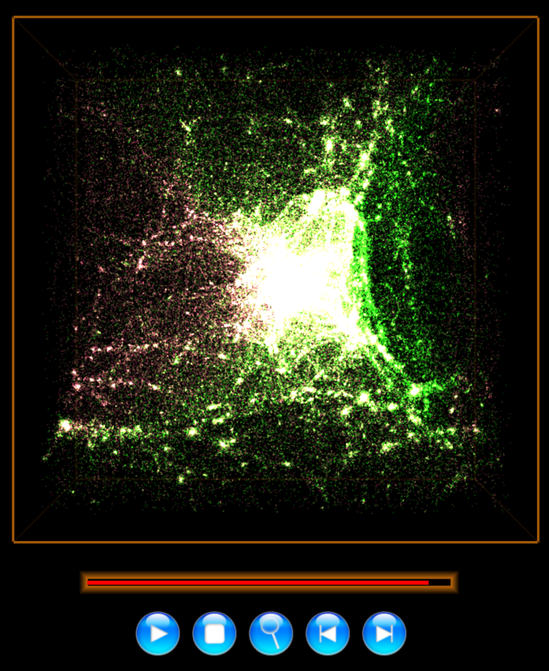
Exploring One- and Two-Touch Interaction for 3D Scientific Visualization Spaces

Lingyun Yu Tobias Isenberg
University of Groningen

Contribution

For exploring large 3D datasets, scientists often have to interactively navigate through and explore large single 3D spaces. We explore the use of large and touch-sensitive displays for this task. In particular, we provide means to control 7 degrees of freedom for exploring these spaces with both dual-touch and single-touch interaction. Our single-touch interaction makes use of the visualization's frame and provides means for precise control for all 7 degrees of freedom.

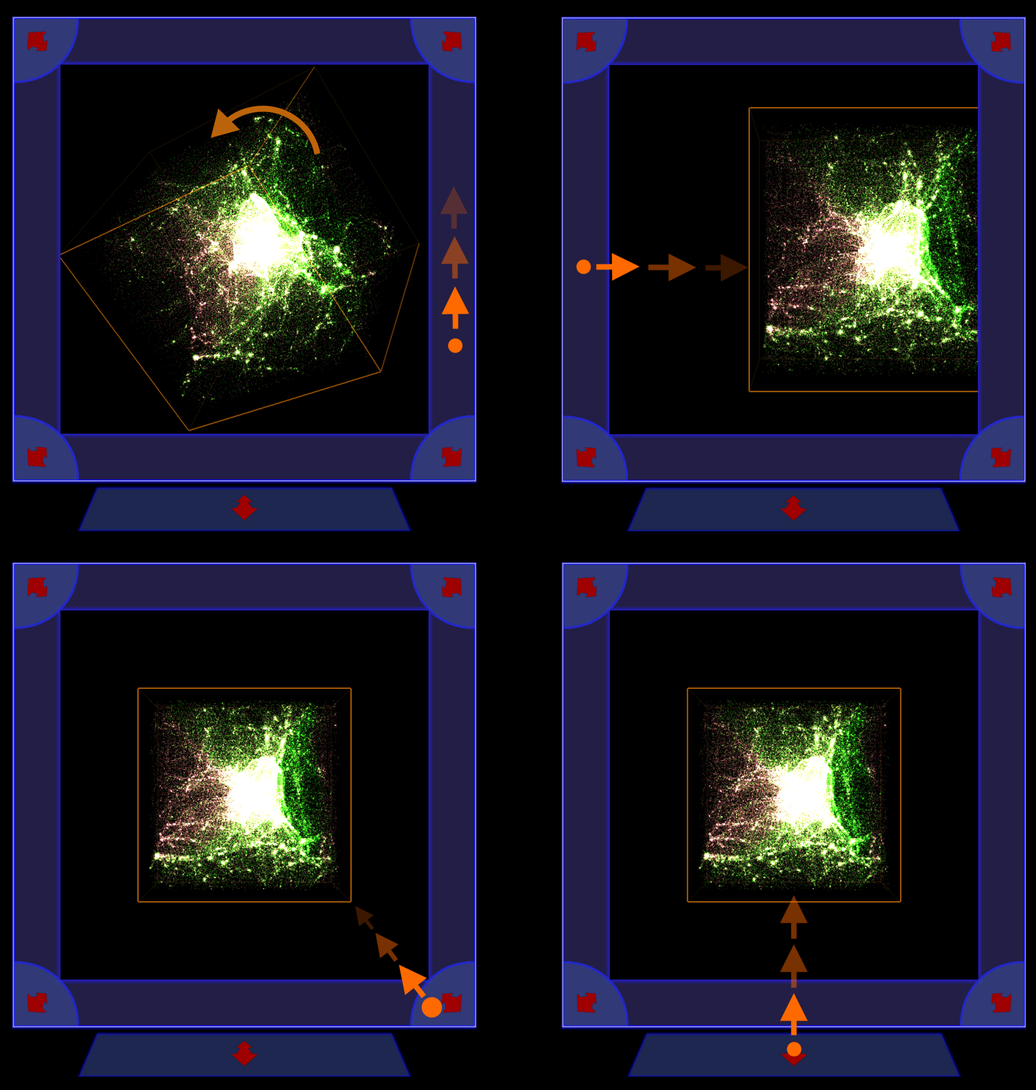
Data (Cosmological Simulations)



Cosmological simulations are used as our dataset [1]. By analyzing astrophysical processes and exploring such large volumes of particles, scientists are trying to understand the fine-scale structure predicted around the Milky Way. Such precise analysis requires us to provide scientists with rapid and accurate manipulation methods at various levels of precision.

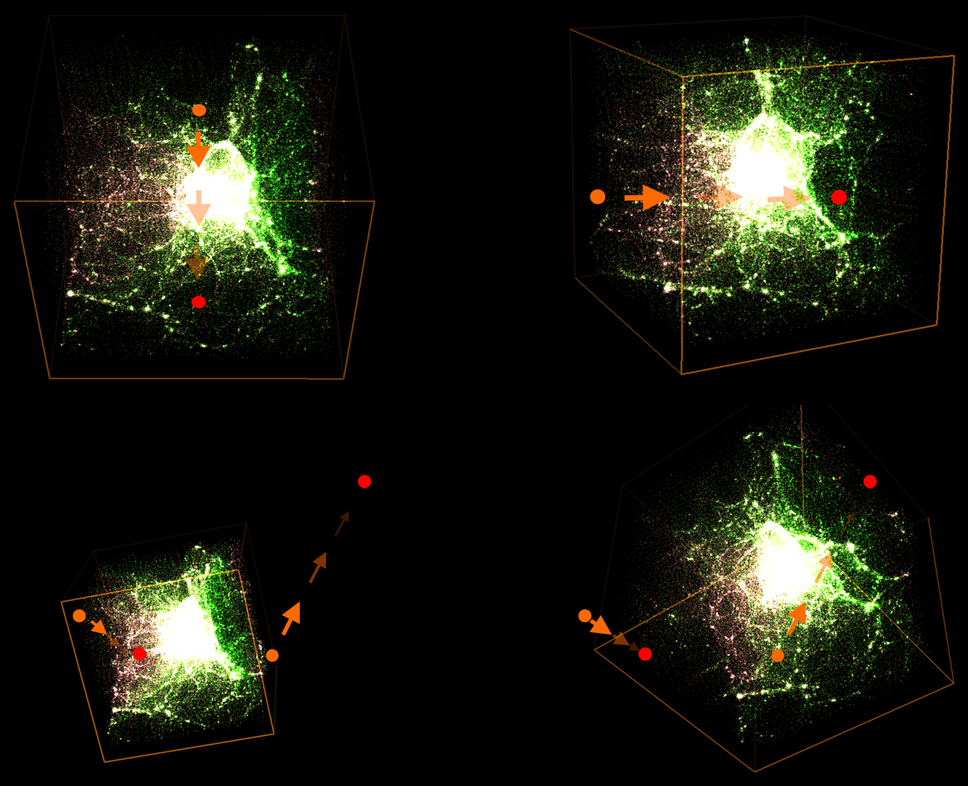
Frame Interaction

Inspired by Nijboer et al.'s [3] interface, we use viewport's border to provide additional means of independent control for the location, orientation, and scale of the displayed space. These are used with a single touch and the invoked action depends on the initial direction of the finger's motion. In addition, we employ the area below the viewport frame to translate along *z* axis.



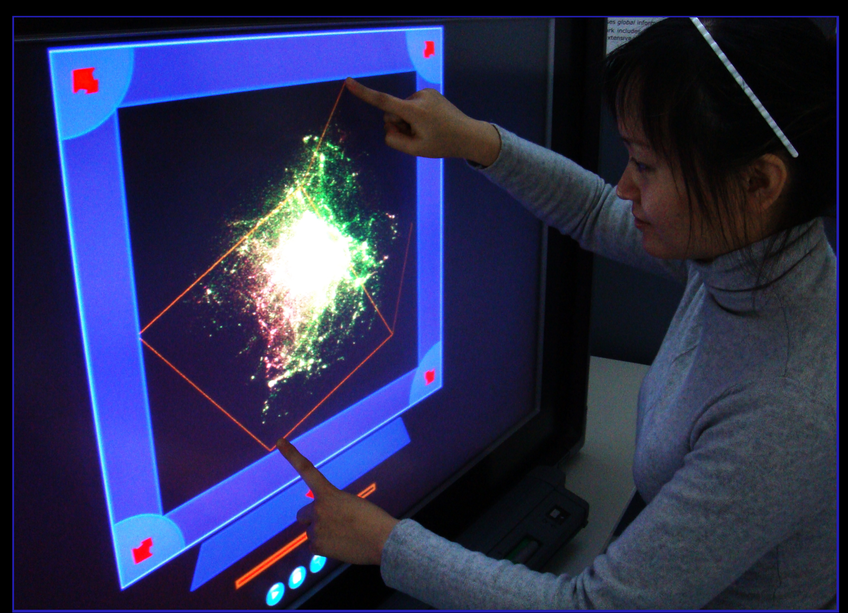
Single- and Dual-Touch Control of 3D Space

We use the trackball interaction to control the rotation around two axes (x and y) using single touch interaction. For controlling the remaining degrees of freedom we are inspired by dual-touch interaction with 2D elements [2]. With two fingers used simultaneously on the same object, we can control an additional 4DOF, i.e, dragging two inputs from the orange points to the red points could perform integral interaction, such as rotation, scaling as well as translation (two-point interaction [2]).



Conclusion

By using the frame, we are able to control all 7DOF with a single input. This allows people to navigate through 3D spaces also on single-touch surfaces. In addition, we also provide integrated dual-touch navigation for multi-touch surfaces. This way we give the user the choice of either fast and integrated interaction with two fingers or precise and separate interaction with the frame.



References

[1] Volker Springel, JieWang, et.al. The Aquarius Project: The Subhalos of Galactic Halos. Monthly Notices of the Royal Astronomical Society, 391(4):1685–1711, 2008.
[2] M. S. Hancck, F. D. Vernier, D. Wigdor, S. Carpendale, and C. Shen. Rotation and Translation Mechanisms for Tabletop Interaction. In Proc. TableTop, pages 79–86. IEEE Computer Society, 2006.
[3] M. Nijboer, M. Gerl, and T. Isenberg. Interaction Concepts for Digital Concept Sketching. In Posters of NPAR, New Orleans, USA, 2009. Extended abstract.
[4] Gerald N. Sahling Robert Kosara and Helwig Hauser. Linking scientific and information visualization with interactive 3d scatterplots. In Proc. WSCG, Visualization and Computer Vision, 2004.

Contact

Lingyun Yu <lingyun.yu@rug.nl>, Tobias Isenberg <isenberg@cs.rug.nl>
Scientific Visualization and Computer Graphics, http://www.cs.rug.nl/svcg/

university of groningen