

Chart Sonification for All: Accessible Multimodal Graphs

Submission Title: Chart Sonification for All: Accessible Multimodal Graphs

Presenters: Bruce N. Walker, PhD (*Georgia Institute of Technology*) and Øystein Moseng (*Highcharts*)

Contact Presenter: Bruce N. Walker (bruce.walker@psych.gatech.edu)

Topic:

Keywords:

Summary: Georgia Institute of Technology and Highcharts have collaboratively developed and evaluated an accessible online multimodal graphing tool, combining sonification and advanced data visualization.

Extended Summary

The Georgia Tech Sonification Lab (GT) has long provided desktop applications for multimodal graphing tools that leverage sonification, mainly aimed at research and accessible educational use (http://sonify.psych.gatech.edu/research/sonification_sandbox/). Highcharts, as a commercial provider of accessible data visualizations, has also investigated the use of sonification in their products (<https://www.highcharts.com/demo/sonification>). We have blended our expertise, and have collaboratively developed and evaluated an accessible online multimodal graphing tool, combining sonification and advanced data visualization. This “Multimodal Chart Studio” (MCS) should help increase the prevalence of multimodal charts on the web, in both business and educational contexts.

We believe sonification is a crucial tool for exploring data. While it can act as a component in multimodal learning systems, it can also provide key insights to users with visual impairments. Traditional solutions for accessible graphics tend to fall short when data sets grow above a certain size, and a faster mode of data exploration becomes a requirement. Sonification can provide the user with a mode of exploration that provides fast access to trends and patterns in the data, while preserving outliers and spikes. It can act as a quick scanning tool, allowing a visually impaired user to identify areas of interest in the data set for further examination. We believe implementing these multimodal techniques into mainstream web charts should be a long-term goal for the data visualization industry, and that the technology required to achieve this is already in place.

We decided to create a multimodal data display tool that would bring current sonification technology to a user-friendly level for non-technical users. We believe this will cause more people to think about sound as part of their data display and exploration, and promote widespread use of accessible data visualizations. For the Multimodal Chart Studio, we

combined the sonification design elements from the *Sonification Sandbox* with the advanced graphing capabilities of the *Highcharts* visualization library. A user can import or generate data, manipulate the data in a spreadsheet, and design visual and auditory renderings of the data. Multiple data sets are supported, along with annotations and context elements such as trend lines; and indicators of data set features like minimum, maximum, and zero crossings. The individual artifacts (e.g., a visual chart or a sound file) can be exported separately, or combined in various ways (e.g., a movie showing an animated chart with the time-synchronized sonification audio). The initial feature set of the MCS can be expanded in subsequent versions of this tool, or via open-source development efforts, leveraging the MCS as a foundation.

We also wanted to improve the user experience of the design, and provide the application through a web platform for easy access and updates. Making the MCS available to as many users as possible had to be a priority, and it must be a goal to make the MCS itself accessible. We expect the MCS will make it easier for content creators and data explorers to make use of multimodal data displays in their environments. We specifically hope the MCS will promote the use of multimodal charts in schools, both as a learning tool and as an area of study.

Based on the research findings from this collaborative effort, Highcharts will also go back and expand the multimodal (sonification) capabilities of the native Highcharts products. This enables existing users of Highcharts worldwide to create multimodal data visualizations without a need for particular sonification knowledge. With Highcharts being used by over 80% of Fortune 100 companies, we see this as a great opportunity to bring the learnings from decades of sonification research into existing tools and channels. We believe this will contribute to elevating the accessibility of web charts in general, through our collaborative MCS, through other Highcharts products, and by leading the way for others in the charting/data visualization industry.

Highcharts and GT will demonstrate the Multimodal Chart Studio, present findings from usability and accessibility evaluations, and communicate challenges related to sonification of advanced data visualizations.