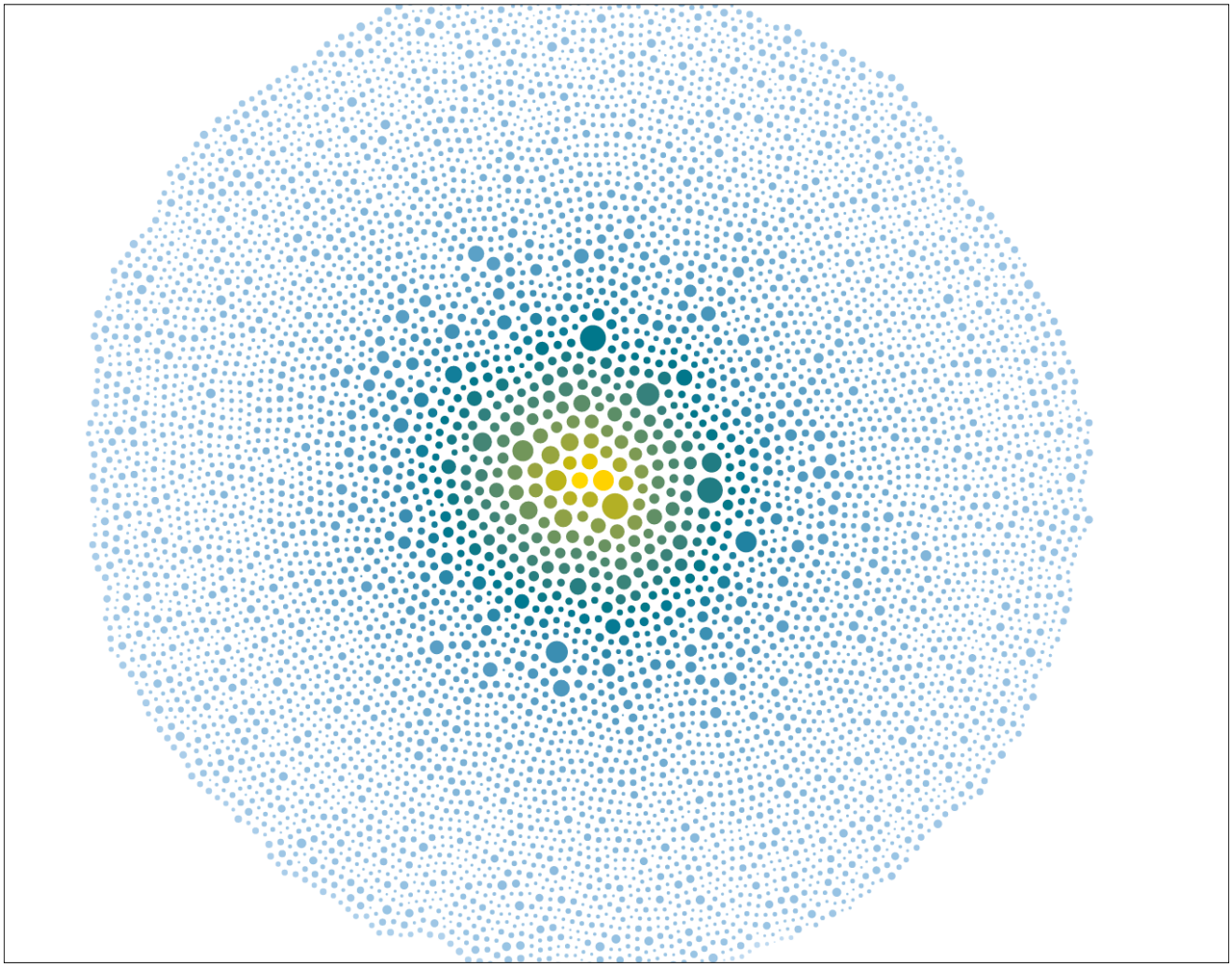
HALOS

Kyle Almryde
Department of Computer Science

Alex Sommerville
School of Design

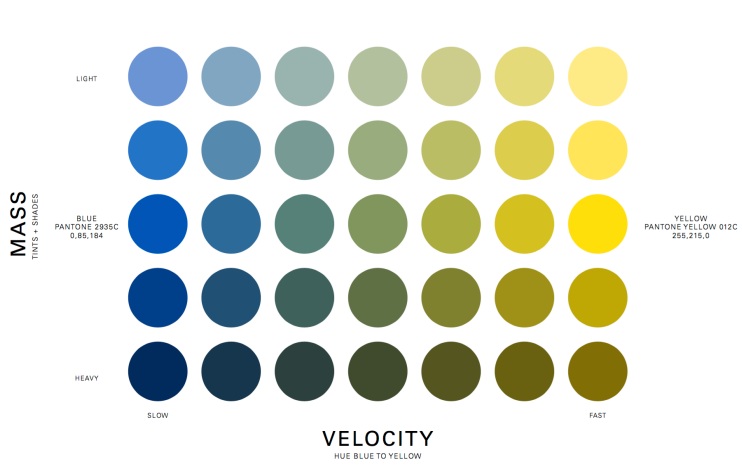
Elizabeth Villarreal
School of Design



Description

This project will explores the complex hierarchical evolution of dark matter Halo merger trees. Through the combined use of **color**, **opacity**, **animation**, and **spatial organization**, we explore the intersection of art and science by letting “the data do the talking”. This project is freely available on the web and can be accessed by following the link provided here: (https://www.evl.uic.edu/krbalmryde/projects/coursework/cs491/Halos/indext.html)

The work presented here is just the first step of many towards developing an informative and effective visualization examining complex hierarchical data. We utilized Animation to show the Halos changing and evolving over time, and utilized an intuitive color scheme that was both informative and still aesthetically pleasing to the eye. We used opacity to mimic chances in color intensity and applied those values to the halos. Our color encoding scheme can be see below.

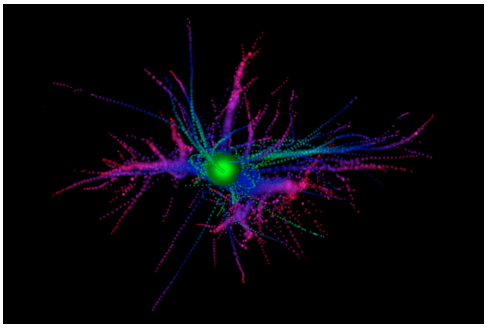


We also included a non-informative, but visually appealing color scheme for the sake of variety. While it does not provide information about the velocity of the Halos, it does provide clear visual feedback about the hierarchical nature of the Halos. We acknowledge that this data may not be as accessible to any so we strived to keep our audience broad.

In addition to effects of colors, this application is ***animated.*** When a user selects on a halo of interest, the tree of that halo is visualized over time. The user can watch the halos blink in and out of existence, and watch as their positions change over time.

Inspiration

This project was motivated by earlier work which examined this complex data through the use of 3D graphics. You can find that project here (https://www.evl.uic.edu/krbalmryde/projects/DarkSky/index.html). That project was the product of a contest which sought to visualize a highly complex dataset and provide a potential tool for domain experts. Though this project utilizes the same data, the desire was as an exploration of the intersection of art and science by taking advantage of the complexities of this data by producing an interactive visualization that is both attractive and compelling visually while maintaining fidelity of the data as a whole.



The long term goals would be to develop a more complete application which could be suitable for use by knowledgable experts. We would also like it if people were inspired and interested in this work to want to learn more about it as well.

Data

The data that was used for this project originates from the IEEE 2015 SciVis data visualization contest aimed at “Visualizing the Universe”. The data consisted of a Cosmological N-body particle simulation of dark matter, a collision less fluid, as a discretized set of particles that only interact gravitationally. These dark matter particle simulations are used to simulation the formation of structure in the Universe. For our project worked with the Halo merger tree data. Halos are described as sets of gravitationally bound particles together into coherent structures. Each halo contains information about its position, shape, size, and other statistics for a total of over 60 attributes. A merger tree is a data structure which links halos evolution and interaction over time, providing an easy way of informing how galaxies form and evolve through cosmic time. More details about the contest and data used can be found here: http://darksky.slac.stanford.edu/scivis2015/data.html Information regarding the simulation itself can be found here: http://darksky.slac.stanford.edu/

Roles

Kyle (CS) will focus on the hierarchical layout and animations as well as interactions of the halo data.

Alex (Design) will focus on color compositions and visual encodings of the halos and their substructure. Specifically, choosing which attributes of the data best highlight the variance between halos of similar mass but varying substructures.

Elizabeth (Design) will work on the user interface and control panels for animation and interaction.