Architecture, biomimesis and 3D

Solutions Inspired by Nature

Key concepts:
architecture, 3D model, 3D printing, scale, model, biomimesis, solar radiation, sun protection, orientation, climate

References: biomimetic architecture

"What if every time I started to invent something I asked myself: How would nature solve this? The answers to our questions are everywhere; We just need to change the lens with which we see the world." (Jainine Benyus)

Biomimetic architecture seeks sustainable solutions in nature, without purely replicating its forms, but through understanding its norms, it uses design ideas in structures, facades, etc.

1. Organism level / abstraction and imitation of form
2. Behavior level / replication of the natural process and operation
3. Environment level / complete recreation of the ecosystem and interactions

https://prezi.com/cfpnozevu2_n/arquitectura-biomimetica/

Ilustración 27. Reproducción de la maqueta funicular de la iglesia de la Colonia Güell usada por Gaudí expuesta en Museo del Templo de la Sagrada Familia. 2016. Imagen propia.

References: 3D printing and modeling

3D printing process

3D design programs and files

Tinkercad

Impressora 3D - Procés Tecnològic impressió 3D
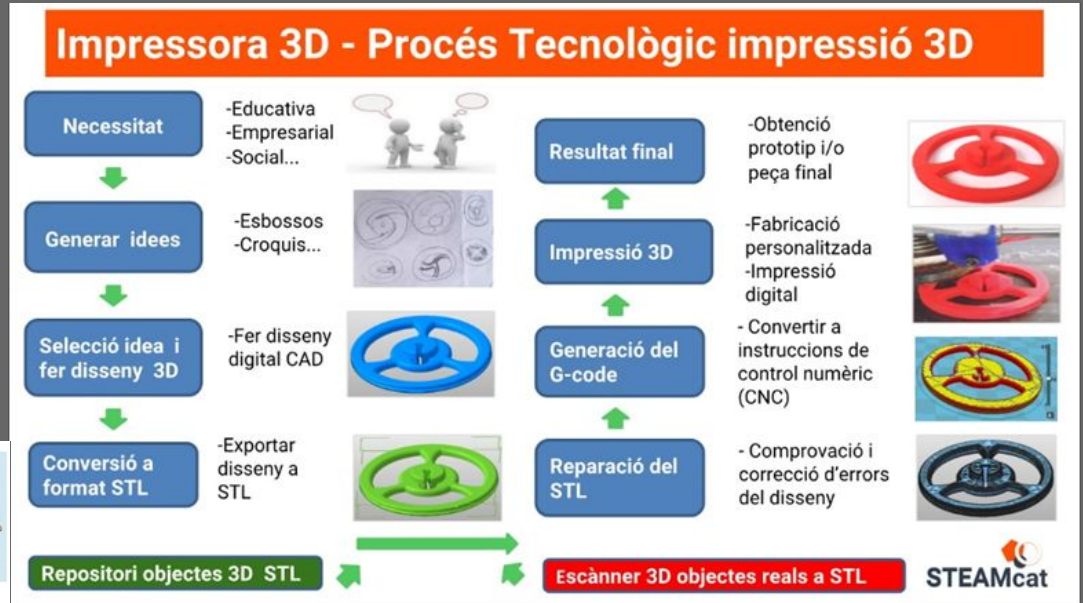
■ Parametric design

■ Vector design

■ Repositories

The importance of models and 3D: the case of the Sagrada Familiahttps://youtu.be/5_aPWihJRrQ
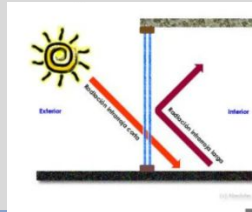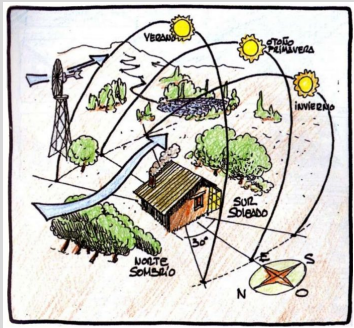
Challenge:

Can you find solutions inspired by nature to control solar radiation in the openings of the facades of a building?
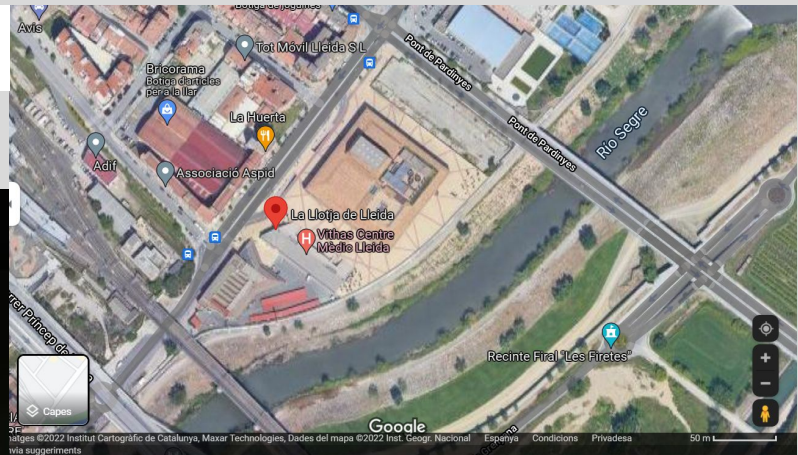
And then, can you apply it on a 3D model and complete the printed model?

Challenge: the goal

Improve passive heat gain by solar radiation in the openings of the facades to save on cooling during summer, while allowing heat gain during winter.

Challenge: the building

La Llotja de Lleida

ARQUITECTO: FRANCINE HOUBEN, MECANOO ARCHITECTEN
AÑO: 2006-2009
UBICACIÓN: LÉRIDA, ESPAÑA

En anglès:

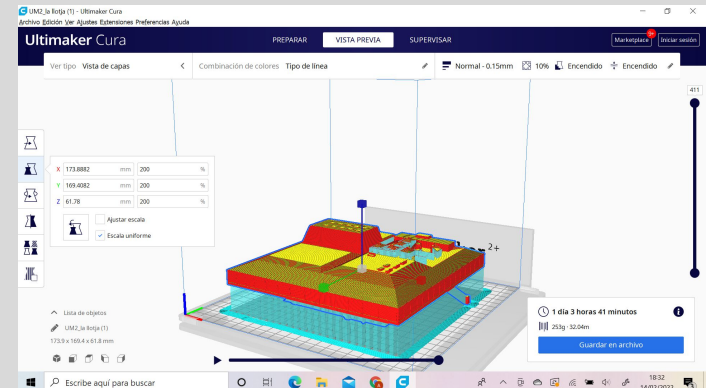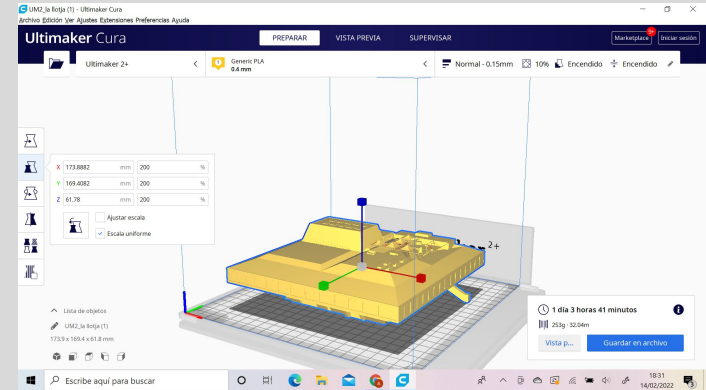https://en.wikiarquitectura.com/building/leridas-theater/

Challenge: model, 3d model and software

Tinkercad o similar / Cura o similar /Ultimaker 2+

E 1/1000

Scale: drawing / reality

E 1/500

The challenge: architecture and sun protection

Orientations, season, climate and constructive solutions. https://guiaverda.gva.es/va/proteccio-solar

Facades with s**outh, south-east and south-west** orientations, where the angle of solar inclination increases during the summer and decreases during the winter, sunscreens will be placed such as:
- Flights (overhan) of adequate length to limit overheating in summer and allow in winter; in a southerly orientation flights may consist of a solid horizontal plane or with plates parallel to the façade and in south-east and south-west orientations they may consist of a horizontal plane with plates perpendicular to the façade.
- Awnings.
- Movable or fixed horizontal sheet systems with the right angle.
- Sliding or walkable exterior windows; or roller shutters with fixed or articulated guide (all with fixed or adjustable sheets).
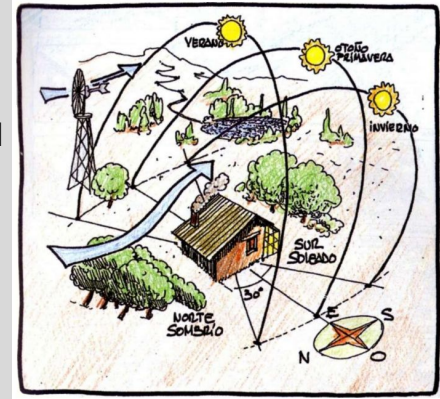
Facade facing **east and west**, where the angle of inclination of the sun is very small throughout the year, sunscreens such as:
- Awnings that allow inclinations above 45 ° to take advantage of the sun during the morning in winter and limit the excess in summer; in a westerly direction, if there is overheating, the awning fabric should be breathable.
- Movable or fixed vertical sheet systems with the right angle.
- Front planes parallel to the façade solid or together with horizontal plates.
- Sliding or walkable exterior windows; or roller shutters with fixed or articulated guide (all with fixed or adjustable sheets).

Solutions used must make it possible to take advantage of solar radiation in the cold months. And what happens with **north**?

Task:

Design and 3D printing of sunscreens inspired by nature on at least 1 facade of the building "La Llotja de Lleida".

Selection and short description of the proposal according to the orientation of the façade: SW facade / SE facade / NW facade / NE facade

Based on a sketch, design work from the 3D model provided with tinkercad or similar.

Delivery of:
- sketch (digitized image)
- short description
- screenshot of the 3D solution
- .stl or .gcode print file

Printing, sharing and conclusions