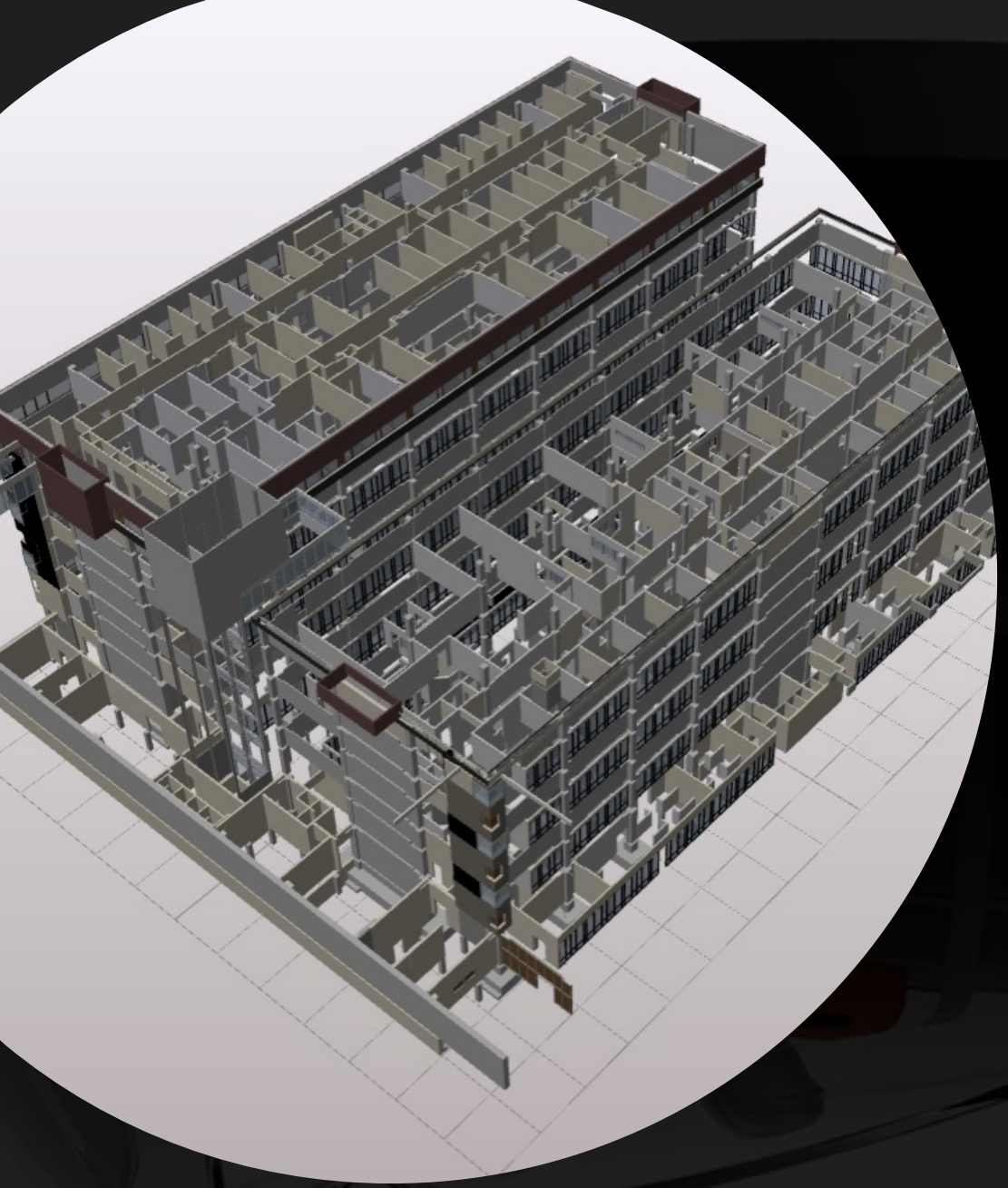

Visualization of BIM through Hololens

Panagiotis Karydakis

Improving & Modernizing Construction

- **Construction projects** [1]**:**
  - **40%** are late
  - **50%** over budget
  - **30%** fail to meet expectations

- **Rework** [2]**:**
  - costs **5%** to **20%** of the contract value
  - contributes to **52%** of the cost growth
  - increases the schedule overrun by **22%**

50% of the rework due to design changes

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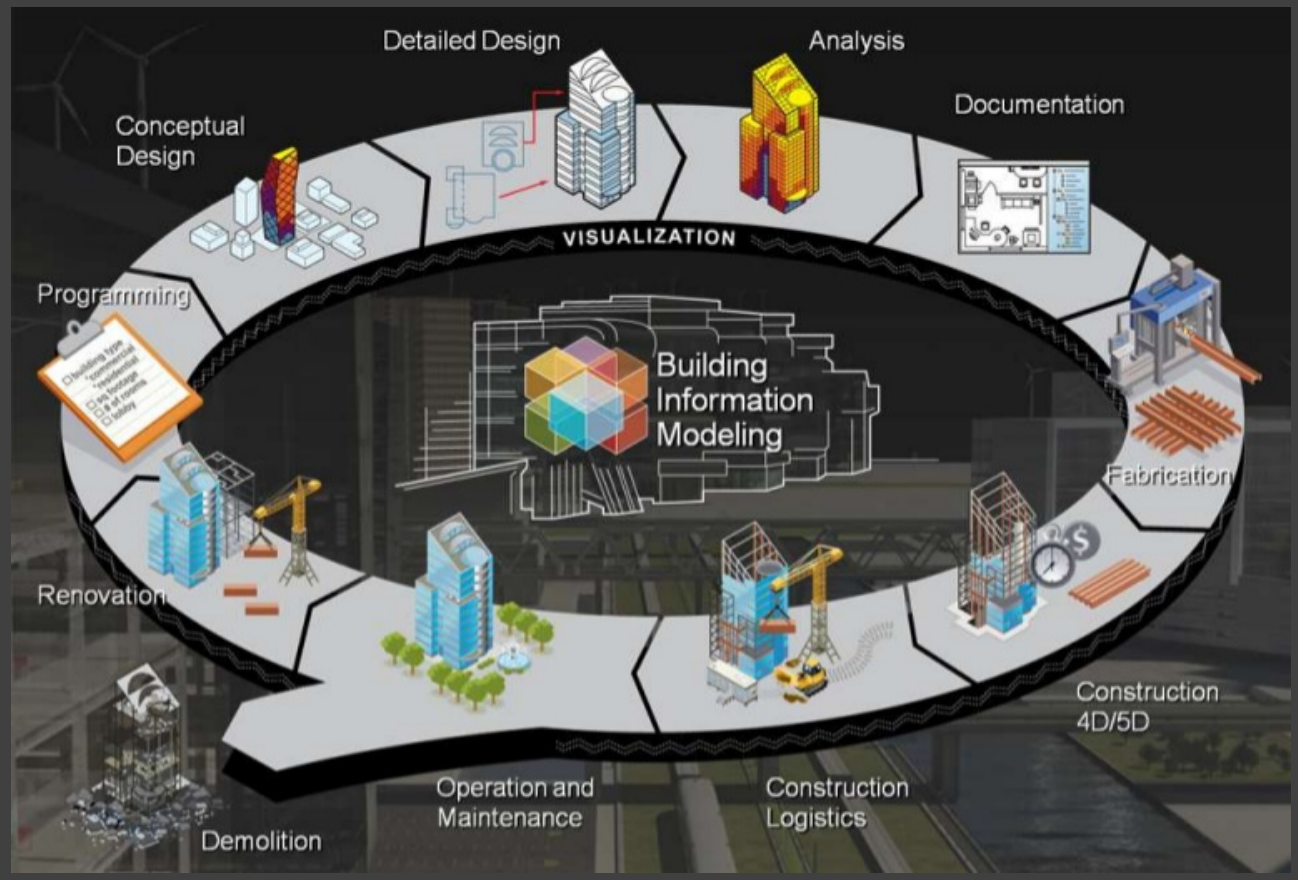
Demand for Visualization of the Final Outcome

- ❑ Error Reduction
- ❑ Time Efficiency
- ❑ Cost Reduction
- ❑ Customer Satisfaction

Building Information Modelling (BIM)

Benefits:

- Improved coordination
- Clarity in task requirements
- Reduction in inconsistencies



buildingSMART
International Alliance for Interoperability

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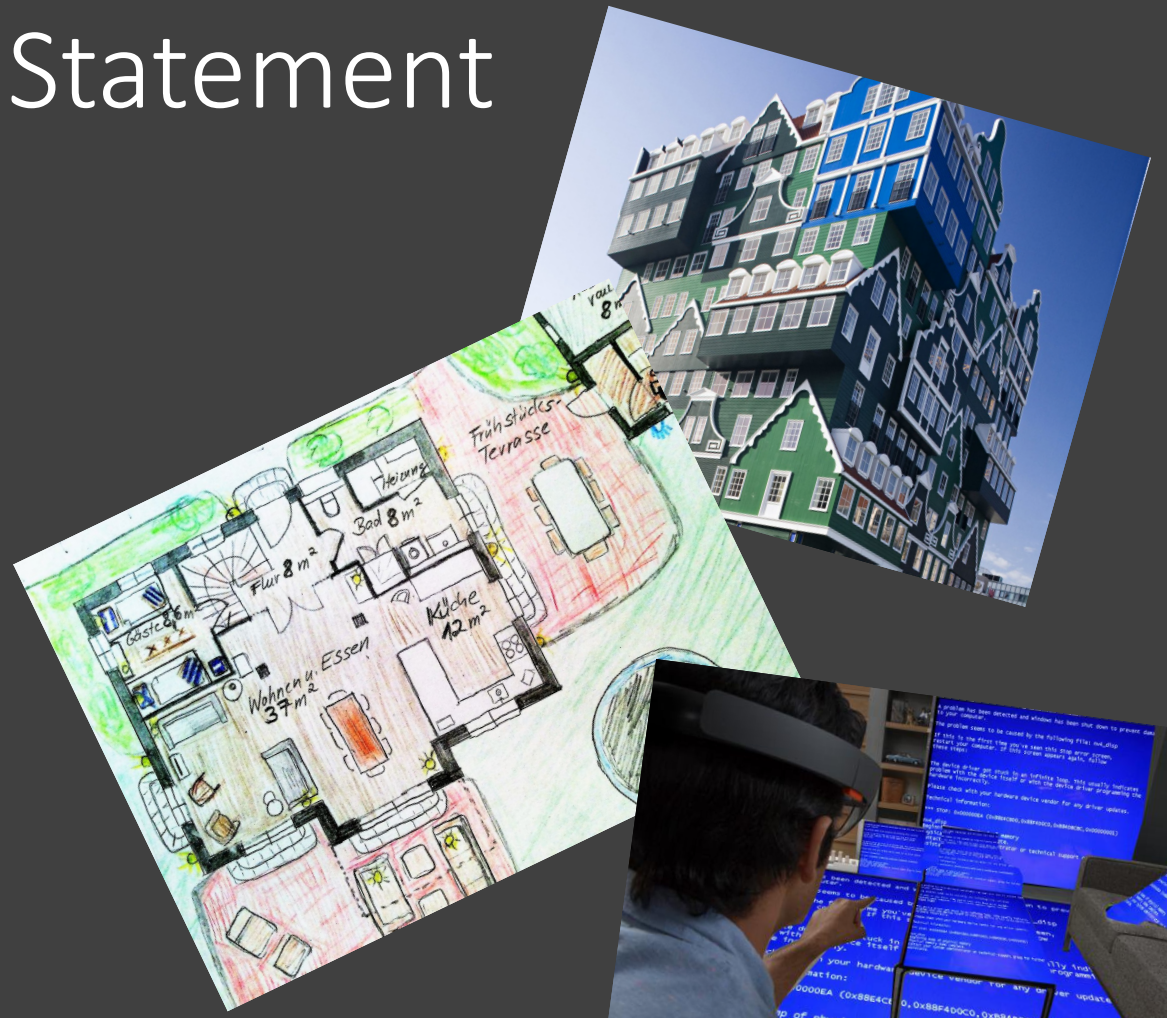
Augmented Reality (AR)

Microsoft Hololens :

- Head-Mounted Display (HMD) unit or a Wearable Windows 10 computer
- The user can interact with holograms using gestures or voice commands
- Creates a 3-D model of the surrounding environment

Problem Statement

- Exterior envelope
- Isolation of every floor
- Creation of Holograms



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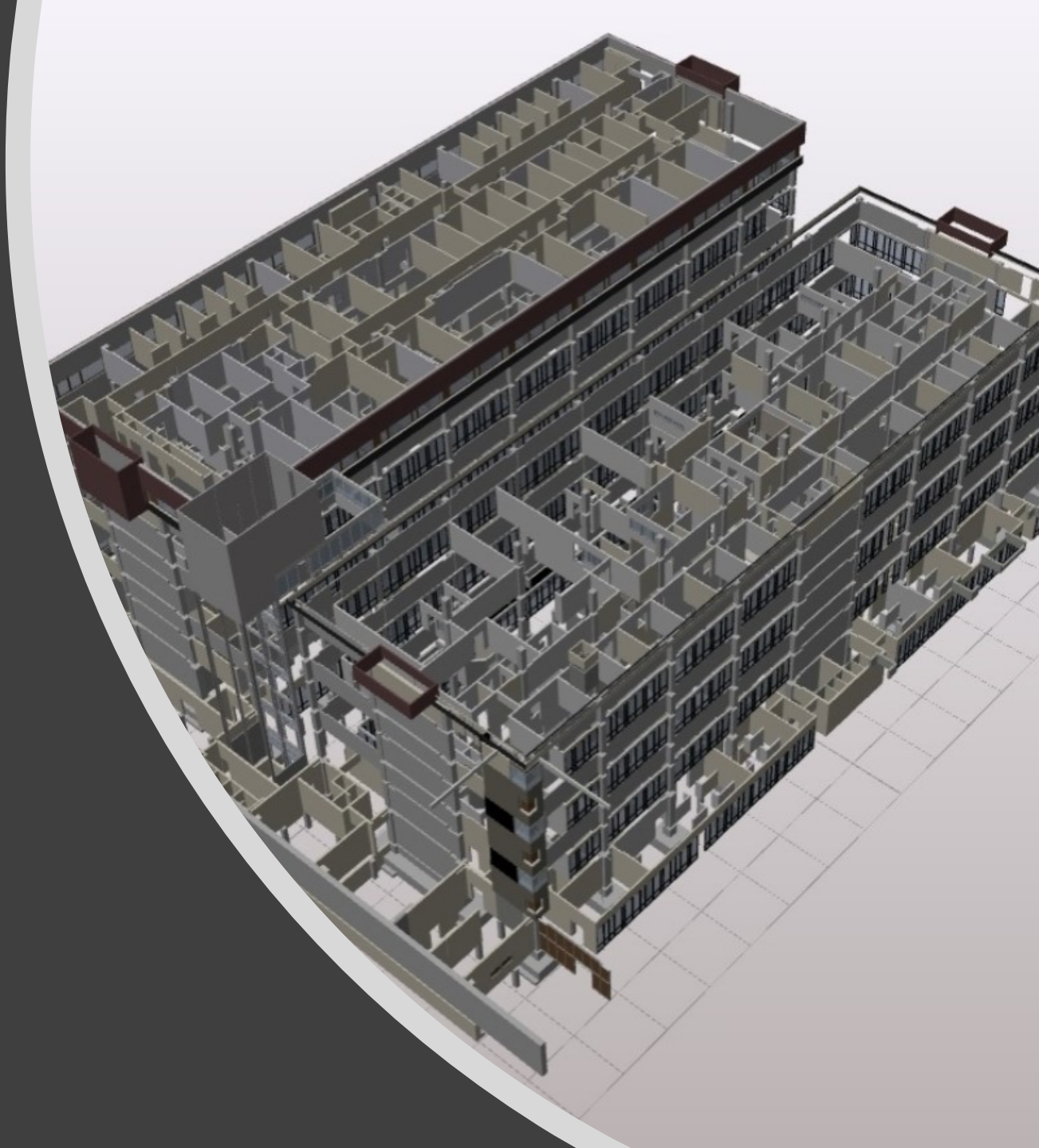
Use Case (AMC)

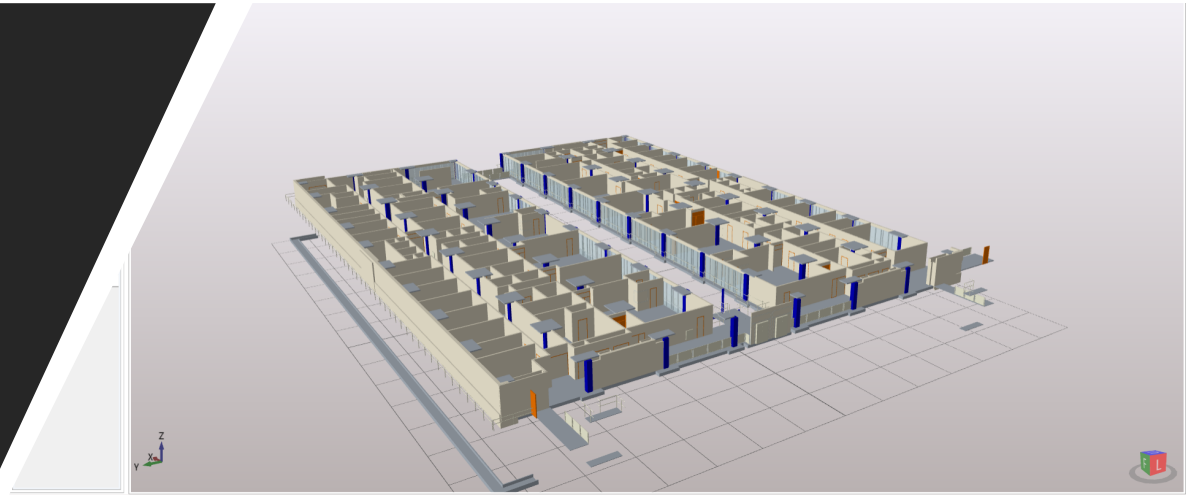
- 127 MB
- 778.000 faces
- Extensive U shape

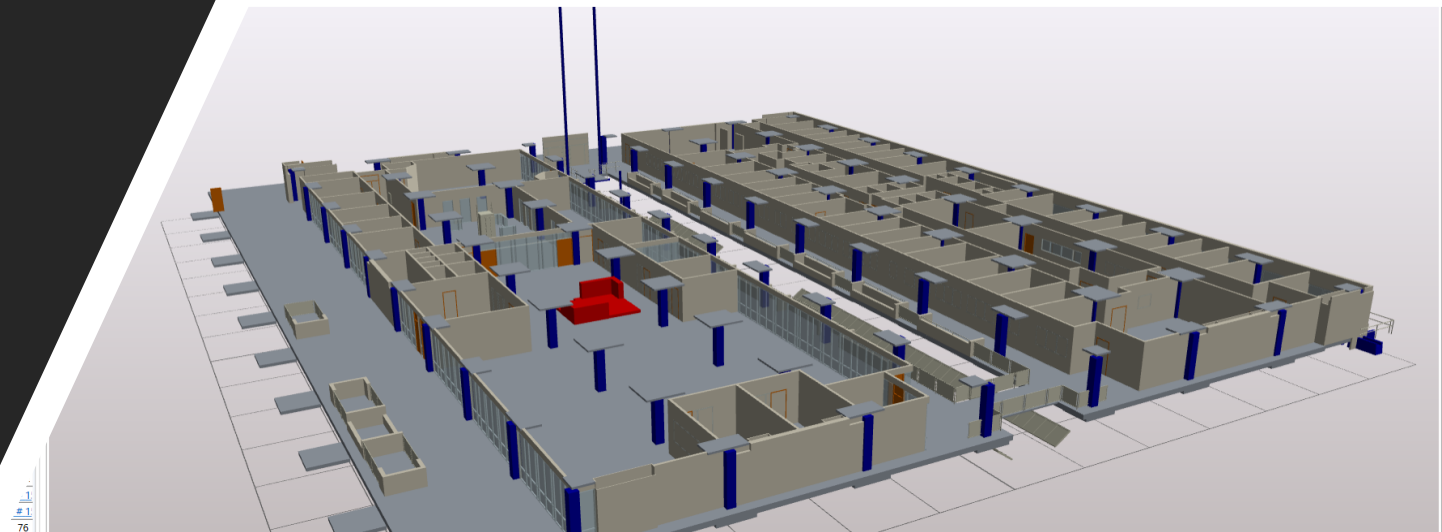


Semantic Isolation of Every Storey

+ IfcOpenShell

- Iterative process
- Identification of relationship among entities
- Grouping of the entities of the same object
- Writing of the objects that belong to the corresponding floor



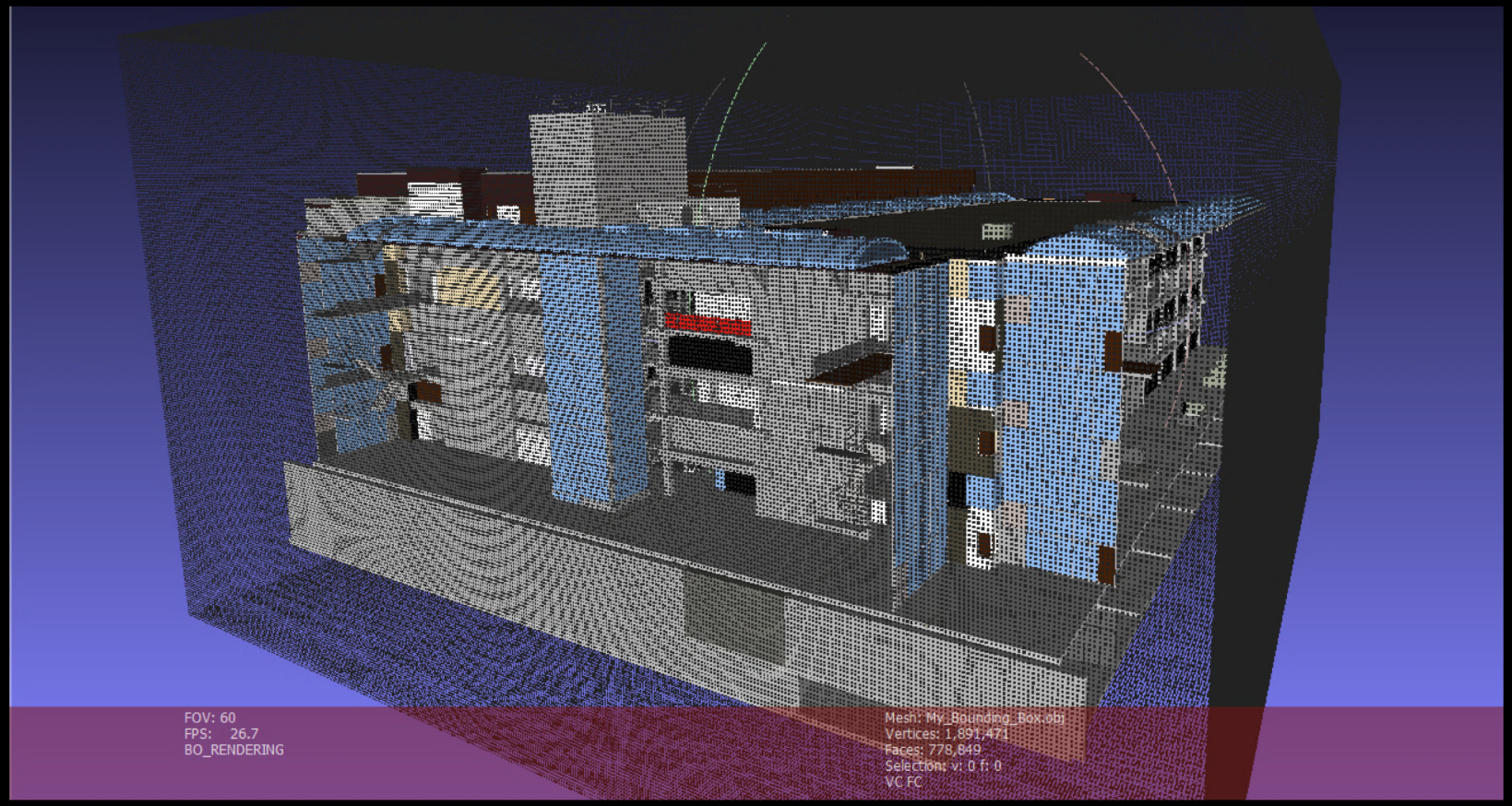


Isolation of the exterior part

- Creation of a Bounding Box & its Population with 3D points
- Raycasting & Distance Check
- Inclination Raycasting
- Split of the Model
- Semantical Enrichment

+ CGAL

Exterior Part: Bounding Box & 3D Points



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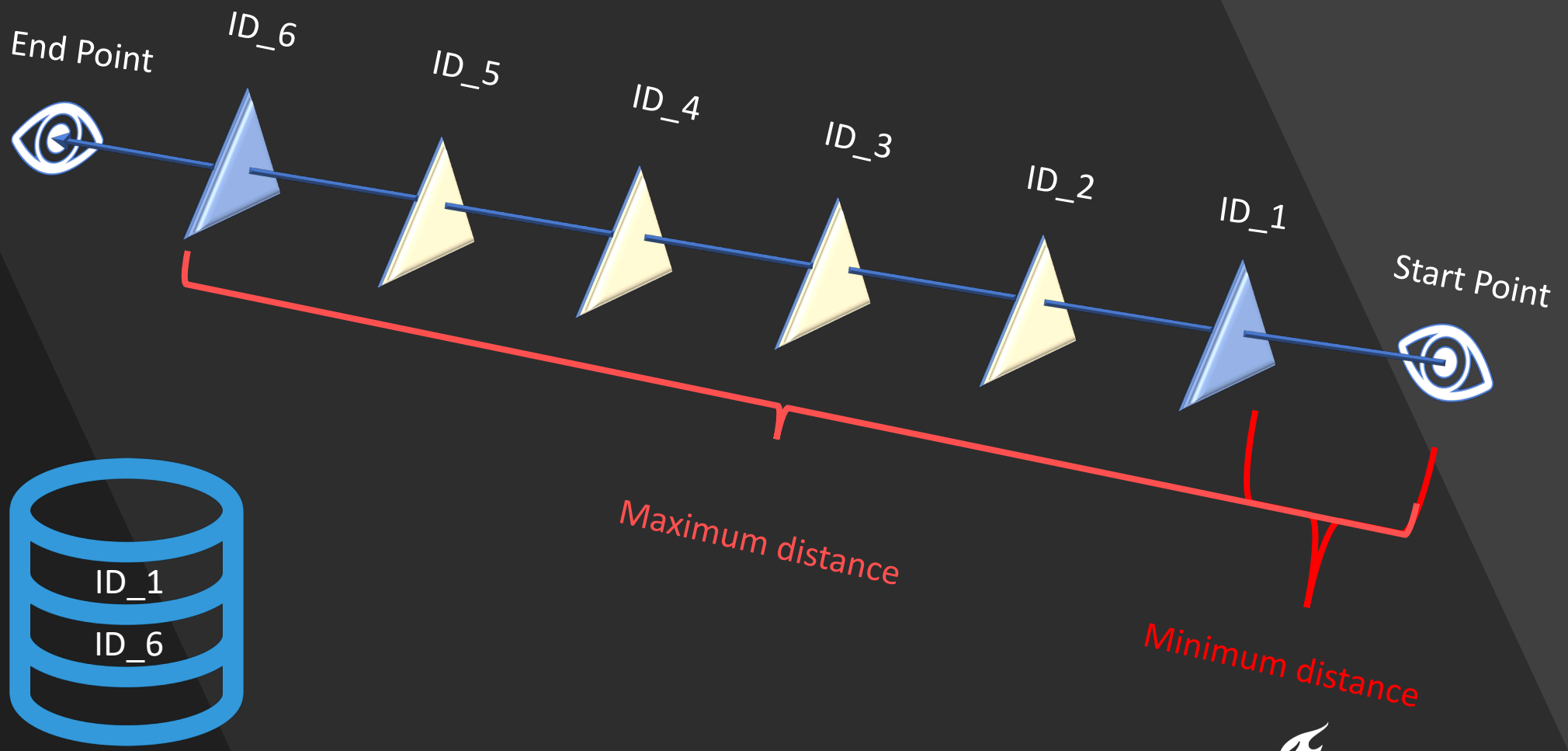
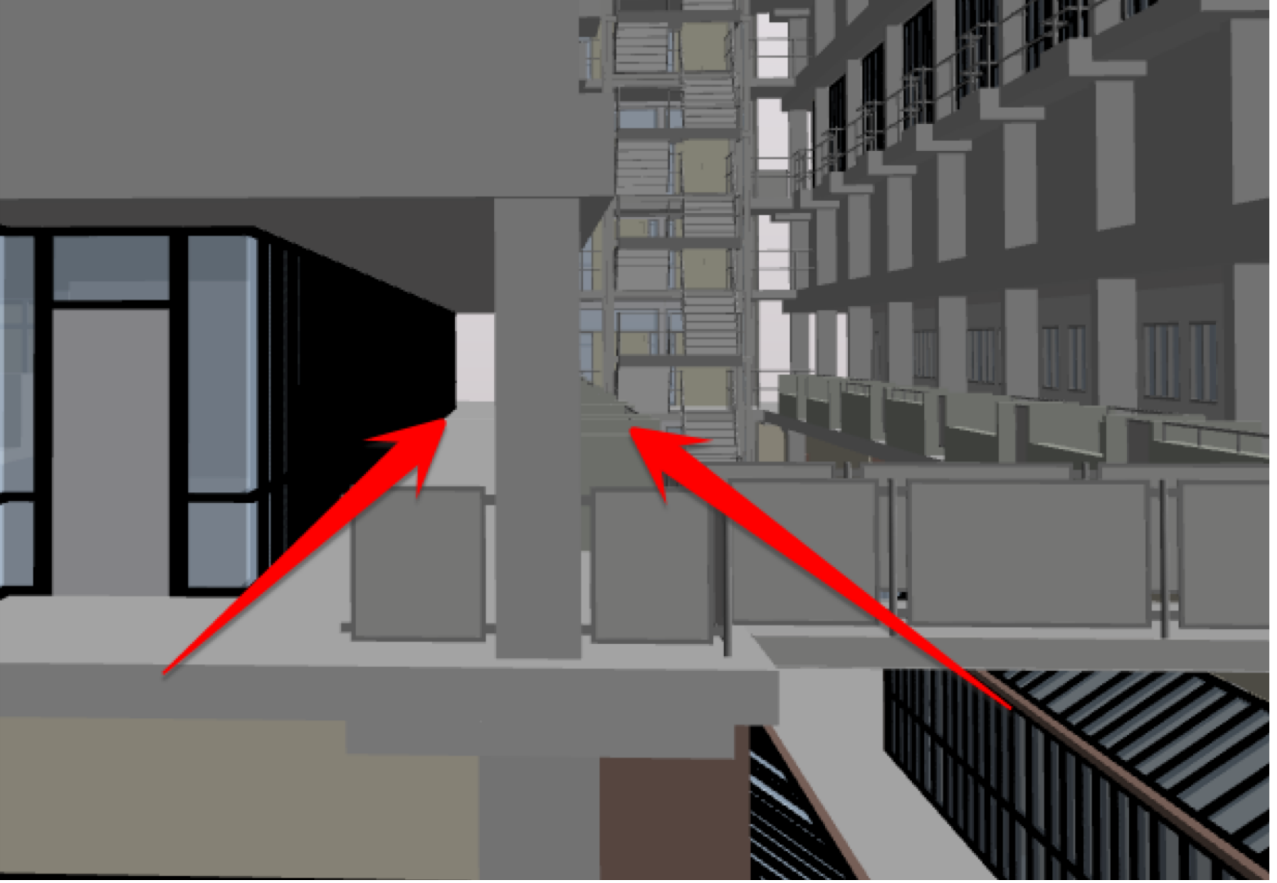
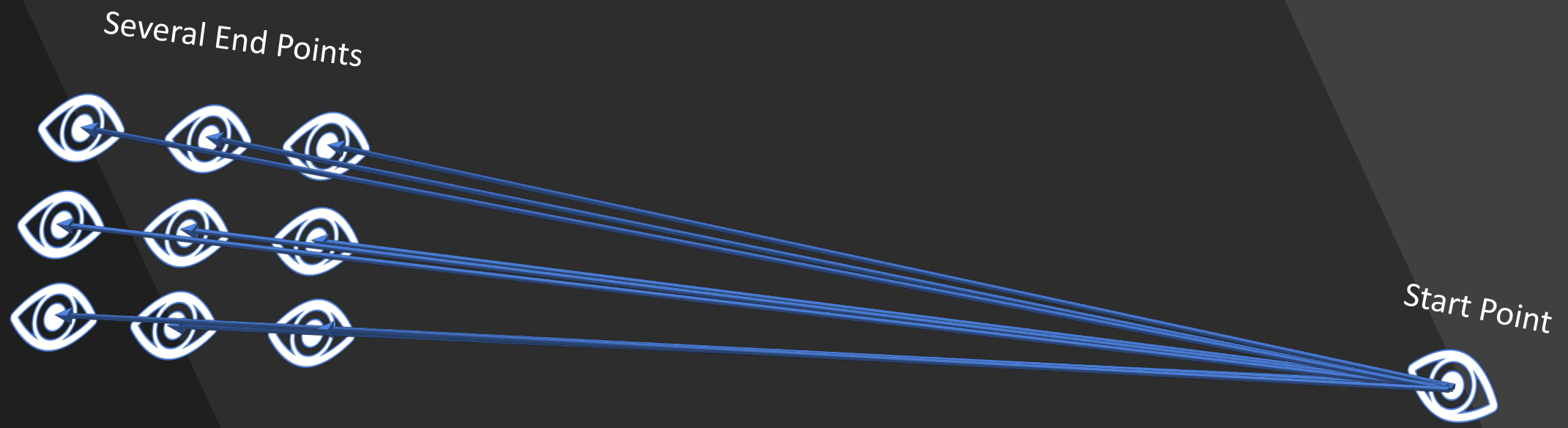
Exterior Part: Raycasting



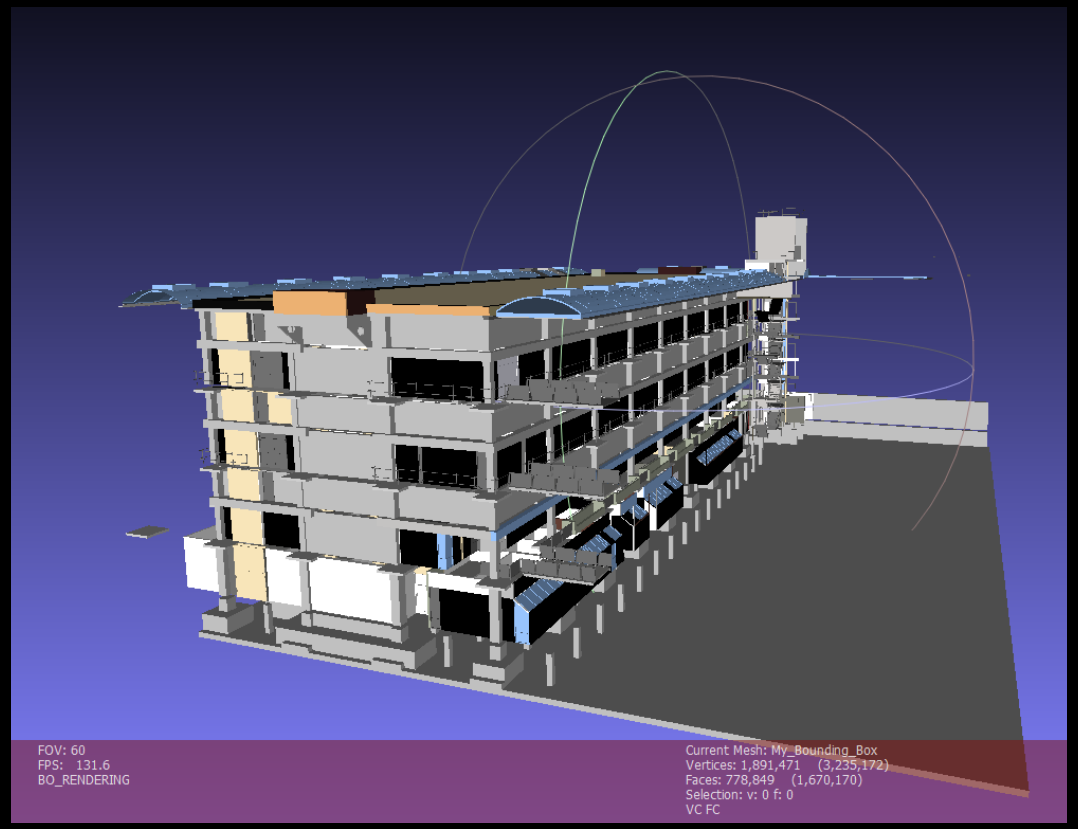


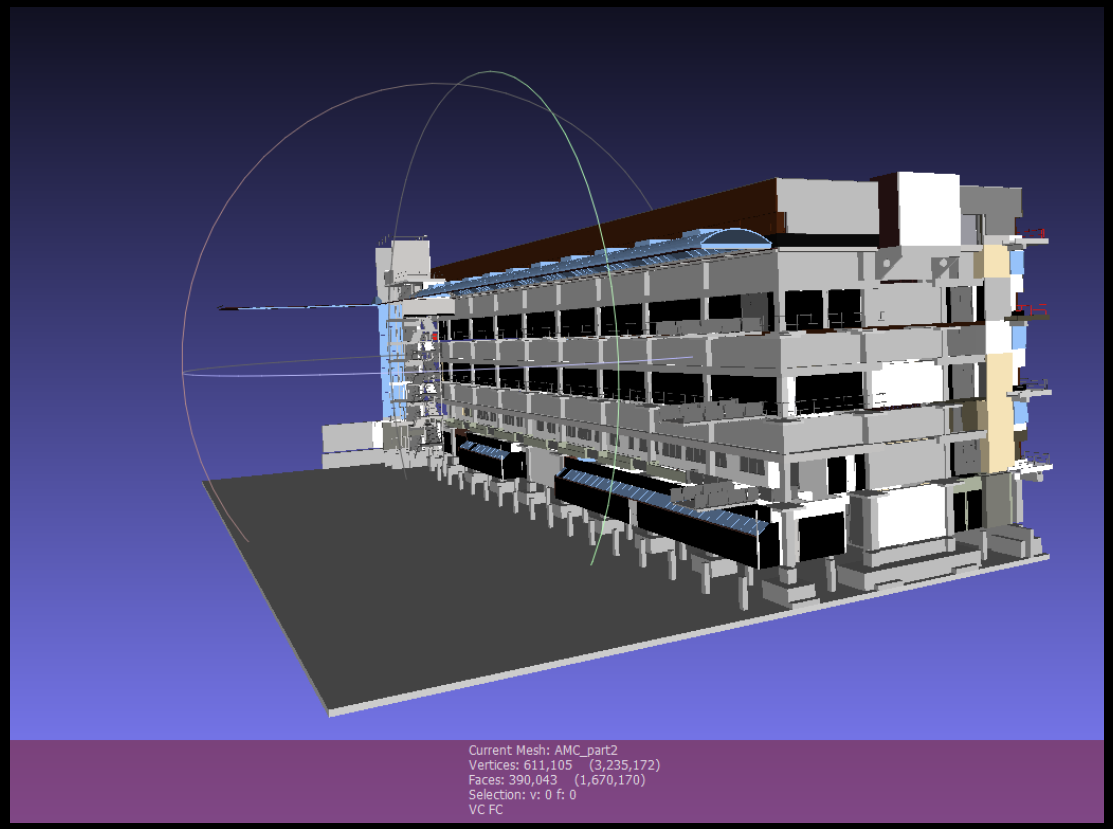
Exterior Part: Inclination Raycasting

Exterior Part: Inclination Raycasting



Exterior Part: Split of the Model





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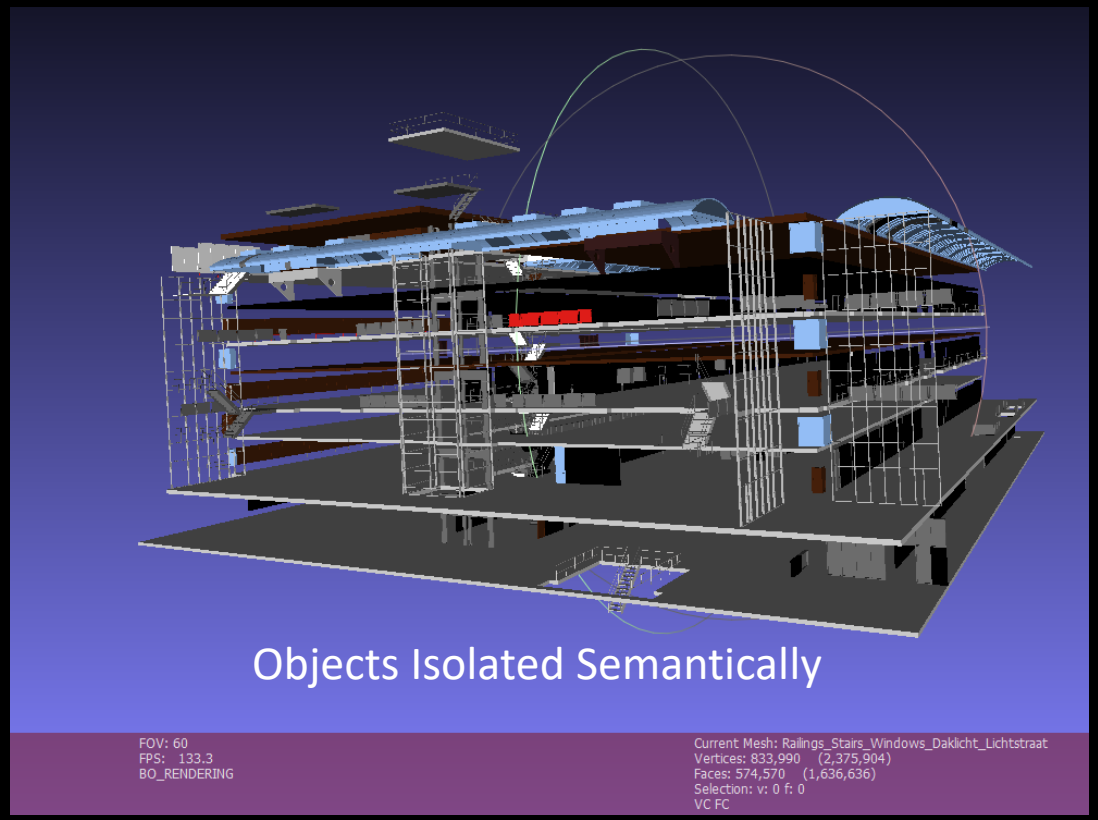
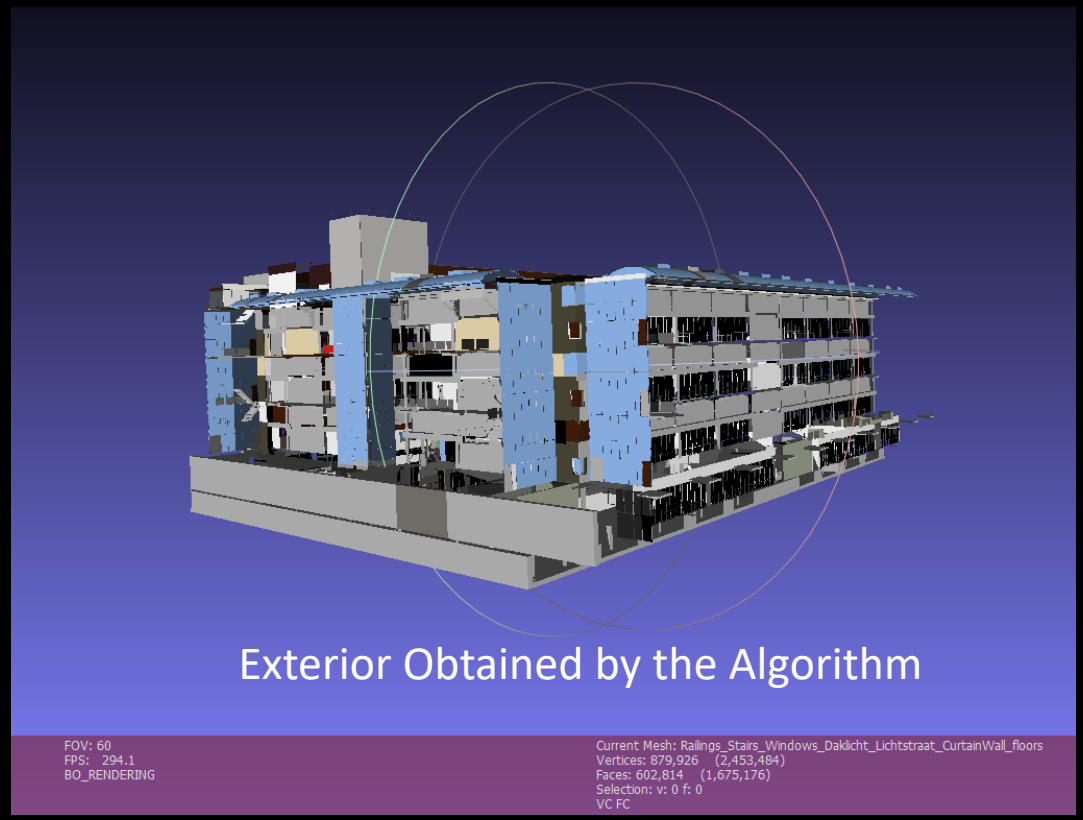
Exterior Part: Semantical Enrichment



Objects Isolated Semantically

+



Exterior Obtained by the Algorithm

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Holographic Scene & Hologram Manipulation

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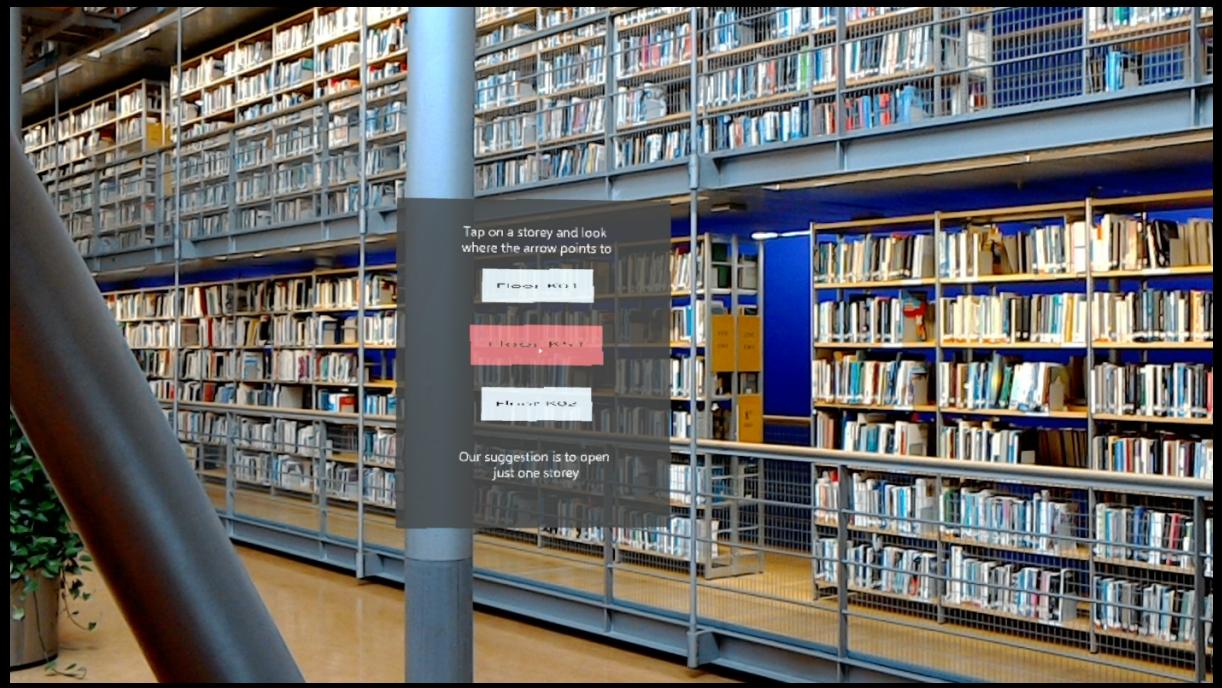
Results: Menu



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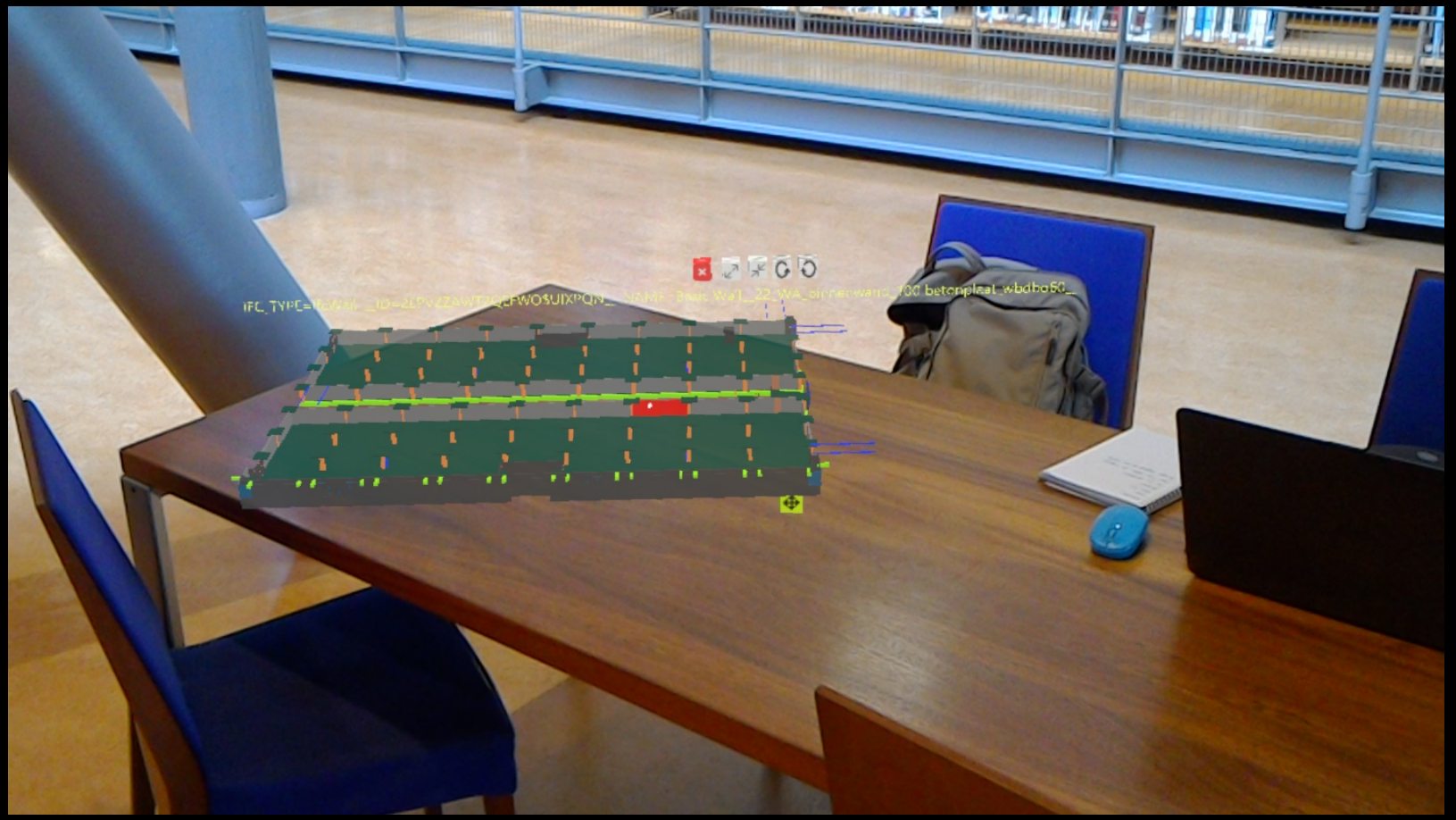
Results: Floor

Results: Color Highlighting & Metadata Visualization



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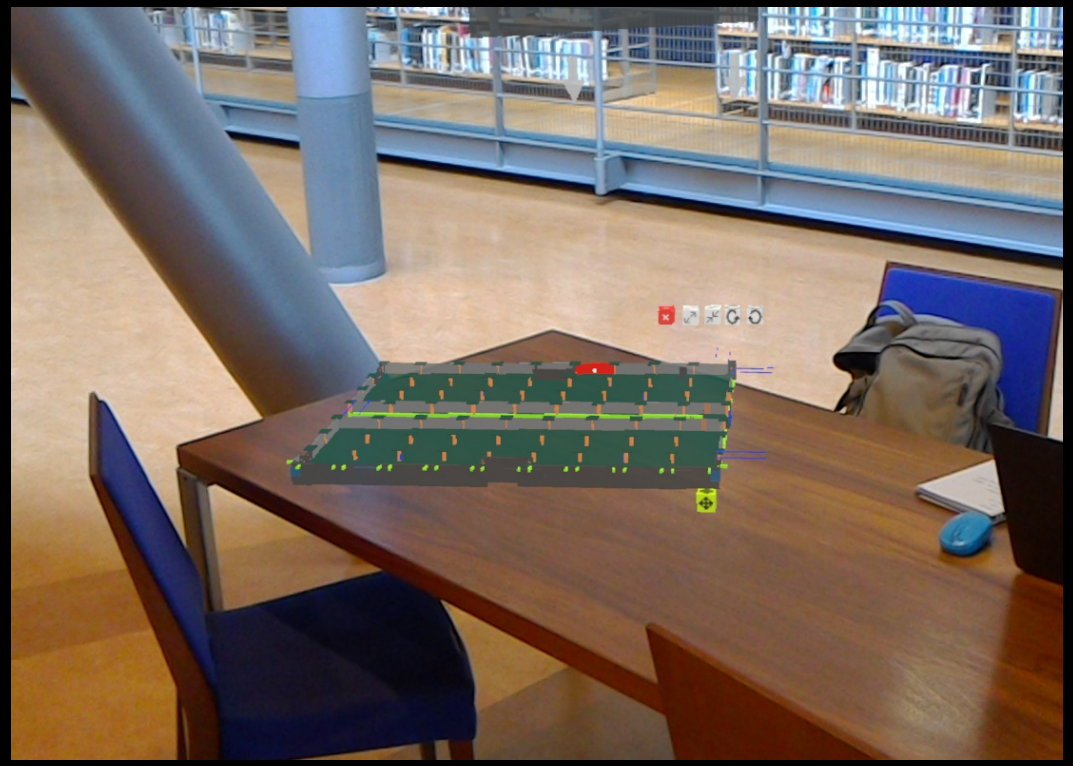
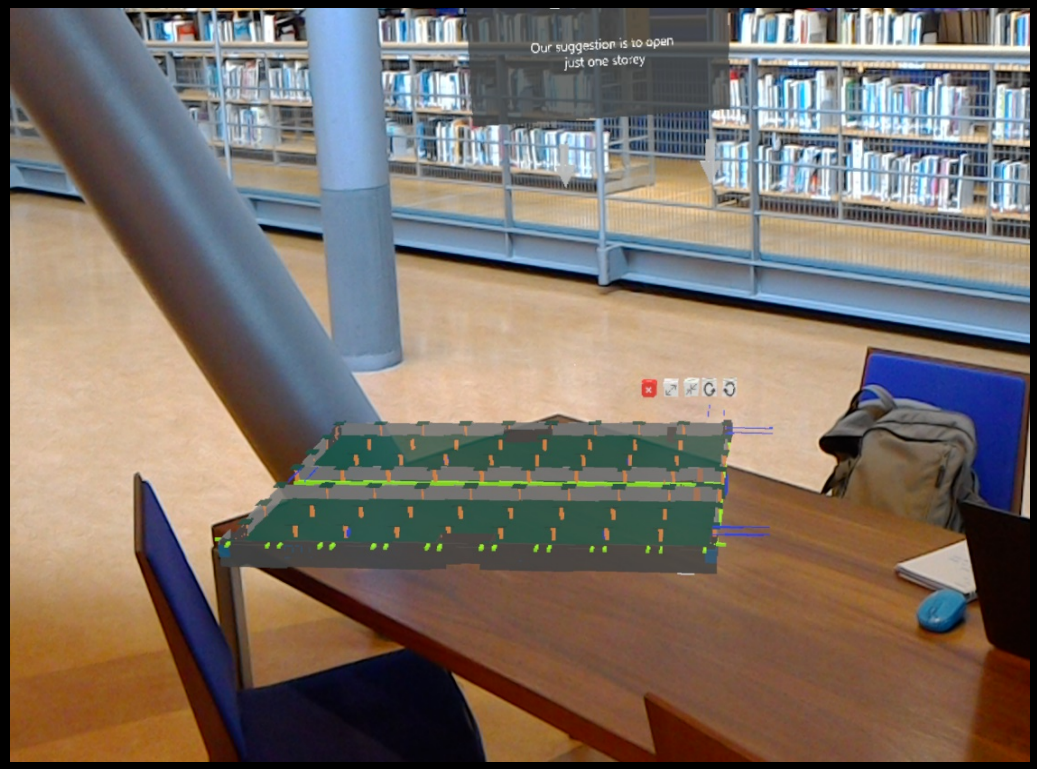
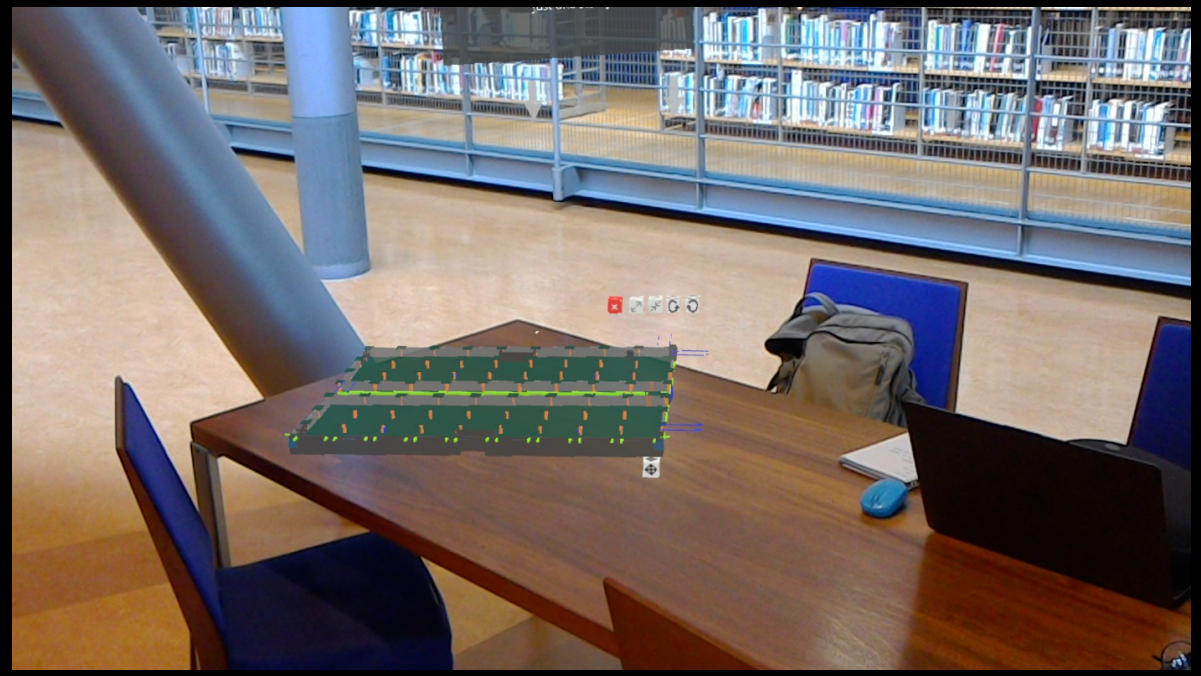
Results: Grow Functionality

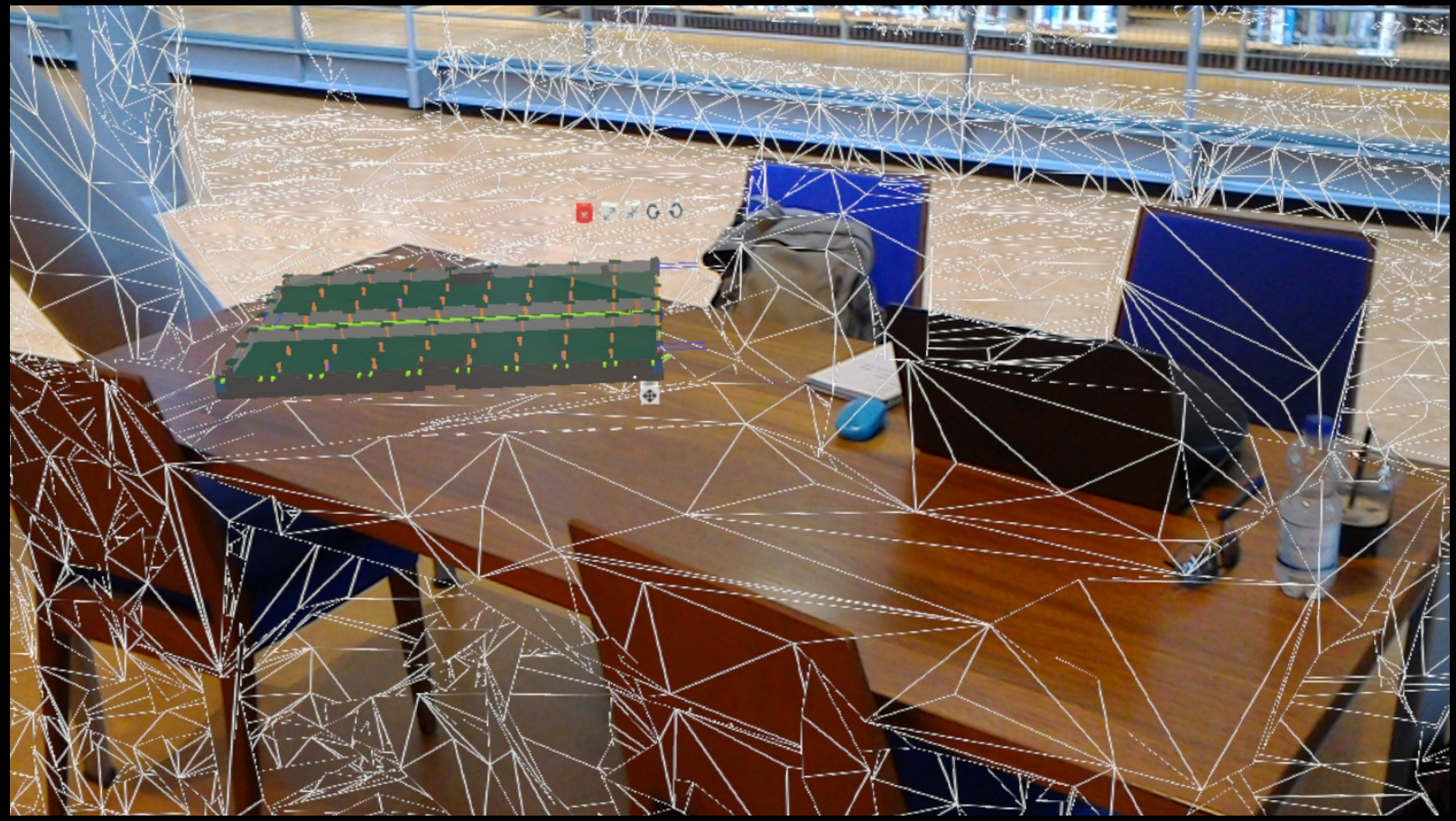




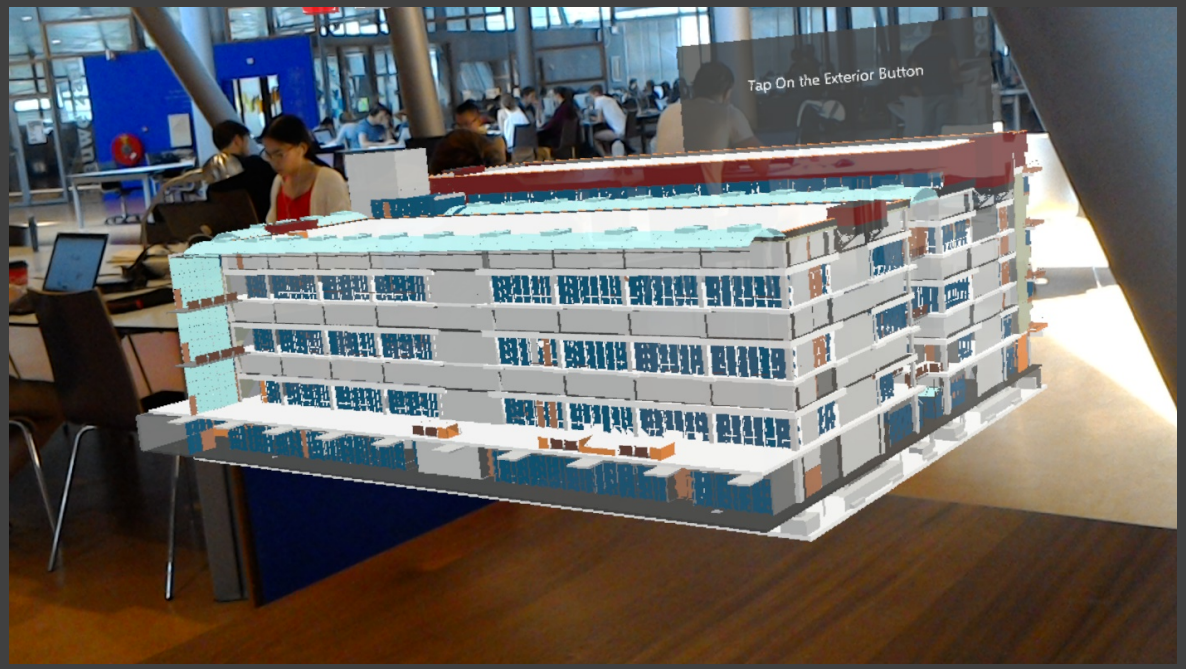
Results: Rotate Functionality



Results: Transportation of the Hologram



Results: Exterior Envelope



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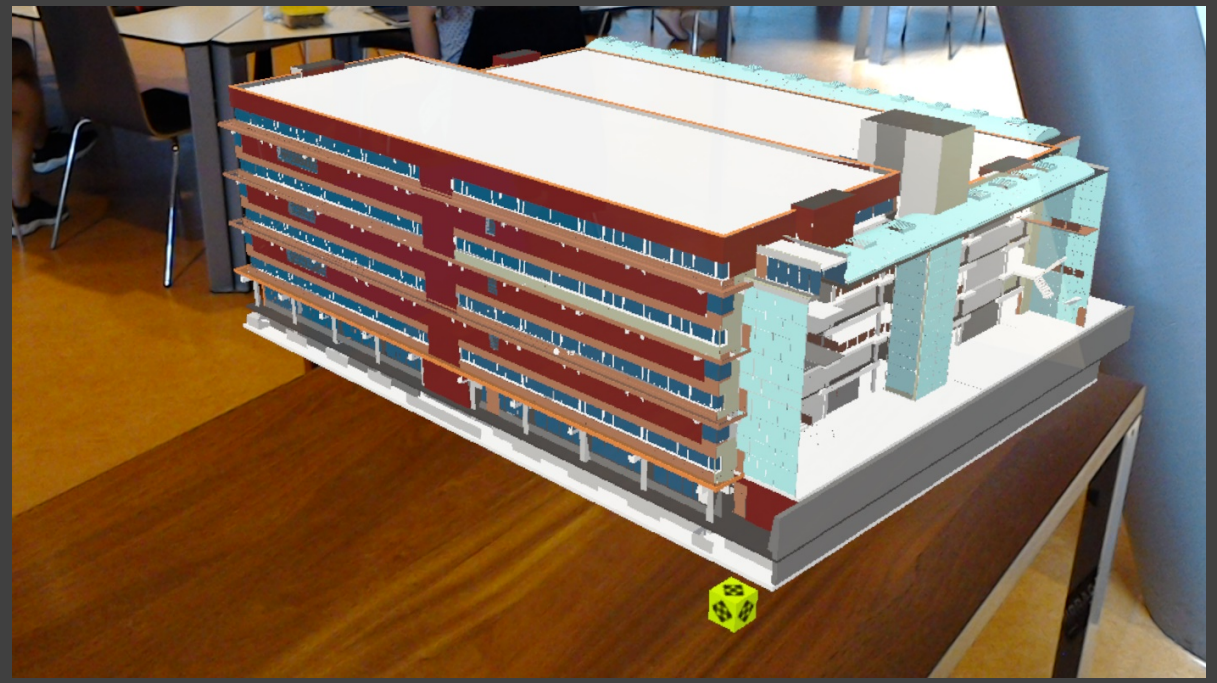
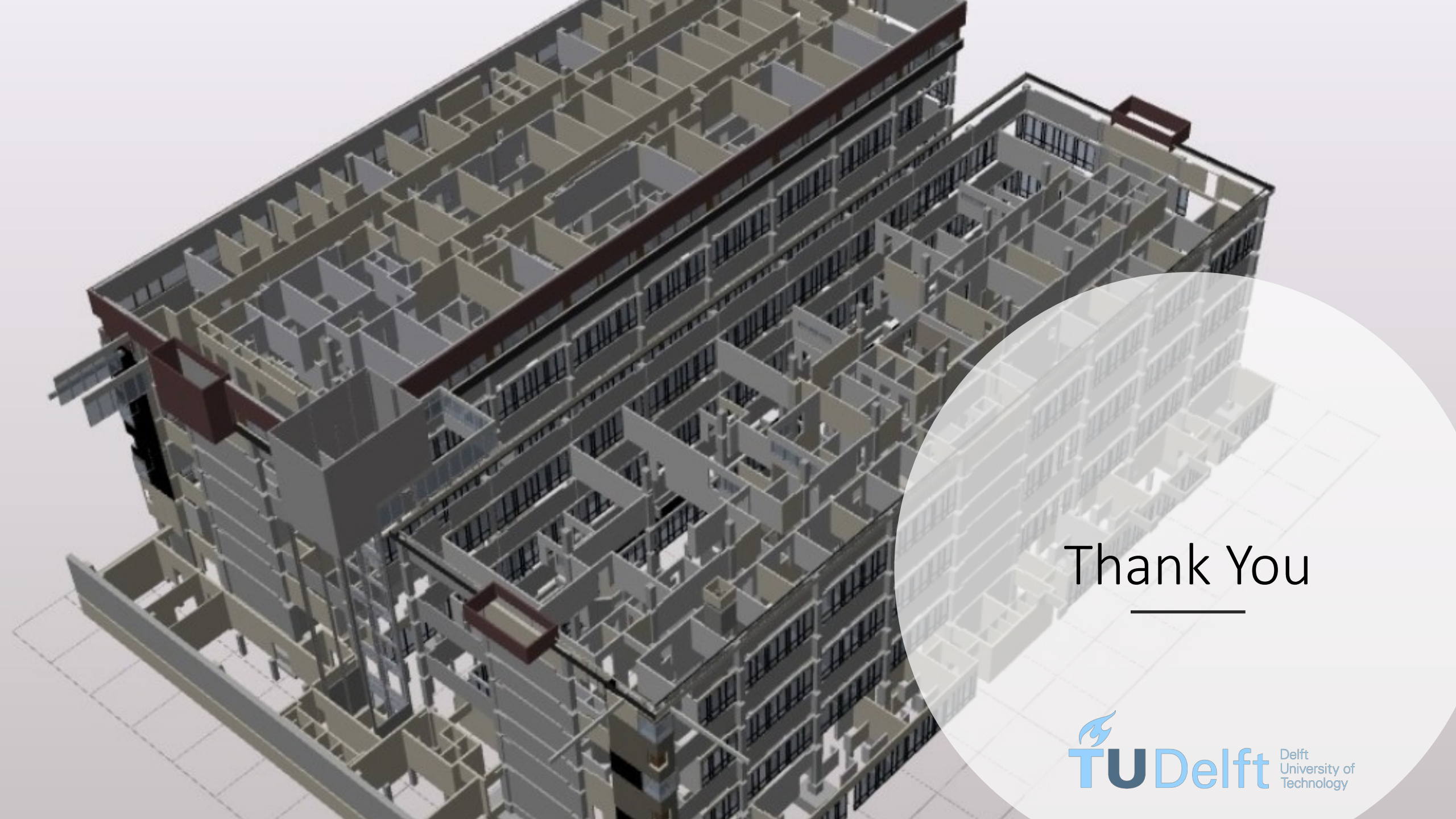
Results: Exterior Envelope



Conclusions

- Intuitive perception of the design
- Precision of the exterior shell depends on the number of points, rays & cores and complexity of the model
- Inclination raycasting facilitates the exterior extraction
- Dynamic interaction with holograms is possible (resizing, rotating and positioning the model)
- Hololens still has certain limitations



Thank You

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