VRAstro

Volumetric Selection In Virtual Reality

Overview

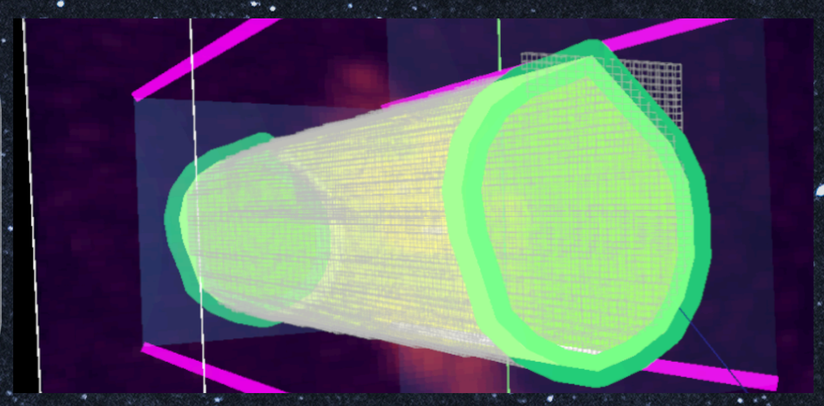
Astronomers explore more of our universe every day. With this comes heaps of data that needs to be isolated and analyzed. The tools out there currently have mostly explored a desktop computer as the avenue for data selection and analysis. This project takes advantage of Virtual Reality to create a new environment for data selection.

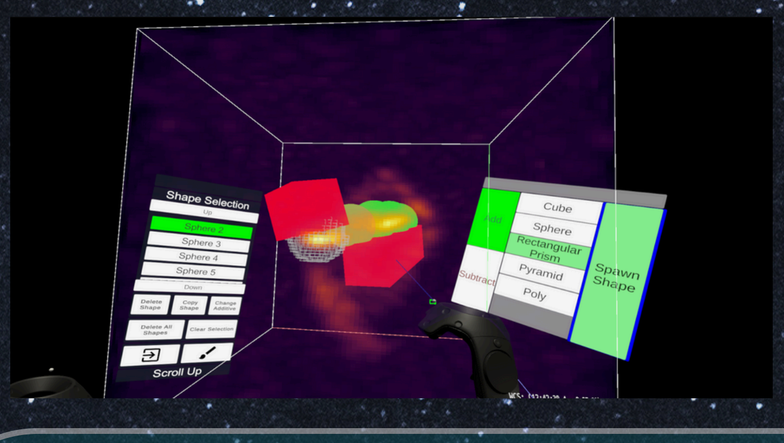
Aim

The Astronomy Department at the University of Cape Town has developed iDaVIE-v: software to visualize and analyze three-dimensional datasets in Virtual Reality. However, the capabilities for selecting sub-regions of data are limited. This project aimed to create three VR selection methods for volumetric datasets, and compare this to selection on a desktop computer.

Lasso Selection

The lasso selection method allows the user to make volumetric selections by drawing “shapes” that define a volume for selection. For example, if a user draws a circle, a cylinder will be generated highlighting the volume to be selected. The method can be used repeadetly in both an additive and subtractive manner to finalize a selection.



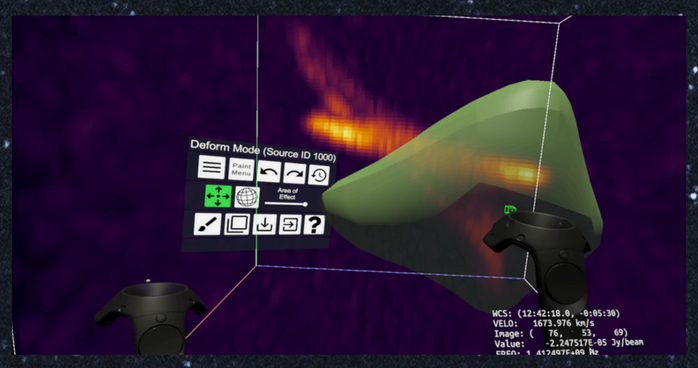


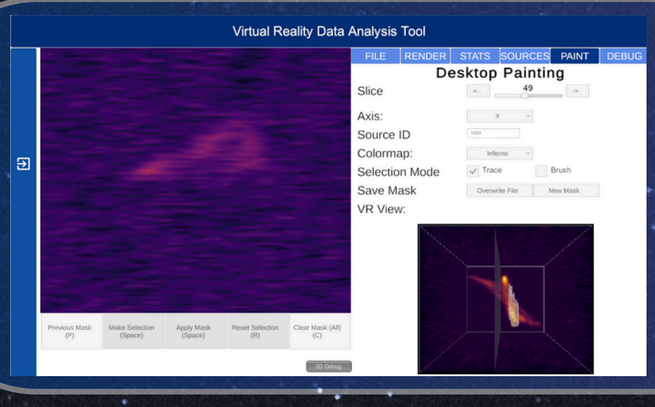
Shape Selection

The shape selection technique allows users to place a culmination of shapes to make a selection. Shapes can either add to the selection (green) or remove from the selection (red). This allowed for complex shapes to be created by overlapping each other, meaning whatever form the volumetric data was in, it could be selected.

Deformation Selection

The deformation selection method made use of a sphere that the user can mold into the shape they desire to select. This allows the user to have full control over the sub-region they want to select, allowing for selection of strangely-shaped regions. All the data within the deformed sphere is selected out.





Desktop Selection

Each one of the VR selection methods was compared to a desktop selection method. This technique allowed users to traverse through the volumetric data in slices of voxels (3D pixels), and make a selection on each slice. These selections are then combined together to form one final volumetric selection.

Results

The results came from the data of 25 participants who all took part in an experiment to compare the VR selection methods to the desktop method. This experiment each participant to make four volumetric selections use each one of the methods. The findings show that there is no significant improvement in VR selection in terms of accuracy, completion time, usability and fatigue. However, there are many factors that contributed to this, such as users needing to learn how to navigate in VR compared to intuitive desktop controls. While no results were significant, some metrics showed slightly higher averages and less spread for accuracy and fatigue in VR, hinting that further experimentation could reveal more accurate and realistic results.

Thomas van Coller (VCLTHO001@myuct.ac.za)
Jesse Plant (PLNJES001@myuct.ac.za)
Willem Van Ryswyck (VRYWIL006@myuct.ac.za)

Supervisors:
James Gain (jgain@cs.uct.ac.za)
Lucia Marchetti (lucia.marchetti@uct.ac.za)