Let's Make Some Noise ... Or Not !

A Study in Sound Absorption

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Background

As society and technology continue to change and improve, there has been a marked increase in the amount of sound and noise around us. People now have at their disposal the means to talk on the telephone, to watch television and much more. However, with this new technology, not only do we disturb others at home, we disturb people at work, on trains or buses, and other places as well. As a result, many are uncomfortable with the noise of those around them. One solution may be in either sound proofing or sound absorption. Sound proofing is designed to block outside noise from coming into a room. Sound absorption keeps the noise from an inside space to a minimum. Sound absorption is the process where sound waves are absorbed by materials. To measure the level of loudness, a decibel meter is used. A decibel meter has a logarithmic scale which is based on the sensitivity of the human ear. One decibel (dB) is equal to one-tenth of a bel. A bel is a unit used to measure the intensity of sound. Decibel meters are used in police departments, factories, alarm systems, and even for hospital noise level control. In fact, having a prolonged exposure to noise over 85 dB can lead to hearing loss.

Purpose

The intention of this project is to observe which of the following materials works best to absorb sound: bubble wrap, carpet, carpet underlay, curtains, cork, or Styrofoam.

Hypothesis

I hypothesize that the carpet underlay, with its thick, spongy and ductile characteristics, will absorb the most sound.

Procedure

1. After being cut to size to fit the six sides of a Banker's box, each one of the five different materials to be tested were placed, in turn, inside the box.
2. The speakers and a microphone were placed in the same space into the box for each type of material.
3. The song, Princess of China by Coldplay, was played at the same volume for the ten seconds at the climax of the song, which is loudest part of the song.
4. This was repeated three times for each material to be sure the results were consistent.
5. As the song was playing, the decibel meter app on the iPod touch was recording the average loudness in decibels for each second outside the box.
6. The average of the ten seconds was calculated from the song.
7. The results were studied to determine which material worked best at absorbing the sound overall.

Results

Each trial represents the average measurement of decibels from ten seconds of the song Princess of China by Coldplay (1:39-1:49).

Materials	Trial One (dB)	Trial Two (dB)	Trial Three (dB)	Average Volume (dB)
Carpet	85.1	85.8	85.6	85.5
Carpet Underlay	85.5	86.8	85.7	86.0
Curtains	87.4	86.4	86.1	86.6
Bubble Wrap	87.2	87.1	86.7	87.0
Styrofoam	89.5	90.6	90.1	90.0
Cork	89.7	91.5	91.5	90.9

Conclusions

Although I hypothesized that the carpet underlay would work best, my hypothesis was proven to be incorrect by my experiment. The data resulting from this experiment showed that the carpet worked best at absorbing sound with an average of 86.2 dB, the next best being the carpet underlay at 87.3 dB. The carpet worked best for several different reasons. The texture of the carpet is such that it has loops of fibre that make it dense and plush. All of the other materials used in the experiment were more flat, hard and less plush. The loops of fibre on the carpet were more effective at stopping the sound waves from getting through. When the sound waves hit the other materials, it was a much harder and stiffer material which the sound waves then bounced off of, rather than being absorbed. The data from this experiment could help in instances

when sound absorption is needed, especially in an affordable way without having to do major renovations. For example, restaurants, recording studios, lecture halls and universities could use this information by either adding or removing carpet, depending on what is needed, more or less sound absorption. However, the effectiveness of carpeting in absorbing sound has proven to be interesting in one particular example. Many churches today are having to find the right balance in how much carpeting should be in a church. Too much carpeting absorbs too much sound and might make it difficult to hear the voice of the minister, as well as limiting the volume in congregational singing. Too little carpeting—especially under the pews or chairs of the church—and all you hear is people shuffling their feet and children dropping their toys and books. Ideally, enough carpet should remain under the pews where children's toys drop and footsteps are constantly heard, but not throughout so that the primary speaker cannot be heard.

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