

Map Symbol Development for 3D Cartography suitable in VR-Environments

Mark Vetter^{a*}, Helge Olberding^a

^a University of Applied Sciences Würzburg-Schweinfurt – mark.vetter@fhws.de, helge.olberding@fhws.de

* Corresponding author

Keywords: 3D-cartography, map symbol, virtual reality, game engine

Abstract:

For using map symbols for 3D-environments (e.g. in Virtual Reality applications) special considerations for the design, use and implementation of these map symbols are essential. The construction of VR environments regarding the necessary implications of immersion and interaction takes place in game engine software, like Unreal Engine or Unity. Therefore, the special workflow to create map symbols should be adapted to conditions given by the development environment of these game engines. Findings on animations and adaptations, which needs to be realized in VR Environments of these map symbols, could be a benefit for the cartographic communication process in 3D-cartography.

Hence, in this study, the authors designed different 2D and 3D map symbols, which could be adapted e.g. according to BERTINs visual variable concept in size, shape, color (hue, lightness, saturation) and pattern.

To reveal which map symbols are more or less suitable in a 3D-cartographic environment the authors develop different scenarios. Furthermore, other use cases by using 2D and 3D map symbols in a 3D thematic map visualization have been realized.

Different approaches were tried to implement cartographic symbols in a VR environment. On the one hand the representation of floating 2D symbols in 3D. On the other hand different variants of 3D symbols up to flat post-processing representations based on map symbols.

Common 2D map symbols were used as the basis for each symbolism. These symbols were used as textures and customized using the Unreal Engine's material editor. The resulting materials (textures with additional visual and interactive properties) were inserted into the VR environment. This resulted in several variants of a scenario. Blueprint (Visual Scripting) commands were used to implement interactions and the ability to switch between different visualizations in real-time. The representations can be changed with the help of motion controllers and users can freely change the visualization of the symbols in the VR environment. The representation of the symbols could also be adapted in real-time according to alterations of variables. For instance meteorological values.

An exemplary 3D city model is used as the 3D environment. Here, the symbols can be viewed in different scenarios or sections of the 3D city model in their effectiveness. The 3D city model can consist of CityGML data and fictitious 3D models.

A workflow has been developed that makes it possible to quickly integrate additional symbols into the application, making it possible to potentially map and extend a wide variety of application scenarios in a VR environment.

Finally, a user case study with students was realized: For the evaluation of the experiment, it is possible to track information on how long a person has stayed in the various visualization variants; in addition, the movements of the eyes could be tracked with VR glasses. Different students were confronted with special cartographic purposes. The way how fast the reception of the intended cartographic message was realized by the students was analyzed and was brought in relation to the visual representation. The experiment is a pre-study. Experiences will help to design a larger-sized study afterward.