

## Sound

- It is meaningful “speech” in any language, from a whisper to a scream. It can provide the listening pleasure of music, the startling accent of special effects, or the ambience of a mood-setting background.
- How you use the power of sound can make the difference between an ordinary multimedia presentation and a professionally spectacular one.
- Misuse of sound can wreck your project.

## The Power of Sound

- When something vibrates in the air by moving back and forth, it creates waves of pressure. These waves spread like the ripples from a pebble tossed into a still pool, and when they reach your eardrums, you experience the changes of pressure, or vibrations, as sound.
- Sound waves vary in **sound pressure level (amplitude)** and in **frequency or pitch**. Many sound waves mixed together form an audio sea of symphonic music, speech, or just plain noise.
- **Acoustics** is the branch of physics that studies sound.
- **Sound pressure levels (loudness or volume)** are measured in **decibels (dB)**.
- **A decibel** measurement is actually the ratio between a chosen reference point on a logarithmic scale and the level that is actually experienced.
- **Note => When you quadruple the sound output power, there is only a 6 dB increase; when you make the sound 100 times more intense, the increase in dB is not hundredfold, but only 20 dB. A logarithmic scale**

(seen below) makes sense because humans perceive sound pressure levels over an extraordinarily broad dynamic range.



- A logarithmic scale is also used for measuring the power of earthquakes (the Richter Scale) and stellar magnitudes (a first magnitude star is 100 times as bright as a typical sixth magnitude star, which is at the limit of human visual perception—magnitude 31.5 is the faintest visible light object detectable by the Hubble Space Telescope).
- You can recognize logarithmic scales because they use divisions that are multipliers (1, 10, 100, 1000) instead of additions (1, 2, 3, 4).
- The decibel scale, with some examples, is shown in Table 4-1; notice the relationship between power (measured in watts) and dB.

dB	Watts	Example
195	25–40 million	Saturn rocket
170	100,000	Jet engine with afterburner
160	10,000	Turbojet engine at 7,000-pounds thrust
150	1,000	ALSETEX splinterless stun grenade
140	100	2 JBL2226 speakers pulling 2,400 watts inside an automobile
130	10	75-piece orchestra, at fortissimo
120	1	Large chipping hammer
110	0.1	Riveting machine
100	0.01	Automobile on highway
90	0.001	Subway train; a shouting voice
80	0.0001	Inside a 1952 Corvette at 60 mph
70	0.00001	Voice conversation; freight train 100 feet away
60	0.000001	Large department store
50	0.0000001	Average residence or small business office
40	0.00000001	Residential areas of Chicago at night
30	0.000000001	Very soft whisper
20	0.0000000001	Sound studio

- Sound is energy and too much volume can permanently damage the delicate receiving mechanisms behind your eardrums, typically dulling your hearing in the 6 kHz range.

- In terms of volume, what you hear subjectively is not what you hear objectively.
- The perception of loudness is dependent upon the frequency or pitch of the sound: at low frequencies, more power is required to deliver the same perceived loudness as for a sound at the middle or higher frequency ranges. You may feel the sound more than hear it.
- **For instance** => when the ambient noise level is above 90 dB in the workplace, people are likely to make increased numbers of errors in susceptible tasks—especially when there is a high-frequency component to the noise. When the level is above 80 dB, it is quite impossible to use a telephone.
- Experiments by researchers in residential areas have shown that a sound generator at 45 dB produces no reaction from neighbors; at 45 to 55 dB, sporadic complaints; at 50 to 60 dB, widespread complaints; at 55 to 65 dB, threats of community action; and at more than 65 dB, vigorous community action, possibly more aggressive.
- Thus, Human hearing is less able to identify the location from which lower frequencies are generated.
- In surround sound systems, subwoofers can be placed wherever their energy is most efficiently radiated (often in a corner), but midrange speakers should be carefully placed.
- There is a great deal more to acoustics than just volume and pitch.
- Your use of sound in multimedia projects will require how to record and edit sounds on your computer and incorporate them into your multimedia work

## MIDI Audio

- MIDI (Musical Instrument Digital Interface) is a communications standard developed in the early 1980s for electronic musical instruments and computers.

- It allows music and sound synthesizers from different manufacturers to communicate with each other by sending messages along cables connected to the devices.
- MIDI provides a protocol for passing detailed descriptions of a musical score, such as the notes, the sequences of notes, and the instrument that will play these notes.
- MIDI data is **not digitized** sound; it is a shorthand representation of music **stored in numeric form**.
- **Digital audio** is a recording. MIDI is a score—the first depends on the capabilities of your sound system, the other on the quality of your musical instruments and the capabilities of your sound system.
- **A MIDI file** is a list of time-stamped commands that are recordings of musical actions (the pressing down of a piano key or the movement of a control wheel or slider). When sent to a MIDI playback device, this results in sound.
- **Note =>** A concise MIDI message can cause a complex sound or sequence of sounds to play on an instrument or synthesizer; so MIDI files tend to be significantly smaller (per second of sound delivered to the user) than equivalent digitized waveform file.

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