RUNNING HEAD: ASSIGNMENT

How Noise Canceling Headphones Work?

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# Introduction

 If you are a music lover or prefer to listen to it more in open spaces, then there is no possible reason why you will want to try voice canceling headphones. Teenagers, even adults, nowadays, are compelled to try new products that provide better quality, due to the ever changing technological innovations. Sound canceling headphones serve by blocking the outside noise while solely allowing the music from internal sources to reach your ears (Williamson, 2007). This is quite a fascinating phenomenon that uses the application of physics. Now the question is, “How do these noise-canceling headphones work?” The essay will give a possible answer to the question in the light of physics.

***Discussion***

It is essential to first know what sound is, in order to learn how to cancel the noise. You possibly perceive it in the shape of a wave if you try to visualize it. Although this two-dimensional visualization may certainly prove useful later, but it is not the right representation of what sound is. The phenomenon cannot be understood unless you thoroughly understand that concept. This is where physics comes in. Sound, as you perceive it, is just the compression and decompression of air molecules (Sapiejewski and Monahan, 2003). Picturing noise as a three-dimensional pulse across air can be rather simpler. Such molecules in motion result in very minor air pressure fluctuations. These changes in pressure are termed as “amplitude” (Kimura, 2010). Our ears and brain detect these changes in air pressure as “sound”. Both the amplitude and magnitude of sound depend on each other. The higher the amplitude, the louder will be the sound produced (Bergeron et al., 2012).

Noise-canceling headphones form a barrier suppressing sound waves of higher frequency (Bergeron et al., 2012). While deliberately eliminating low-frequency sound waves, they add an additional level of noise reduction. How does this happen to noise-canceling headphones? The answer is that they generate their specific sound waves, which in all respects, emulate the input noise with the exception of one: there is a phase shift of 180 degrees between the input waves and the waves of a headphone (Trajkovic et al., 2002).

The figure below represents the mechanism of how these noise-canceling headphones work. Consider the two waves: one is generated by the noise-canceling headset and the other one is generated by the ambient noise. Both of them seem to have the same amplitude and frequency which shows that their crests and troughs are configured so that crests of one wave align with the troughs of the other wave and the trough of the first wave aligns with the crest of another (Trajkovic et al., 2002). The phenomenon of destructive interference is observed as the two waves completely cancel the effect of each other. As a result, the listener is able to pay attention to the sound that he desires (Trajkovic et al., 2002).



Moreover, the additional structure present in headphones contributes to producing the noise canceling effect (Sapiejewski and Monahan, 2003). This includes a microphone that is mounted inside the ear cushions and receives external stimuli that cannot be actively silenced. Signal-canceling circuitry, which includes electronics mounted in the ear cushions. It detects the microphone signal and produces a sound "fingerprint," which records the received wave's intensity and magnitude. At last, the speaker, which detects the "anti-sound" produced by the signal-canceling electronics along with the regular sound. The anti-sound eliminates the noise by the phenomenon of destructive interference, however, it does not alter the intended sound waves in the regular sound.

***Conclusion***

Noise-canceling headphones provide an extra compression of twenty decibels with the utilization of the above features. This implies that approximately 70% of background noise is successfully blocked, rendering noise-canceling headphones perfect for airplane and bus travel, open floor atmospheres or other destinations with elevated ambient noise thresholds.

***Bibliography***

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