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Introduction

The ear can be divided into three sections each performing a specific role to change sound particles into messages the brain can read. The three major parts of the ear are the outer, middle and inner ear. Simplistically it is somewhat like a mechanical process that changes an analogue signal into a digital message that your brain can understand. However, there are certain factors that can affect our hearing in terms of perception of loudness, pitch and direction. Psychoacoustics needs to be considered when looking at the process of hearing as it examines the relationship between sound and the effect it has upon the brain.

Physical Description of the Ear

The process of hearing utilises all three sections of the ear. The first section, the outer ear consists of the pinna, the auditory canal and the wax. The pinna is the main part of the ear that you can see, its role, to collect sound and direct it down the auditory canal towards the ear drum. The outside of your ear is perfectly designed to collect sound. This design helps to determine the sound’s direction. Sounds waves bounce off the Pinna depending on from which direction they came from. The sound reflection from the Pinna alters the pattern of the sound wave which the brain is able to distinguish and determine where the sound came from.

The auditory canal is the main pathway of sound, its role is to direct sound towards the eardrum, the canal is also where earwax is produced. The

purpose of ear wax is to keep the ear canal clean by collecting dirt and debris.

Once the sound wave has passed through the outer ear and has been directed down the auditory canal to the middle ear it hits the Tympanic Membrane (Ear Drum), this is a very tight thin piece of tissue which converts the sound wave into vibrations. The ear drum separates the outer ear with the ossicles, these are the three main bones in your ear. When the ear drum vibrates this causes the bones to move, the vibrations set the bones into motion passing the signal from one bone to the other. These tiny bones are called the Malleus (Hammer) directly connected to the ear drum, the Incus (Anvil) which is attached to the Malleus and finally the Stapes (Stirrup) which is attached to the Incus and is the smallest bone in the human body.

The stapes is attached to the oval window, a membrane which is part of the cochlea and separates the middle ear from the inner ear. The inner ear is the most complex and detailed part, containing the main sensory organ called the cochlea. Its role is to convert the vibrations absorbed through the ossicles and passed through the oval window membrane into electrical impulses.

The cochlea’s shape is a small spiralled tube resembling a snail shell, this is filled with fluid and miniscule hairs. The vibrations from the stirrup cause the oval window membrane to flex which in turn sets the fluid into motion, the moving fluid brushes across thousands of microscopic hair cells called cilia, These are tuned in to certain frequencies, higher frequencies by cillia located near to the oval window membrane and lower frequencies by cillia located at

the apex of the cochlea. This allows it to act as a frequency spectrum analyser. The cillia convert the vibrations into electric nerve impulses sent to the brain by the auditory nerve which is then interpreted as sound.

Psychoacoustic Phenomenon

Psychoacoustics also needs to be considered when looking at the process of hearing as it examines the relationship between sound and the effect it has upon the brain. The Doppler Effect is an example of this. It “ is the change infrequencyof awavefor an observer moving relative to the source of the wave.” For example, a car emitting a constant horn sound starts to approach you at speed as you are stood at the side of the road. As the car approaches you, the sound of the horn starts to get louder and higher in pitch. Once the car has passed you the sound of the horn starts to lower in pitch and decrease in volume. As the vehicle passes, sound waves from the horn are crowded together in front of the car, the crowded sound waves produce the relatively high pitch sound, as the car passes the sound waves are more spread out resulting in the relatively low pitch sound, as you can see on the diagram below

The second phenomenon that can affect our perception is the Haas effect. If two sounds of equal frequency content and intensity are played from different directions, we will only hear the first one to arrive, and we will perceive only one sound coming from that direction.

An example of this used in public address systems so that multiple speakers do not affect the perceived direction of the sound coming from the stage.

Second part (also 750 words): Giving at least 2 significantly different examples, discuss why certain instruments sound the way they do, How do factors such as their physical construction and the method of playing affect their individual characteristcs and timbre? How does the harmonic series come into play, and how does this determine concepts such as scale and temperament

Acoustic Guitar

Construction and playing style

A guitar's construction is split in to three parts, the body, the neck and the head. The sound generating part can be found on the body and is called the soundboard. The soundboard has a large round hole in the centre called the sound hole. Also attached to the soundboard is a piece called the bridge, to which one end of the six strings are attached. The bridge has a thin, hard piece embedded into it called the saddle, which is the part that the strings rest against. When the strings are plucked, the vibrations travel through the saddle onto the bridge and then into the soundboard. The soundboard then vibrates. As the body of the guitar is hollow, these vibrations are amplified and emanate from the sound hole.

Harmonic Series

When a note is struck on a guitar the sound produced is a series of notes. The first harmonic, the fundamental is the loudest and lowest of the series. Along with that you are also hearing tones that accompany the fundamental and are responsible of making the guitar sound the way it does. Guitar harmonics are created when you lightly touch the string at specific positions and then pluck the string, when plucked the string vibrates at its

fundamental frequency, also vibrating the integer multiples of the frequency as displayed on the diagram below:

The performance of the guitar depends on the quality of the wooden soundboard. The Timbre of the can have a huge impact on the choice of wood, the way the wood is supported, the glue and even the varnish are all taken into consideration as this can have an effect on the sound of the guitar due to the quality of the sound produced

DRUM

A drum consists of a skin, a shell or body and a mechanism that holds the two pieces together. The skin of the drum is a flexible membrane, stretched tightly around the rim. Drum skins were originally made from animal skins but nowadays most use synthetic skins. The skin is held onto the rim in a variety of ways. Some use tacks or glue while others use ropes or adjustable metal brackets to attach the skin to the body.

When a drum is struck, it makes a loud sharp sound followed by a rapidly decreasing tone. The sharp sound is called the attack, and it is made by a stick or hand banging onto the surface. The strike also pushes the drum head downwards. Because the drum head is elastic, it springs back up again with a lot of energy, causing it to go up higher than the position it started in. This causes it to spring back down again. The drum skin goes up and down very quickly, pushing air in front of it and creating the tone, sometimes known as the decay. Some drums, such as the snare, have a sharp attack with almost no tone. Others, like frame drums, have a more mild attack with a tone that goes on and on.

The hair cells in the organ of Corti are tuned to certain sound frequencies, being responsive to high frequencies near the oval window and to low frequencies near the apex of the cochleaThe hair cells in the organ of Corti are tuned to certain sound frequencies, being responsive to high frequencies near the oval window and to low frequencies near the apex of the cochleaThe hair cells in the organ of Corti are tuned to certain sound frequencies, being responsive to high frequencies near the oval window and to low frequencies near the apex of the cochleaSecond part (also 750 words): Giving at least 2 significantly different examples, discuss why certain instruments sound the way they do, How do factors such as their physical construction and the method of playing affect their individual characteristcs and timbre? How does the harmonic series come into play, and how does this determine concepts such as scale and temperament Second part (also 750 words): Giving at least 2 significantly different examples, discuss why certain instruments sound the way they do, How do factors such as their physical construction and the method of playing affect their individual characteristcs and timbre? How does the harmonic series come into play, and how does this determine concepts such as scale and temperament Second part (also 750 words): Giving at least 2 significantly different examples, discuss why certain instruments sound the way they do, How do factors such as their physical construction and the method of playing affect their individual characteristcs and timbre? How does the harmonic series come into play, and how does this determine concepts such as scale and temperament Bottom of Form