

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, blue, sans-serif font.

# 3D Drucker – was nun?

Eine Einführung in die Welt der 3D Modellierung mit  
Sketchup

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# Agenda

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## Was erwartet euch heute ?

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

A 3D CAD model of a mechanical part, possibly a bracket or housing, is shown in a semi-transparent view. The model is rendered in a light gray color and is enclosed within a dashed gray bounding box. The part has a complex shape with various features, including a circular hole on the left side, a rectangular cutout on the right, and a central section with a curved top edge. The text "TODO :: DOWNLOAD" is overlaid in large, bold, blue letters across the center of the image. Below the text, there are three numbered instructions in black text, each starting with a lowercase letter in a circle. The background is white.

# 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 sensor or actuator, shown in a semi-transparent grey view. The assembly features a rectangular main body with rounded corners, a protruding base on the left, and a top surface with two circular components. The model is surrounded by a dashed grey bounding box. Several colored lines (blue, green, red) extend from the corners of the bounding box, suggesting a coordinate system or alignment. The word "About" is overlaid in the center in a bold blue font.

**About**

# About

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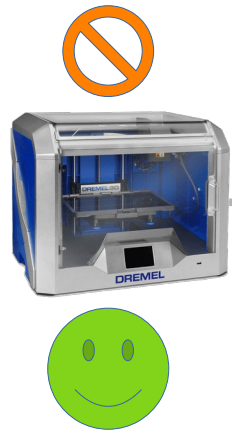
- ♦ MMS & Superveil
- ♦ SWE & Architektur
- ♦ DIY addict



A 3D CAD model of a mechanical assembly, possibly a bracket or housing, shown in a semi-transparent grey view. 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**

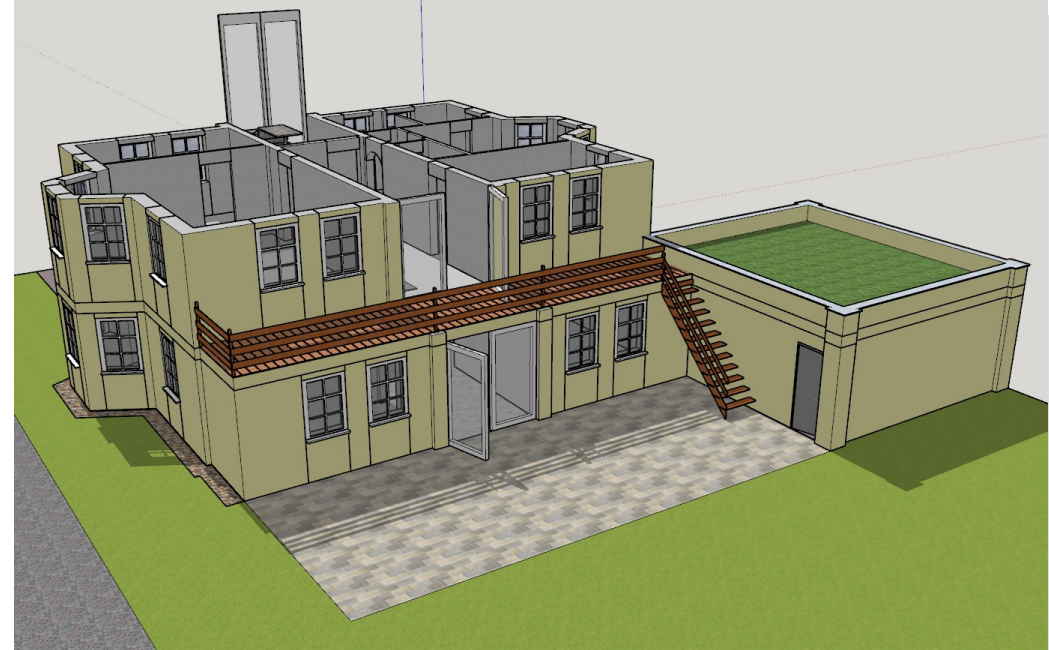
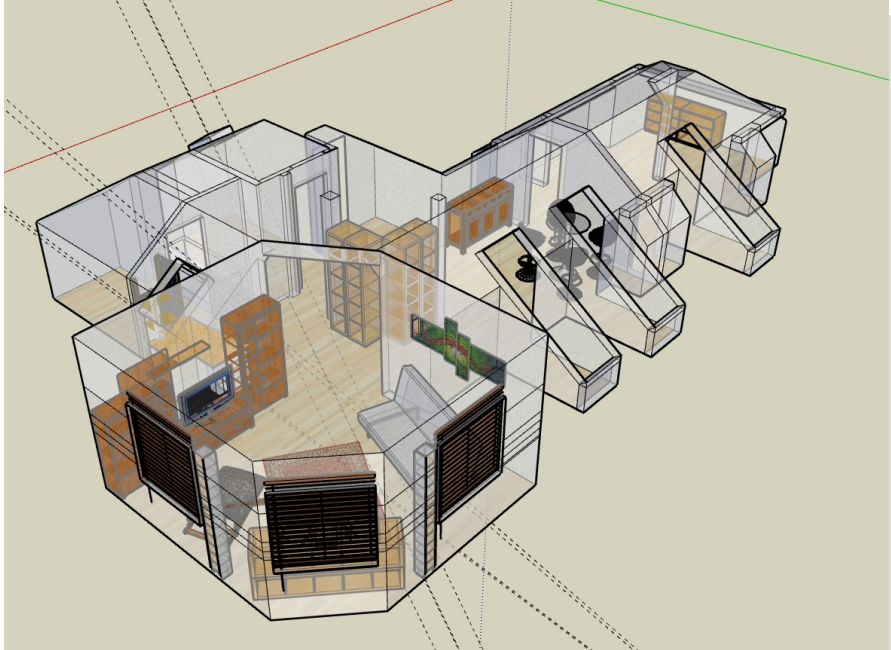
Gehäuse Ersatzteile

Tools &  
Gimmicks

...

# What – Wohnen & Möbelrücken

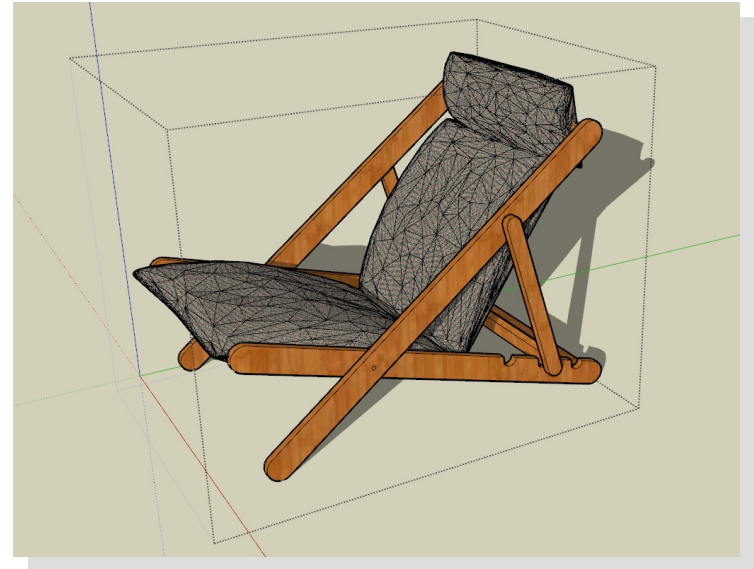
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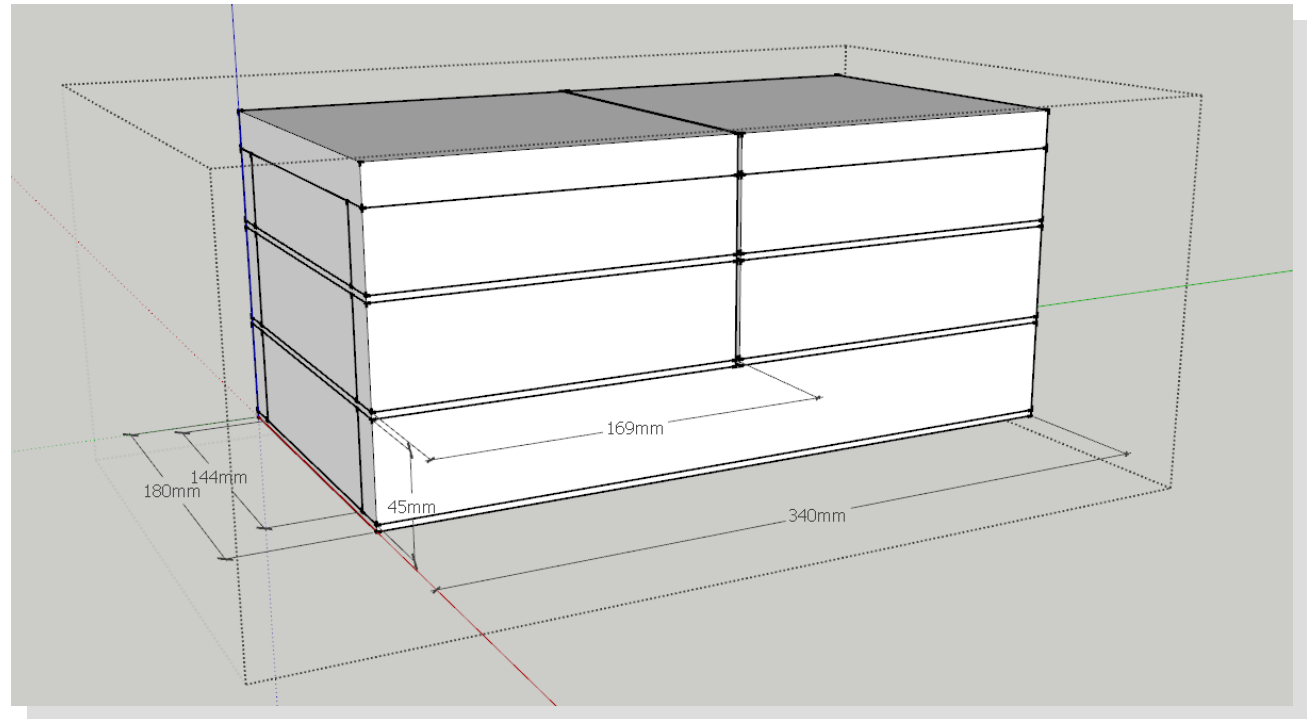
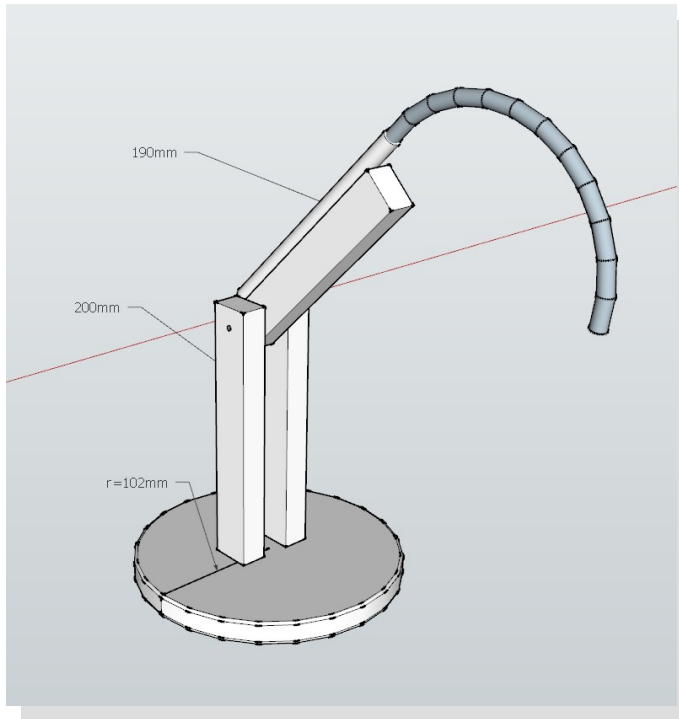
# What – Möbel Modellieren

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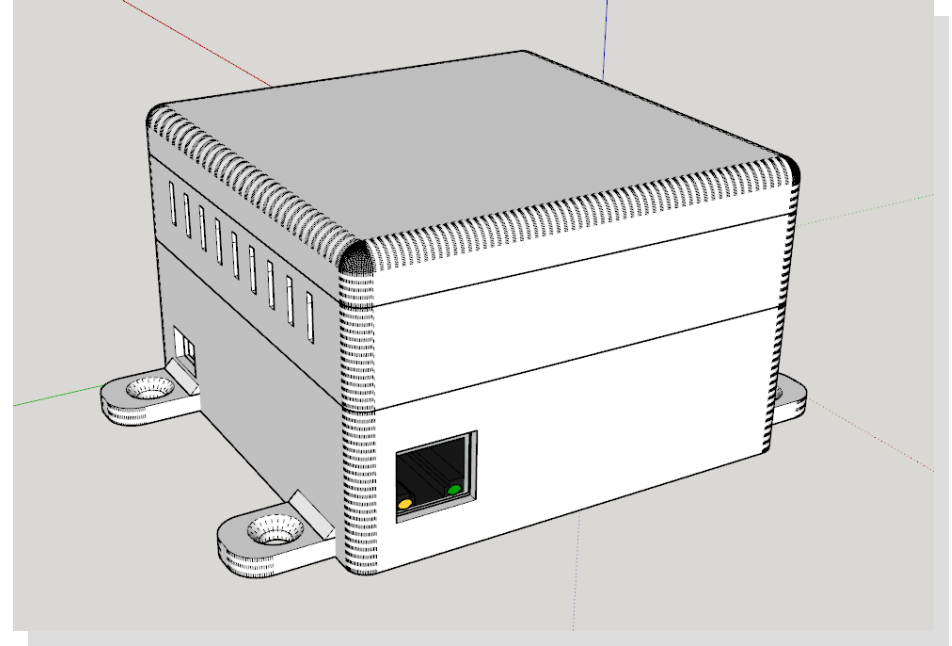
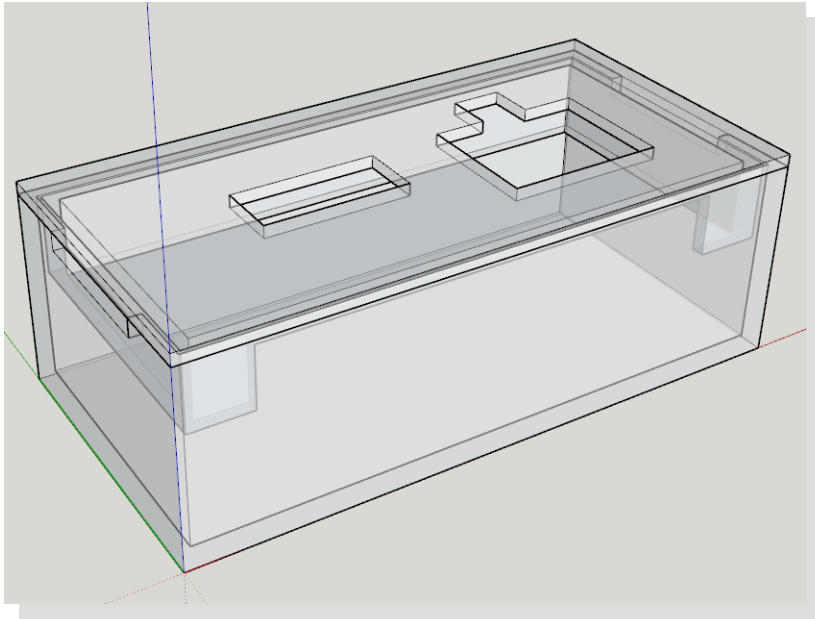
3D Drucker - was nun ?

# What – Baupläne & Bemaßung



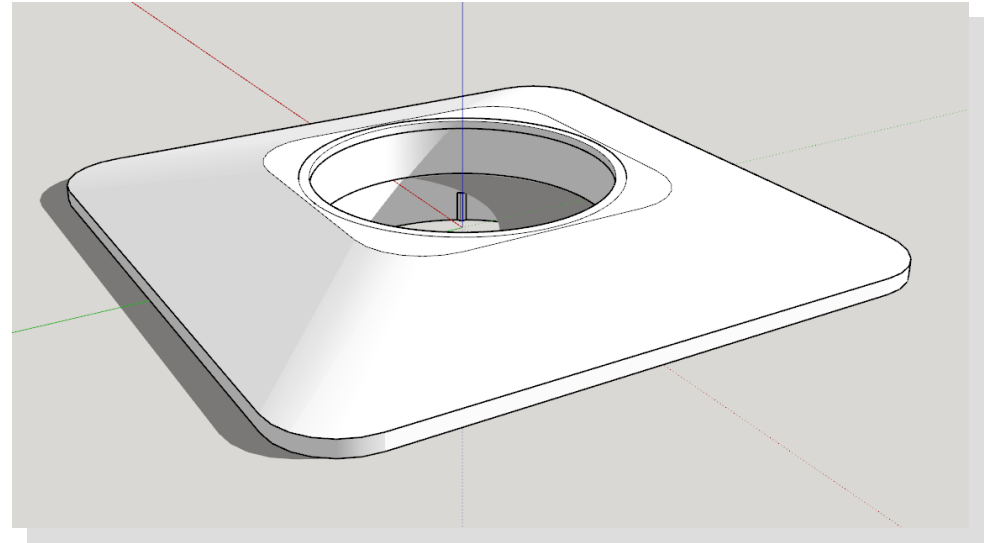
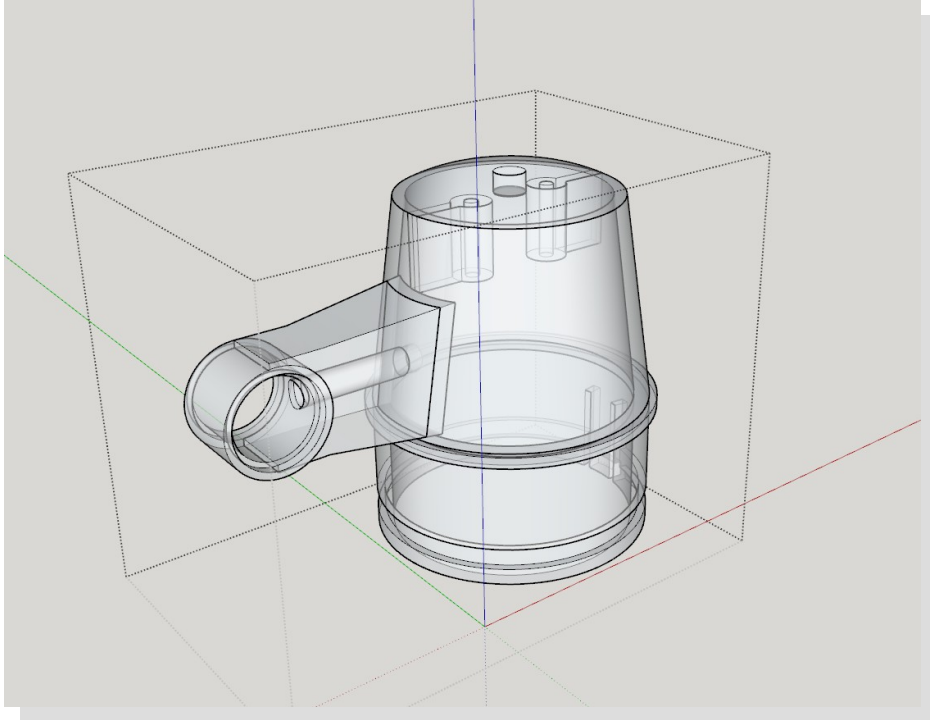
# What – Gehäuse

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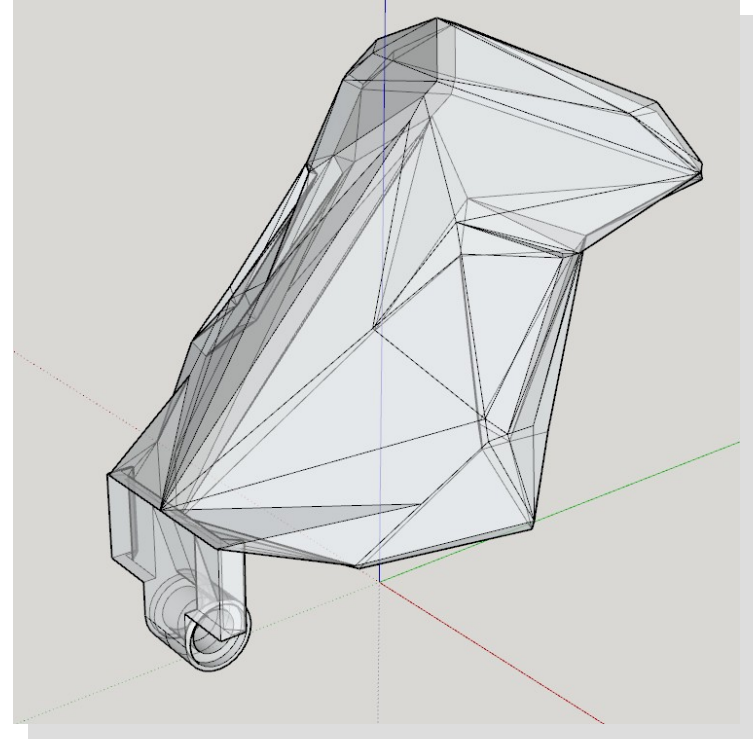
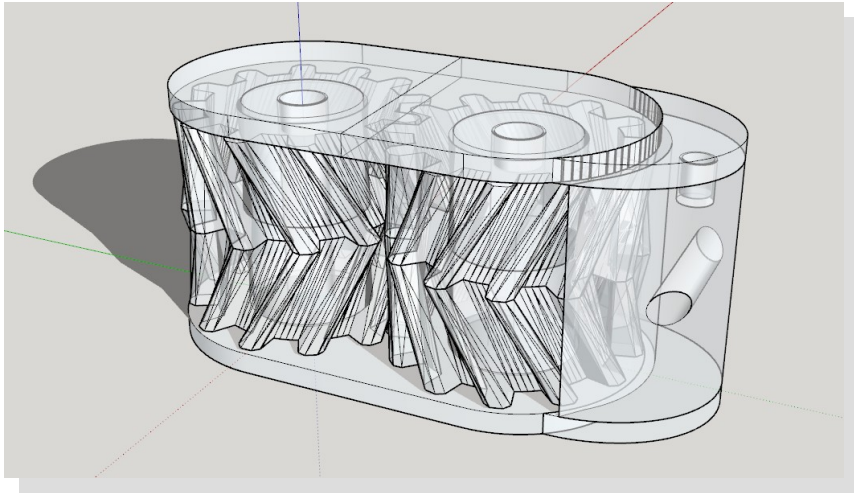
# What – Ersatzteile

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# What – Tools & Gimmicks

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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?

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**Fertige Modelle**

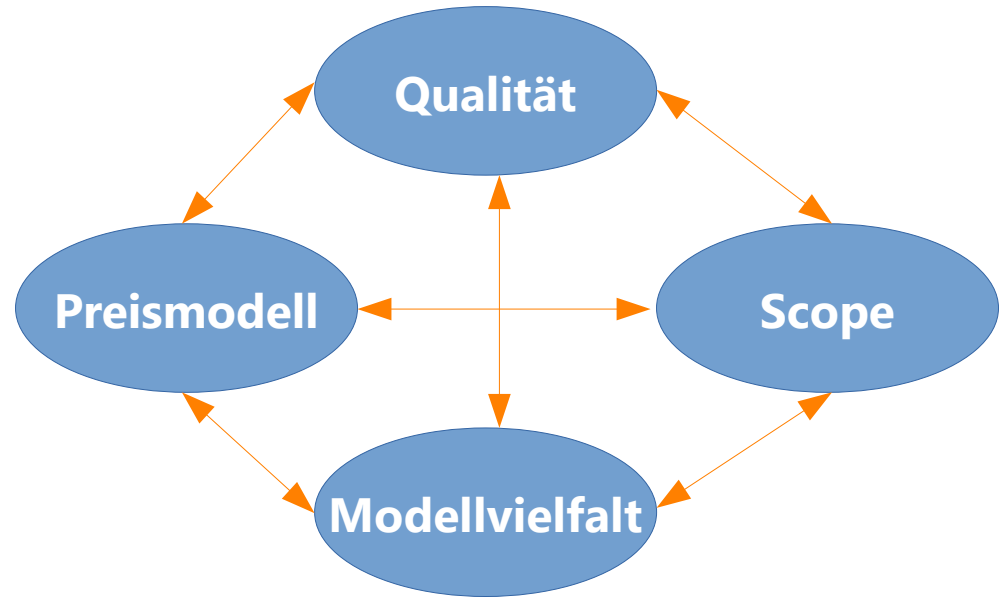
**VS**

**Modellieren**

# How – Modelle?

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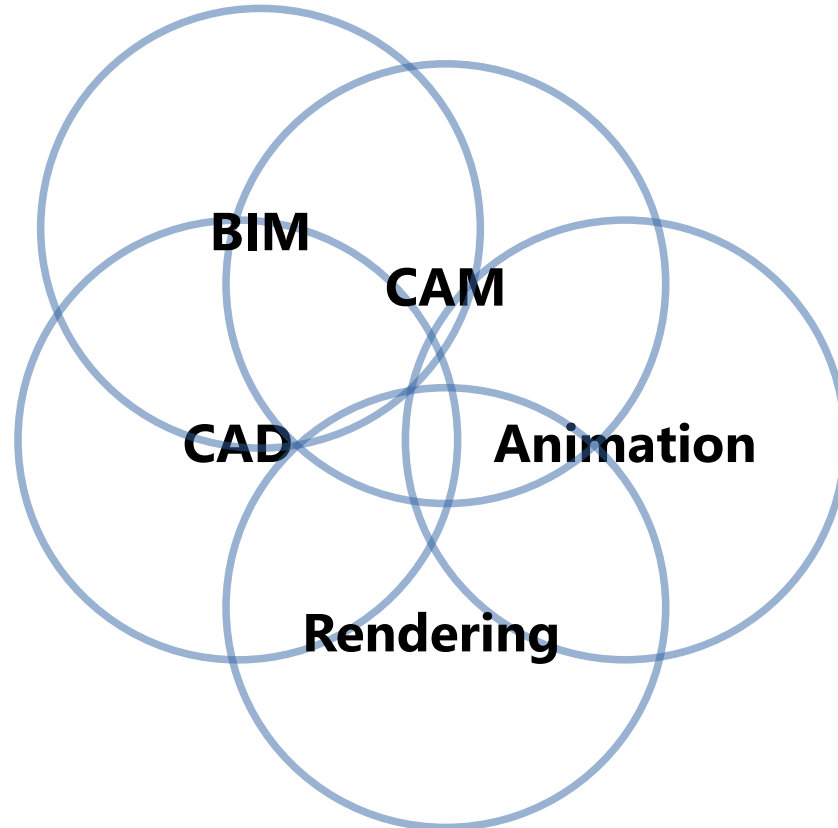
- ♦ TinkerCAD
- ♦ Sketchfab
- ♦ Thingiverse
- ♦ MyMiniFactory
- ♦ Trimble 3D Warehouse
- ♦ Clara.io
- ♦ ...





# How – Tools?

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3D Drucker - was nun ?

# How – Tools?

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## ***Kommerziell***

- AutoCAD
- Solidworks
- Catia
- Rhino
- Revit

## ***Kostenlos / Freemium***

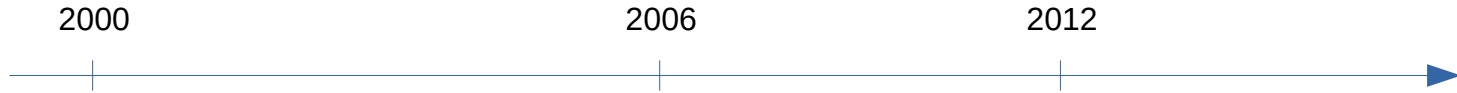
- FreeCAD
- OpenSCAD
- Fusion 360
- Blender
- SketchUp

A 3D CAD model of a mechanical part, possibly a bracket or housing, shown in a wireframe view. The model is rendered in a light gray color and is enclosed within a dashed gray bounding box. The part features a rectangular main body with rounded corners, a flat top surface with a central slot, and a base with a circular hole. The word "Sketchup" is overlaid in a large, bold, blue font across the center of the model. The background is white, and there are faint blue and green lines extending from the corners of the bounding box, suggesting a coordinate system or projection planes.

**Sketchup**

# Sketchup – Intro

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

# Sketchup – Warum gerade?

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

# Sketchup - Versionen

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

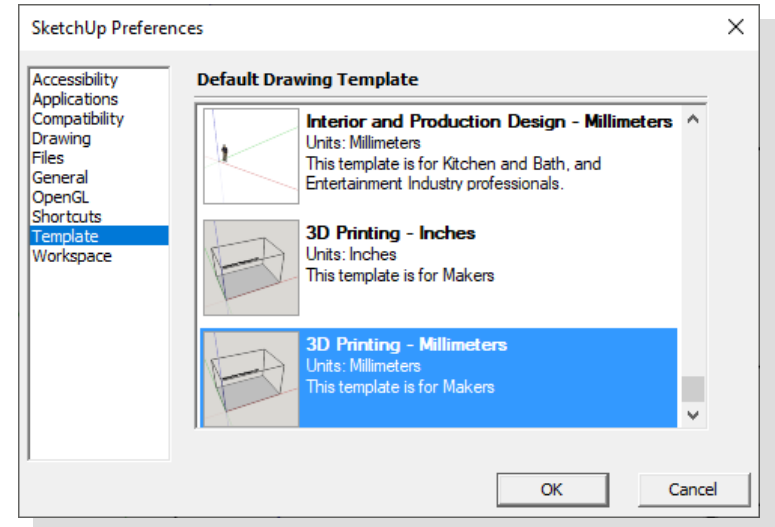
# Sketchup - Setup

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 main rectangular body with rounded corners and a smaller, flange-like section extending from the bottom left. The cutaway reveals internal features, including a central vertical slot, a horizontal slot, and a complex internal structure with curved surfaces. The model is enclosed within a dashed gray bounding box. Several colored lines (red, green, blue) are visible, likely representing coordinate axes or selection lines. The text "Sketchup - Setup" is overlaid in a large, bold, blue font across the center of the model.



# Sketchup - Setup

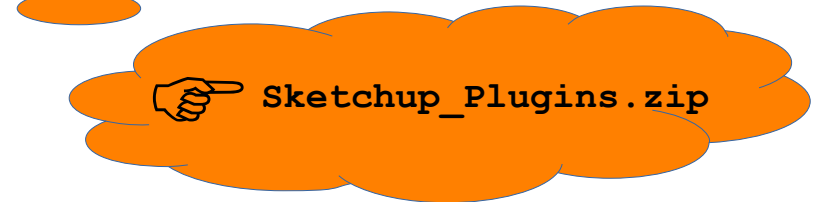
- ♦ Das Template
  - Ansichtstyp („Style“)
    - Kanten
    - Flächen
  - Maßeinheiten
  - Toolset
- ♦ Windows → Preferences → Template → „3D Printing - Millitmers“



# Sketchup - Setup

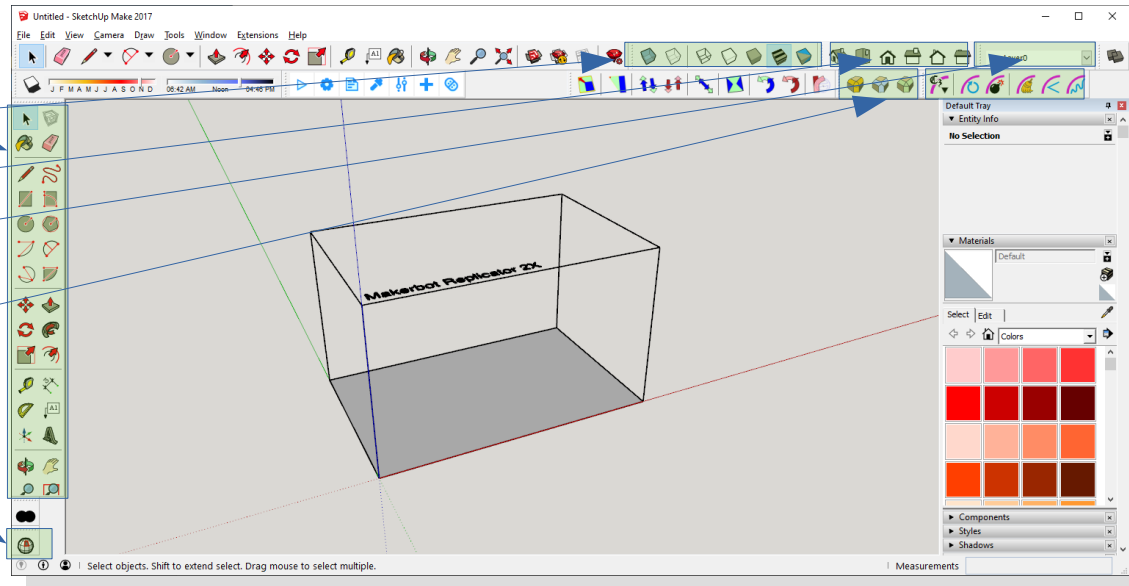
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- EN statt DE
- **Plugins**
  - Ruby-basiert
  - „Trimble Extension Warehouse“ und „sketchUcation“ → Account nötig
  - **Installation:** Window → Extension Manager → Install Plugins:
    - **LibFredo6**
    - **Solid Inspector** <sup>2</sup>
    -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



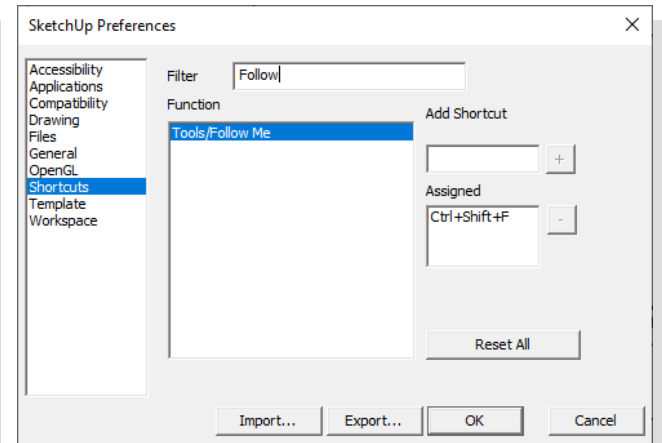
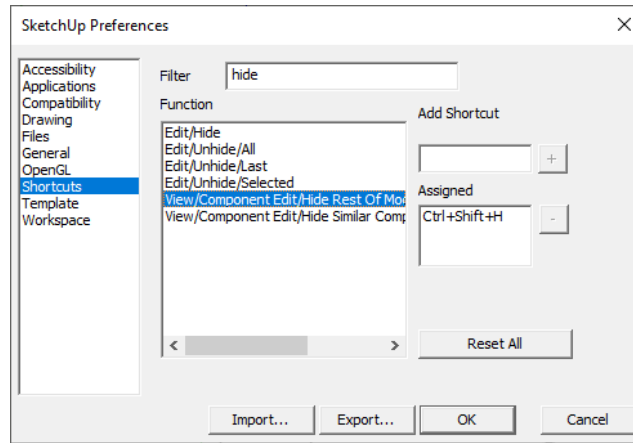
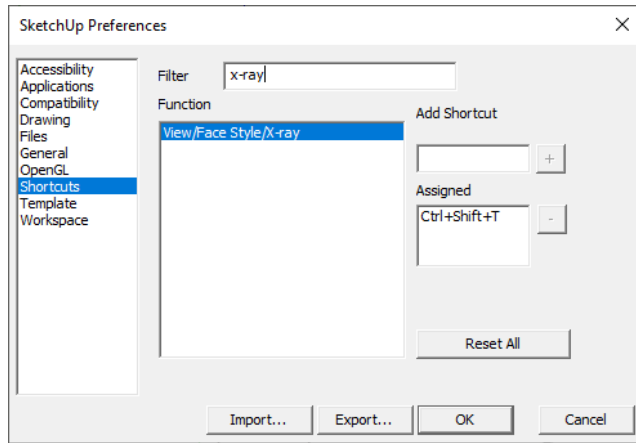
# Sketchup - Setup

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



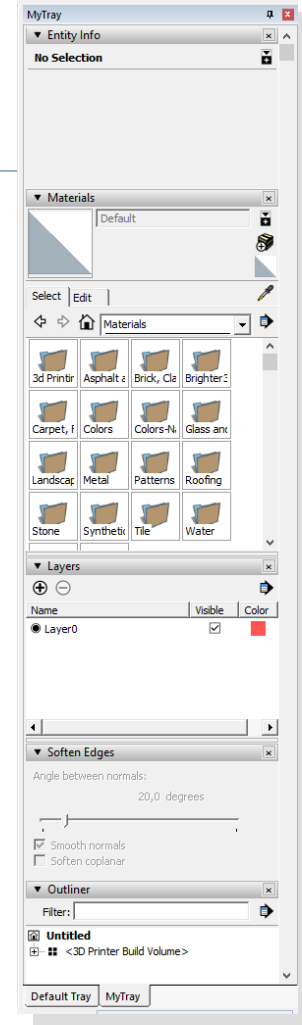
# Sketchup - Setup

- ♦ 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. 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 specific dimensions or features.

**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

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



A 3D CAD model of a mechanical part, possibly a bracket or housing, shown in a cutaway view. The model is rendered in a light gray color. The cutaway reveals internal features, including a central rectangular cavity, a smaller rectangular slot, and a circular hole. The part has a complex, multi-faceted design with various chamfers and fillets. The model is surrounded by a dashed gray bounding box, and several colored lines (blue, green, red) are visible, likely representing coordinate axes or selection lines. The text "Finally...Modellieren!" is overlaid in a large, bold, blue font across the center of the image.

**Finally...Modellieren!**

# Modellieren – Grundlagen

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Monkey see, Monkey do

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

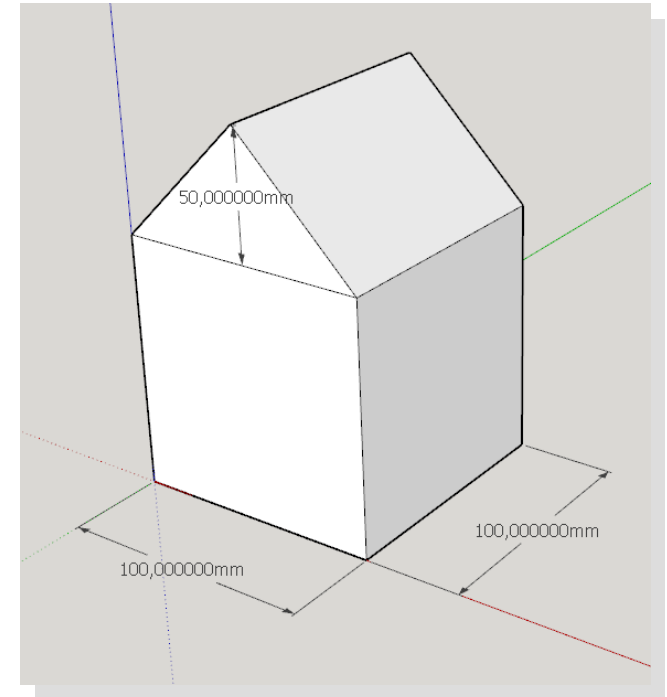
Fragen!

Hinweise?

Teilen

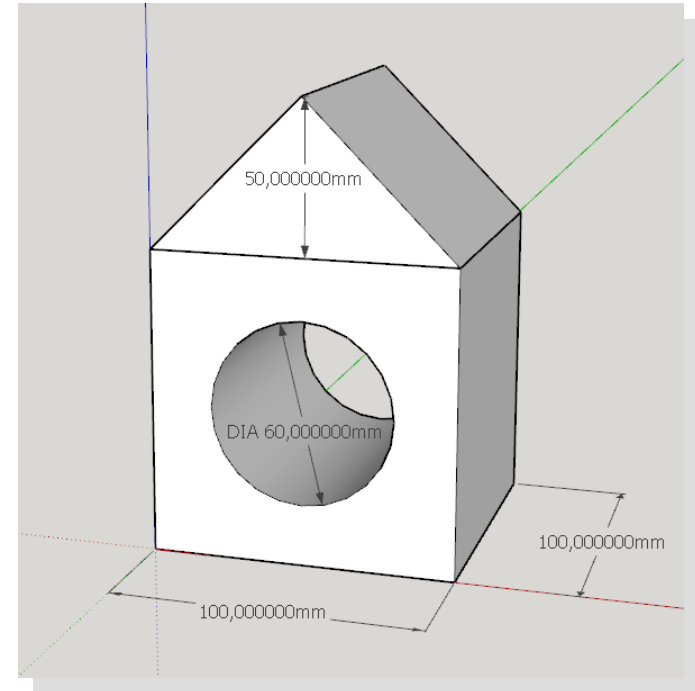
# Modellieren – Aufgabe #1

- ♦ Modellieren eines Würfels mit Dreieck darauf



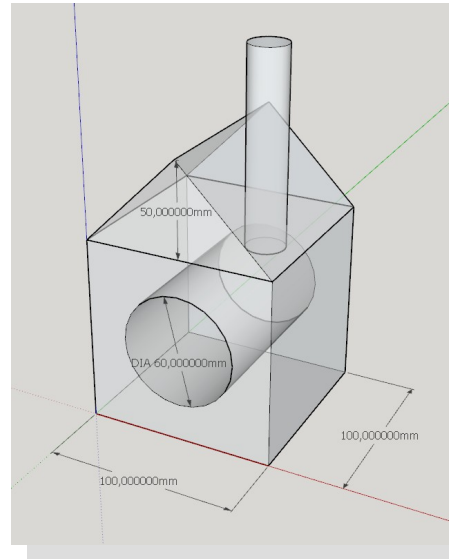
# Modellieren – Aufgabe #2

- ◆ Einfügen eines Loches

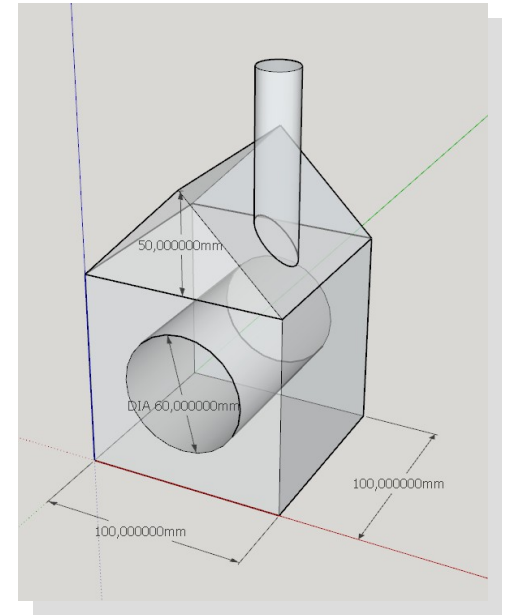


# Modellieren – Aufgabe #3

- ♦ 3.1) Schornstein hinzufügen



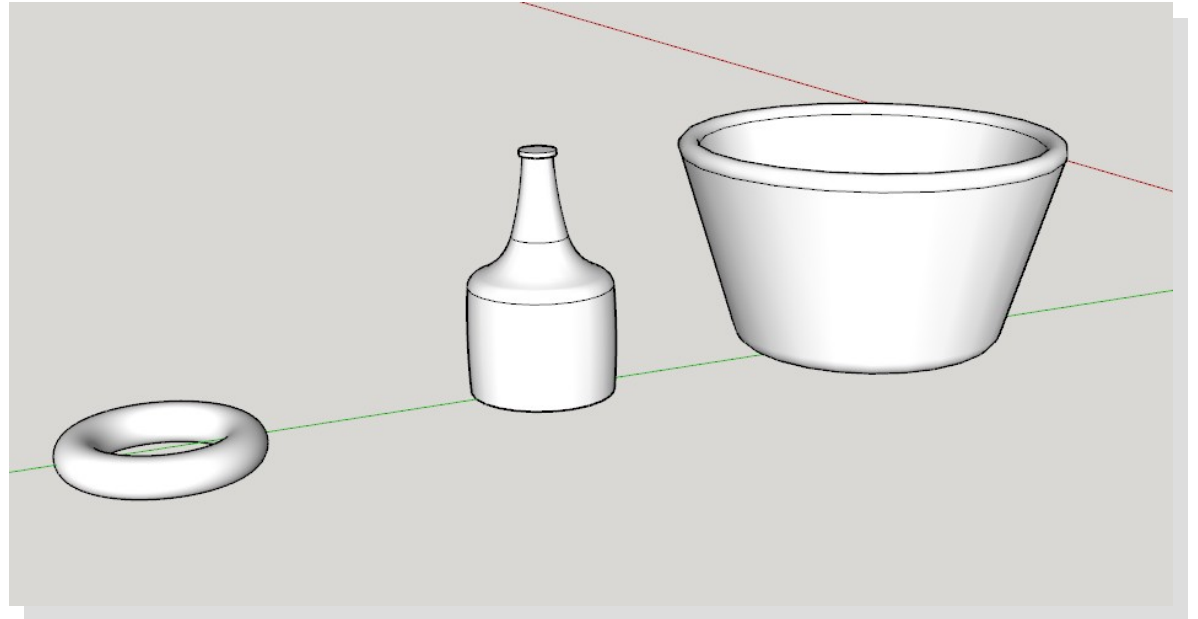
- ♦ 3.2) Schornstein mit Dach verschneiden



# Modellieren – Aufgabe #4.1

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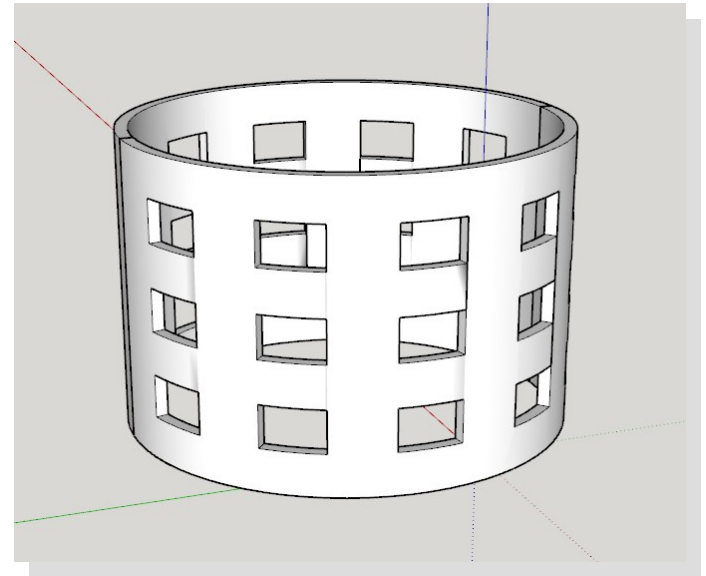
- ♦ Geschwungene Formen erstellen



# Modellieren – Aufgabe #4.2

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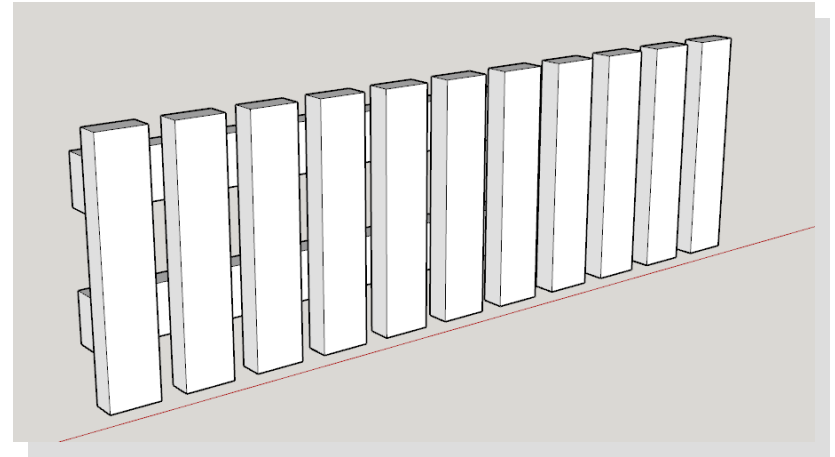
- ◆ Gebogene Formen erstellen



# Modellieren – Aufgabe #5

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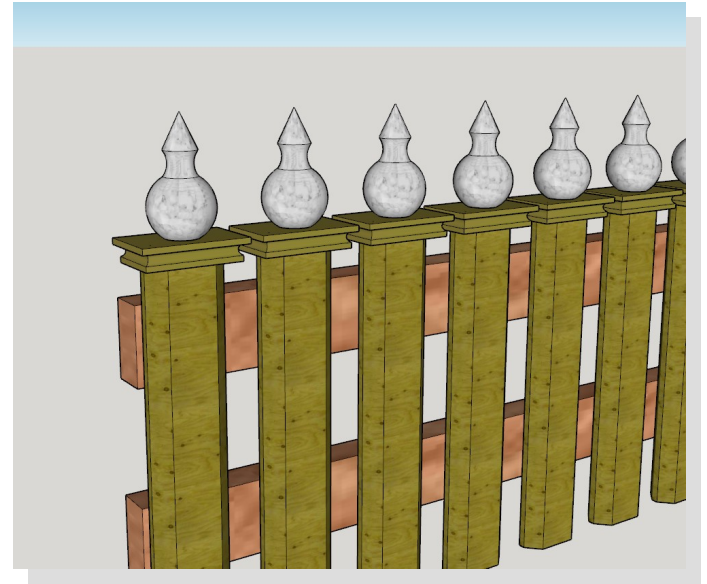
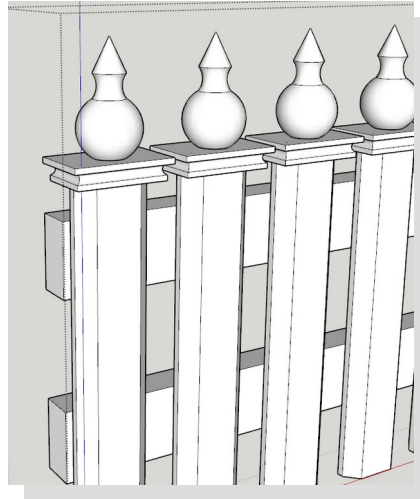
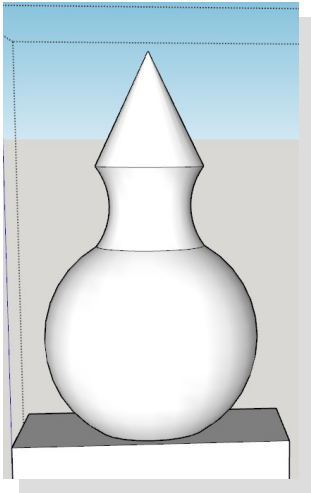
- ♦ Erstellen eines einfachen Zaunsfeldes mit viereckigen Zaunslatten  
→ **Längs- und Querlatten als Component!**





# Modellieren – Aufgabe #6

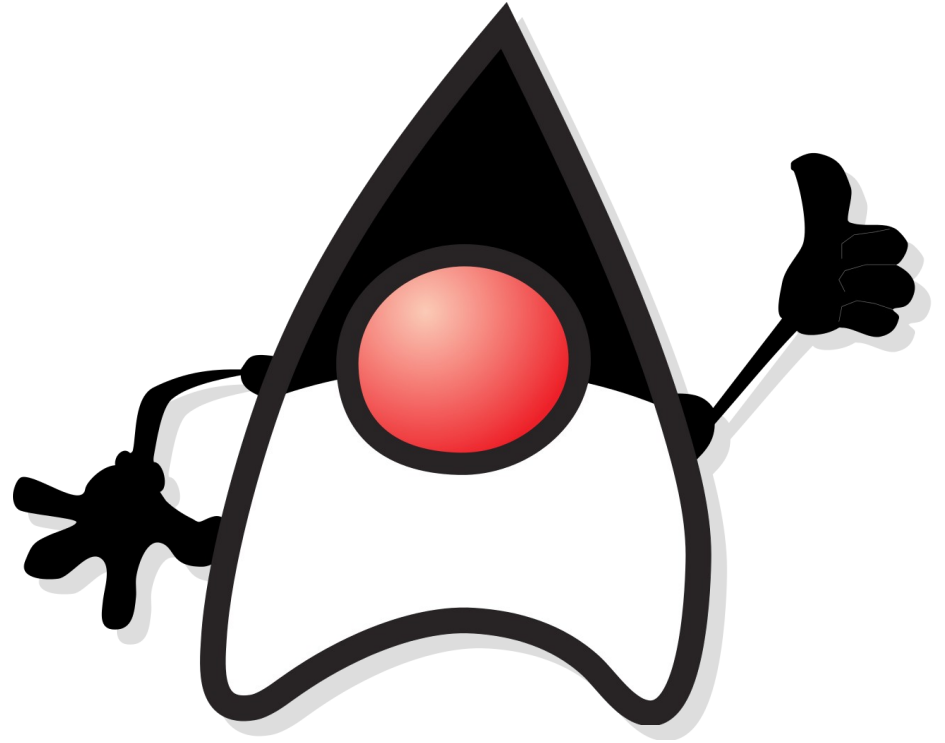
- ♦ Zaun „aufhübschen“



# Modellieren – Aufgabe #7

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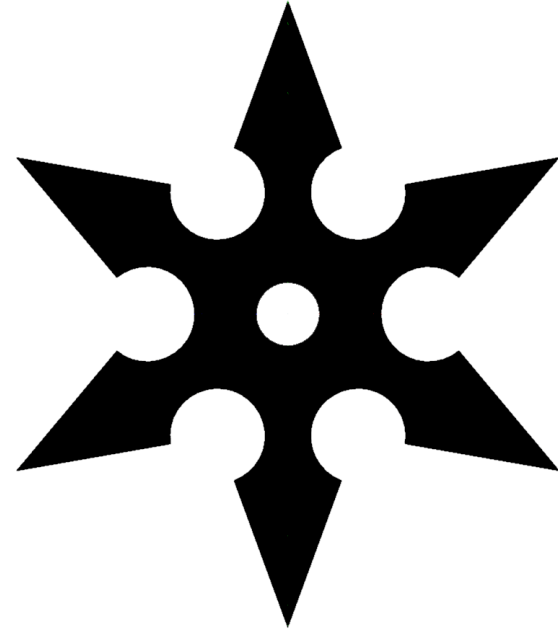
- ◆ Konstruiert Duke nach, ihr werden ihn gleich noch einmal brauchen



# Modellieren – Aufgabe #8

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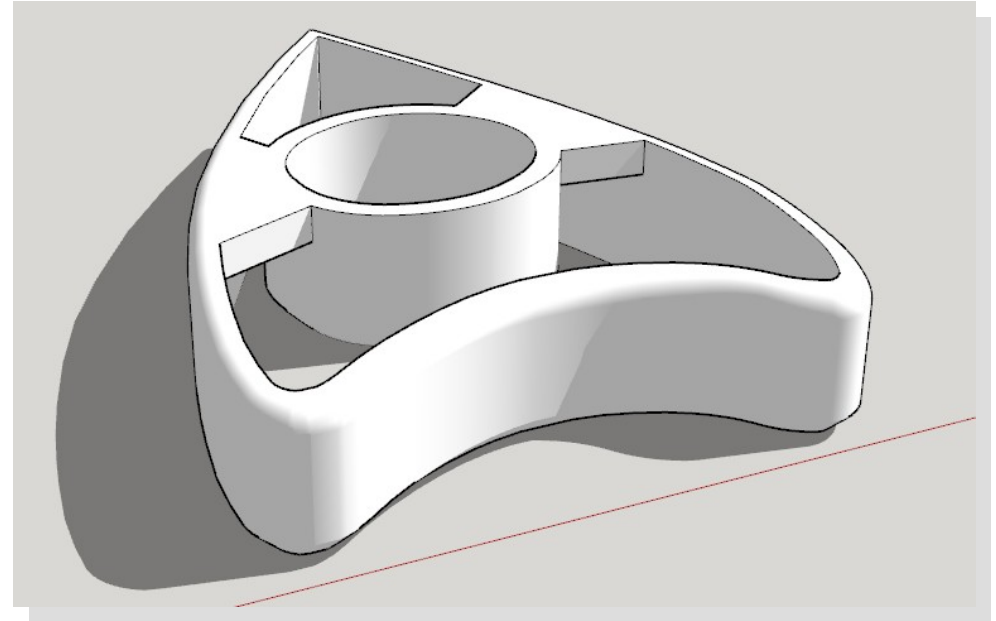
- ♦ Wer konstruiert am schnellsten einen Shuriken?



# Modellieren – Aufgabe #9

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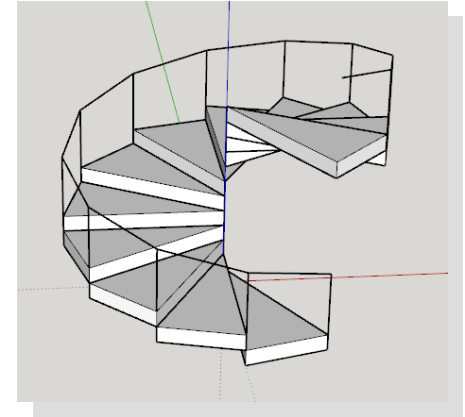
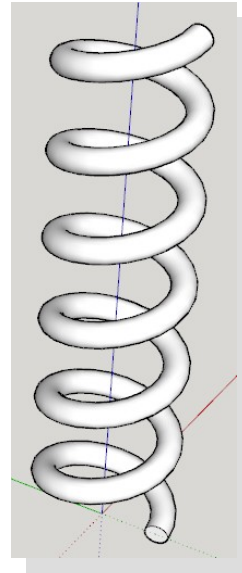
- ♦ Jetzt braucht ihr Gedult:  
Wie wäre es mit einer Keksförmung von Duke?



# Modellieren – Aufgabe #10

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



# Modellieren – Solids

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

A 3D CAD model of a mechanical component, possibly a handle or a bracket, shown in a semi-transparent grey view. The part has a rectangular body with rounded corners and a handle-like extension on the left side. Internal features include a central slot, a circular hole on the handle, and a complex internal structure on the top surface. The model is surrounded by a dashed grey bounding box. Colored lines (blue, green, red) extend from the corners of the bounding box towards the edges of the image.

**Jetzt ihr!**

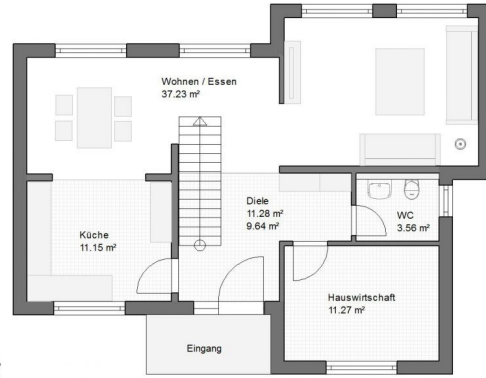
Umsetzungsideen, Fragen, Probleme, usw.

# Jetzt ihr!

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



3D Drucker - was nun ?



**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**

**Secure end**

**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

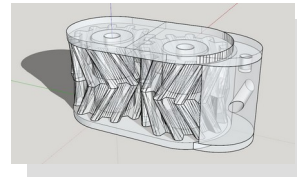
**Fits rope sizes:**  
3/16" (5mm)  
1/16" (2mm)

**Load limit**  
50lbs. / 22.5kg

**1. Pull to adjust rope tension**

**2. Pull to adjust rope tension**

**3. Secure end**





# Jetzt ihr – Pitfalls & Tips

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- ♦ 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

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- ♦ 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

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- ♦ 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

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

# Herstellen – Drucken

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- ◆ ...dauert immer länger als man denkt

# Herstellen – Nachbearbeitung

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- ◆ 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 sensor or actuator, shown in a semi-transparent view. The assembly consists of a main rectangular body with rounded corners, a base plate, and a top cover. The top cover features a complex internal structure with two circular openings. The base plate has a circular hole and a rectangular cutout. The model is surrounded by a dashed bounding box, and several colored lines (blue, green, red) are drawn across the scene, likely representing coordinate axes or alignment lines. The word "FAZIT" is overlaid in the center of the model in a bold, blue, sans-serif font.

**FAZIT**

# Fazit

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- ♦ 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.

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