Sound Spectrogram

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THIS IS **NOT** A DEFINITIVE FINAL REPORT

FORMATIVE evaluation studies like this one often:

- **are conducted quickly**, which may mean
  - small sample sizes
  - expedited analyses
  - brief reports

- **look at an earlier version** of the exhibit/program, which may mean
  - a focus on problems and solutions, rather than successes
  - a change in form or title of the final exhibit/program

Sound and Hearing – Formative Evaluation
Sound Spectrogram

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PURPOSE

Questions:
• What do visitors do with this exhibit?
• Do they find this exhibit interesting?
• What are some difficulties that visitors have with this exhibit?
• What do visitors think this exhibit is trying to show?
• How do visitors interpret the graphical representation of sound?

METHOD

Type: Observation followed by Cued Interviews.

Every third visitor who crossed an imaginary line was approached and asked to play with the Sound Spectrum exhibit. On slow days, every other visitor was approached. If a particular visitor was with a small group, the rest of the group was invited to use the exhibit as well. An evaluator took notes on how the visitors interacted with the exhibit. After visitors played with the exhibit, they were asked a series of questions (see Appendix A). If there was a group, the response to each question was the union of the responses from each group member except for the interest rating which was the response of the representative of the group. The representative was self-selected (the first to respond to the question).

Data Collection Times

Date	Day	Time	Number of Interviews
10/20/01	Saturday	10:45 – 12:45 3:45 – 5: 00	9
10/24/01	Wed	11:15 – 12:15 1:00 – 1:30 3:15 – 4:15	6
10/25/01	Thursday	11:00 – 12:30	5

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Demographics

- (N = 20)
- Age Groups

Age Group	Count	Percentage
<8	1	5%
8-12	5	25%
13-17	0	0%
18-20s	6	30%
30-50s	6	30%
60+	2	10%

- Gender

Gender	Count	Percentage
male	11	55%
female	9	45%

RESULTS

What do visitors do with this exhibit?

- Most visitors made some sort of noise, either spoke, sang or whistled into the microphone.

Made sounds into microphone	Count	Percentage
Yes	19	95%
No	1	5%

- Most visitors read the label.

Read parts of the label	Count	Percentage
Yes	15	75%
No	5	25%

- There was some confusion about how to use the side view. Specifically, 2 (10%) never looked at the side view and 8 (40%) never made any noise while pressing the side-view button making it difficult to see any causal change in the side-view. One visitor remarked "[the side-view is] doing the same thing all the time. [I] don't know what it is."

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Pressed Side View	Count	Percentage
Pressed button while making sounds into mic	10	50%
Did not press button	2	10%
Pressed button w/o making sound	8	40%

- Also, 10 (50%) visitors used the pause button, but of those, 6 make sounds into the microphone while pressing pause. It is, therefore, unclear whether the pause button was of much use to the visitors.

Pressed Pause Button	Count	Percentage
Pressed button while making sounds into mic	6	30%
Did not press button	10	50%
Pressed button w/o making sound	4	20%

Do they find this exhibit interesting?

- On the average, visitors found Sound Spectrum somewhat interesting. This is despite some confusion with interpreting the graphical interface.

Interest Rating	Count	Percentage
Uninteresting	1	5%
Somewhat uninteresting	3	15%
Neutral	3	15%
Somewhat interesting	6	30%
Interesting	7	35%

What are some difficulties that visitors have with this exhibit?

- Half of the visitors interviewed reported being confused by the exhibit. The most frequent complaint involved difficulties interpreting the graphical display.

Reported Difficulties	Count	Percentage
Nothing confusing	10	50%
Difficult to figure out the graphic display	7	35%
Lots of / too much reading	2	10%
Difficult to read label and look at display at the same time	1	5%

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What do visitors think this exhibit is trying to show?

• Most visitors thought that Sound Spectrum showed something about the voice or sound. Ten (50%) of the visitors interviewed did not go into any more details about the sound (e.g., pitch or loudness).

Shows	Count	Percentage
Voice [unspecified]	6	30%
Sound [unspecified]	4	20%
Pitches in sound / voice	5	25%
Loudness	3	15%
Don't know	2	10%

How do visitors interpret the graphical representation of sound?

• Visitors do not clearly distinguish between pitch and loudness when using this exhibit. Although all the visitors interviewed describe the colors, 10 (50%) specified that the colors indicate loudness, and 4 (20%) mistook the colors for frequencies (In fact, of the 10 that identified color as loudness, 3 of them at first said that different colors indicate different pitch.)

Color Meaning	Count	Percentage
loudness	10	50%
[unspecified] variations in sound or speech	4	20%
pitch or tone	3	20%
don't know	2	10%
something in body	1	5%

Only 25% described the horizontal lines that indicate pitch.

Mention Horizontal Lines	Count	Percentage
Yes	5*	25%
No	15	75%

 * Of the 5 who noticed the lines, 3 (correctly) interpreted the lines as
   indicating different pitches in voice/sound.

• I posit two reasons for this lack of distinction between loudness and pitch:

 – Some visitors (especially the younger visitors) do not come to the exhibit making a clear distinction between pitch and loudness: of the 6 visitors who are age 12 or younger, none mentioned pitch at all during their interviews. This is in contrast to the 12 out of 14 adults who mentioned pitch.

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– The graphical interface is difficult to interpret. The noticeable horizontal lines indicate the louder frequencies in the input. Therefore, loudness and pitch are conflated in the graphical representation.

RECOMMENDATIONS

• Help visitors notice sound patterns without relying on pitch and loudness

(Currently, the label relies too much on an understanding of pitch and loudness.) Give suggestions in the label for generating and noticing voice patterns and sound patterns. For example, suggest that visitors a) repeat their name and see how the same graphical pattern is generated for each repetition, or b) try to replicate each others' patterns, or c) try different sounds and compare the colors and contour.

Some things that visitors tried with the exhibit that did not depend on discriminating loudness and pitch:

    a. A father and son team tried to replicate each other's voice patterns and began to speculate on the sound patterns of words and phrases. (e.g., do all greetings have the same look?)
    b. A visitor imitated whale songs to see how it would look.

• Help visitors notice how loudness and pitch are represented

(Currently, even those visitors who seem to know the difference between pitch and loudness have difficulties interpreting the graphical representation.) Provide more concrete suggestion in the label as to what to do to decouple the two, pitch and loudness. For example, recommend that visitors also try to sing/whistle a note loudly and softly. Recommend that they sing a high note and low note.

Because the side-view decomposes the signal according to frequency makeup, using and understanding the side-view will depend on an understanding of pitch. Position the side-view button next to the suggestions that deal with loudness and pitch on the label. Also, give explicit directions to speak or otherwise make noise when holding down the side-view button.

APPENDIX A

1. How interesting would you say the exhibit is to you? Would you say it is …

Uninteresting	Somewhat uninteresting	Neutral	Somewhat interesting	Interesting
1	2	3	4	5

2. What was it about the exhibit that made it _____ for you?

       c. Was there anything in particular that was not interesting?

       d. Was there anything in particular that was interesting?

3. Was there anything confusing about the exhibit?

4. What do you think this exhibit is trying to show?

5. What did you notice here?

6.   a. Are you able to see the different colors? **Yes   No**
     b. What do you think the different colors mean?

7.   a. Did you look at the side view? **Yes / No**
     b. What do you think the side view shows?

8. Do you have any other comments about this exhibit?