**Instructional Days: 11-14**

**Topic Description:** In this lesson, students learn how computers can be used as a tool for visualizing and understanding data. Sonification, the transformation of data into sound, is explored in particular.

**Objectives**:

The student will be able to:

* Explain how computers can be used as tools for visualizing data and interpreting data
* Explore relationships between different statistics and geographical location.
* Create their own hypotheses and test them using data.

**Outline of the Lesson:**

* Journal: In what ways can data be stored? In what ways can it be transmitted? (5 minutes)
* Discussion: Have students share their answers. Some examples are tables, journals, databases, graphs, text (like a stock exchange), voice, sonification… Guide them toward the idea that data can also be represented as sound in a way deeper than just saying numbers. (20 minutes)
* Examples of sonification?
* Introduction to iSonic and geographical sonification (15 minutes)
* Students follow tutorial below with assistance(90-120 Minutes)

**Student Activities**:

* Discuss methods of storing and transmitting data.
* Listen to examples of sonification.
* Learn to use iSonic
* Create and investigate their own hypotheses on geographical data using iSonic.

**Resources:**

This activity makes use of iSonic (<http://www.cs.umd.edu/hcil/audiomap/>), a program that uses sonification to display geographic data to blind users. It can be used by both sighted and visually impaired users. It is designed from the ground up to be completely accessible.

Before being run, it requires some installation and setup. It will only work on Windows. The instructions are available on the website above, but they are briefly summarized below.

1. Download and install the Java JRE *if* you do not already have it. It is likely that you already do. Any version at or above 5.0 will work.
2. Download and install the Microsoft Speech SDK 5.1 (this has not been tested with other versions.) Go to <http://www.microsoft.com/en-us/download/details.aspx?id=10121>, click Download, and select “SpeechSDK51.exe”. Run the executable to install the program.
3. Once Microsoft Speech SDK 5.1 has been installed, download and run the “SpeechServer” program from (<http://www.cs.umd.edu/hcil/audiomap/demo/SpeechServer.exe>). It should open an empty black terminal window. This must be running in the background before you run the iSonic program.
4. Download the 2003 Disability and Census Data with scatterplot, table, and map iSonic version from (<http://www.cs.umd.edu/hcil/audiomap/demo/us_states_withscatterplot.jnlp>) and run it, bypassing any warnings that may show up. If it runs correctly, it will make a chiming sound and play an introductory message.

A drawing tablet is helpful on the last step of the tutorial. It must be set up so that the drawing surface is proportional to the screen (e.g. touching the same spot on the tablet always touches the same spot on the screen) and to avoid inadvertent right-clicks or zooms. Here we detail the instructions for a Wacom Bamboo tablet.

1. Install the driver using the installation CD.
2. Go to Pen Tablet Properties on the Bamboo dock and go to the pen menu. Map both side buttons to disabled.
3. Go to the Windows Control Panel. Click on Hardware and Sound then “Change tablet pen settings”. Click on the “Press and hold” option and click on Settings. Uncheck “Enable press and hold for right-clicking” and press OK.
4. If the tablet is not sensitive over the entire tablet area use something tactile to mark off the boundaries of the sensitive area so the students know where the edges and corners of the sensitive area/screen are. Wikkistix can be attached and removed easily.

The following is a guided tutorial for students to familiarize themselves with the tool, learn how sonification can display data, and at the end use the tool to find information about the United States. Advise the students to not use the help menu on F1 (it doesn’t seem to work correctly), but to feel free to use F10 to browse the menu and check out the different commands and shortcuts.

**Student Tutorial**

1. Once iSonic has started, use the tab key to cycle through the different displays. You should hear the program display what view it is on. Contact an instructor if it is not saying anything.  
     
   Go to the map view.
2. Press F10 to access the menu, then select “Information Level” and then “Increase Level”. Keep doing this until it says “Information Level 3”. This will make the program give you enough information to complete the activity.
3. Use the arrow keys or the mouse and space bar to find the following states, and then use the space bar to announce the population 21-64 years old with a disability in that state. Record the values below:
   1. Texas:
   2. Mississippi:
   3. New York:
   4. Alaska:
   5. Oregon:
4. What does the frequency/pitch of the sound have to do with the value of the statistic it reports? Record your answer below.
5. Go to the table view by using the tab key. It is arranged as a spreadsheet with a list of states in the leftmost column and different columns of statistics to the right. Use the arrow keys to explore the states and their statistics. The space-bar will display the state-name if you forget what state you are on.
6. Using the table view, find the “Percent Employed Population 21-64 Years Old With No Disability” for the following states and record them.
   1. Alabama
   2. Virginia
   3. Vermont
7. If we want to find the states with the lowest or highest employment rate, we can sort the data. After selecting a box in the column of the “Population 21-64 Years” statistic, press “o” to sort it in lowest to greatest order. Record the three highest population states. Then, press “o” to sort it in greatest to lowest order. Record the three lowest population states.  
     
   Greatest Population  
   1.  
   2.  
   3.  
     
   Lowest Population  
   1.  
   2.  
   3.
8. Geographical information can often be difficult to analyze when it’s in a chart, especially when it has to do with location. We’ll try using the “filter” tool and a tablet to investigate which regions of the country have the highest employment rate for people without disabilities.  
     
   Press F10 to access the top menu, then find “More Actions” and then “Filter” inside that. A new window will pop up, showing slider bars for every statistic in the table. In this menu we can set a range for each statistic, where if a state’s value for that statistic is outside of that range it will be greyed out on the map and make a muted sound when you mouse over it.  
     
   Use the left and right arrow keys to find the statistic for “Percent employed population 21-64 years with no disability.” Once you’re on that statistic, use the up and down keys to adjust the minimum value. You will hear some chimes for every state that’s “filtered out.” Set the minimum to 80.9, close the window (alt-f4), and try using the tablet and stylus to drag over the map.  
     
   What areas have the highest employment rate?  
     
   By going back to the filter menu and using the ‘a’ key you can switch between moving the minimum bound and the maximum bound. Go back to the filter menu and try selecting states with the *lowest* employment rate.  
     
   What areas have the lowest employment rate?