Quiz: Frequency and Amplitude

Introduction to Mobile Robotics > Frequency and Amplitude Exploration

- 1. Amplitude of a sound wave is perceived as (circle the correct answer):
 - i. The volume of the tone
 - ii. The pitch of the tone
 - iii. The timbre of the tone
 - iv. The rhythm of the tone

The correct answer is A (the volume of the tone). Amplitude of a sound wave is perceived as loudness, or volume.

Pitch corresponds to the frequency of the sound wave. Timbre refers to the specific mix of qualities that gives a sound its characteristic acoustic "feel" (e.g. a violin vs. an air horn). Rhythm is a reference to a pattern in the timing of a sequence of sounds, and has nothing to do with sound waves themselves.

- 2. Frequency of a sound wave is perceived as (circle the correct answer):
 - i. The volume of the tone
 - ii. The pitch of the tone
 - iii. The timbre of the tone
 - iv. The rhythm of the tone

The correct answer is B (the pitch of the tone). Frequency of a sound wave is perceived as the pitch, the highness or lowness of the sound "note."

Volume corresponds to the amplitude of the sound wave. Timbre refers to the specific mix of qualities that gives a sound its characteristic acoustic "feel" (e.g. a violin vs. an air horn). Rhythm is a reference to a pattern in the timing of a sequence of sounds, and has nothing to do with sound waves themselves.

TEACHER Answer Key

3. Four tones were played and their values recorded on the graph below.



i. Did the Sound Sensor detect any difference between the tones? Explain.

The Sound Sensor did not detect any significant difference between the tones. The values are all within a few points of each other, which can easily be due to random variance in the sensor, or background noise in the classroom. Because they are so indistinguishable, they are effectively the same.

ii. Does this prove conclusively that the tones were the same, different, or neither? Explain.

The lack of difference suggests that the sounds may be the same, but does not prove anything conclusively. It gives some evidence that the tones may be the same, but it does not guarantee that the sounds were not different in some way that was undetectable by the Sound Sensor. For example, a trumpet and a clarinet could play the same note (frequency) at the same volume (amplitude), and the sound sensor may give identical readings, but that does not mean the sounds were the same.

TEACHER Answer Key

4. Four tones were played and their values recorded on the graph below. The tones were labeled "In order of increasing ------", but unfortunately, the last word was too smeared to read.



- Did the Sound Sensor detect any difference between the tones? Explain.
 Yes. The measured values are clearly different from each other. They range from about 22 all the way up to 91. This is a very significant difference.
 Note that the fact that the numbers are in increasing order has no bearing on whether the values are actually different or not. The increasing order comes into play when considering whether there is a pattern, not merely whether there is a difference.
- ii. Is there a clear pattern to the way in which the Sound Sensor values changed based on the differences between these four tones? Explain.
 There is a clear pattern that the sound sensor reading increases with each tone in the sequence. Each tone produces a higher sound sensor value than the one before it, with approximately the same difference between successive tones. In fact, the sensor readings are approximately linear (they lie along a straight line). Whatever the difference is between the tones, the sound sensor seems to read higher when there is *more* of it.
- iii. Does this pattern resemble the results you got for either frequency or amplitude in the Frequency and Amplitude Exploration? This pattern closely matches the series of four <u>increasing-amplitude</u> tones that students observed during the Frequency and Amplitude Exploration activity. Sound Sensor readings increases steadily with increasing amplitudes.