Sound Quality

Have you ever been told that the music you really like is just a lot of noise? If you have, you know that people can disagree about the difference between noise and music.

You might think of noise as sounds you don’t like and music as sounds that are pleasant to hear. But the difference between music and noise does not depend on whether you like the sound. The difference has to do with sound quality.

What Is Sound Quality?

Imagine that the same note is played on a piano and on a violin. Could you tell the instruments apart without looking? The notes played have the same frequency. But you could probably tell them apart because the instruments make different sounds. The notes sound different because a single note on an instrument actually comes from several different pitches: the fundamental and several overtones. The result of the combination of these pitches is shown in Figure 1. The result of several pitches mixing together through interference is sound quality. Each instrument has a unique sound quality. Figure 1 also shows how the sound quality differs when two instruments play the same note.

**Figure 1** Each instrument has a unique sound quality that results from the particular blend of overtones that it has.

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**Sound Quality of Instruments**

The difference in sound quality among different instruments comes from their structural differences. All instruments produce sound by vibrating. But instruments vary in the part that vibrates and in the way that the vibrations are made. There are three main families of instruments: string instruments, wind instruments, and percussion instruments.

**Reading Check** How do musical instruments differ in how they produce sound? (See the Appendix for answers to Reading Checks.)

**String Instruments**

Violins, guitars, and banjos are examples of string instruments. They make sound when their strings vibrate after being plucked or bowed. Figure 2 shows how two different string instruments produce sounds.

**Figure 2** String Instruments

- Cellos and guitars have strings of different thicknesses. The thicker the string is, the lower the pitch is.
- The pitch of the string can be changed by pushing the string against the neck of the instrument to change the string's length. Shorter strings vibrate at higher frequencies.
- A string vibrates when a bow is pulled across it or when the string is plucked.
- Pickups on the guitar convert the vibration of the guitar string into an electrical signal.
- An amplifier converts the electrical signal back into a sound wave and increases the loudness of the sound.
- The vibrations in the cello string make the bridge vibrate, which, in turn, makes the body of the cello vibrate.
- The body of the cello and the air inside it resonate with the string's vibration, creating a louder sound.
Music or Noise?

Most of the sounds we hear are noises. The sound of a truck roaring down the highway, the slam of a door, and the jingle of keys falling to the floor are all noises. Noise can be described as any sound, especially a nonmusical sound, that is a random mix of frequencies (or pitches). Figure 5 shows on an oscilloscope the difference between a musical sound and noise.

***Reading Check***
What is the difference between music and noise?

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**Wind Instruments**

A wind instrument produces sound when a vibration is created at one end of its air column. The vibration causes standing waves inside the air column. Pitch is changed by changing the length of the air column. Wind instruments are sometimes divided into two groups—woodwinds and brass. Examples of woodwinds are saxophones, oboes, and recorders. French horns, trombones, and tubas are brass instruments. A brass instrument and a woodwind instrument are shown in Figure 3.

**Percussion Instruments**

Drums, bells, and cymbals are percussion instruments. They make sound when struck. Instruments of different sizes are used to get different pitches. Usually, the larger the instrument is, the lower the pitch is. The drums and cymbals in a trap set, shown in Figure 4, are percussion instruments.

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**Figure 3** Wind Instruments

- A trumpet player’s lips vibrate when the player blows into a trumpet.
- The reed vibrates back and forth when a musician blows into a clarinet.
- Standing waves are formed in the air columns of the instruments. The pitch of the instrument depends in part on the length of the air column. The longer the column is, the lower the pitch is.
- The length of the air column in a trumpet is changed by pushing the valves.
- The length of the air column in a clarinet is changed by closing or opening the finger holes.

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**Figure 4** Percussion Instruments

- The skins of the drums vibrate when struck with drumsticks.
- Cymbals vibrate when struck together or when struck with drumsticks.
- Each drum in the set is a different size. The larger the drum is, the lower the pitch is.

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**Using Key Terms**

1. Use each of the following terms in a separate sentence: sound quality and noise.

**Understanding Key Ideas**

2. What interaction of sound waves determines sound quality?
   a. reflection b. pitch c. diffraction d. interference

3. Why do different instruments have different sound qualities?

**Critical Thinking**

4. Making Comparisons: What do string instruments and wind instruments have in common in how they produce sound?

5. Identifying Bias: Someone says that the music you are listening to is “just noise.” Does the person mean that the music is a random mix of frequencies? Explain your answer.