SLHS 1301W Lab 3: Sound Level Measurements and Scientific Report

Learning Objectives
Upon successful completion of the lab, you will be able to
1. use sound level meter to quantify spoken language and other sounds
2. understand the requirements to write a good scientific report

EQUIPMENT: Digital Sound Level Meter (SLM)

- Liquid Crystal Display (LCD). The numbers display the sound level in dB SPL. The level is updated once each second.
- 21 dot analog bar graph that provides visual representation of the sound level.
- Intensity range of 50 – 126 dB SPL.
- Under-range and over-range indicators that inform you when the sound level is below or above the range selected.
- Option of slow (0.5 sec) or fast (0.2 sec) bar graph response. We will use the slow response.
- A and C weighting networks (see figure below). With A-weighting, the meter responds to frequencies between 500 Hz and 10,000 Hz – energy below 500 Hz is attenuated and does not contribute to the measurement. With C-weighting, the meter responds to frequencies between 30 Hz and 10,000 Hz.

![Diagram of A and C weighting networks]

SETTINGS

Range Dial:
- Sound level is measured over a range of 50 – 126 dB SPL, in variable ranges. Each range spans about 20 dB SPL.
- The number you select is in the middle of the range. For example, if you set the dial to 60 dB SPL, the meter measures sound levels from 50 – 70 dB SPL.

Bar Graph Display:
- If the sound level is lower than the lowest level for your selected range, LO will be displayed. If this happens, select a lower range.
- If the sound level is higher than the highest level for your selected range, the digits that represent the next highest range will flash on the display. If this happens, select a higher range.
### MEASUREMENT OF RECORDED NOISES

Your lab instructor will play you a series of 10 recorded noises. The duration of each noise segment will be about 30 seconds, with 15 seconds of silence in between each segment. Hold the SLM in a steady position and do not move it until all the measurements have been completed. For each segment, record the C-weighted and the A-weighted levels. For all measurements, use the slow response. Record your measurements below.

- The readings will fluctuate over time.
- Observe the readings for about 5 seconds and choose the modal value to record.

<table>
<thead>
<tr>
<th>Noise Segment</th>
<th>C-weighted</th>
<th>A-weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. WN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. LP 2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. LP 1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. LP 500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. LP 300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. LP 200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. HP 200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. HP 300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. HP 500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. HP 1000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MEASUREMENT OF SPEECH INTENSITY

Your laboratory partner will read the following passage.

“When an object moves back and forth, it is said to ‘vibrate.’ This vibratory motion disturbs the air particles near the object and sets them into vibration, which produces a variation in normal atmospheric pressure. The disturbance spreads, and when the pressure variations reach our ear drums ( tympanic membranes), they too are set into vibration. The vibration of our tympanic membranes is translated by our complicated hearing mechanisms into the sensation that we call ‘sound.’ To put this in more general terms, sound in the physical sense is a vibration of particles in a gas, a liquid, or a solid.”

Position the SLM at a fixed distance from the reader’s lips and record both the C- and A-weighted levels. Begin with your meter on C-weighted, and when your partner reaches the halfway point in the passage (the / symbol), switch to A-weighted.

<table>
<thead>
<tr>
<th>C-Weighted Level</th>
<th>A-Weighted Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LAB QUESTIONS

Take into account the different types of sound level measurements you made during today’s lab. With your partner, answer the following two questions. You may hand write your answers on the back of this sheet, or use a separate piece of paper if you wish. Be sure to use complete sentences and legible handwriting. Hand in your answers, along with the sheets on which you recorded your sound level measurements, before leaving lab today.

1. What is true of the frequency composition of the signal when the C-weighted and A-weighted values are essentially the same? Explain your answer.

2. What is true of the frequency composition of the signal when the C-weighted values are significantly greater than the A-weighted values? Explain your answer.
WRITING A SCIENTIFIC REPORT

Manuscripts that constitute a scientific report to describe an experiment, at least in the behavioral sciences, ordinarily are organized into sections. Although different reporting formats are acceptable, one of the most simple forms includes the following:

- **Introduction.** This section usually has no heading; it just begins with text that describes the problem, reports the relevant review of previously published literature, and concludes with a *statement of purpose*. The statement of purpose is just what it sounds like; it defines the purpose of the experiment succinctly.

- **Method.** The Method section describes the procedures that were used in the experiment, and it must be written very carefully. It should contain sufficient detail to enable the reader to evaluate critically whether the experiment was designed and executed with sufficient care. If there are uncontrolled factors that might have influenced the outcome of the experiment, the results might be rendered invalid. In addition, a detailed Methods section will assist future researchers who might choose to replicate the experiment to see if the same, or similar, or predictable results are obtained.

- **Results.** The Results section describes the outcome of the experiment and ordinarily contains not only text, but also figures and/or tables that support the text.

- **Discussion.** The Discussion section also should be self-evident. The author discusses the results in the context of previous literature or in the context of some theory, and speculates about the implications of the findings. In short, “What do the results mean?”

**During Lab** today you will write a practice Methods section and a Critique of the methods for a sample experiment. As **Homework** for next week you will write a lab report including Introduction and Methods sections, as well as a Critique of the methods, for the experiment described on the next page.

Assume that the audience for your lab report is a peer – someone who might need to explain or replicate the experiment, but who might not be familiar with all the terminology involved yet. You may write the report in first person (pretending that you were the one who did the experiment) or in third person (reporting on another experimenter who did the experiment).

- Your Introduction section should include an explanation of the purpose of the experiment described. What did the experimenters hope to learn?
- Your Methods section should include (1) definitions of some terms with which your reader might not be familiar, and (2) a brief explanation of experimental details. *Do not simply copy the purpose, definitions, or procedures from your assignment.* Try to explain things in your own words.
- Your Critique section should address any problems either with the amount of information you received, or the procedures described. For example, did the author omit any important experimental details from the description of the methods? Were experimental variables controlled sufficiently?
EXPERIMENT DESCRIPTION

Purpose: The purpose of the experiment was to compare performance-intensity functions for spondaic words and phonetically-balanced lists of monosyllabic words.

Definitions of terms:
1. Performance-intensity function: A function that displays how percent-correct scores (on the ordinate) change with changes in intensity (on the abscissa) of a message.
2. Spondaic words (aka spondees): Two-syllable words spoken with equal stress on the two syllables (e.g. hotdog, baseball, toothbrush, etc.). The list used in this experiment was called CID W-1 and contained 36 spondaic words.
3. Phonetically-balanced lists of monosyllabic words: Lists of words of one syllable each (e.g. cow, egg, dog, etc.). Each list usually contains 50 words, and all phonemes (speech sounds) in the language appear in the list with a frequency that approximates the frequency with which they are used in the English language; hence, the list is said to be balanced phonetically (or phonemically). The list used in this experiment was called PB-50.
4. Speech intensity: The level, or intensity, in decibels (dB) at which the speech message is presented to listeners.

Experimental details:
- Twenty listeners tested – 15 female; 5 male
- Performance-intensity functions defined for each of two forms of speech materials: spondaic words (CID W-1) and monosyllabic words (PB-50). Six equivalent lists were used for each type of speech material.
- Speech materials presented at six speech intensities that ranged from 14 dB SPL to 24 dB SPL in 2 dB intervals.
- For both kinds of speech materials, lists were presented in a descending order of intensities (i.e. 24 dB then 22 dB then 20 dB, etc.)
- Speech materials pre-recorded on audio tape by a male talker.
- Speech materials presented to one ear of each listener via an earphone (Telephonic, TDH-39).
- For both spondaic and monosyllabic words, listeners repeated each word aloud.
- Half of listeners received spondaic words first, followed by monosyllabic words; the reverse order was used for the other half of listeners.

GRADING

Your assignment will be graded with respect to both content and style. The grading rubric is provided so you can see how various elements are weighted. Your report should be textual, not just lists; it should include correct spelling and punctuation; and it should be written in a style appropriate for formal academic writing. If you have questions about any of these (or other aspects of the assignment), please ask your lab instructor!

Your first draft (NOT to be confused with a rough draft!) is due at the beginning of lab next week. Your lab instructor will read and critique the draft and return it to you the following week. Your revised draft, upon which your grade will be based, is due the week after that.
PRACTICE LAB REPORT

(turn in today – write on the back of this sheet)

Purpose: Participants were presented with spondee word lists with their hearing aids on and their hearing aids off. Performance-intensity functions were used to compare the performance of the participants in these two different listening scenarios.

Methods:
- Twenty participants with moderate hearing loss who are experienced hearing aid wearers
- Used six different word lists of spondaic words – three lists presented with hearing aids on and three lists presented with hearing aids off
- Reversed order of testing so half of participants were tested with hearing aids on first and other half tested with hearing aids off first
- Lists read by experimenter into a microphone and presented to the participant in another room through a speaker
- Lists of spondee words were presented to participants in both listening situations (aided and unaided) at the following intensities: 20, 40, 60 dB SPL
- Listeners repeated each word back after hearing it
- Performance-intensity functions were defined for each of the two listening situations

Examples of performance-intensity (PI) functions:

![Graph showing performance-intensity functions for Hearing Aids ON and Hearing Aids OFF]