Organisation of Engineering Systems and Human Resource Management
Department of Management
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Module - 2
Effectiveness and Performance
Lecture - 23
Man-Machine Relationship (Contd.)

Continuing the discussion from the man machine relationship, given the kind of issues it would raise. It would be a good idea to take a look at, how this relationship can be made smooth, how it can be made functional, and how the interactory concerns which have been highlighted as we went along, can be handled best at a design level or at a production level itself.

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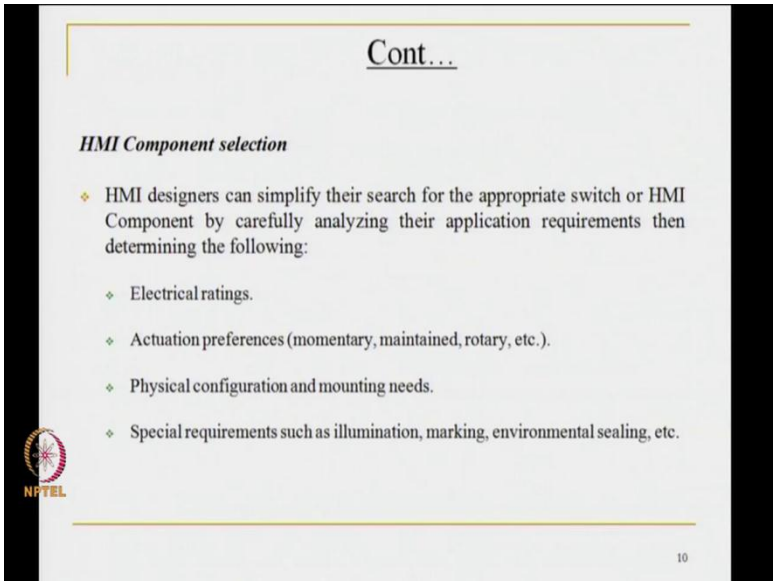

The man machine component selection, or the human machine interaction component selection, begins at a design stage, and design can simplify their search, for appropriate switch or H M I components, by carefully analyzing their application requirements, and then determining the following. If you determine the application requirements, then it becomes a technical issue, and the technical issue can be handled in the following manner. It can be handled through proper electrical ratings. It can be handled through actuation preferences, momentary maintained, rotary, and physical configurations and mounting needs. Special requirements such as illumination markings and environmental

sealing would help. Brings us back to one of the key propositions of this analysis, namely a lot of engineering problems are sorted out through managerial tools, and a lot of managerial tools may be easier to apply, if the engineering under pinning to it, is consistent, and engineering under pinning to it, is amenable to easy manipulation.

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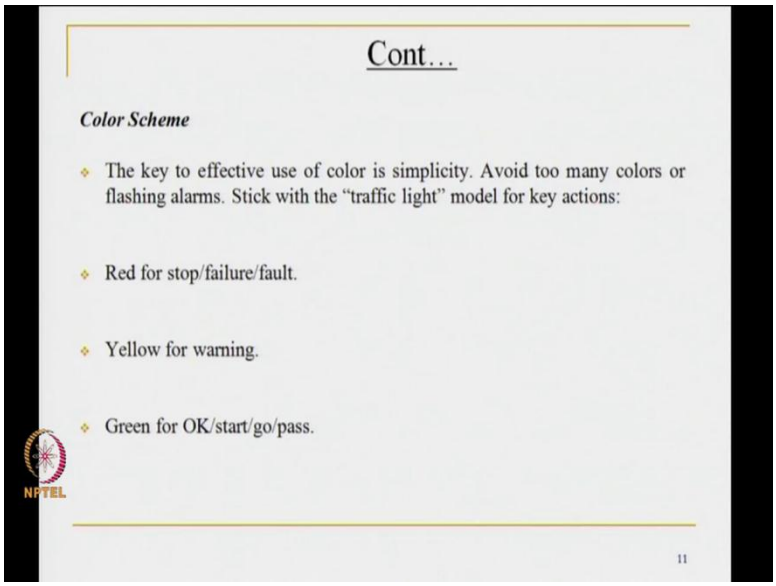

Just as there are H M I component selections, so there is the issue of the color scheme, which is central to understanding the man machine interaction. The key to effective use of color is simplicity, like everywhere else. The purpose is to avoid too many colors, or flashing alarms, stick with the traffic light model for the key action. If you stick to the traffic light model for key action, what is it that you get you. You get red for the stop or the failure, you get yellow for the warning, and you get green for start; that is go and pass. In other words, it is always possible to have a situation where the color scheme to which, a user is conditioned is put in place, for the kind of messages which you want to give at an operational level, to the gadget user or to the machinery user. From the color scheme we move to the information presentation, and I would like to go through you to go through these three suggestions.

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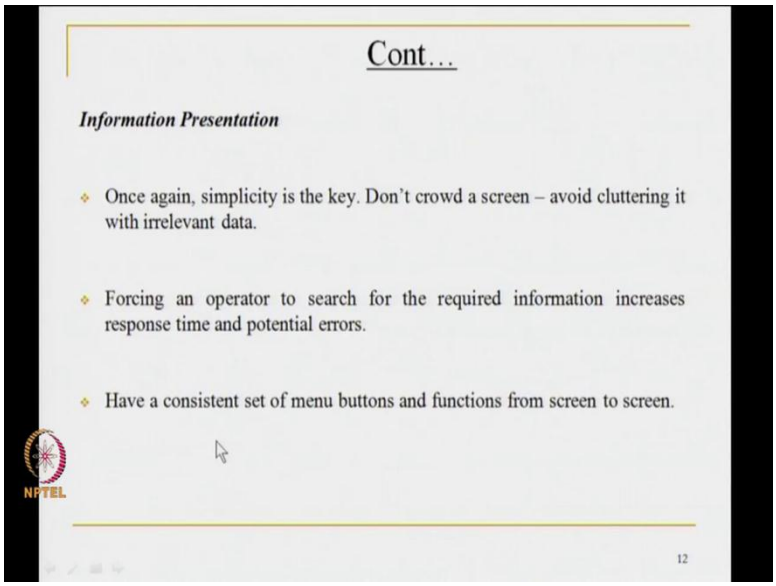

Here again you notice that the emphasis is on simplicity, not crowding the screen, avoiding clutter. Therefore, the operator does not have to go in for the required information in a painful manner, with possibilities of errors. This helps smoothen the man machine relationship.

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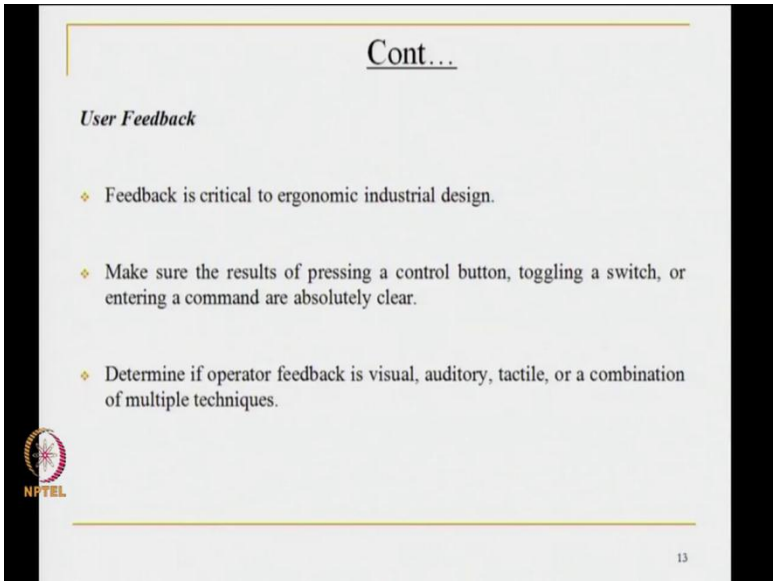

Then there is always scope for the use of feedback. Feedback is critical to the ergonomic industrial design, then there is a case for revision. Make sure the results of pressing a control button, or toggling the switch or entering a command are absolutely clear.

Determine if operator feedback is visual, auditory tactile or a combination of multiple techniques. Now, one does not have got into too many these details, but the proposition is the simple one, and later on i will be giving you some suggestions on how to handle it. As of now all that you have to do it is, a recognize the lack in many other areas. Engineering and management have to move hand in hand, to make sure the operational aspect is handled effectively, so that the machine works at an optimal level, and the individual operating it is not put through a painful process.

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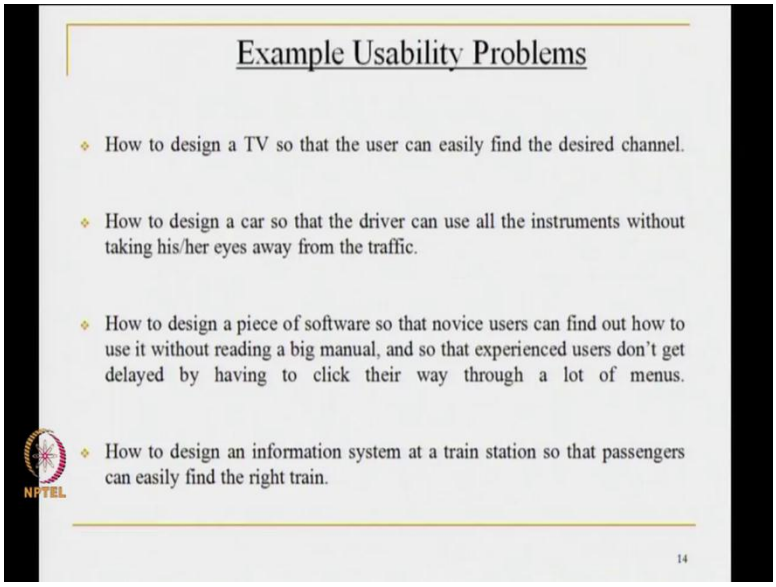

Let me illustrate what I am saying with examples with usability problems. Please go through this listing. Now, here are four examples, which would touch everyday life, which would touch most people who can afford; say a TV or a car or a software, and indeed even those who cannot afford these gadgets, will have to deal with say; travel issues, and therefore would need to get onto a train. In each case, you cannot expect the user, to understand the technology, to understand the changing commands, as the product evolves from one design to another.

So, engineering can be used to keep it simple, so that the interface from engineering to user, is made as simple as possible, and therefore as effective as possible. It seems to me that it is important to recognize; that, be it a TV, be it a car, be it a software or be it even the train system. Engineering cannot be used as merely a framework of reference, for

handling an effectiveness issue, effectiveness for engineering results. Effectiveness here has to do with components of user comfort.

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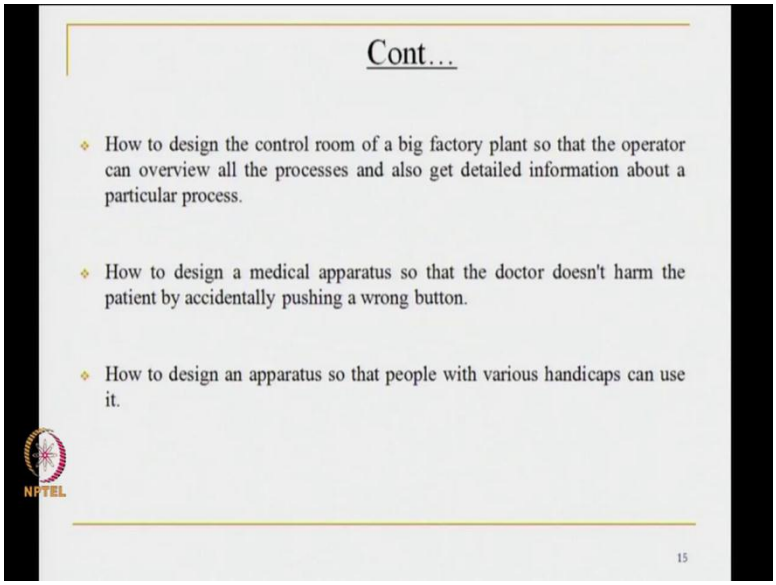

I would give to you further examples, where user comfort will have to factored in, to get into man machine relationship. For example, moving away from lame user systems to technical situations, which may be industry based, or which may require a subject expertise. One has to recognize, that one has to design the control room of a big factory, as is stated here plant, so that the operator can overview all the processes, and also get detailed information about a particular process.

So, the control room has to have an integrated view, and also have a limited perspective on a particular process, so it is both atomized and integrated. How to design a medical apparatus, so that the doctor does not harm the patient by accidentally pushing the wrong button, a very operational perspective, but a very relevant perspective, when it comes to man machine. How to design an apparatus, so that people with various handicaps can use it, and this is becoming increasingly common. And there is a general feeling all around, that handicap should be only treated only as a challenge, and not as a disability.

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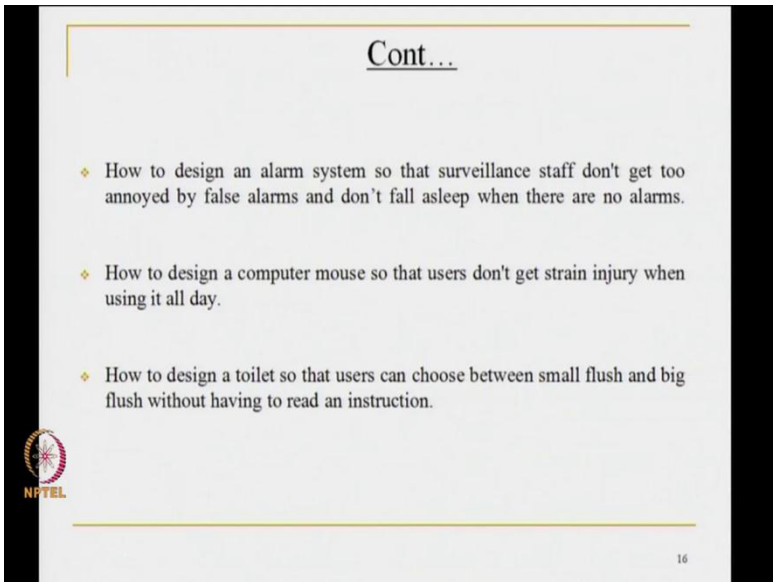

The illustrations can go on, but the important thing is, you must understand all aspects of man machine relationship comprehensively, so that you understand the user friendliness of designing machines. Not to overlook the fact that, unlike it was 70 80 years ago, man machine interface is neither discrete nor occasional, but it is a continuous way of life. So, further examples would help, to illustrate what is sought to be achieved.

How to design an alarm system, so that surveillance staff do not get too annoyed by false alarms, and do not fall asleep when there are no alarms; a very basic question in security systems. How to design a computer mouse? So, that users do not get strain injury, when using it all day; how to design a toilet? So, that users can choose between small flush and big flush, without having to read an instruction. And of course, in the process save water, which is central to resource management these days.

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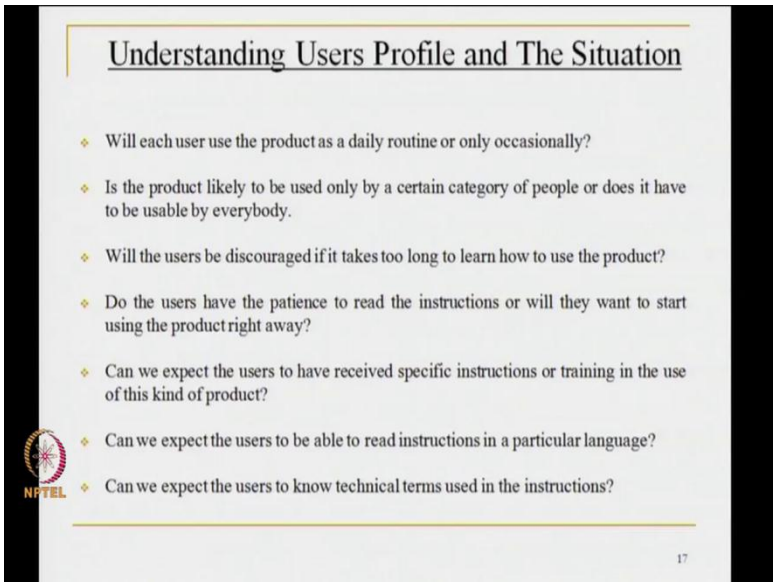

For this, it is important to understand the user profile and the situation. I give to you below a set of seven questions, which you may wish to take down, or internalize an applied to any product development issue. Any design issue which you in your capacity as an engineer may be a party to, or may be responsible in a managerial situation, to give a feedback on to the product usage.

Here is therefore, really a checklist of questions, which are not engineering questions, but are used questions. And given the kind of man machine relationship we are talking about, needs to be internalized into the design or product development phase, and that will have its consequences on machine maintenance and field engineering. The last question, can we expect the users to know technical terms used in the instruction, is important, because from the illustration which I have already given to you, with reference to computers. The technical terms can get to be fairly confusing and difficult, if they are not used in the sense in which those words are used in everyday usages, and you recall my reference to expression; such as cookie or a bar.

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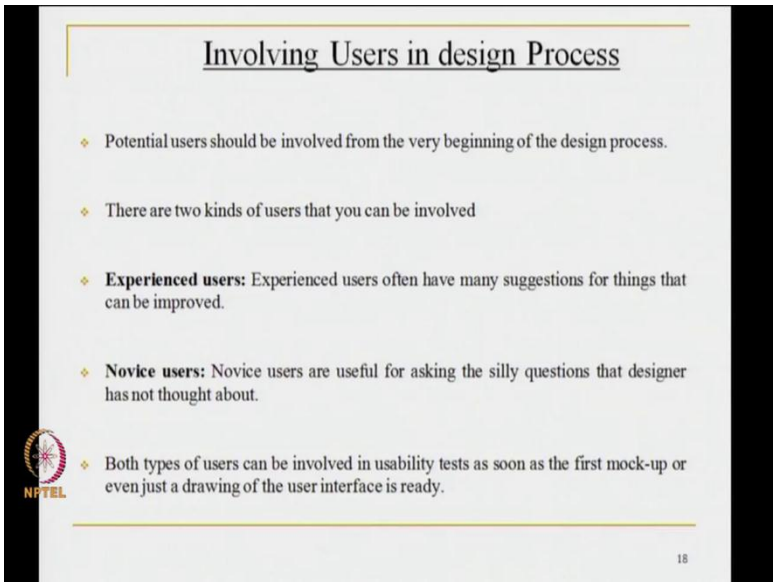

Using the person, who will be actually working with the system, in the design process, is now generally being accepted as the way forward, in handling issues of man machine system. And potential users it is being recognized, should be involved from the beginning of the design process. There are two kinds of users that help to classify the system; one is experienced users. Experienced users often have many suggestions for things that can be improved. Especially from the perspective of the running of the machine for extended period in a trouble free manner, which will always have a feedback on the sales quantum on the life of the product, and when up scaled what components to up scaled, and what components not to touch. Very often, up scalability is carried out for the sake of novelty, rather than any functional advantage, and that is not the best way forward.

So, there are the experienced users, and there are the novice users. Novice users are useful for asking the silly questions, that designer has not thought about. Silly questions have their own roles in development. Silly questions are questions, which an expert would come would probably term as axiomatic, would probably term as so irrelevant, as not even worth tackling. But to a person who is entering the interface of the machine it is so basic that, this is the first question which comes to his mind. An example from everyday usages will help to establish, what I am thinking to put across. Consider the different ways in which a tap can open; you can push, you can pull, you can rotate, you can turn, you can tilt, and you can simply pass your hand across a beam, if that is the

common word which will be communicating what I am seeking to communicate in this situation.

And the possibilities are almost so large and endless; that as you move from your familiar terrain to a terrain which you are new, and an area which you have not experienced, or move from one type of hotel to another type of hotel, you almost need a briefing on how to open a tap. Now that is an example of what could be called as silly question. Who would think that opening a tap, can be such an issue.

Similarly, with the coming into the touch screen, and the emphasis on varying shaded on luxury or comfort. Switches have given way to touch, and touch has given way to pressure, and pressure has given way to how much light you can have, with an adjustment, and all this is not quite clear to a person who has not been briefed. And indeed the question arises, are all these multiplicity of choices, necessary for everyday living, which requires simple support systems of utilities. Or is it merely adding a novelty value to a universal facility, and there by complicating what is basically simple.

These are questions which cannot be attempted to be answered here, but these are questions which cannot be ignored either. Therefore, when it comes to a man machine system, I have suggested to get a use of feedback, from the stream of experienced users, and from the stream of novice users. Both types of users can be involved in usability tests, as soon as the mock up or even just drawing of the user interface is ready. So, the message is very simple. In case of engineering business, there is a definite case of involving the users, or as it works the non engineers, to get the feedback, because in the ultimate analysis the products of engineering business are for mass use, mass interface, and they cannot be source pressurised that you are expected to have an understanding, of how the engineering system itself would be working.

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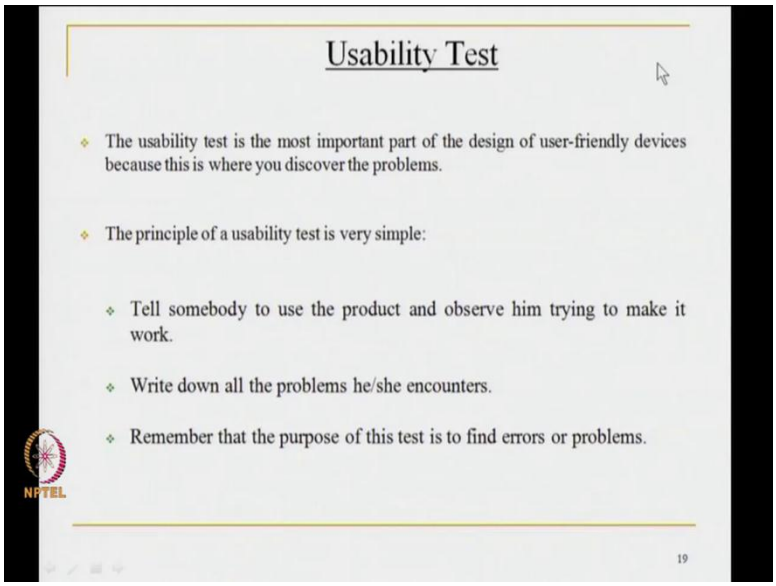

So, I would recommend for your consideration, what can be called a usability test. Please go through with this. The usability test is the most important part of the design of user friendly devices, and because this is where you discover the problems. Tell somebody, to use the product and observe him trying to making it work, but there is an interesting sideline to that issue to which i draw your attention, and it has been in the public domain for quite a while. If you do not understand the technical dimension of a product, which is the line that I have been pursuing in the last few minutes of my presentation, to make it user friendly, what can you be faced with. Your voice calls recorded over five years, or places you visited the last year or the video calls that you made last three months, or the e mails you sent in the last six days, and indeed even the online chats in the last hour. All these could be accessed by someone at will.

Therefore, your voice calls, your places of visit, your video calls not to overlook your e mails, and your online chats are all open to public scrutiny, because there may be a bug in your gadget. To install that bug, is not a very complicated process, and if you are a part of the governors system, you can almost do it in will. So, what happens to the freedom of a descant of a governors system, which is considered so essential and basic, to operation of a democratic framework. This sensor platform, and it is about time, we have brought in a few technical terms in this discussion, so that you understand what am talking about. Is that only for snooping purposes, but it can be a violation, of basic human rights of privacy. Who would want to spend his 24 hours open to public scrutiny,

or at will of anybody powerful, not because he has something to hide, but everyone wants a few private moments, where they do not feel they are open to scrutiny.

Therefore, to get back to the usability test, I have interrupted your reading of the slide, presented to you, to draw your attention, to the recent phenomenon where proliferation of smart phones has made it easier, for agencies to spy on people. It gives them an additional channel, to monitor apart from snooping devices, plugged to core telecom networks; a leverage which can be very painful and disconcerting. Indeed smart phones are treasure troughs of information daily user activity. Our phones today are collecting more data, and storing more data, then they were doing a decade ago. Those are few who are familiar with, what has been in the press. With Vicky League with Snorden and others and the details are not relevant. You have a view of what even international relationships are, really in the real world, and the distance they mark from how they are presented.

So, while recommending to you solutions like write down all your problems, the user encounters, for application of the usability test. Remember that the purpose of this test, is to find errors o r problems. One is essentially working at a very simple level of gadgets. There is a complicated level of gadgets, and the complicated level of a gadgets, has to do with security issues. It has to do with issues of privacy. It has to do, with safety issues of information, and therefore they need to recognize, that we are living in changing times, with reference to man machine relationship, just as we are living in changing times with reference to everything, and turbulence is a fact of life, in all human activity, and the sooner we accept it and we get used to it, the better it is.

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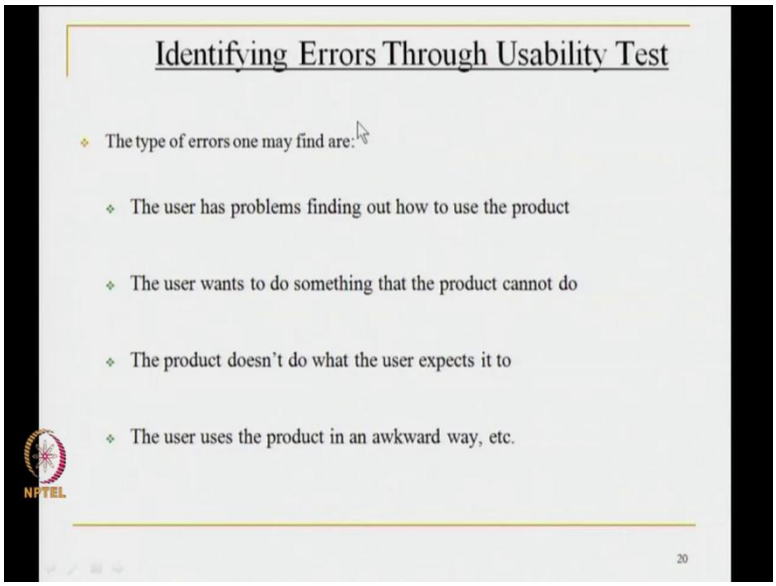

To revert back to issues of identifying errors, through usability tests, here is a possible listing of the kind of errors, which you may find. The users have problems finding on how to use the product. In fact, here again, I would like to interrupt, my presentation with a walk down the alley, of possible unexpected situations in which, a user can find himself, and let me restate you reference to a car. Everyone wants a secure system for car, for the safety purpose, so that it is not stolen. As engineering has permeated, the body of the car, concerns of control have become more and more ubiquitous, even in terms of window screen which can be put up, and how they can be locked up, from where that can be locked, from where that lock can be released, and the argument has been, that it reinforces the safety of the child who has been left behind in the car, or it multiplies the choices of security; you cannot argue with that.

What one needs to recognize, is that with multiplicity of security control points, the risks of carelessness, lack of knowledge, and shear accidental laps, not to overlook a conscious misuse of these control points, have added new experiences to dimensions. For example, there are cases, where socially unacceptable behaviors' has taken place in cars, by rolling up the windows, by locking them from a panel to which the victim would have no access, and is rendered helpless, because the car has been converted into a cage. If that was the end of the story, well then solutions could be attempted, but the story goes on; that is the conscious misuse of the security device. But imagine a car, and there are illustrations of this, catching fire, and the control linkage has been snapped. The

windows are up, the doors are locked, the passengers of the car are locked in. And since the control network has been affected by fire, the doors cannot open, the window panes cannot be rolled down, and you are burnt inside the car.

Now you have had illustrations just now of the conscious misuse. You have illustrations just now, of a situation of helplessness. Let me give you an example of something, which has recorded history. Where in certain types of high end luxury cars, the security system is so thorough, and so tamperproof; that just in case, you have lost the key, or the duplicate is not accessible. You have a situation, where in case of a loss of a key, or non availability of a duplicate. There is no way you can gain entry into the car, short of getting hold of the servicing system of the manufacturers, which may or may not be available in that city, and then you have to wait till the manufacturer, and you get in touch on how to access that particular vehicle, to get it started again.

Now I have no comment to make on that situation. What you have to ask yourself, the designer has to ask himself, and the user has to ask himself, is this what creates a level of comfort, or would you rather change it. Be that as it may, to get back to the simple everyday illustrations, and simple everyday choices. I would erg you to recognize, that types of errors which user surveys or usability test can throw upon would include, the user wanting to do something that the product cannot do. Now this is the other end of the spectrum. I was talking just now to you of a situation, where the product can do something, and the user is dealing from the command giving key touch interface with the machine. Now here you have a situation being highlighted, the user wants to do something that the product cannot do.

Now where do you rate it on the usability test. The product does not do, what the user expects it to do. So, there is a maintenance issue, and the more complicated the cut-out system, the more complicated the wiring system. The grater are the chances that the maintenance interventions which may be available to you, are simply not good enough to set the system right. So, what do you do. If the price of rectification of a gadget era, is higher than the price of the product itself, then what does it do to the market, and these are managerial issues of man machine interface, which one needs to handle. The user uses the product in an awkward way and then what results. So, these are errors which need to be identified, and solutions bound for them, at the product design level itself.

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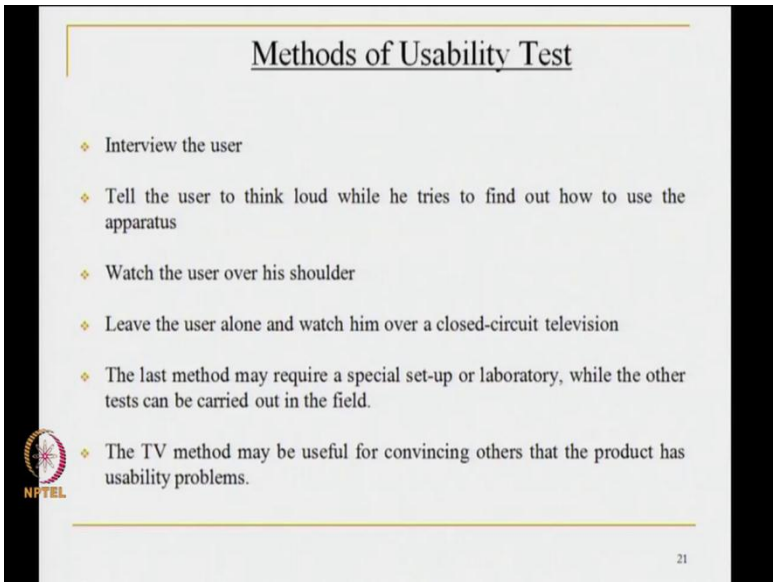

Now, here are a set of suggestions on the methods of the usability test. In other words, what are the ways in which the usability test can be administered. Here is a listing of six techniques, which can be used for undertaking a usability test. These are suggestions from the managerial perspective on engineering business. Why just engineering business, any interface with a machine.

Let me make it even simpler by saying, besides theses methods, it may be simple, merely to recognize that a simple toll free number, easy to recalls, should accompany any kind of a product, where in time of need, the customer can merely dial that number, record what the problem is, and stop there. I am not even recommending the manufacturer to render services of rectification though it would be a great idea, if they were these rectification systems were put in operation, but getting that information from the user, is really free R and D feedback to the manufacturer. And I for want cannot understand, why this simple process of getting feedback is being not put to use, when its impact could be so definitive over the sales, dimension, and over the competitive dimension. From methods of usability test which I was elaborating, let's move on to defining operational and functional effectiveness of the man machine interaction system.

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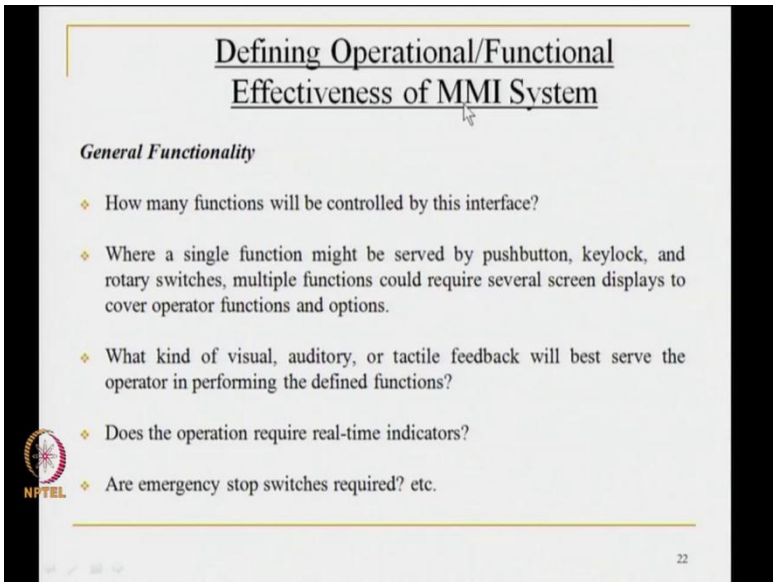

The general functionality can be analyzed by a set of questions. How many functions will be controlled by this interface, because this interface would be requiring a human command. The same can be converted into automatic control system, but then converting into an automatic control instead of requiring a human command, would have its own complications. The complications would be, in the form of a circuit problem. A complication which cannot be maintained, by interventions of rectification available easily at hand, and thereby rendering the entire machine dysfunctional. Or the listing goes onto say, where a single function might be served by a push button, key lock, and rotary switches.

Multiple functions could require several screen displays to cover operator functions and options. Read this very carefully, because it sound like a little complicated. It is really very simple if you have followed the sentence, and I would read out for you again, as you try to read it yourself. Where, a single function might be served by a push button, key lock, and rotary switches.

Multiple functions could require several screen displays to cover operator functions and options, and each stage you check, whether the user wants to continue. The next question, what kind of visual audio or tactile feedback will serve the operator, in performing the defined functions. Does the operation require real time indicators, and

finally, an emergency stop, or switch may be installed. To continue with the elaboration, I think I would like to briefly touch upon the degree of input complexity.

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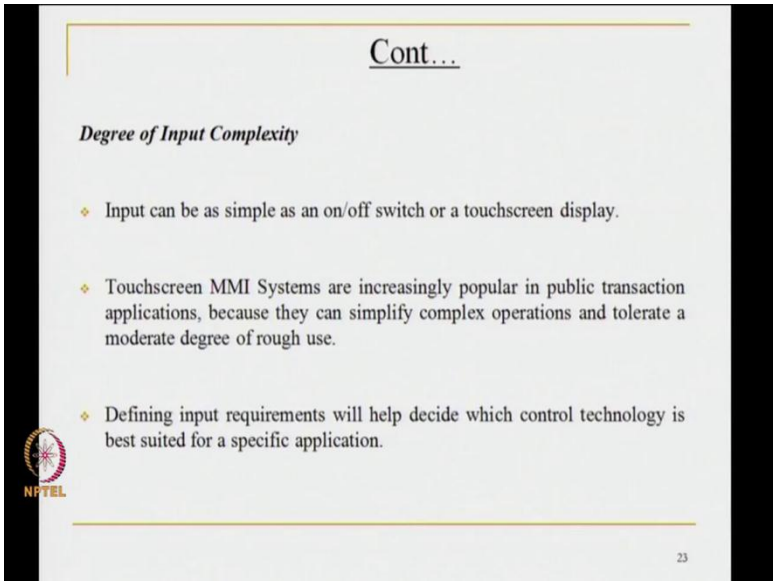

The input can be simple as an on an off switch or a touch screen display. A touch screen machine man interaction systems, are really on the way up today, because these transfer applications simplify complex operations. And what is equally important in terms of usage, because all consumers are not equally sophisticated. All consumers do not have the same level of sensitivity. The equipment is bound to put to rough use, or rough use is inherent. Let me give you an example, any mobile handset is a sensitive gadget, any bump can affect the circles, but then all mobiles do fall, do slip from the hand, do come out of the case in which they are put, or do fall out of the packet, or the pocket, or slip away from the table, what do you do then. If the gadgetry is fragile, you have a problem at hand, to carry the discussion further defining input requirements will help decide, which control technology is best suited for a specific application.

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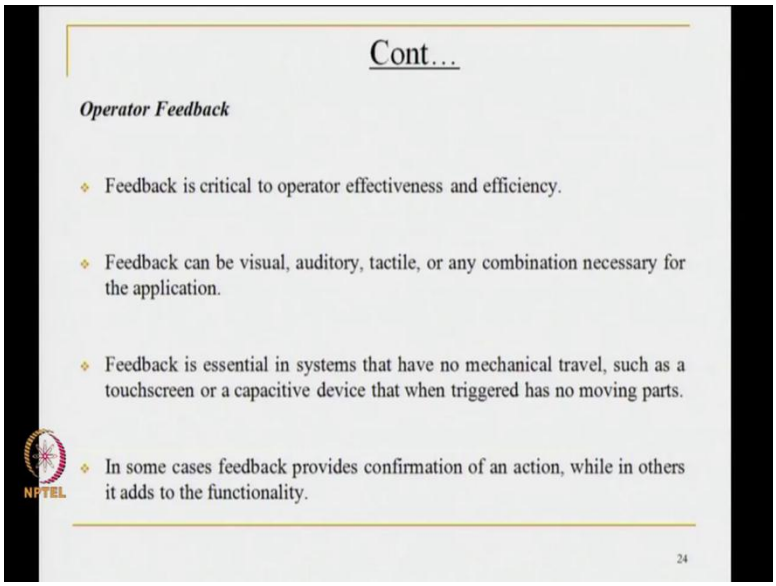

It is also important to get an operator feedback. Read this screen. Treat this merely as a listing, this is by no means an exhaustive situation, but it is indicative of the operator feedback. The concepts are simple, and self explanatory, therefore am not going to take any time to explain it beyond what has been stated on the screen.

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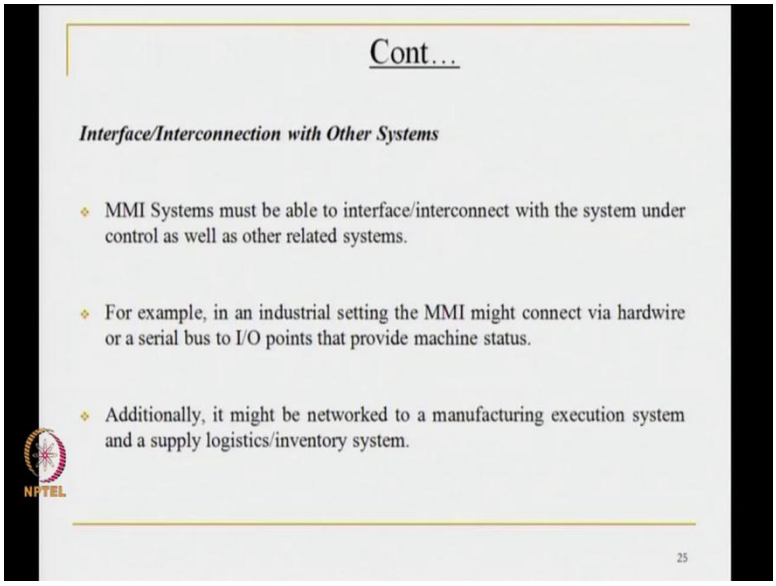

The interface or the interconnection with other systems, is described in an squally simple manner. You may wish to read through it carefully, or take such ideas down as may be of interesting. Nothing complicated, but what this presentation does, is builds into your

cognitive system. The recognition that interface, and interconnection with the other systems, is a concern in dealing with machines, a concern which sometimes, is not built into the design or the production process.

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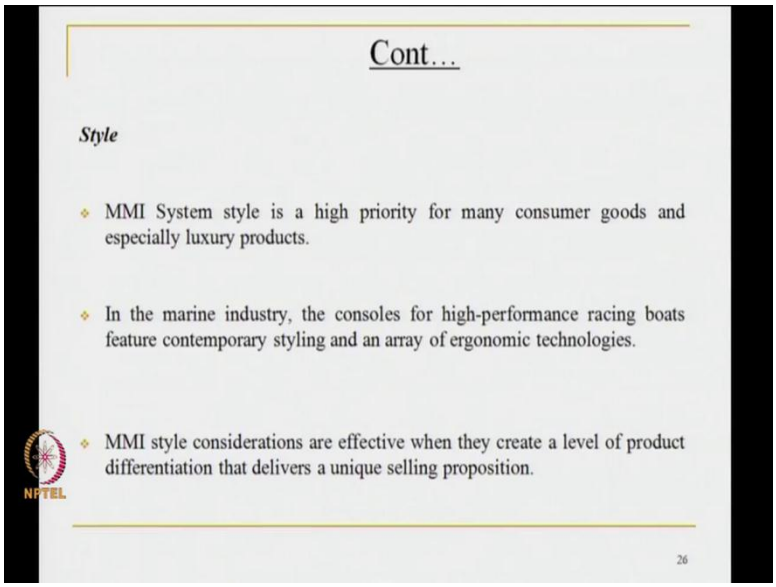

And of course, the style, the man machine interaction systems style is high priority for many consumer goods, and specially luxury products. In the marine industry the consoles for high performance racing boats, feature contemporary style and an array of ergonomic technologies, and marine industry is not the only industry. Man machine interactory style considerations are effective, when they create level of products, differentiations that delivers a unique selling advantage, and back you are to seeing an interface between profits and engineering action, very simply management and engineering have to work hand in hand.

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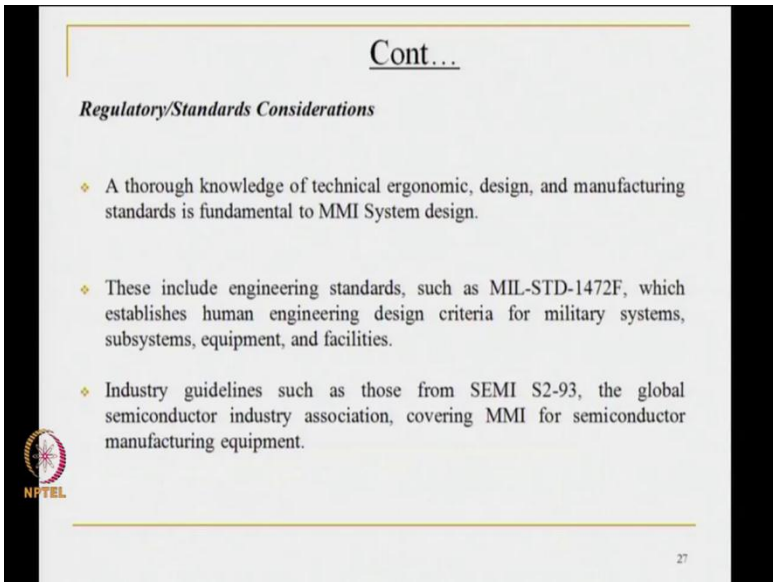

Inevitably the regulatory and the standards consideration would be come in, because a knowledge of the technical ergonomics design, and manufacturing standards is fundamental to these considerations, these including engineering standards, industry guidelines and more. It is not for us here, to get into these guidelines, or to discuss them, but it is certainly our business to draw your attention, to the existence of such considerations.

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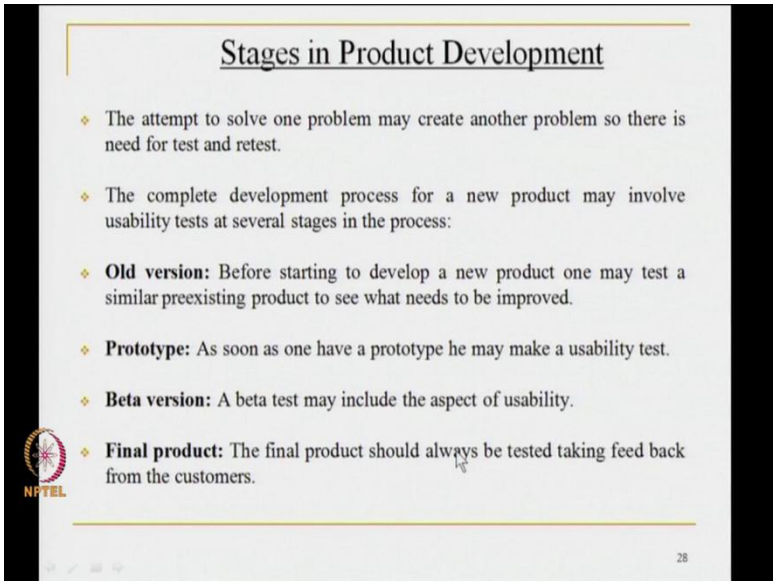

Now, this will have to be integrated with stages in product development. I would like to draw your attention to the need of referring to old versions, the prototypes, the beta versions, the final product issues in management of products, which are important, but which are not central, to understanding how man machine interface, or interconnection is positioned. This is more by the way of solutions, which will need to be sort for the problems which would arrive is this interaction. So, I would leave that with your thought, and try to conclude this presentation, by reminding you that like everything else, man machine system, has backward linkages and forward linkages in a manner in which, solutions cannot be found, unless you take an integrated perspective on the exercise itself.