Advanced Cognitive Processes
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Lecture – 24
Reasoning & Decision Making – II

Welcome to the course Introduction to Cognitive Processes; I am Ark Verma from IIT Kanpur and we have been talking about aspects of reasoning and decision making in this the in this lecture last lecture.

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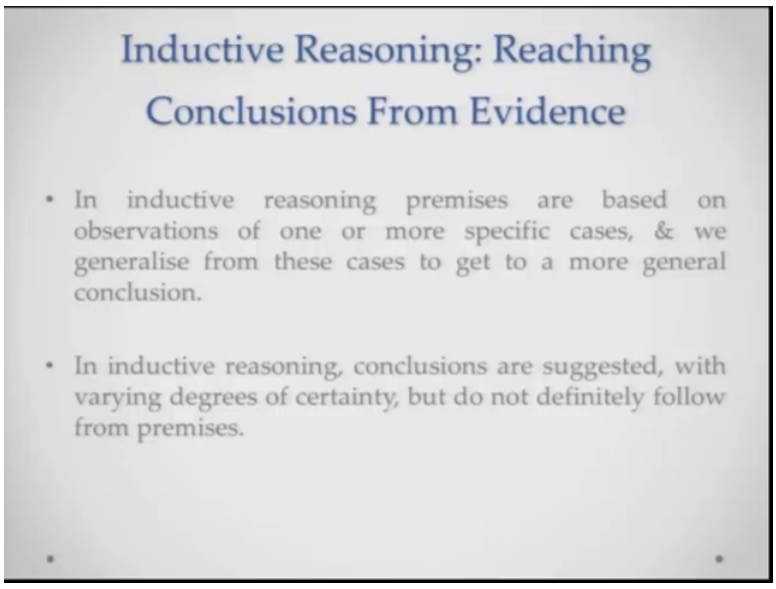

I talked to you about kinds of reasoning; inductive reasoning, deductive reasoning and today I will talk about. So, I talked about deductive reasoning in the last lecture, today we talked about inductive reasoning and how do we reach two conclusions from particular kinds of evidences.

We will also talk a little bit about how are making of conclusion from these evidences are affected by various biases that we come to at some point. So, in inductive reasoning the premises are based upon the observations of one or more specific cases and what we do is, we generalize from our observation from these cases to get to a more general conclusion.

Now, one of the things is that in inductive reasoning these conclusions are that are just suggestive they are not really very definitive. And these suggestions have various degrees of certainty, I can be 10 percent sure, 20 percent sure, 30 percent sure or 70, 80 or 90 percent sure, but generally I am never 100 percent sure. So, this is one of the classical differences major differences between inductive reasoning and deductive reasoning.

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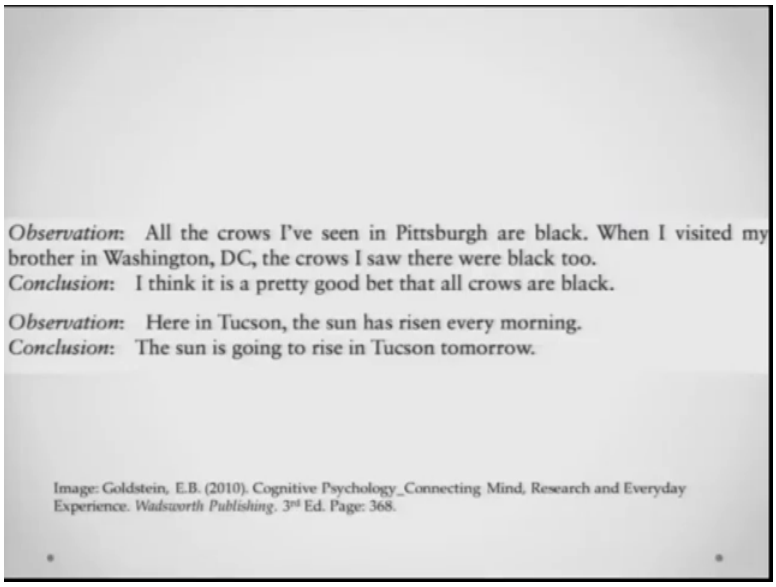

Suppose I am reading out a couple of examples for you from Goldstein's book, observation all the crows have seen in Pittsburgh are black, when I visited my brother in Washington DC, the crows that I saw they were black too.

A good conclusion would be there I think is a pretty good bet that all the all crows are black. So, this is again I it is a guess another observation could be here in Tucson the sun has risen every morning, the conclusion could be the sun is going to rise you know induction tomorrow. So, different degrees of confidence in the last one the degree of confidence is much more.

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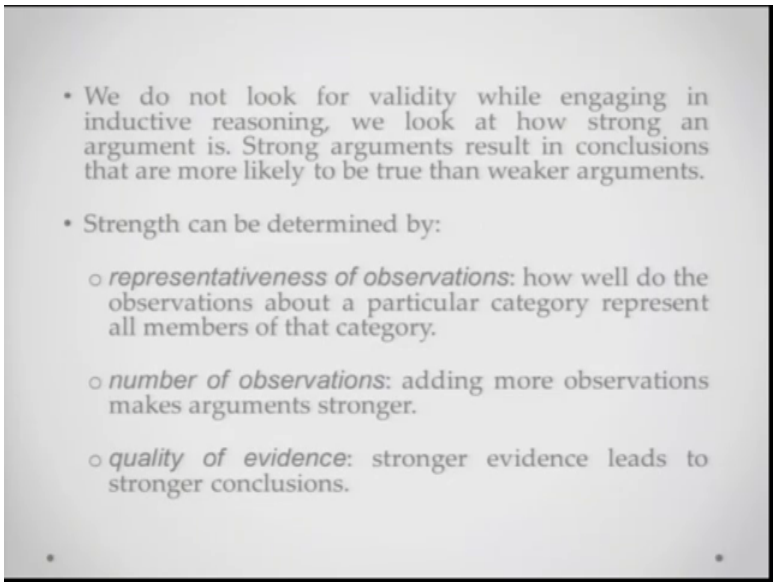

You do not really look for validity when we are trying to engage with detect inductive reasoning. What we are actually looking for is how strong the evidence is, you know how strong the argument is. And strong arguments basically result in conclusions that are more likely than weaker arguments. We do not really talk about final you know conclusions or stuff.

Now, the strength of these arguments can be basically determined by three things representativeness of observations. So, if you are looking at an observation, how well does the observation about a particular category resemble or represent all members of that category. Also a very important factor is number of observations how many observations have you made? 1, 2, 20, 200, 2000, 20000 adding more and more observations basically makes the argument much stronger.

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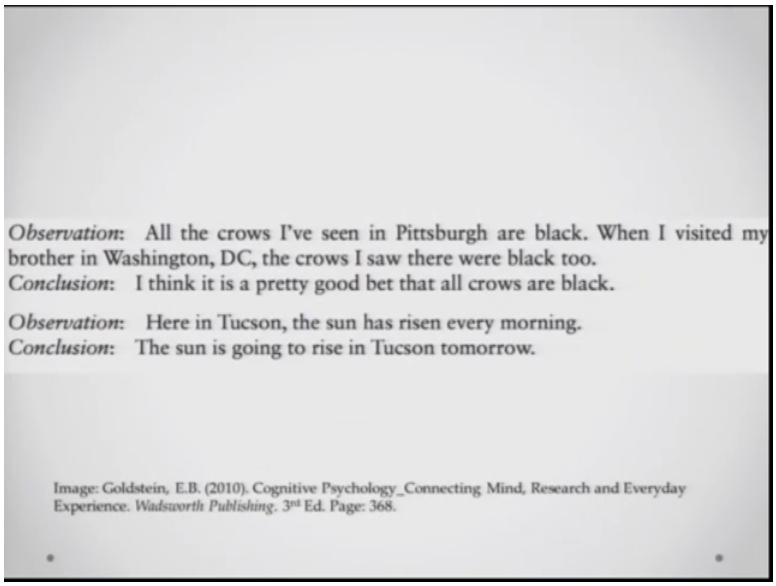

If you remember the last example, here in Tucson the sun has risen every morning. So, the confidence in the conclusion is a bit more as compared to the confidence in the earlier statement.

And the third is the quality of evidence that you are looking at, the stronger evidence leads to stronger conclusions and more definitive more you know let us say better conclusions.

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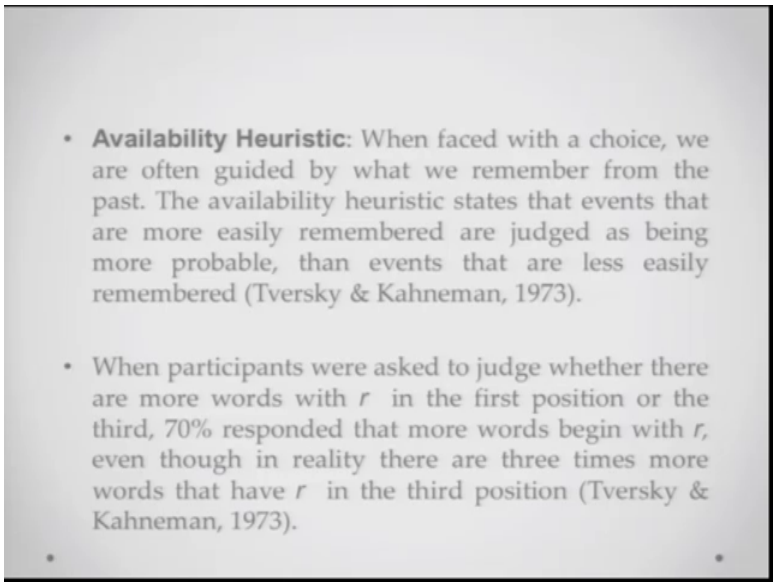

Now, let us talk a little bit about how our you know process of inductive reasoning is affected by a variety of biases and variety of things that come in when you talk about availability heuristic. So, when faced with a choice and somebody is asked to make a choice, what we are doing what we do is we are often guided by what we remember from our past you know and the most recent past is remembered most you know more.

So, the idea is the availability heuristic states that events that are more easily remembered more and you know especially events that have just occurred, our choice as being more probable than events that are less easily remembered ok. I will give an example when participants were asked to judge whether the you know whether there are more words with r in the first position versus more words there r in the third position, a lot of people basically responded that there are more words that begin with r 70 percent participants responded that there are more words that begin with; r compared to more words that have r in the third position.

However, it is actually the case that there are much more words that have r in the third case in the third position as compared to words that begin with r. Because it was easier to remember words that begin with r as compared to be remember words that have r in the third position, people thought that you know much more words must begin with r. So, this is one of the examples or demonstration of availability.

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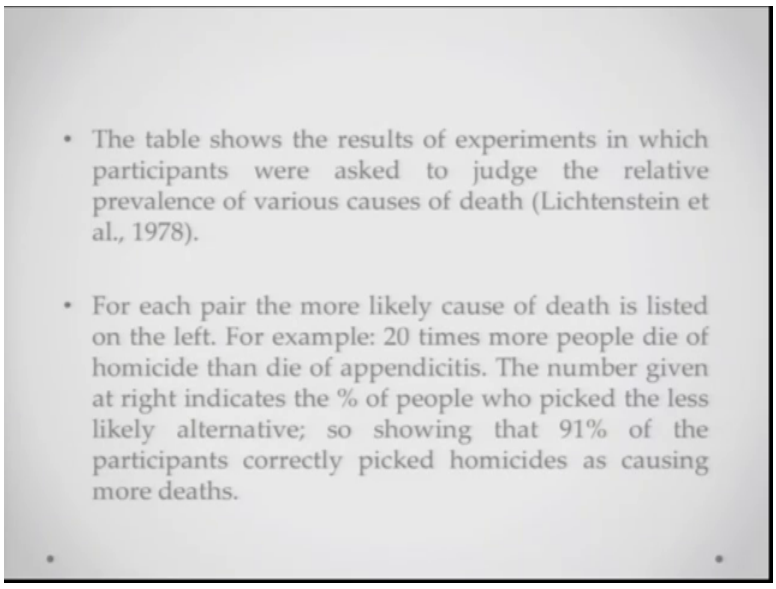

I will show you table right now, which basically has likely causes of debts and people who are asked to respond to them.

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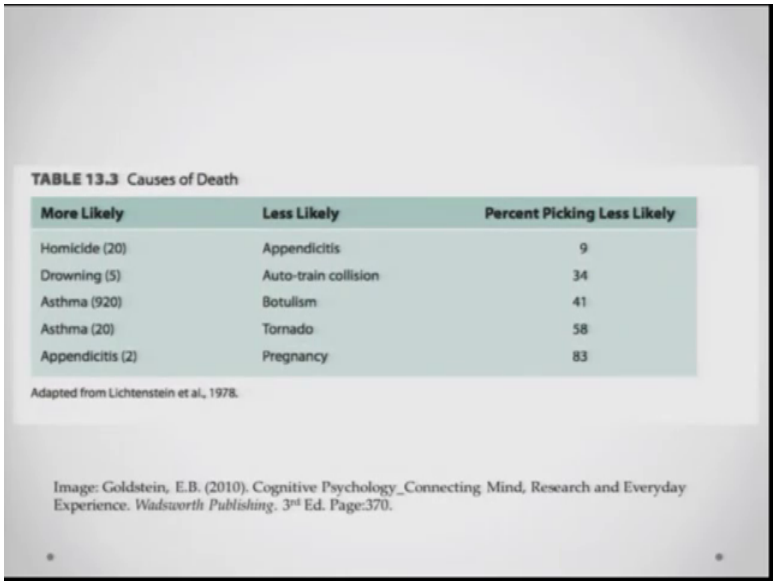

TABLE 13.3 Causes of Death

More Likely	Less Likely	Percent Picking Less Likely
Homicide (20)	Appendicitis	9
Drowning (5)	Auto-train collision	34
Asthma (920)	Botulism	41
Asthma (20)	Tornado	58
Appendicitis (2)	Pregnancy	83

Adapted from Lichtenstein et al., 1978.

Image: Goldstein, E.B. (2010). Cognitive Psychology_Connecting Mind, Research and Everyday Experience. *Wadsworth Publishing*. 3rd Ed. Page:370.

You will see that as far as homicide is concerned, 20 percent you know homicides basically happen 20 times more than you know then appendicitis. And 91 percent picked the more likely cause of death as compared to appendicitis. But if you look at some of the other things almost say 83 percent of the people wrongly chose pregnancy as you know causing more deaths as compared to appendicitis.

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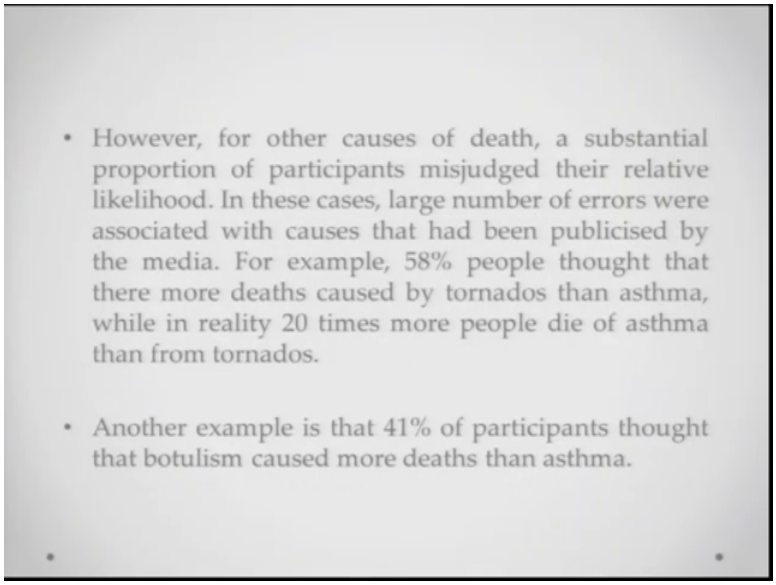

So, in this pair; So, the idea is that what is happening here is, a substantial proportion of parchments are misjudging the relative likelihood of these causes of death. Large number of errors are basically associated with causes that has been publicized by media. For example, 58 percent of people thought that they were more deaths caused by tornados than asthma, while in reality 20 times more people died of asthma than from tornados, but because tornados in the in the United States are more on the news they are publicize, they are talked more and they are you know there are so many pictures and visuals available, that a lot of people misjudge the fact that asthma basically leads to more deaths as compared to tornadoes.

You can look at the fourth figure four figure here, now 42 percent people are only are making their correct choice. Another example is that 41 percent and people thought 40 percent people thought that participants thought that botulism causes more deaths than asthma.

So, you see here asthma in botulism. So, 41 percent people are thinking I am making the wrong judgment and selecting botulism over asthma.

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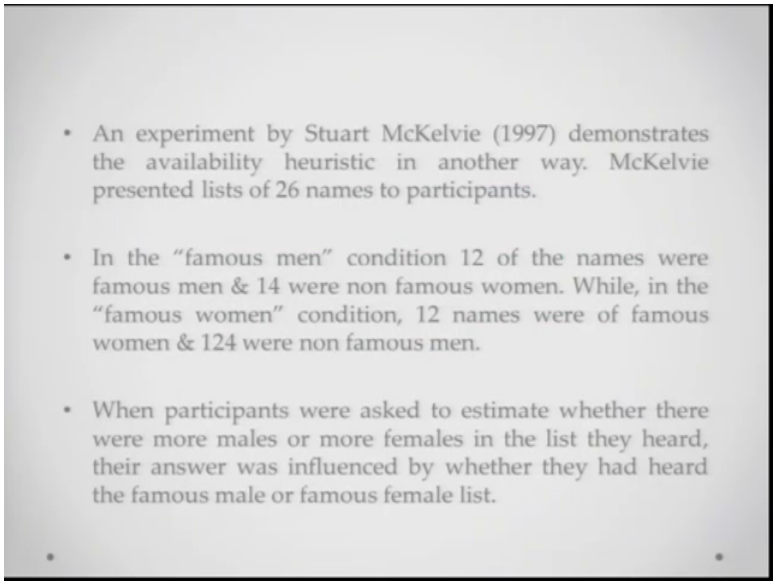

Now, an experiment was done by Stuart McKelvie in 1997 and that demonstrates the fact that availability heuristic you know it kind of demonstrates different way. So, what did they did was McKelvie presented lists of 26 names to participants. There were two conditions in the famous men condition 12 of the names were famous men and 14 were

non famous women. While in the famous women condition 12 of the names were famous women and 124 were and 14 were non famous were non famous men ok.

So, 12 famous men, 14 non famous women, 12 famous women, 14 non famous men; When participants were asked to estimate whether they were more males or more females in the list they had heard their answer was in influenced by the fact that whether they had heard a famous male or the famous female list.

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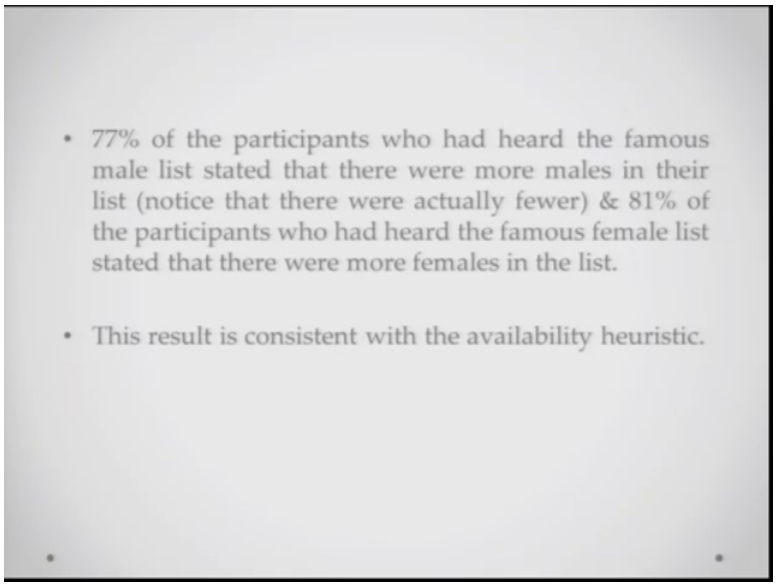

77 percent of the participants who had heard the famous male list suggested that there were more males in the list, even though you see there were 14 non famous women and 81 of the participants who had heard the famous female list suggested that there were more females in the list.

So, the result is consistent with the availability heuristic because you hear more famous you know you hear more of you know famous people, the idea is that that is influencing your judgment of you know how many people were there in all.

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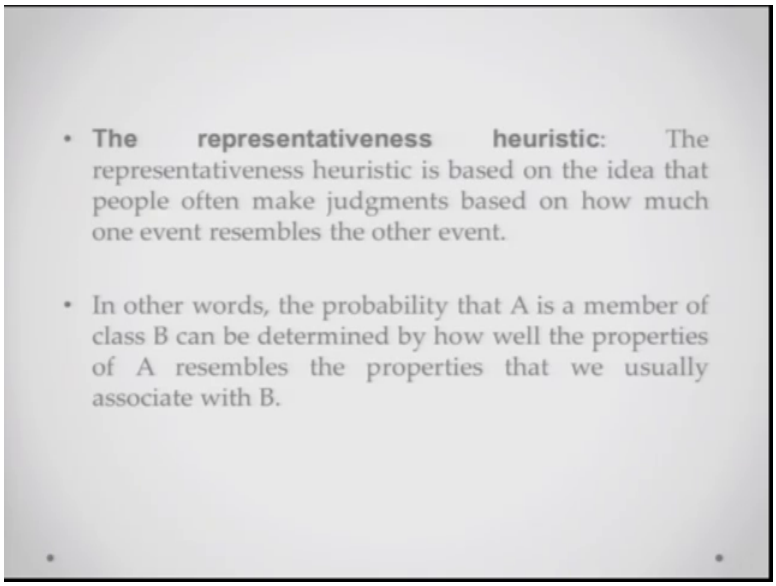

The next heuristic that affects our decision making is referred to as the representativeness heuristic. Now the representativeness heuristic basically is based on the idea that people often make judgments based on how much one event resembles the other event you know how suppose for example, one of the you have observed one event, and you kind of try and liken this event to all the other events you know this has happened, this one did it resembles what I saw last year or this one resembles what I saw 2 days ago or 5 years ago or 5 years ago and you kind of make this likeness.

So, in other words what is happening is that the, probability that for example, A is a member of class B can be determined by how will the properties of A resembles you know to what we associate with being the general properties of being I show you this with an example.

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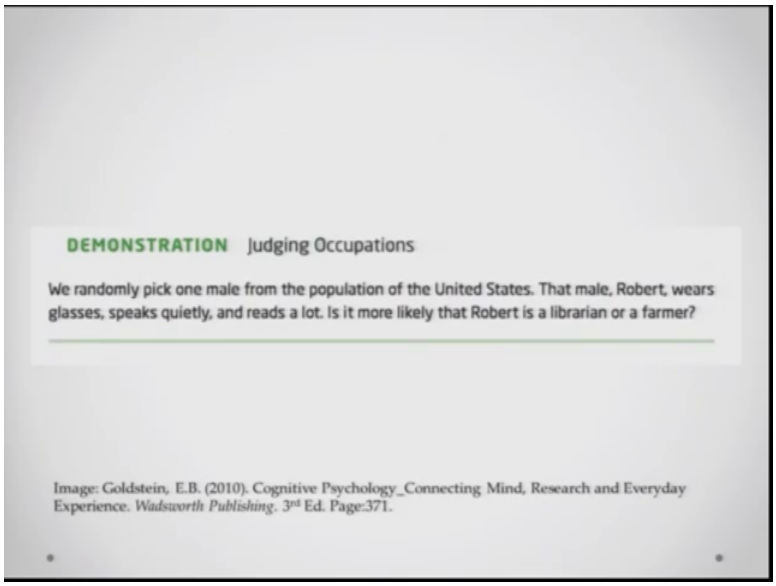

So, randomly you know people picked one male from the population of the United States, the male Robert and it speaks and quietly and he wears glasses and he reads a lot. Now then people were asked whether Robert could be a librarian or a farmer.

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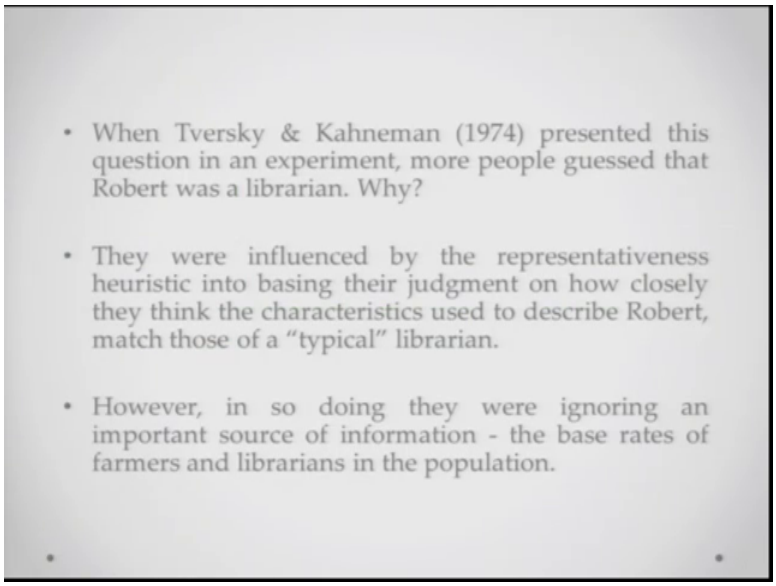

So, you can guess it while I am going to the next slide what do you think Robert basically does? When Tversky and Kahneman produced you know they present in this question in an experiment, more people judged that Robert was a librarian why? Because this is more associated to how we perceive librarians they were influenced by the

representativeness heuristic into basing their judgment on how closely, they think their characteristics of this male Robert resemble that of a typical librarians. What you are doing is you are likening these characteristics to what the stereotype of a librarian is. However, in doing so, they were ignoring a very important source of information that the base rate of farmers and librarians.

There are far more farmers in the country as compared to librarians. So, if somebody is randomly picking some male, there is a much higher chance of that person being a farmer as compared to a librarian I am sure this kind of example would work very well in our country as well.

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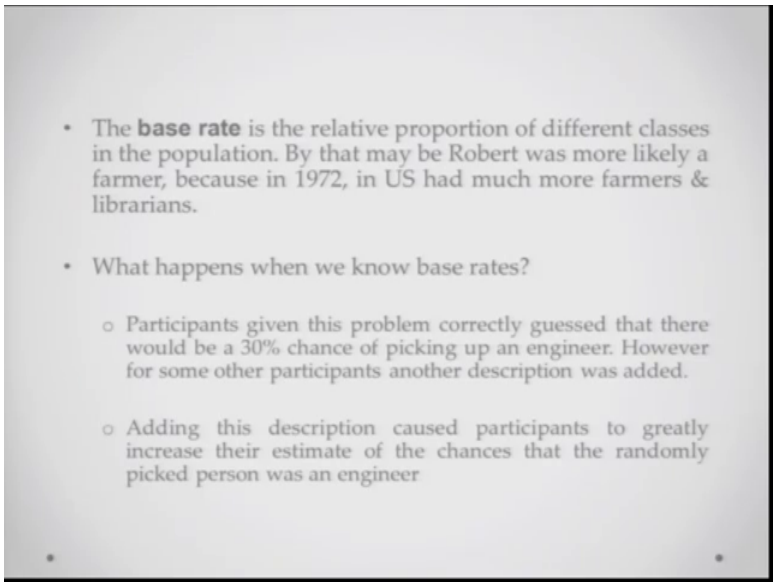

So, this aspect of base rates, what is the base rate? Base rate is basically the relative proportion of different classes in the population. So, by that you know maybe Robert was more likely a farmer because in 1972 at that time, you guys had much more farmers than librarians. If I talked of India; obviously, the thing applies here much more that you know we probably have much more farmers than librarians in the country.

So, what happens suppose if you tell the base rates to people if you inform them of the base rate while you are asking them to make these decisions? So, participants given this problem correctly guessed that there would be a 30 chance of picking up an engineer; however, for some participants another description was added. So, the similar task was there and they were basically given that you know the base rate is 30 percent of the

chances that you will select an engineer. Some other for a different group of artisans other information was also added. Now adding this description cause participants to greatly increase their estimates that randomly picked person was engineer. So, what they are doing is, they are including the base rate information in their judgment.

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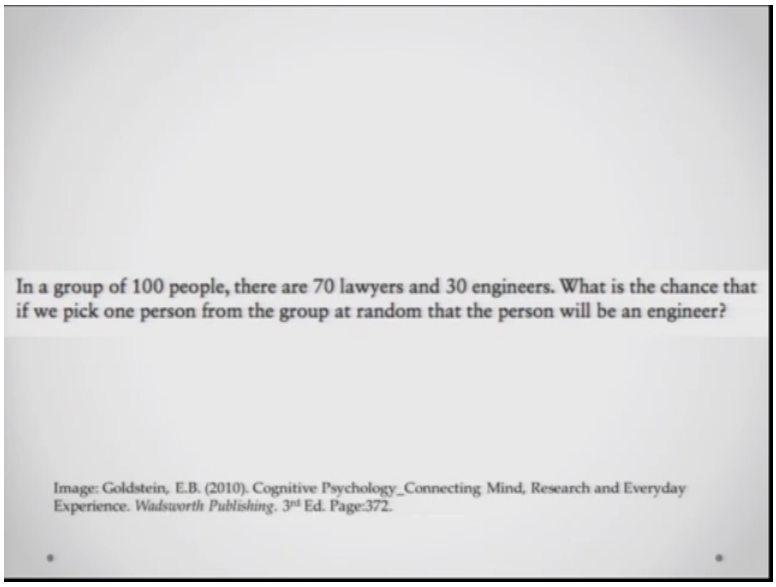

Let us say this example in a group of people there are seventy lawyers and thirty engineers what is the chance that we pick one person from the group at random and that person will be an engineer so; obviously, 30 percent will be an engineer.

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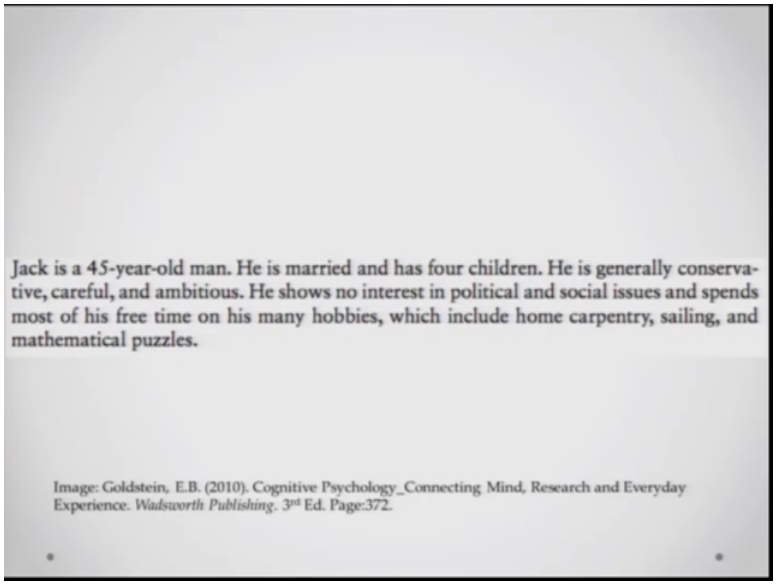

Now, let us take a different example, jack is a 45 year old man he is married and has four children, he is generally conservative careful and ambitious, he shows no interest in political and social issues and spends most of his free time on his many hobbies, which include home carpentry, sailing and solving mathematical puzzles.

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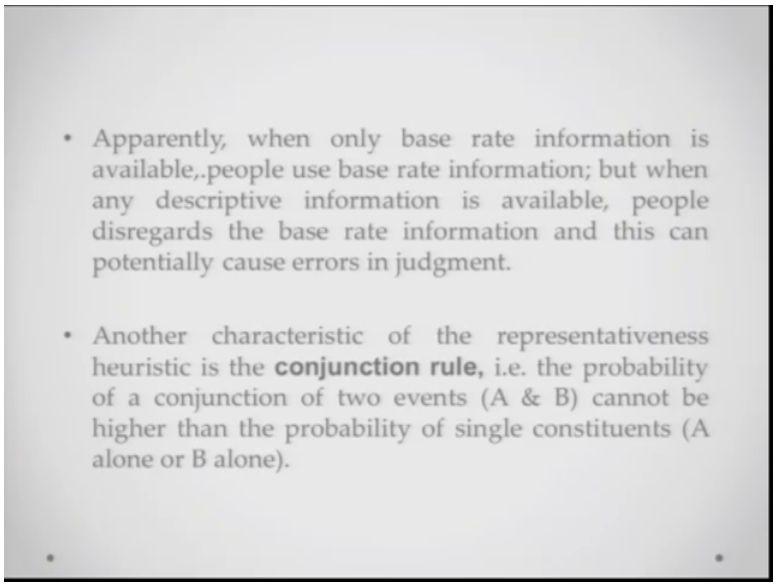

Now, apparently when only base rate information is available, what people do is people use the base rate information, but when other descriptions are available, people disregard the base rate information and this also can lead to potential errors in judgment as you will see in the last lecture. So, what is happening is another characteristic of this representativeness heuristic is the conjunction rule, that is the probability of a conjunction of two events is much less than the probability of you know it cannot be higher than the probability of a singular event.

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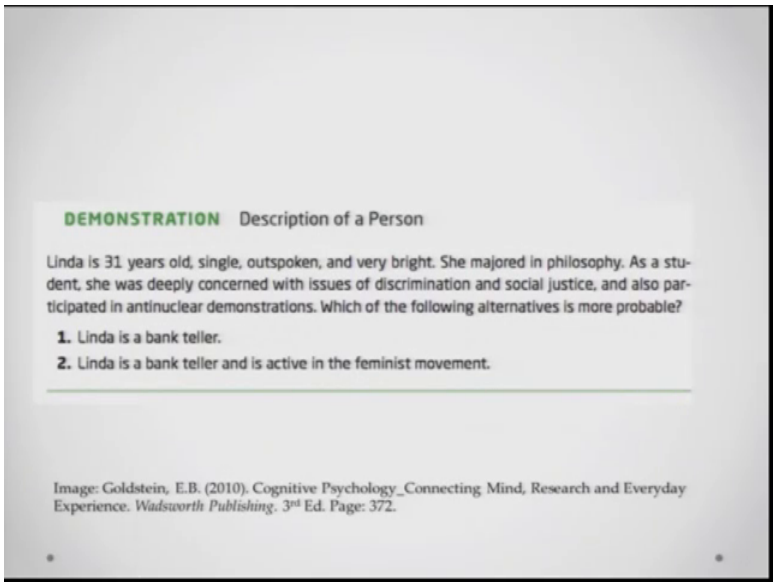

So, if I am talking about two scenarios, let us say you know I have a description here, Linda is 31 year old single and outspoken very bright, she is majored in philosophy as a student she was deeply concerned with issues of discrimination and social justice also you know at the end she participated in anti nuclear demonstrations now what is the likelihood of the following two alternatives and there are two examples Linda is a bank teller, and second is Linda is a bank teller whose active in a feminist movement.

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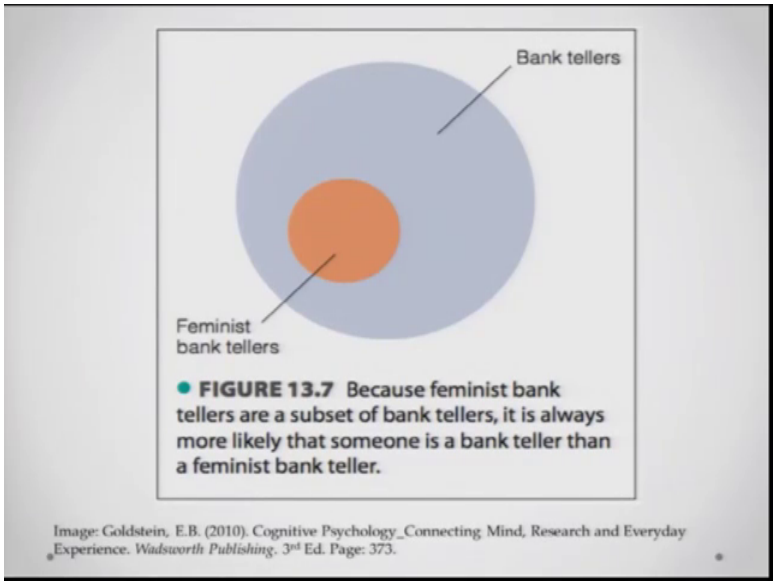

Now, the fact is a lot of people basically mistook this thing. A lot the technical thing is hear that because feminist bank tellers are basically a subgroup of all bank tellers the probability of feminist bank tellers should be much lesser as compared to the probability of Linda being a bank teller ok.

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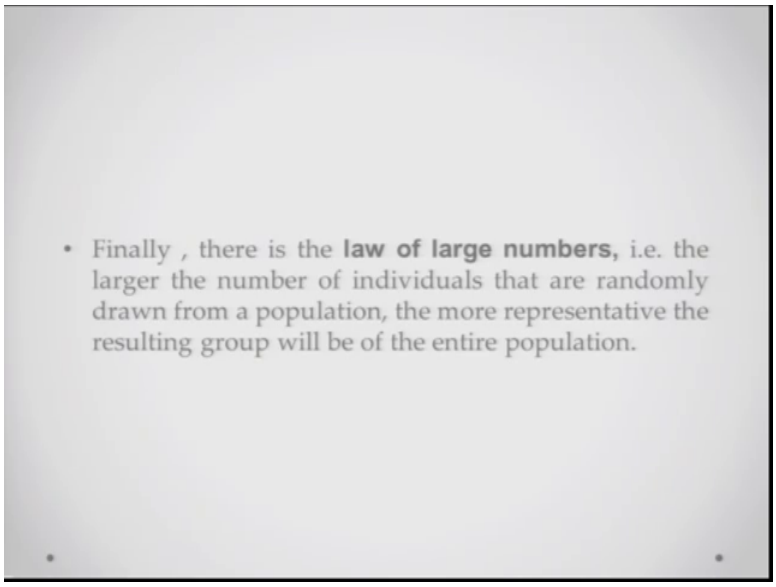

So, a lot of people would make this kind of a mistake, but the second you know a different kind of heuristic that also operates while people are doing inductive reasoning is the law of large numbers. What is the law of large numbers? The idea is that is the largest a number of individuals that are randomly drawn from a population, the more representative the resulting group b group will be of the entire public. Suppose I am drawing a sample of 5 people, how likely is it that these 5 people represent the whole population?

Suppose I am drawing a sample of 1000 people, how likely is that this 100 people will represent the more population? So obviously, you will assume that the second picking we will have more representative you know we will be more representative of the entire population.

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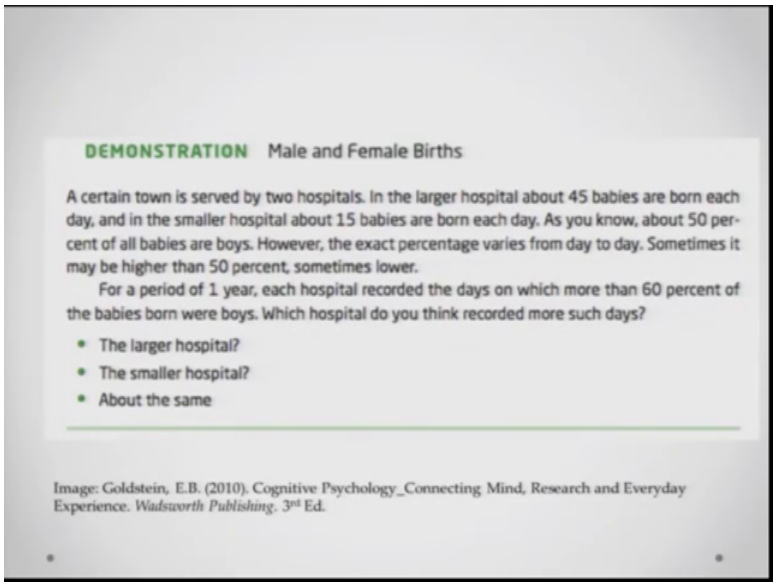

So, you know let us have this example again borrowed from Goldstein. A certain town is served by two hospitals in the larger hospital about 40 babies are born each day and in the smaller hospital around 50 babies are born each day. As you know about 50 of all babies are boys, how the exact percentage of boys and girls must be varying from a you know a day to day? Sometimes it might be that it might be the fact that higher than 50 percent of them are boys or sometimes lower than 50 percent are boys.

For a period of one year both of these hospitals are large hospital where 45 babies are born every day, and a small hospital at 55 15 babies are born each day; recorded the day is in which the more than 60 percent of the babies were boys which hospital do you think would have recorded more such days? So, the larger hospital or the smaller hospital or both would have done about the same.

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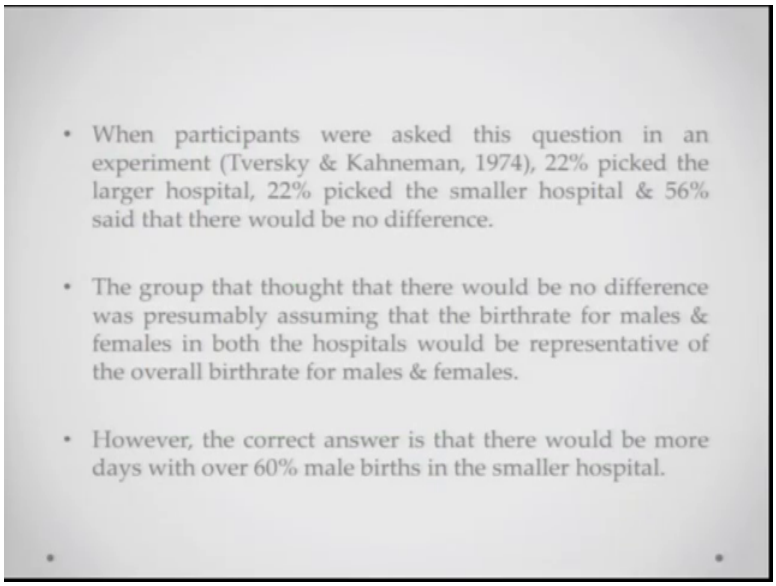

Now, what happens here is when Kahneman and Tversky basically presented this 22 percent of people picked larger hospital, and 56 percent of the people picked there they were the rates will be about the same.

Now, what is happening with the second group is, that they are assuming that there will be no difference because in the larger and in the long run and the birth rate for both the hospitals would be almost identical which should you know will not be really very different because its being observed for up to one year.

But the correct answer is that there would be more number of days with 60 percent male, but more male births in this smaller hospital why is that because the fact is again there are there is a sample sizes are very small there, but people what they are doing is because they are looking at the global sample size, they are looking at one year and they are saying in one year time both the birth rates in both of are really should be identical.

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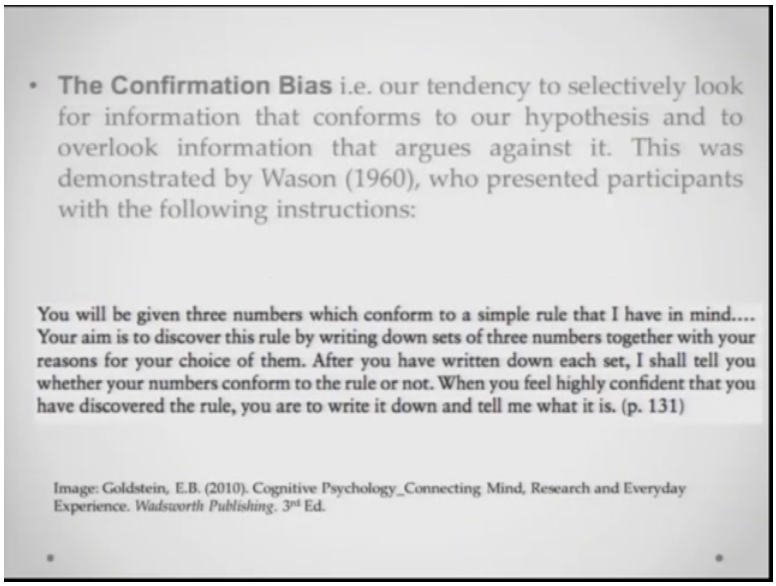

Another bias that I can talk about is referred to as the confirmation bias that is our tendency to selectively look for information that conforms to our hypothesis and overlooked information that r use against it. You look around yourself you see how you read you news or how you listen to news or how you know evaluate what people are telling you, you will find that a lot of times we are much more likely to believe we are much more ready to believe, what is consistent with our points of view as compared to what is not consistent with our points of view.

Let us say you know Wason basically did this a very interesting task and he presented the participant should following instructions. I am going to give you a bit of an experimental demonstration. So, what happened was, the instructions were like you will be given three numbers which conform to a simple rule that I have in mind your aim is to discover this rule by writing down sets of three numbers together with your reasons for your choice of them. So, the ideas Wason will give you three numbers and then people will basically be writing three numbers which should test the rule which Wason has in mind.

After you have written down each set you shall tell you whether your numbers confirm to the rule or not. When you feel highly confident that you have discovered the rule you have to write down the rule and tell me about it. So, this is what the instruction that Wason gave.

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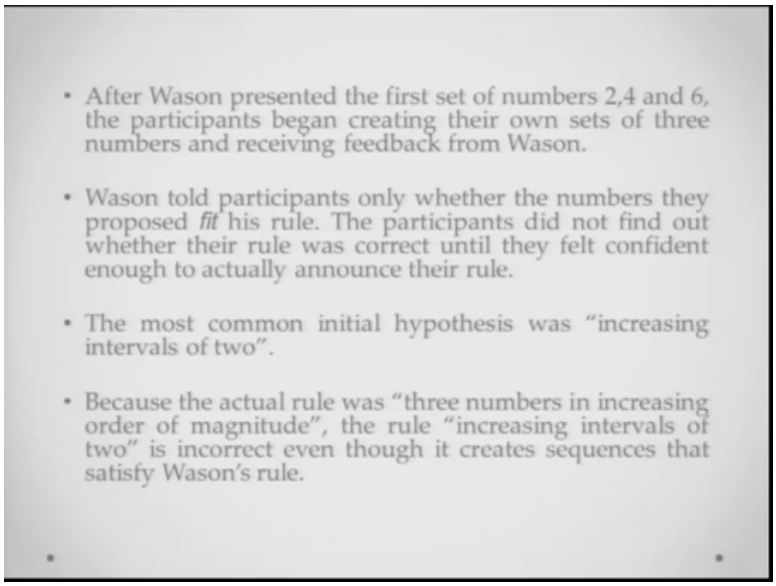

After the instructions of presented Wason give the first set of numbers, which were 2, 4, in 6 the participants then began creating their own sets of three numbers and they start receiving feedback from us. Wason told participles only whether the numbers proposed fit their rule the participants did not find what their rule was correct until they felt confident enough actually to announce the rule.

The most common initial hypothesis was increasing intervals of 22 plus 2, 4 plus 2, 6. Because the actual rule was three numbers increase increasing order of magnitude the rule increasing intervals of two is incorrect even though it kind of fits the overall you know rule even though it kind of creates the you know sequences that satisfy Wason's rule. So, they were not being able to test it.

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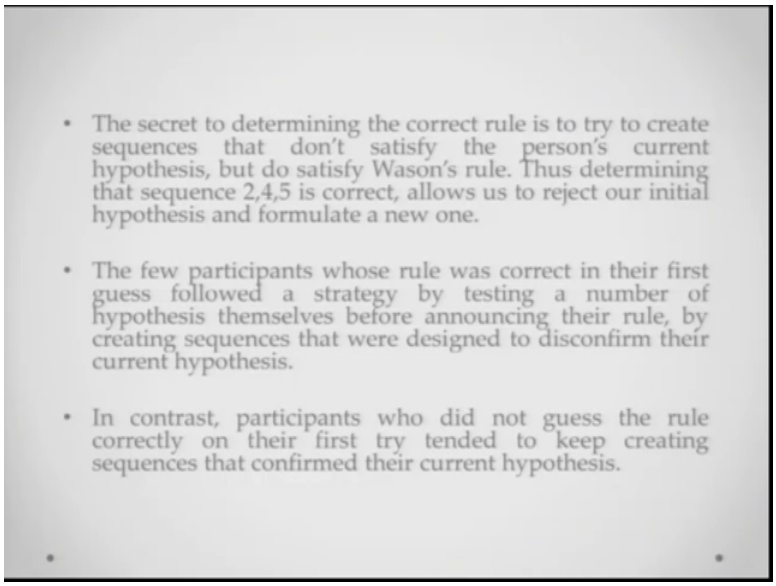

And the secret to determining the correct rule is to try and create a sequence that does not satisfy the rule. So, if somebody comes over this sequence 2, 1 and 5 or something like that that is what we test the rule. So, thus determining that the sequence 2, 4; 5 is correct allows us to reject our initial hypothesis and it allows us to make a new hypothesis ok.

So, there were few participants whose rule was correct in their first guess followed by a strategy and basically what they did was they followed a strategy by testing a number of hypotheses themselves before announcing their who by creating sequences that were designed disconfirm their current hypothesis, the idea was what these people were doing is and they saw this three were and three numbers that Wason was given and they came up with an hypothesis then they started coming with numbers which dis confirm their hypothesis and it is you know kept doing it again and again till they were very confident that they have figured out the correct hypothesis.

In part in contrast participants who did not who could not guess the correct rule on their first try they tended to keep creating hypotheses that confirm their current you know sequences that confirm their correct with hypothesis though they kept creating a numbers which kind of fitted with what they were thinking.

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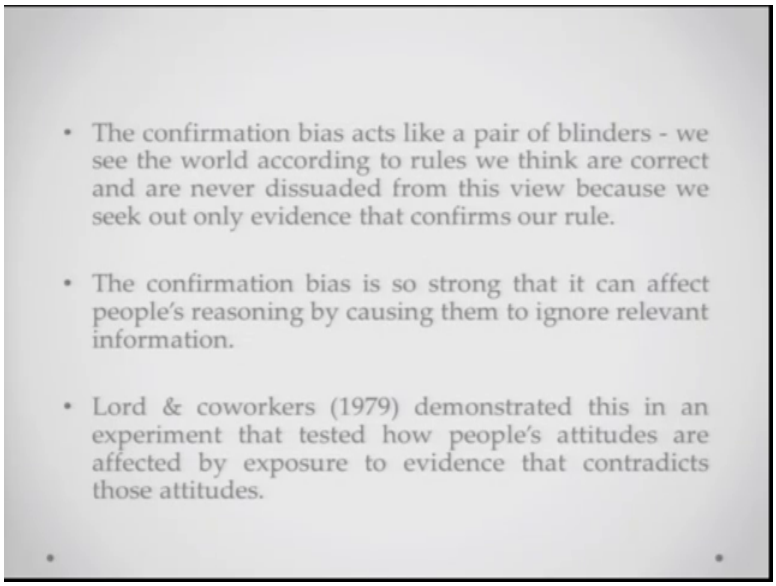

Now, this confirmation bias you know this is really what confirmation bias actually works like. So, the confirmation bias kind of acts like a pair of blinders, you know its just like you put two things on your eyes and what we do is you seeing the world according to the rules you think are correct or we think are correct and. So, that we are never dissuade it from this view because we seek out only evidence that confirms this rule.

If you have a particular kind of a opinion about somebody if you have a particular kind of you know opinion about a particular you know class, what you tend to do is you can you only look at those aspects of the behavior of this person, that fit what you initially thought. You kind of tend to very conveniently ignore everything else that does not fit your hypothesis, and this in sense is the problem with your reasoning and this is basically what confirmation bias is all about.

And this confirmation bias is so, strong that it can actually affect peoples reasoning by causing them to ignore sometimes very relevant information as well. So, lord and coworkers they wanted to test this out and they basically demonstrated this in an experiment that tested how people's attitudes are affected by exposure to evidence, that contradicts those attitudes. So, sometimes people are not able to change their attitudes even in presence of you know particular kinds of evidence.

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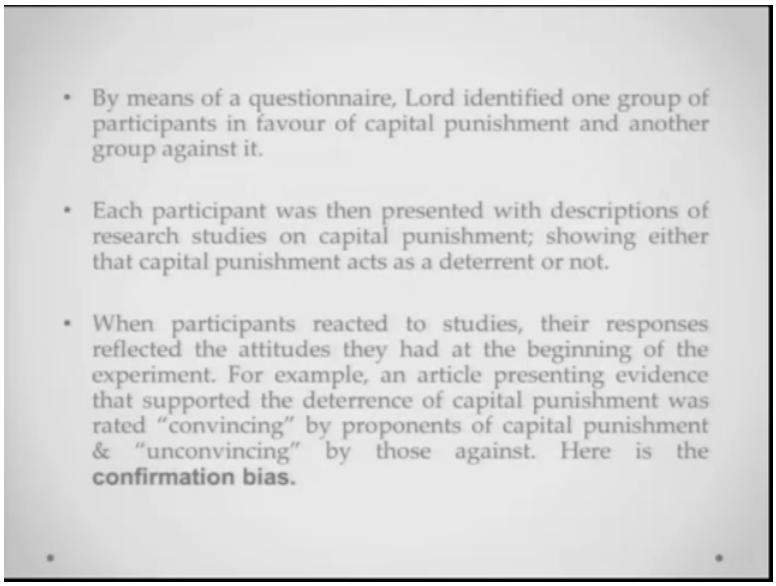

Let us see by means of a questionnaire lord identified one group of participants, who were in favor of capital punishment, and another group of participants that were not in favor of capital punishment. Each participant was then presented with descriptions of research studies on capital punishment showing either that capital punishment was acting as a deterrent or not. So, they were presenting each participant with the studies as some studies showed that it was acting as a deterrent; some study showed that it was not acting as a deterrent. When participants were reacting to these studies their responses reflected the attitudes they initially had they had at the beginning of the experiment.

For example, A 1 an article representing the evidence that supported the deterrence of the punishment was rated as convincing by proponents of capital punishment and unconvincing by those that were against it. Here you see the working of how the confirmation bias is going. So, people are kind of you know finding things that are you know, they think that anything that confirms with my perspective is more convincing evidence and anything that does not confirm with my perspective is less convincing evidence and you will see this operating all the time all around you, and in the way people talk and create arguments.

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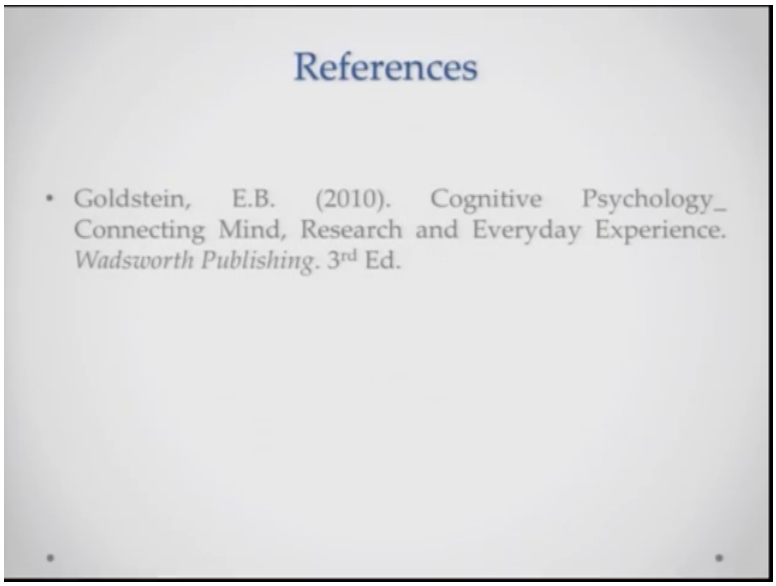

So, this is all about inductive reasoning from my side, today we have one more lecture to go from reasoning and decision making and we will talk about that in the next lecture.

Thank you.