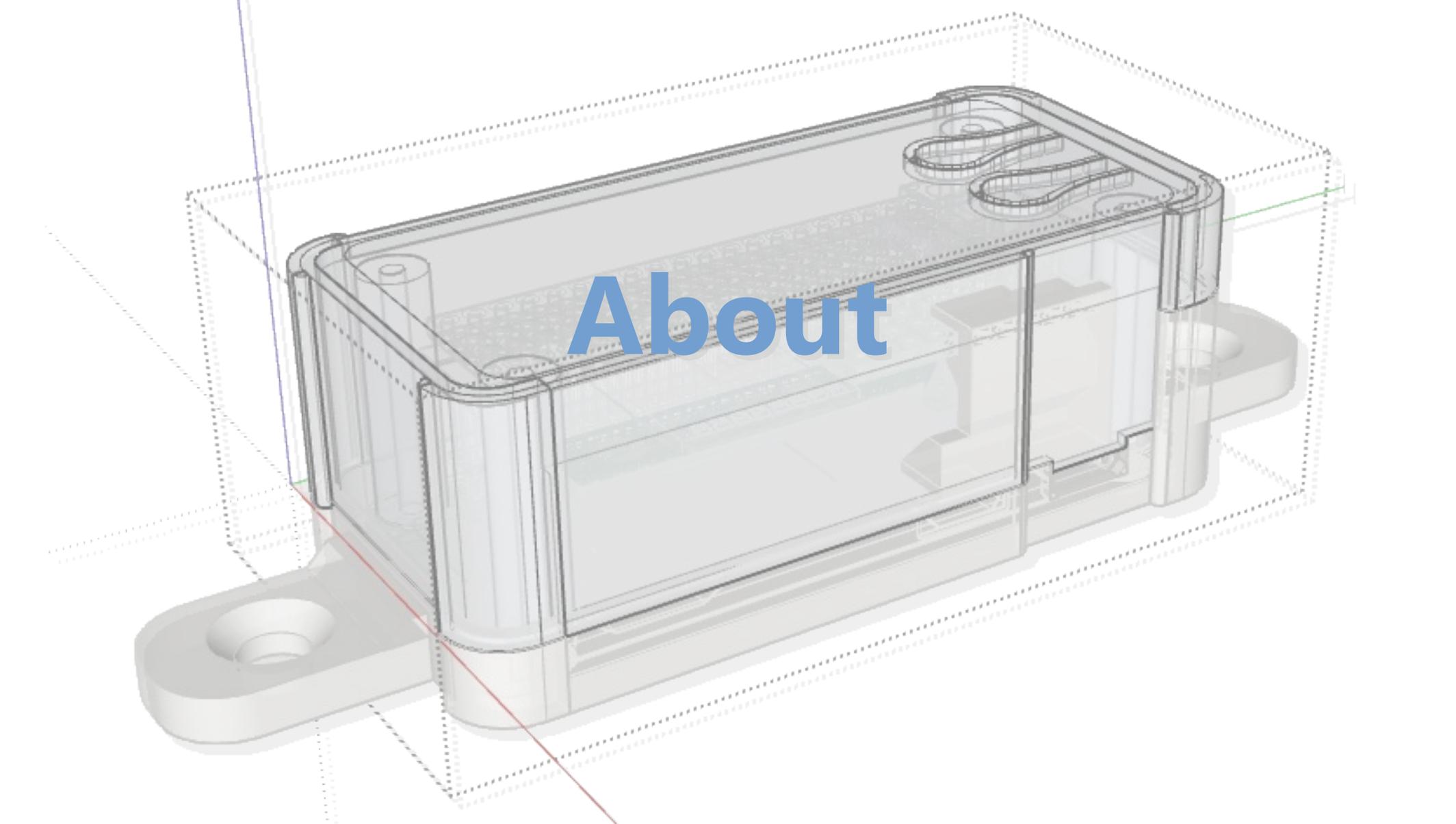
Was erwartet euch heute ?

- ♦ About .
- ♦ How ?
 - Modelle ?
 - Tools ?
 - **Setchup** !
 - Modellieren ? !
 - **You** ! ...ok... **WE** !
- ♦ Herstellen ? !



TODO :: DOWNLOAD

- a) Connect to WiFi „sketchup”
Passwort: „jugsaxony”
- b) Navigate to **<http://192.168.0.2>**
- c) Download **sketchup/Sketchup_Plugins.zip** file

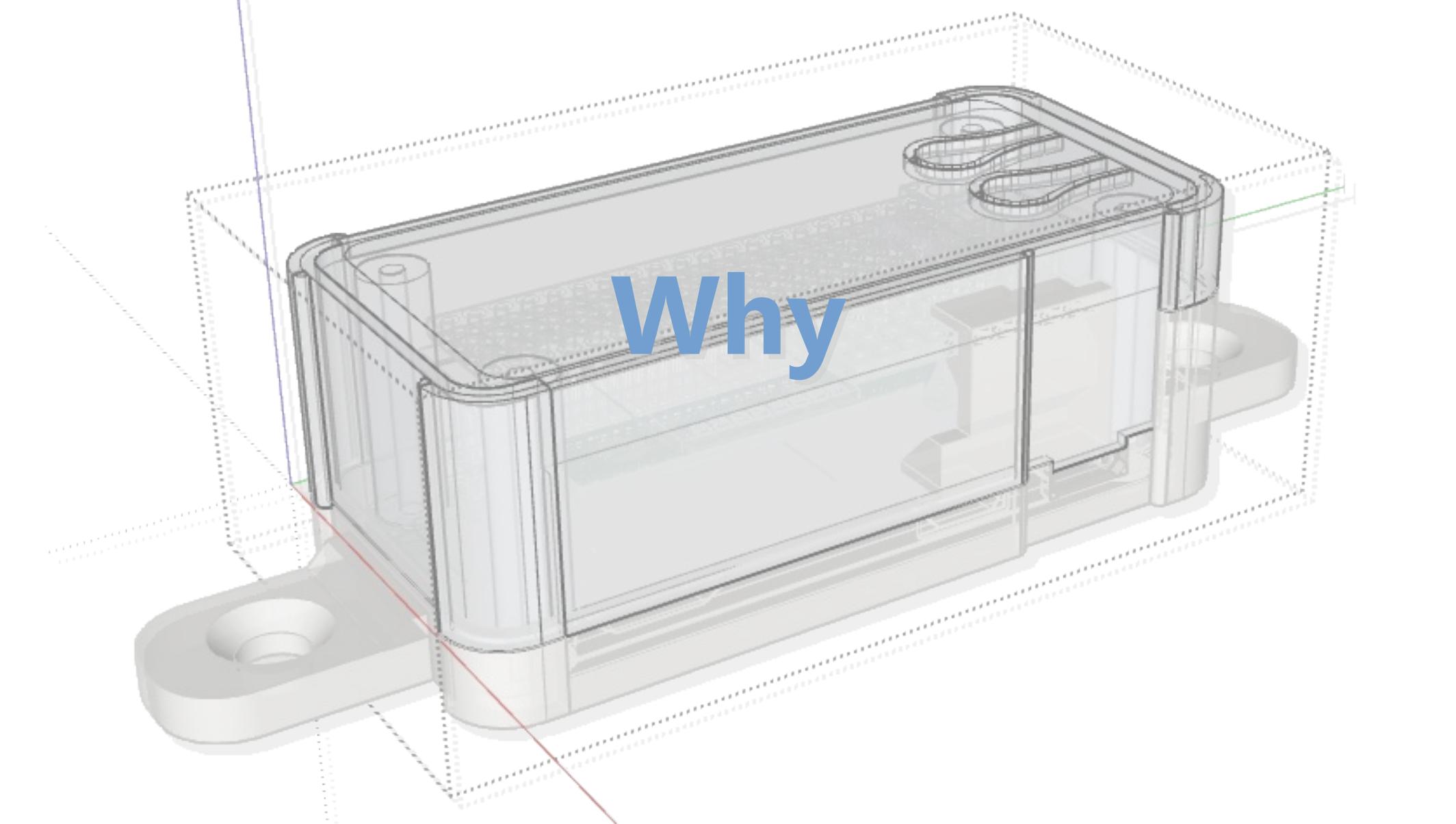
A 3D CAD model of a complex mechanical assembly, possibly a mold or a precision instrument component. The model is rendered in a semi-transparent grey style, revealing internal features such as a central cavity, a top surface with two circular patterns, and a base with a protruding handle-like structure. The assembly is enclosed within a dashed-line bounding box. Several colored lines (blue, green, red) extend from the corners of the bounding box, suggesting a coordinate system or alignment axes. The word "About" is overlaid in a large, bold, blue font in the center of the image.

About

About

- ◆ MMS & Superveil
- ◆ SWE & Architektur
- ◆ DIY addict

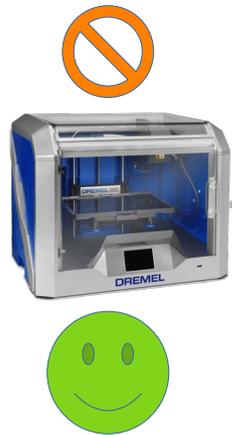




A 3D CAD model of a mechanical assembly, possibly a bracket or housing, is shown in a semi-transparent grey style. The model is enclosed within a dashed-line bounding box. The word "Why" is overlaid in a large, blue, sans-serif font in the center of the model. The assembly features a main rectangular body with rounded corners, a protruding base on the left side with a circular hole, and a complex internal structure with various slots and features. A blue vertical line is on the left, and a red diagonal line is at the bottom left. A green horizontal line is on the right side.

Why

Why



Wohnen &
Möbelrücken

Möbel
modernisieren

Baupläne &
Bemaßungen

ein Leben ohne 3D
Drucker ist möglich,
aber sinnlos

Gehäuse Ersatzteile

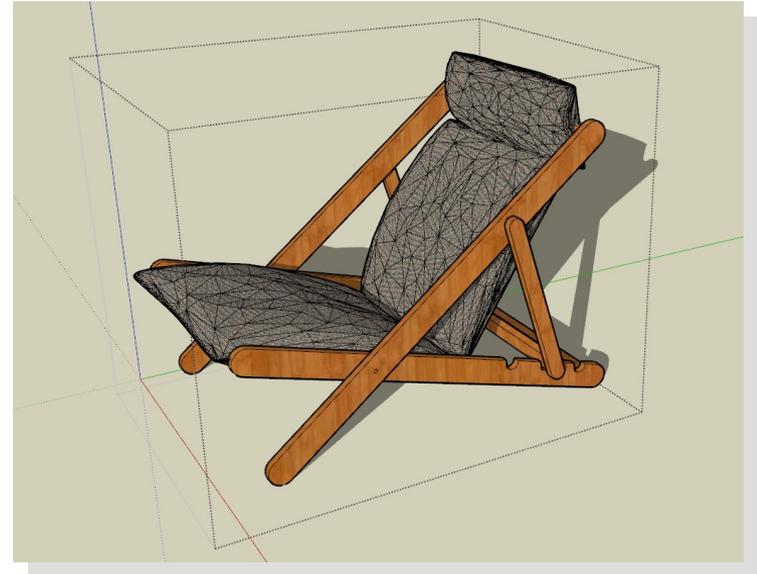
Tools &
Gimmicks

...

What – Wohnen & Möbelrücken

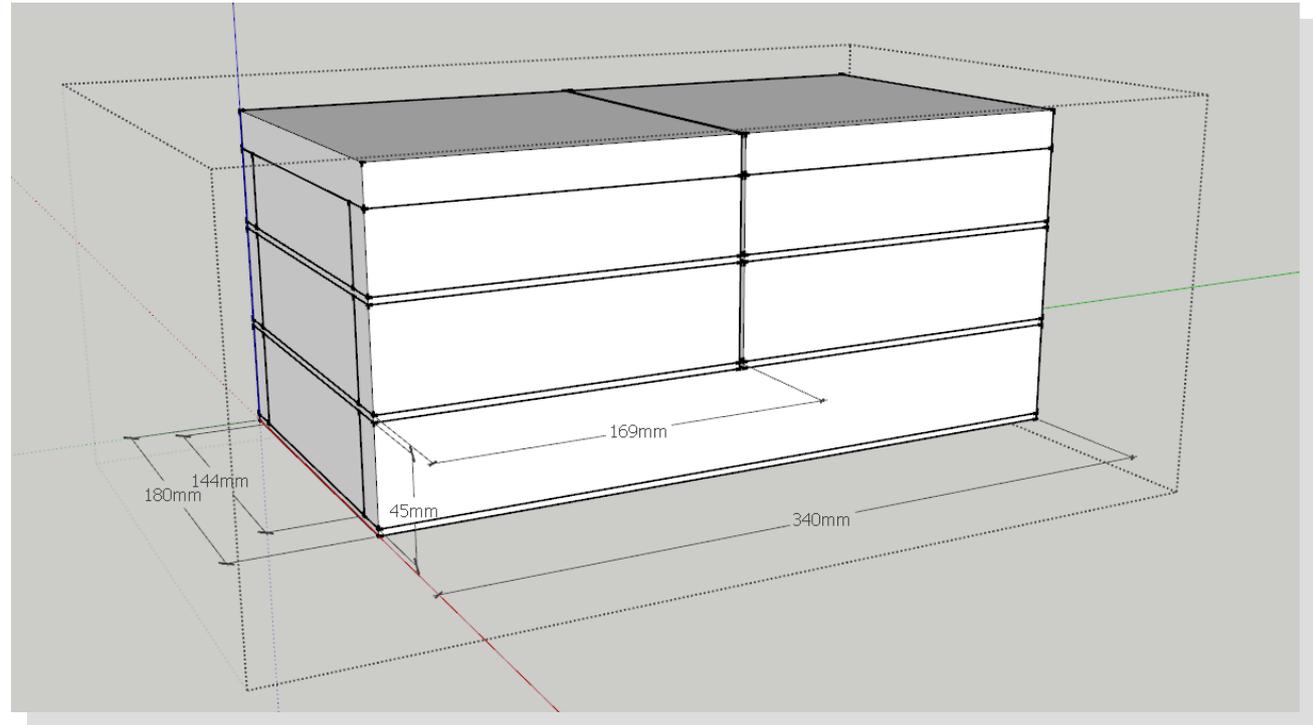
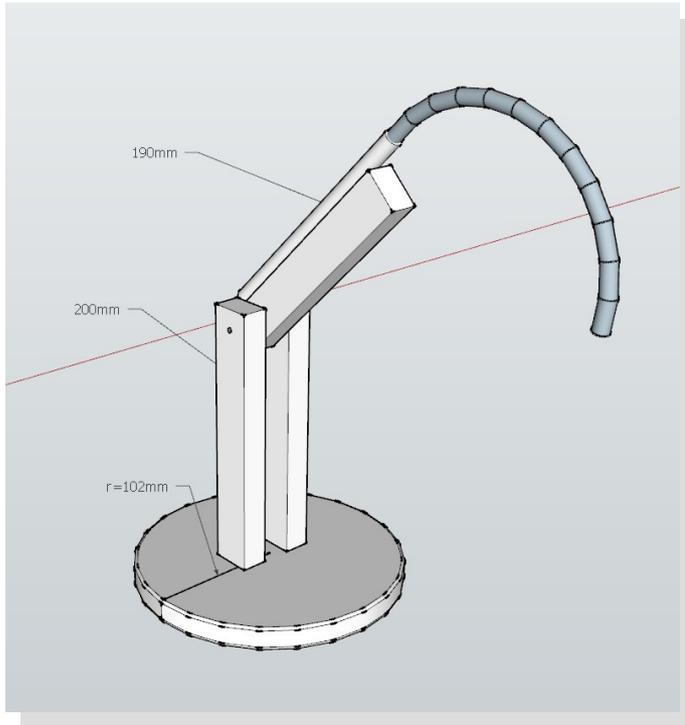


What – Möbel Modellieren

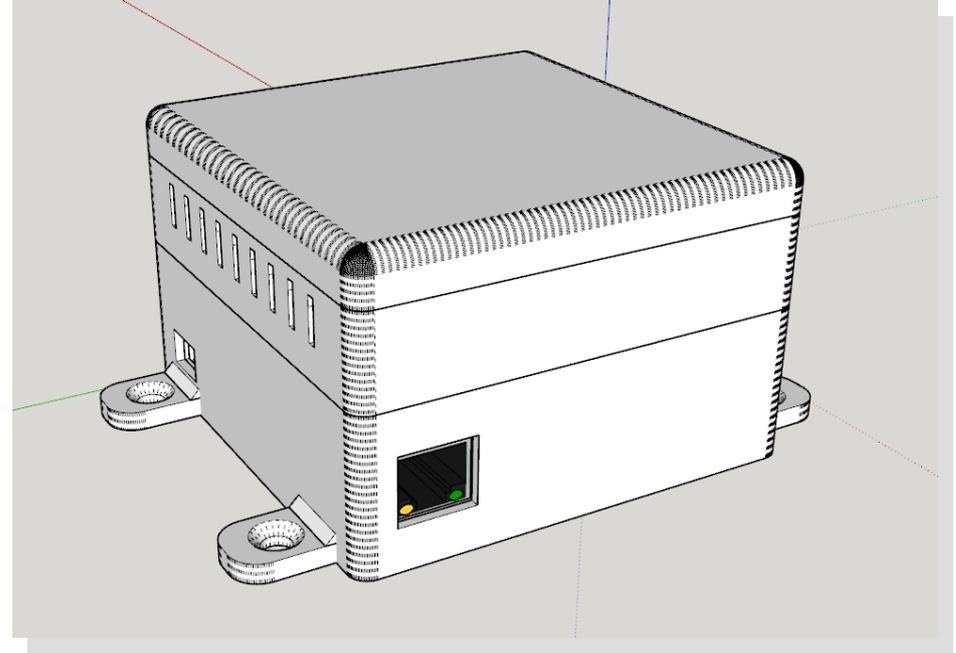
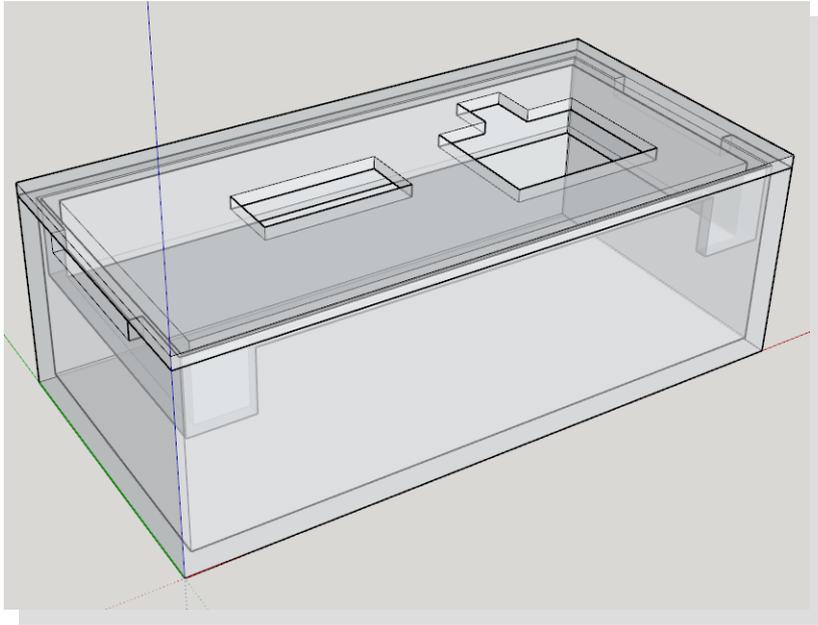


3D Drucker - was nun ?

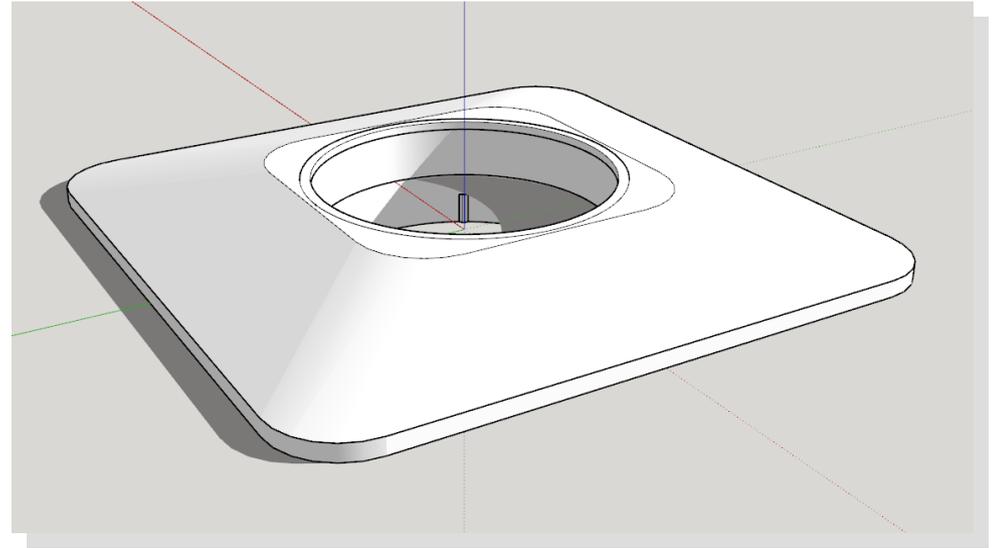
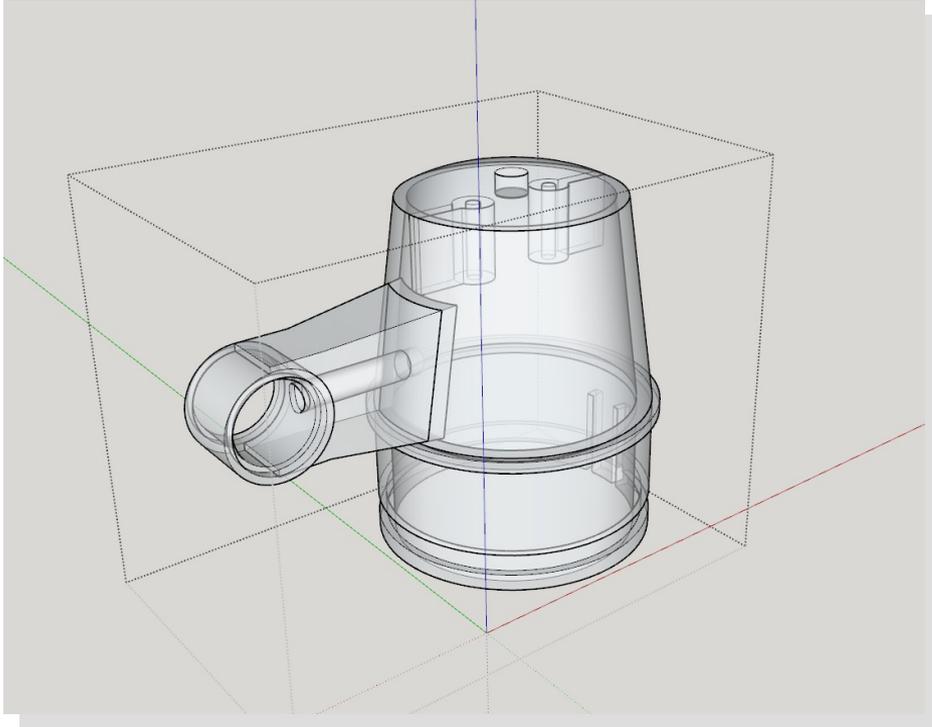
What – Baupläne & Bemaßung



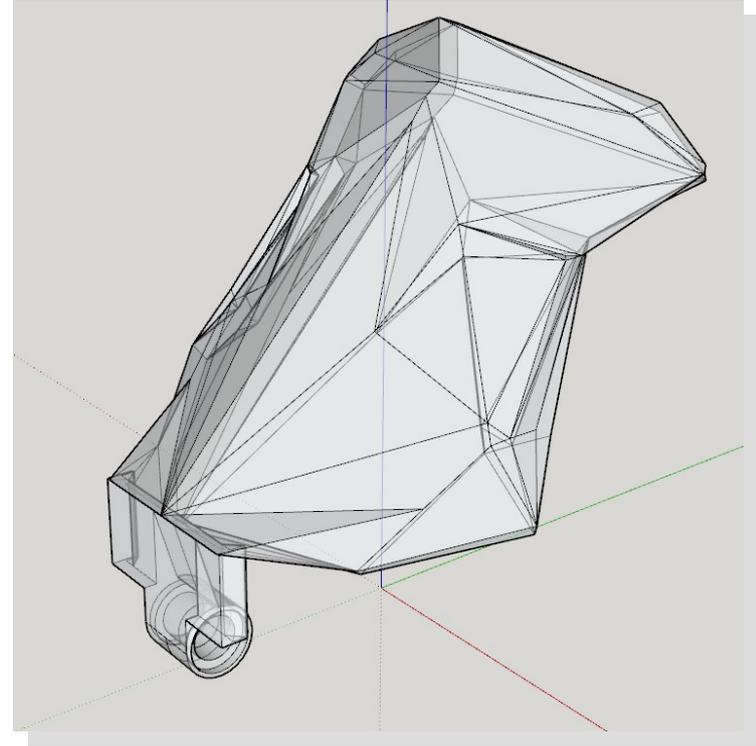
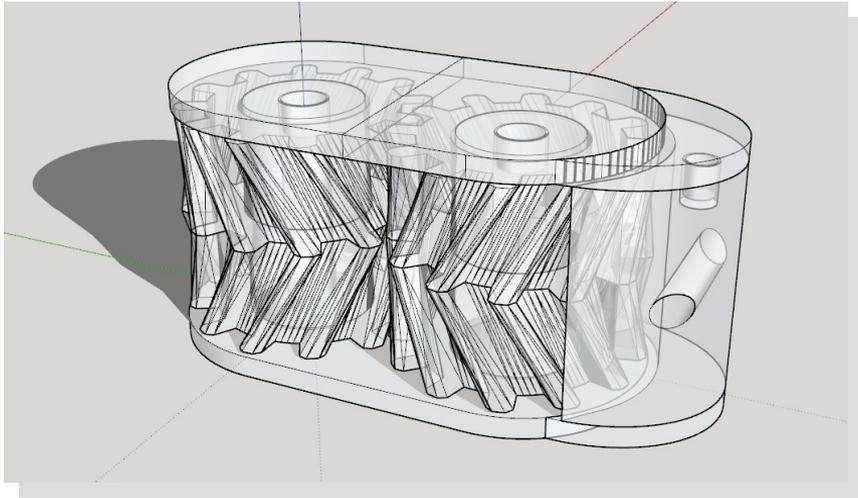
What – Gehäuse

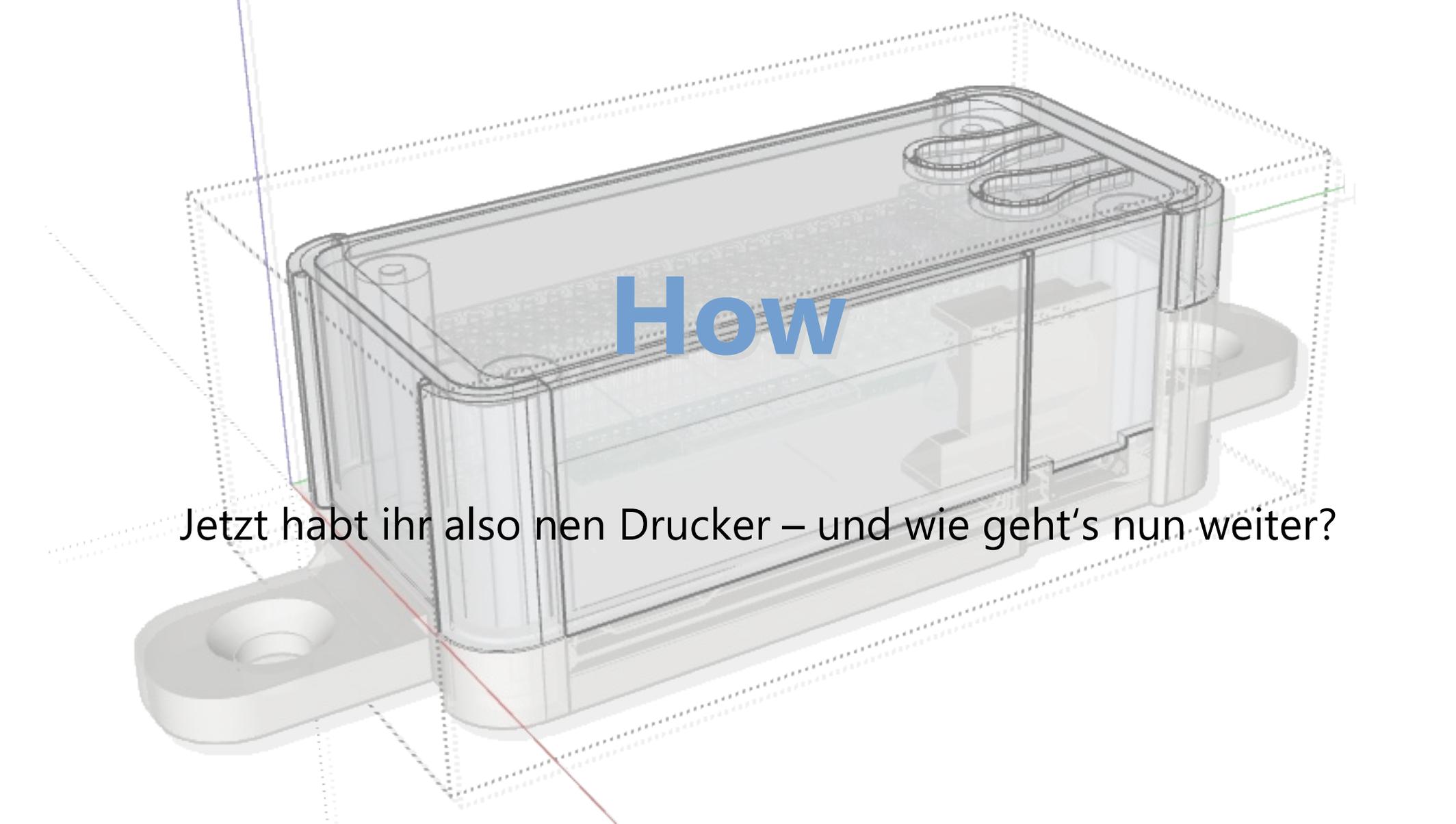


What – Ersatzteile



What – Tools & Gimmicks



A 3D CAD model of a mechanical part, possibly a bracket or housing, shown in a cutaway view. The part is rendered in a light gray color. The cutaway reveals internal features, including a central rectangular cavity, a circular hole on the left side, and a complex internal structure on the right side. The model is surrounded by a dashed gray bounding box. A blue line is visible on the left side, and a red line is visible at the bottom left. The word "How" is overlaid in the center of the model.

How

Jetzt habt ihr also nen Drucker – und wie geht's nun weiter?

How – Modelle?

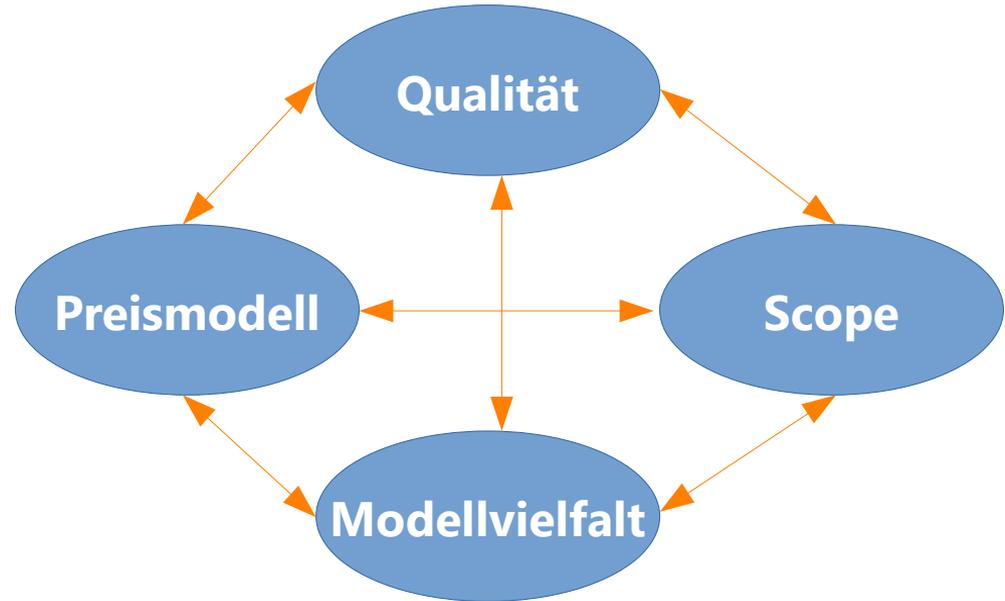
Fertige Modelle

VS

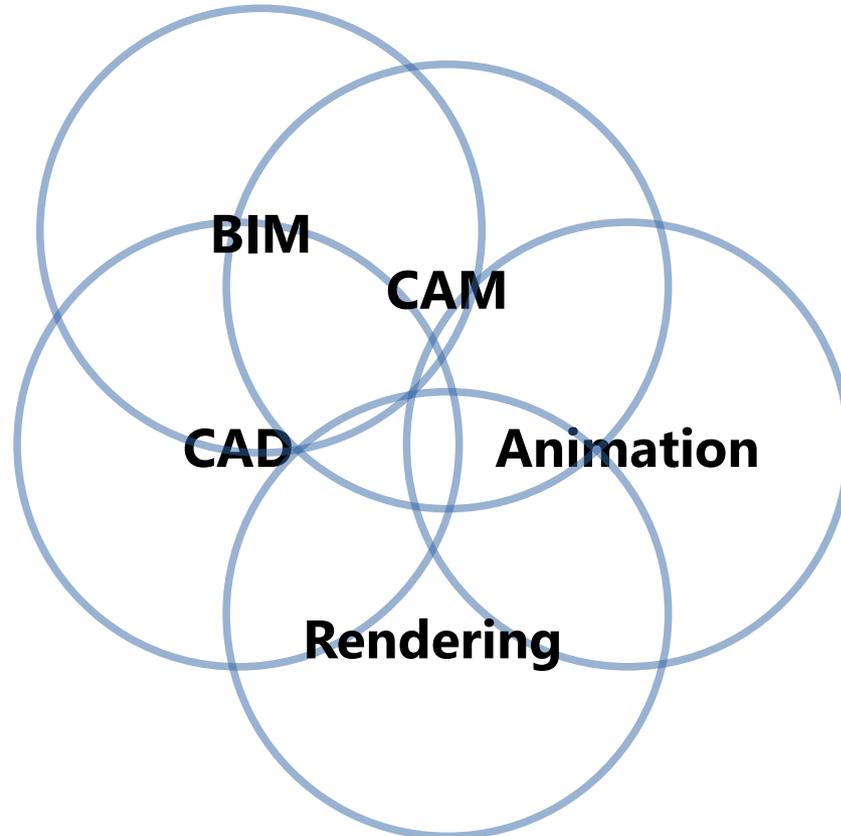
Modellieren

How – Modelle?

- ♦ TinkerCAD
- ♦ Sketchfab
- ♦ Thingiverse
- ♦ MyMiniFactory
- ♦ Trimble 3D Warehouse
- ♦ Clara.io
- ♦ ...



How – Tools?



3D Drucker - was nun ?

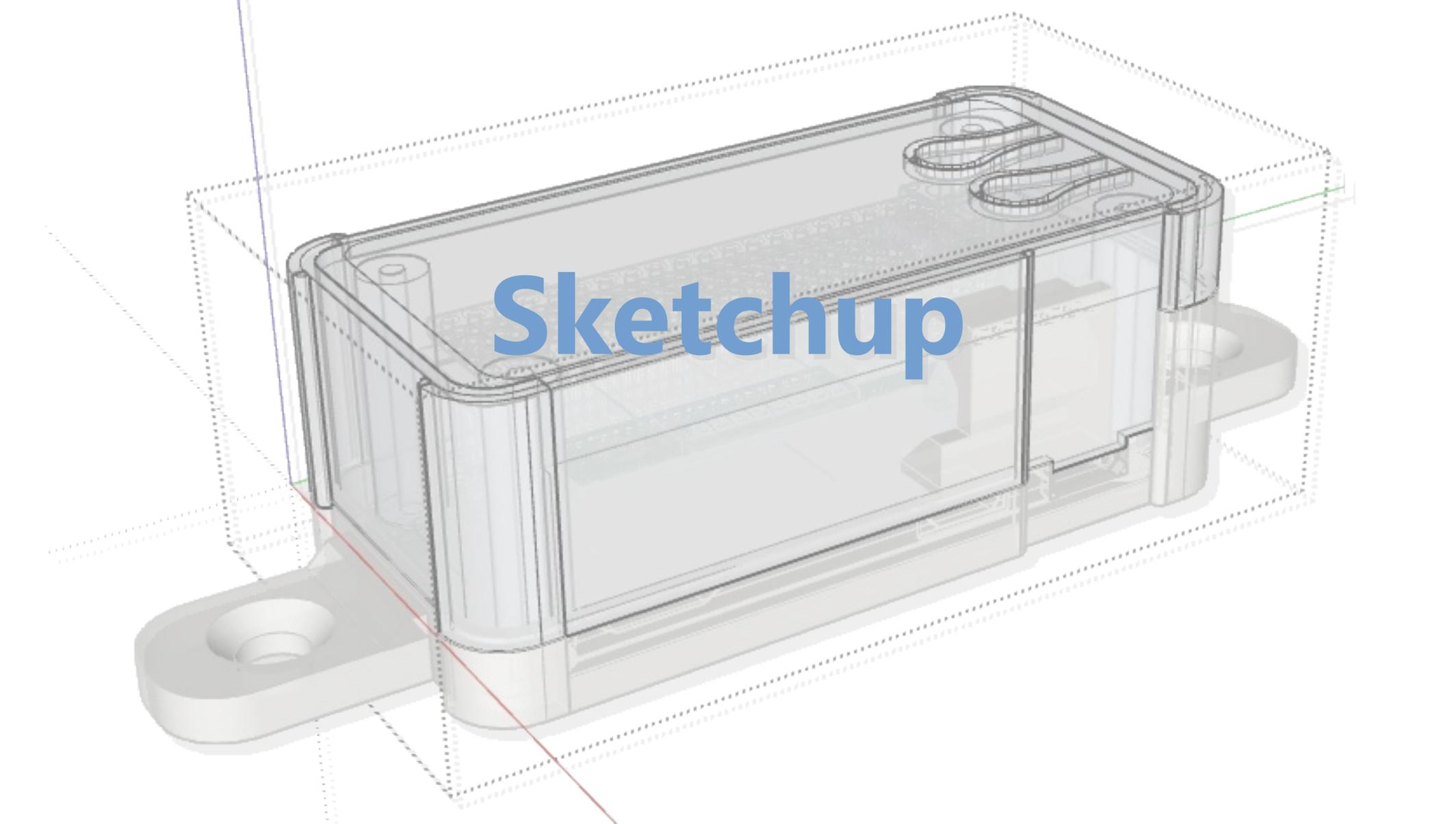
How – Tools?

Kommerziell

- AutoCAD
- Solidworks
- Catia
- Rhino
- Revit

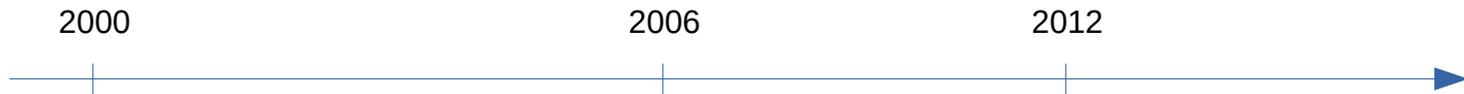
Kostenlos / Freemium

- FreeCAD
- OpenSCAD
- Fusion 360
- Blender
- SketchUp

A 3D CAD model of a mechanical part, possibly a bracket or housing, rendered in a wireframe style. The model is semi-transparent, revealing internal features like a central slot and a circular hole on the left. The word "Sketchup" is overlaid in a large, blue, sans-serif font across the center of the model. The model is surrounded by a dashed grey bounding box and several colored lines (blue, green, red) extending from its corners, suggesting a coordinate system or alignment planes.

Sketchup

Sketchup – Intro



- ♦ @Last Software → Google → Trimble
- ♦ „Pen & Paper“ (zeichnendes Konstruieren)
- ♦ GP-3D, Architecture, Modelling, Construction

Sketchup – Warum gerade?

- einfach
 - Einstiegshürde eher moderat, aber danach sehr schnelle Erfolge
- erweiterbar
- kostenlos
- gutes Spagat zw. CAD, CAM und BIM



- * Architektur
 - * Gebäude
 - * Landschaft
 - * Teilekonstruktion
 - * Technische Zeichnungen



- * Dynamische Teile
- * Teile mit Interaktion
- * Teile mit gegenseitigen Wechselwirkungen



- * Freihandmodellieren (Sculpting)
- * Echtwelt Modelle (Tiere, Personen, ...)
- * Animationen

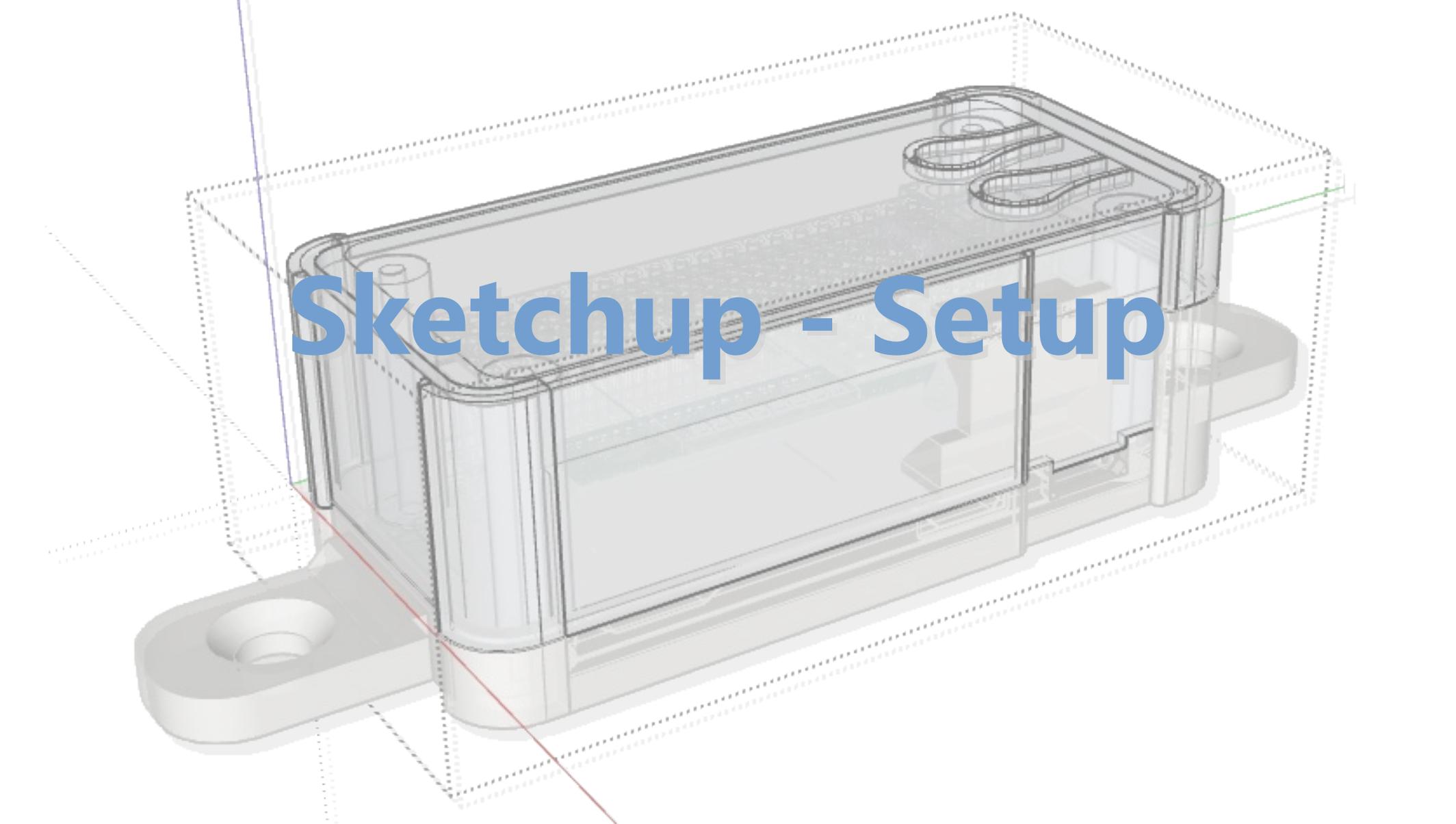
Sketchup - Versionen

Sketchup Make	Sketchup Free	Sketchup Shop	Sketchup Pro	Sketchup Studio
<ul style="list-style-type: none">• 2017• Desktop• Win & Mac• Tools• Plugins (!)	<ul style="list-style-type: none">• Web• kostenlos• Outliner• Plugins	<ul style="list-style-type: none">• Web• Subscription• Tools• Plugins	<ul style="list-style-type: none">• Web & Desktop• Win & Mac• Tools• Plugins	<ul style="list-style-type: none">• Web & Desktop• Win & Mac• More Tools• AR / VR• Plugins

Sketchup - Versionen

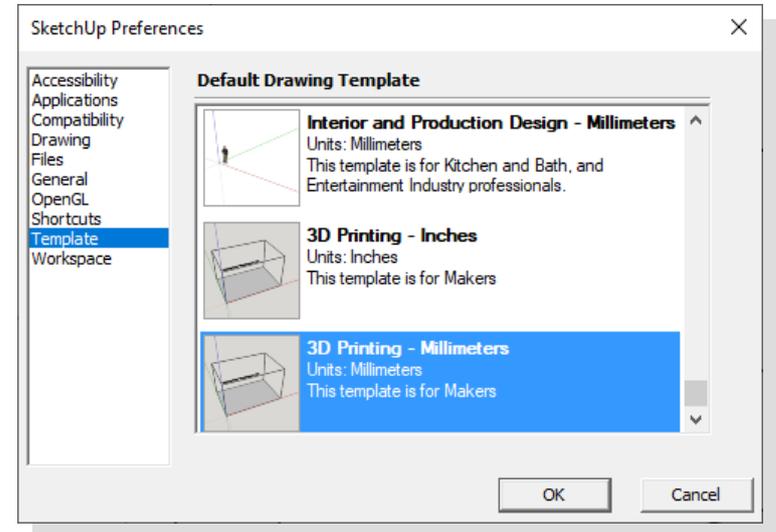
Sketchup Make	Sketchup Free	Sketchup Shop	Sketchup Pro	Sketchup Studio
<ul style="list-style-type: none">• 2017• Desktop• Win & Mac• Tools• Plugins (!)	<ul style="list-style-type: none">• Web• kostenlos	<ul style="list-style-type: none">• Web• Subscription• Tools	<ul style="list-style-type: none">• Web & Desktop• Win & Mac• Tools	<ul style="list-style-type: none">• Web & Desktop• Win & Mac• More Tools• AR / VR

Sketchup - Setup

A 3D CAD model of a mechanical component, possibly a bracket or housing, shown in a cutaway view. The model is rendered in a light gray color. It features a rectangular main body with rounded corners, a smaller protruding section on the left side with a circular hole, and a complex internal structure. The top surface has several circular features, possibly for screws or mounting points. The model is enclosed within a dashed gray bounding box. A red line is drawn across the bottom left corner, and a green line is visible on the right side. The text "Sketchup - Setup" is overlaid in the center in a large, blue, sans-serif font.

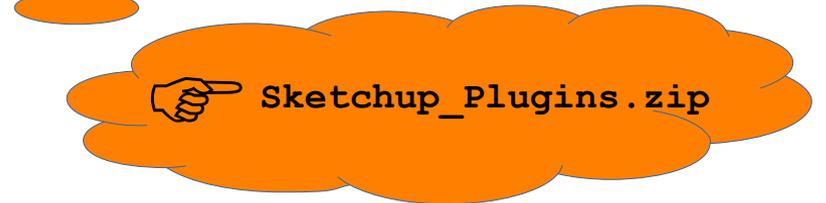
Sketchup - Setup

- ♦ Das Template
 - Ansichtstyp („Style“)
 - Kanten
 - Flächen
 - Maßeinheiten
 - Toolset
- ♦ Windows → Preferences → Template → „3D Printing - Millimeters“



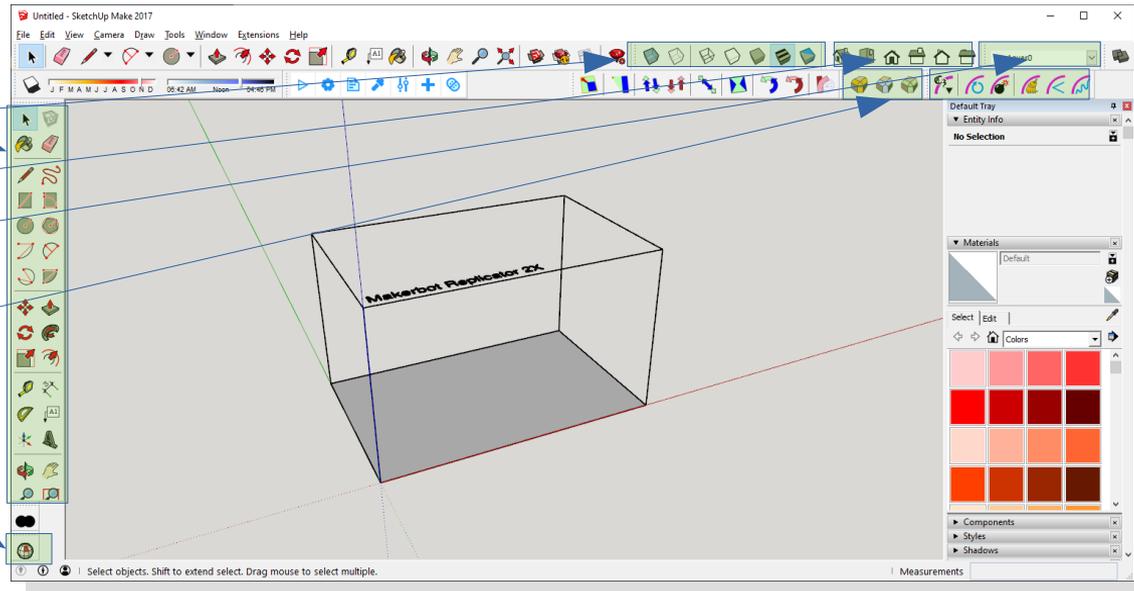
Sketchup - Setup

- EN statt DE
- **Plugins**
 - Ruby-basiert
 - „Trimble Extension Warehouse“ und „sketchUcation“ → Account nötig
 - **Installation:** Window → Extension Manager → Install Plugins:
 - **LibFredo6**
 - **Solid Inspector** ²
 - **Round Corner**
 - **Sketchup STL Ex- & Import**
 - Weld
 - Curvizard
 - *BoolTools 2 (kommerziell, 20\$ lifetime)*



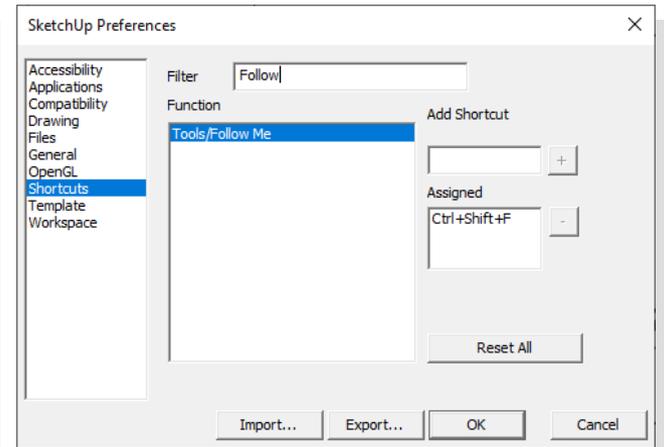
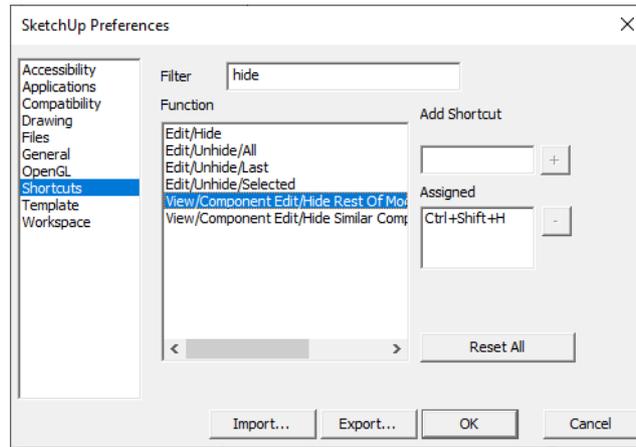
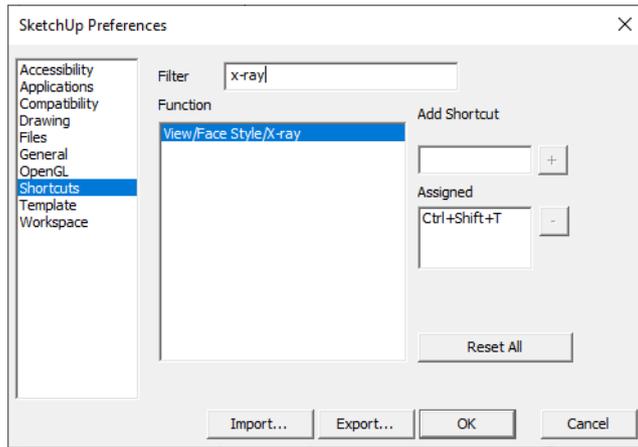
Sketchup - Setup

- Window → Preferences → Tempalte → 3D Printing
- View → Toolbars
 - **Large Toolset**
 - **Styles**
 - **Views**
 - **Layers**
 - **Round Corner**
 - **Solid Inspector** ²
 - FredoScale
 - Curvizard



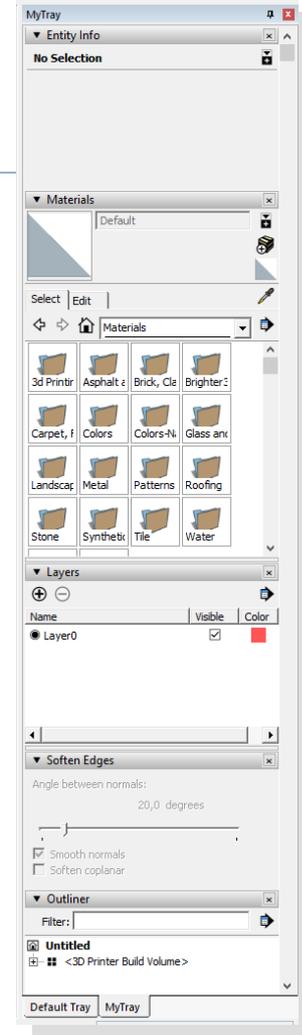
Sketchup - Setup

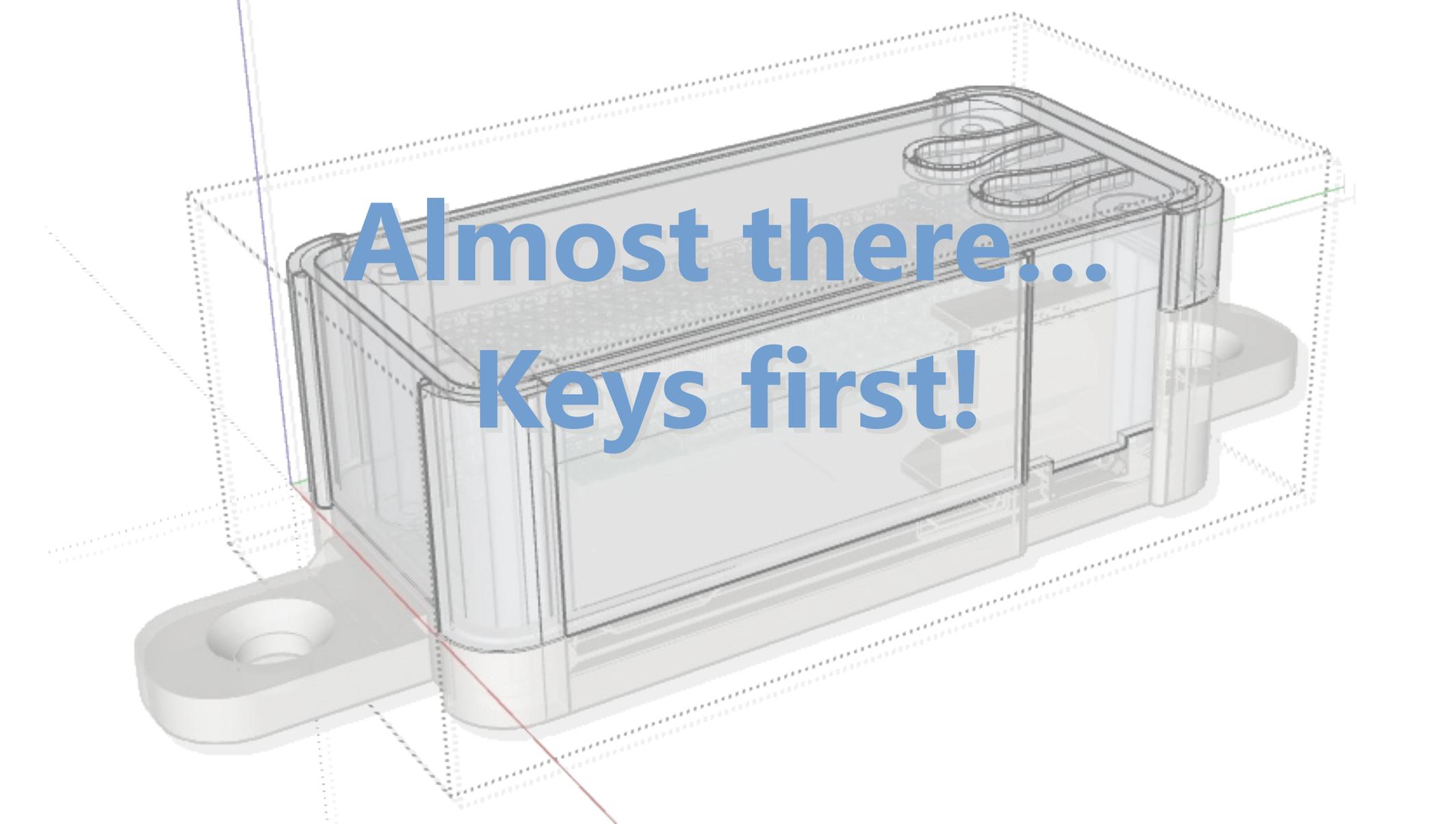
- ♦ Custom Shortcuts: Window → Preferences → Shortcuts
 - **X-Ray** → Strg + Shift + T
 - **Hide Rest of Model** → Strg + Shift + H
 - **Follow Me** → Strg + Shift + F



Sketchup - Setup

- ♦ Window → Manage Trays → Default Tray (or new)
 - **Entity Info**
 - **Materials**
 - **Layers**
 - **Soften Edges**
 - **Outliner**



A 3D CAD model of a mechanical assembly, possibly a bracket or housing, is shown in a semi-transparent grey color. The model is enclosed within a dashed-line bounding box. Overlaid on the model is the text "Almost there..." and "Keys first!" in a bold, blue, sans-serif font. The text is centered horizontally and vertically over the main body of the part. The model features a complex internal structure with various slots, holes, and a circular feature on the top surface. A red line is visible on the left side, and a green line is visible on the right side, possibly indicating alignment or measurement points.

Almost there...
Keys first!

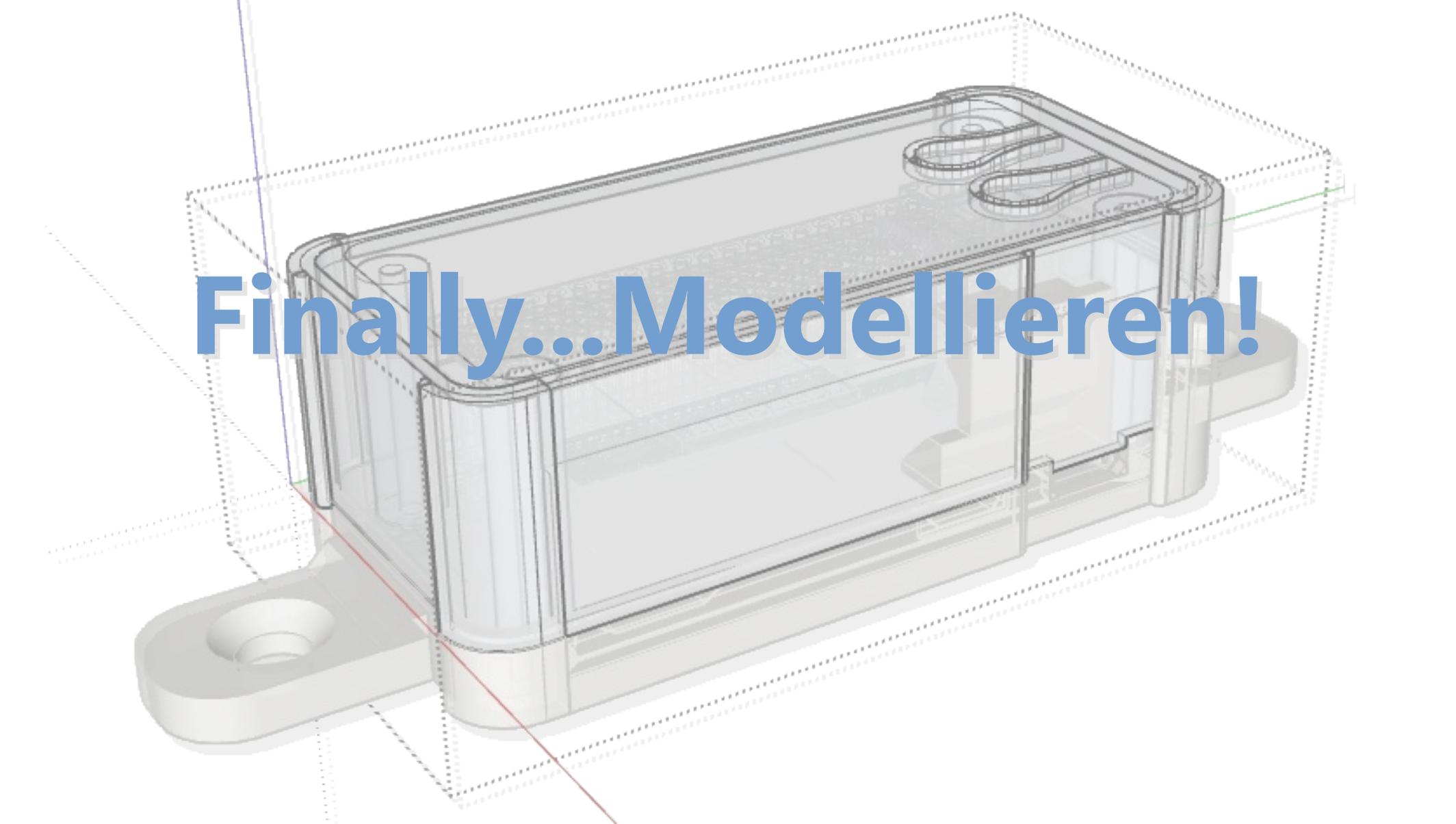
Bedienung

- ♦ Maus (!) & Tastatur
- ♦ Shortcuts, Shortcuts, Shortcuts
- ♦ Praxistip:
Aktionen Abschließen mit „Space“
(Auswahl-Werkzeug aktiv), ggf. ESC
vorab

Gruppe	Funktion	Icon	Key(s)
Selection	Auswahltool (Select)		Space
	Löschen		E
	Gruppieren	/	Shift+Strg+G
Zeichnen	Linie		L
	Kreis (Circle)		C
	Bogen (Arc)		A
Bewegen	Verschieben (Move)		M
	Drehen		Q
	Skalieren		S
	Offset		F
Modifiers	Ebene forcieren	/	↑ ↓ ← →
	Ebene beibehalten	/	Shift
	Kopieren	/	Strg
	Wiederholen	/	* + Anzahl + Enter
Ansicht	Versteckte Geometrie anzeigen	/	Strg + -
	Selektion heranzoomen		Shift+Strg+E
Custom	Transparenz toggeln		Shift+Strg+T
	Verstecken inaktiver Gruppen	/	Shift+Strg+H
	Follow Me		Shift+Strg+F

Bedienung - Orientieren

	Orbit	Middle Mouse Button
	Pan	Shift + Middle Mouse Button
	Zoom	Scrollrad

A 3D CAD model of a mechanical component, possibly a bracket or housing, shown in a cutaway view. The model is rendered in a light gray color. It features a rectangular main body with rounded corners, a flat base, and a protruding tab on the left side. The cutaway reveals internal features, including a central slot, a small rectangular block, and a complex internal structure on the right side. The model is surrounded by a dashed gray bounding box. Several colored lines (blue, green, red) are drawn across the scene, likely representing coordinate axes or alignment lines. The text "Finally...Modellieren!" is overlaid in the center in a bold blue font.

Finally...Modellieren!

Modellieren – Grundlagen

Monkey see, Monkey do

... mach's mit – mach's nach – mach's besser ...

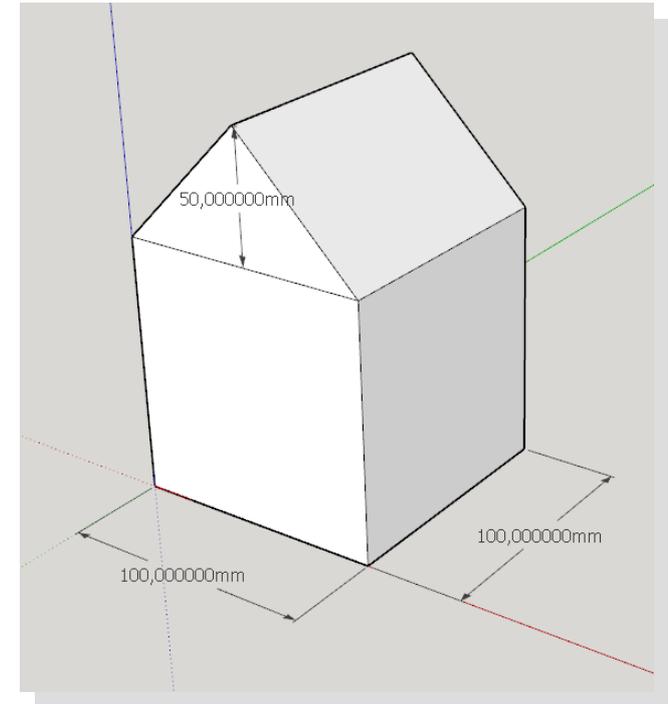
Fragen!

Hinweise?

Teilen

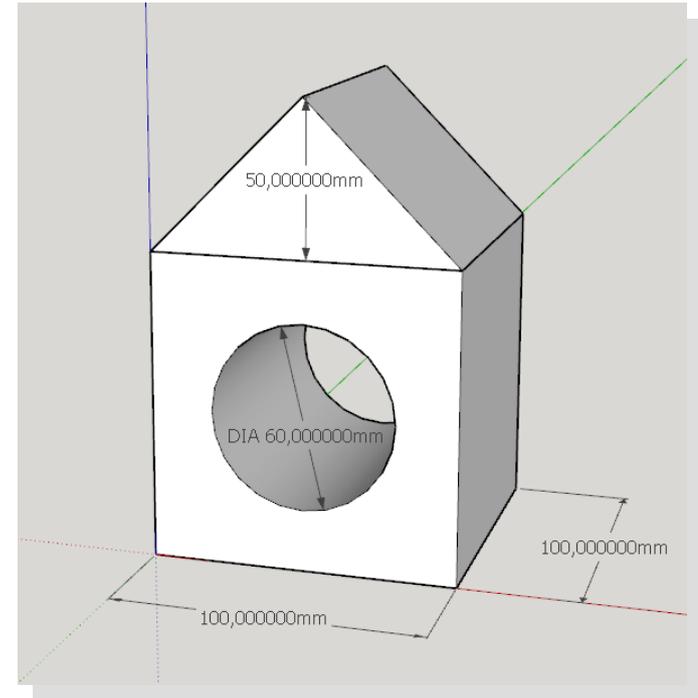
Modellieren – Aufgabe #1

- ♦ Modellieren eines Würfels mit Dreieck darauf



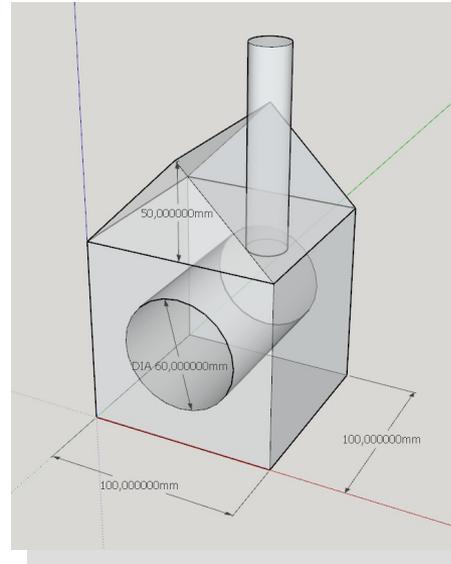
Modellieren – Aufgabe #2

- ◆ Einfügen eines Loches

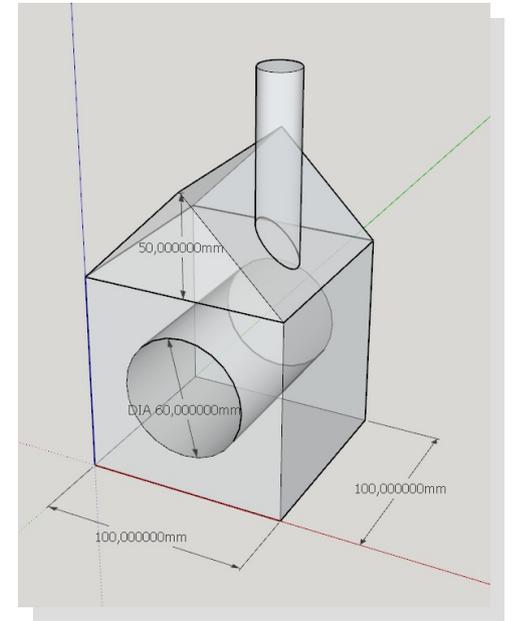


Modellieren – Aufgabe #3

- ♦ 3.1) Schornstein hinzufügen

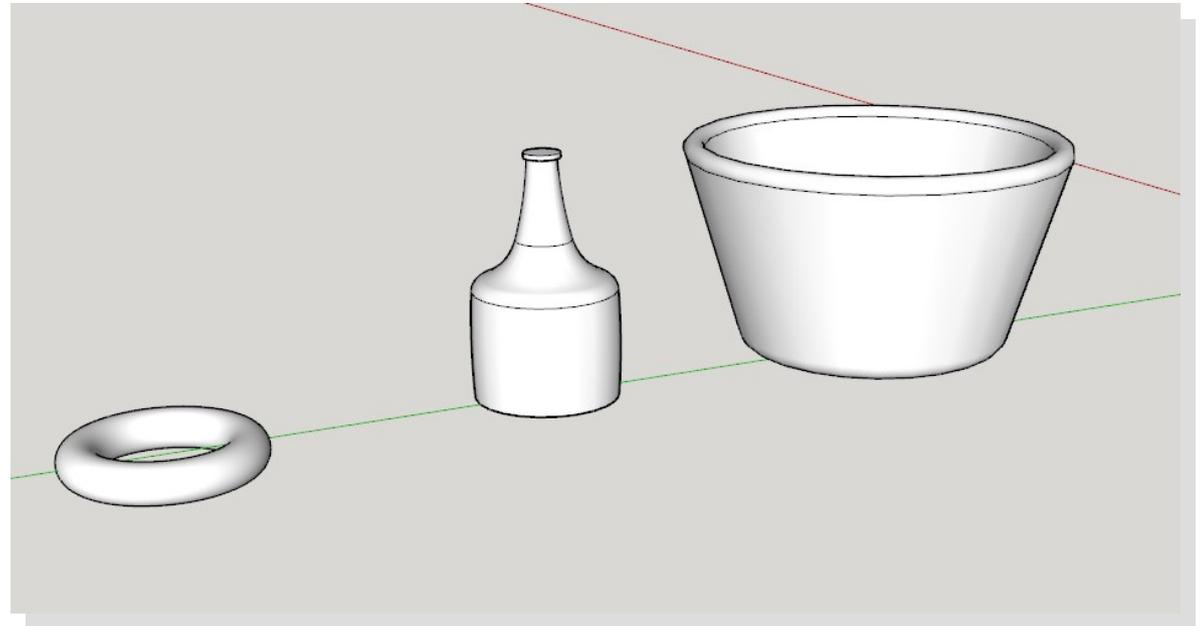


- ♦ 3.2) Schornstein mit Dach verschneiden



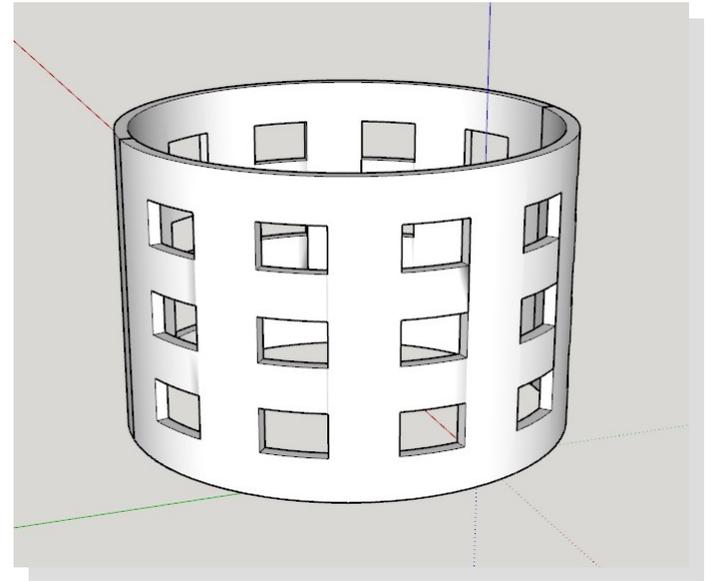
Modellieren – Aufgabe #4.1

- ◆ Geschwungene Formen erstellen



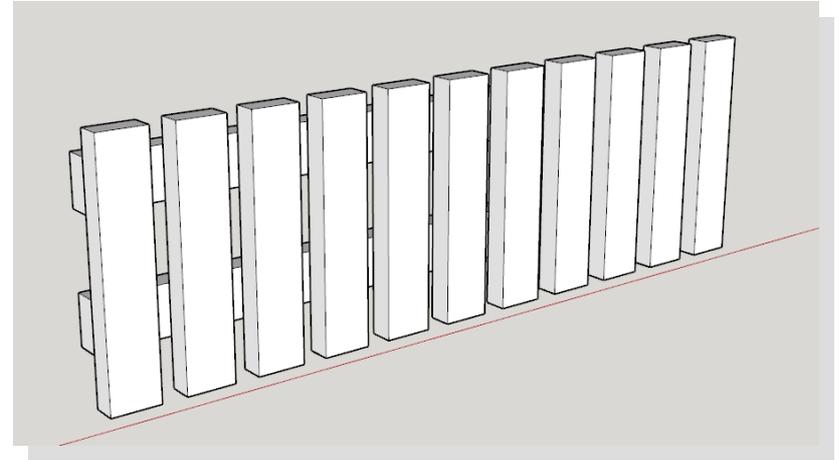
Modellieren – Aufgabe #4.2

- ◆ Gebogene Formen erstellen



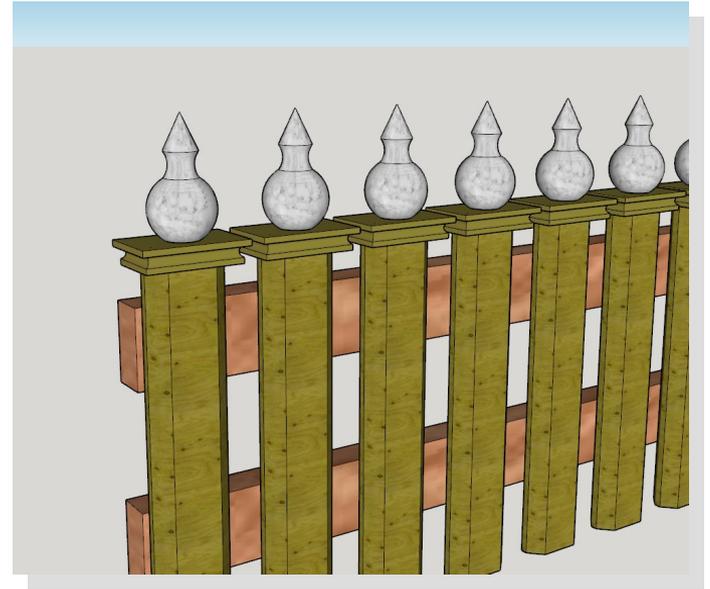
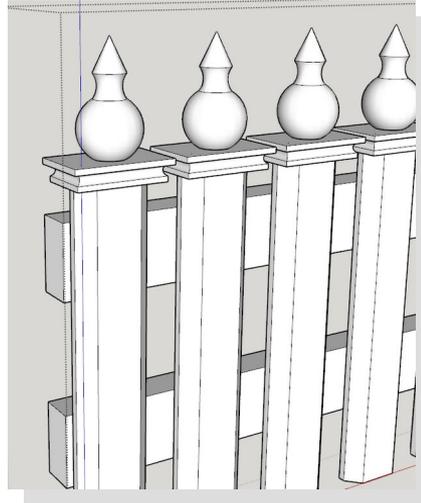
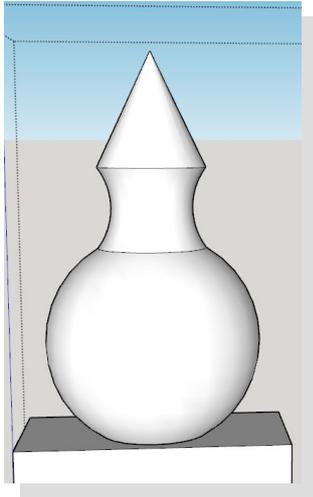
Modellieren – Aufgabe #5

- ♦ Erstellen eines einfachen Zaunsfeldes mit viereckigen Zaunslatten
→ **Längs- und Querlatten als Component!**



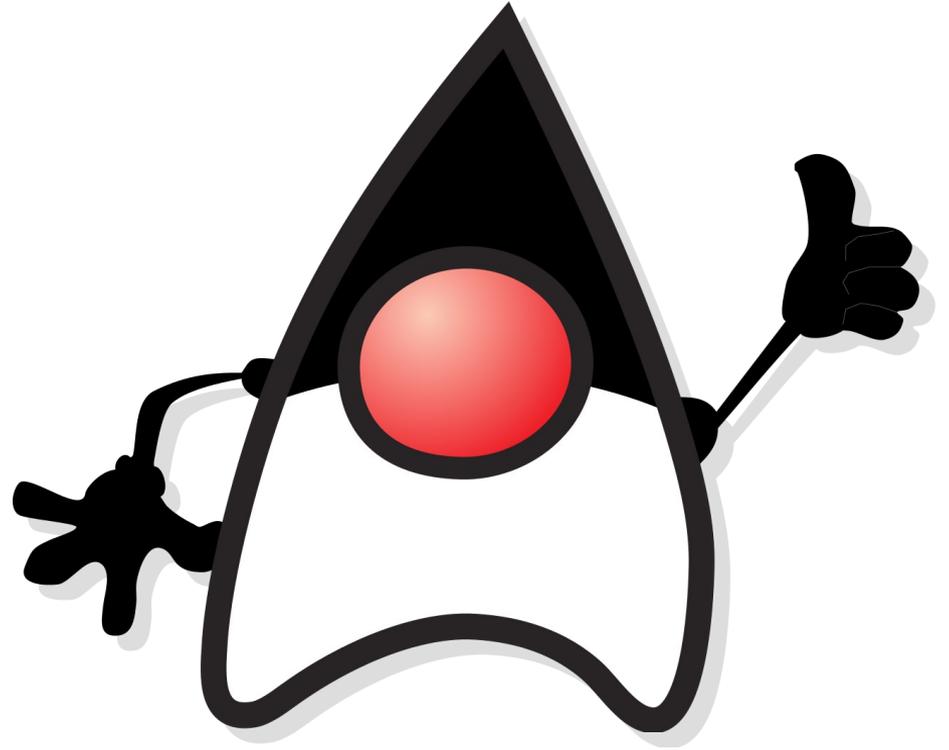
Modellieren – Aufgabe #6

- ◆ Zaun „aufhübschen“



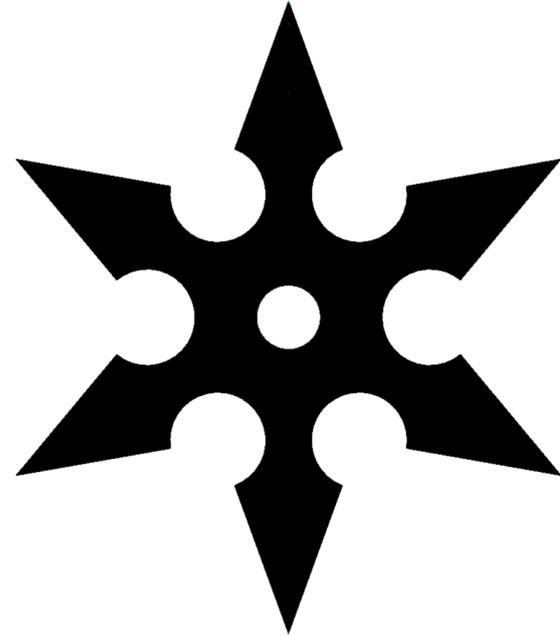
Modellieren – Aufgabe #7

- ◆ Konstruiert Duke nach, ihr werden ihn gleich noch einmal brauchen



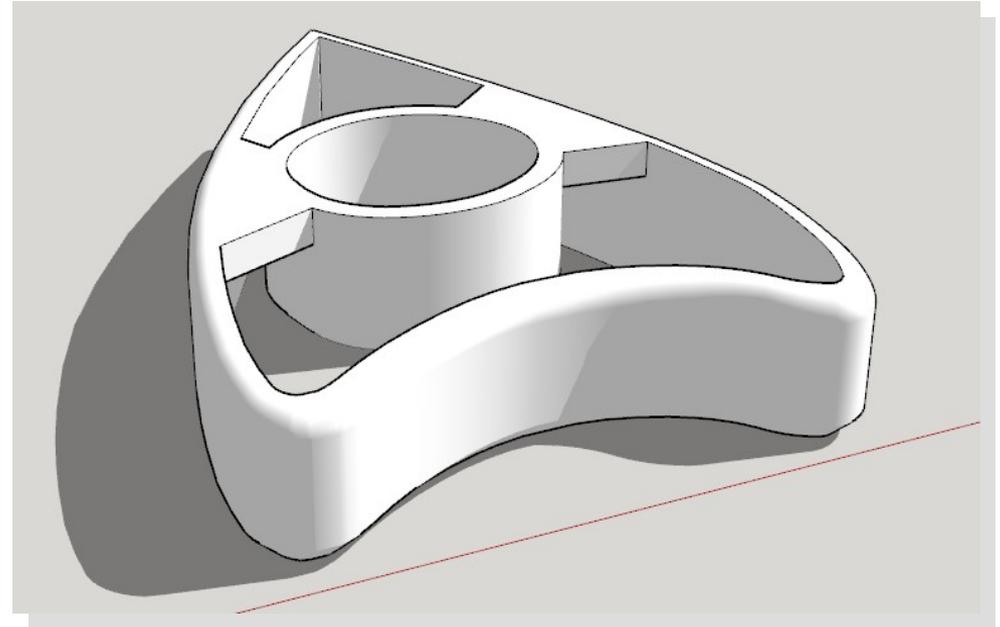
Modellieren – Aufgabe #8

- ♦ Wer konstruiert am schnellsten einen Shuriken?



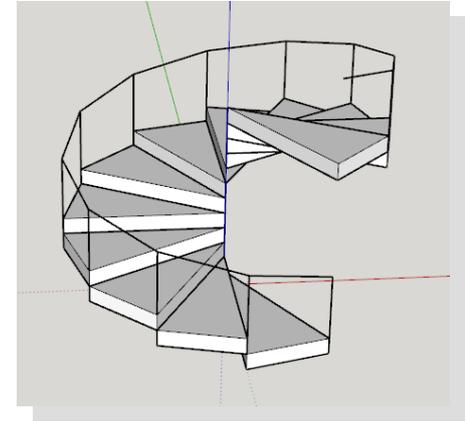
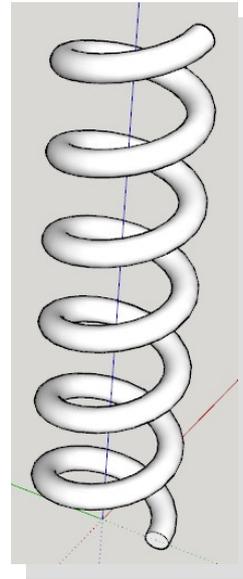
Modellieren – Aufgabe #9

- ◆ Jetzt braucht ihr Gedult:
Wie wäre es mit einer Keksförmigkeit von Duke?



Modellieren – Aufgabe #10

- ◆ Noch Lust?
 - Zeit für eine Helix!
- ◆ Eine Wendeltreppe geht genauso einfach!



Modellieren – Solids

- ♦ 3D-Druckbare Modelle müssen ein „Solid“ sein
 - Modell darf keinerlei Lücken in äußerer Hülle aufweisen

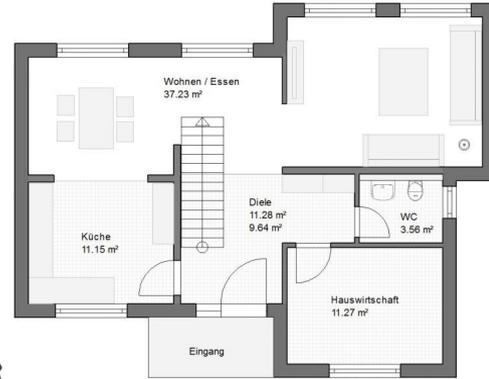
A 3D CAD model of a mechanical part, possibly a bracket or a housing, shown in a semi-transparent grey color. The part has a rectangular main body with rounded corners and a smaller, wider flange extending from the bottom left. On the top surface, there are two circular features with internal patterns, possibly representing screw holes or mounting points. The model is surrounded by a dashed grey wireframe box, and several colored lines (blue, green, red) are drawn across the scene, likely representing coordinate axes or alignment lines.

Jetzt ihr!

Umsetzungsideen, Fragen, Probleme, usw.

Jetzt ihr!

- Maker Coins
- Seilstraffer
- USB Stick Case
- Haus per Grundriss
- Lego Stuff
- Fidget Spinner
- Fidget Spinner
- Schlüsselanhänger
- **Eigene Ideen!**



Secure to the end of a rope

Works two ways!

Secure in any location along the length of a rope

Simply form a loop in the rope and pass it around the FIGURE 9

Strong aluminum

Laser engraved instructions

Product Dimensions:
1.5 x 1.125 x .125 inches
40 x 28 x 3 mm
Weight:
.13 ounces, 3.6g

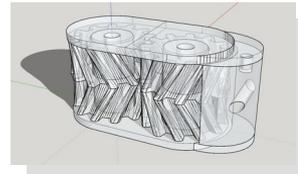
Fits rope sizes:
3/16" (5mm)
1/16" (2mm)

Load limit
50lbs. / 22.5kg

1. Pull to adjust rope tension

2. Secure end

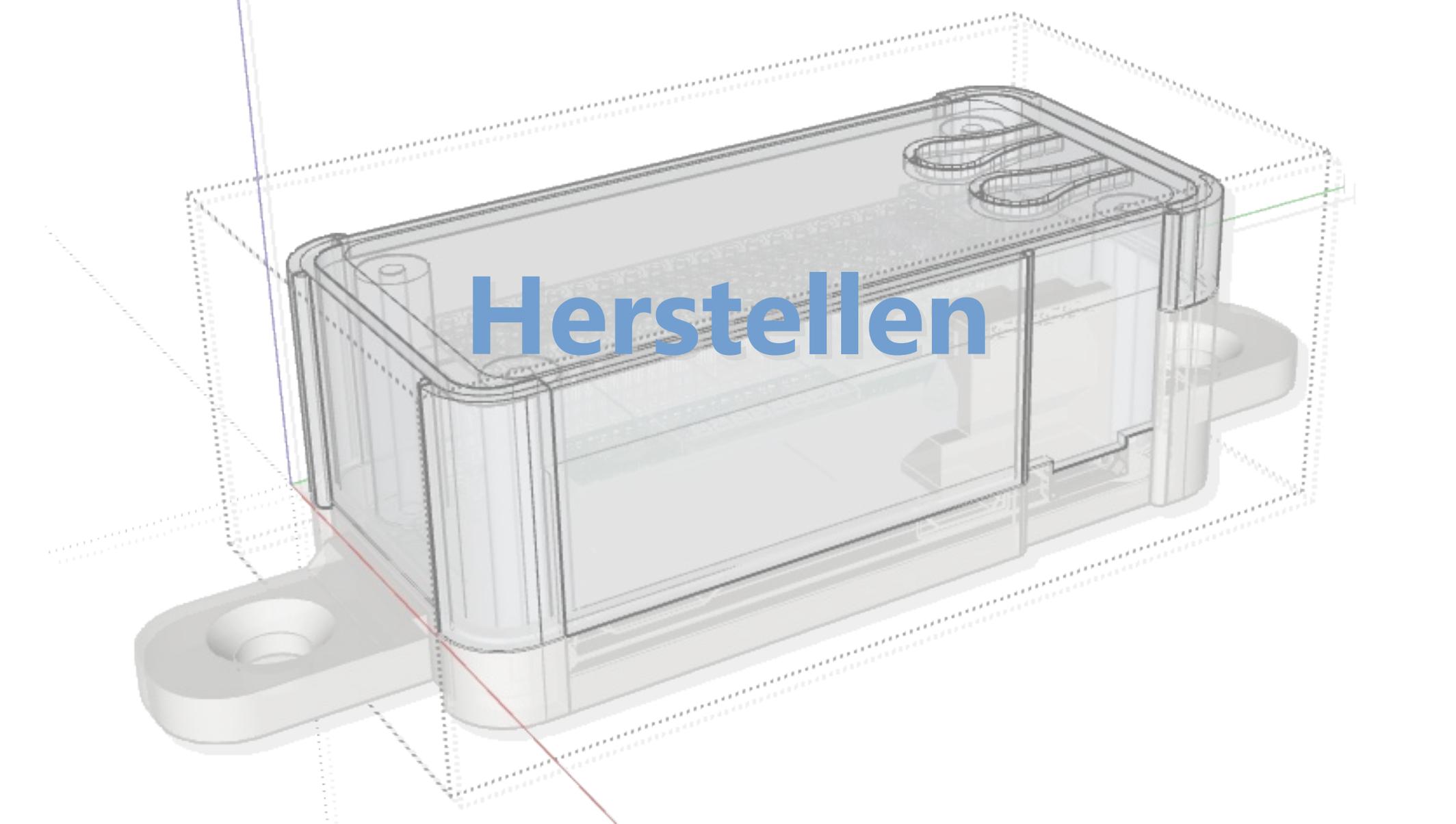
3. Secure end



3D Drucker - was nun ?

Jetzt ihr – Pitfalls & Tips

- ♦ Mergende Geometrie
 - Nutzt Gruppen!
- ♦ Nicht-reversierbare Änderungen
 - Macht regelmäßig Backups!
- ♦ Segmentzahl initial berücksichtigen
 - Segmentzahl frühzeitig hochdrehen wo nötig!
- ♦ Prüft ständig, ob euer Model ein „Solid“ ist!
 - Wenn jede Einzelgruppe Solid ist, ist es auch das gesamte Modell!
- ♦ „Krumme“ Längen führen zu kaputten Modellen (Rundungsfehler)
- ♦ ggf. Faktor-100-Skalierung (echt jetzt!)
- ♦ Gehäusebau:
 - Modelliert das „Ding“ zuerst
- ♦ Zappeliger Zoom
 - Nutzt Szenen für wichtige Ansichten!
- ♦ Deckel & Mechanismen, die ineinander greifen:
 - Seht Lücken vor. Faustregel: 0,2mmLücke lässt Teile gut ineinander klemmen

A 3D CAD model of a complex mechanical part, possibly a bracket or housing, rendered in a semi-transparent grey. The part features a rectangular main body with rounded corners, a protruding base on the left, and a complex internal structure with curved channels. The model is overlaid with a dashed grey bounding box and several colored lines (blue, green, red) indicating axes or specific features. The word "Herstellen" is written in a bold, blue, sans-serif font across the center of the part.

Herstellen

Herstellen – Solid ex-& importieren

- ♦ Modell muss ein „Solid“ sein sonst macht der Slicer was er will um es zu fixen
- ♦ File → Export STL
- ♦ In Slicer importieren
 - ggf. Skalierung beachten

Herstellen – Slicen

- ♦ Druckqualität und Zeit sind vor allem abhängig von
 - Layerdicke
 - Infill
 - Muster
 - Dichte
 - Supportbedarf

Herstellen – Slicen

- ♦ Wichtige Überlegungen
 - Orientierung!
 - Supportbedarf
 - „Brechrichtung“
 - die „schöne“ Seite nach oben!



Herstellen – Support

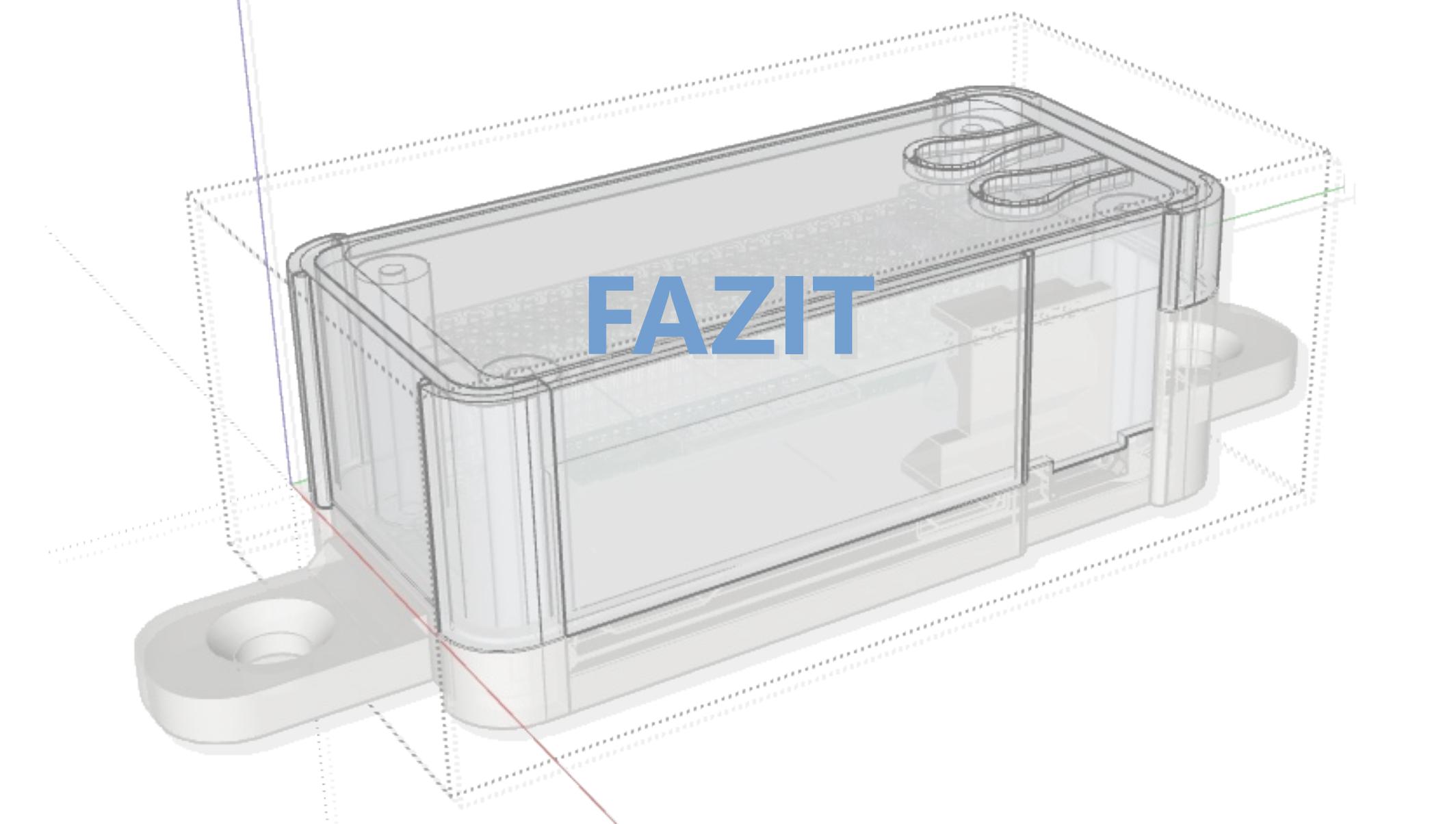
- ◆ Überlegungen:
 - Materialverbrauch / Druckzeit
 - Entfernbarekeit des Supportmaterials („komm ich da ran“)
 - Oberflächenqualität über Support nicht optimal

Herstellen – Drucken

- ♦ ...dauert immer länger als man denkt

Herstellen – Nachbearbeitung

- ◆ Support herausbrechen
- ◆ Schleifen vs. Lackieren vs. „Chemie“
(Polyurethan, Isopropanol, Terpentin usw.)
- ◆ Kleine Anpassungen durch Erhitzen und Pressen
- ◆ Härten durch Erhitzen und langsames Abkühlen
- ◆



A 3D CAD model of a mechanical assembly, possibly a bracket or housing, shown in a semi-transparent view. The model is rendered in a light gray color. It features a rectangular main body with rounded corners, a flat top surface, and a protruding base on the left side. The base has a circular hole. The top surface has several cylindrical features and a complex, curved structure. The model is surrounded by a dashed gray bounding box. A blue text overlay "FAZIT" is centered on the model. A red line is drawn across the bottom left corner, and a green line is drawn across the top right corner.

FAZIT

Fazit

- ♦ mit heute gelernten Grundkenntnissen kommt ihr ab nun durch Youtube Videos weiter
- ♦ Schaut euch weitere Plugins an
- ♦ **Baut Dinge! :-)**

A blurred portrait of a man with dark hair and a beard, wearing a dark jacket over a light-colored shirt. The portrait is centered in the background of the slide.

Tobias Nebel (nebel.tobias@gmail.com)

<http://bit.ly/justincaseof-at-3dwarehouse>