



## A Review of the Effects of Noise Pollution In The Light of Acoustics

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(Submitted: August 31, 2019; Accepted: September 15, 2019)

### Abstract

Noise is said to be a sound (with no periodicity) created by different human and animal activities. Noise pollution is a major source of worry to those living in urban areas owing to its harmful effects. Some of the harmful effects of noise pollution include: insomnia, hypertension, annoyance, lack of concentration, temporary or permanent hearing loss, etc. As such, controlling noise pollution becomes inevitable. Controlling noise pollution from the source requires taking the source of the noise further away from the receiver or taking adequate measure to reducing noise emission from the source. Noise can also be controlled along its path of propagation by the planting noise inhibiting trees. In a situation where controlling noise from its source or along its path becomes difficult, wearing of ear muffs becomes necessary. This is referred to as noise control at the receiver section.

**Keywords:** Noise, pollution, insomnia, plants.

### 1.0 Introduction

Noise can be defined as sound with no periodicity (Onuu, 2000). It is a weightless form of pollution which interferes in day-to-day communication and disrupts human health (Prabhat and Nagarnaik, 2007). Noise is the main source of pollution in urban areas and it interferes with communication and human health (Agarwal and Swami, 2011; Pathak *et al.*, 2008). Noise is said to be the harmful external sound or undesired sound created by different activities. Noise is an environmental problem and thus we refer to its pollution as environmental noise pollution. Environmental noise continues to increase both in magnitude and intensity due to rapid increase in population and urbanization.

Increase in noise levels owing to urbanization also affects wild lives in addition to humans and thus, environmental noise pollution is poised to become a major threat to humans in the near future. Motor vehicles, industries, aircraft and entertainment like music at high volumes are prime sources of environmental noise pollution. In this article, sources of noise pollution will first be considered followed by effects of noise pollution on humans and animals.

### 2.0 Sources of Noise

Noise sources can be classified into two: the industrial sources and the non-industrial sources. The industrial sources include: heavy duty machines such as blasting and crushing machines such as used in quarry sites. On the other hand, automobiles form the major sources of non-industrial noise pollution (Schell *et al.*, 2006). Road traffic noise, aircraft noise and noise from railway traffic constitute the non-industrial noise sources.

Road traffic noise is the most extensive source of noise in all countries and it causes annoyance and disrupts communication (Pandya and Dharmadhikari, 2002; Sinha and Sridharan, 2003). The intensity of noise is said to be proportional to the number of vehicles at a particular point in time and place. Increase in population accompanied by increase in standards of living of people has led to increase in the number of vehicles operating on our roads. This in turn has resulted to escalation of noise pollution (Birgitta and Lindvall, 1995; Fidell *et al.*, 1995). Apart from the density of vehicles, road traffic noise depends on the following factors: road conditions, traffic clearance, size of the vehicle,

condition of vehicles and speed of vehicles (Berger, 1994; Berry, 1983).

In cities, the major sources of noise pollution are from vehicle engines and exhaust systems (Berglund *et al.*, 1975). This type of noise is enhanced by tall structures like buildings and narrow lanes which produce a gap in which traffic noise reverberate.

This noise intensity can reach up to a higher value when measured at a specific point in time and place. The noise levels vary depending on the speed of the vehicle. The noise from the engine is mainly observed at low speeds. Other contributors to road traffic noise include: traffic flow rate, horn, road surfacing, and change in engine speed.

Looking at aircraft noise, the intensity of noise here is usually very high. The noise is emitted from the engines of aircrafts when the planes are about to take off or land (Ogobiri *et al.*, 2013). Increasing air traffic only results in higher levels of the noise pollution problems. Noise levels from the engine increase with speed as more gases are emitted from the exhaust. The invention of supersonic aircraft increased the speeds tremendously. These airplanes travel at speeds greater than the speed of sound in air and the increase in noise output is to compensate for this high speed.

### 3.0 Effects of Noise

The effects of noise pollution include: hearing impairment, disruption of communication, restlessness, sleep disorders and erratic behavior etc. (Onuu, 2019). All the above have adverse effects on our day to day life. The effects of noise on humans (organisms) can be temporary or long lasting depending on the level of the noise.

The world health organization (WHO) referred to the adverse effect of noise as the change in the morphology and physiology of an organism that results in impairment of functional capacity, or impairment of capacity to compensate for additional stress. Noise pollution increases the susceptibility of an organism to harmful effects of other environmental influences.

Noise develops annoyance, irritation and fatigue in humans and also causes disturbance in work, rest, sleep and communication patterns. All these can lead to psychological problems rendering the affected person incapable of leading a normal life. Therefore, noise can rightly be referred to as a potential health hazard.

The exponential growth in noise pollution is a direct consequence of the advancement in technology. The duration of sound wave, intensity of wave, frequency of sound wave and the duration of exposure are few of the factors on which the harmful effects of noise pollution depend on. The impacts of noise pollution on human health can be studied in four parts (Onder and Kocbeker, 2012). They include:

- i. Physical effects such as, temporary or permanent hearing impairment.
- ii. Physiological effects such as, respiratory problems, high blood pressure (BP), etc.
- iii. Psychological effects such as emotional outrage etc.
- iv. Performance related effects, such as decrease in one's efficiency.

The affected people may have one or all of the above listed effects (Miedem and Outshroon, 2001).

#### 3.1 Physical Effects

The most immediate and intense effect of noise pollution is hearing impairment. A sudden loud noise can cause some hearing loss that may become permanent. According to research, exposure to noise above 90 dB(A) can cause hearing impairment (Thompson, 1996). Traffic in urban establishments is a major source of noise with a wide range of effects on humans (Pandya, 2003; Skanberg and Ohrstrom, 2002). In line with this, Nelson and Abbott (1987) reported auditory fatigue caused by sounds over 90dB(A) and permanent deafness caused by sounds over 100 dB (A).

According to Ward *et al.* (1986), the primary effect of noise is increase in hearing threshold. A temporary hearing loss is called "Temporary Threshold Shift", since the ear by nature tends to recover when the source of noise is taken away. High exposure to noise may lead to "Noise Induced Permanent Threshold Shift".

It is important to note that detecting any sound in the audible range of frequency is referred to as normal hearing. Decrease in the ability of the ear to hear sound as age increases is called "Prebycusis". Hearing sensitivity decreases as the frequencies fall below 100Hz. In addition to Prebycusis, exposure to noise decrease hearing sensitivity. This sort of hearing loss is known as "Noise Induced Hearing Loss". Exposure to noise is hazardous and can cause physical or psychological stress (Peng and Mayorga, 2008).

### **3.2 Physiological Effects**

Noise Pollution can have complications as serious as air or water pollution. Millions of industrial workers are at potential risk of temporary or permanent hearing impairment. Prolonged exposure to noise can lead to chronic hypertensions or heart diseases. This topic is viewed under the following sub-heading:

#### **a. Disturbance of sleep**

Sleep is very important in the overall well-being of human beings. Sleep rejuvenates and revitalizes the body and its functions. Noise leads to disturbance in sleep patterns as it is difficult to sleep soundly in a noisy environment (Agarwal and Swami, 2011; Goswami et al., 2011). Berry and Thiessen (1970) observed that noise from trucks and aircraft flyovers disturb sleep a lot. Dobbs (1972) observed that sleep of children and young people were less affected when compared with those of middle or old aged people. Thiessen and Lapointe (1978) reported sleep disturbance were due to variations of noise levels from night to night. They also reported that free flow of traffic at medium range of noise (47-60 dB (A)), led to an increase in the percentage of deep sleep along with increase in the number of awakenings. Lukas (1972) observed that women were more sensitive to noise during sleeping hours than men. Chakrabarty et al., (1998) conducted interviews of people living in buildings near a traffic junction and found out that a good number of people in that building had severely disturbed sleep.

#### **b. Effect of noise on task performance and cardio-vascular system**

Noise can act as a distracting stimulus and may also affect the psychological and clinical health of the individual.

It has been reported that symptoms of mental disorder were more common among those who were very irritated by noise exposure (Tarnopolsky et al., 1978). Continuous exposure to noise causes constriction of blood vessels in humans, which may eventually lead to heart ailments (Lehmann and Tamm, 1956). Kapoor et al. (2000) reported the effect of pleasant and unpleasant sounds on physiological and biochemical functions of human volunteers. Health outcome deriving from long-term exposure to noise include both cardiovascular and respiratory events, a phenomenon that has been well documented by various studies undertaken in recent years (Hart et al., 2013).

#### **c. Blood pressure**

Noise pollution affects human's peace of mind. In addition to the existing vicissitudes in life, noise pollution further worsens our condition. It elevates blood pressure leading to ailments such as hypertension.

### **3.3 Psychological Effects**

Behavioral changes are observed in both animals and humans owing to exposure to noise. Noise may cause annoyance particularly, when the source of the noise is not known (Rao and Rao, 1991). Interruption during speech (owing to noise) may hamper the flow and efficiency of the speaker. This invariably leads to annoyance (Chakrabarty et al., 1998; Mohan et al., 2000). Patil et al., (2011) reported utmost annoyance of 47% which was more during midday and afternoon, while 50% of subjects reported headache, nervousness and hearing difficulties due to severe noise pollution.

It has been found that noise pollution is responsible for strains and tensions in the muscles. Noise pollution is also known to increase the rate of heartbeat, constriction of blood vessels, muscle constriction leading to nervous breakdown. This may lead to heart diseases (Morrell et al., 1997). Noise pollution affects the quality of life (Meiedema and Outshroon, 2001). Repeated exposure to high level of noise causes stress on nervous and auditory system (Subramani et al., 2012).

### 3.4 Performance Related Effects

Noise can lead to disruption in communication. Humans can distinguish between different sounds. The production of sound from two different sources at the same time is called Masking. Masking disrupt communication, although sometimes it can be beneficial.

Another performance related effect of noise is that it can lead to lack of concentration. Better concentration yields better results. Noise disrupts concentration levels. In cities noise due to vehicular and industrial movements disrupt concentration levels in individuals. People cannot concentrate on their work when exposed to noise pollution. They tend to take extra time to complete an allotted assignment.

### 3.5 Effect of Noise on Wild Life

It has been observed that high noise levels adversely affect animals not only human beings. Animals are usually forced to relocate to other places when exposed to high levels of noise. Many birds for example leave a particular place (to somewhere else) if it becomes too noisy. During breeding period, Migratory birds avoid noisy places. It has been reported that the zoo animals, particularly the deer, lions and rhinos, are worst affected by noise pollution (Shastri and Trivedi 1988). They become dull and inactive in noisy environment. This invariably leads to deterioration in their health conditions and consequent decrease in their population. In essence, the psychological and ecological consequences of noise pollution is that the very existence of these animals are threaten.

### 3.6 Effects on Non-Living Things

High noise intensity has been observed to affects non-livings thing too such as buildings and other architectural works. Apart from the vibrations such buildings receive, depreciation of the values of such building becomes imminent. Consider for example, residential buildings sited near airports, no one would want to leave in such houses with his clear mind and this automatically reduce the value of such houses. As such, the effects of noise are of great concern even for non-living things.

## 4.0 Conclusion

It is obvious that the effects of noise are enormous and noise pollution requires urgent attention to mitigate its effects on animals and humans at large. It may not be possible to do away completely with the sources of noise pollution as such, reduction of noise levels from these sources becomes very important. For example, the air horns of motor vehicles and motorcycles are major contributors to environmental noise pollution and one cannot stop the usage vehicles and motorcycles. Thus, enacting laws that will checkmate the erratic use of these horns becomes necessary.

Again, it has been discovered that plants generally help in reducing noise levels in an environment. Although some plants are said to be more effective in noise reduction when compared to others. The pollution preventing characteristic of plant materials varies depending on the plant variety. So, planting of trees along the road can be a useful solution to reducing road traffic noise.

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