Applied Ergonomics

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Lecture – 12

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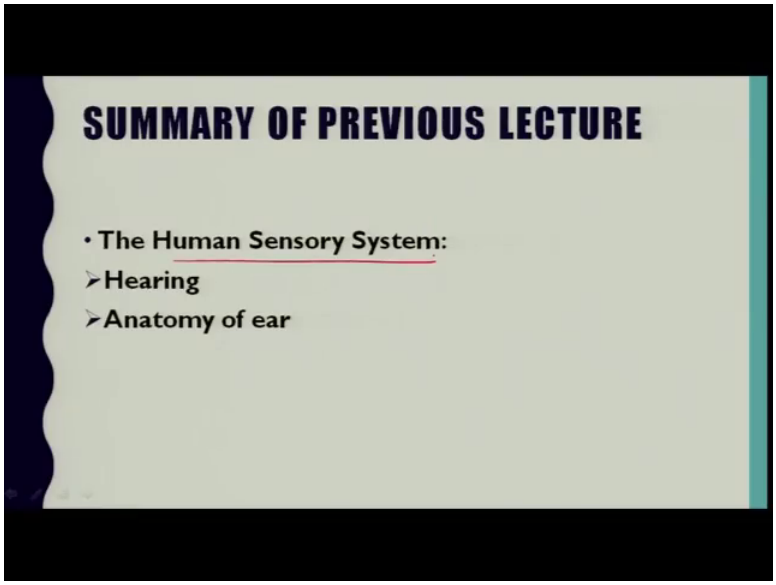

So, this lecture as an continuation with the previous lecture which was based on the cognitive ergonomics in which we have covered the description of human sensory system and we covered the hearing phenomena and as well as anatomy of the ear, and its related operation. So, there are different components of the ear, and what are the basic mechanism through which sound waves entering from the from the left side of the ear and it is going through various path inside the ear and finally, going to the brain giving work to the brain for interpretation purpose, so that we discussed in the previous lecture.

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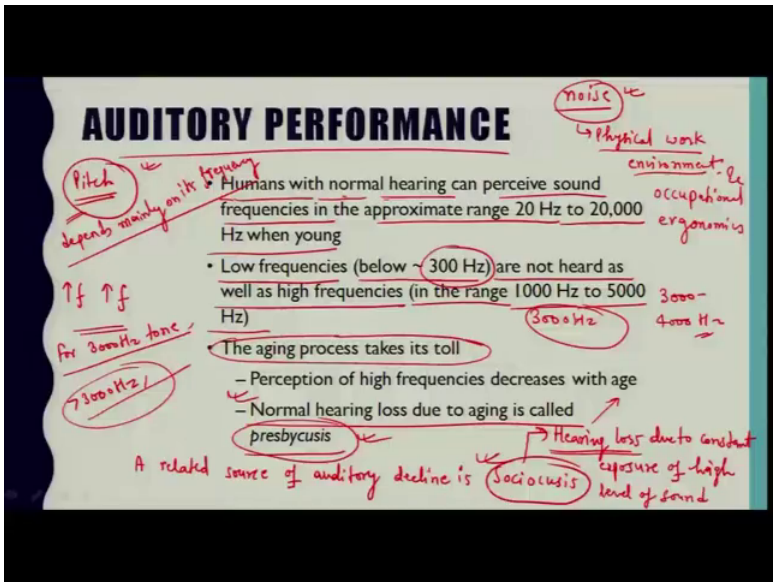

And now we will start with auditory performance. So, in this lecture basically we cover auditory performance as well as other sensory organs which are being utilized by human body in order to interpret the information around us. So, in fact as far as auditory performance is concerned, so there are certain analogue is existing between hearing and visual senses. So, let us say in purely physical terms, sound intensity is analogous to luminous intensity; and sound frequency is analogous to view.

So, human perceive sound intensity and loudness is also similar to the brightness. So, does not comparing the human senses of hearing and sight, the loudness is basically similar to brightness and which is similar to color. So, we will discuss some of the performance characteristics associated with the hearing and as well as we will also discuss about the occupational workplace design issues which is related to excessive sound waves that we call as a noise, and its effect to the physical work environment, so that we will discuss in the coming lectures. So, the noise is playing very important role in the system performance and that system may be composed of the human or any machine, so that will be discussing in the physical work environment and as well as when we will be discussing about the occupational ergonomics or occupational safety and health.

Now, coming back to the some of the facts that is essential to know here in this case that humans that normal hearing can perceive sound frequencies in the approximate range of 20 hertz to 20,000 hertz, when they are young; however, humans have a different

auditory sensitivity to different frequencies. So, low frequencies which is below 300 hertz are not heard as well as high frequencies which is in the range of 1,000 hertz to 5,000 hertz. Another we have saying can be that 300 hertz tone at a given intensity level will not seen as loud to the human listener as a 3,000-hertz tone of same intensity level. So, maximum sensitivity is in the range of 3,000 to 4,000 hertz.

And as well as there is another world that is called pitch. So, we also have to know about the pitch. So, pitch is nothing but the perception of a sound that depends mainly on the frequency mainly on the sound frequency. So, as frequency increases this pitch is also increased. One sense of pitch is also affected by the loudness of sound. Let us say for 3,000-hertz tone, the pitch remains relatively constant over a wide range of intensity levels; however, for tones lower than the 3,000-hertz pitch is reduced as this density as the intensity of the tone increases. So, pitch seems lower as the sound becomes louder all though frequency remains the same. Similarly, for tones higher than the 3,000-hertz pitch seems to increase for the louder tones even though the frequency is actually the same.

There is another factor, which is aging; and the performance of capturing the sound goes on decreasing as human age advances. So, the aging process takes its toll on hearing just as it does on vision and so many other human capabilities. So, a normal hearing loss due to aging is known as presbycusis. So, I will related source of auditory decline is sociocusis. So, another presbycusis is also one of the term which is caused due to the aging problem and another term as related source of auditory decline is sociocusis. This sociocusis is the hearing loss due to everyday sound such as television, traffic noises.

So, if you are constantly exposing to the loud sound on the daily basis let us say so the hearing loss, which is happening as sociocusis. So, hearing loss, which is due to constant exposure of high level of sound, so that is creating hearing loss and that is known as sociocusis. So, basically this sources are non occupational and because of examine occupational noises and their consequences. And we in a industry or in a job we which as an ergonomists, the duty of an ergonomists is to check the certain noise level whether it is exceeding certain limit or not, because it is directly going to affect the performance of their workers, so that is an main important part in the role of an ergonomist. So, this presbycusis and sociocusis and another kind of a loss is nosocusis.

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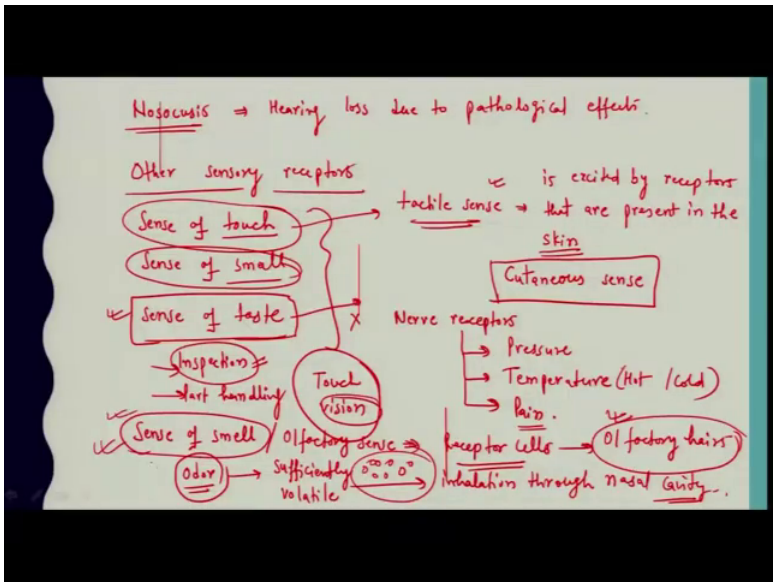

So, there is another kind of hearing loss is nosocusis which is the hearing loss due to pathological effects. So, in this way there are various losses which we covered in this particular series, and now we will try to understand other sensory receptors. So, in that context of vision and hearing we have learnt that these are the most important human sensory receptors for occupation. So, together as an vision and hearing both will give in general term the 95 percent of the information that we perceive on the daily basis. So, other than like 5 percent of the information that we get that is based on the other human senses, those senses include sense of touch, sense of a smell and sense of taste. So, these are the other senses through which we perceive information, but their percentage is very less in comparison to the vision and hearing.

So, in these three senses the sense of taste; however, it adds to the pleasure of eating is really applicable as far as workplace is concerned except during the lunch hour, which the most worker awaits on the daily basis. So, if you leave that lunch hour, so this sense of taste does not play any role in occupation. So, accordingly we always coverage of this senses like this sense of taste and now another kind of sense and we can say that human extra receptors, so this sense of touch is also known as the tactile sense, that is excited by receptors that are present in the skin.

So, this particular sense of touch is excited by receptors that are present in the skin. And for this region this particular tactile sense is mostly or generally known as a cutaneous

sense. So, there is another term which is used for this tactile sensing or the touch sensing is known as cutaneous sense. The nerve receptors in the skin are very much sensitive to several types of stimuli including pressure. So, basically the nerve receptors present in our skin are sensitive to several types of stimuli such as pressure which come closest to the tactile sense temperature. So, we immediately feel whether particular object is hot and cold and the most important thing is pain, so which might derived from either of the previous two types or from an injury.

So, in the workplace, in any job or in any industry, the tactile sense is used in task such as inspection, inspecting for surface roughness or sharp burst that has been created by manufacturing any product, so that inspection part handling or operating controls using switches and dials. So, in these applications it is usually an auxiliary sense applied in conjunction with the vision also. So, this particular touch is also being coupled with vision, so that the worker can perform the assigned work, so its functionality is more than auxiliary for people with serious vision impairment.

Now, in the thing that has left is a sense of smell. So, this sense of a smell, which is also known as olfactory sense; it is basically derived from the sensory sense located in each nostril that are stimulated by vapor molecules in the air. So, these receptor cells contain olfactory hairs that actually perform the sensing function. For a substance to have an order it must be sufficiently volatile to release molecules into the air that can be in healed through the nasal cavity. So, this olfactory hairs what is doing here these are actually performing the sensing operation and the prerequisite of this particular senses to work is it should have an order an object should be having an order, so that it should be sufficiently volatile also. So, that it releases the molecules into the air that can be inhalation through nasal cavity.

So, most of the substances are organic compounds. So, the sense of a smell is not generally useful in the workplace except in the operation of let us say food industries and other industries who are making those a smelly products like perfumes etcetera. So, in some instances, the sense of a smell may alert a worker to an abnormal condition which such as something burning or a machine producing hazardous odor.

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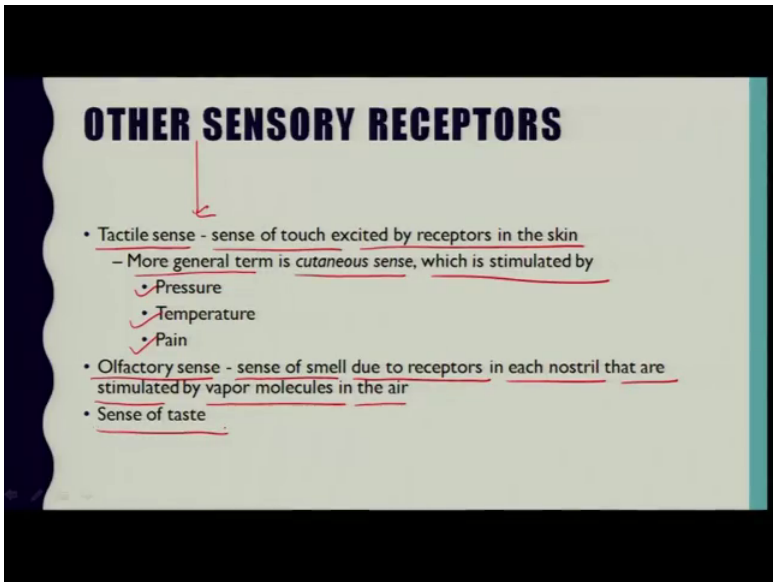

So, as a summary of these other sensory receptors we completed the tactile sensing. So, tactile sensing is nothing but it is a sense of touch excited by the receptors in the skin. More general term is cutaneous sense, which is stimulated by pressure, temperature and pain that we discussed in the previous slide. Olfactory sense this sense of the smell, which is due to receptor in each nostril that are stimulated by vapor molecules in the air. And third is sense of taste. So, we are on the closer of this lecture

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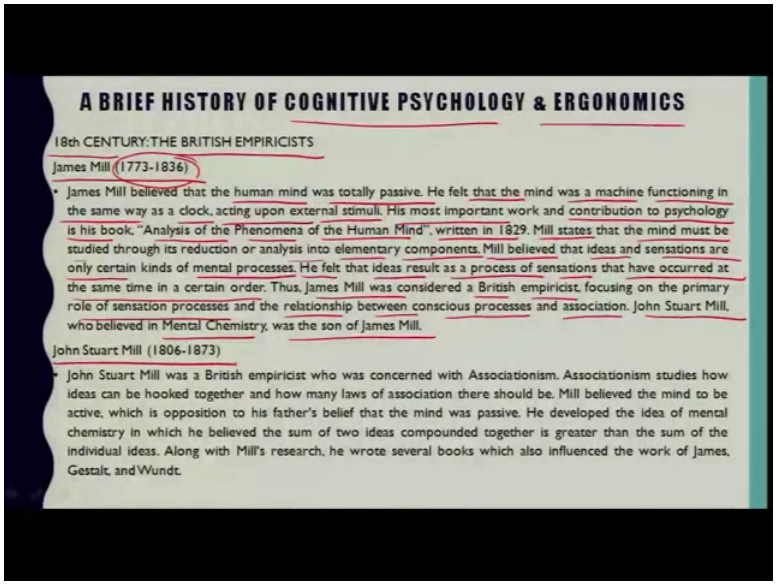

And before that let us have a brief history that is I personally believe that we need to remember those who have contributed in any field. So, since we are focusing towards cognitive ergonomic understanding so in that cognitive psychology and ergonomics play a very important role. So, in 18th century there are some British empiricists James Mill whose live tenure is 1773 to 1836. So, he believed that the human mind was totally passive. He felt that mind was a machine functioning in the same way as a clock acting upon external stimuli. His most important work and contribution to psychology in his book, Analysis of the Phenomena of the Human Mind written in 1829. Mill states that the mind must be studied through its reduction or analysis in to elementary components. Mill believed that the ideas and sensations are only certain kinds of mental processes. He felt that the ideas result as a process of sensations that have occurred at the same time in a certain order. James Mill was considered as a British empiricist, focusing on the primary role of sensation process and the relationship between conscious process and association. John Stuart Mill who believed in mental chemistry was the son of James Mill.

So, this is now I am going to tell about the story of John Stuart Mill whose life tenure was 1806 to 1873. So, he was a British empiricist who was concerned with Associationism. Associationism studies how ideas can be hooked together and how many laws of association there should be. Mill believe the mind to be active which is opposition to his father's belief that mind was passive. He developed the idea of mental chemistry in which he believed the sum of two ideas compounded together is a greater than the sum of the individual ideas. Along with the Mill’s research, he wrote several books which also influenced the work of James, Gestalt and Wundt who were the protagonist of this cognitive psychology.

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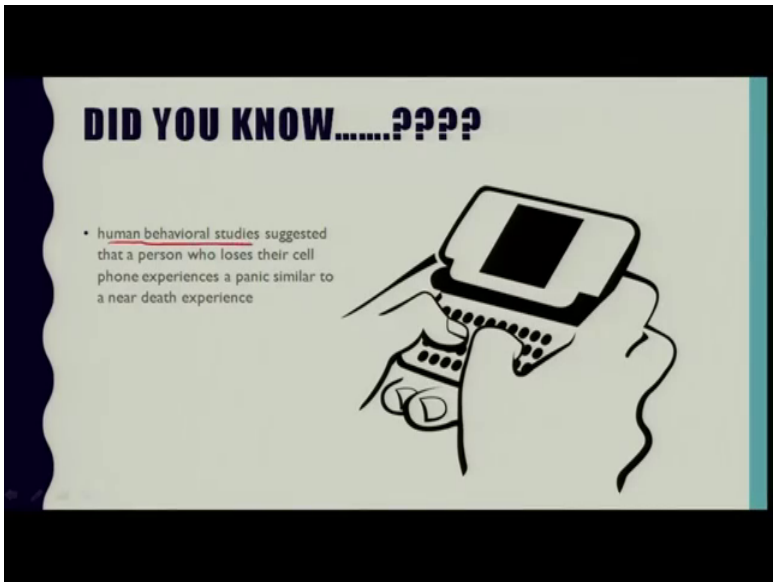

So, as a refreshing fact that do you know that human behavioral studies suggested that a person who loses their cell phone experiences a panic similar to near death experience.

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As graffiti for you, I bang my head against the wall several times a day. That is why I need ergonomic hair. So, that is all for now.

Thank you very much for patient hearing, thank you.