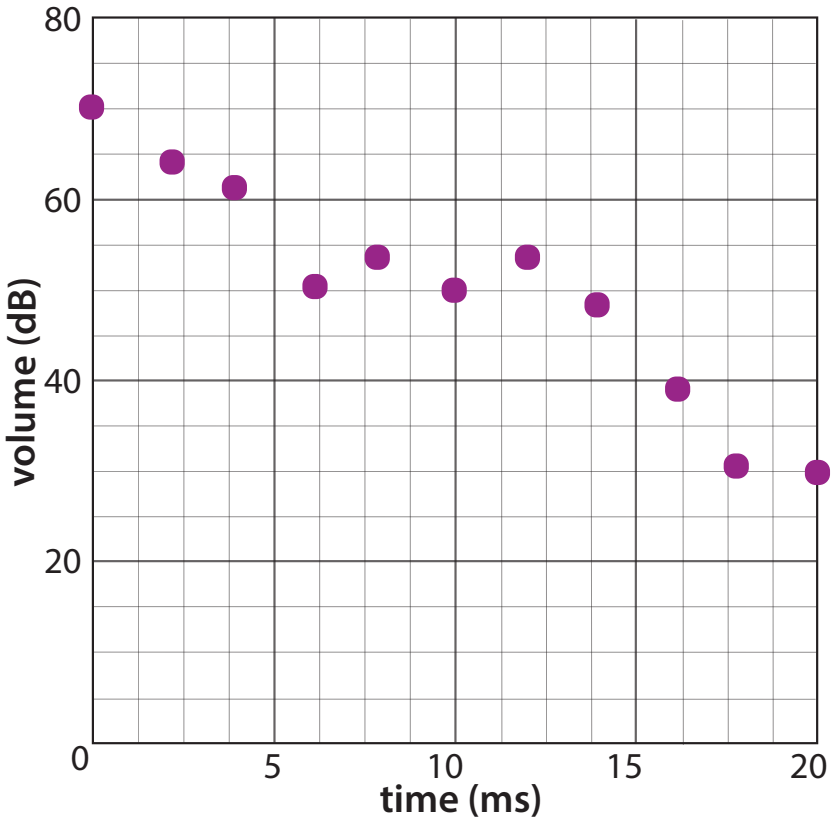
Unit 6: Statistics

Activity 6.1 - Reverberation Time

Recall that sound waves spread out and bounce around. So sometimes we can still hear a sound a bit after it is no longer being made. If we hear it clearly after a short pause, then it is usually called an *echo*. If we hear it fade away–often without a pause–then it is usually a *reverberation*. As the sound waves spread, it weakens and becomes quieter. The loudness of the sound is called volume and is measured in decibels (dB). This definition of volume should not be confused with the volume that describes the amount of space in an object, which is measured in liters or cubic meters.

Suppose that you're setting up a large room for a Hawaiian music concert. To test if it is set up the way you want, you hit kālaʻau sticks together once (at time 0 ms) and use a machine to record the volume of the sound. You can watch a video about kālaʻau sticks on the book's website (`https://www.stemd2.com`).

1. Here is a graph of the volume in the recording from the first setup.

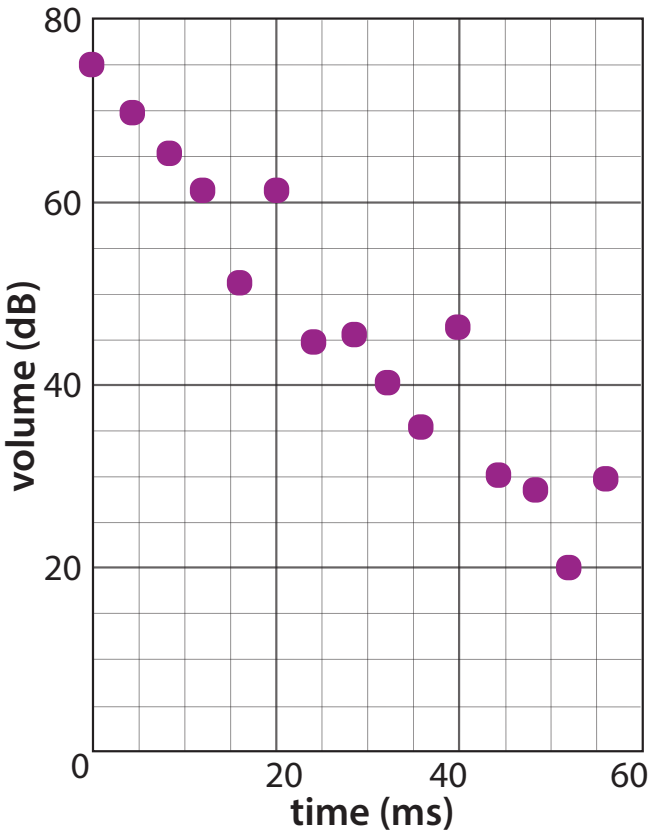


a. Does this scatter plot show a positive association, a negative association, or no association?

b. Describe the real-world reason why your answer to Part 1a makes sense.

c. Assume that there is a linear relationship shown in the graph. What is the equation for this line? Let y be loudness (volume) and t be time.

2. Here is the recording from the second setup.



a. Does this scatter plot show a positive association, a negative association, or no association?

b. Describe any clusters that you see on the plot.

c. Describe some of the outliers on the plot.

d. Take a look at the outliers you found in part 2c. Why might there be outliers? Are these readings higher or lower than expected? Why might they be going higher/lower?

e. Assume that there is a linear relationship shown in the graph. What is the equation for this line? Let y be loudness and t be time.

3. *Reverberation time* is the time it takes for a sound's volume to drop 60 dB. For example, if a sound starts at 100 dB, the reverberation time is how long it takes for the sound to dampen to 40 dB.

a. What is the reverberation time of the first setup?

b. What is the reverberation time of the second setup?

c. One of these setups results in more echoes. Which one do you think it is and why did you think it was that one?

d. Which of these setups would you choose for a concert and why? Discuss and share your ideas with other groups and on the on the online comment section.

Activity 6.2 - Music Preferences I

Now that we have the room set up for the concert, let's choose the music. We can do this by asking other students what kind of music they want to hear. Here's the data we've collected by asking 210 students about their music preferences.

Music preference

Age	Hawaiian music	Jawaiian music	TOTAL
10-12	52	78	130
13-15	52	28	80
TOTAL	104	106	210

1. Let's take a look at each age group separately.
Next to letters A-G, write the relative frequency compared to the total of that **row**. Here, two boxes in the first row are filled as examples. Give your answers as a percentage and round to the nearest whole number. You may use a calculator for this part.

Music preference

Age	Hawaiian music		Jawaiian music		TOTAL	
10-12	52	40%	78	A	130	100%
13-15	52	B	28	C	80	D
TOTAL	104	E	106	F	210	G

2. Let's take a look at each music genre separately.
Next to letters A-G, write the relative frequency compared to the total of that **column**. Here, two boxes in the Hawaiian music column are filled as an example. Give your answers as a percentage and round to the nearest whole number. You may use a calculator for this part.

Music preference

		Hawaiian music		Jawaiian music		TOTAL	
Age	10-12	52	50	78	A	130	B
	13-15	52	C	28	D	80	E
	TOTAL	104	100%	106	F	210	G

3.a. Explain the meaning of the percentages you wrote in Part 1. What do they tell you?

b. Explain the meaning of the percentages you wrote in Part 2. What do they tell you?

4. Of the types of songs that you're thinking of playing for the concert, what percent of them should be Hawaiian songs? What percent of them should be Hip Hop? How did you use the data from the table to help you make your decisions?

Activity 6.3 - Music Preferences II

Your kumu noticed that not everyone voted. Maybe some students wanted to hear other kinds of music. To prepare for the next concert, we let students vote for "other music." Here are the results.

Music Preference

Age	Hawaiian	Jawaiian	Other	TOTAL
Age 10-12	55	104	21	180
Age 13-15	57	15	8	80
TOTAL	112	119	29	260

1. Let's take a look at all the votes.
Next to the letters A-I, write the relative frequency compared to the total number of votes (260). Give your answers as a percentage and round to the nearest whole number. Three boxes are already filled. For example, we can see that 21% of all votes were from 10-12 year old students who wanted to hear Hawaiian music. You may use a calculator for this part.

Music Preference

Age	Hawaiian		Jawaiian		Other		TOTAL	
Age 10-12	55	21%	104	A	21	B	180	C
Age 13-15	57	D	15	E	8	F	80	31%
TOTAL	112	G	119	H	29	I	260	100%

2. What are some conclusions or statements that you can make about the data? For example, can you say that certain groups have a stronger preference for certain kinds of music? If you cannot make any conclusions, why not?

3. Share your ideas with your classmates and online. Did you see any conclusions from other groups that you disagree with? How is it possible for two people to look at the same data and come up with very different conclusions? This actually happens a lot. Talk with your other classmates about how or why this is happens.