Ergonomics for Beginners Industrial design Perspective

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Module No. # 07

Environments Factors

Lecture No. # 30

Environmental factors influencing human performance

Welcome to this thirtieth session of ergonomics for beginners industrial design perspective.

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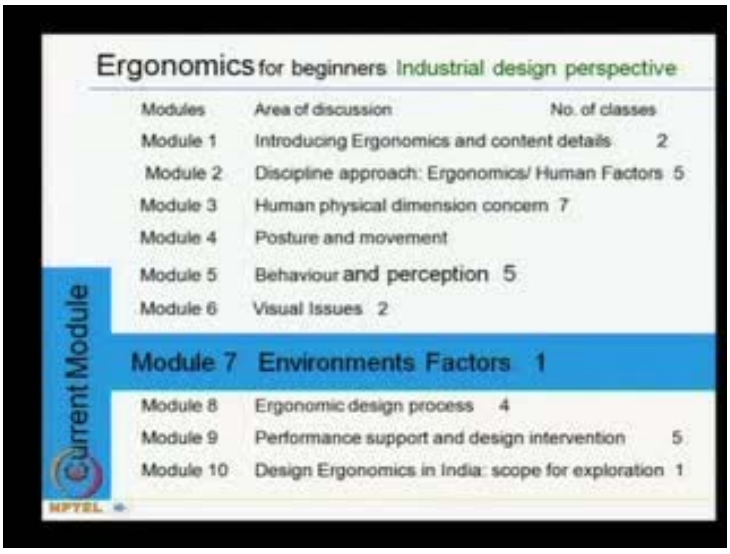

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Today's current module, the module number 7, Environmental factors and this is the one class. So, today's session the class number 30, Environmental factors influencing human performance.

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Now, if we see the work place, where we work together; in this figure, we can see some of the arrangements are shown here. Now, what is the potential to perform? The space, the total ambience with the illumination, heat, ventilation, vibration and privacy feeling, etcetera.

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So, how our work place is assisting us to perform based? Now, the corporate call, if we see in this figure, which is taken from a newspaper article and it says that - today's corporate or today's work environment that we feel, it will be free, near to nature, but how far we can go.

The reality versus the dream work place. Now, if we, if our expectation matches with the work space and the work equipment, then obviously we will be able to perform as the desired, but how it affects.

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Now, in this figure, we can say, we can see one work environment of a fruit processing unit. In reality, this is our work environment where people work. Now, it looks clumsy, it looks unorganized, it looks various environmental factors are also influencing the total productivity.

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Now, here, if we see that open environment work, still people are working. In this figure, it seen that the pers people are placing some grassy grass pieces, the chunk of grass pieces on a barren hill wall and they are just putting like this. Suppose, this is a grassland and they are placing it here and then one small bamboo piece, they are fixing to keep it in place with small hammer like this, the bamboo made hammer. Now, the people are working with direct sun, the placement and the equipment; they are using this type of open work environment, what can be done. Now, the people are working with direct sun the placement

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and the equipment; they are using this type of open work environment, what can be done. Now, here, it is shown to climb, obviously in the normal available ladders, bamboo made ladders are being used to.

Now, here, it can say the total work plan that how this truck is carrying the grasses, the grass is being carried over and then it is being fixed on the hill top.

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So, this is the one area where the open work is going on. Now, another work area, it is open coal mine where the space is open but people inside who is running this equipment, this machine, they are inside in their specific space. So, in that, this is the cabin from where the driver or he works. Now, it can be seen that, from the front area of this machine, is that, this is the cabin where this type of few persons are working and these are the work equipments.

Now, in this, the dust is there, heat, also the humid conditions. Now, inside this cabin, if we can make a air cooling system or a specific controlled environment, then it may have been better. Now, another equipment, another work area, that is, in the, at home, the kitchen; the kitchen a compact work environment requiring multi sensor activity.

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Now, here, what is the multi sensor activity? It means, in this case, when some work is going on, now this is the fire one has to concern; this the illumination level, etcetera, it is to be concerned and then some other, the power point and etcetera and displacement and also, when this chimney is working then this fume, etcetera should go out. So, the smell is also another factor like that and then the total illumination level in this is also another factor. So, all these environmental factors influence the person who is working here to perform at the best.

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So, now, what are the factors are responsible for this? Not only the physical factors, so all these environmental factors influence the person who is working here to perform at the best. So, now what are the factors are responsible for this? Not only the physical factors another factor that is the privacy. Now, the privacy and the factors relevant, the viewing distance, viewing angle and related environmental issues are there.

So, the privacy is also one of the another important factor that influences the work space and product design.

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Now, if we can see this thing, this figure says that the facility and conveniences. Now, in this figure, if we read, this is a published in paper; two persons are talking, what is heaven? This persons says - a place where you live forever and do nothing but watch 600 channels; they are all happy and hell? No remote controls are there. From this cartoon, what essence we can get, we can relate that facilities all may be there, but how to use it properly, that is necessary. The human issues in relation to those factors that is not only the facility provisions are necessary, but the convenience to use those facilities also need to be seen.

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Like this one equipment, here showing on a corridor a fire hazard; this equipment is placed, but the thing is that when there is no free, no fire and when the people are crossing this, through this road or this corridor, after a certain period, a system component, is a, in a busy work environment easily gets adapted, people forget its presence. So, then the placement location of an equipment is also important and the information which is presented here, how to use? How to operate? Whether it is easy to access?

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Now, the moving built environment: the moving built environment is that, in this car the space inside, heat, humidity, ventilation and all vibration all are on considered and it should match with our expectation.

Now, what is the expectation that limit is yet to be finalized and it is a progressive regular progress, somewhere, some vibration is necessary; somewhere, vibration is not necessary; it means, sometimes what is happened when you are driving? If lorry or a truck on a rough road with a heavy luggage in back, then that road feeling that comes to that vibration is necessary. Some studies mention this, but when you have your own car or you are sitting in a theater, at that time that vibration is not necessary, but to create a specific ambience that vibration may be required. So, the need and the demand, this relation are not in a fixed proportion; the context specifically is application is necessary.

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Now, another area is that the airports approach. This has both the open system, the open area environment as well as confined is a mixture kind of thing. An environment needing multisensory information system; for example, we can say that railway platform; railway station, in a railway station, it is a noisy area. If only train arrival and departure etcetera or some other information is if it is only the auditory and if there are many auditory information are coming at a time, then it very difficult to recognize the specific information you require and at the same time, if we give only the light sensors sensation like, suppose there is some kind of an electronic display and that gives these things, train incoming, going, arrival, those information and others.

Now, it also has a specific placement location or otherwise you may miss it. So, in certain cases, where the much many people are there and there is no specific location fixed to see the information, to get the information, in certain cases more than one sensory information are to be presented. So, from this, we can say that what will be the display modality.

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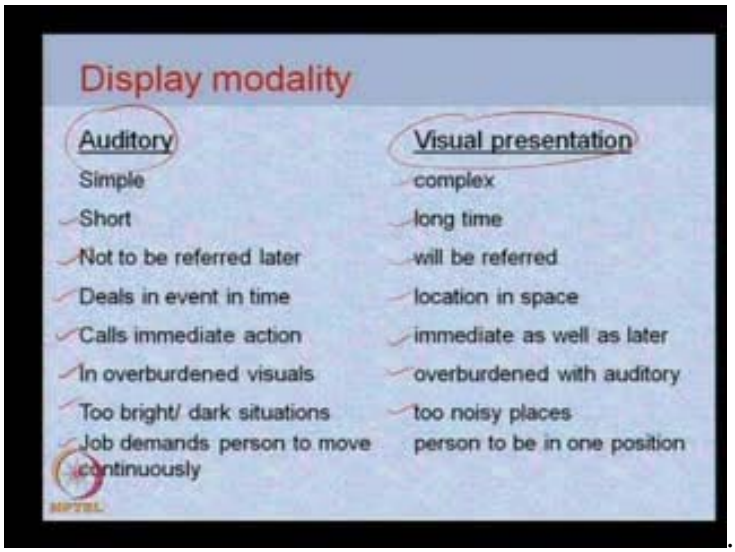

Now, under this display modality matter, suppose we are discussing the auditory and visual presentations. Now, where will we stress on auditory? Where will we stress on visual presentation? Where should we use both the things? Like auditory when the information is very simple. Visual presentation, at the complex information is to be presented.

Auditory is a very short duration, short information auditory; with long auditory matter we cannot retain for longer time, but for long time requirement, visual presentation is necessary because you can refer it back.

Auditory signals are better when not to be referred latter, but when it requires to be referred later, then visual presentation is important. Delays deals with the event in time, visual presentation deals location in space. Like Auditory calls immediate attention, this visual presents immediate as well as latter, means, we can ignore some of the visual information at that moment, but after sometime with the same input being present there one can act upon it, but auditory signal it comes and it vanishes; its life span is very short.

Auditory symbols - auditory signals may be used where the overburdened visuals are there; where overburdened visuals are there. Some sound may be necessary to identify that overburdened with auditory there; like in a fair, where lot of noise are there to draw

attention or somewhere else some light signal maybe necessary. Auditory signals can be used in too bright or dark situations, too noisy places, visual presentations are required.

Job demands person to move continuously, means, mostly, normally the visual presentations are in a static format in a specific place, but when person is constantly moving, it is very difficult to concentrate on that. In that cases, the auditory signal will be better; in a bus stand, the buses are moving and etcetera, there it would be good to use auditory information like broadcasting kind of thing - mike, but where person to be seated in a position like in a waiting hall; there, in a railway station, waiting hall, there some kind of electronic display may be successful.

Now, the question comes, where both things are necessary? Something like that, when you are taking a turn with a bicycle or a motor cycle left side or right side, when you are switching it, the signals, then the signal light, as well as sounds should be there.

Signal light, from far distance people can recognize the sound where the near people, they can get good information. Now, in another case, suppose in a railway station waiting hall, in an electronic display board many trains and their information are coming up, but the particular train information that I require is not coming in the regular way. So, after seeing this whole board where my required information is not present, I may tend to avoid its presence, but as per regular updates my required train information appears, I maybe seat. At that time, with some sound when the changes are there in the visuals, if the sound signal also accompany with that then I may notice this.

In this type of contest, both the signal combinations are necessary. Suppose, a very big machine, in that machine there many functional components are there and to know all the machines are functioning well, the individual light signals are there and all light signals are running. If any problem in a specific component, so that light signal will start differing from intensity point of view light or may be blinking or whatever, to get final further attention, if it accompanies with the sound, it will draw my attention very fast. So, in this type of things, cases, both the signals mixture are necessary.

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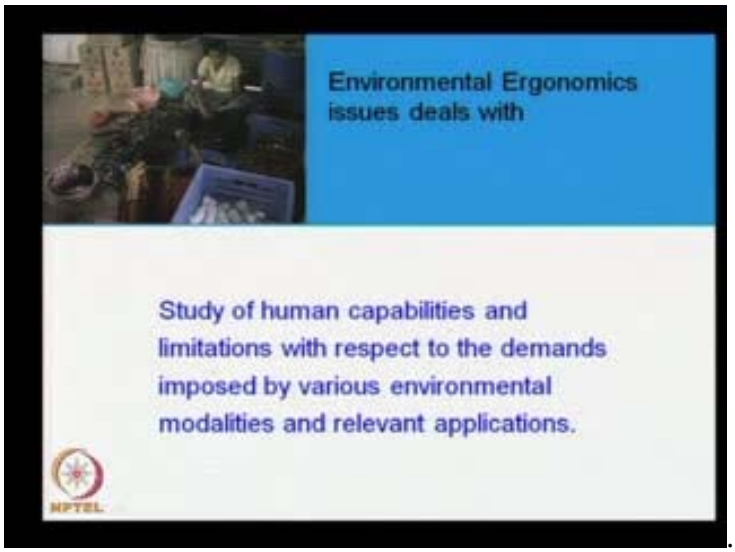

Now, environmental ergonomics issues deals with the study of human capabilities and limitations with respect to the demands imposed by various environmental modalities and relevant applications. In this figure, it says that the total display of the work equipment.

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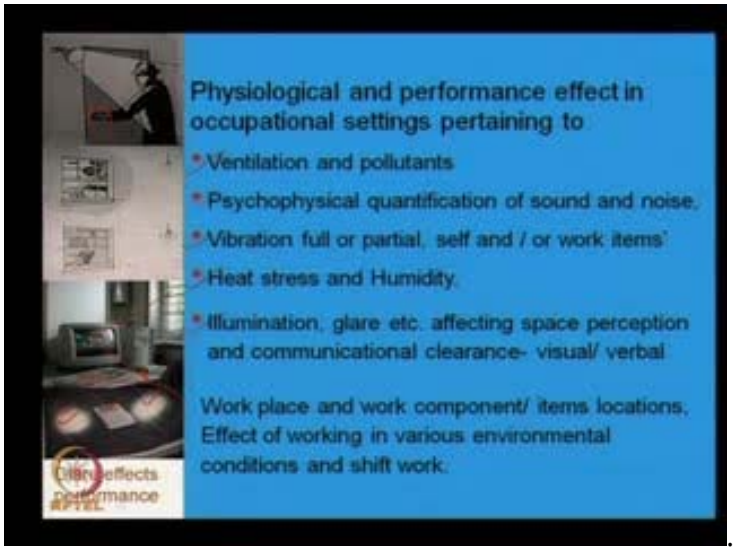

Now, for example, environmental, in this case, this figure, in this top left figure, it says that a keyhole operation. When you are opening the key hole, normally on the top of the

door the light is there. So, the light comes to you, but light does not fall on this required area. So, though light is there, but still, for doing that work how far is it helping?

In certain cases, that inside light and outside light, the variation it gives or it assists in visual or to see that things. Like it, If in the outside of a room is less lighted, inside the room is a more lighted, then you can see the inside details. But, inside less lighted and outside room is a more lighted then from outside, it is difficult to see inside. So, these type of things, the light intensity at the variations, it plays a role in this type of understanding or to see the details.

Now, the glare effects performance; when we keep a computer near the window, the window light comes to the person. In this case, it is the glare that is the glare comes; so, the placement location of the equipment also required to be considered. Then, in this case, it is said that - when one can read this book, no problem, but on top of the ceiling that lamps are there, it is lamps reflections are here, that gives a discomfort.

So, the component locations, the environmental fact issues needs to be considered that where the installations will be there. So, the Physiological and performance effect in occupational setting pertaining to ventilation and pollutants; if pollutants are there in certain area, people will try to avoid that location.

Psychophysical quantification of sound and noise; vibration full or partial, self and or the work items, means, vibration, if the full vibration whole body vibrates then how it effects within the Physiological bone joints and etcetera, as well as the performance full or partial, by the self or the work item. If the person moves or the work item want to concentrate that moves, then what are the differ, what are the. The heat stress and humidity, illumination, glare etcetera affecting space perception and communicational clearance that is visual or verbal requirement. Work place and work component or item locations, effect of working in various environmental conditions and shift work. These are the area that we need to consider while talking environmental issues.

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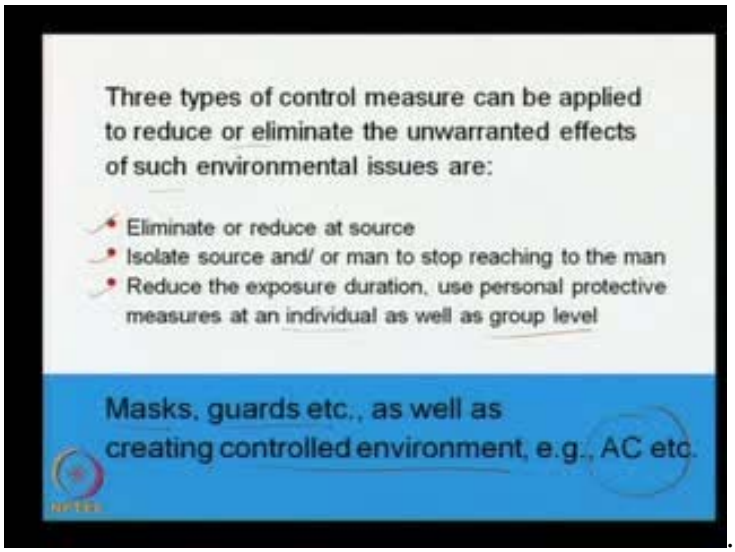

Now, there are three types of control measures that can be applied to reduce or eliminate the unwarranted effects of such environmental issues. Those are mostly we can say eliminate or reduce at the source, if there is some problem heat is there it cannot work upon it may be like that when I am working, if that incandescent lamp gives a heat. So, at the source, I can change it to some other lamp that does not produce that much heat. So, by this, we can suggest elimination or reduce the source.

Isolate source and or main to stop reaching to the main, if there is some other problem, suppose some hot material is there or I am working in a hot, near a hot oven, so either I can go away from that place or what Ican arrange like that. So, these are the isolate source. Another Third is that reduce the exposure duration, use personal protective measures at an individual as well as group level - I can have some cover kind of thing.

Suppose, if I have to work in a blacksmith's work area, there what is happen, when the put the air? So, the fire suddenly, it intensity increases, intensity and that a heat comes to me. Now, either I can have a protective clothing with me, then it is becomes the individual level. If there are many people are working near a very hot area; there I may have a curtain kind of thing or something or something like that. Suppose, there are many people are working in a hot area, suppose they are breaking some stone or something, few people, then I can put a cover over that area. So, these are the group level protective measures which I am taking

So, the direct sun's radiant heat will not come to them. So, what that masks, guards etcetera, as well as creating controlled environment can we make; in that case, air conditioning and etcetera may be cited as an example.

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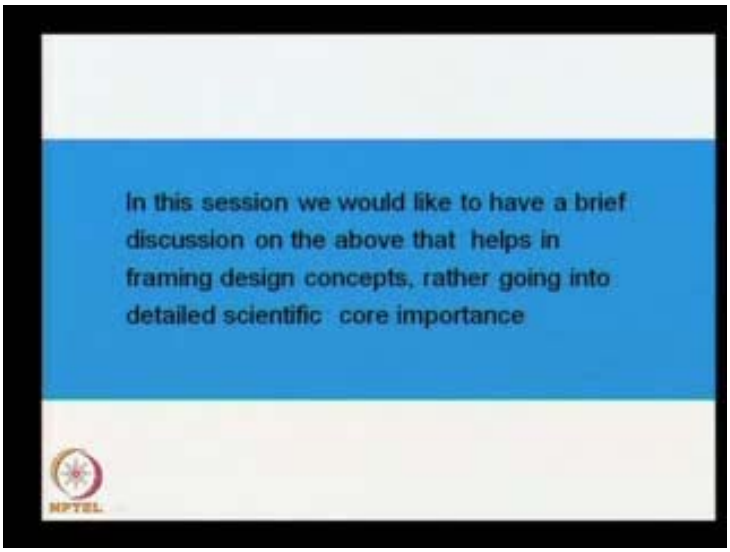

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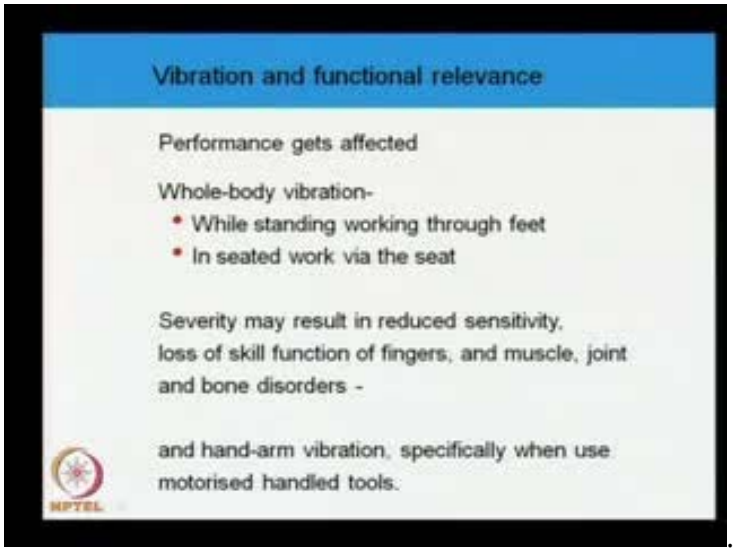

In this session, we would like to have a brief discussion on the above, what had we from cases we have shown that helps in framing design concepts, rather going into detailed scientific core importance.

Vibration and functional relevance: performances get affected that we know, if there is vibration, performance reduces. The whole body vibration is there while standing, working, the vibration comes through feet or in seated work via the seat.

So, it is severity may result in reduce sensitivity. If the constant vibration is there, the sensitivity reduces, loss of skill function of fingers, and muscles, joint and bone disorders are there; hand-arm vibration, specifically when use motorized and handled tools.

Now, in certain cases, suppose some combat vehicles where the military personnel travels, normally what is happen? The seats are hung from the ceiling of the buses because if anything happens below land mine or something blast, then that effect will not create any problem, for much problem, to this people; because once the blast that comes to the lower part of the vessel, it gets that heat that jerk and so that will not go directly to the people who are sitting there and that seat plates, if we can hang from the ceiling. So, there is no direct touch with the floor.

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So, there is no direct touch with the floor. Now, how the hand tool creates a vibration? In this case, we can say that work equipment in this vibration hazard and that this machine where, when it moves; it is a drill machine, it gives a vibration and to maintain that position and to operate with vibration it requires a vibration. So, how to reduce this thing? How can we design? So that the vibration reduces that is a constant that we need to think on it.

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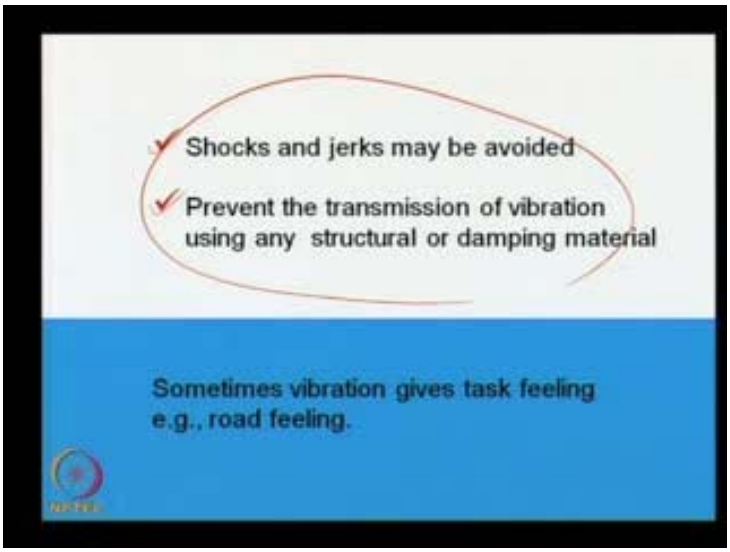

What can be considered? Shocks and jerks may be avoided. Such things, Prevent the transmission of vibration using any structural or damping material. So, this may be considered while attempting a design of such type of equipment. Sometimes, vibration gives task feeling that is the road feeling also. Vibration sometimes is also necessary but obviously within control a limit. Like, we can say that the mobile phones to get attention it gives a vibration when it is in a sound off mode, but when an incoming call comes, so it starts vibrating; so, you can feel of that.

So, in that in this context, vibration is helpful in identifying the information, but when we are running a tractor that vibration damages us. It is an, its imposition, occupational health hazards; so, there we need to control it. So, these two are the specific areas that can be considered.

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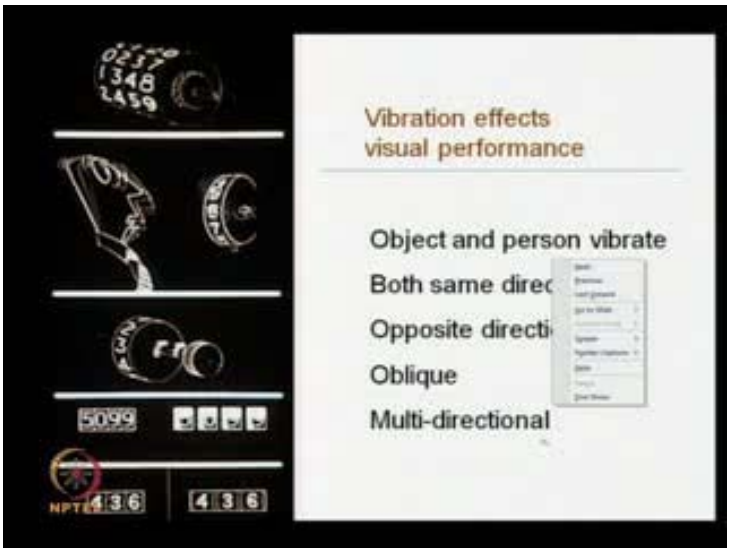

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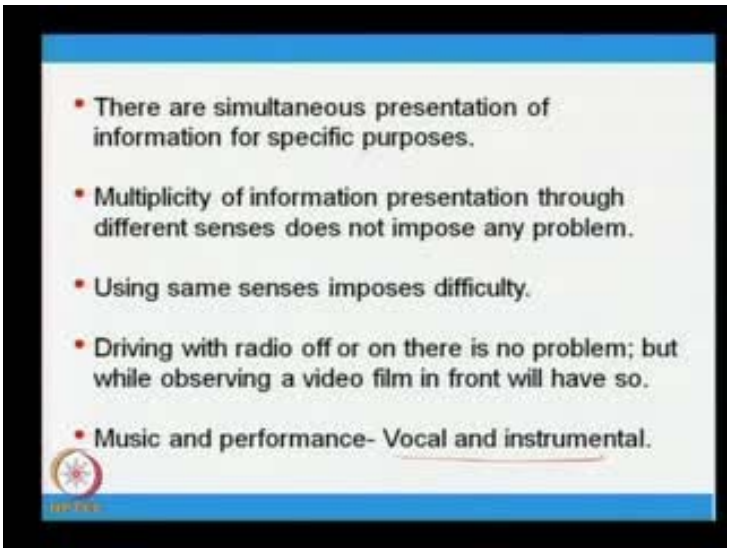

Now, vibration effects visual performance; if the, if I want to read something this figures, so if it vibrates, then it is difficult to read and this some kind of information. So, object and person vibrate; object and person both vibrate both in the same direction, means, the object is also moving, person is also moving; opposite direction, person and object both are vibrating in different; oblique means, like this vibration and then multidirectional is something like this multidirectional movements, person as well as the object both or one; so, it affects our performance (Refer Slide Time: 31.26). As For example, this is an escalator going down. Now, if we, in this case, if one electronic information are passing like this and the person is going down, then he is going down information is passing like this way; so, it is the same way (Refer Slide Time: 31.50), if it comes backwards, then in a different way. So, in this case, this person is not also smooth moving, it also vibrates; so this vibration affects; then, to overcome that vibrational visual performance problem, what will be the shape size and space of material movement on this. That is necessary to be considered and relevant studies are necessary to be conducted.

There is simultaneous presentation of information for specific purposes. Multiplicity of information presentation through different senses does not impose any problem. Using same senses imposes difficulty. Driving with radio off or on position there is no problem; I can drive a car with that radio on, but while observing a video film in front will have so. means If the driver also keeps a small video television or media set or television set in front, and while driving he may need to see it whereas he needs to concentrate on the

front. So, both are the same senses - same sensual feelings are required; there the disturbances are there but while driving my visual requirement is there, but the sound it does not help that does not impose some problem.

In this case, also another thing is that, what type of auditory information increase performance or act of the performance? Some studies are done, they say that some musical instrument it increases your concentration to do a certain task, because the instrumental music creation ambience, but if it is a vocal you want to understand the language part in that words, in that so, what happen? Ever You are deviating your attention. So, these are the some of the cases like music and performance, it has vocal as well as instrumental music differences, different type of effects.

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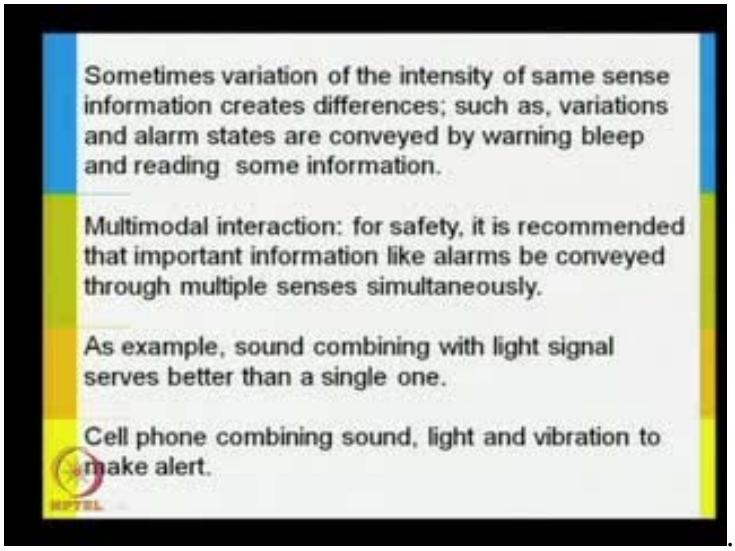

Sometimes variation of the intensity of same sense information creates differences; such as, variations and alarm states are conveyed by warning beep and reading some information. Multimodal interaction: for safety, it is recommended that important information like alarms be conveyed through multiple senses simultaneously. As example, sound combining with light signal serves better than a single one, like cell phone combining sound, light and vibration to make a person alert about the incoming information.

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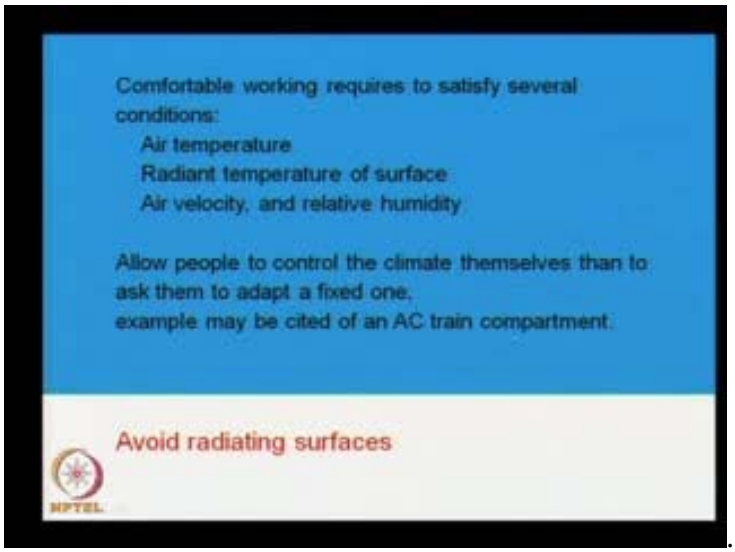

Comfortable working requires to satisfy several conditions like: air temperature, radiant temperature of surface, air velocity, and relative humidity. Allow people to control the climate themselves than to ask them to adapt a fixed one. For example, may be cited of an air condition train compartment. In this air condition train compartment, the total environment, total inside is controlled by some other person (()).

Now, if you feel cold and sit, then some you can have a cover on your body and that is being supplied, means, it is thought that, it is assumed that, all people will not have the same comfort with a certain degree of air conditioning. This is for that, where some other people are coming, but inside your room where the air condition is for yourself use, then you can make it as per your own requirement, comfort.

So, an another thing is that radiating surface, another area. Now, if another problem is that where you are working, if that surface is hot, cold, vibrating, then it affects like a it radiating surface etcetera, it can be said that.

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Radiating surface, another area, now if another problem is that where you are working, if that surface is hot, cold, vibrating, then it affects like a it radiating surface etcetera. It can be said that - so much, suppose, in this case the umbrella is being used; now, why everybody does not like umbrella? Must be some problem is there; otherwise, such good product people do not use always. May be they do not know how to carry it, when it is not in use; that is the problem, like that. So, for that, some studies have already been done, that says that, how this umbrella can be fitted on your head and etcetera, so that your arms can be free, that type of design is required.

The helmet, it has a specific purpose, for safety from physical hazards as well as heat, rain water and so many other things, but it is seen that people are reluctant to wear it always, why? Because the ambience, it provides to the head perhaps, it does not match with the people requirement at a comfort period.

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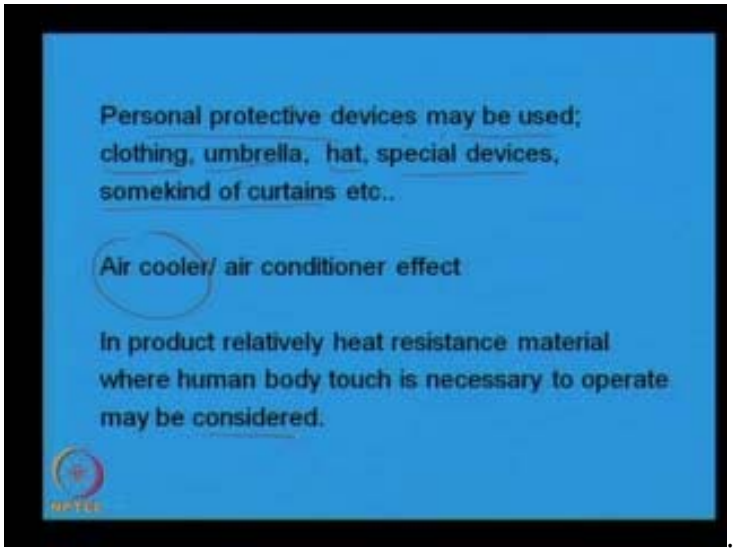

Now, in open area, the local material are being used for rain or sun only; so, this is to such type of things and some other, only cloth cover is also performed, the similar function. Now, personal protective device may be used in certain cases to avoid these

environmental hazardous factors; clothing may be used, proper clothing; thick, thin, different open material, umbrella, hat, special devices; some kind of curtains can also be used.

Now, the air cooler and air conditioner effect, some people complain that, in air conditioning the dry air is there; so, some people have some problem. Some people do not like to use air conditioning always, but wherever, where the heat is due to mostly the dry heat like in Rajasthan area or Delhi and that type of area where the dry heat area; if moist air is given, then it effects very good; so, for that air cooler system has started.

So, now, where what type of things is necessary? The same air cooling system like with that moist air throwing may not be applicable near seashore area. So, what type of products to be used? And where it will be used? The target group as well as the context, it needs to be considered and designed accordingly. In product relatively heat resistance material where human body touch is necessary to operate may be considered.

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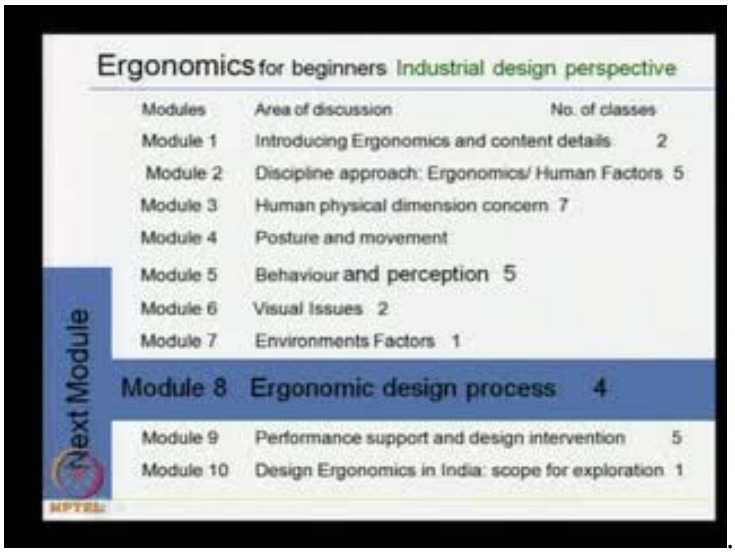

In product relatively heat resistance material where human body touch is necessary to operate may be considered. So, with this, we can say that the varieties of environmental factors are relevant to our performance, how we perform, how this environmental factors affect us, and accordingly we have to make design.

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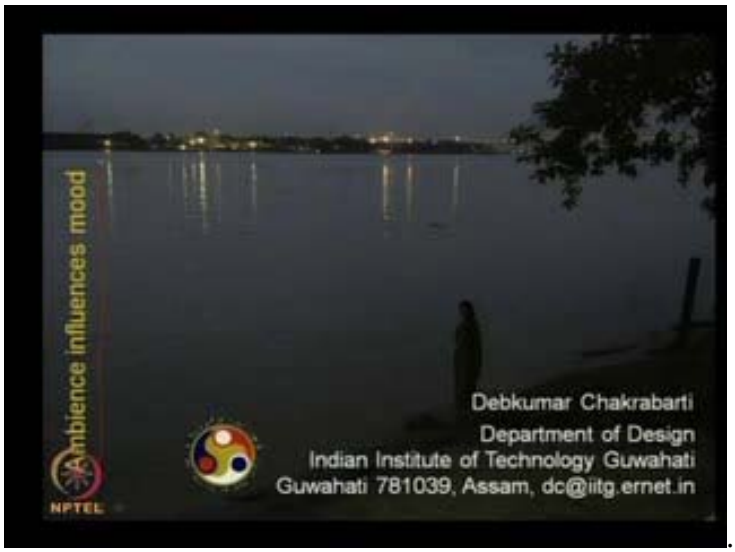

So, next module will be the ergonomic design process, where all these issues we will consider, we will discuss taking specific design applications. The ambience influences mood, how we perform? How we self-perform? The mood creates through the ambience heat, humidity, ventilation, dust quality and etcetera, and the cleanliness, the space, the privacy feeling, etcetera, it creates an ambience; with that ambience creates our working mood.

So, with this, we are concluding today's session and next session will see, it is a direct design applications.

Thank you.