

*ETH*zürich

**GRAMAZIO
KOHLER
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MAS Digital Fabrication

Mesh subdivision

October 19th, 2020

ETH zürich

DARCH

Departement Architektur



dbt

**GRAMAZIO
KOHLER
RESEARCH
EA**

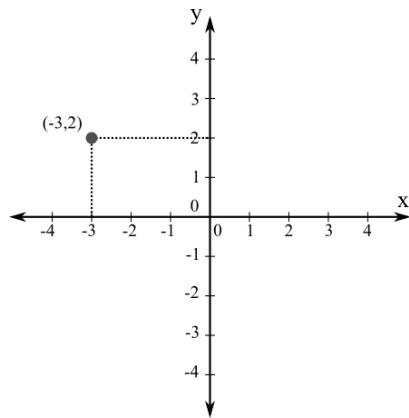
Week 1

Mesh Subdivision
Rule-based design

Week 2

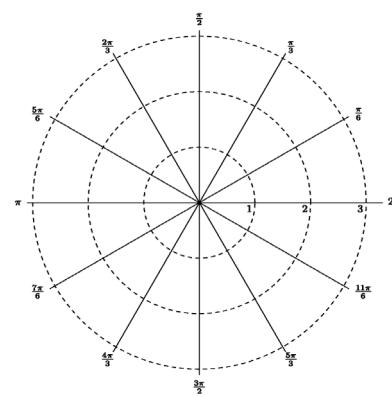
Implicit Modeling
Volume representation
Distance functions

cartesian coordinates



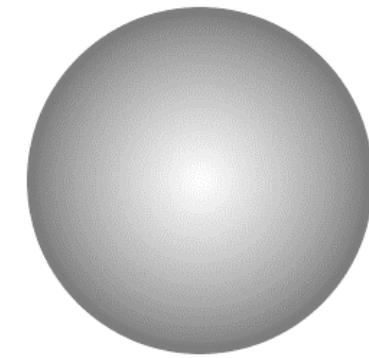
$$c : p(x, y)$$

polar coordinates



$$c : p(\rho, \theta)$$

distance function



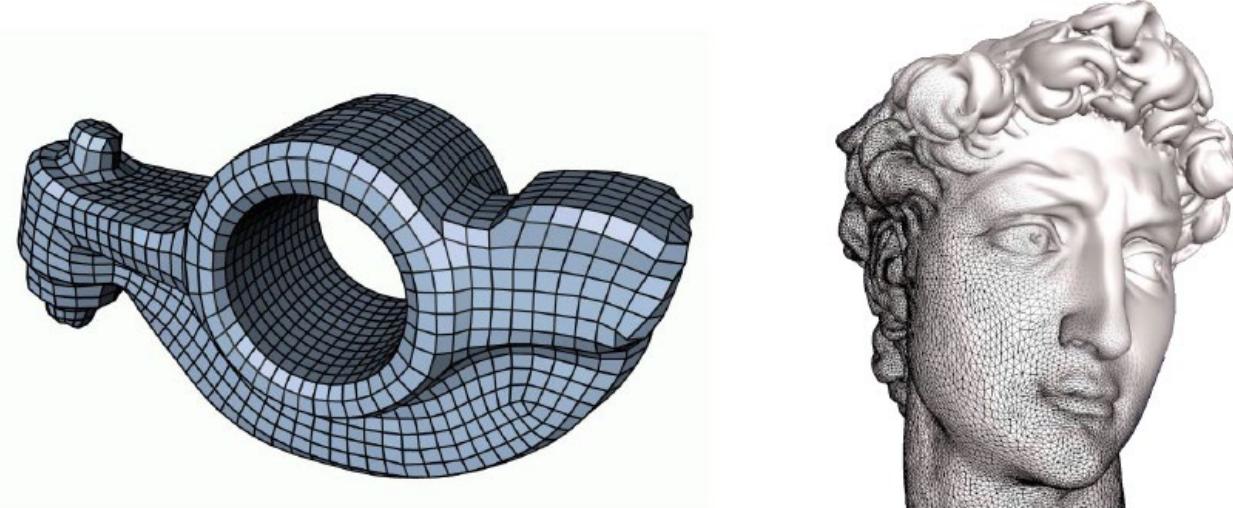
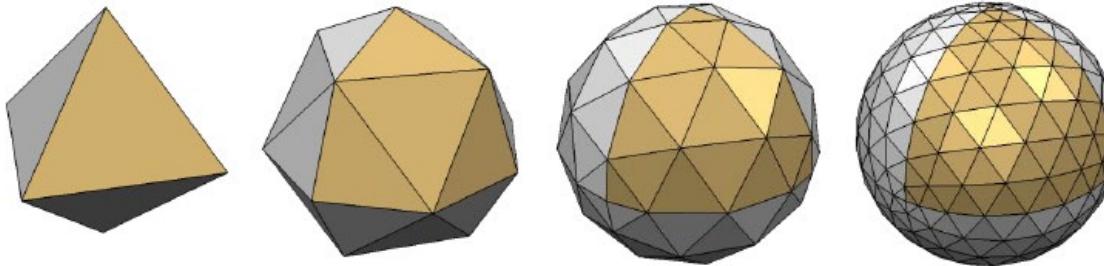
$$c : p - r = 0$$

Domain Transforms in Architecture – Encoding and Decoding of Cultural Artefacts

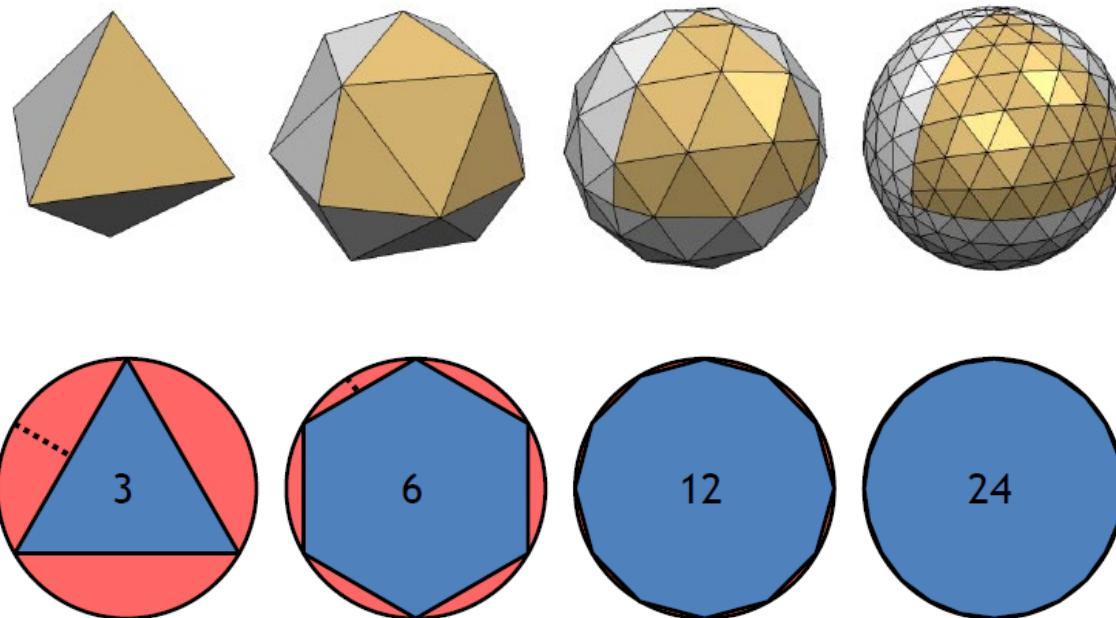
Mathias Bernhard, 2019
<https://www.research-collection.ethz.ch/handle/20.500.11850/381227>

What is a mesh ?

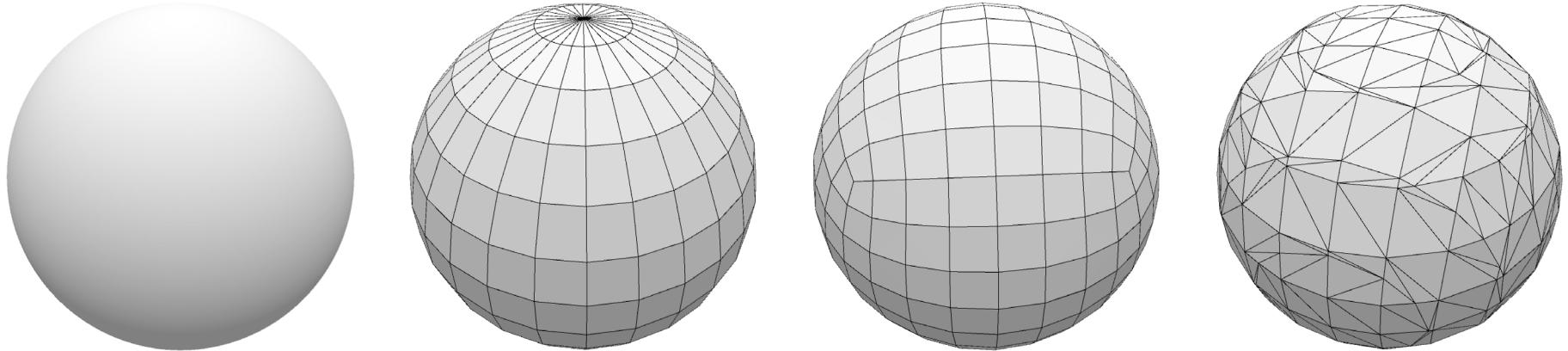
Boundary representations of objects



They are only approximations

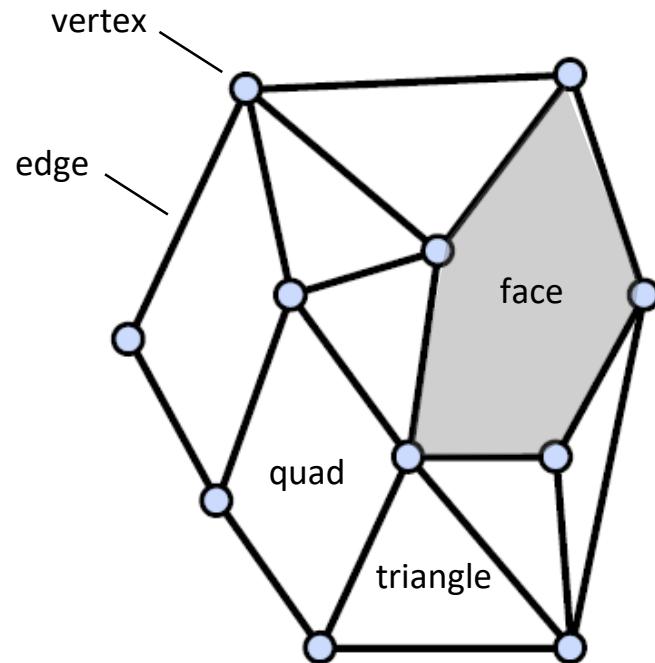


A sphere is a sphere



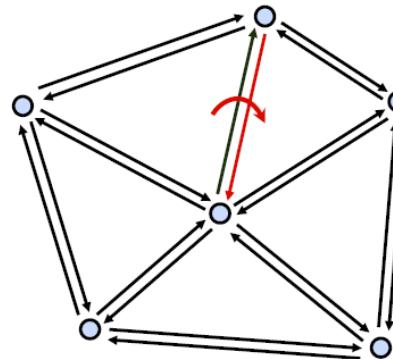
(relatively)
regular tessellation

A mesh



Mesh datastructure in COMPAS

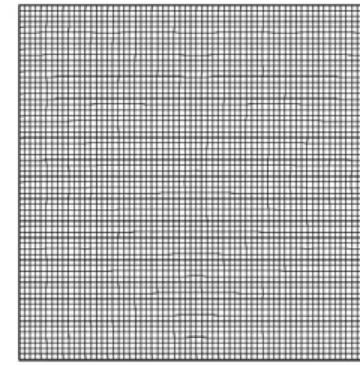
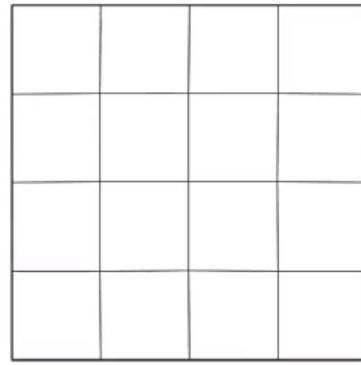
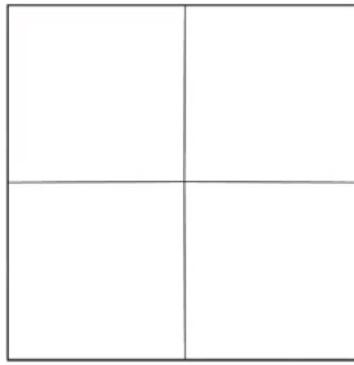
half-edge
datastructure

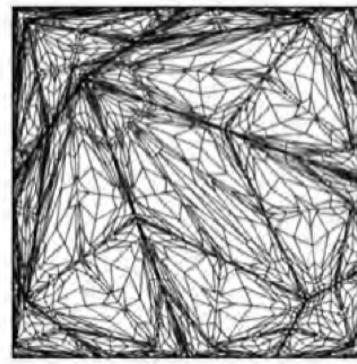
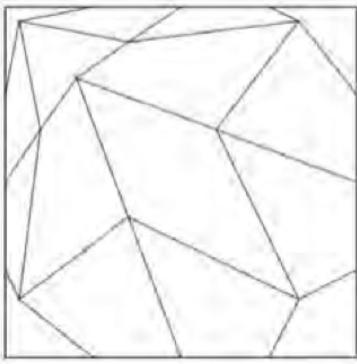
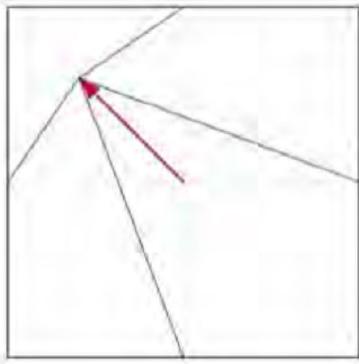


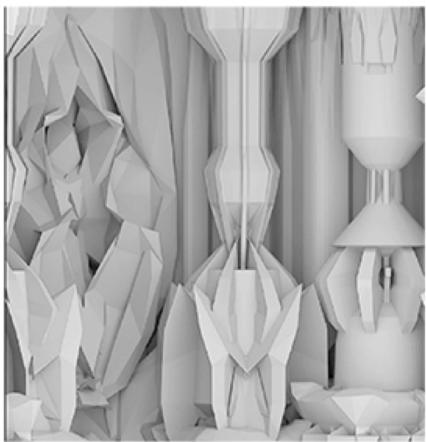
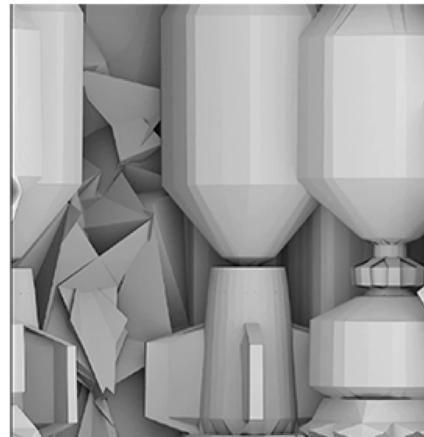
```
>>> from compas.datastructures import Mesh  
>>> mesh = Mesh()  
  
>>> a = mesh.add_vertex()  
>>> b = mesh.add_vertex(x=1)  
>>> c = mesh.add_vertex(x=1, y=1)  
>>> d = mesh.add_vertex(y=1)  
  
>>> mesh.add_face([a, b, c, d])
```

```
>>> key_index = mesh.key_index()  
>>> vertices = list(mesh.vertices())  
>>> edges = [(key_index[u], key_index[v])  
           for u, v in mesh.edges()]  
>>> faces = [[key_index[key] for key in mesh.face_vertices(face)]  
           for face in mesh.faces()]
```

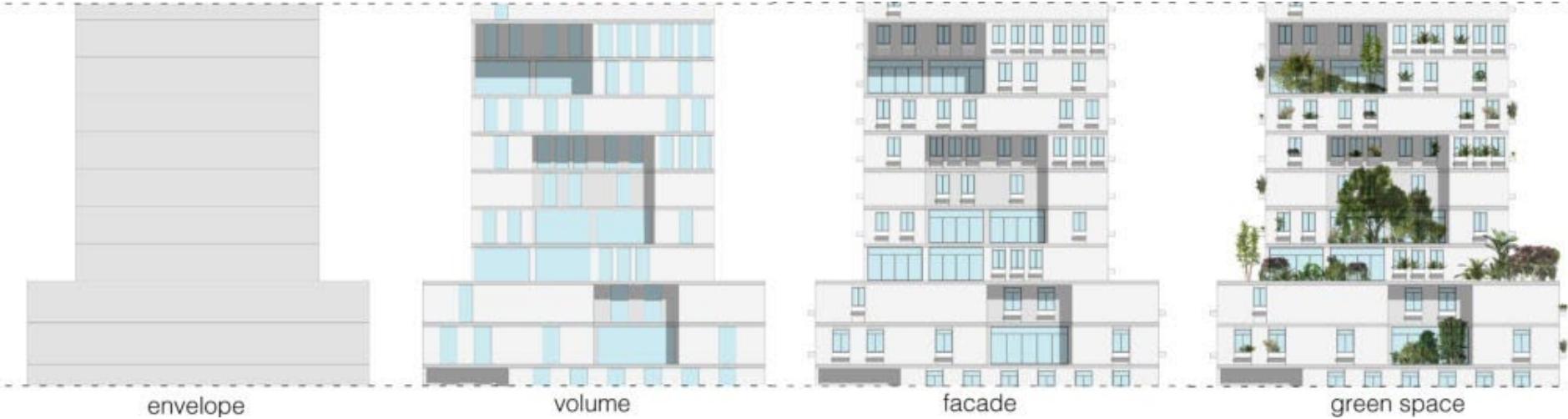
What is rule-based design ?



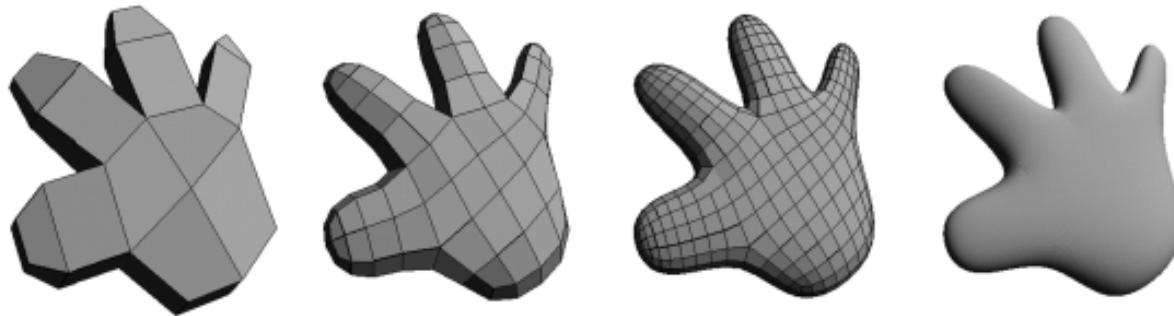


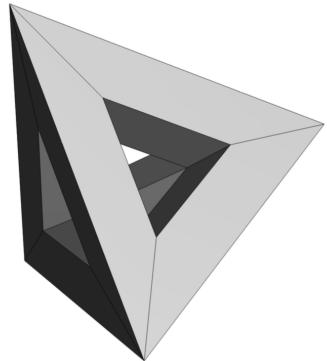




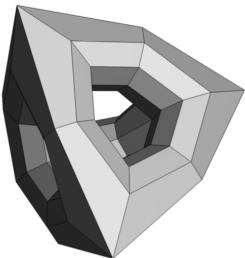


Mesh subdivision

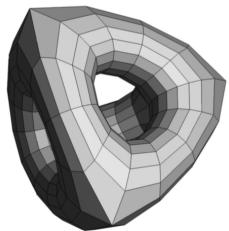




(a)



(b)



(c)



(d)





Thank you