Management Information System
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Lecture - 05
Concept of Information - II

In the previous lecture a concept of information we had seen that the information has a value and information has particularly a surprise content so we have also seen how we can measure information and we have also checked the usefulness of redundancy of information.

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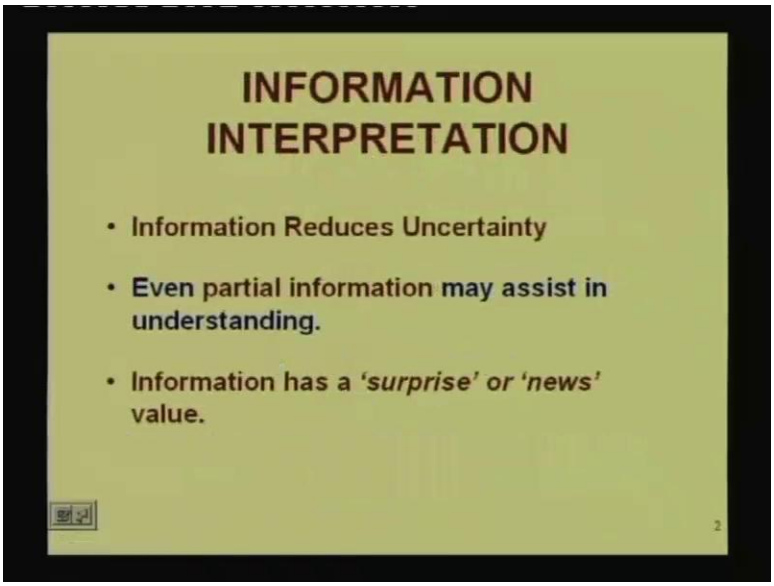

In this particular lecture let us quickly review them that is information reduces uncertainty, even partial information may assist in understanding. Information has a surprise or news value.

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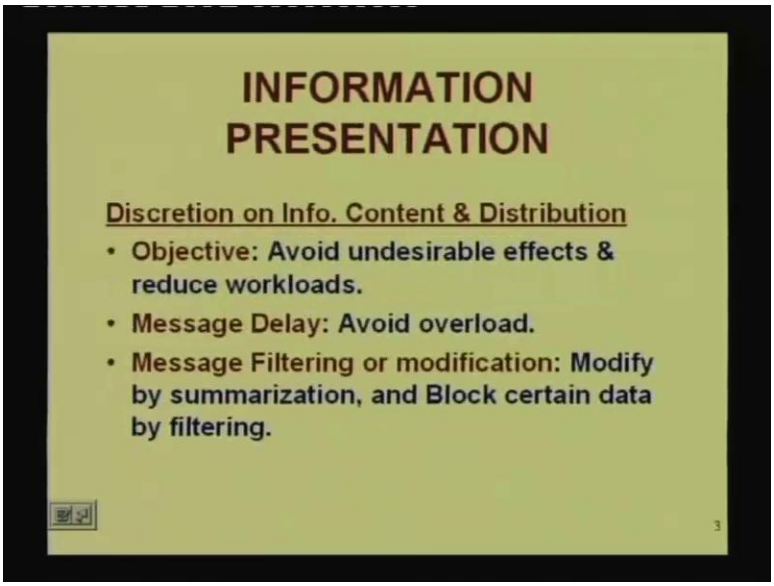

Now after that we have also seen that discretion of information content and distribution:
Objective: Avoid undesirable effects and reduce workloads. Then message delay and message filtering or modification: that is avoid overload and sometimes may use message delay and modify by summarization and block certain data by filtering. So why these are all required because as we all know that basically whenever we have let us say the we have the management triangle and various levels of management like top, middle, knowledge level and operations.

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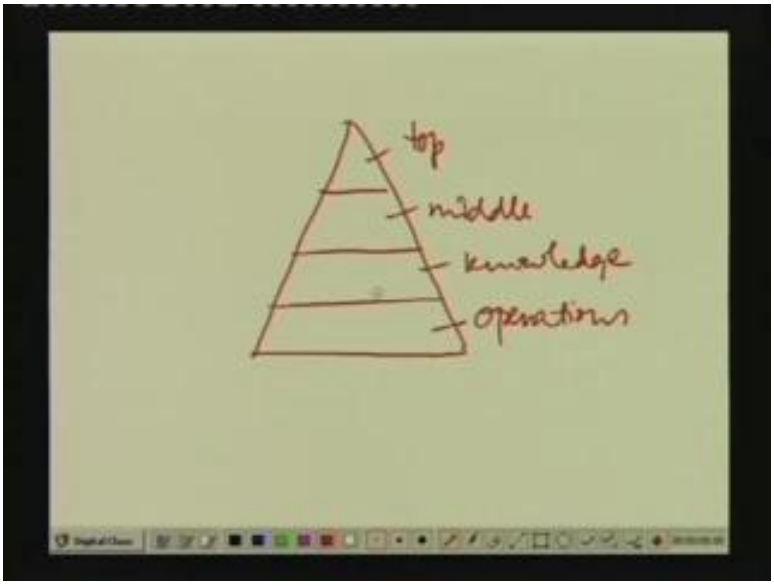

So the operations level is basically the day to day applications. The knowledge level supporting functions, middle level control of the operations level and obtaining policy guidelines from top top strategic management. So as you can see there is a continuous interchange of information of various kinds from operations levels to middle level and vice versa, knowledge level to middle level, knowledge level to top level, middle level to top level so all kinds of information exchanges are basically taking place. Information exchanges of all types take place right.

So when there are so many different types of information exchanges but from the very fact that the operations level there are huge number of you know transactions so essentially if if say from size wise if you have let us say in the top level if you have say 10 people the middle level in a large organization may be there will be somewhere between 70 to 80 people, knowledge level may be around 120 people and operational level from management point of view there may be quite a large number say 300 to 400 people. So you can see here that if the entire report which is generated by 300 and 400 people finally land up as it is to the 10 top management people there will be information overload they just cannot manage the huge amount of information as it is.

So it is very important the top and particularly middle level of management because top level is using the information for strategic purpose strategic management purpose but the middle level of management they are using information for operational planning and control and these operational planning and control at the middle level of management requires in depth you know study of the operations. So it is very important that they have what is known as summary, message summarization and message delay and similar kind of things.

So avoid undesirable effects to reduce workload; go for message delay: avoid overload; message filtering or modification: modify by summarization and block certain data by filtering that is very important from an information presentation point of view.

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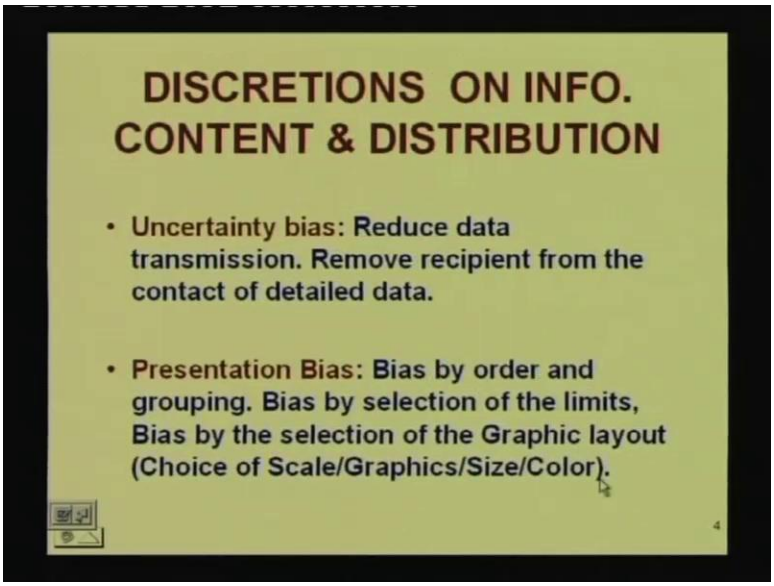

Now what kind of discretion on information content and distribution can actually be done?
First one is an uncertainty bias: reduce data transmission, remove recipient from the contact of detailed data. So reduced data transmission, remove recipient from the contact of detailed data so this is... usually what happens whenever you are let us say changing the you know not showing the detailed data and you are basically summarizing, many a time the uncertainty in the data which may be revealed if you really look at the detailed data gets absorbed gets absorbed. Say for example; if in a particular organization you you find that let us say report on the performance of machines alright; if you see that let us say 70 percent of the machines are working fine, 20 percent of the machines are not working so well and 10 percent of the machines have problem okay.

Now what is the type of problem?
If this 10 percent of machines have got a huge amount of maintenance problem that is a that is a very very important issue as far as the organization is concerned. But sometimes the operational level people they tend to down play this and they may just say that 90 percent of machinery more or less working fine alright. So that kind of you know absorbs the uncertainty and is really not good really not good. So uncertainty bias... but again it has been shown, time and again by experiments like it has been seen that the managers can make better decision when they have

they are certain about the information. So if you send all the information without any absorption of uncertainty then the managers will not be able to make good decisions. So basically again there are situations where uncertainty bias is bad and there are situations where uncertainty bias should be removed right.

Then the presentation bias: presentation bias usually happens as bias by order and grouping bias by selection of the limits, bias by the selection of graphic layout like choice of scale, graphics, size or color. So all kinds are there let us see some of them.

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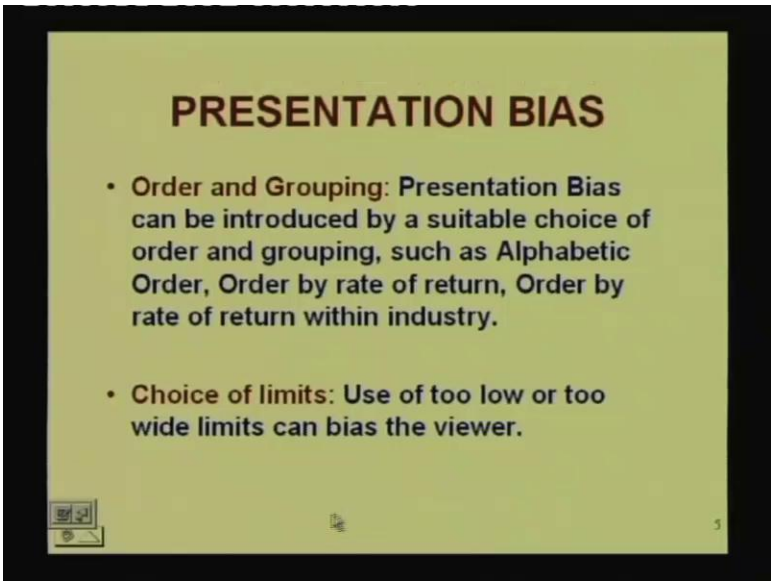

So sometimes like as an example we can we can see that... so suppose see... just look at a simple graph. So this is year versus performance of a particular organization. Now you can see here that this particular graph shows that suppose this is 1000 crores okay and this one is 2010 okay so a similar graph suppose you see then you you plan to think or you tend to think that this particular organization is operating around 1000 crores. But the reality is see this is actually 2004 and this particular figure is say say something like 50 crores okay. So you can see here that really speaking for the past few years this particular organization is in the range of 50 crores operation whereas all the other values that he has projected the company has projected are basically projections they are not realities alright they are what they want to achieve. So the company

wants to become a 1000 crore company may be by 2010 but as far as today is concerned the company is a 50 crore company.

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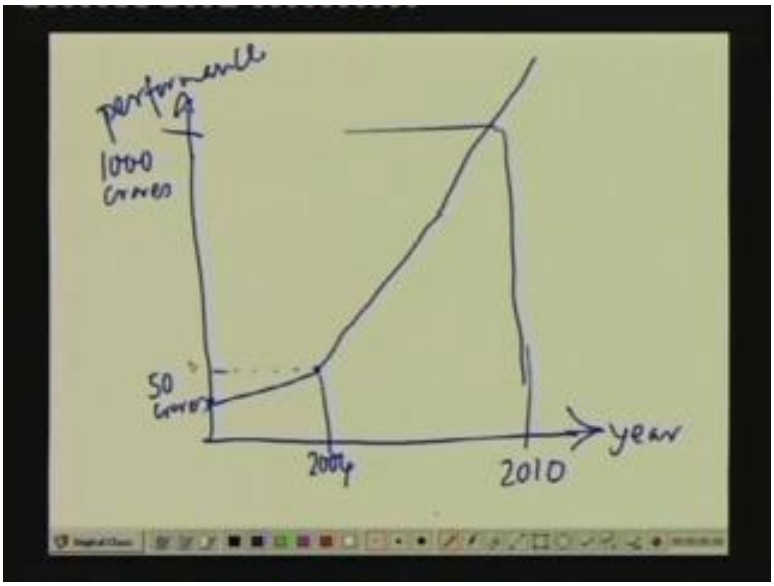

So this graph cleverly disguises the facts by choice of scales alright. So it is a kind of scale that has been used by which you can see that it appears as if the performance is really that much right, the reality may not be so. So you can see that it is easy for biasing the information by selection of limits similarly by choice of scale, graphic, size, color. So suppose now if you choose appropriate scale and if there are lot of variations in the data by choosing scale you can create a situation where it may appear that really the variation is not that much; size again you know if you put the graph in a very small size it may appear that the variations are less.

Color: bright red color; if you want to highlight a certain graph and that is drawn in bright red and another graph that is you do not want to highlight but if you put it under a very light color may be it may create a situation or it may create an impression as if the particular graph is not that important. So, order and grouping various presentation biases can be introduced by a suitable choice of order and grouping such as alphabetic order, order by rate of return, order by rate of return within industry so various order and grouping can really create a havoc like suppose one performance is really very very outstanding compared to others, take... or a suitable

grouping may be made by which you can actually show that the performance is not that good, I mean not that good means that exceptional thing may be taken out.

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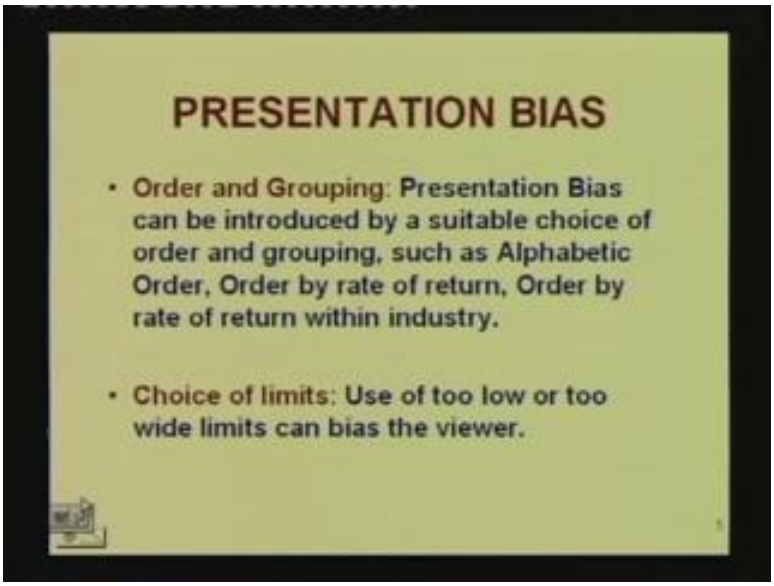

So one such example we can show... let us see some values let us say there are four or a few sales region sales regions: 1: 250; 2: 200; 3: 400; 4: 1250; 5: 100. So suppose this is my sales region data; now as you can see in this particular sales region data we have four data in the range of 100 to 400 and one data which is really very high 1250, but even here we can think of grouping; suppose our groupings are... see just the same data when represented in this way below 180: 1; 181 to 350: 2 and 351 and up: 2 so these very cleverly conceals the fact that the fourth sales region as done really exceedingly well whereas the other sales regions has not done so well, right.

So even another very clever way of putting this is you know the total is I think 2200 by 5 so this is 440 so there is an average of 440. So if you if you present the average 440 which may appear that as if the performances is also pretty good everywhere right so this particular thing that an average performance of 440 if you present then it may appear that average performance is very good everywhere. So all these you know the various kinds of bias can actually be created when you are you are putting various kinds of presentation bias.

Now obviously a question may come that why do we require presentation bias; is it good or do we go for it or it is not worth it. The meaning really is that it is not that we want to have presentation bias or whether presentation bias is good or presentation bias is bad. The fact is it is a it is a practice in organizations. Every every group interest group... because we must understand that management information system is very much dependent on the management that exists.

So suppose think of a very very vital application like financial accounting and payroll; who should control the financial accounting and payroll related information. We all know that these are supposed to be to a finance director right but you can you can also see organizations that the finance director is not having control on these very vital applications or financial accounting and payroll. In fact you may see organizations where payroll is under a different head. These are actually situations that are basically the organizational political structure. So the information system cannot be devoid of the organizational structure.

So whatever is the organizational structure that has been designed in a particular organization we have to have our organization build around that and our information system should also be dependent on that. So no point complaining that in the previous management the information system was like this, in this managements today's management the information system has undergone a drastic change, it it is bound to be because with the change of management the information needs will also change, the way information we processed, disseminated, presented will also differ.

So therefore you see that in if the new management wants information in a certain way the information processing department will also present it in that manner. So therefore this presentation bias of information is a fact of life and we should know about it because if we are managers we should see what should we do so that we can remove the presentation bias if there are any or sometimes if we have to present our information in these possible ways then we should know that there are different presentation bias which we can also employ. So these are some of the issues that are important.

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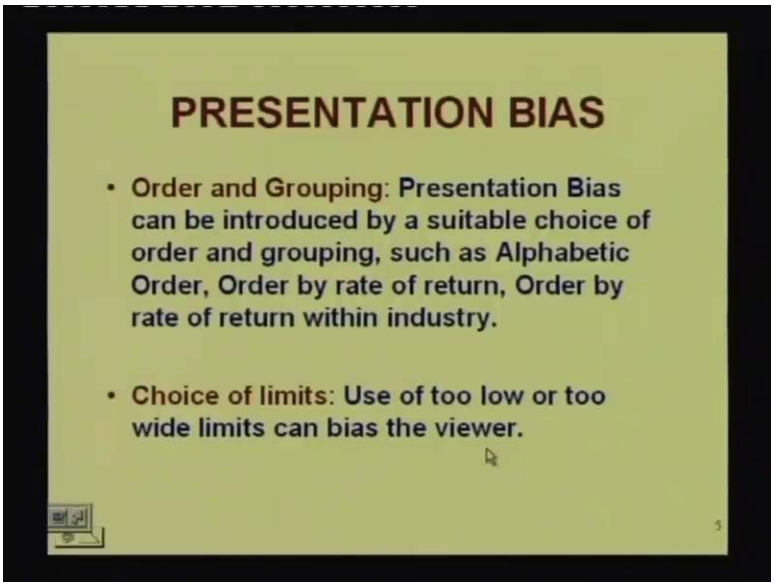

Choice of limits: again use of too low or too wide limits can bias the viewer.

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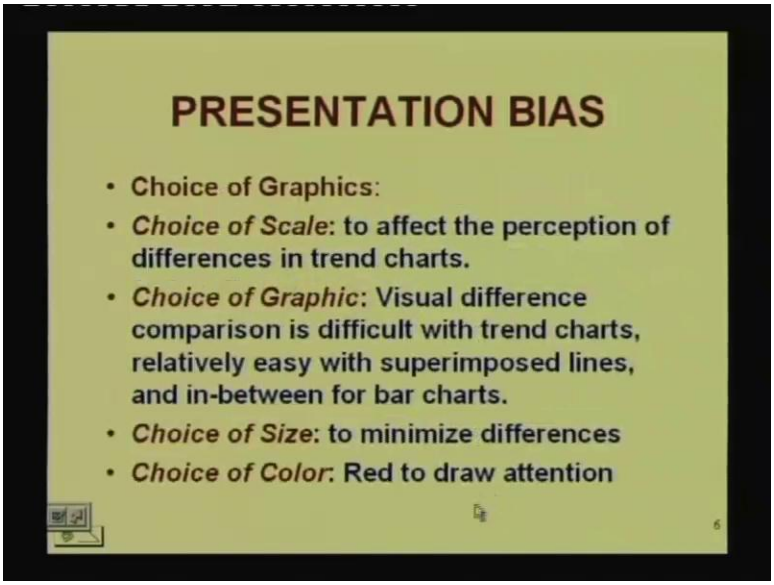

Then some examples like choice of graphics, choice of scale to affect the perception of differences in trend charts; choice again graphics: visual difference comparison is difficult with trend charts, relatively easy with superimposed lines and in between for bar charts. So whether to go for bar charts or superimposed lines or trend chart if we need to highlight the difference then

it is better to go for superimposed lines or bar charts. But if we go for trend charts probably the visual difference will be difficult.

Choice of size: minimize the differences; choice of color: something like red to draw attention.

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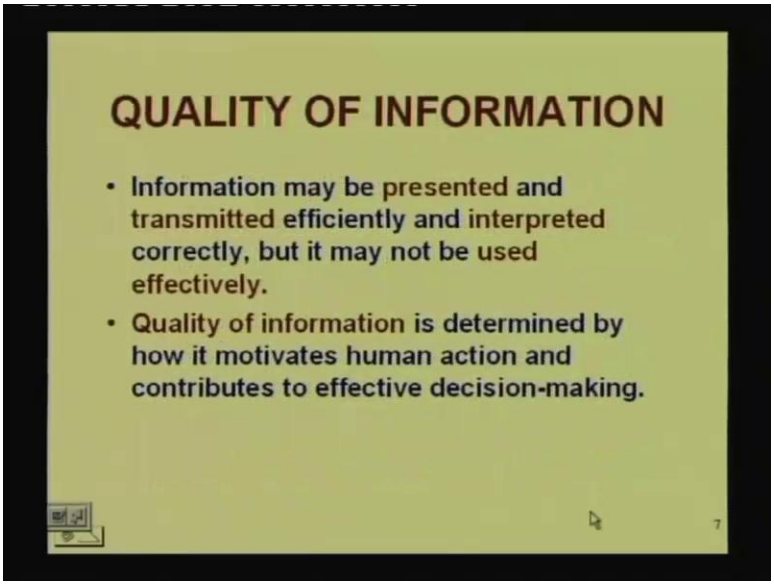

Then quality of information: The quality of information is a very important thing and this is essentially determined by a number of factors. But what is the basic idea? The idea is that how it motivates human action and contributes to effective decision. Because we may say that information may be presented and transmitted efficiently and interpreted correctly but it may not be used effectively. So you see the very definition of information is that it helps in present or prospective decision-making.

We may have information which is presented, transmitted and finally interpreted. But what use has it made? If it is not used properly then we can say that its quality is not good. So quality is related to effectiveness of the decision-making. So we have information how that information leads to effective decision-making so that is how quality should be measured, we should not measure quality purely based on information transmission.

Obviously that is one kind of quality that is the quality of transmission, quality of interpretation, quality of presentation all very good. But finally from the management point of view it has to be related to effective decision-making.

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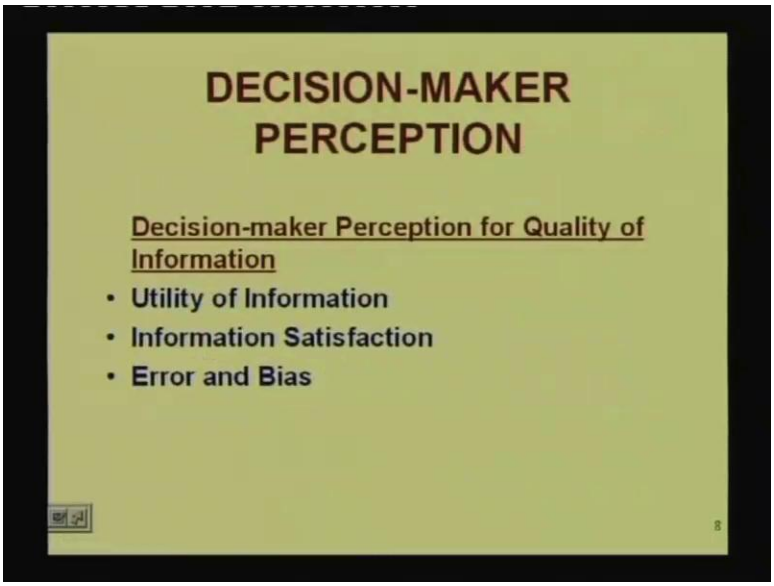

In this in this context we have basically three perceptions from the decision maker's point of view: one is what is the utility of that information okay. From the decision maker's point of view, suppose I am a decision maker I am going to make a financial investment decision and I receive a piece of information; say I receive a piece of the information with regard to that the company is going to start up a new venture and we find out that similar venture elsewhere in the country has become extremely successful. So how how does this particular information helps helps us or makes us change our decision. So you know it is a kind of utility of information, what is the use.

Then the information satisfaction: very very important because we we have seen that that it is the ultimately whether the decision maker is happy or decision maker is satisfied with the information that is available. So information satisfaction is a very important idea.

And finally error and bias: which can actually the part of any information processing; how much how much error and bias is present in the particular information. So this utility of information, information satisfaction and finally error and bias all these are going to be important with regard to the perception of the decision maker.

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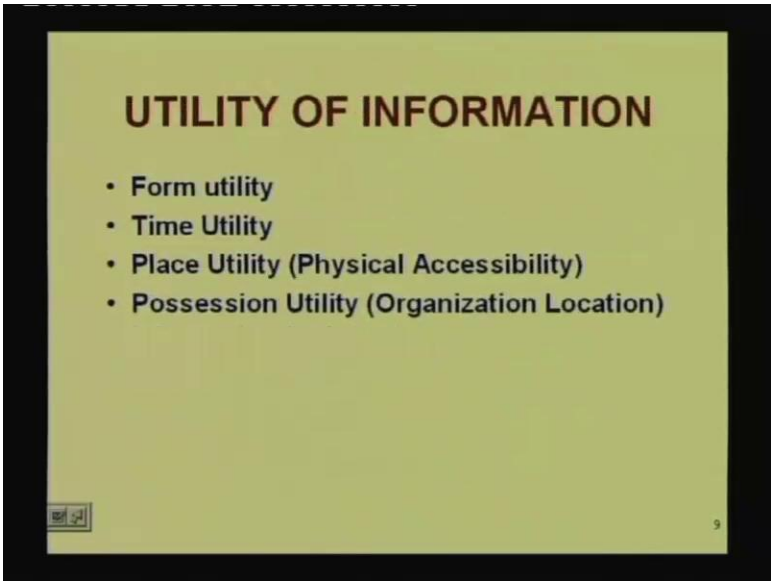

Utility of information: essentially there are four types of utility: the form utility, the time utility, the place utility, and the possession utility. The form is about if the information is in the right form, if it is not... suppose we really require information sorted in a particular sequence alright and also categorized by certain criteria. Unfortunately we may not have information in that particular format; either it is sorted or it is categorized. The worst part is the category data is not available.

As an example; suppose we have with us the machine performance data which machine has performed how well in the past month? In other words, which machines were under maintenance, how much time they were down and how much work has been carried out using these particular machines. But really speaking we also want to categorize the machine performance product wise. That means what are the different products and their components that has been made by using these equipment or these machines.

Now if we are interested in these type of information it is very vital that whenever we have got data with regard to machine performance let us say hour wise data or whenever the machine is used some of its performance data is very vital that we have the details as which product component has been made using that machine at a given point of time. Suppose this information is not available then what is the way, I mean no computer can make miracles, you have to enter the data there is no other way. If the information is not available it is not available, you have to have it. That means you have to connect the machine performance with the product information. That means a given machine at a given point of time which product or product component has it made. So these coupling have to be made. And if the coupling is not made then using this particular set of information we cannot prepare the report that we are thinking of. That means we have the information, we have the information of products, we have the information of machine but we cannot categorize them product wise that means the information does not have form utility alright.

Then time utility: the information should be available at the right time at the right place. So you have the information with you but not here and it may be available at a at a subsidiary headquarter which is far off from here. So what use? Say this is a very peculiar situation; particularly in coal sector it has been very clearly seen that you require a vital material for your particular coal mine and you have to have it; without having that particular component or particular material your production will stop. Whereas the next coal mine which is say 5, 10 kilometers from your particular coal mine is having that piece of material, but since you do not have information that the second coal mine is having it you cannot utilize it alright. So most likely scenario could be in this case, since you do not have information you may have to go through the lengthy procurement procedures before you can actually utilize that material for the purpose.

So you have the information with you but not at right time at the right place so that is our third point place utility: the right time and right place both are important alright so information should be available um not only available at the right time but also at the right place that means you should be able to physically access that information whenever we require.

Then possession utility: That means organizational location that means although information is available but you do not possess it right so you have to possess that means you have to have an authority over that information so that that can be actually utilized.

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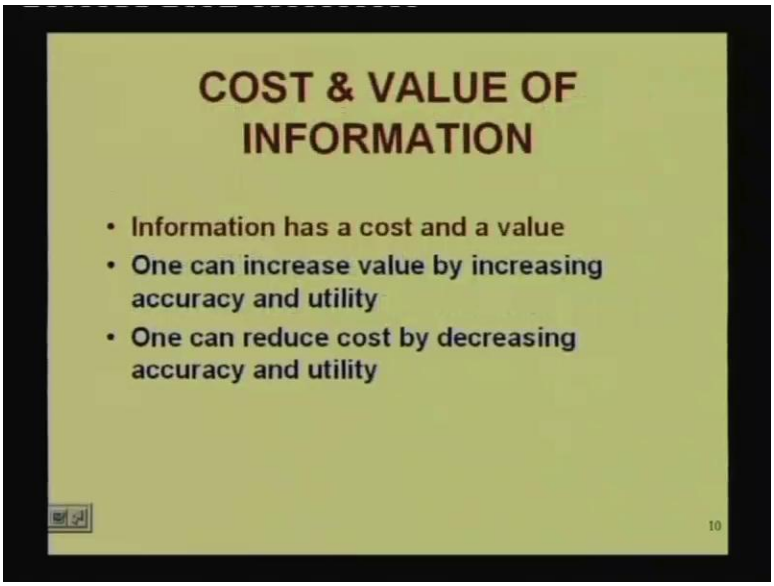

Then information has a cost and a value; one can increase value by increasing accuracy and utility and one can reduce cost by decreasing accuracy and utility. So as you can see that they are basically having a tradeoff. So if you want higher value of information, increased accuracy and utility but cost will go up but if you want to reduce then value will go down. So there has to be a tradeoff; if you want a high value information you have to spend for it.

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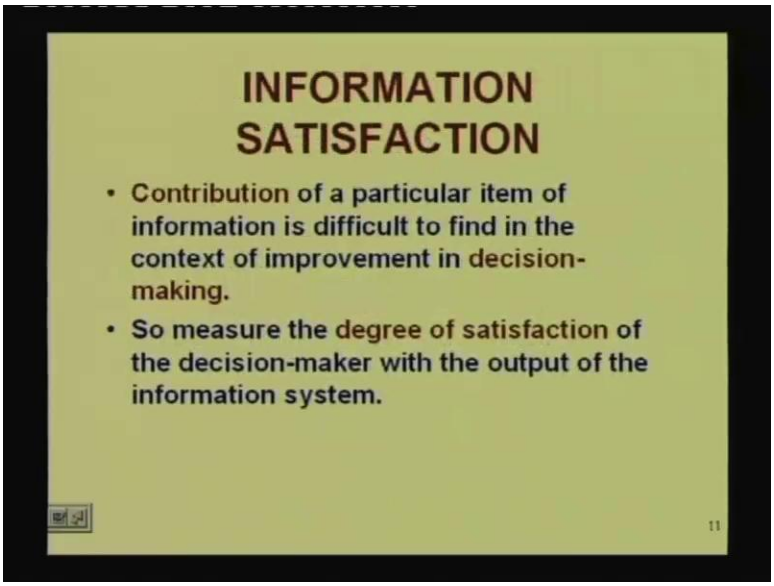

Information satisfaction: contribution of a particular item of information is difficult to find in the context of improvement in decision making. So measure the degree of satisfaction of the decision maker with the output of the information system.

You can see here that it is not easy um to know because we have defined the quality of information with how this particular information helps in making a good decision alright. Now how do you know that which bit of information has made this particular decision making possible? It may not be easy to find that out. So a qualitative method has to be followed that is ask the decision maker how satisfied is he; let him specify his satisfaction as a measure in degrees; degrees of satisfaction may be on some scale 5.0 scale or 7.0 scale or 9.0 scale you know we have to design some scale in which he will say that what is the degree of his satisfaction with regard to the availability of a bit of information.

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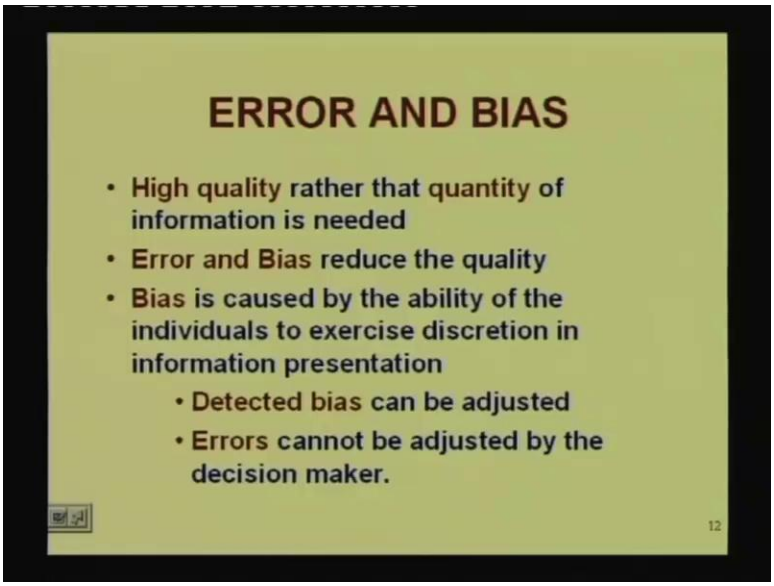

Then the error and bias: so there are two concepts: the high quality rather than quantity of information is needed and it is a very common fact that error and bias reduce the quality whereas bias is caused by the ability of the individuals to exercise discretion in information presentation. The error, on the other hand, they are actually something wrong that has happened and therefore whereas detected bias can be adjusted but error cannot be adjusted by the decision maker. Because errors are errors that have happened and you cannot rectify until unless you have the source of information right. If you have the processed information you cannot adjust the errors that have been part of the thing. So that is the difference between error and bias. So bias is something which is a kind of error definitely but individuals has exercised their discretion in information presentation and these can be adjusted only when you can detect them.

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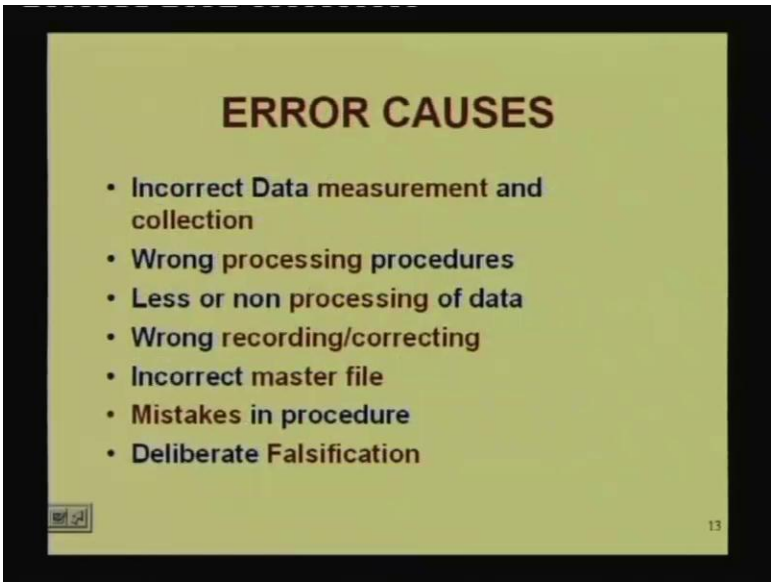

Now what are the effects of error?

Error can cause data incorrect data measurement and collection, I mean it is not what error causes but it is basically the causes of error. These are the various causes because of which error can actually take place.

The first one is incorrect data measurement and collection:

You see a very simple saying is that whenever you have information or data try to capture data at the source. That means if you are really talking about let us say household electricity meter data the practice is that there an inspector who writes it on his ledger and these ledger is given to the data entry operator who then enters it into the computer. So you see the same bit of data is first entered by inspectors and then then these data suppose sometimes in inefficient organizations there may be a third stage where after the data is obtained by the inspector in their diaries somebody puts them nicely in the data entry formats data entry formats and then these data entry formats are given to the data entry operators. So there are three stages of entry. So now when there are three stages of entry there is always a chance that errors may creep in; somebody or the other may make a mistake. Think of an alternate situation where the the inspectors directly enter their data into palmtops and these palmtops are entered directly into the computer to be taken so

that the electricity meter readings are entered directly into the computer may be through palmtops without much error alright.

Sometimes you can make use of turnaround documents. Say for example there are many data; for example: job card data in production situations which are actually... you know when they come back by filling filling it up much of the information is already available. Say the machine number, the equipment number, the product number; only two three things that are entered is who is the worker and how much time he has taken so that reduces the data entry load and that reduces the error also.

Think of in an academic scenario where we have to enter the grades of the students. Now if if we have to write the names and roll numbers and grades of the student in a piece of paper and send it for entry what may happen, we may write the grade correctly but we might have written the roll number and name incorrectly. So if that data is entered it may not match. May be one student's roll number is written wrongly, one student's grade may go into another student's grade. But suppose the teachers are given as it is the practice in IIT now, that printed documents, printed grade sheets where the roll number and name is already printer from the computer what all the teachers do is enter the grades. So when that particular document goes back to the academic section they just enter the grades. So in this way you can reduce the errors right. So it is very important that we follow the correct data measurement and collection procedures, we follow the right processing procedures alright. Sometimes what happens the data is available but it has not been processed, so less or non-processing of data; wrong recording or correcting: again the same point keeps coming back.

That means whenever we have too many procedural steps, too many stages of data entry there will be definitely a chances of human errors. So reduce human errors by reducing data entry by reducing levels of data entry by reducing number of data entry for the same item.

Say reporting: whenever you have a multitier system; suppose you have a number of coal mines, then number of areas and number of subsidiary headquarters and then finally the the ultimate you know the Coal India limited headquarters at Calcutta, now see what happens they have to

compile their production information every day and send it to the ministry to give an idea of what is the extent of coal production. What happens every day they send the data from the mines to the area but again the area people compile them and again enter them in the computer and again send it to the subsidiary headquarters, the subsidiary headquarters again processes the data and sends it to the CIL headquarters and finally CIL headquarters again sends it for onward transmission to ministry. So same production data of all the coal Aries is being entered so many times as it moves up from the coal mine to the ministry.

A much better approach is have an interconnected system a proper networking connection so that once it is entered in the coal areas it can it need not be entered again and again so that is the important thing here, that way you can reduce the errors.

Then incorrect master files, mistakes in procedures but finally deliberate falsification; means also a very important security thing. sometimes we have people who falsify very deliberately so that is why there should be controls and checks, security measures so that it does not happen. Sometimes we resort to double entry of information, sometimes we resort to... once you have entered the data you cannot go back to that if at all somebody has to check so the person who enters and person who checks the data there should be two different persons so all these are very important from the control and security point of view of information.

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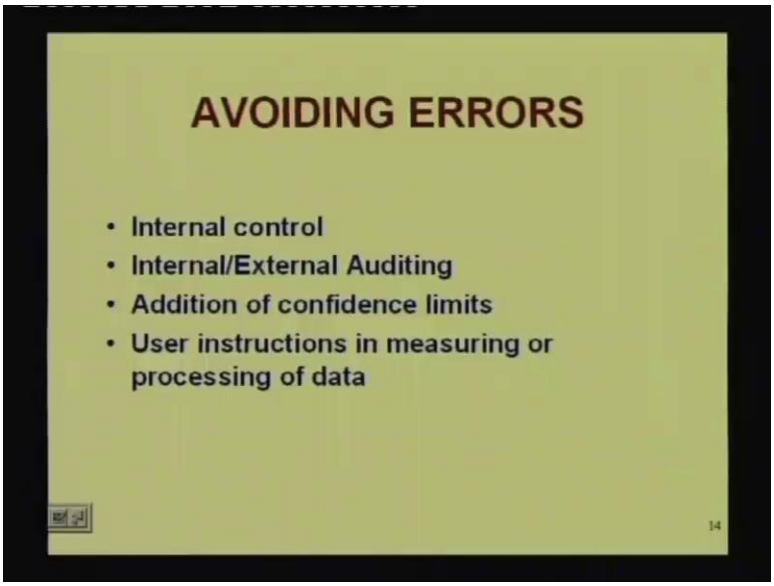

So how to avoid errors: internal control as I said, internal or external auditing from time to time, addition of confidence limits, redundancy, user instructions in measuring or processing of data so all these things are to be added so that we can avoid errors.

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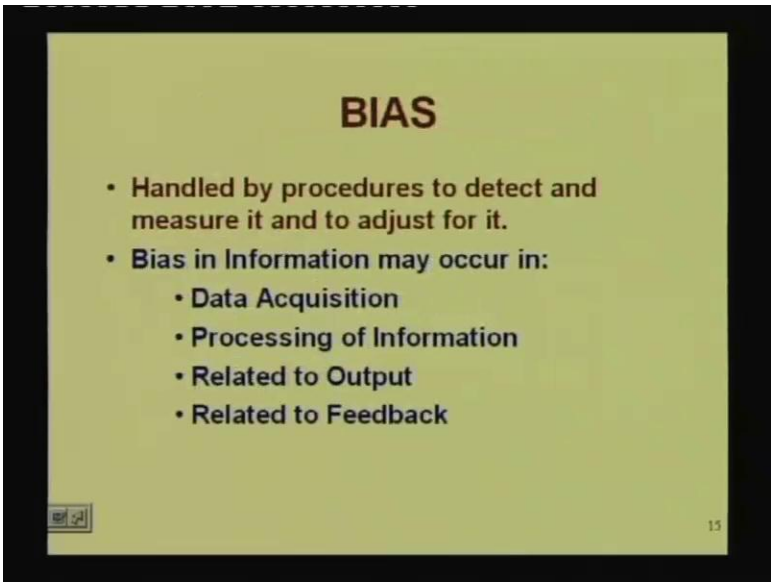

Now comes the bias. Now biases are handled by procedures to detect and measure, measure the bias and makes suitable adjustments. In fact there are various types of bias that can actually

occur in information processing. It could be at the time of data acquisition, it could be at the time of processing, it could be related to output, or it could be related to feedback. So we have different kinds of biases: data acquisition biases, processing of information biases, output related biases, and feedback related biases. Let us try to see what are these different kinds of biases.

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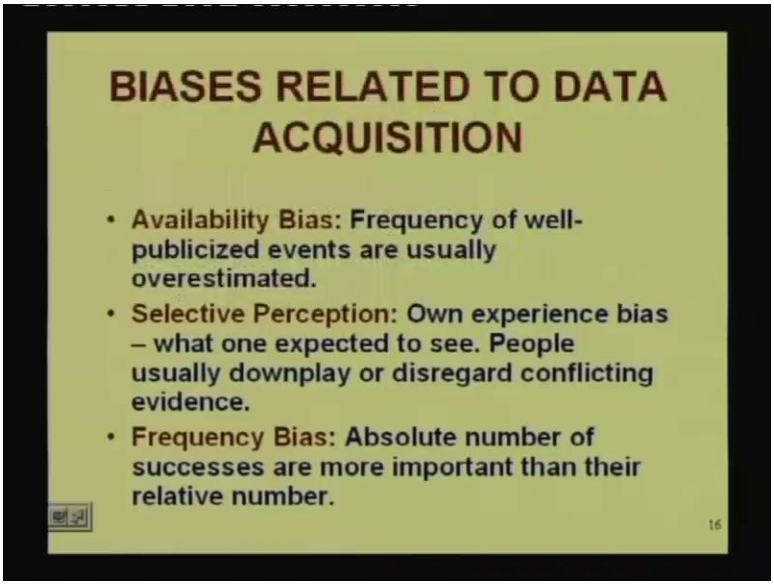

First one: biases related to data acquisition. So there are various types of biases. The first one that are available in data acquisition bias is the availability bias. So what happens when data acquisition means collection of data, so when we are collecting data obviously if we are collecting data such as electric meter meter reading or attendance of people I do not think the availability bias is going to very important. But these kinds of biases are going to be important in situations where we are collecting data for a qualitative kind of situation.

Say for example we are collecting machine performance data. Now how good is the performance of machine; is it good, very good, bad; I mean if you have a quantitative measure well and good you can put the quantitative measure. But if this is a qualitative measure alright... so when you are rating a particular person naturally the question that comes is that is it very good or excellent, good or satisfactory. The same person who has rated it as very good may be may be rated as good or even excellent by some other people. So this is the kind of situation where there could be

differences of opinion. And in this case what really happens is the frequency of well publicized events are usually over estimated. Right? So when you are collecting data; say suppose you are collecting data that how many of the let us say the newspaper reporters are highly successful, what happens the highly successful newspaper reports reporters are very well publicized, we all know about them, we all see them day in and day out in various television channels, newspapers, reports etc so we tend to think that these kind of people they are always successful. But the fact may be that they are very few in number. We are really not collecting the whole gamut of data with regard to these class of people and then assessing whether how many of them are successful right. So this is called availability bias where we are over estimating the frequency of well publicized events.

Then we have the selective perception. Own experience bias, what one expected to see. People usually down play or disregard conflicting evidence. now you see because you you are a person of a certain type you have gone for a certain type of choices then you tend to think that that is the right choice because that is the right choice as far as you are concerned but if someone chooses a different opinion, a different kind of lifestyle, a different kind of opinion, a different kind of job probably he has his or her justifications right so that is why the own experienced bias can lead people to collect data in that particular manner.

Suppose your particular perception is that in a very factory setting again let us say that workers in general are highly productive; suppose you tend to believe theory x or theory y you know, you tend to say that things are very rosy all the time, everything is good so you will see that you want to see that every worker is good and they are really doing well so you know you you tend to collect that type of information where you you find that things are very nice alright. So that is the kind of thing and sometimes we used to we downplay or disregard conflicting evidence.

Then we have the frequency bias the absolute number of successes are more important than their relative number. I mean the reason why people still buy lottery tickets right because the probability is exceedingly low but even if they are exceedingly low we also we always see the people who have actually done well, I mean who has got lottery tickets. So in that sense you can say that there is some similarity between availability bias and the frequency bias.

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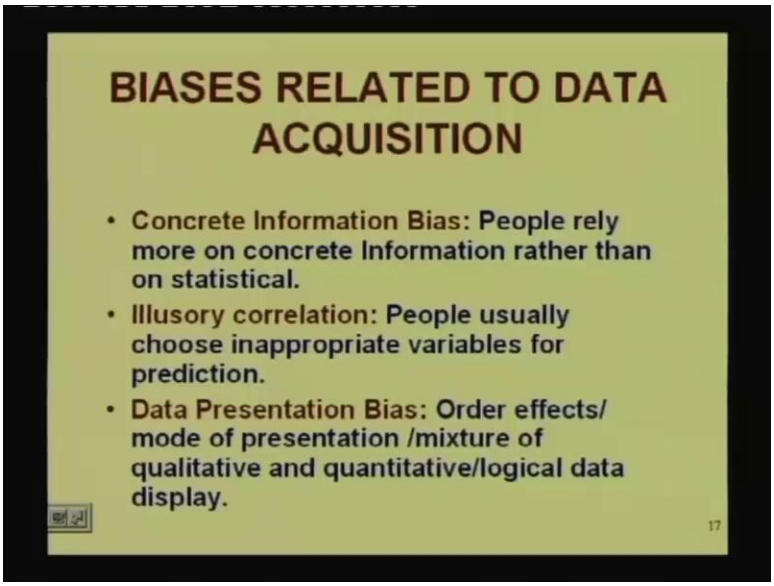

Then we have the concrete information bias. People rely more on concrete information rather than on statistical information right. So if you really know that this has happened, you know something that is known very clearly compared to that if a probability is assigned to that suppose you are you are told that if you take this path you will definitely earn 50 rupees whereas if you take the other path you will earn 1000 rupees but the probability is 0.2 20 percent probability alright so it depends on the payoff.

If you say 50 rupees probably you may not be interested but suppose it is say 200 rupees probably a person may go for the 200 rupees path rather than the1000 rupees with a 0.2 probability alright because this is a concrete information.

Illusory correlation: sometimes people choose inappropriate variables for prediction right so we tend to correlate with variables that really cannot be correlated right. But what we tend to do it is like you know believing in fortune telling; someone tells you that if you look at right and find a crow you will do well. Now finding a crow and doing well probably they are not related at all but still we tend to believe them. So these are sometimes illusory correlation. This is a very obvious example but in real life the examples are not always so obvious but they do exist.

Then data presentation bias: we have already seen various kinds of data presentation biases that can come due to order effects, mode of presentation, mixture of qualitative as well as quantitative information and logical data display. So various kinds of data presentation biases can actually come in.

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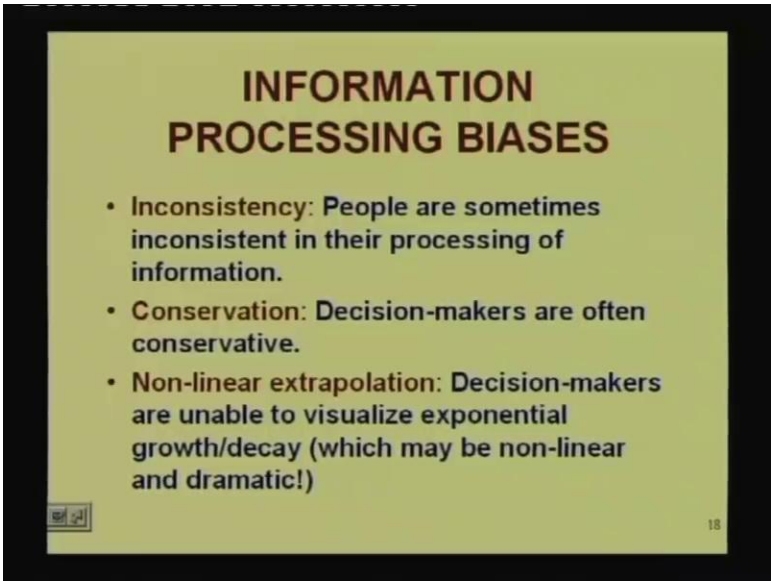

Then we have various kinds of biases due to information processing. The first one is an inconsistency bias. People are sometimes inconsistent in their processing of information.

Then conservation: decision makers are often conservative right. Non-linear extrapolation decision makers are unable to visualize exponential growth or decay which may be non-linear or dramatic. A beautiful example is that if you ask many people what will be the population of India 100 years from now assuming the population today is 100 crores and the population growth rate continues as it is continuing today.

In fact when I asked the similar question to a large number of people and students I have got an answer to the tune of 150 to 200 hundred crores that is the general impression people give that okay if today is 100 crores in 100 years it will be 150 to 200 crores. But the fact is that Indian population in today's context is doubling in around 35 years and we all know that doubling time

is constant for exponential growth. So if the same growth pattern continues the fact is Indian population in 35 years it will be 200 crores, in 70 years it will be 400 crores and in 105 years it could be somewhere around 800 crores. That means it will be multiplied eight times doubling three times 2 to the power 3 is 8.

That means in 105 years Indian population can reach somewhere around 800 crores that is is very dramatic and non-linear but we do not understand this until unless it is shown to us in a very very clear manner right. So that is why we still downplay the population problem and we think even with 100 crores we are managing we will manage like this forever. But this problem will very rapidly you know take over and it will be too dramatic we still fail to realize something like awareness for AIDS, you can still see that the population the AIDS you know the HIV positive people in India particularly the number is alarming but not so alarming and we are really we not bothered.

But we must understand it also has a constant doubling time and it is growing in an exponential manner until unless we check it. So this non-linear extrapolation really is a very very important consideration and particularly those situations which undergo exponential growth and decay we should be very very careful; say particularly awareness of people within an organization is often exponential in nature. So if you have if your company is not doing well the employee morale can go down very very quickly, you may say that it is a temporary phase and everything will be alright but everything will be alright with a very very poor employee morale scenario so we have to be very careful on seeing that the positive word of mouth really goes and not negative ones.

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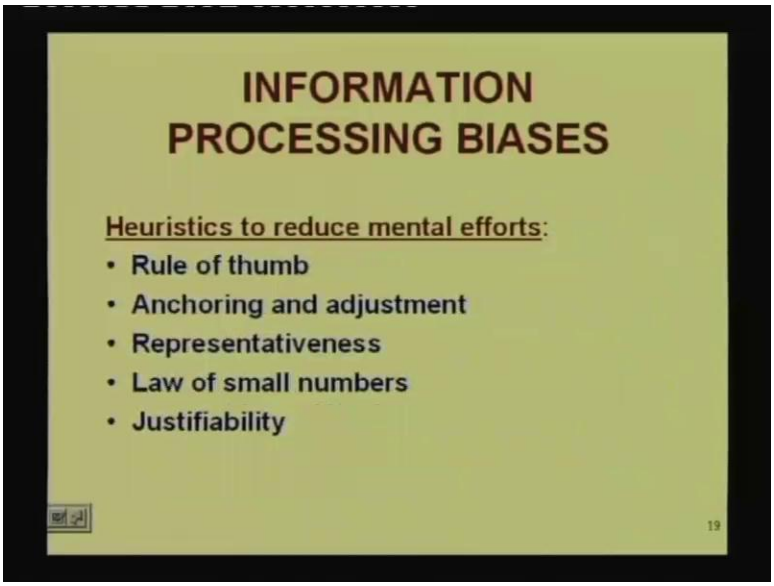

Now, whenever there is information processing bias there is always certain heuristics that people tend to follow to reduce mental efforts. Some of them are: rule of thumb, and anchoring and adjustment, representativeness, law of small numbers, and justifiability. So basically what exactly they mean is that people tend to quickly reside. So in fact many of us we have probably little idea now how to manage a complex organization but we can still manage we can still be confident of managing a complex organization by following a descriptive model.

Exactly what this descriptive model means is that suppose we we could see how people have done in the past. So what people have done in the past we can take it like an encore and adjust our decisions around that encore alright? So it is really not that we make a normative decision based on our own decision making but we just find an encore from the past decisions and adjust around it and survive. So these heuristics to reduce mental efforts are very much true, now is very much a human behavior and probably in complex situations they are the only way to cope up.

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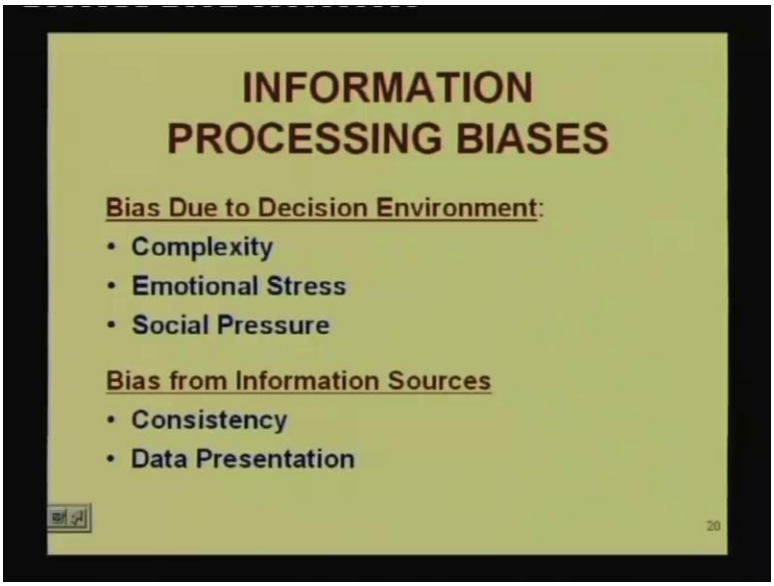

Then there are various biases due to decision environment and some of them are: complexity, emotional stress, social pressure, so they actually lead to information biases to be taking place and then information biases may come in from information sources like: consistency, data presentation and so on.

So we stop here today. The other kind of information processing and other biases we will continue this discussion in our next lecture. But apart from that we shall see specifically that how the management particularly... we have focused on the information part but now we want to focus on the management part that what are the various contexts in which the management responds to an information technology situation. Thank you very much.