3D GEOVISUALIZATION & STYLIZATION TO MANAGE COMPREHENSIVE AND PARTICIPATIVE LOCAL URBAN PLANS

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Motivation:

To adapt 3D renderings to Local Urban Plans elaboration









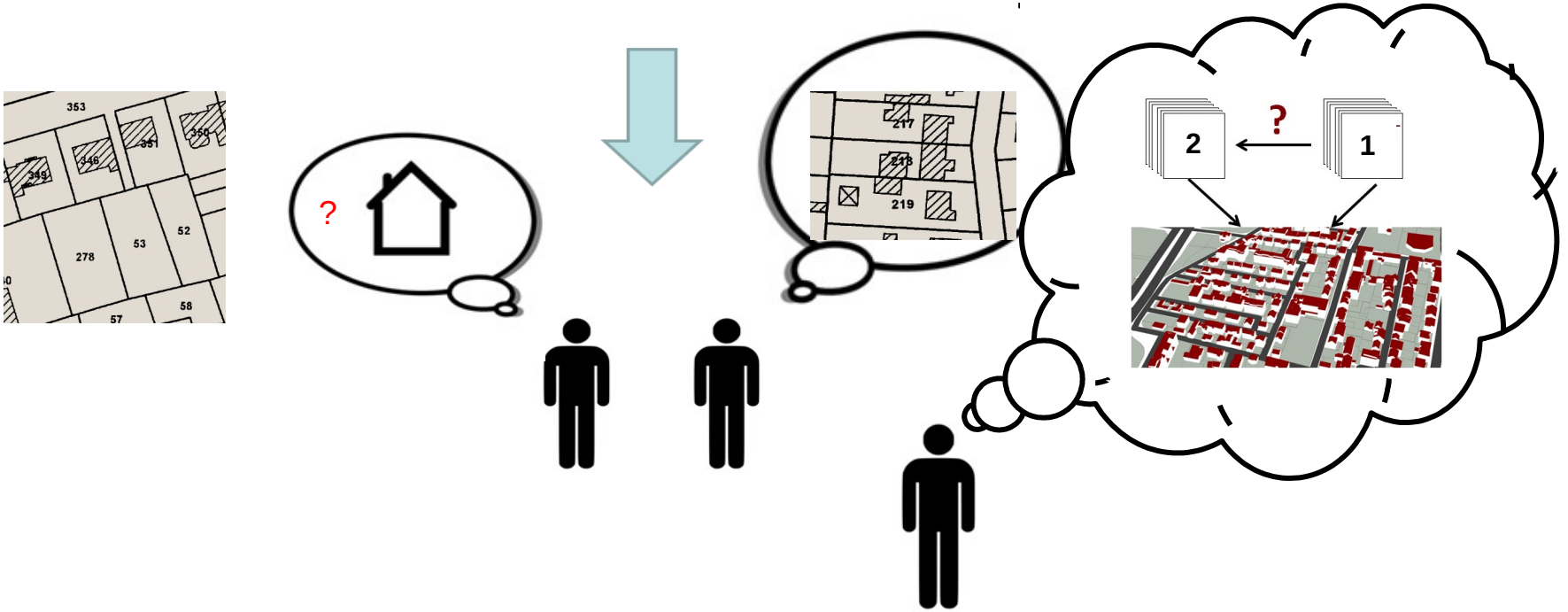







Public participation about urban regulation

- **Rights to build through 3D morphological constraints.**



« Horizontal distance measured from every points of the building to the nearest point of the parcel boundary must be lesser than the difference of altitude between these two points. »

➢ **How to design a 3D geovizualisation platform…**
….to ease public participation about LUPSs ?

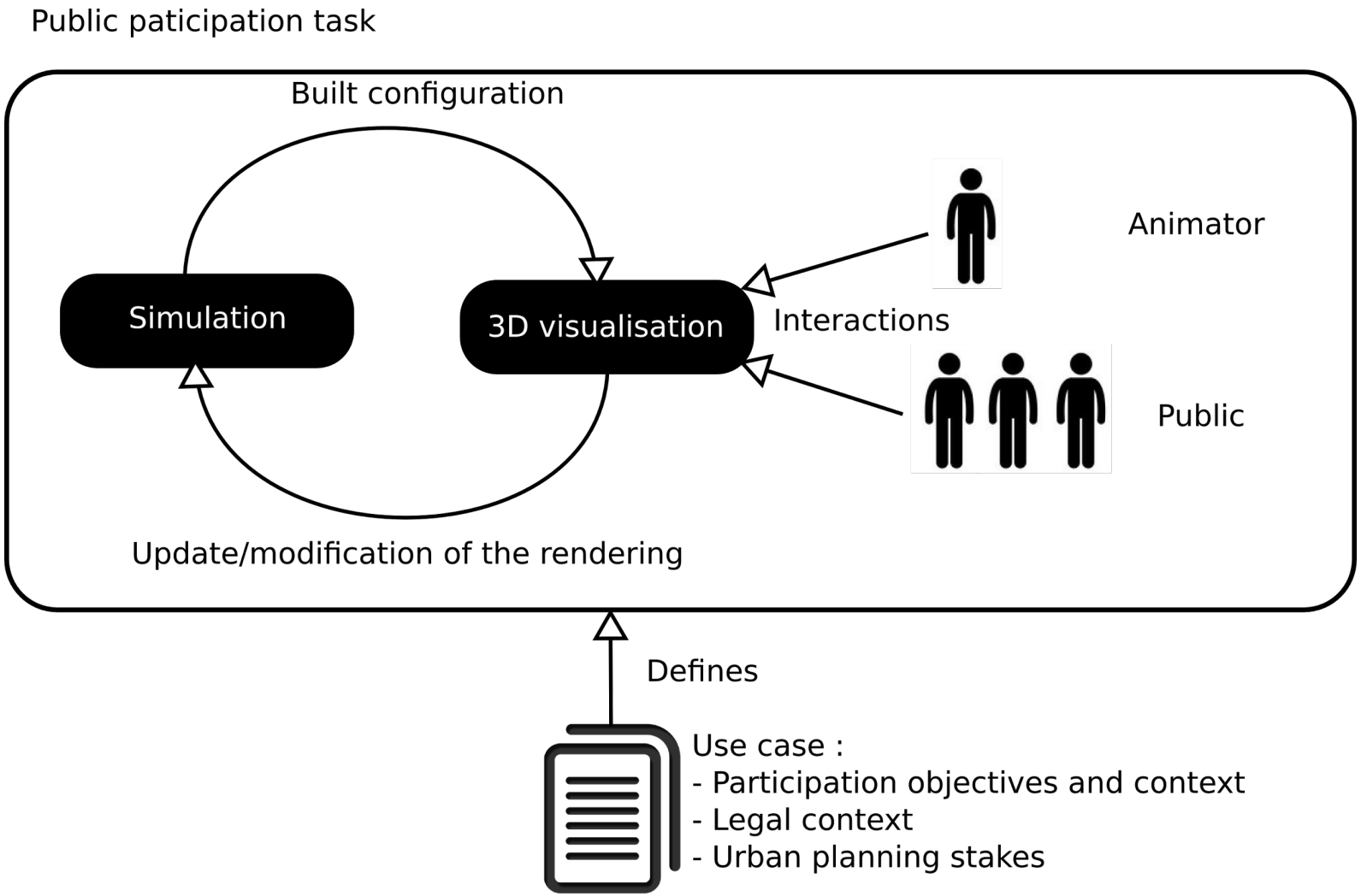
3D systems for public participation

- **Advantages of 3D visualizations**
  - Volume representation
  - Landmarks for spatial cognition
  - Interactive navigation

- **Practitioners' needs:**
  - Citizens participation to the making of morphological rules.
  - ➢ **Automatization of the pipeline & graphical versality**
  - Abstract stylization for simulation results
  - Simplified environment representation
  - Homogeneous LOD visualization
  - Complete 3D scene
  - ➢ **To design and implement a set of useful 3D styles**

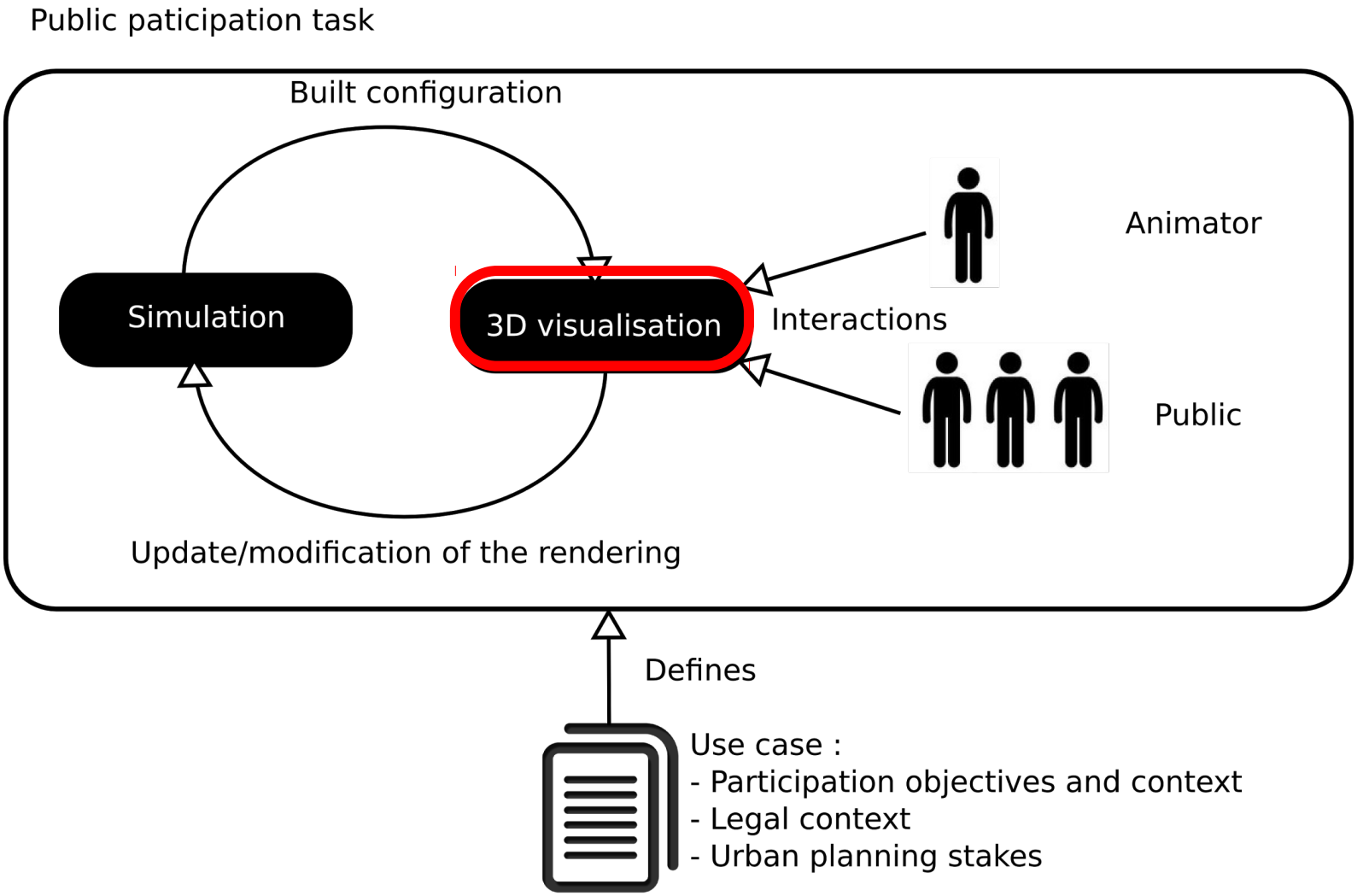
PLU ++ project: interdisciplinary approach

- **PLU ++ : 3D simulation, visualization and users' interactions, in order to ease public participation.**

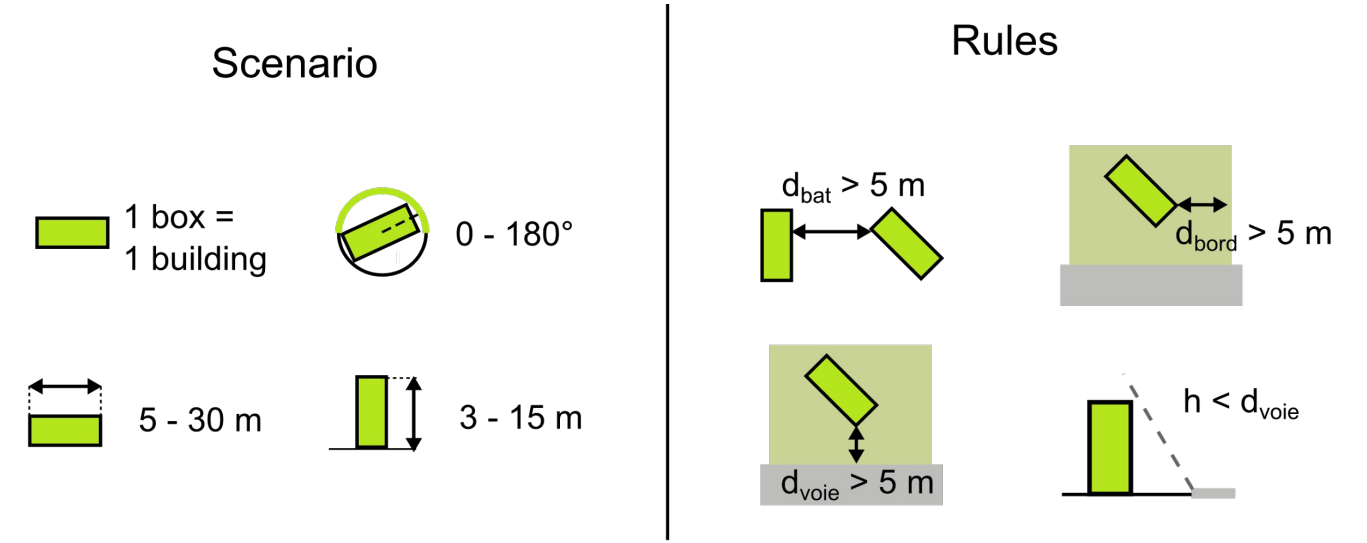


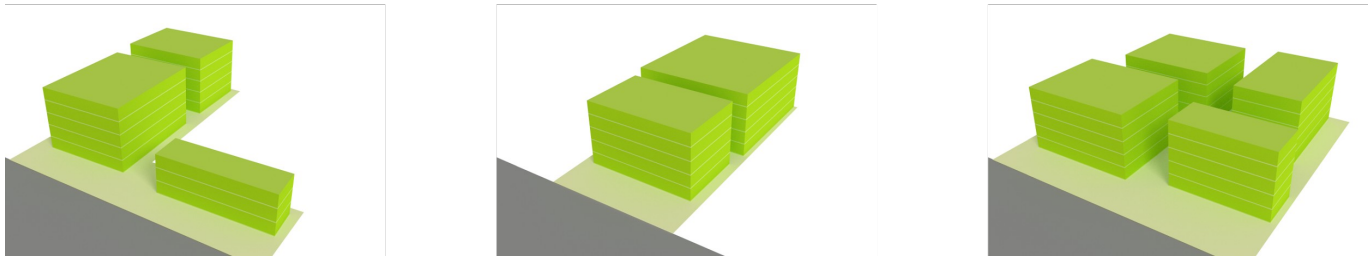
Goal of presented work

- **How to design a tool that provides a wide variety of 3D renderings to support tests about 3D perception ?**



3D simulator (SimPLU3D)



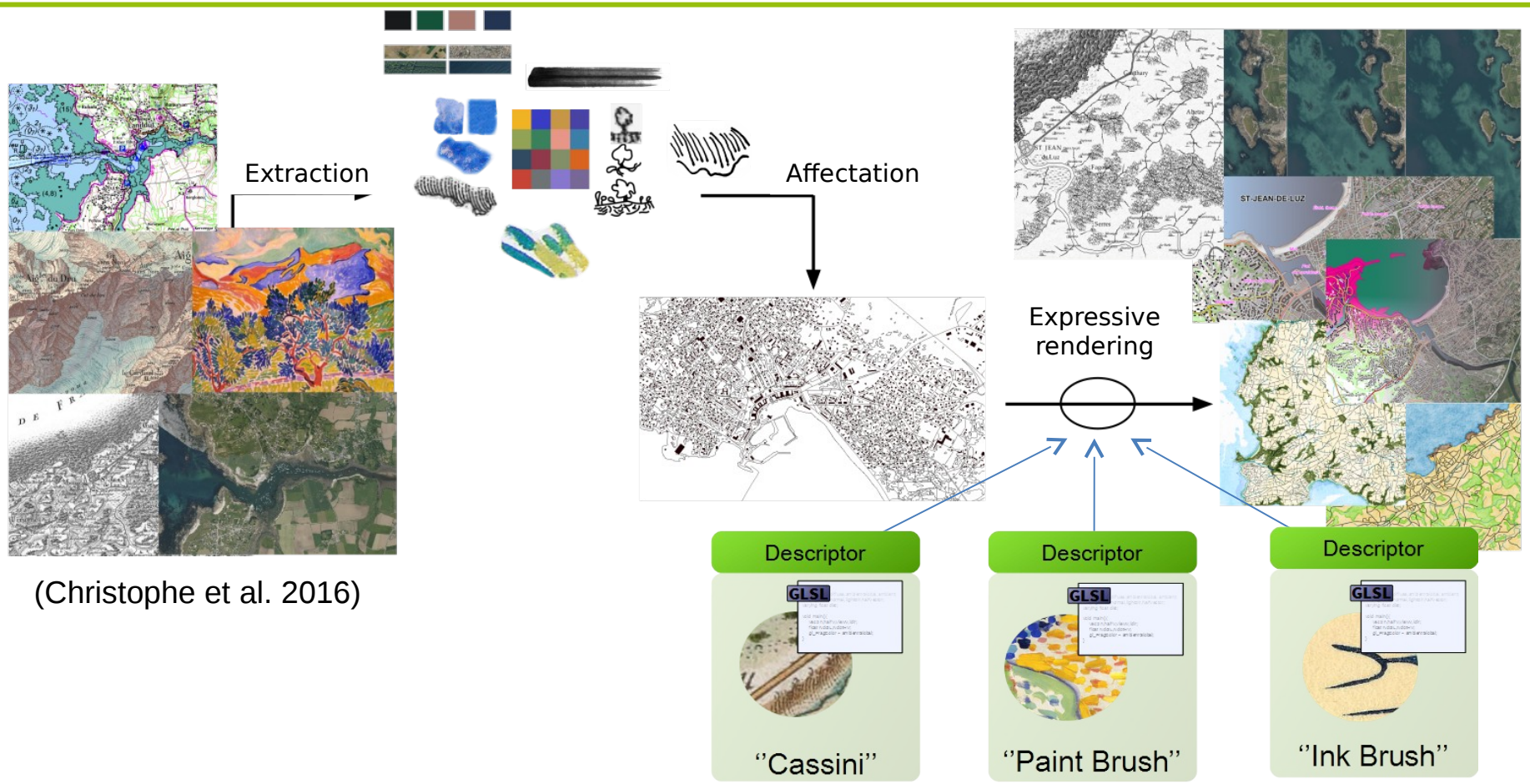


(Brasebin et al. 2015, 2016)

- **Information concerning constructibility: providing built configurations from a tested regulation.**
- **What could be built at the scale of a parcel: not what will be built…**

How to help citizens perceive morphological rules?

2D -> 3D stylization

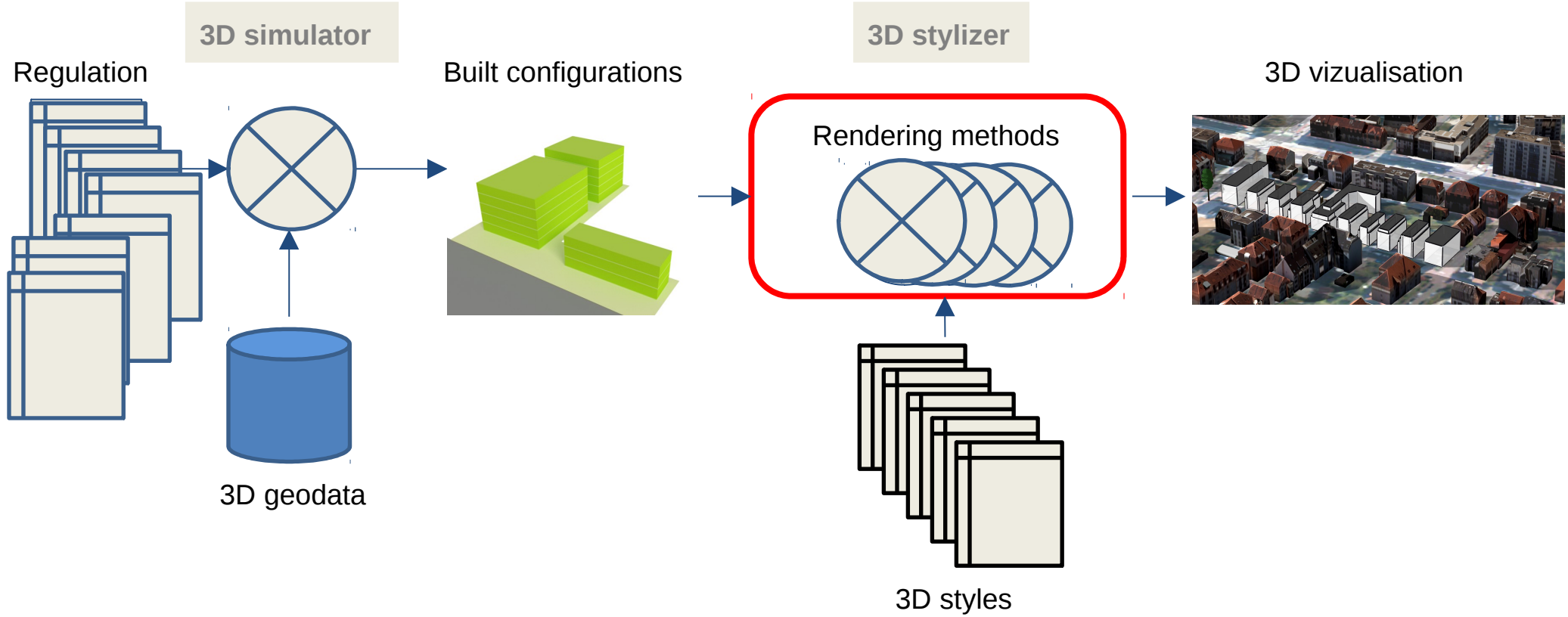


(Christophe et al. 2016)

- **OGC SLD/SE extension in order to integrate expressive rendering techniques:**

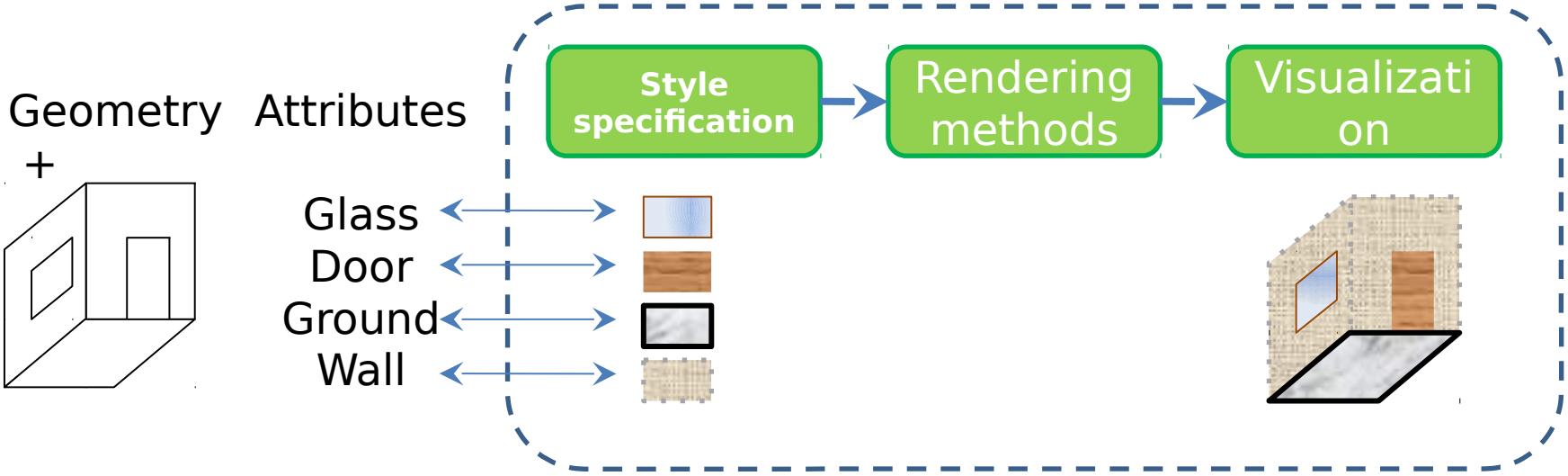
➢ **How to upgrade 2D map styles/rendering methods for 3D visualization?**

Purpose

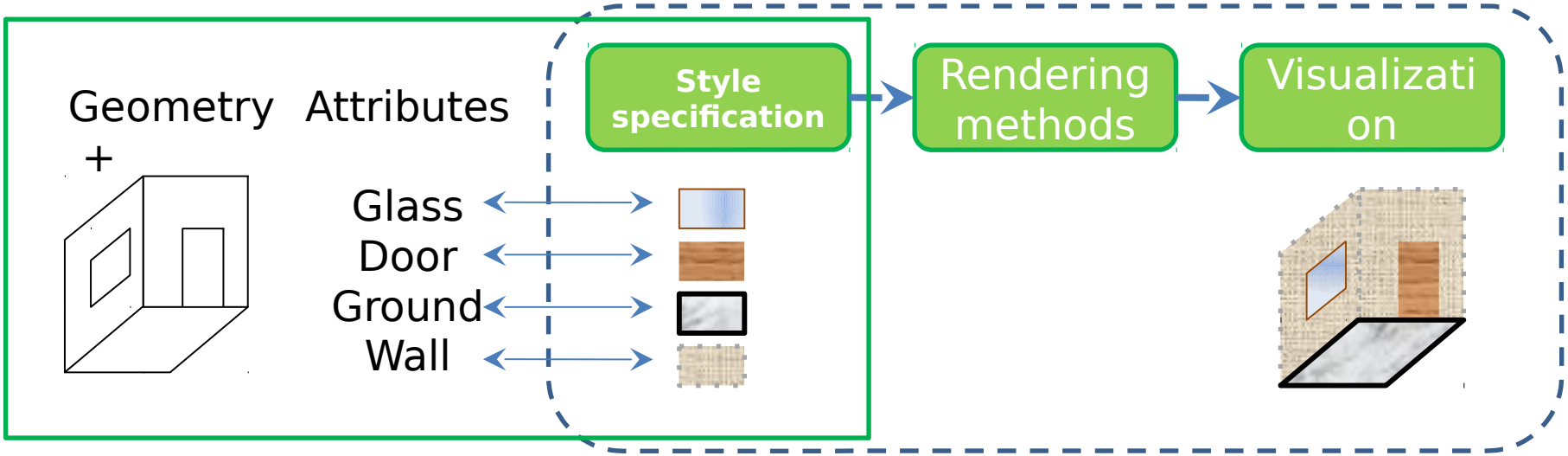


- **3D Geovisualization system requirements:**
  - Generic and expressive formalization of 3D styles
  - Possibility to integrate new rendering methods

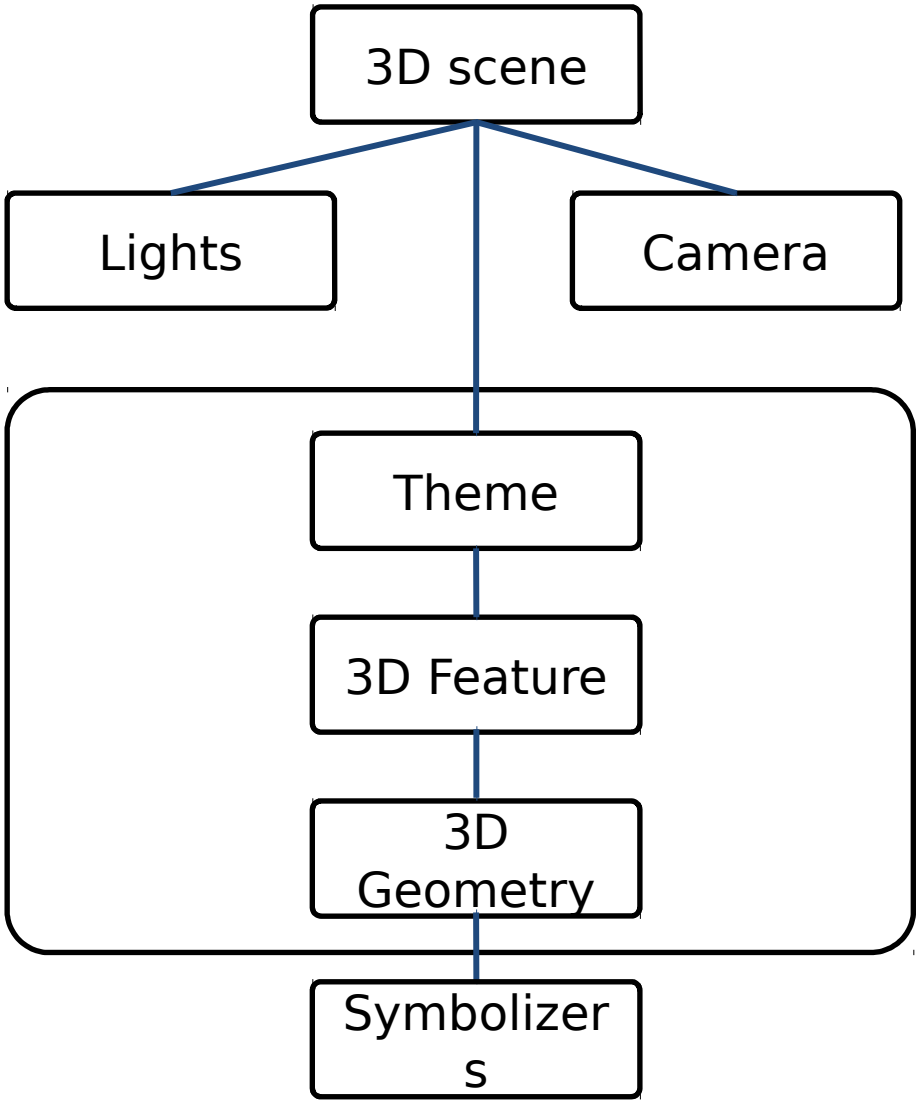
From Data to 3D geovisualization



From Data to 3D geovisualization



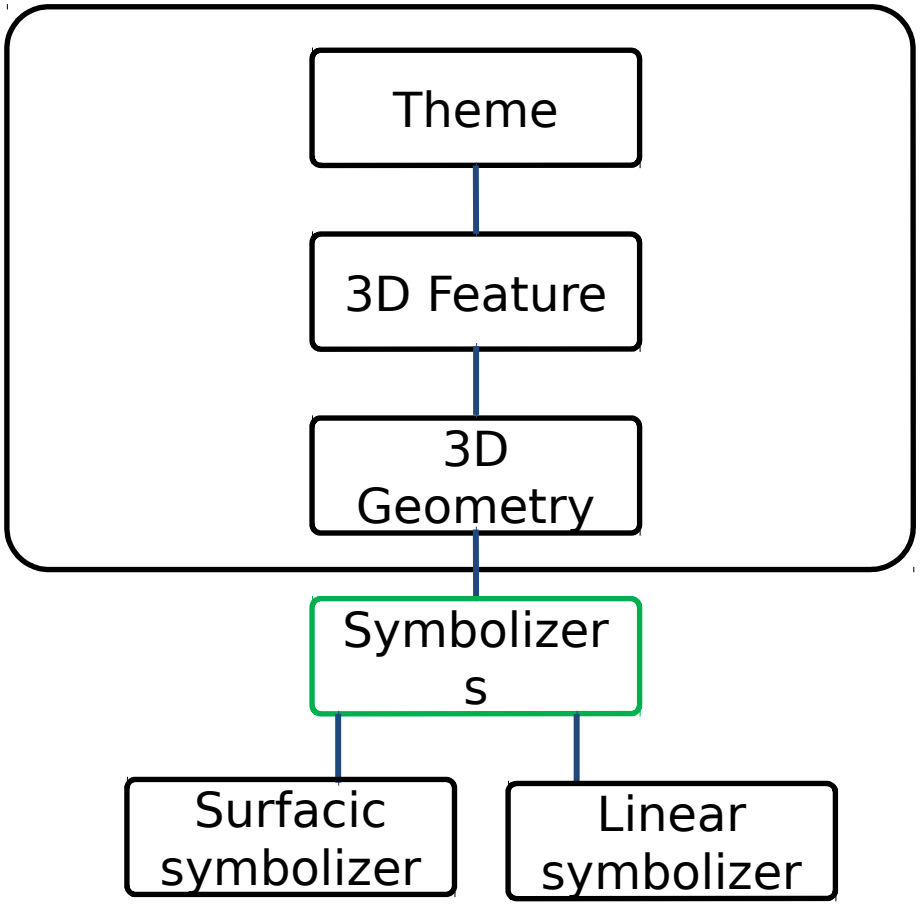
Style specification: scene organization



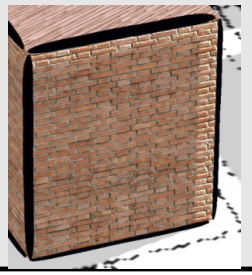
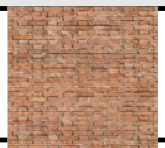
- **Scene content description**

Style specification: *Symbolizer* model

- ***Symbolizer*:** style descriptor assigned to each type of geometry.



- Several symbolizers could be applied to represent data.
- Controlled by a set of parameters.
- Expressiveness is related to variety and complexity of parameters.

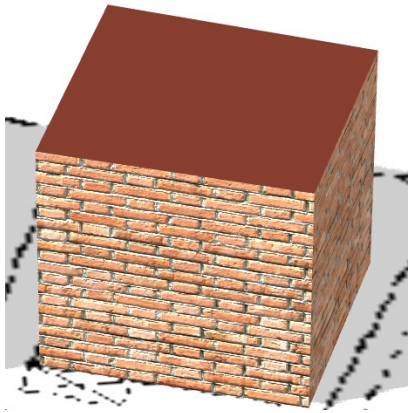
3D geometry	*Symbolizer*	*Visualization*
Edge		
Face		

3D styles specification to test the model

4 characteristical 3D styles for various uses

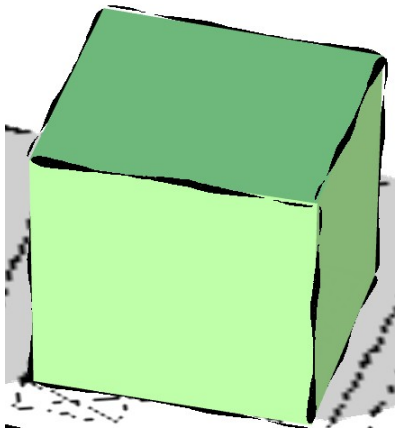
- Definition of expected visual properties: parameters and rendering methods.

Photorealistic

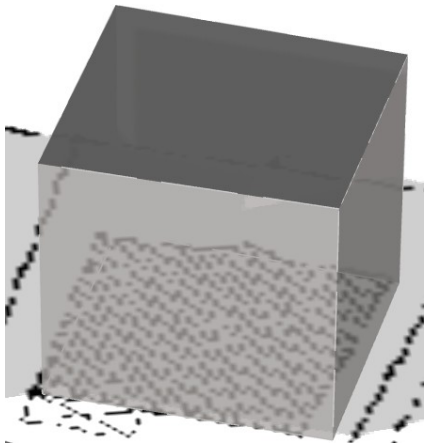


Typical

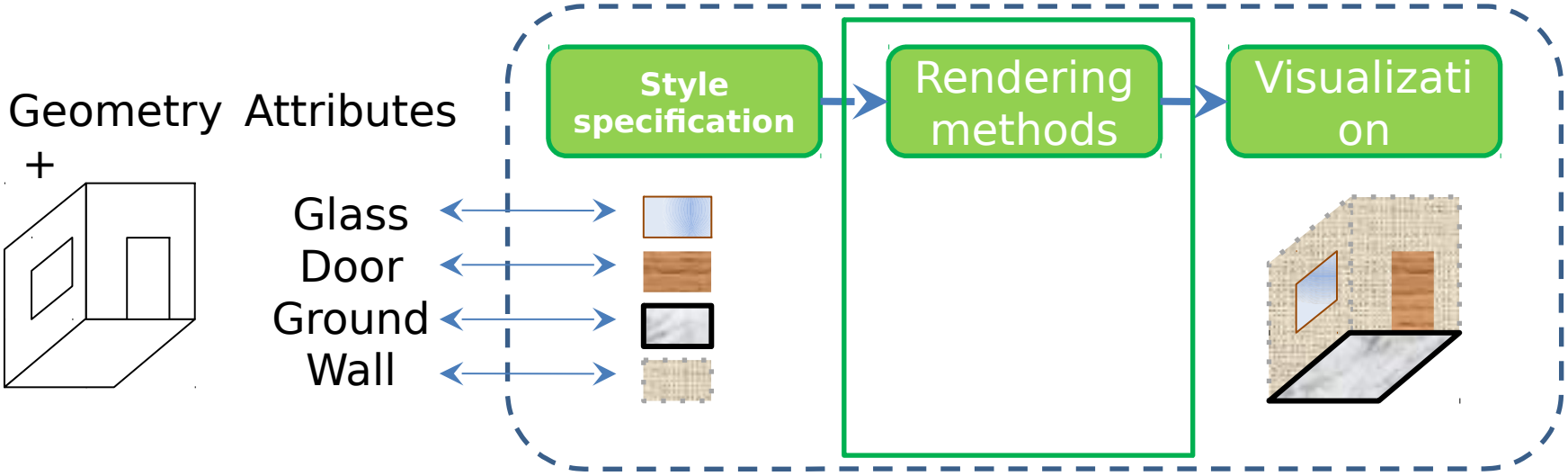
Sketchy



Discreet

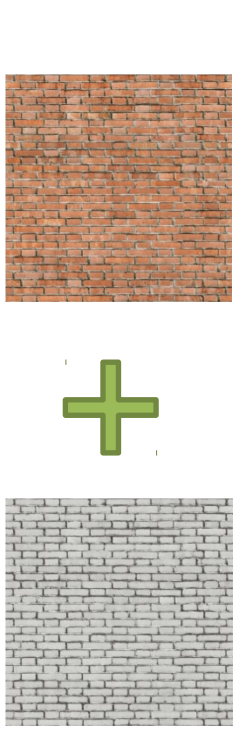


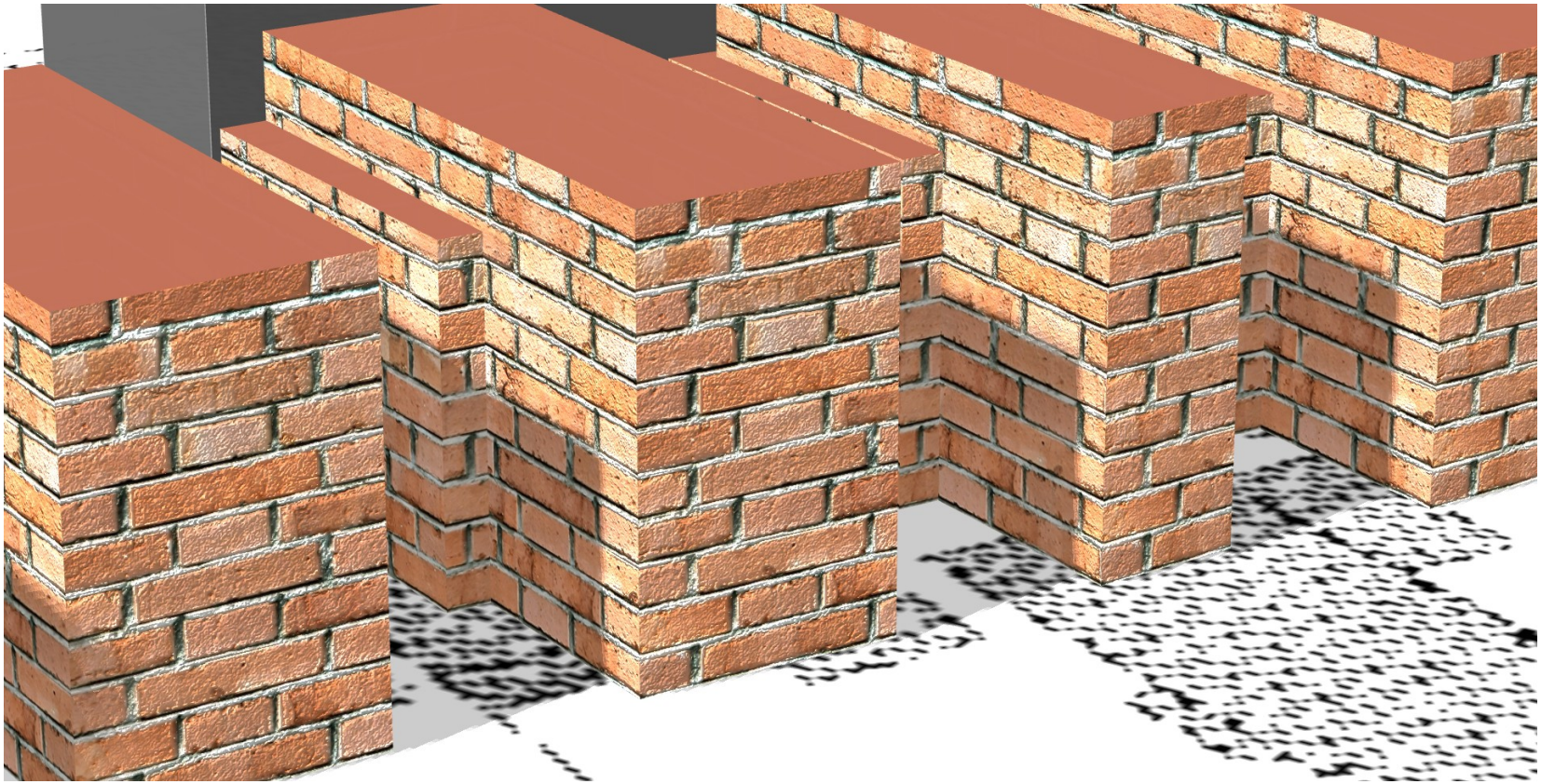
From Data to 3D geovisualization



Rendering method: example

- **UV mapping and bump mapping:**
  - Association between 2D texture coordinates and 3D geometry coordinates
  - Relief creation by considering grayscale

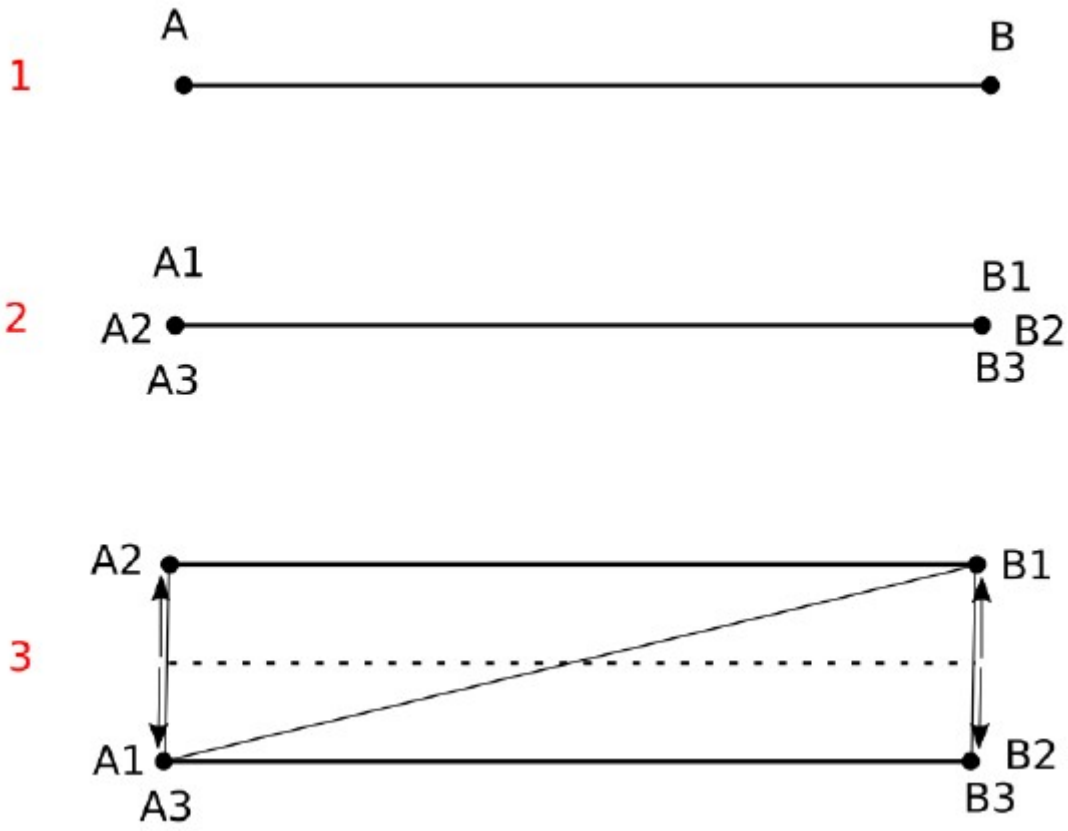




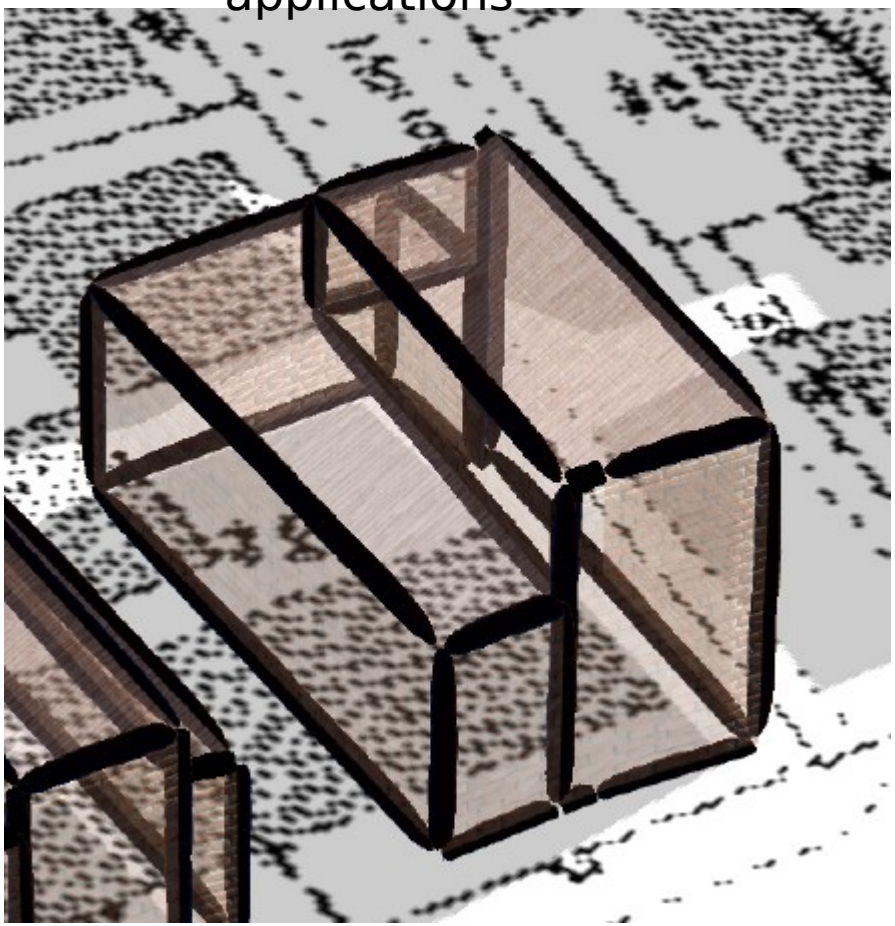
Rendering method: example

- **Expressive stroke**

Edge transformation to rectangles

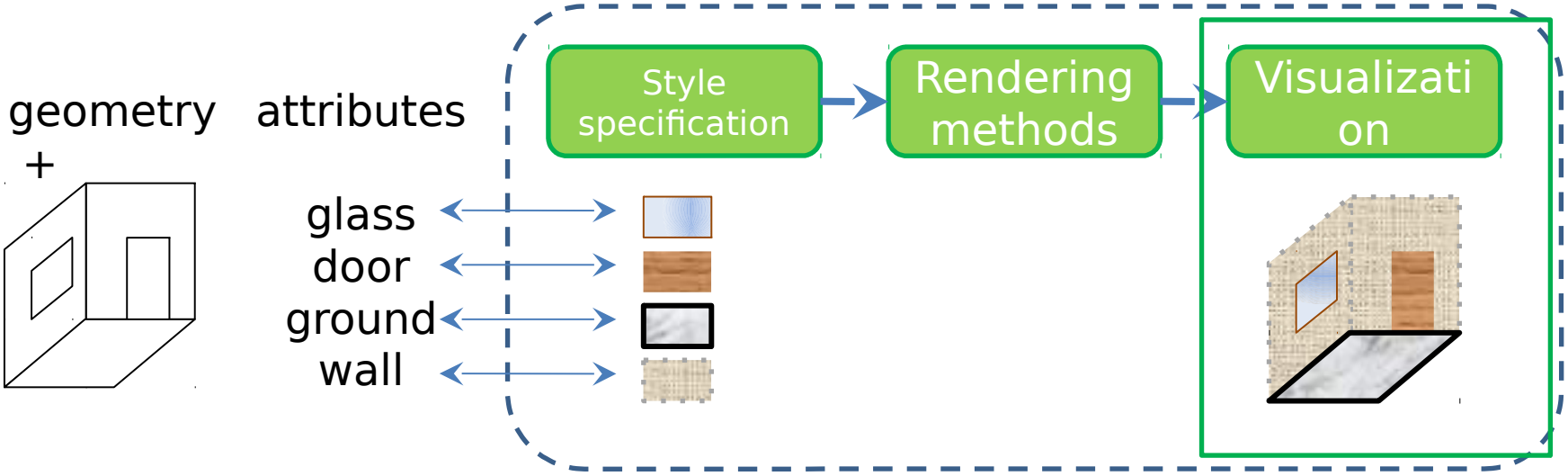


Texture applications



Rectangle orientation is controlled according to camera position

From Data to 3D geovisualization



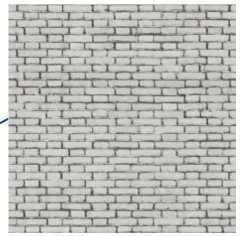
Implementation

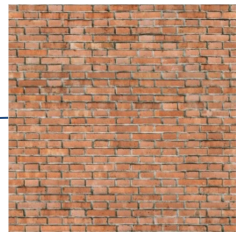
- **PLU ++ proof of concept** (https://github.com/IGNF/PLU2PLUS)
  - GUI implementation: Javascript + ThreeJS
  - Rendering method: GLSL

JSON style implementation

```
{
    "id": "2",
    "name": "Murs focus",
    "URI": "./models/Wall_Hini_4.0_Slope_2.5.obj",
    "style": {
        "name": "Discret",
        "parameters": {
            "fill": {
                "opacite": 0.99,
                "color": "#1da485",
                "type": "shader",
                "parameters": {
                    "bmap": "./textures/bump_brick.jpg",
                    "image": "brick.jpg",
                    "repeat": 0.1,
                    "shader": "hatching",
                    "id": "hatch_",
                    "diffuse": 0.7
                }
            },
            "stroke": {
                "opacite": 0.5,
                "color": "#000000",
                "type": "Sketchy",
                "parameters": {
                    "shader": "sketchy_strokes",
                    "image": "thick",
                    "width": 60
                }
            }
        }
    },
    "order": 1
},
```

Layer management

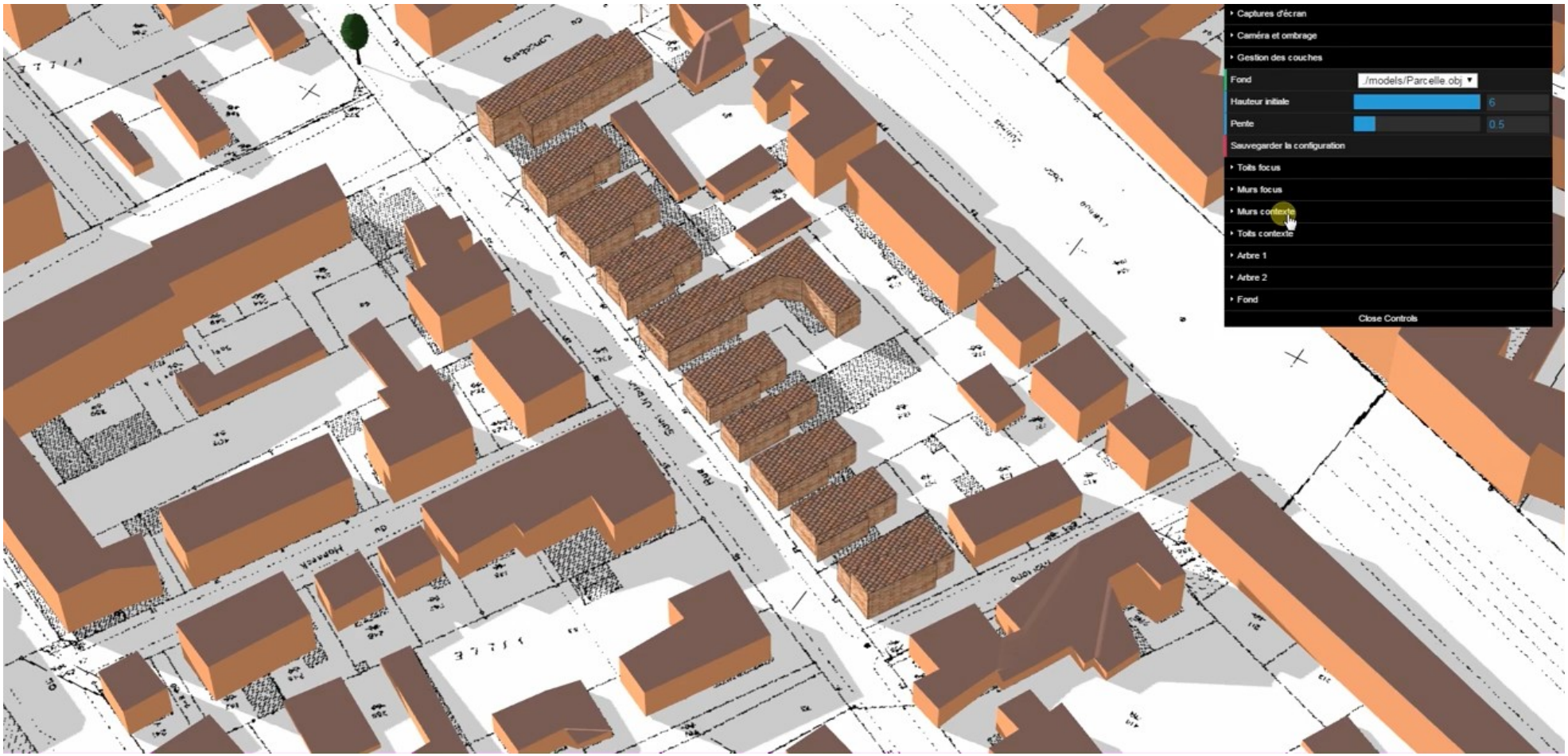




GLSL

GLSL

Interface and control of the 3D stylization

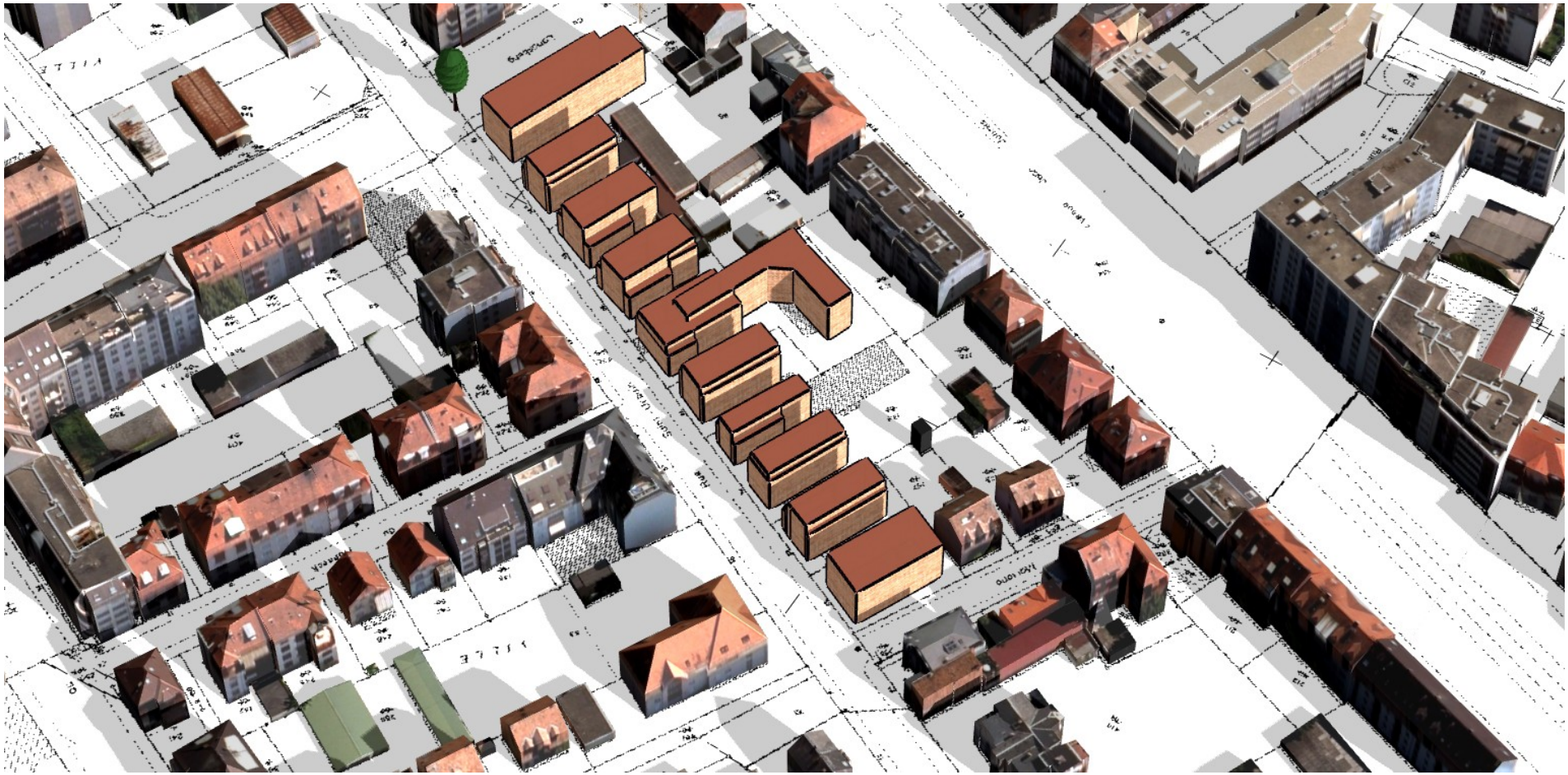


Different 3D geovisualizations

- **Typical focus and discreet context**

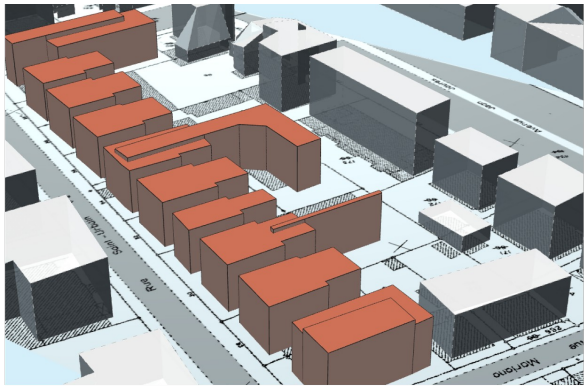
Different 3D geovisualizations

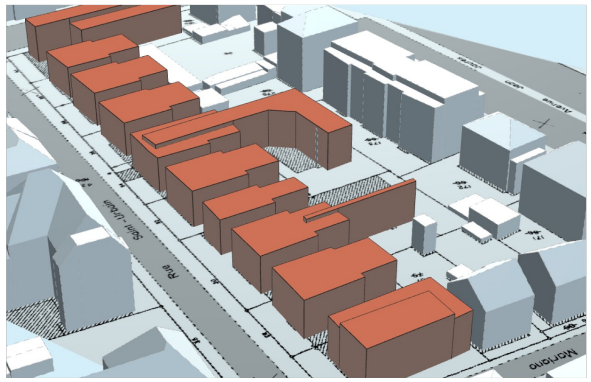
- **Sketchy focus and photorealistic context**

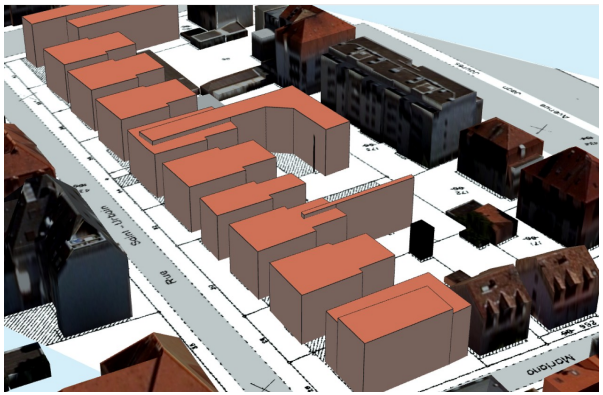


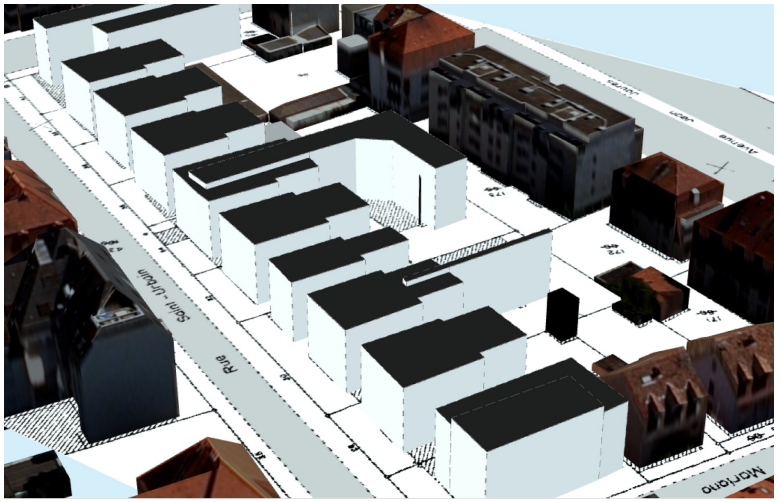
Different 3D geovisualizations

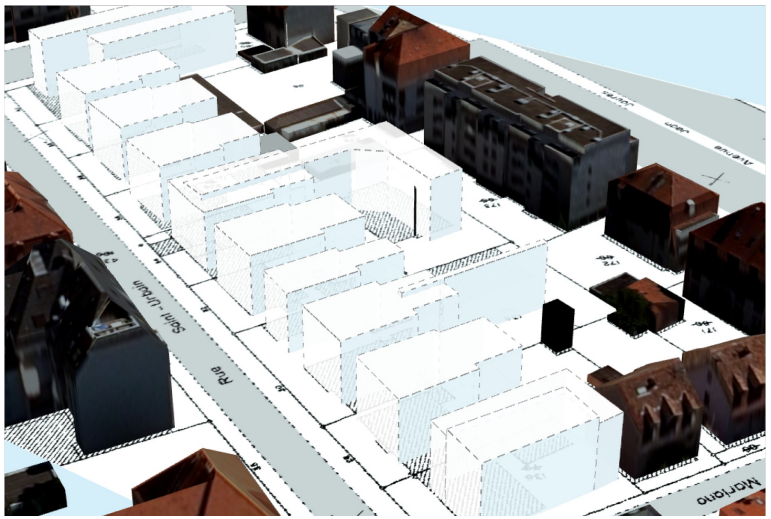
- **Navigation between levels of generalization**







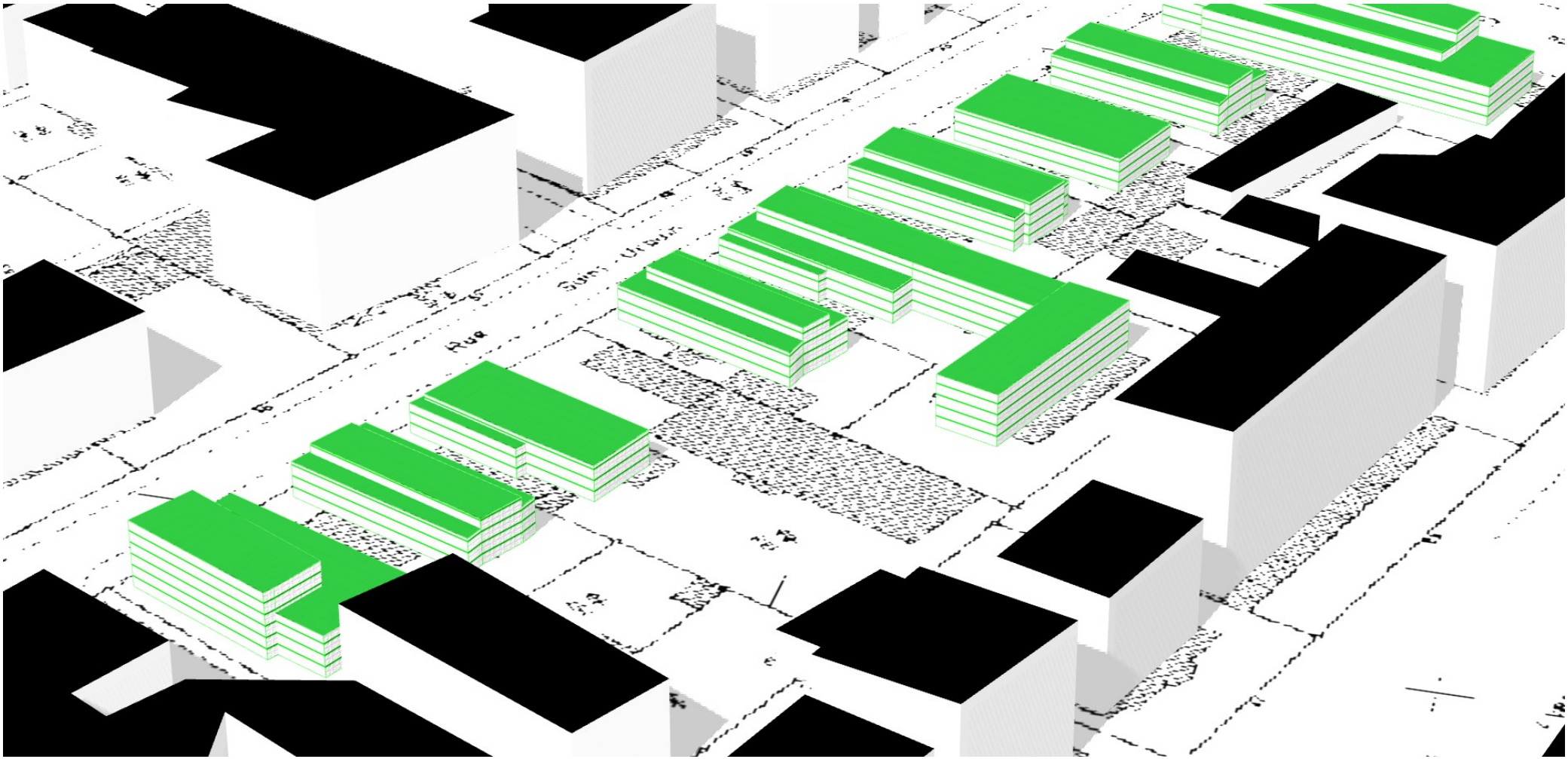




- **Feature differentiation**

Different 3D geovisualizations

- **Floor visualization with a specific rendering method**



Conclusion & future works

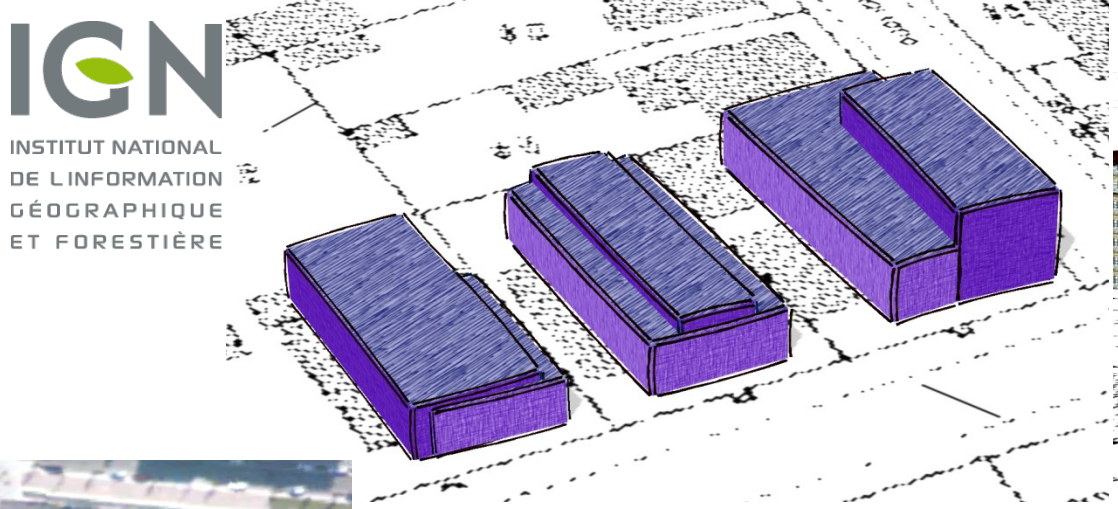
- **Open Source extensive 3D geovisualization system**
  - 3D style specification
  - New rendering methods

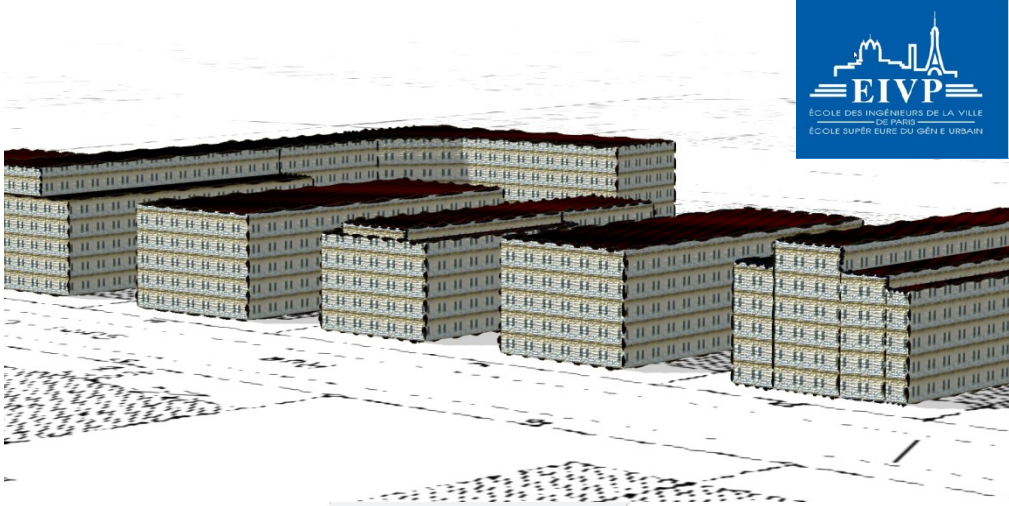
    https://github.com/IGNF/PLU2PLUS

  - Improvement of style specification and implementation in the iTowns project

    http://www.itowns-project.org/

- **Support for user experiments in public participation context**
  - ➢ Protocols for users tests on real use cases





Thanks for your attention!

https://github.com/IGNF/PLU2PLUS