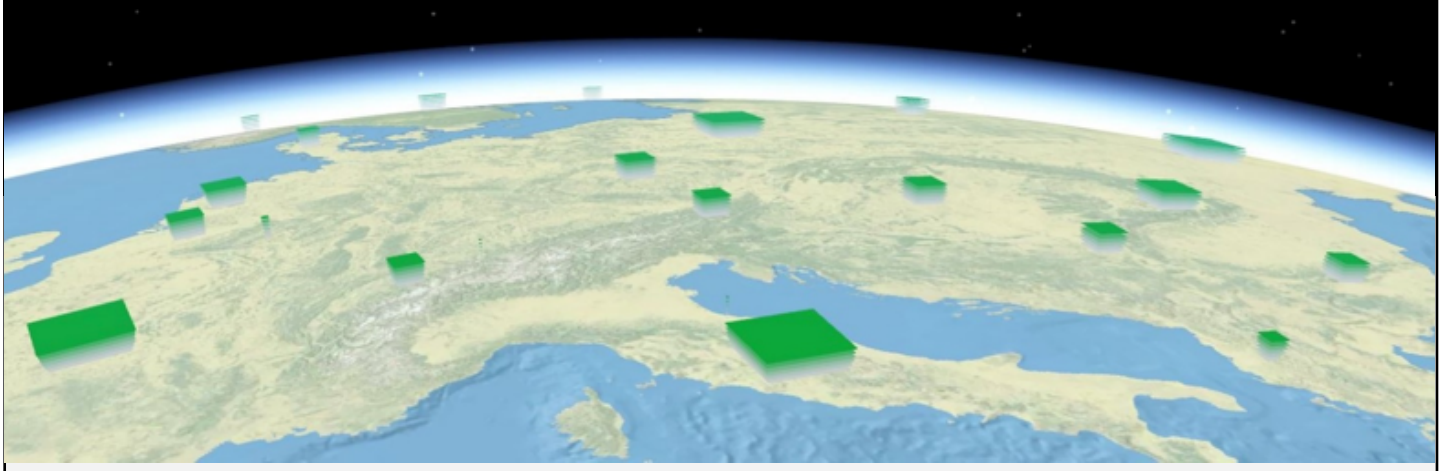
Project: Algorithmic Modeling of Solid 3D Charts

University of Zurich[UZH]



Topic

Charts are key elements in thematic cartography to visualize statistical data. While tools for creating 2D charts are well-elaborated, frameworks for constructing 3D charts are still largely missing. One recent attempt is made by Microsoft's Power Map where stacked 3D bars and extruded pie charts can be created on a virtual globe surface. The approach of procedural modeling is exemplified by ESRI's CityEngine which enables the generation of 3D buildings based on a set of rules.

Charts, in particular 3D solid charts, are composed of geometric primitives which can be differently scaled, arranged, colored, and optionally labelled. Examples comprise stacked pyramid frustums, nested hemispheres, or helix charts. By encoding univariate or multivariate data with graphical variables, charts help to depict geographic data, for instance population counts (see header image).

3D solid charts offer a large potential to catch the interest of the map reader so that he or she can "dive" into the 3D space and find out correlations which would not be that obvious as on a 2D map. By enabling map editors to experiment with procedural 3D chart models, they can design attractive but at the same time still readable chart types for experts and the general public.

Assignment

In this student project, you are going to implement a 3D solid chart viewer embedded in a simple graphical user interface with the following functionality:

1. Create procedurally 3D meshes for charts without using CSG operations
2. Offer a set of chart properties, e.g. shapes, alignments, scaling and rotation options, segmentation types, surface and outline properties
4. Render appropriate chart outlines regarding their presence in the geometric model, scaled widths, and line joins
5. Export geometries of charts combined with attribute data for querying.
6. Show attribute values, translate the active chart part or make other parts more transparent when clicking/hovering a chart component
7. Use smooth transitions when changing attribute data or chart properties

Requirements

Experience in C++ and OpenGL or JavaScript and WebGL. Interest in GIS and cartography.

Work Load

- 25% theory
- 65% implementation
- 10% testing

Project Type

The project can be realized as a software project. When including additional functionality, it can be carried out also as a bachelor thesis. Goals can be adjusted depending on experience and project type.

Supervision

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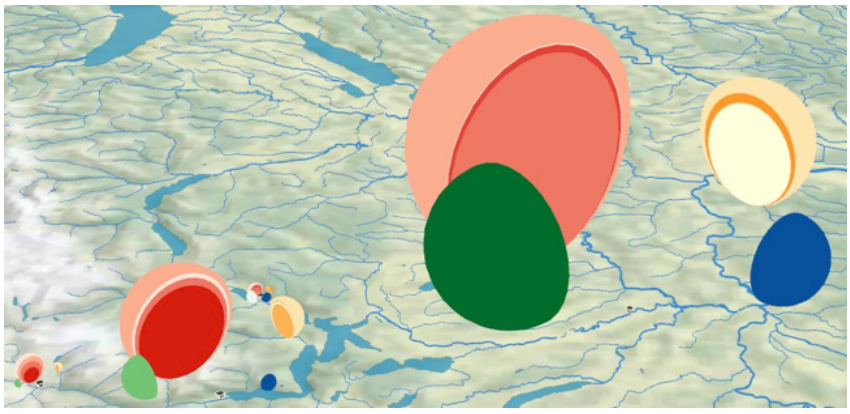

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