Introduction to Cognitive Psychology

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Lecture – 28
Classical Theory of Decision Making

Hello, friends. Welcome back to this last section of Decision Making which could be the last concept with that we will discuss in this course on Introduction to Cognitive Psychology. In the previous lecture, we discussed complex thought process and under that we discussed two basic phenomena in complex thought process namely reasoning and judgment. Reasoning and judgment when they finish up they lead to the process of decision making and that is the topic that we will be discussing in today's lecture. So, what this lecture will be comprised of is decision making, what the term implies, what processes are involved in decision making, how it is done, what are the various models of decision making and at the end of it the various other cognitive processes which interact with decision making to effect idea or to give rise to final choice.

So, before we go into the process of defining what is decision making let us first revise a little bit on to the topic of reasoning and judgment. So, the last class on topics of reasoning and judgment we thought and I showed to you how this is the last step in any cognitive process. So, within this whole lecture series we have been studying various cognitive processes starting from perception pattern recognition in perception to attention then leading to the process of memory and following by processes of language thinking and problem solving and then coming to the higher order cognitive process of reasoning, judgment and decision making.

Now, what does decision making actually imply and the classes are in the lectures of reasoning and decision making we saw that reasoning is basically a phenomena which leads to verification of facts based on current knowledge. So, basically when the lower order cognitive processes which are basically perception, attention, memory and these basic cognitive processes when they produce an input or when they produce a kind of a knowledge or representation a mental representation. These mental representations needs to be further analyzed and process. Further analysis and process of the mental

representations is generally done by the process of thinking reasoning judgment and decision making.

So, in reasoning what we tend to do is the mental representation the solutions which have been generated through or the kind of output that has been generated to the basic cognitive processes they are evaluated or they are considered in terms of the present information in terms of the given information at that point of time. So, basically reasoning is a process of finding evidence for the conclusions that are been generated or there have been there are generated for the conclusions which have been drawn from the basic of the cognitive processes.

Now, from reasoning we move into or the second process which is called judgment. So, basically in reasoning we define there are two kinds of reasoning we have something called syllogistic and conditional reasoning which is which are part of reductive reasoning and then we have inductive reasoning which has the ephor's kind of a statement two kinds of reasonings are out there. Now, the reasoning process basically goes ahead and finds out evidences or provides evidences of to support the conclusions which have been generated as an output.

In judgment what we tend to do is looking at the conclusions we go ahead and judge whether whatever the conclusions have been brought up in which of those conclusions are valid in which of these conclusions are not valid. So, let us say that the basic order cognitive processes gave us a number of conclusions and through the process of reasoning we then go ahead and provide evidences for the existence of each of these conclusions which have been derived. So, through in a cognitive process or in a in a let us say in a cognitive pipeline in the process of perception attention and memory we have generated an output.

Now, this output or this kind of mental representation which has been generated from the basic level property processes have to be supported by evidences and reasoning is a process through which we go ahead and provide the evidence of why these conclusions are valid and not. Judgment is a process through which we look at those conclusions which are valid in those conclusions which are not valid and so, these are something which we have done in the previous classes. What is decision making? Decision making is a process which is a step ahead of judgment. In judgment we look at a number of

conclusions we look at a number of outcomes from the basic level processes. In the process of decision making we make a choice.

So, out of the number of given available inclusions to us through judgment and reasoning we then make a choice according to our needs according to our requirements of which of the choices which of the options or which of the conclusions which have been drawn from the basic level currently processes should we go ahead and choose and this choice process is actually a very very risky process. The reason being that once we make a choice once a number of options are available to us we are and we make a choice there are always a chance that the choice will backfire, meaning which that if there are four different options or four different conclusions which can be drawn from a particular mental representation or four different interpretations of a particular mental representation choosing one representation or over the other basically puts up puts us into a situation where if the choice that we are making is wrong we could have a wrong judge wrong decision and that could that could harm us in some way.

So, basically decision making is then a very complex process. In decision making what we need to do is we need to make choices also another interesting thing that we should remember here is that when we are making choices in decision making when we are making decision choices most the time that these choices have to be made in uncertainty or with certain amount of risk. With the fact that human beings are not calculating machines and human beings do not have all the information available for making a choice selection out of the number of options which have been given to us. So, we tend to make these selections which come out of judgment through a process or through in a state of uncertainty in a state of risk and so, what we tend to do as humans is we tend to minimize this risk or uncertainty we try to make decisions which do not backfire on us.

So, let us then take a look at what is decision making and how do we go ahead and make decisions because these decisions are the ultimate or the final point of any cognitive process because these decisions finally, decide how the goal that we have said how do we attain a goal. So, basically then decision making is a process of making a choice one of the alternatives which is been available from the process of judgment and this choice has to be made mostly in terms of or in situations where there is considerable amount of risk present and considerable amount of uncertainty presents and for that we need to

understand how this decision process really works and the various models of decision making which are available.

So, let then start with a very basic model of decision making how do people actually go ahead and decide let us take a very simple situation.

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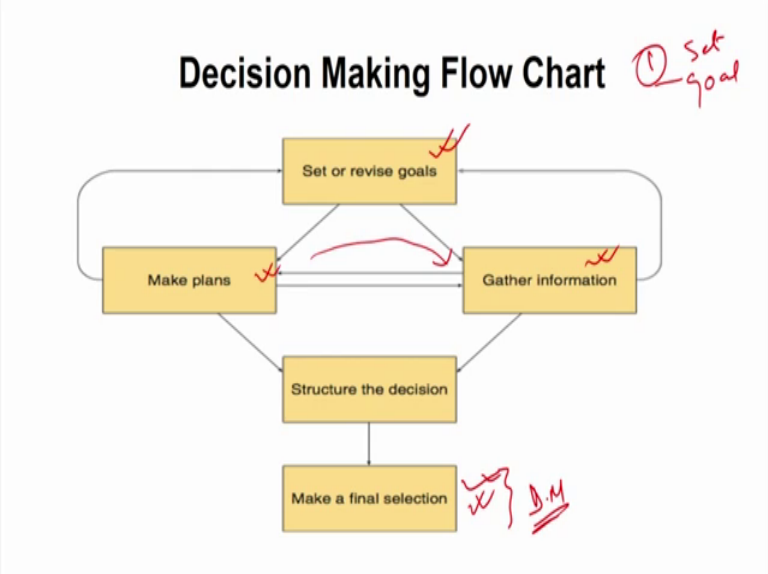

For example a situation could be in terms of identifying major course that you would like to take. When you enter a college when people or when students freshman enter a college the very basic question which is in front of them is to choose a major, is to choose a stream of study and so, how do people go ahead and make this choice of stream of study. So, basically what they do is they look at the number of courses which are available and they look at the goals that they have what they want to want they want to become in their life. And based on the goals that they have based on their personal values based on the number of courses which are available and based on so many other variables they make a final choice and this choice once made cannot be reversed that has to be understood that once you have selected a particular kind of a year.

So, what is the flow chart or how does our decision actually made or how is the decision actually made. So, this is a simple decision making flow chart which explains how decisions really work. So, first the first thing is to in any decision making process the first step is to set a goal. First of all in making a decision in making decisions among choices you people have to set some kind of a goal. So, let us take this example of

choosing a major or choosing a particular branch of study and then evaluate this particular flow chart. So, let us say that somebody x enters a college as a freshman and then he has to make a choice of which a particular subject to take or which particular subject to choose.

For that process first he has to set a goal this goal is to the first step in decision making is setting a goal. So, the person who is making a choice has to first set a goal of what he wants to become and this is the first step. So, let us say somebody wants to become a doctor he or she will not opt into course which has mathematics and physics onto it and will opt into courses which are closer to medical sciences and closer to biology and those kinds of courses. So, first in decision making process if you want to become a doctor or if somebody wants to has a goal of becoming a doctor into the medical field or doing work with primates or an animals in that case he has to choose that kind of a set that goal first.

Now, once that goal is set once somebody says that goal he has to then make plans and gather information this is the second step. So, before say taking up a major or before taking up a stream of study, first step is setting a goal and somebody have not they have set up a goal that they want to be in a medical field that they want to do work on people they now have to make plans. The making plan step basically evaluates of what has to be done what are the requirements of this kind of a study in a medical field.

So, you have to then make plans of what is to be done and what is not to be done. In terms of making plan is which universities to select, which universities are offering this kind of courses, which are what is the rating of these universities, which is the best kind of a rating within the medical field which branch that you want to select and so on and so forth, that kind of planning has to be done for this planning to be efficient or for this planning to proceed you have to go through a step which is called gathering information. And so, if within this step what people tend to do is to look at a number of universities which are available which offer these courses in medical; and n number of universities are there what kind of courses that they offer what are the specializations are there who is a good teacher what is the ranking of the university and all those kinds of information has to be gathered.

And, with this information says then has to be started along several dimensions or several requirements which people might prefer based on their values based on the likeliness. For example, one of the things that people could decide is I want to be a doctor, but I do not want to supposedly say practice dentistry and so, I want to work with basic anatomy or I want to work with dermatology in these cases they have to select the university of that requirement or somebody would say that I would not like to work too hard. So, I will take a medicore university and so, they would not be going for top class institutions and going for secondary institutions and so on and so forth.

Other people would like to specialize in certain areas and so, they would have to select hospitals or a institutes which specialize for example, if somebody wants to work on to brain in India they would like to go to NBRC and so, this kind of a thing has to be there. So, then you have to collect number of institutions which work on to brain and you know come to know that in India there are three or four institutions which offer you medical degrees or medical specializations in brain and so, you were to apply to that and that is the process which is there.

So, first in any decision making process the first step has to be setting up a goal. Once the goal has been set we gather information or people gather information and then make plans according to this information and this process of setting the goal gathering information and making plan is cyclic in nature. In the sense that as more and more information comes to you your plants keep on changing and so, does the goal keep on shifting and so, this has to be done until and unless people are team a certain level of certain it is that this is what I want to do and they get satisfied with the incoming information or the information that the FHA.

Once they have decided to go to a particular institute and be in a particular kind of select a particular kind of major for their graduation degree they have to then structure their decision. The structuring or decision basically requires you to follow what path do you have to follow to carry out this decision. For example, in structuring decisions in terms of choosing a major is basically understanding how do you go and role what are the kind of activities that you are going to do there, and what are the kind of tests that you are going to do afterwards, and then which is the kind of practice that you want to do and so, this is structuring this is not how are you going to take up this decision how you are going to basically carry on with this decision. And then, based on this structure you know

decisions making looking at all the finer points looking at all the pluses and minuses from all the institutes of your choice or all the institutes of your liking taking all the benefits of one institute and the non-benefits of that institute and comparing it with benefits and non benefits of all available institutes of your liking you then go ahead and make a final selection.

So, basically this is how the decision making process really works. So, this is how the flowchart of a decision making processes. It starts up we setting up a goal then fetching more information up related to the goal and then making plans of how effective this information is or making up plans of how to go about in attain this goal once that is done we need to structure our decision which basically means that we need to recalculate the plusses and minuses of all the options which have been available. So, all the things check coming out of reasoning and judgment all the conclusions which are coming out of reasoning and judgment we need to go ahead and balance them on some way. And then make a final choice and make a final selection and so, this is the final step which is generally in decision making. So, although all of these steps require decision making, but this is where the final step of decision making is all about.

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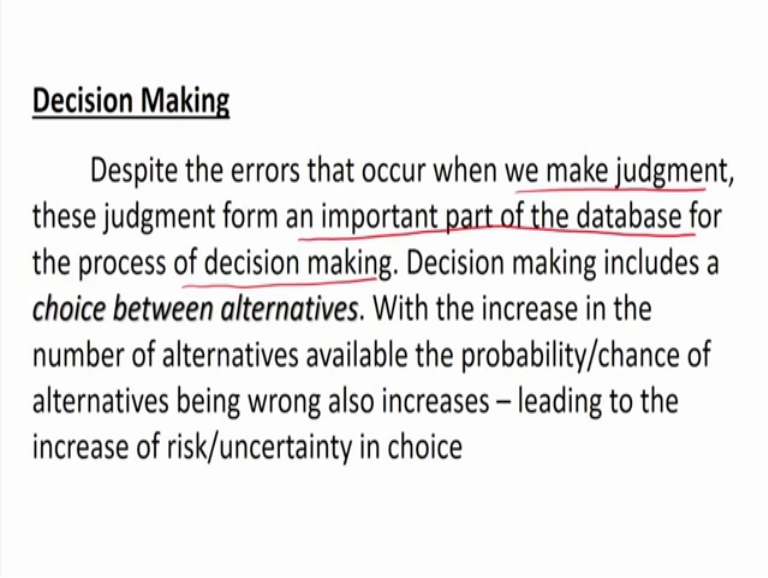

So, what is then how do we proceed with decision making. So, as we studied in the section under reasoning and decision making that judgment the process of judgment which comes before decision making it suffers from a lot of errors. For example, the

three most errors which affect the process of judgment is the error of using heurist such as availability furies the representative furies and the anchoring and judgment theorists. Now, what are these are some kind of mental shortcuts? These are some kind of shortcuts which people use for making judgment. Now, since all information is not available to people at all point of time people use this kind of heurist in terms of the availability heurist people trust on their memory. So, based on the memory whatever comes first to their memory people make conclusions or people make judgment based on that.

For example, the fact that if I ask people or if I ask anyone what is the most common name in India people will come up with which word for example, is the most common name what represents the most common name in India people will come with the idea that it is s or r this comes from the fact that the dictionary has more number of words under s and r and so, this is called the availability heurist, because this comes to us or this comes to the person. If people look into the memory these are the two letters which comes to the name. So, what people will tend to do is that they will tend to know or they will tend to recollect the name of all the people that they know. And since most people are from s and r in somebody's let us say in somebody is nearby area and so, that is what they tend to do that it is basically s and r and so, this is this is turning on or this is basically the use of availability heurist in comparison to this or in contrast to this basically is the representative heurist which affects judgment.

And, this heurist is basically the one in which people look at data and compare it with some representative sample. Examples if you see somebody who is 6 foot 2 inches tall 6 foot 3 inches tall the first thing that comes to mind is he has to be a basketball player because he is tall and so, most basketball player are all and so, this has to be basketball player and this is representative heurist because what we tend to do is we tend to use this basic shortcut of taking this tall person and matching him with everybody who is tall and this idea somewhere is inside our head that everybody who is tall has to be there and so, these are some of the kind of errors which are there for example, there are other errors or miss calibration of confidence and the errors or spotlight effect and so, these are the errors and judgement.

Now, despite these errors which are coming from judgment that occur when we make a judgement. These judgments form an important part of the database for the process of decision making. Judgments are very important although judgment can be routed or

judgments has afflictions or judgment can be affected by a number of errors, but judgments are important to us. Why? Because they form the very basic data or they provide the very basic data for decision making. Now, decision making includes generally a choice between alternatives as I said now the process of judgment gives us a number of alternatives, gives us a number of conclusions which are there is a number of options which are there what decision making does is to make a final choice or to make a final liking for a particular choice.

Now, with the increase of number of alternatives now, there is another problem. As the number of alternatives increase, as the number of options increase the probability or chance of alternatives being wrong also increases leading to the increased of risk or unsecured choice. What does this really mean? It means that if a number of alternatives are available we have to do a number of comparisons and so, if let say if a process of judgment leads to many number of alternatives then the chances of the alternatives number of alternatives being wrong also becomes more and more or the probability of those alternatives become more and more and this chance or this probability that a particular that some of these alternatives are wrong will lead to increasing the risk and uncertainty.

Let say there are process results in only two options. Now, if there are two options the chances of some one of these option being wrong is half and so, the chances of the other option being right is always half now if we increase this two four the chances of a particular option being right becomes one by four and the it being wrong becomes three by four and similarly,. if we keep on increasing the number of alternatives the chances of an option being wrong increases and this increases the risk and uncertainty as number of options increases the uncertainty in risk also of increases. Try to understand this in the present consumer society with only a few choices available a few brands available for us to pick up. We are very sure of what to buy and what not to buy.

Let us look at phenyl brands the number of brands of phenyl which are available now since there are only couple of brands of phenyl which are available and so, we do not have to be very certain we do not have to be very choosy and so, these kind of products are called low involvement products and people do not have to do go ahead and get themselves involved get the choices very easy, but look at beauty products. Now, in beauty products there are a number of choices which are available and every day there is

a new choice which is out there and so, as a new as new and newer choices gets increased into or newer or newer choice gets included into what really happens is that the chances of failure also increases because people are not very certain the risk increases as people have not seen a new product or not tested a new product the chances that it will fail also increases and so, this increases their risk or this increases the uncertainty.

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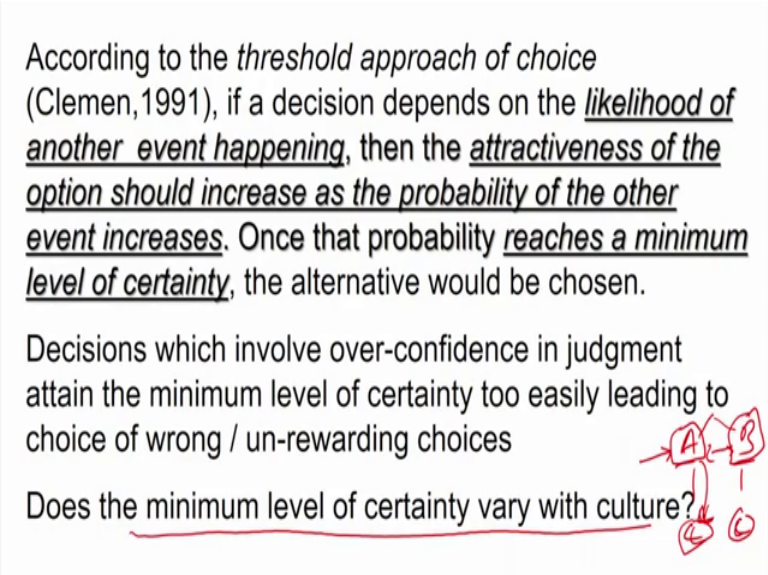

Now, there is something called the threshold approach of choice thing to be remembered is that as the number of choices increases as the number of alternative increases the risk of or risk and uncertainty of failure also increases or the risk or uncertainty in making decisions also increases. Now, there is threshold theory or choice which were proposed by someone called Clemens and what it says is if a decision depends on likelihood of an event happening the attractiveness of the option should increase as the probability of the other event increases. So, what it really means is that if a particular event or a particular decision depends on an event another event happening and if the second event becomes more and more sure then people will choose that option.

Let us take a shopping experience let us say that somebody wants to buy something and this buying of this product depends on let us say whether kind of rebate is given onto it and so, as you become more and more sure that. So, you buying a product depends upon whether something is given free with it or not. So, as you are promised more and more that things are becoming free or things are being given free for you to buy that particular

product as the people advertise as the advertise are makes more sure that you get free things out of it your choice or your likeliness or your probability of buying the particular product A also goes on increasing.

So, what it basically says is that if an event is there if a particular buying of a product is dependent on some other event which could be whether something is offered with it or not and as the conformity or as it becomes more certain that when you buy a product A product with which you think comes free with it that certainty of it becomes more and more you will buy product A and not buy product B because product A is offering something which is free and so, the more certain you are that it is being offered free the more chances that you will buy product A instead of B let us look at this in this way. So, let us say that there are two products A and B and these products have some associate product C right it could be that you are buying a washing machine and this washing machine has an additional accessory which is C which is required for and so, product A is product both product A and B require this accessory C.

Now, product a announces that C comes free with a this accessory C comes free with this washing machine this C could be a dish loader or any and any other thing which is there now the more certain or the more confirm that the manufacturer of A becomes with the fact that they are providing C free product A will be chosen more or product B because pure product B is not of thing C. So, is an event of if you buying a washing machine depends on whether C comes free with it or not and as C becomes more and more certain you start buying product A more and more and that is what is called the threshold choice of or threshold approach to choice. So, basically it stated as is a likelihood that another event happening that the attractiveness of an option should increase as the probability of other event also increases.

Now, once that probability reaches a minimum level of certainty the alternative will be chosen and this is called the threshold approaches choice. So, as producers of product A confirm that they are going to give C for free you choose product A. So, till the point of time that A and B both say that they are going to offer C, but you do not have an idea you do not have any confirmed news, you have both these options of buying A and B washing machines, but the moment that manufacturer of a say is that it is certain it is minimum level of certainty is provided or given the fact that they say that some charge some minimum charges will be incurred from you and then C will be given to you for a

very minimum value, but B does not say anything about the accessory C the product manufacturer of product B does not say anything about the buying of product C you will buy a because a is not saying that some amount of money will be taken from you a minimum amount of C will be given and so, this is certainty and so, you will choose this particular thing and this is called the threshold choices or decision making.

Now, decisions which involve overconfidence and judgment attain a minimum level of certainty to easily reading to choice of wrong or un dividing choices now what does it really mean now when once we become overconfident with a particular judgment once we display some kind of a overconfidence we increase or we get the minimum level of certainty is reached at a very early stage and so, at this point of time the wrong or unrewarding choices can come over.

Now, going back to this incident in which A and B are two washing machines or companies which are offering washing machine and C is an accessory let us say that I trust A. So, much as that the fact that since A is a company which has always been offering something for minimum rates or with giving things for free and so, with this trust I have an over confidence that A is going to launch a machine with manufacturer or a product A is going to launch this machine. And, I am confident am more confident with the fact that it is going to give free, because previous decisions or previous buying of this product shows that this particular manufacturer give things are free I am then leading to something called overconfidence and this will lead to wrong choices, because it may so happen that although you get C for free, but a may not be very good. And so, overconfidence actually leads to attaining of or selecting of wrong choices. So, if people are overconfident in making a choice if people ignore certain facts and becomes show over confidences in accepting a number of choices out of judgment they turn on or they basically invite something called faulty choices.

Now, basic question which comes with it is that is there a minimum level of certainty which varies with culture. So, is it true that certain cultures are overconfident than certain other cultures and so, there was a study done by Yeats Lee and Shamoto Suka in 1996 where the Asian culture and the and the and the western culture was compared and so, in this study what really happened is the overconfidence effect was tested in people from US and Taiwan and so, a situation was given to people from both these situations or both these countries in which they were told or they were given this profile that a

particular two medicines have been invented for a particular kind of two different kinds of diseases which are there and so, this since these two diseases are very similar in nature very similar in symptoms these are the two different kinds of medicines that they work on to it.

And, then they were asked to give this medicine basically provide these medicines for these two kinds of diseases. So, basically two different kind of diseases or two kind of diseases were thrown in which had similar symptoms and two kind of medicines were prescribed for or two kinds of medicines were given or were suggested for these two kinds of diseases and then it was people from both these cultures were asked to go ahead and diagnose what is the looking at a profile of a patient. And so, several profiles were given to the evaluators from both the countries and they were then asked to basically then diagnose the kind of disease that they have and then give the medicine. This is the kind of setup which was there and so, people from both Taiwan and US actually went ahead and did that.

What really happened what was the result of an experiment like this it was found out that in general people were more confident in the in the sense that people showed overconfidence in terms of assigning a particular disease to a particular symptom. So, particular disease are assigning a particular medicine to a particular disease. So, they were overconfident that, but in general the results showed that people from Taiwan were more overconfident and made more number of errors in terms of assigning the wrong medicine to the wrong kind of disease. Now remember initially I said that what happened here was that the two diseases had similar symptoms and so, two different medicines are given to two different kind of a diseases, but then people from Taiwan may were more overconfident and made more errors than people from the western culture of the United States.

Why could this be what is the reason for this kind of a overconfidence and this kind of a more error proneness and so, one of the reasons for this was right of the fact that people from Asian culture from Taiwanese culture they depended more on their memory and so, they searched more of their memory and use more of their memory in terms of finding or the symptoms or assigning the symptoms, whereas people from the western cultures they referred to written manuals. And so, they were more correct whereas, people from the Asian cultures they depended more on their memory of what they have learnt and

assigning a medicine and so, one of the reason is this has to be one of the reasons just provided was this kind of a dependence on memory versus dependent on written literature or written directives and following these directives which is the result for minimal level of certainties with various cultures.

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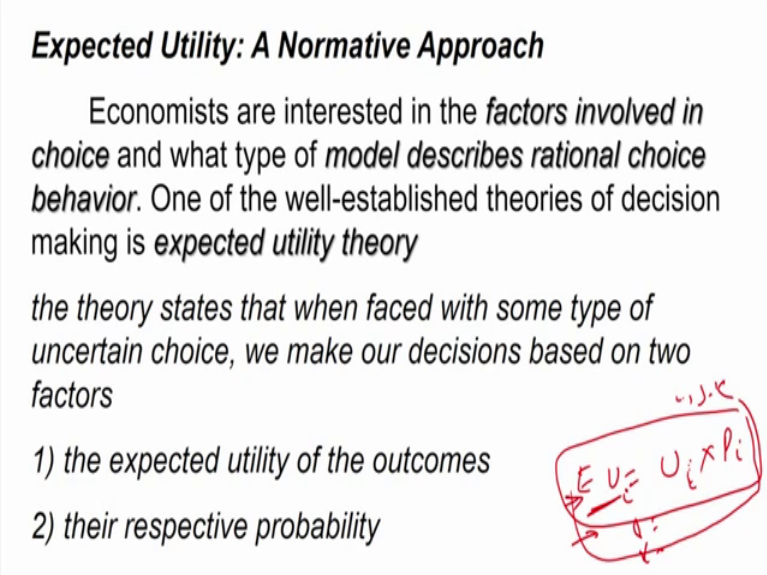

Now, decision making in decision making there are several models which have been used. And so, one of the there are two different kinds of model which have been used in decision making one is called the normative model and the other is called the descriptive model. So, in the normative model as we saw in the chapter one or in the section on reasoning we saw there are two different models of reasoning also one is called the normative models and the other called the descriptive models. The normative models are the models which are ideal which are the ones which should be followed and these are rational models. So, normative models are those models which actually should be followed in a situation or those models which have been prescribed or those model which are prescribed for any kind of an investigation or any kind of use and descriptive models are those models which actually are not ideal models, but which make a goal attainment easy and so, these are the models which people actually follow.

So, let us say if there are if there is a problem which needs to be solved there it can be solved in two ways; one is using analogue or one is using algorithmic approach and in algorithmic approach using the algorithm is basically a normative model because here

everything will go in algorithm fraction and a result is expected out of it. Whereas, in the descriptive model people use heuristic approaches people use heuristics to apply or to come up with a solution and so, they do not follow these ideal solutions or they use some kind of a rules of thumb to arrive at a solution and so, these are the two different kinds of models and so, one of these normative models way of decision making is called the expected utility model or the EU model to be brief.

Now, what is this model? This is a model which have been borrowed from economics. So, economics are interested in the factors involved in choice and what is the type of model we describe a rational choice and behavior. So, basically in an expected utility model the idea is that how do economist want to know what are the factors with which makes people choose between alternatives. So, given the fact that you have a number of alternatives which comes out of judgment how do you go ahead and make a choice and once you make a choice what is the model we describes a rational choice.

Now, what is the rational choice? A rational choice of choice which provides you the better good which basically needs the rational choice is that choice which provides which leads you to goal attainment with minimum or losses and so, a rational choices that choice which has which maximizes gains and minimizes loss. So maximizes gains in the sense that you get more gain of a out of it, but even if you do not gain then you do not lose too much. So, a rational choice is a choice which maximizes which tends to maximize gains and minimize loss a situation like this.

Now, what are the wire established theories of decision making is something called the expected utility theory which comes from economics and what is this theory. So, the theory states that when faced with some type of a uncertain choice when because in decision making it is always uncertainty because we do not have enough of information available to us. So, we make decisions under uncertainty and risk. So, the fact that when people make decisions and uncertainty we make our decision based on two factors. Generally, when we make decisions and when this decision is under uncertainty when we once we do not know all the information which is available we do not know all the facts which are available to us we tend to make our decisions with two factors with two different under two different factors.

One is the expected utility of the outcome. So, any decision which is rational according to the expected utility choice or expected utility theory is to be made in terms of the how much the expected utility of the of each outcome is. Now, will define utility in a in a while. So, the one factor which defines a rational choice a choice which gives maximizes gain minimizes loss is the one which provides the expected which provides the maximum utility and the second is what is the respective probability. So, the probability of the outcome versus in multiplied by the expected utility the outcome will define a rational choice. So, basically expected utility theory says the expected utility is equivalent to the utility of the outcome into the probability of all outcomes and so, this has been done. So, I have done for the i-th outcome it can be for n number of outcome.

And, so, if there are three outcomes let say i, j and k we find out the expected utility for i-th item for j-th item and for k-th item and based on this we then go ahead and tend to make the choice in which we have the maximum utility and the highest probability of the outcome being offered.

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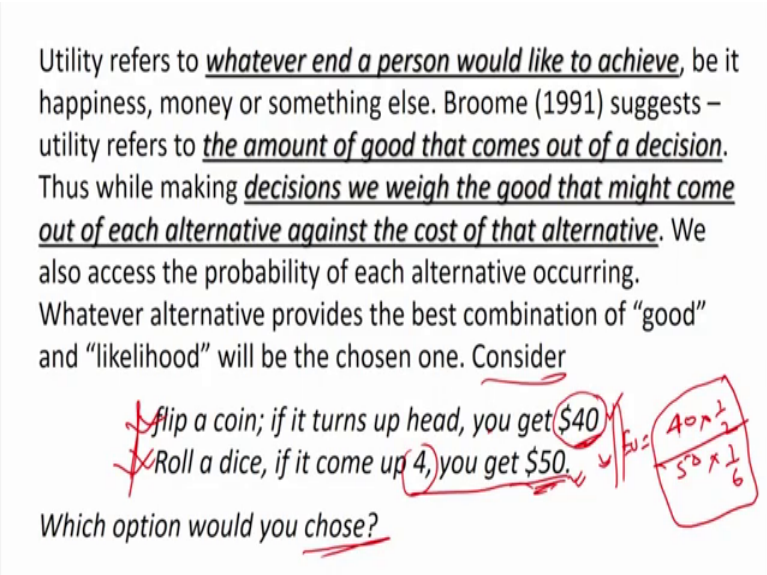

Now, utility refers to whatever ends what is utility? How do we define utility? So, utility refers to whatever end a person would like to achieve. It is basically what do you want to get out of a particular decision, it is that particular thing that you want to get at the end of a decision. Be it could be happiness it could be a money it could be something else satisfaction or whatever it is.

Now, Broome 1991 they suggest that utility refers to the amount of good that comes out of a decision. So, basically once we make a decision what is the benefit that we are getting out of it what is the good that we are getting out of it. So, utility is basically defined in terms of the greater good which comes out of making a decision. Now, thus while making a decision we weigh the good that might come out with each alternative against the cost of that alternative. So, when we make a particular kind of a utility assessment of a particular outcome we look at what is the good that comes out of it and what is the payment that we are making, what is a sacrifice that we are making to get a particular good that what are is the particular kind of a sacrifice that we are making in acquiring or in selecting a particular alternative and what is this one selected what is the good that this alternative is going to provide to us.

We also access the probability of each of the alternative occurring. We also look at if there are four alternatives, what is the probability of an alternative happening? let say that if there are four alternatives one alternative has the probability of happening which is 0.8, 80 percent the times and one alternative has the or the probability of happening which is on the 1 percent time. Now, the fact that if there is the alternative which has or the probability of occurring of only one percent that should not be chosen, because it will never occur or it will never be available and so, we should not select that thing and so, that particular alternative.

So, not only the utility say if an outcome presence or if a outcome gives you greater utility if it is very good for you, but then the chances of this thing particular happening is very less we should not take that outcome we should take only that outcome which provides you utility in association or in addition to it is probability also a probability of occurrence also which means that the availability of it. So, if a particular choice is available is vastly available and it provides even if less good then some other alternative which has a very less formative occurring we should choose that and that is called the rational decision making.

So, whether alternatives provide the best combination of good and the likelihood will be chosen. For example, let us consider this example let us look at these two options which are there. Now, if you flip a coin it turns up head and you get 40 dollars. Now, if you roll a dice it comes up four you get a 50 dollar. Now, which is the choice that you are going to make if you look at the expected utility if you look at to the lens of expected utility

here you are getting a more higher dollar amount then in this case, but then people generally go ahead and take this see the utility is forty here the utility is 50 here.

But, the probability of if you if you calculate the expected utility the value is 40 here, right and the probability of getting ahead is half whereas, the probability of getting a 4 is 1 by 6 and so, in this case if you look into if you calculate the expected utility or the second is less or the expected good that is going to get the appropriateness of this is lesser than this, because the probability of 4 is 1 by 6 a probability getting a 4 in a throw of dice because there are 6 faces of a dice and getting a 4 is 1 by 6 and so, in this case this is more lucrative than this although this is a lesser dollar amount. Now, which options would you choose and definitely the option that you are going to choose is the one which is the first one and so this expected utility theory.

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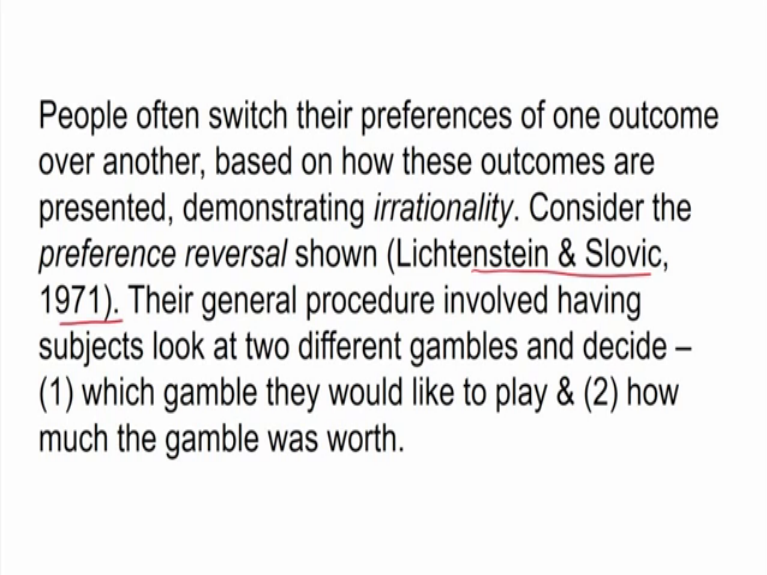

Now, generally speaking this is a mechanical theory it is an economic theory or mechanical theory of choice behavior or decision making. And so, generally speaking how people make decision is they violate this expected utility and the violation comes in terms of in variances of choices. Let us look at what is in variances of choices.

Now, one of the normative predictions that need to be expected from the utility theory is that our choice should be invariant. Now, one of the predictions which comes from this expected utility theory is the fact that the choice that we make for a particular option should be invariant which means that you want if we choose A under situation 1, then we

should stick with our choice and say under situation 2, but that is not what happens. Let us say that there are two in the previous case only given the fact that you choose the first one or the second one or the choices you take the choice of rolling a dice and flipping a coin and you choose the 50 dollar option given the fact that if situation changes.

How does the situation change? The fact that it is the fact this becomes an even number if some situation changes, in the fact that you know that the dice is biased in such a way that it will always fall towards even numbers. Now, if this situation changes even then you should consider or you should go with this dice or the fact that you come to know that the coin that is being flipped is somehow biased is in the it will always in it will give more number of heads than tails. Then, you should not be varying your choices and the why is this kind of a thing there or why is this kind of a invariance not being followed the people do not follow this invariance or they change their outcome or they change their decision process. And this is called the in variances or people show in variances of choices and this is one of the violations of expected utility theory.

What is it that a decision makers choice should not depend on the way a choice is presented. So, if a choice is presented in a negative frame or positive frame which means that if it is positively worded or negatively worded people should not go ahead and make flip between their choices. If you make a particular choice if you have consider all the information and if you make a particular kind of a choice you should not be going ahead and flipping between choices that should be one of the things. So, example if I prefer choice A over choice B in situation one then I should prefer choice A over choice B in situation number 14 as long as A and B are identical in two situations. So, if situation changes in some other things in the external environment changes people should not be changing their choices, but this is what does not happen and this is called preference reversal or in variances of choices.

Now, people often switch their preferences from one outcome to another as situation changes people go on changing their choices and so, this is one of the problems with the following of the expected utility theorem. In the expected utility theorem the fact is given the fact that a particular option is chose particular kind of utility to you. It is highly utilized good providing you higher good and it the probability of it occurring is also the same if situation changes you should not be changing your options, but people do change. So, people often change their preferences of one outcome over another based on

how these ought comes are presented demonstrating irrational irrationality and this is basically what is called irrationality this is what people show in terms of irrationality.

Now, consider the preference reversal which is shown. So, Lichtenstein and Slovic, 1971 they showed something called a preference reversal and they showed this violation of expected utility through a through a phenomena which is called preference reversal. Now, the general procedure involved having subjects look at two different gambles and decide one which gamble they would like to play and number two how much the gamble was worth.

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1) 80% chance to win $ 4.00 20% chance to lose $ 0.50	4) 10% chance to win $ 40.00 90% chance to lose $ 1.00
2) 95% chance to win $ 3.00 5% chance to lose $ 2.00	5) 50% chance to win $ 6.50 50% chance to lose $ 1.00
3) 99% chance to win $ 4.00 1% chance to lose $ 1.00	6) 33% chance to win $ 16.00 67% chance to lose $ 2.00

So, given the fact that people were given six different choices and so, in each choices I will show you the choice which has been given to that there are six different choices to people and each one of has a winning percentage. So, there is there is a probability of this gamble happening and then there is a utility of it happening, but the situation changes. So, understand that each of these choices have a particular utility and a particular probability.

Now, the fact is two different options or two different things are there in one case you are the one who is playing this gamble or who is playing this kind of a game and the other case you are the one who is owning the gamble and you want to sell this gamble or you want to other people to gamble on this in which in the first case which gamble are you going to choose in the second case which gamble are you going to choose, let me give

you 1 minute time to basically go ahead and make your choice. If you are the one who is playing which gamble or which of these choices are that that you are going to basically accept or which are the these choices are the are the one which are going to play, but if you are the one who is the owner of this gamble and want other people to invest in this which is the choice that you are going to choose.

Now, as you would understand that if you are the one who is going to play most people choose this gamble because there is a 99 percent choice of probability of winning. So, you would win only 4 dollars, but the chances of winning is higher. So, if the chances of winning are higher people actually when they play a gamble this is what they bet into. But, if you are the one who holds this gamble if you want other people to basically go ahead and put a knee or play your gamble we will look into something like this in which case 33 percent that you win 16 dollars.

So, you will now look at the higher amount of money, right. So, it is the money value in which so, you put more money on to a higher gamble. And so, the very fact as it appears to be the fact that people should be choosing this in both the cases that is not how it is one use once you own the gamble you would want other people to get attracted by the money value, but the fact that the higher money value has a lower probability of winning is the one gamble that you will choose, but when you are playing it you will play that gamble which has higher certainty, but lower gambling money. So, this is how preference reversal happens.

So, one once I am playing I will always look at a gamble which has higher certainty of being played or higher certainty of giving me even if it is giving me lower values, but when I am selling a gamble I will always think of a gamble in which higher value money is there, but the chances of winning it are very less and that is what we need to do and so, in this in this case I will be the particular gamble where I will own. So, while owning I will own this, but while playing I will play this and so, this is called preference reversal.

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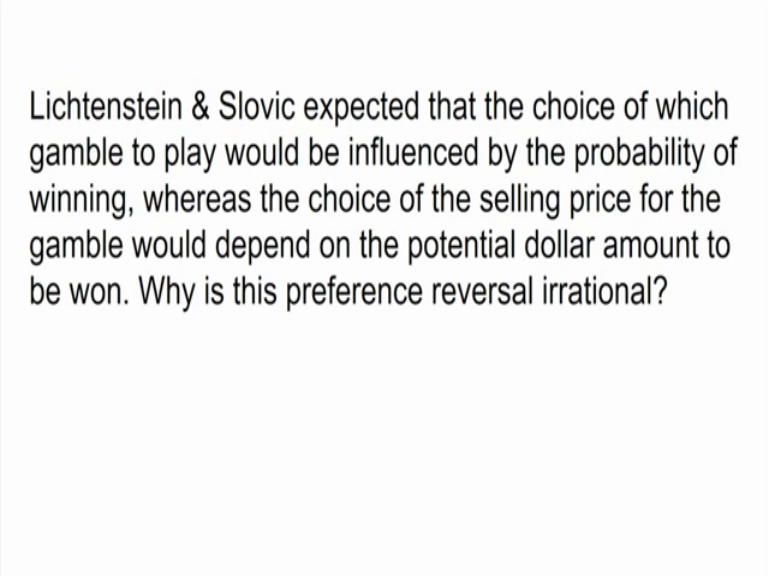

Now, Lichtenstein and Slovic expected the choice of which gamble to play would be influenced by the probability of winning whereas, the choice of selling price for the gamble would depend on the partial dollar amount to be won. So, if you are looking at the amount of dollar that is to be won that is the decision factor in selling a gamble, but when you are playing the gamble it is the probability of winning which decides you how or why you are going to the play a particular gamble.

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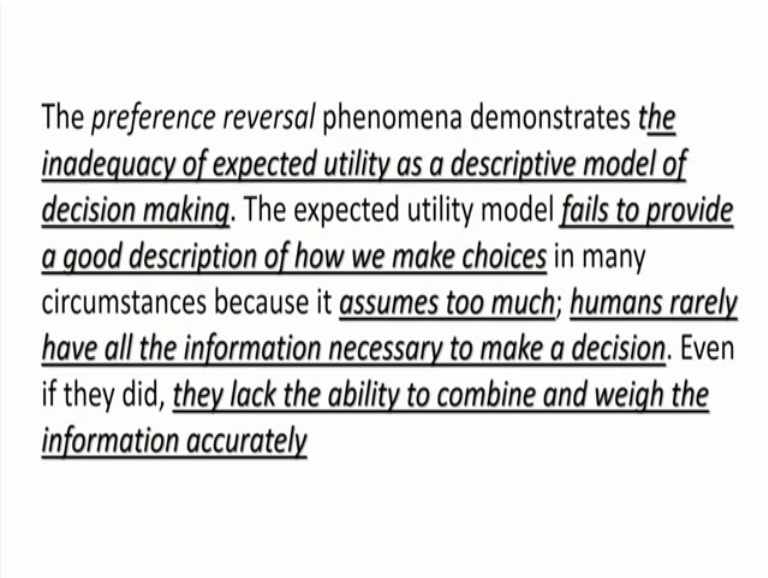

Now, why is this preference reversal irrational? what is the reason for the irrationality. The preference reversal phenomena demonstrates the inadequacy of expected utility as a descriptive model of decision making the utility model fails to provide a good description of how we make choices. The utility model does not reflect how humans actually go ahead and make choices. The utility model is very good in terms of economic factors in terms of prices in terms of other non living entity, but when can when it comes to humans it is very difficult to understand how people make choices. Now, in many circumstances because assumes as much human rarely have them because it assumes as much. Now, the expected utility theorem it understands or it assumes that humans have all the information necessary for making a choice, but it is to be noted that humans do not have all the information which is available or with humans do not have all the information available for making a choice at any point of time.

So, humans rarely have all the available information necessary to make a decision. Even if they did they do not have they lack the ability to combine and weigh all the information accurately and so, this is one of the reason or this is one of the factor in which or this is one of the reason why there is this preference reversal. So, in terms of machines, in terms of economics, in terms of prices the expected utility theorem is the one which fits, but with humans it does not fit in the sense that humans do not first of all have all the information for making the choices. And so, most of the times they are irrational in making the choices or they show irrationality and the other reason is even if they have all the information are possible they are not able to combine all the information to make the right kind of a choice, because this computation this calculation requires a lot of other factors to be there. And so, this is the reason why people do this preference reversal or switch choices.

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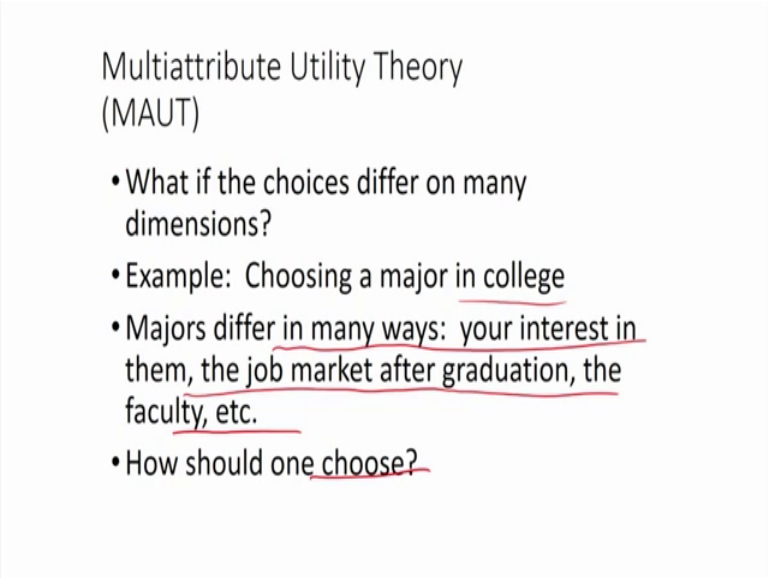

Now, in addition to the expected utility theory there is something called the multi attribute utility theory and what is the multi attribute utility theory? It is an extension of the expected utility theory. Now, what if choices differ on many dimensions? Now, given the fact that in expected utility theory there was just one dimension on which the choice was varying. Now, if the choice is varying on number of dimensions or number of variables we use something called the multi utility theory or a multi attribute utility theory, example; choosing a major in college. Now, if you are choosing a major in college it is not the goal of becoming a doctor that is making you take a medical field there could be several other things for example, how close is the campus from your home how pleasing is the campus in this so, many other variables which let us you decide a particular college or a particular medical college to go to and so, once we are doing that there are multi attributes or multiple dimensions on which the final decision is dependent.

So, major differences in many ways as you are interested in them, your job market after graduation, the faculty etcetera and so, number of variables will actually go ahead and decide not just one goal of becoming a doctor.

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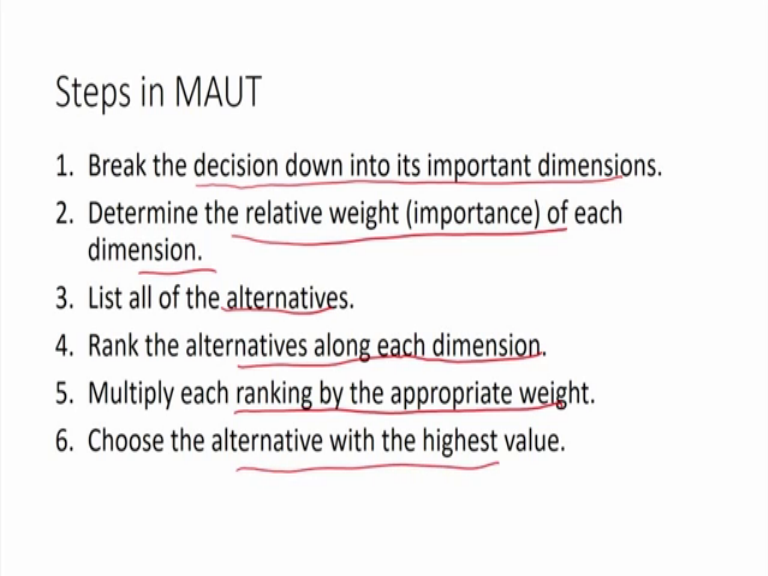

Then, how should one make the choice? First of all in multi attribute utility theory as against the expected utility theory where there is one choice and one utility there if there are multiple utilities and multiple probabilities based in people need to first make decision down into it is important dimension. We have to understand those dimensions which are important to us and those dimensions which are not important has to be thrown out or given lower weightages.

Determine the relative weights importance of each dimension. Each dimension which is there for example, one other dimension that people for example, for me another dimensions are choosing college was how near it is to my hometown and that was one of the highest and I gave it the highest weight and so, other things got lower weight. Weight is basically how much preferable that dimension or that particular attribute is to me and so, we give the kind of a weights. Then we have to list all the alternatives of which are available with their weights. Run the rank the alternatives around each dimension and then multiply each ranking by the appropriate weight which leads us to choosing the alternative with the highest value.

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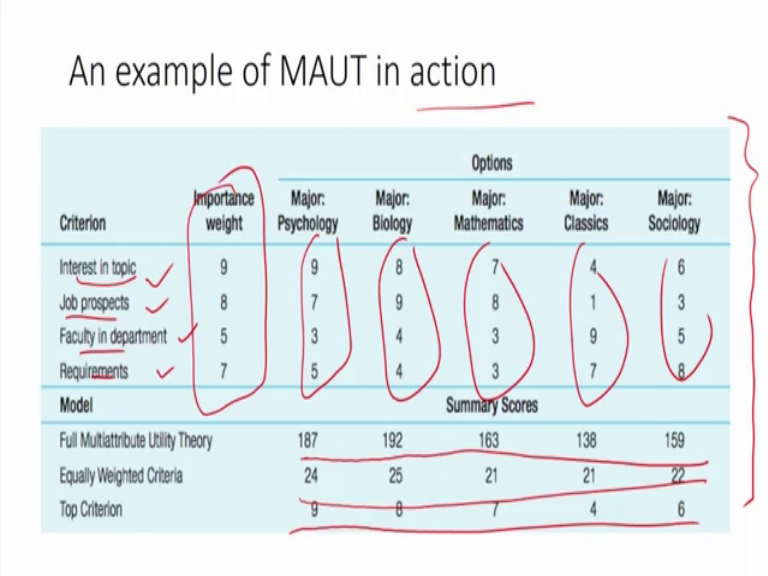

For example look into this suppose this is a particular scenario which I have created. So, then the criteria on which you want to select a school is interesting topic job prospects faculty in department and requirements. This is the important weights that you give to it and these are the majors that you would like to choose. And so, once you look into this the each one of it has multiplied by the weight will give you a final summary score. This is the multi attribute theory, this is the equal weighted criteria, and this is the top criterion. Based on that you will then finally be able to decide which college you would like to go and which college you would like to avoid. And so, this is the multi attribute theory which is again a normative model of decision making.

Thank you.