5 Material intensity of inner development

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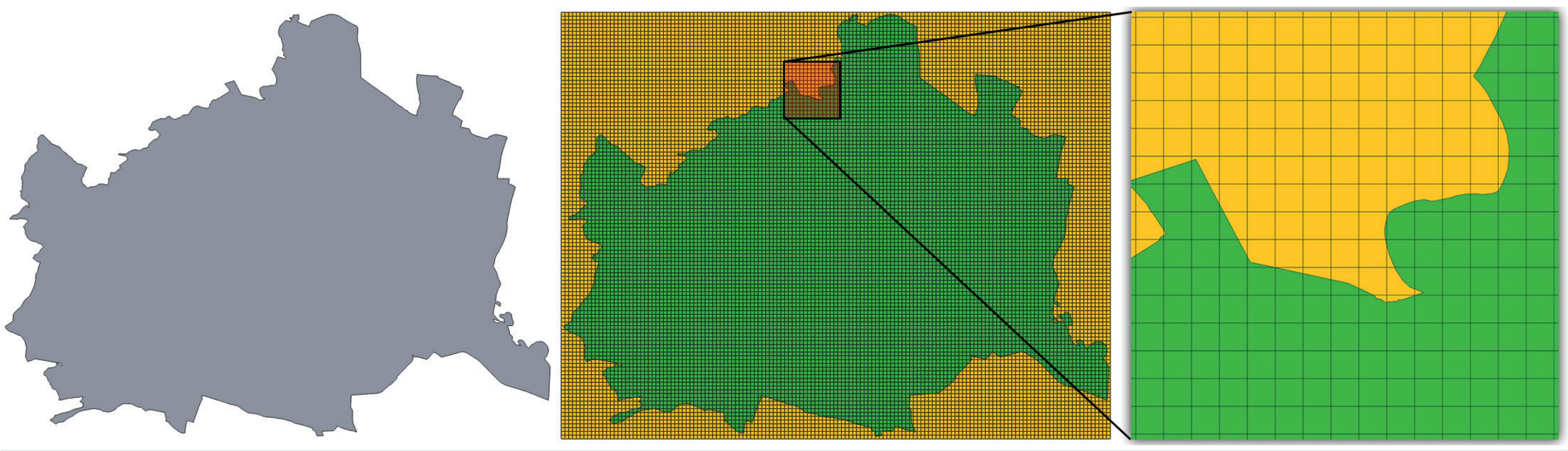

Fig. 1: QGIS model with grid (cells); left: borderline of Vienna; center: overlayed grid; right: detail (own representation).

DEFINITION OF THE CELL SIZE

The information obtained from the GIS data, provided by the city of Vienna, is transferred to a city-wide grid; i.e. thematic information is localized and processed in cell data. Accordingly, the choice of cell size is crucial for the result (similar to the application of the box-counting method in architecture; see Lorenz 2013) since it can lead to over- or under-representation (high data density or high degree of aggregation).

The final cell size is defined according to Zoom Level 17 (level of detail). This corresponds, for example, to a displayed area of the urban building block or a park (see OpenStreetMap Wiki contributors,‚Zoom levels').

BUILDING PROFILES

Five characteristic „Building Profiles" based on multiple vector layer attributes and a material mix typical for each building type were defined. Specifically, these are calculated from three groups:

1. Cell-related values (area percentages of total area): Key values are compared with data from the zoning plan.
2. Block-related values (block of houses per site): Key values are compared with data from M-DAB (predecessor project).
3. Typical material mix [in t/m3]: Key values concerning typical material composition is compared with data from M-DAB (precursor project), aggregated and updated on the cells.
4. The probability of assignment to each of the five pre-defined potential profiles is calculated from these relations. The correspondence according to which a certain cell fulfills the specifications of the respective profiles as a result of the aggregated values is hereby calculated as the Euclidean vector distance.

THE POSITION FILTER

In the present model, three position filters are available to specify a cell's „percentage match" with the selected profile:

1. energy filter,
2. mobility filter,
3. green space filter.

These filters are composed of static and dynamic data. The first group includes data from QGIS, such as whether or not a district heating connection exists in a cell. The second group includes data calculated from simulations in NetLogo (Wilensky, 1999), such as distances of a cell to the nearest cell containing a subway station.

VERIFICATION OF THE DATA

The first step is to verify the data representation using a model in the multi-agent programming language NetLogo, where the discrete division of the world into cells accommodates the visualization for verification. Each cell contains the static data from the previous analysis in QGIS. In addition, a dynamic calculation of data (e.g., distance to a subway station) is performed, which, when combined with the static data, produces a property vector. This vector is then used to calculate the similarities between the cells.

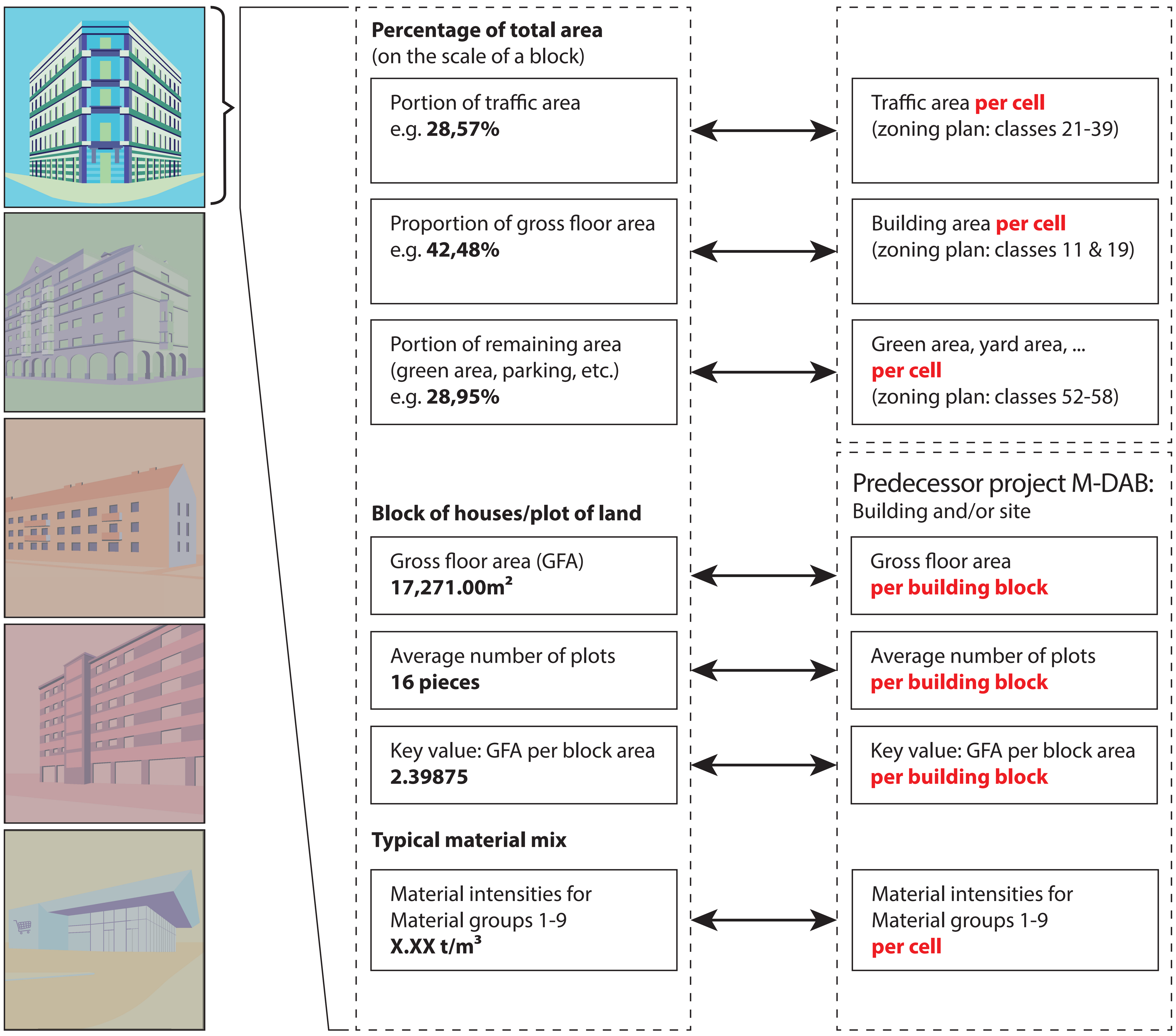

Fig. 2: Summary of the calculation of the percentage match with a selected potential profile [%] (own representation).

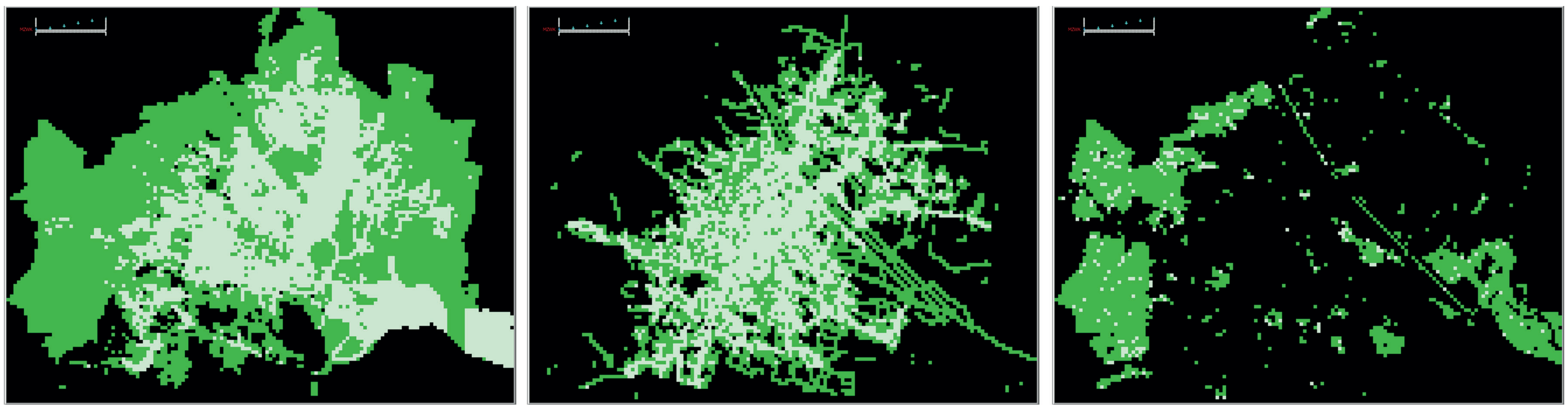

Fig. 3: Visualization of the energy filter (left), the mobility filter (center), and the green space filter (right); the coloring in the NetLogo model shows the three possible states (black = 0, medium green = 1, light green = 2) (screenshot from QGIS, own representation).

LITERATURE

Lorenz, W. (2013) Combining complexity and harmony by the box-counting method - A comparison between entrance façades of the Pantheon in Rome and Il Redentore by Palladio. In: Proceedings eCAADe 2013 - Computation and Performance, Brüssel: Delft University of Technology, S. 667 – 676

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Wilensky, U. (1999) NetLogo. Center for Connected Learning and Computer-Based Modeling, Northwestern University. Evanston, IL. Verfügbar unter: http://ccl.northwestern.edu/netlogo/ (zuletzt aufgerufen am 9. November 2022)

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