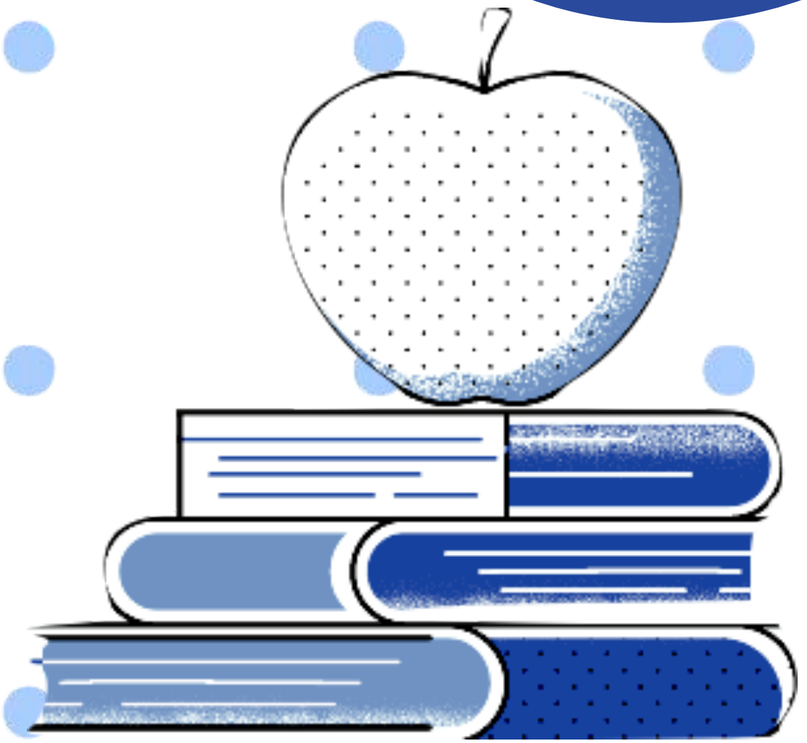
# INTRO TO 3D DESIGN

3D PRINTING IS THE SOLUTION.

WHAT WAS THE PROBLEM ANYWAY?

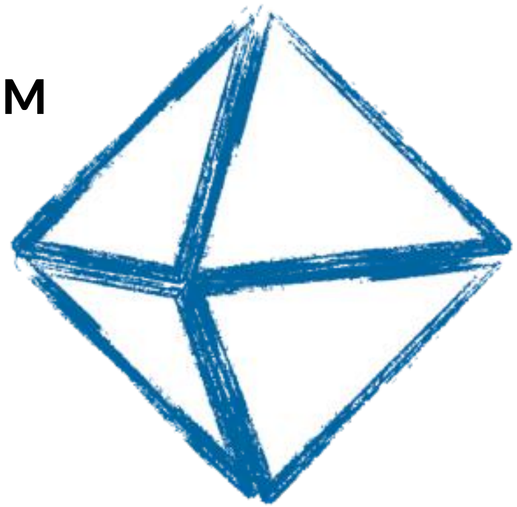
# From the object to the design

THE PROBLEM, THE RECOGNITION & THE SOLUTION



# How do I solve a problem?

**IDENTIFY THE PROBLEM**



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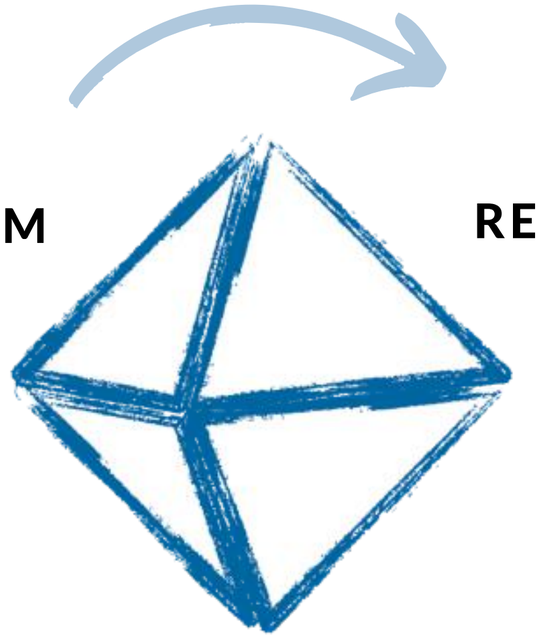
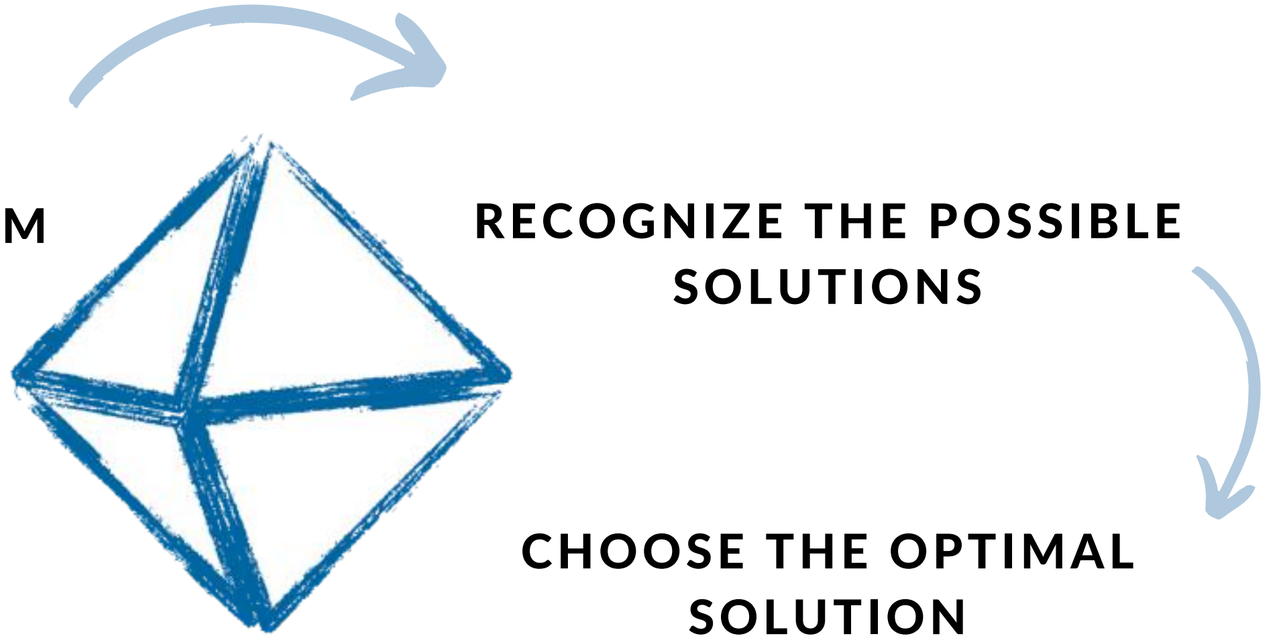


**RECOGNIZE THE POSSIBLE SOLUTIONS**

# How do I solve a problem?



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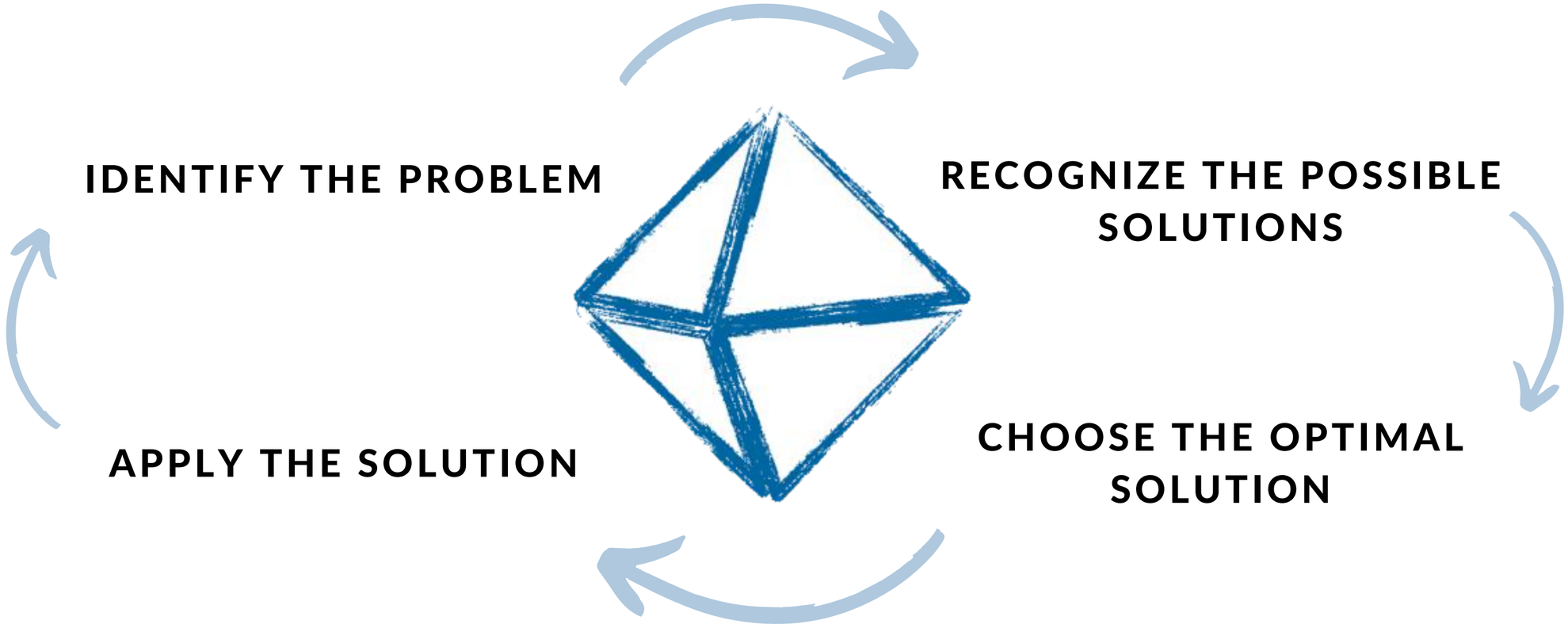


# Problem Solving Logic

## Algorithm

*is defined as a finite series of actions, strictly defined and executable in a finite time, aimed at solving a problem*

## Creation of an algorithm

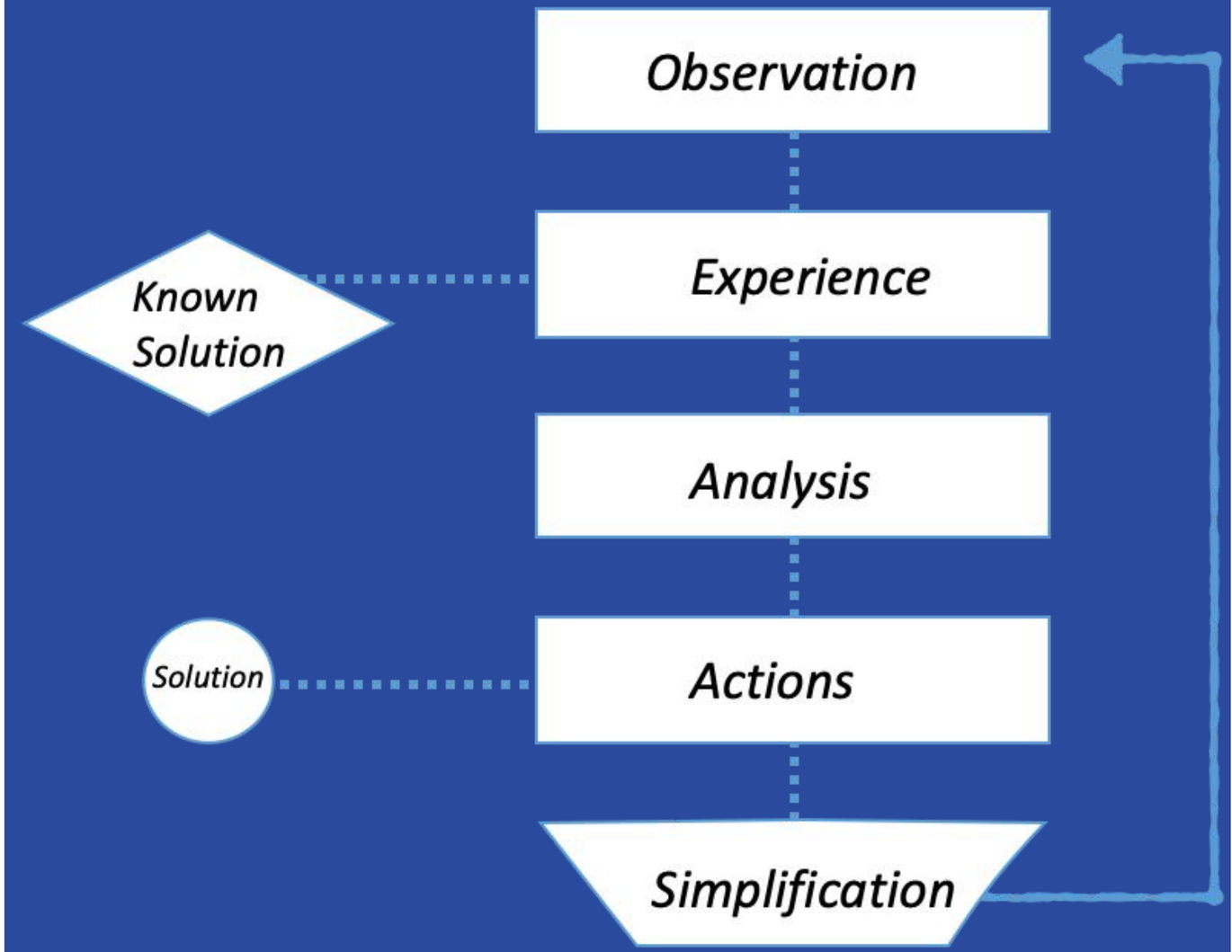
*(1) Formulation of the problem*
*(2) Understanding the problem*
*(3) Solving the problem*
*(4) Formulation of the algorithm*
*(5) Checking the Solution*

## Feynman's problem solving algorithm

*(1) Write down the problem*
*(2) Think very hard*
*(3) Write down the answer*

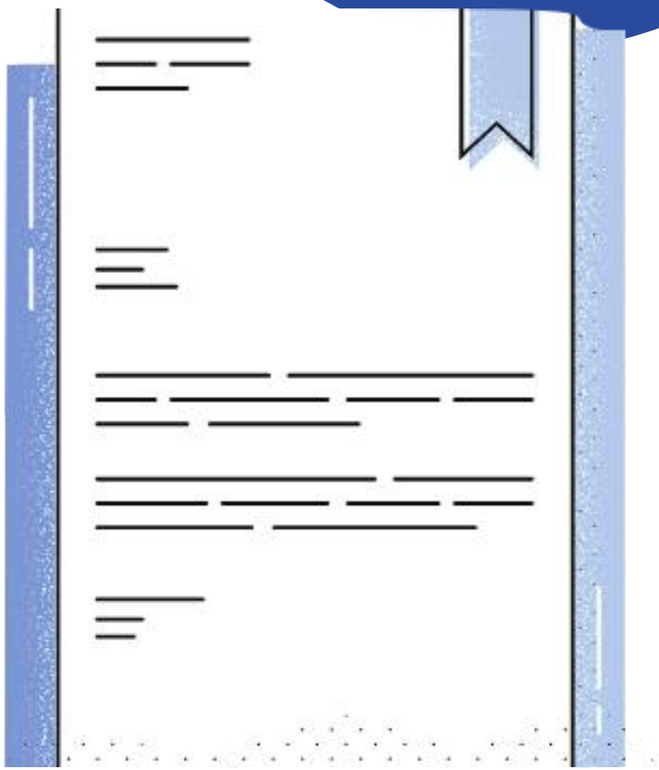
!

***The steps - algorithms - that we can follow are countless...***



# Introduction to Technical Design

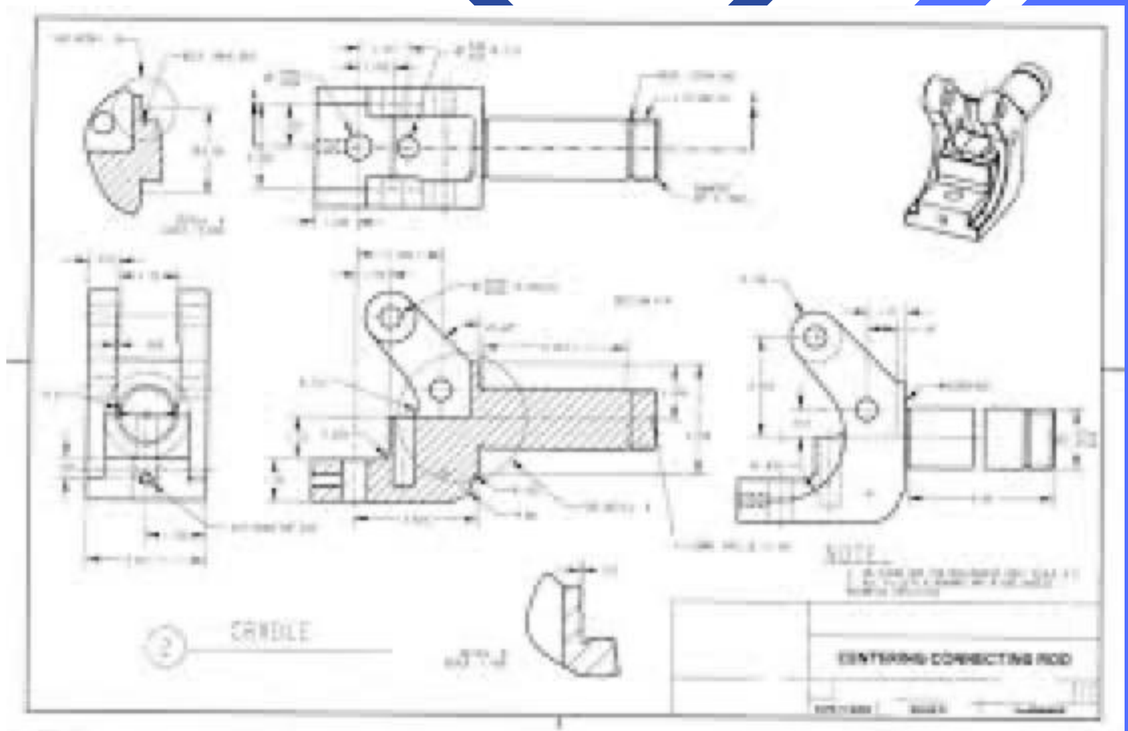
UNDERSTANDING THE 2 DIMENSIONS



# Technical Design

***Mechanical Design***

*is defined as the description of an object by means of a virtual representation in a simple form with a view to its accurate construction by whoever has the drawing in question*




!

*For universal reading of drawings we follow international standards that define the type of lines, scale, metric system, etc.*

# Projective Theory

1 MATH

2 SKETCH

# Projective Theory

## 1 MATH

The concept of a projective space is a set of lines originating from the vector space V, where:

$$V = \mathbb{R}^2 \text{ (projective line)}$$
$$V = \mathbb{R}^3 \text{ (projective space)}$$

the corresponding instances denoting ordered pairs and ordered triads of real numbers.

## 2 SKETCH

# Projective Theory

## 1 MATH

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## 2 SKETCH

The concept of projective space is related to the concept of **perspective**, the geometric technique where the projection lines of a real space are concentrated by design at a common point on a given horizon, the **vanishing point**.

# Projective Theory

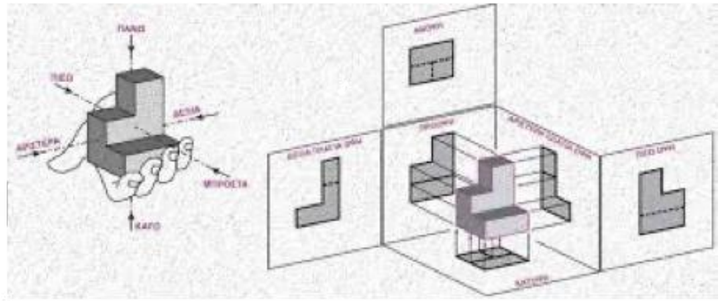
## 3 VIEW POINT

**Projective theory**

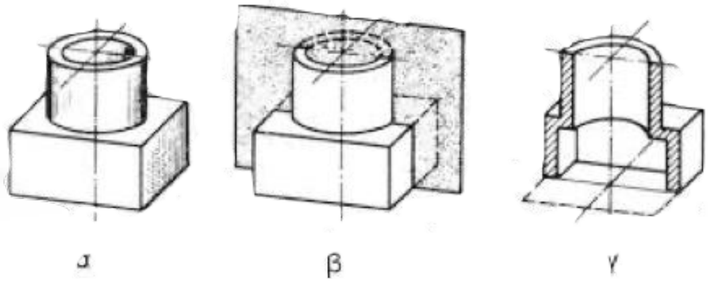
- ***Viewing angle (angle of view)***
- ***Display level***

***The 2 variables of projective theory lead to the 2 most basic concepts of Mechanical Design***

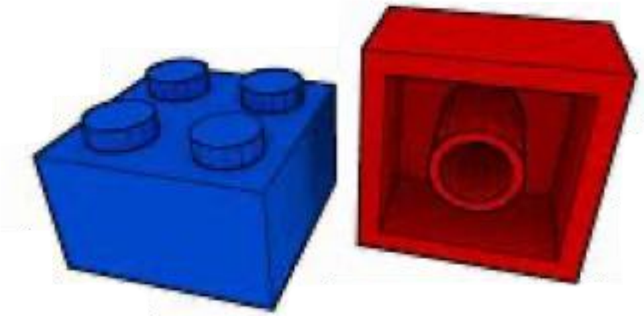
***Aspects***



***Sections***



# Object Study



***Aspect*** — *the image resulting from the projection of a three-dimensional object onto a plane*

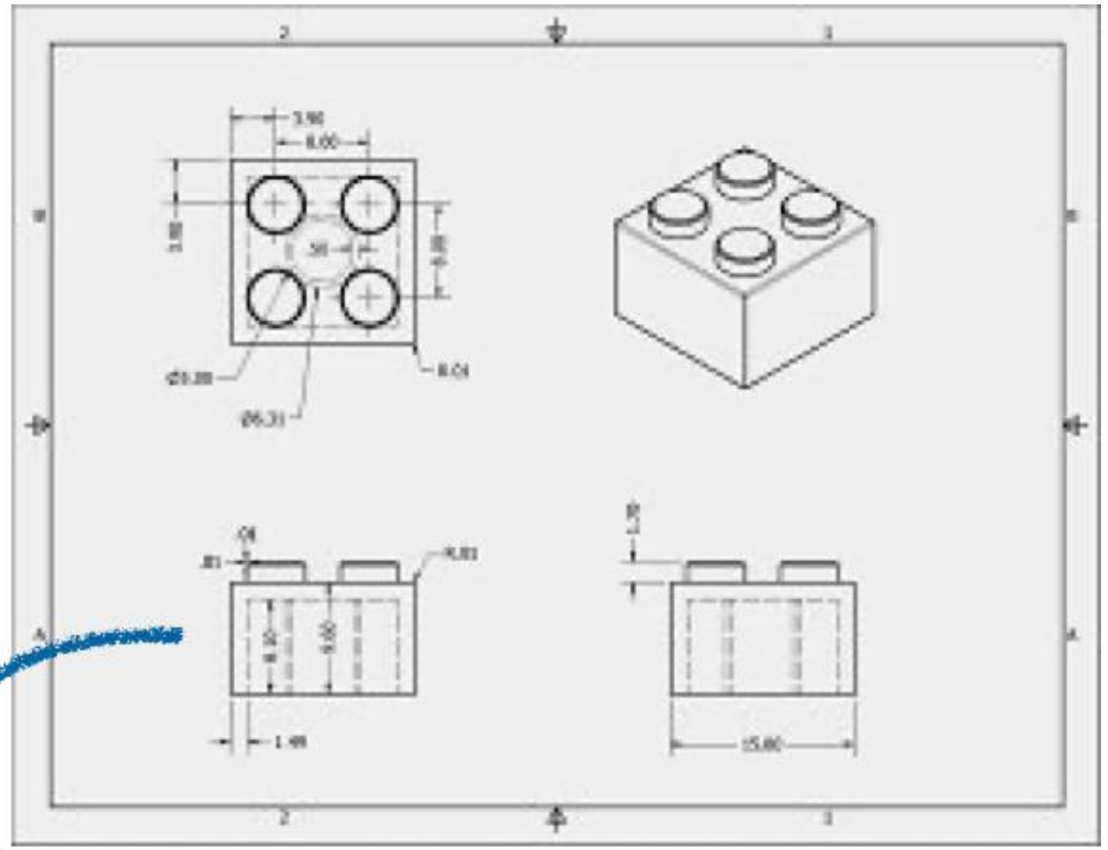
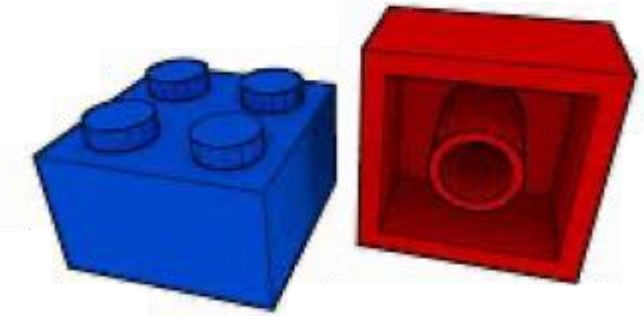


Illustration of mechanical design of a lego

***Facade***

# Object Study



*cross-section*

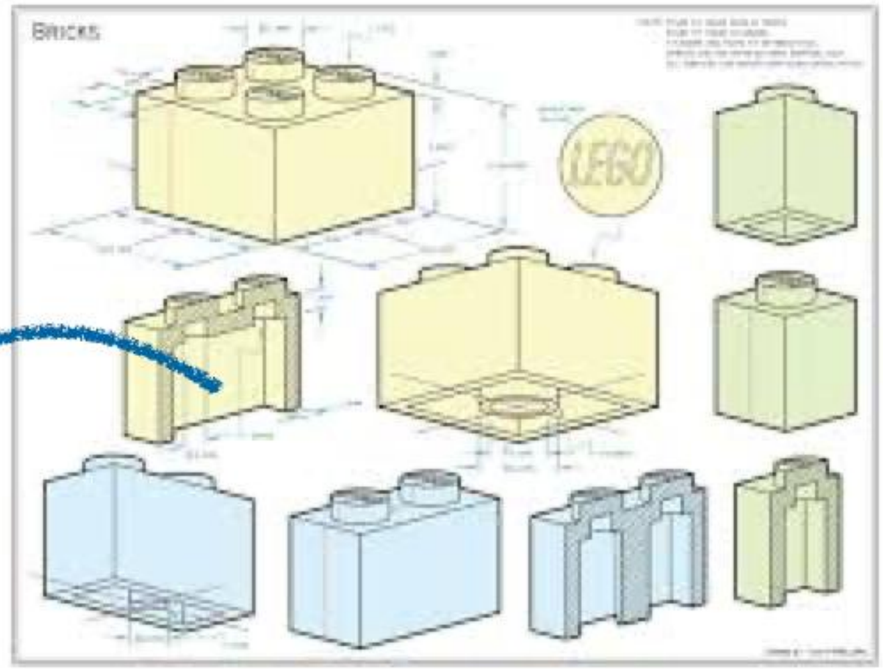
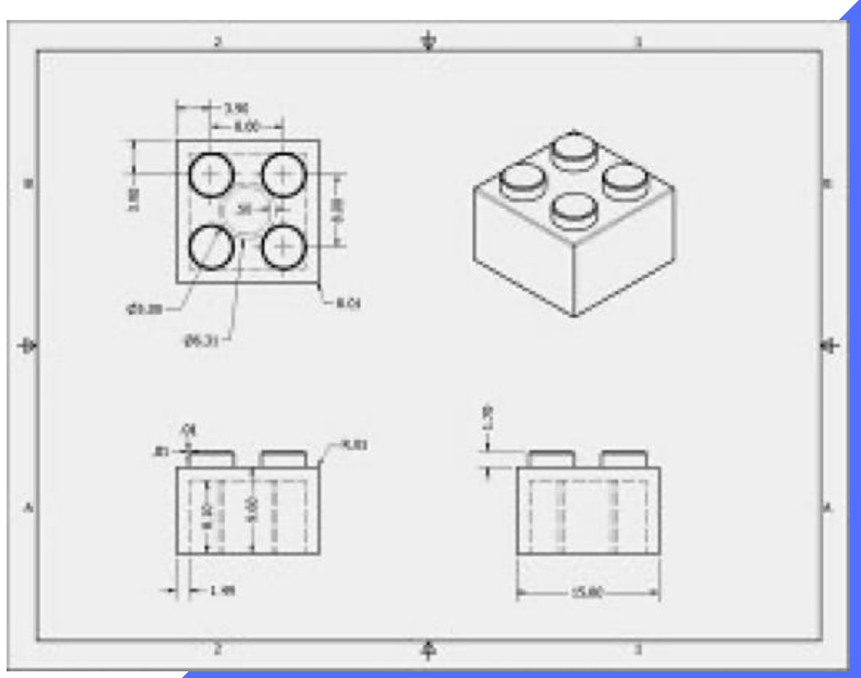


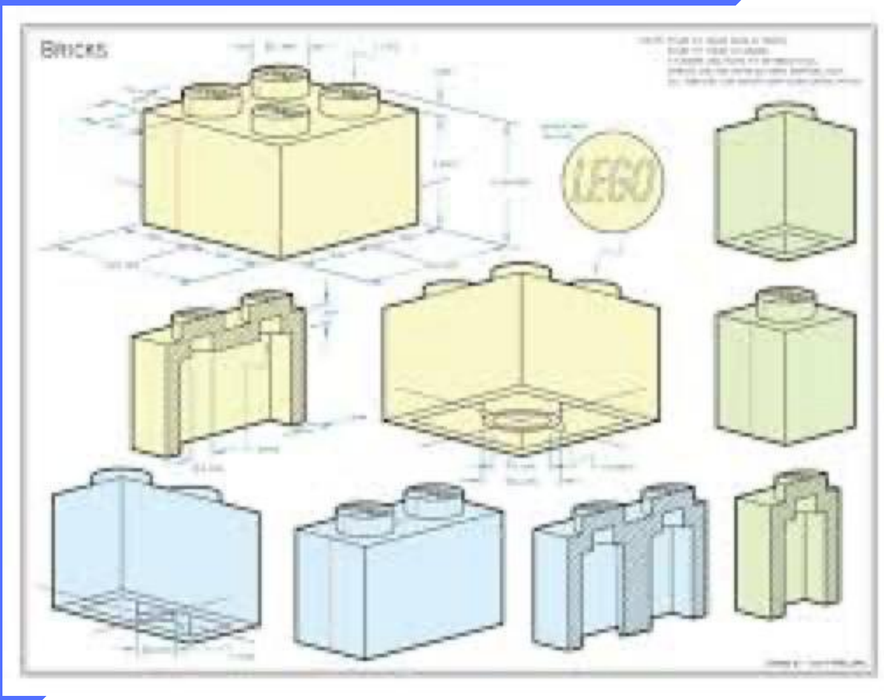

Illustration of different sections and views of a lego

***Why do we use cross-sections?***

# Object Study

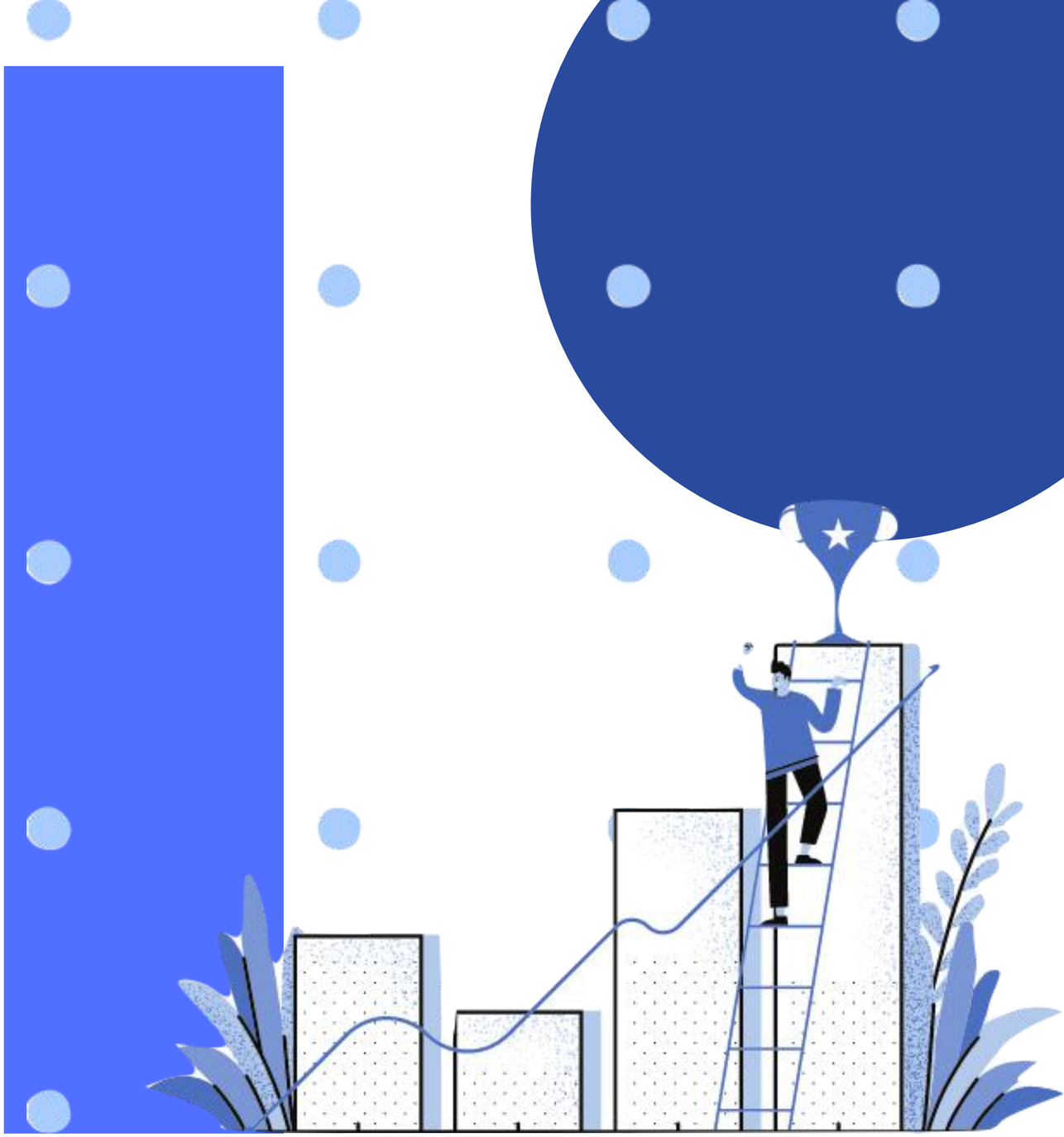


"We can approach the the design of any object as a problem to be solved..."



# Software and Printing

WHAT ARE THE DRAWING SOFTWARE AND HOW WE GET TO PRINTING



# 3D printing & printers

***CAD - Computer-Aided Design*** *is defined as the use of computers as auxiliary means of creating, modifying, analysing or optimising a design*

***CAE - Computer-Aided Engineering***

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## Historical Review

**1953**

**MIT**
Display System

**1959**

**1963**

**1966-68**

**1988**

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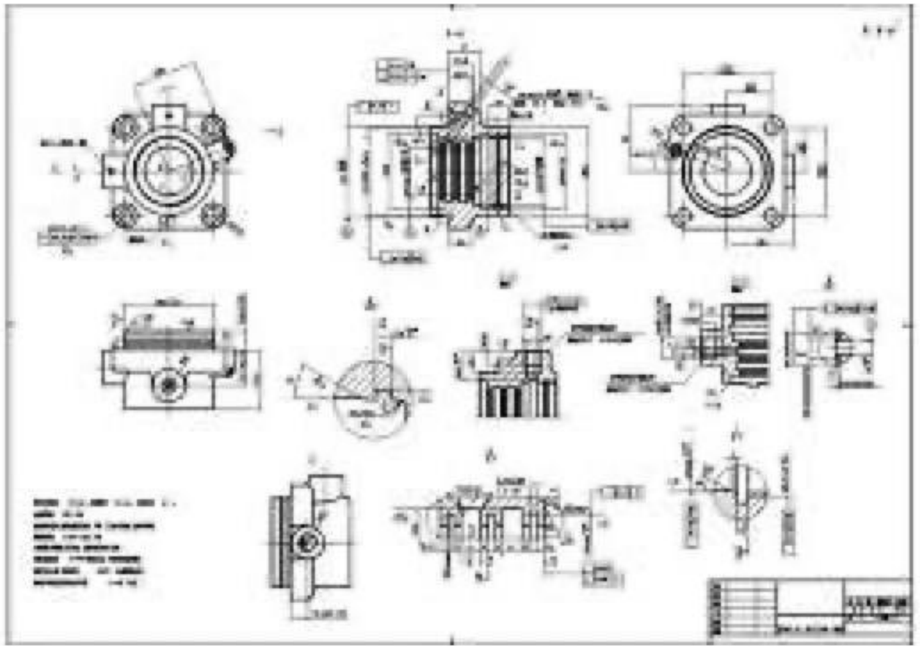
**1988** — **Autodesk**
Establishment & appearance of AutoCAD

# 2D VS 3D

## *2 Dimensions...*



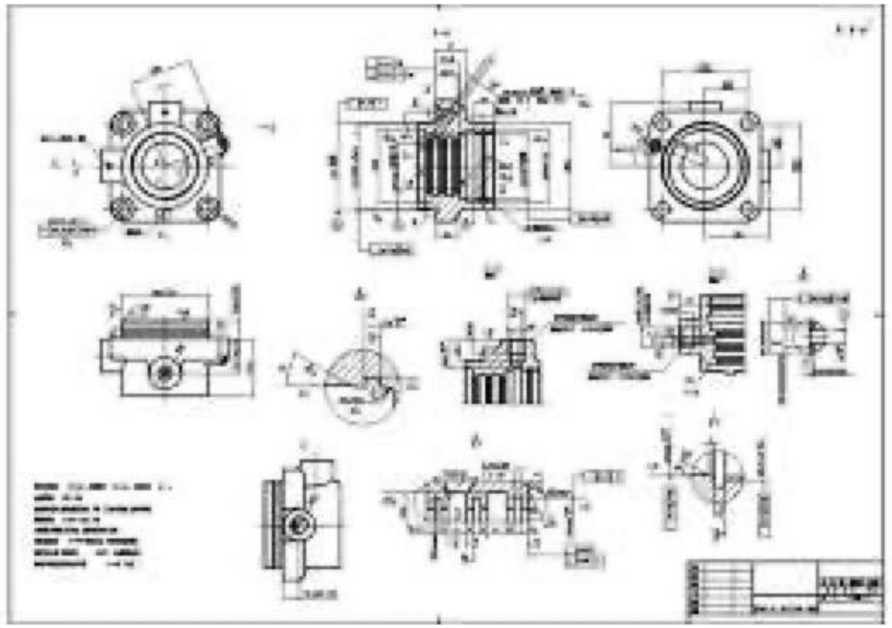
Engine illustration in right view (2-dimensional drawing)

## *3 Dimensions...*

Engine illustration in axonometric drawing (3 dimensions)

# 2D VS 3D

## *2 Dimensions...*



AUTOCAD LIBRECAD

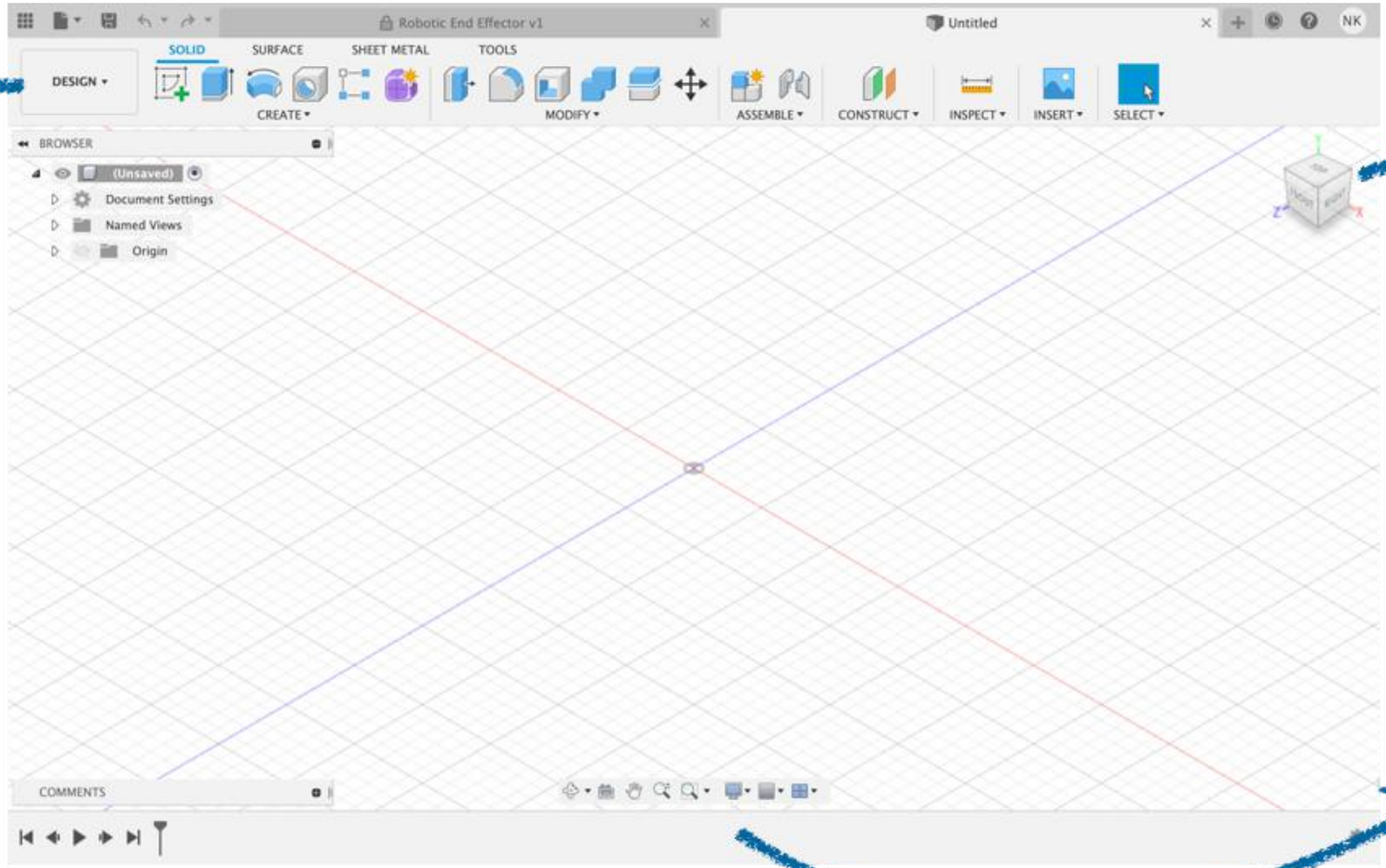
## *3 Dimensions...*

SOLIDWORKS CATIA

AUTODESK FUSION 360 AUTODESK TINKERCAD

blender SketchUp

# AUTODESK FUSION360

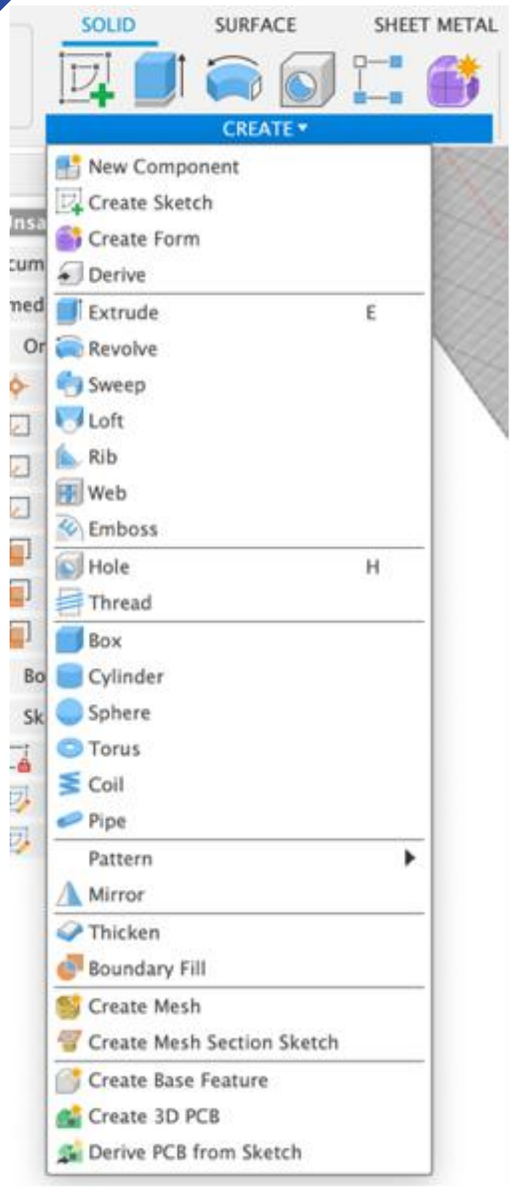


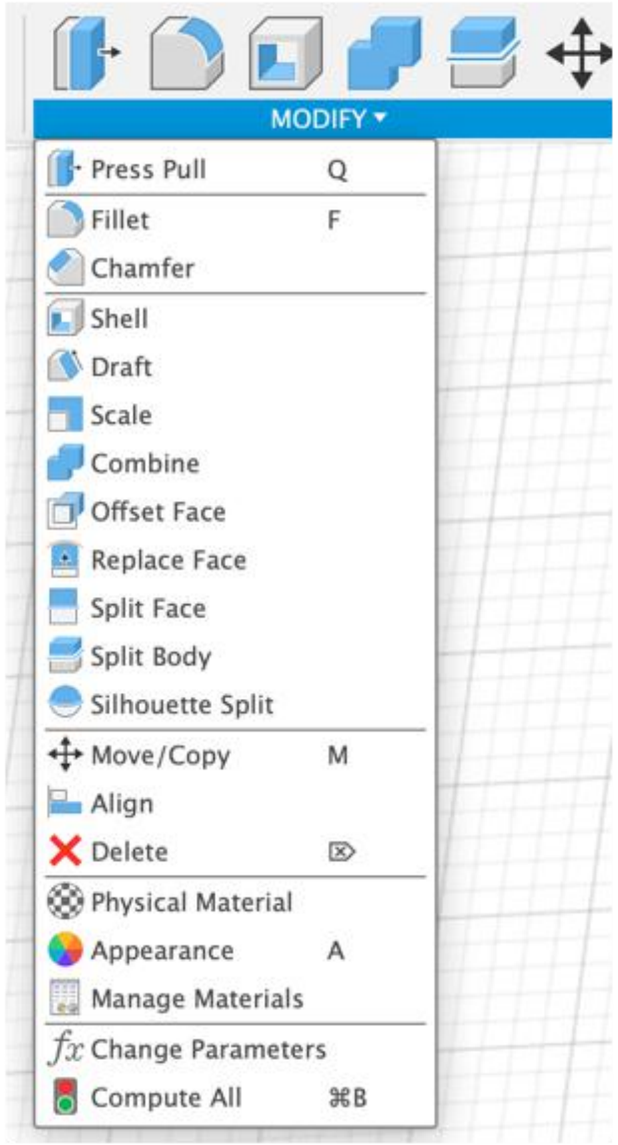

*Control Panel*

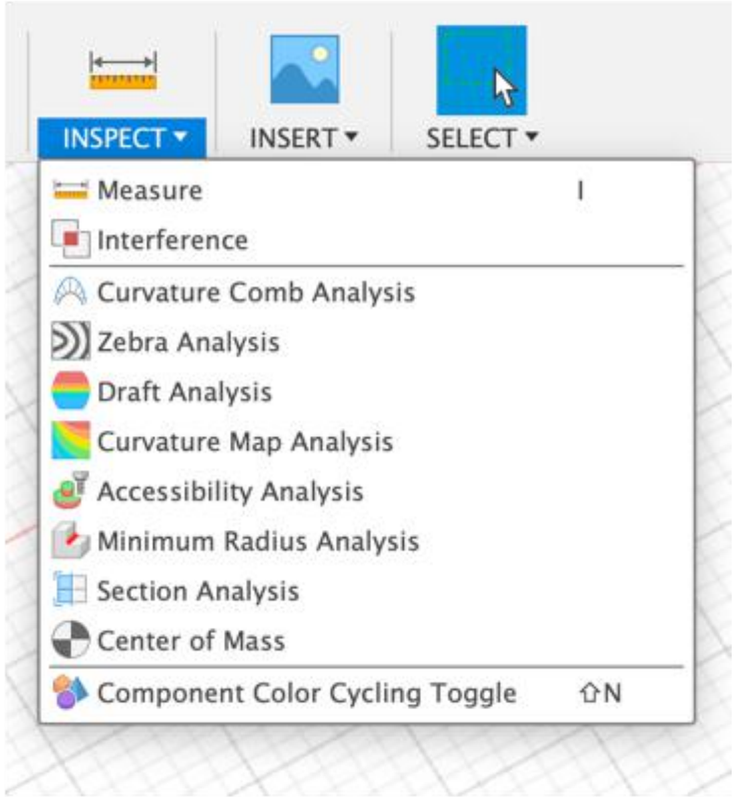
*Perspective View*

*Viewing Panel*

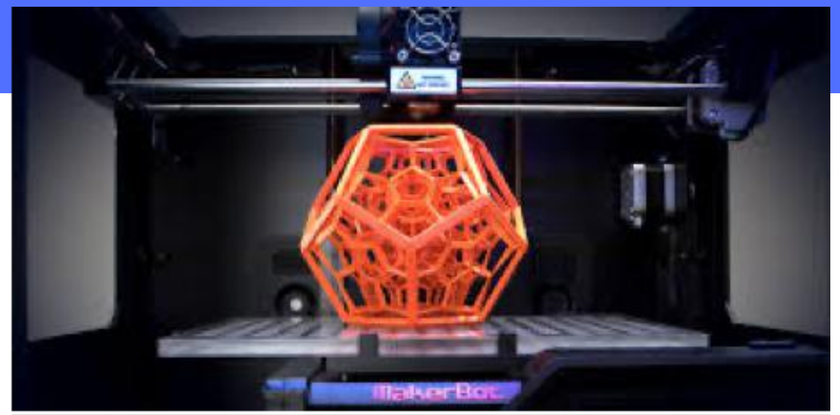
# Key Commands



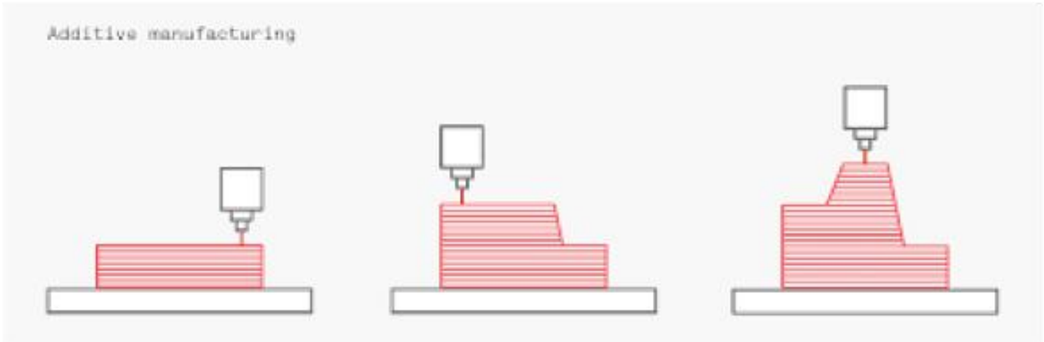



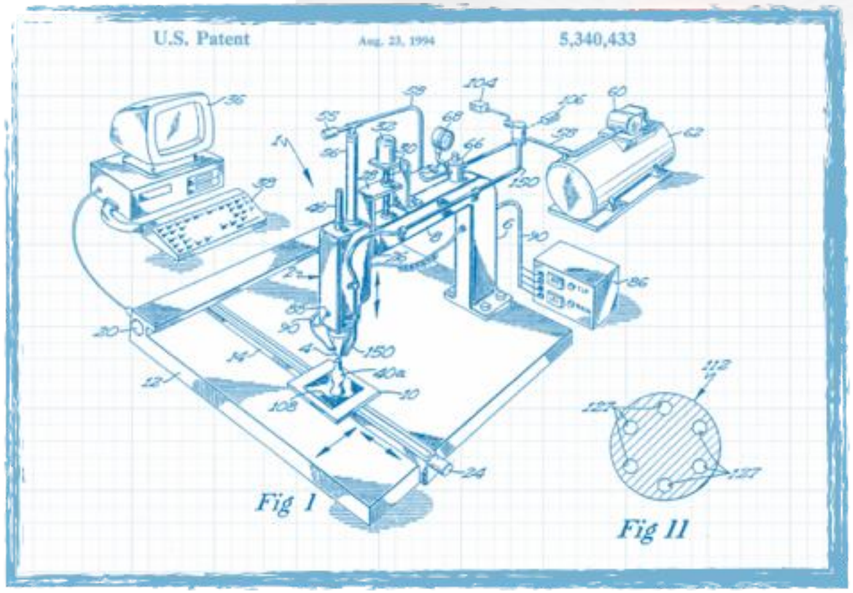



# 3D Printing & Printers




- 1980, Chuck Hull -> 3D Systems
- The function of 3d printers is based on additive manufacturing
- Thermoplastic materials -> plastics/ceramics/metals



# 3D Printing & Printers

?

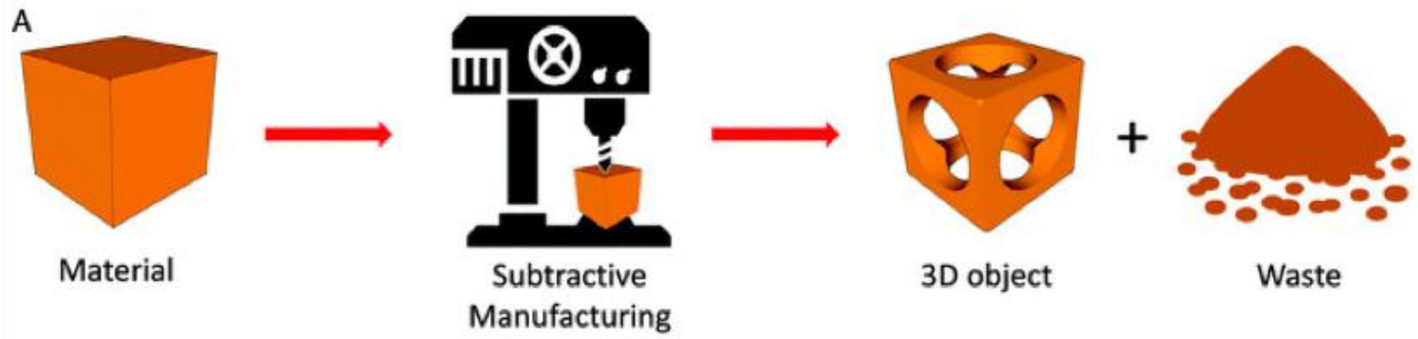
**3d printing or CNC manufacturing?**

# 3D Printing & Printers

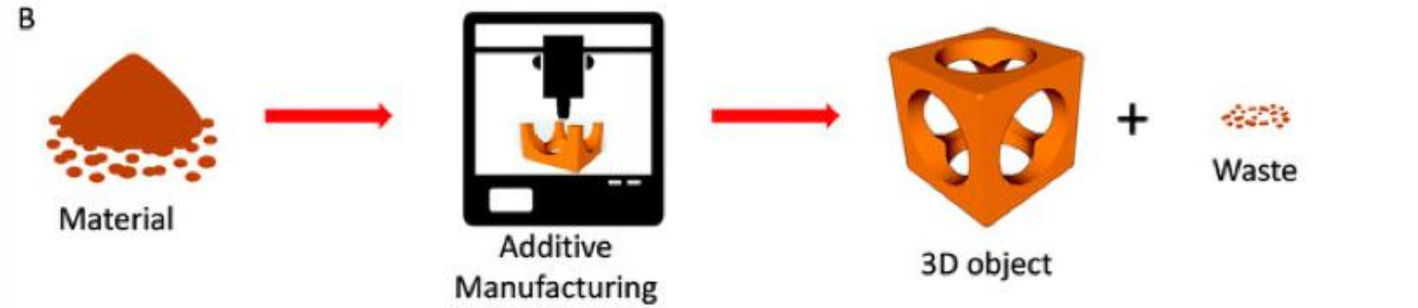
?

*3d printing or CNC manufacturing?*

***CNC manufacturing***

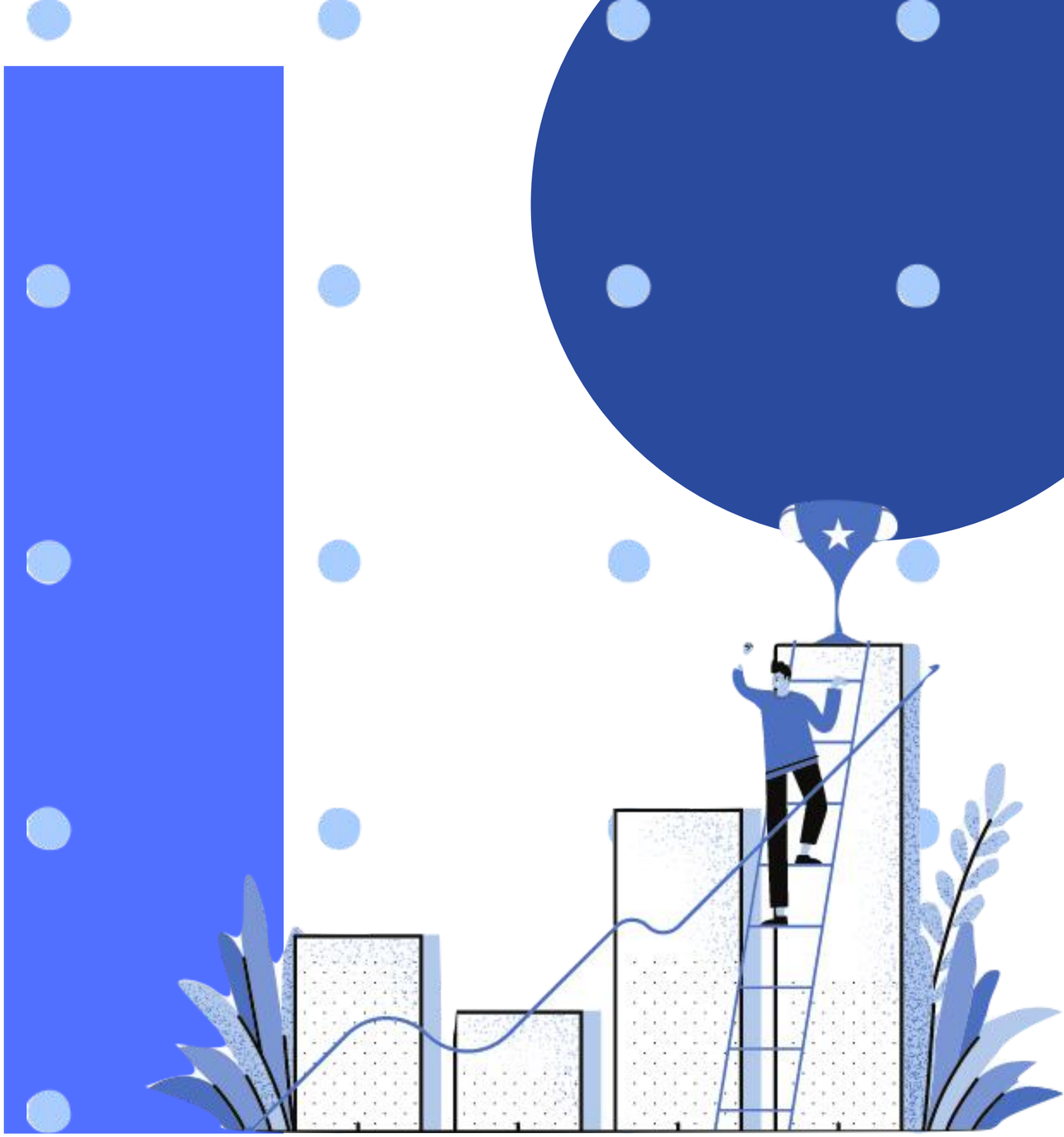



***3d printing***




# Applications of 3D printing

WHERE IS 3D PRINTING USED TODAY



# Applications in industry

## Aerospace & Aeronautics

- *low manufacturing costs*
- *functional prototypes & models*
- *easy maintenance & repairs manufacturing process*
- *wide range of materials*

*A 3D-printed injector head for Ariane 6 launcher [Image credit: EOS]*

## Automotive industry

- *low manufacturing costs*
- *high flexibility in design*
- *personalization*
- *spare parts*

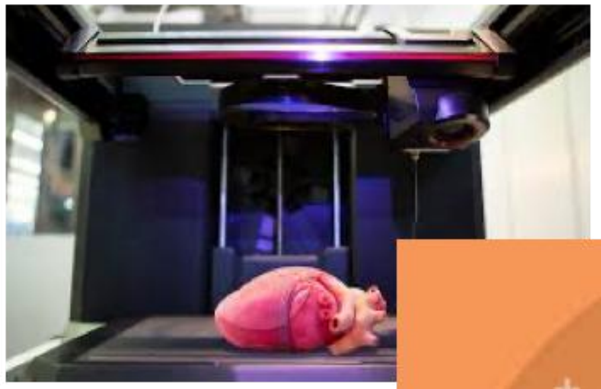
*Porsche's custom 3d printed seats for sports cars*

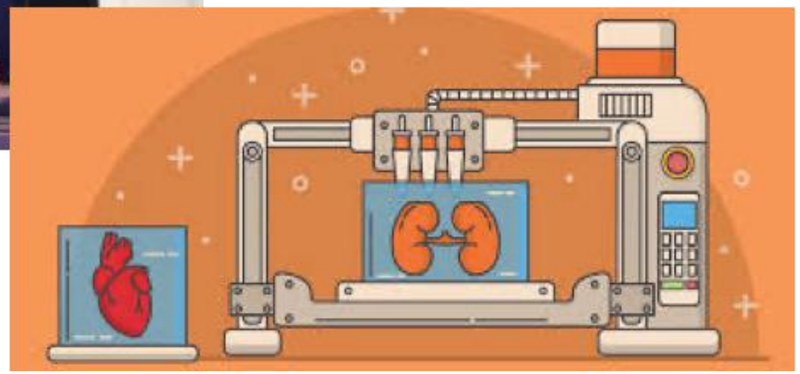
# Applications in architecture – Construction

- *low manufacturing costs*
- *minimum time for the same result*
- *environmentally friendly manufacturing process*
- *high durability due to the use of concrete*

# Applications in medicine

## *Implants, Prosthetic Parts & Dentistry*



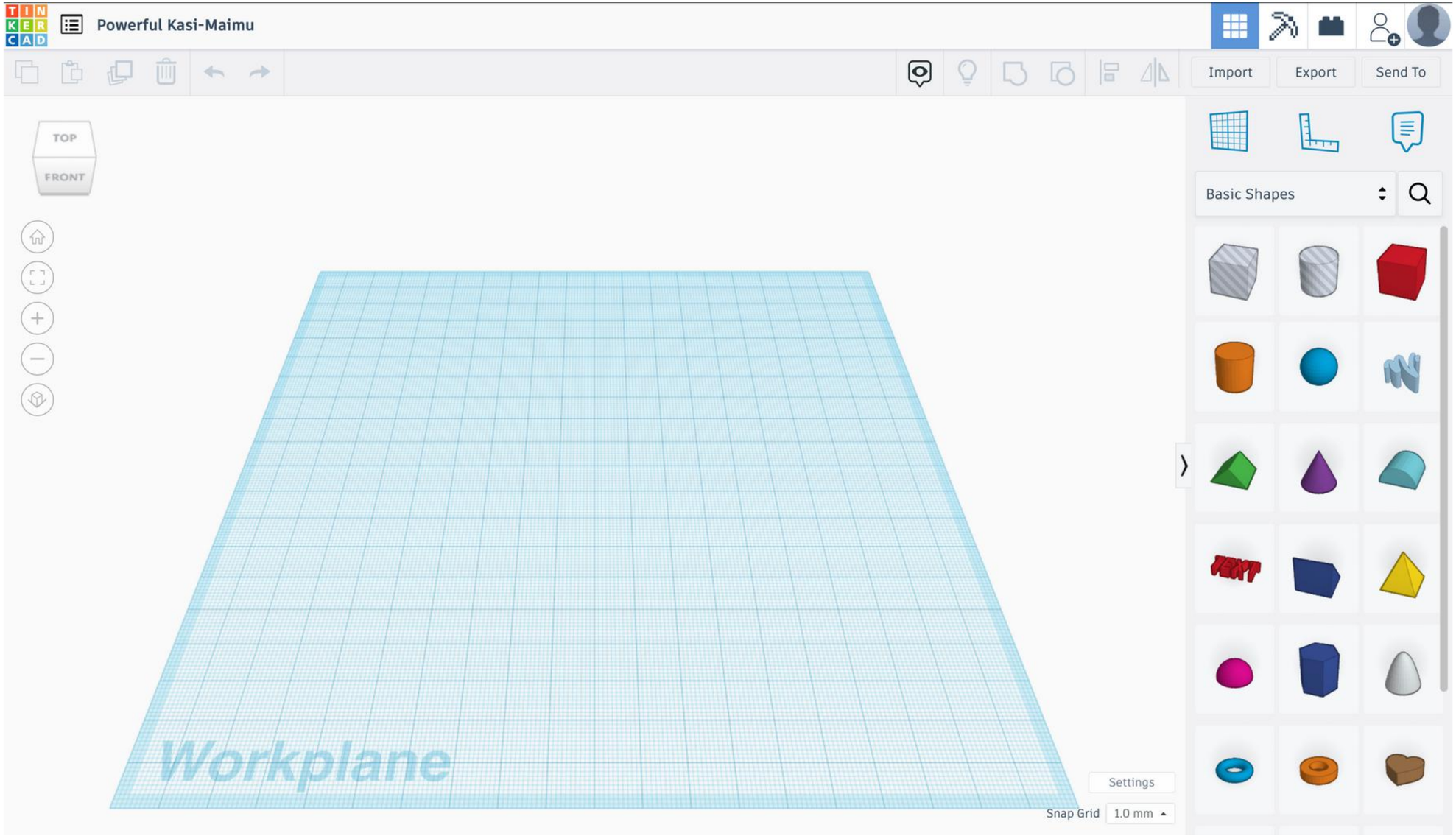


*Osseus' Aries titanium spinal implant [Image credit: Osseus]*

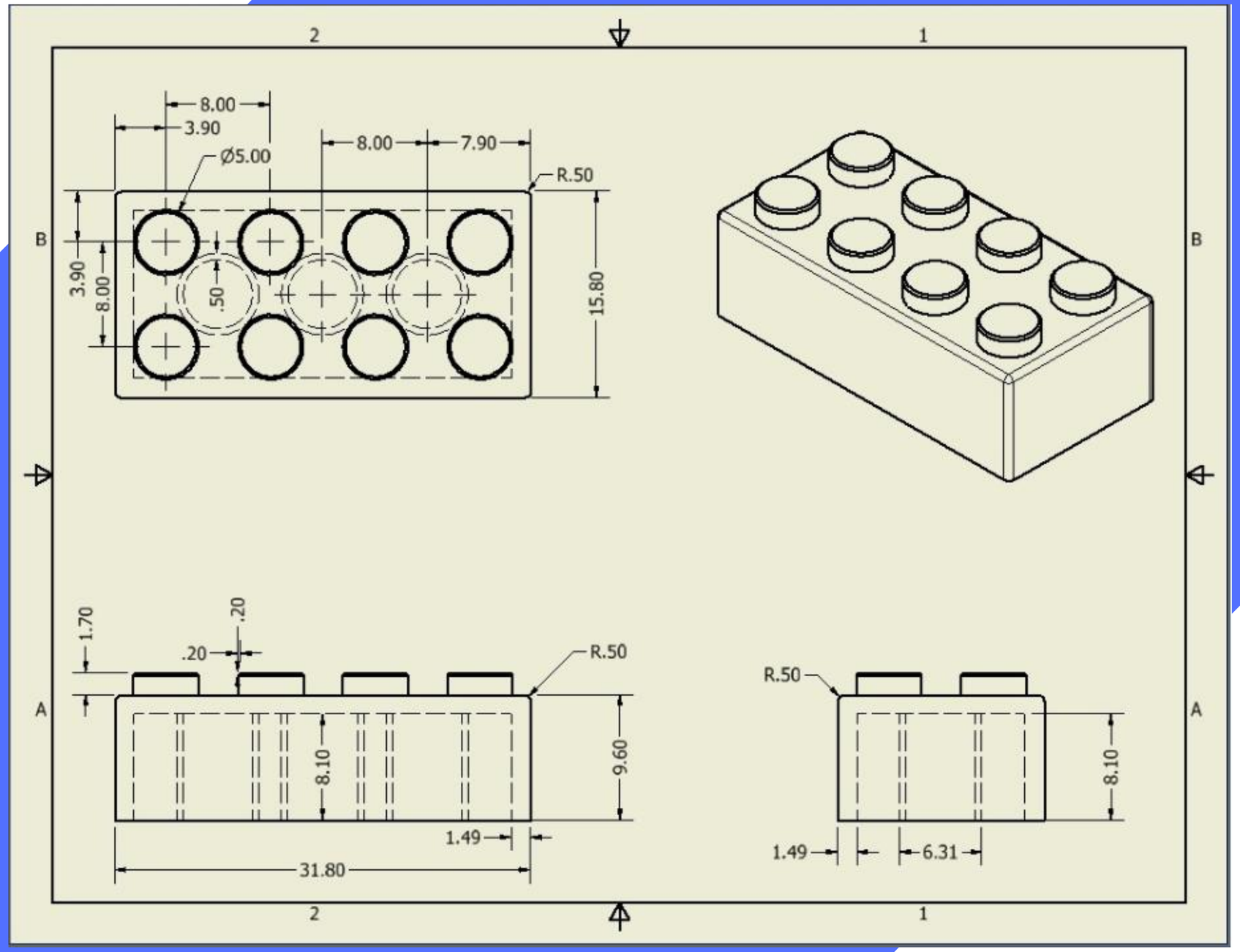
*clear aligner manufacturing*

*An OXPEKK SLS 3D printed cranial implant [Image credit: Oxford Performance Materials]*

# TINKERCAD


Powerful Kasi-Maimu
Import
Export
Send To
TOP
FRONT
Basic Shapes
Workplane
Settings
Snap Grid
1.0 mm

# Reading of Engineering Drawing



# QUESTIONS


SCIENTIX
The community for science education in Europe
CISCO
STE(A)M PARTNERSHIPS
Education Resilience in Europe
European Schoolnet
SCIENTIX