

SONIFICATION OF DYNAMIC CHOROPLETH MAPS: GEO-REFERENCED DATA EXPLORATION FOR THE VISION-IMPAIRED

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ABSTRACT

Interactive data visualization tools are helpful to gain insight about data, find patterns and exceptions, but are usually inaccessible to vision-impaired users. In the case of geo-referenced data where users need to combine demographic, economic or other data in a geographic context for decision-making, we designed YMap, a dynamic choropleth map tool that visualizes data attributes on the choropleth map and enables slider-based dynamic queries. User studies show that YMap can help users find specific geographic regions that match a query and retrieve details, find trends and patterns or detect the correlation between attributes. As our first step to design a multimodal (audio+haptic) counterpart exploration tool for the vision-impaired, we created a virtual spatial sound display for the interactive map by synthesizing 3-D sounds of various timbres and pitches using head-related transfer function (HRTF) and tying these sounds to map regions and interface widgets. The 3-D sounds create the effect of a virtual map hung on the surface of a large virtual sphere with the user sitting in the center. Three audio interactions have been implemented: (1) gliding the cursor over the map to examine the sound of individual regions; (2) adjusting dynamic query sliders and hear the sounds of regions being filtered-out / filtered-in; and (3) using sweeping lines to scan the map and hear the sound patterns. We designed an interface using either keyboard or tablet. Our research goals are to identify effective sonification mechanisms, especially as applied to dynamic choropleth maps, explore coupled use of tactile perception with sound for maps, and examine the effectiveness of our tool in helping vision-impaired users in large geo-referenced data set exploration. We also want to investigate the sonification of maps for sighted users to use over the telephone or as a complement to visual modes.