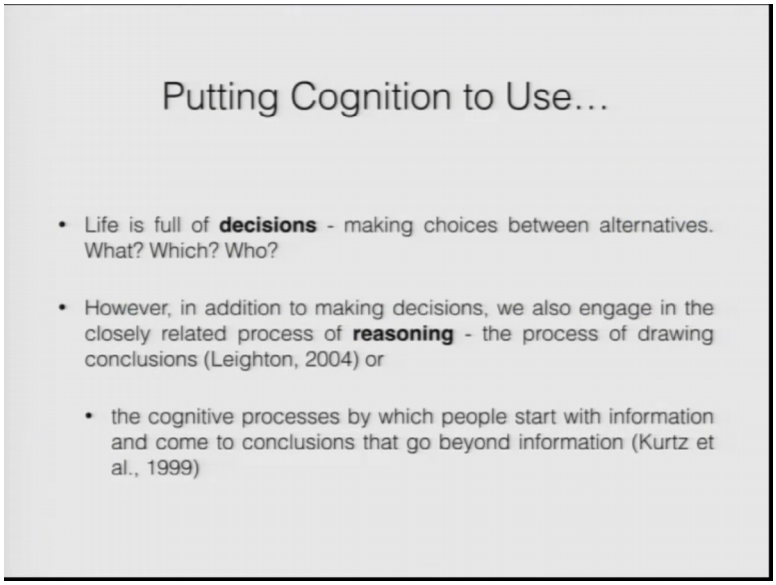
Advanced Cognitive Processes
Prof. Ark Verma
Department of Humanities and Social Sciences
Indian Institute of Technology, Kanpur

Lecture – 23
Reasoning & Decision Making

Hello and welcome to the course introduction to advanced cognitive processes, I am Ark Verma from IIT Kanpur. In the past 2 weeks a little bit over than 2 weeks we had talked about language. We had talked about various aspects of language, language comprehension production, language acquisition, reading aphasias dyslexias and so on and so forth.

Before that we talked about knowledge, we talked about concepts and so, and stuff. Tis time now to move on to the third cognitive function that we will cover in this course. Now I will talk in this week and in the next 2 lectures, 3 lectures about 2 very important cognitive functions that basically form a significant portion of why and this course is referred to as higher cognitive processes. I am going to talk about reasoning and I am going to talk about decision making across the next 2 or 3 lectures.

(Refer Slide Time: 01:11)



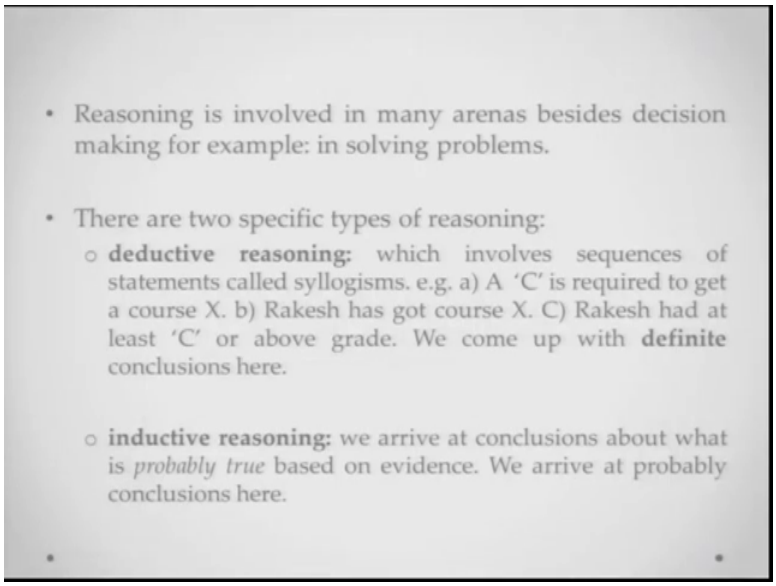
Now, life if you see it is really full of making decisions. Now I am not really going to talk about perception, attention and memory now, those are basic cognitive processes those are things that you need to deal with the world let us move a little bit towards the

realm of thought and realm of thinking and deciding stuff. So, this whole point of life being full of decisions you have sometimes simple decisions to make like you know which flavor of the ice cream you want for your dinner or harder decisions to make that you know, which person to marry or what kind of job to get in and those kind of things.

Now, in addition to ah. So, this is basically a very important aspect of life you know, making decisions is something very important that we tend to do. How do we come up with these decisions? You know a lot of times our decisions are preceded by some sort of thinking some sort of reasoning, we will talk about reasoning also in this course, but what is reasoning? Reasoning is basically the process of drawing conclusions you know. So, you draw conclusions from sometimes from whatever is there in front of you whatever evidence is there in front of you, whatever your past knowledge is, whatever the current scenario is telling you and you kind of process those kind of those things and you come up you do you know a churning if you do a reasoning.

And on the basis of that reasoning you kind of you know can make decisions. So, in this week basically or in the next 2 or 3 lectures basically we will talk about aspects of decision making and we will talk about aspects of reasoning. And we will try and see that how are these processes accomplished by you know us the cognate by which people start with a particular kind of information and they come to a certain kind of conclusions is referred to as reason. So, if I were to define reasoning is basically when you take up some given information and you arrive at a particular conclusion. Whatever you know technique or whatever strategy you use at arriving that conclusion is basically what reasoning is about.

(Refer Slide Time: 03:07)



So, we will talk about reasoning today a little bit. Now reasoning is; obviously, it is involved in so, many arenas of life and also sometimes that even when you do not really have to make a decision you know even when you do not have to come up with a particular choice, you are still performing some kind of reasoning on or the other you know reasoning is a very important aspect of your thought processes.

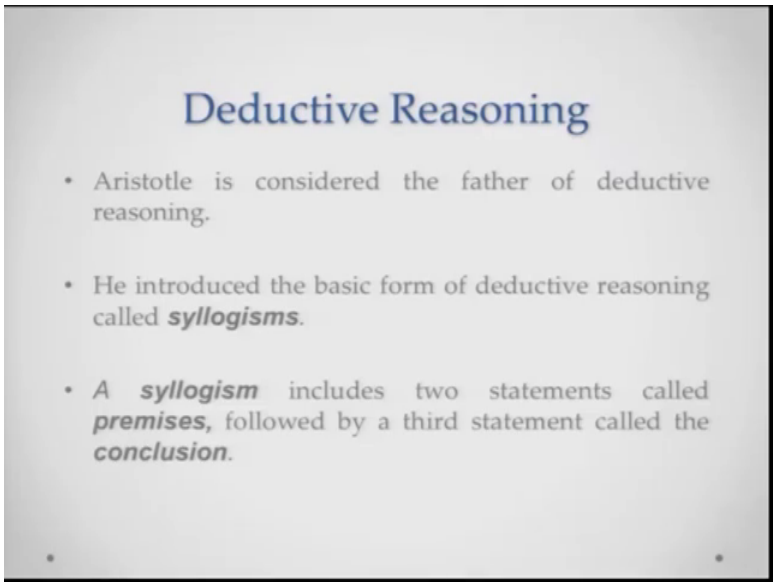
So, there are 2 kinds of reasoning that you might be engaged in at different points in time the first one is referred to as deductive reasoning. What happens in deductive reasoning is, that it involves a sequence of statements let us say let us called syllogism for jargon sake yes you have certain kinds of statements, and basically you compare those statements and then you come to a third part which is a conclusion.

So, the 2 statements could be suppose for example, I tell you that you know a c is needed, a c is absolutely necessary to get a course x and then you come across a person that you know Rakesh has got the course x. So, it definitely you know it is automatically you will conclude that Rakesh must have got either a c or some above grade that is why he is got the course x. So, you know automatically almost involuntary you will come up with this kind of reasoning. This is what definite and deductive reasoning is about and the conclusions you come up generally are definitive conclusions.

On the other hand sometimes you could basically be pitched with scenarios where you do not really have a definitive conclusion to make. Sometimes you could arrive and you

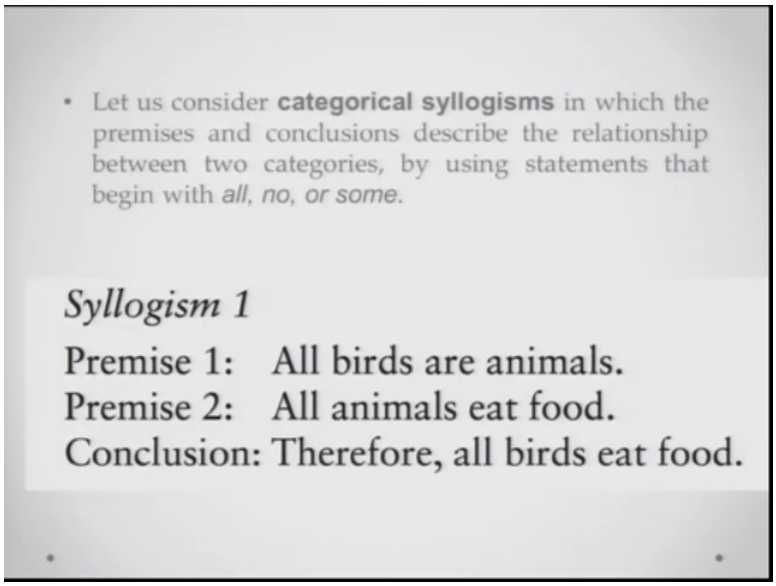
try to arrive at conclusions based on probably true evidence you know something you heard something you not 100 percent sure, but on the basis of whatever you know you start making a conclusion and again because the nature of evidence is not definite the nature of the conclusion is also probable. So, this kind of reasoning is referred to as inductive reasoning and it is it is a bit more free it is a bit more flexible and obviously, but it is its not definite.

(Refer Slide Time: 05:01)



So, we will talk about how these 2 reasonings work. Let us talk a little bit about deductive reasoning first. Aristotle introduced the basic forms of an introductory reasoning called syllogisms. Syllogisms are statements, syllogism basically includes at least 2 statements which I refer to as premises and followed by a third setting which is called a conclusion. So, there are 2 premises and there is one conclusion.

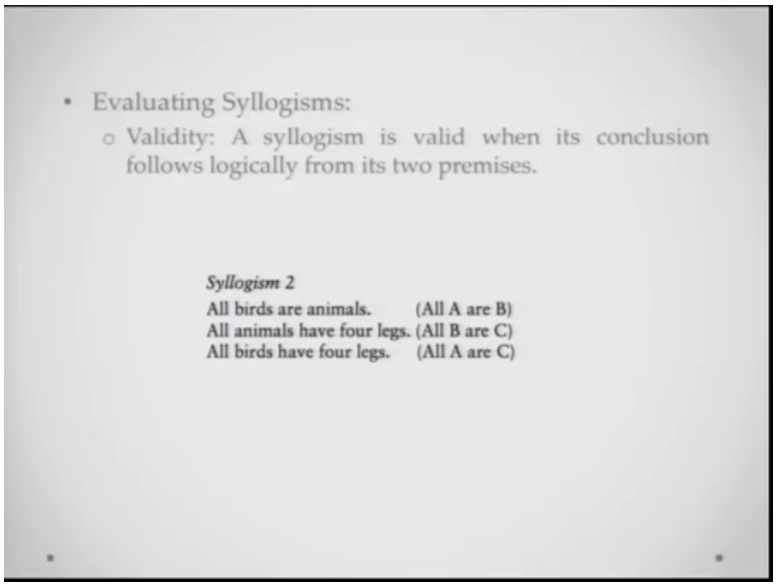
(Refer Slide Time: 05:21)



So, let us consider a categorical syllogism. A categorical syllogism is basically in which the premises and conclusions describe the relationship between 2 kinds of categories and these categorical syllogisms basically include words like all none or same something idea.

So, the first syllogism is again borrowing from Goldstein's book, the premises all birds are animals all animals eat food is the second premise. So, on the basis of these 2 premises you come up with a conclusion that therefore, all words eat food this is a categorical syllogism.

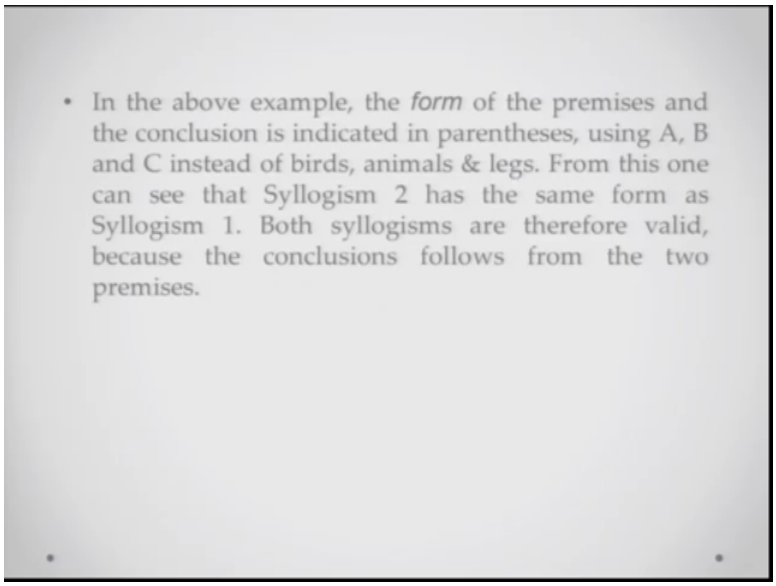
(Refer Slide Time: 05:55)



Now, categorical syllogisms might or might not always be correct. In the sense if you have to evaluate how good or bad a syllogism is you might want to look at its validity what is validity? A syllogism is valid where its conclusion is following logically from the 2 premises ok.

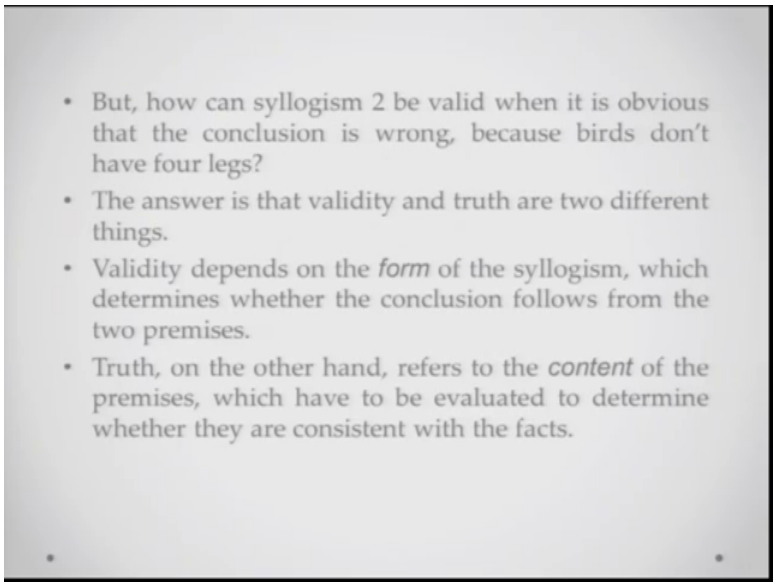
So, when it is fitting the logical operation, I will give you an example the example is all birds are animals all animals have four legs is the second one, and then the conclusion is all birds have four legs. Now if you look at this syllogism here the third statement the conclusion follows logically from the first 2. So, the conclusion is following logically from the 2 premises; however, just will read it once again all birds are animals or animals have four legs all birds have four legs. Now you know for a fact that all birds do not have four legs.

(Refer Slide Time: 06:54)



So, now how is this possible? It is possible because the idea is that even though the form of the 2 premises is correct and basically if you see the conclusion follows the 2 premi the form of the 2 premises almost completely.

(Refer Slide Time: 07:11)

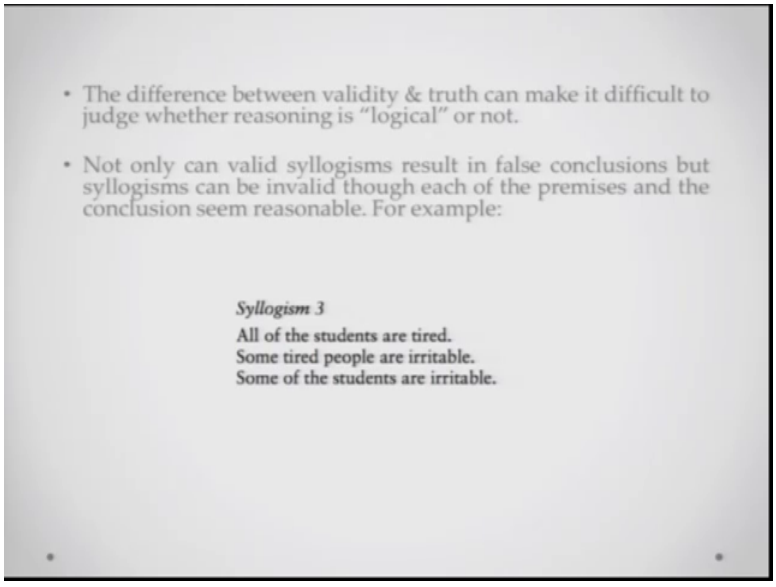


The whole point is that even though the conclusion is valid and is logically following from the premises, truth is a different thing truth is not only whether the syllogism is valid or not. When validity in that sense depends upon the form of the syllogism and which determines whether the conclusion follows logically from the 2 premises;

however, truth on the other hand refers to the content of this premises. So, it will also take into account what is the content actually saying, which have to be also evaluated to determine whether they are consistent with facts.

So, logically there are third sitting follows from the 2 you C all A are B all B are you know by law of association all are C this is all very good, but if you look at the content you would know that; obviously, all are C is not correct in this case. So, you have to evaluate the content of the syllogism at hand.

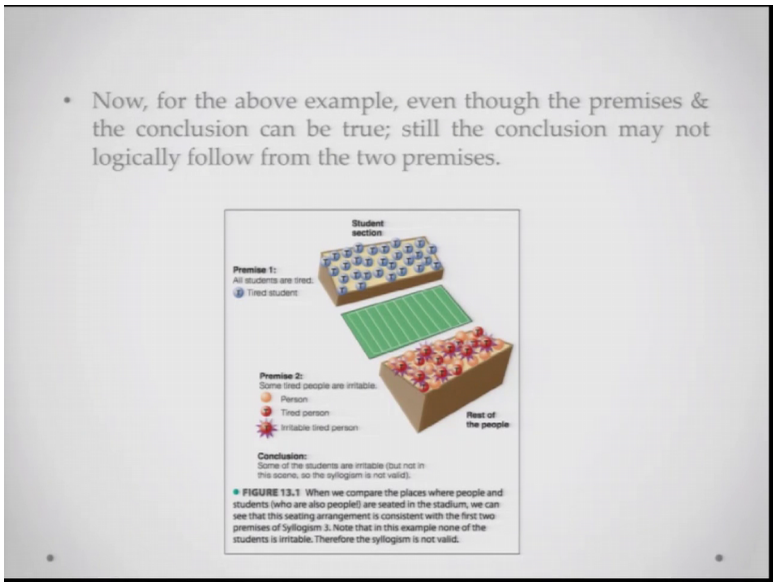
(Refer Slide Time: 08:01)



So, one of the things we know now that there is a difference between validity and different and truth. So, the difference between validity and truth sometimes; however, can make it difficult to judge whether the reasoning that somebody is applied is logical or not. Not only can valid syllogisms leads to false conclusions, but also syllogisms can be invalid though each of the premises and the conclusion still seem reasonable.

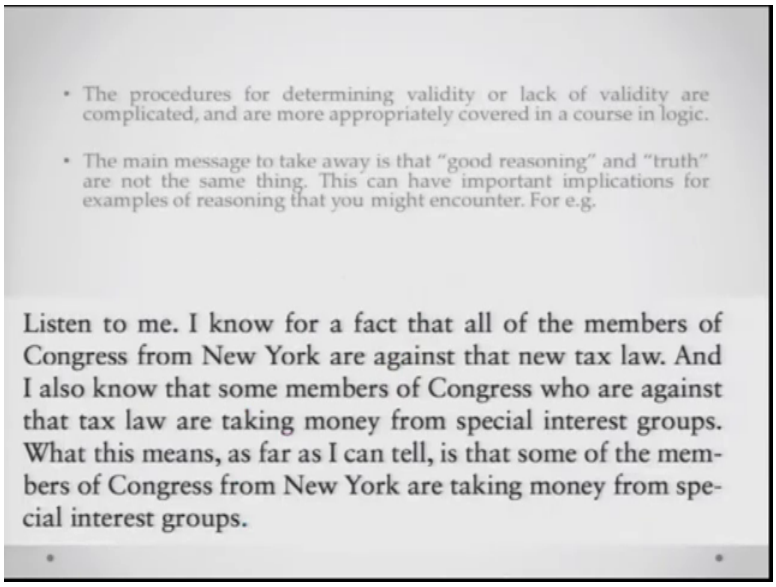
For example all students are tired some tired people are irritable, some of the students are irritable now you do not really I mean logically it is I mean you can actually because it is not an all or none kind of statement, you can probably correctly derive some of the students are irritable from the above 2 premises.

(Refer Slide Time: 08:47)



But again it is it is not really its not really correct in some sense. Because even though the premises and the conclusions are true still the conclusion is not really logically following from the 2 premises.

(Refer Slide Time: 08:57)



So, there has to be some procedure for determining the validity or lack of validity and this procedure is slightly more difficult, I probably not really get into it because this is better handled by a philosophic class and in a course on logic. But I will just give you the main message in the main message is that, good reasoning and truth are not really the

same thing. You know sometimes with good reasoning very rationally you can come up with you know something, but it that thing might not be that conclusion might not be the true conclusion. So, these 2 things a lot of times I think people can you know confuse good reasoning with truth, but truth in good reasoning are slightly different things.

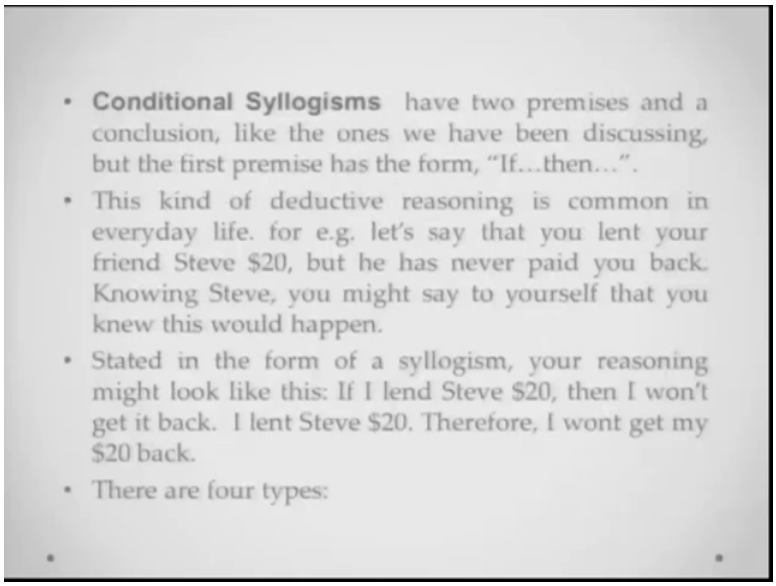
Let us let us show this from this example. Now I am just putting a real world example here again borrowed from goldsteins book listen to me I know for a fact that all members of the congress from new york are against the new tax law, I also know for a fact that some members of the congress who are against the tax new tax law are taking money from special interest groups.

So, what this means as far as I can tell is that, some of the members of the congress from New York are taking money from special interest groups. Now just examine this a little bit more closely this earlier argument that I was just giving is very similar to this third syllogism that we were talking about. And as with the third syllogism it does not really logically follow that because all members from New York are against the new tax law and some members of the congress are taking money from that are against the new tax or taking money from special interest groups.

You cannot still conclude that some members of the congress of New York are taking money from the special interest groups. It just does not really follow because those some in the second and third statements might not really you know overlap with each other.

So, even though the syllogisms may sometimes seem academic and people often you will find people often using syllogisms to prove their point, they sometimes do not realize and you know people do not realize that this reasoning might be invalid ok. You can actually see it a lot in the way newspapers operate a lot of you know media operates and a lot of people around us operate and again this should basically help you solve some of those things.

(Refer Slide Time: 11:00)



Let us move to a different kind of syllogisms for a while. So, there are conditional syllogisms conditionals syllogisms have 2 premises and they have a conclusion like the ones we have been discussing, but here the first premise basically begins with the form if and this kind of deductive reasoning is very common in our everyday life. Suppose for example, your friend comes to you Steve comes to you and asks for 20 dollars again I am using an American example here, suppose you have a friend called Steve and it comes to you asking for 20 dollars ah, but you have known Steve for some time now and you know that even if you are if I give him 20 dollars then he is not going to give me back.

So, if I try and put this in a form of a syllogism, I can say if I lent it in a dollar twenty 2 to Steve that I would not get it back I lend Steve dollar 20, I am not getting back my and dollar 20.

(Refer Slide Time: 11:59)

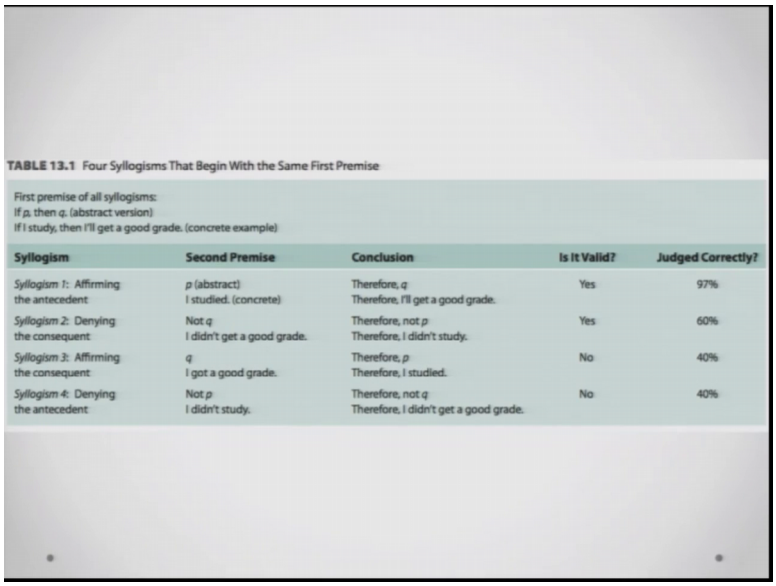


TABLE 13.1 Four Syllogisms That Begin With the Same First Premise

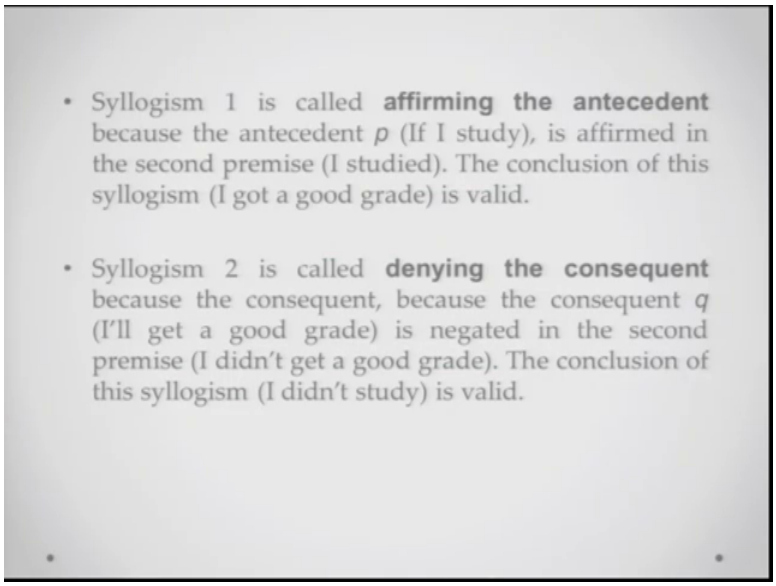
First premise of all syllogisms:
If *p*, then *q*. (abstract version)
If I study, then I'll get a good grade. (concrete example)

Syllogism	Second Premise	Conclusion	Is It Valid?	Judged Correctly?
Syllogism 1: Affirming the antecedent	*p* (abstract) I studied. (concrete)	Therefore, *q* Therefore, I'll get a good grade.	Yes	97%
Syllogism 2: Denying the consequent	Not *q* I didn't get a good grade.	Therefore, not *p* Therefore, I didn't study.	Yes	60%
Syllogism 3: Affirming the consequent	*q* I got a good grade.	Therefore, *p* Therefore, I studied.	No	40%
Syllogism 4: Denying the antecedent	Not *p* I didn't study.	Therefore, not *q* Therefore, I didn't get a good grade.	No	40%

So, this is the conditional syllogism a conditional syllogisms are of four types and I am just talking about them right now. So, affirming the aunts antecedent, suppose I studied therefore, I get a good grade. So, my getting a good grade affirms the fact that I studied then there is denying the consequent, I did not get a good grade therefore, I did not study. So, basically the idea is that I did not get a good grade it is kind of denying the fact that I did not study. Then there is affirming the consequent I got a good grade therefore, I must have studied this is again something.

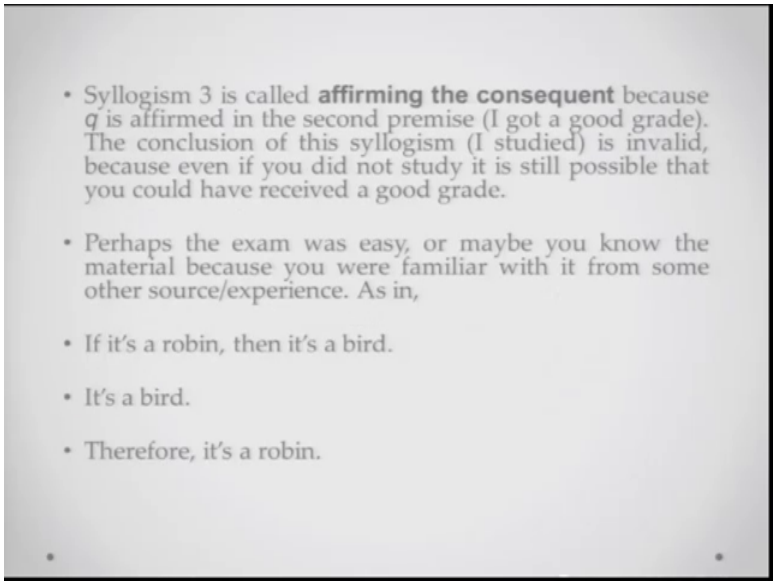
Then there is denying the antecedent I did not study therefore, I did not get a good grade. So, it is kind of basically denying the first part. Now you can see here that there is this validity judgments here and only the top 2 were judged as valid the bottom 2 words are judged invalid and 97 percent of people could the first syllogism, 60 percent people could judge the second solution, but a lot of people if only 40 percent of people could judge the third and the four syllogisms correctly.

(Refer Slide Time: 13:05)



Now, what is happening here syllogism one is called affirming the antecedent because antecedent p if I study is affirmed in the second premise that I studied. That I get a good grade the conclusion is therefore, valid syllogism 2 is called denying the consequent because consequent q, I will get a good grade is negated in the second device I did not get a good grade. The conclusion of this syllogism is again valid because I did not study because I did not get a good I must not have studied.

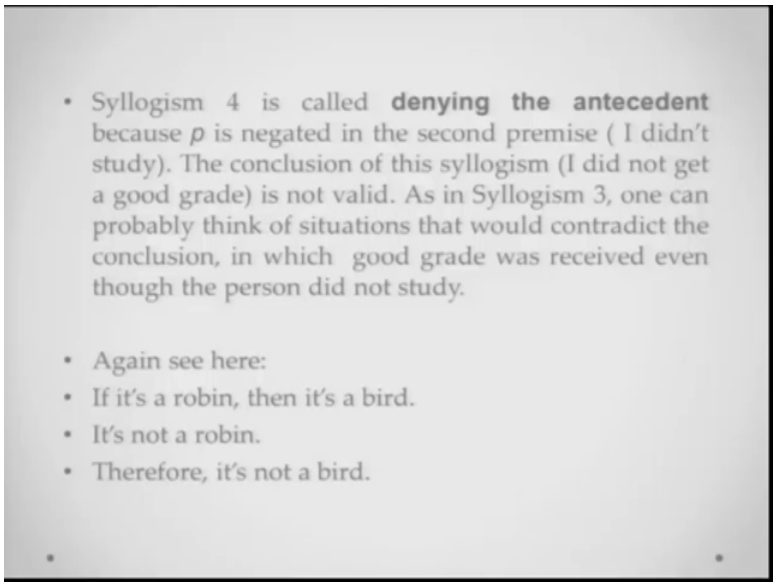
(Refer Slide Time: 13:33)



Syllogism 3 is called affirming the consequent. So, what is happening here is because q that is the consequent. So, the form is if p then q the consequent q is affirmed in the second premise. So, I got a good grade.

Now, the conclusion of the syllogism, I studied is invalid because even if you did not study it is still possible that you might have got a good grade. So, again this is this one is therefore, not valid now perhaps the exam was easier maybe you know the material because you are familiar with it you had practiced something, you might not have studied it still got a good thing you know it is its like for example, if it is a robin, then it is a bird it is a bird therefore, it is a robin is not correct. Because if it is a bird it could be some other bird as well, but if it is a robin certainly it must be a bird you know this is the kind of comparison you got to make.

(Refer Slide Time: 14:19)

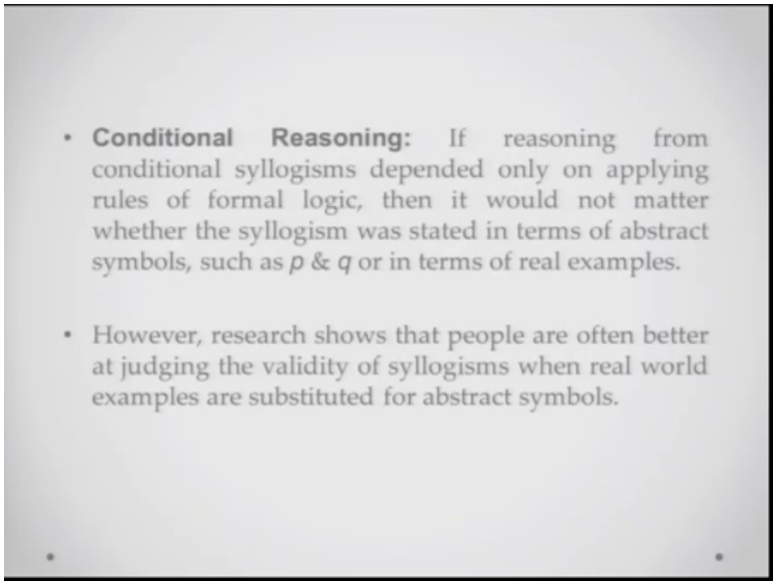


Talking about syllogism four; syllogism four is called denying the antecedent. So, it has to negate p because n p has to be negated in the second premise. So, the conclusion of the syllogism I did not get a good grade is also not valid because as in syllogism 3 the last one; one can probably think of a situation that would contradict the conclusion you know you study very hard, but you still did not get a good grade or a good grade was got even by a person who did not really study so much.

So, again I give you a simpler example, if it is a robin then it is a bird it is not a robin therefore, it is not a bird you know, it could be some other bird and not a robin. So, it is

there because it is not a robin therefore, it is not a bird does not really follow. So, this is this is again how the conditional syllogisms works.

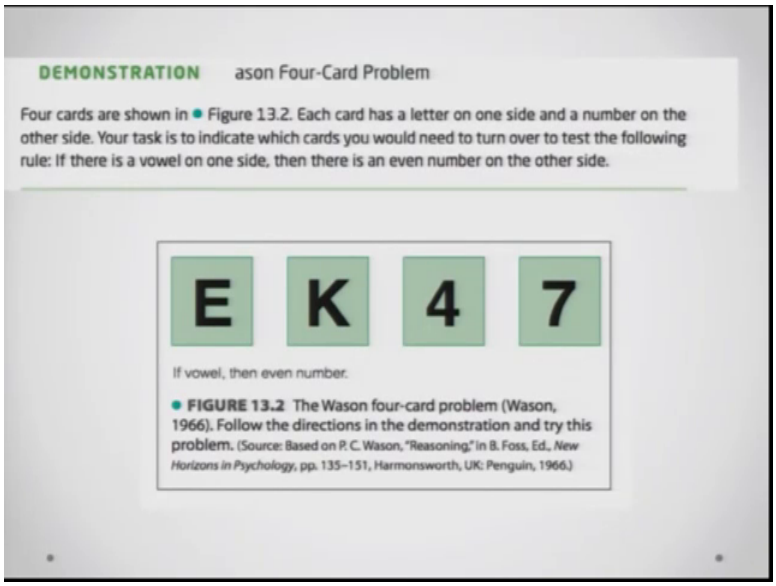
(Refer Slide Time: 15:01)



So, because we were talking about conditional syllogisms it only fits that we start talking a little bit about conditional reasoning what is conditional reasoning? Now if reasoning from conditional syllogisms dependent only upon applying the rules of formal logic the ones which we were talking about, does the conclusion follow from the premise that kind of thing. Then it would not really matter whether the syllogism was stated in terms of abstract symbols such as p and q or in terms of real examples.

So, I could always say if p then q and if q would not be is something like that it did not matter that I am talking about if it is a robin, then it is a bird or if it is not a bird and it is not robin those kind of things, it does not it would not really matter if it were just following logical notations. So, research shows that people are often better at judging the validity of syllogisms, when real-world examples are used as opposed to when p and q and these kind of if p then q kind of statements are used.

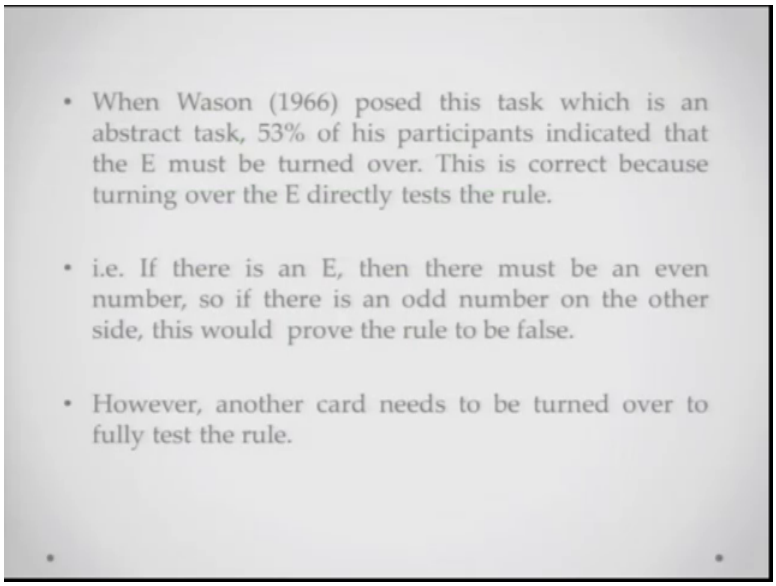
(Refer Slide Time: 16:01)



Let us take an example. So, there is this very famous Wasons card sorting task. So, what happened was each card has a letter on one side and a number on the other, and the task is to indicate which cards you would need to turn over to test the following rule. And the rule is if there is a vowel on one side then there is an even number on the other side. Now the idea is you have to really check that if there is a you have to really check which is the card that you will turn over to check this rule consistently.

So, there these things are E K 4 and 7 what do you really need to check ok. So, I think here there are at least 2 things that you can check you can either check E because it is a vowel, if there is no even number on the other side there will be a problem or you could just check for that because if it is four here and there should be an even number less.

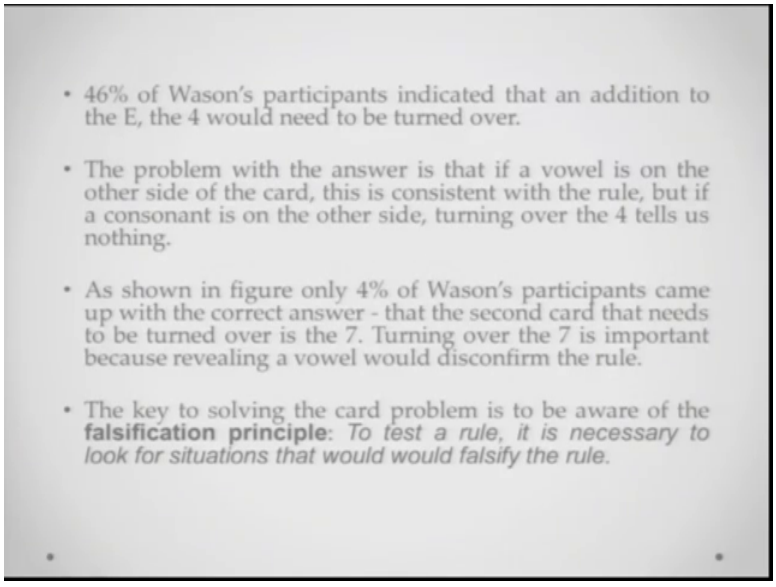
(Refer Slide Time: 16:50)



Let us let us check what happens. When Wason 1966 posed this task to people 53 percent of his participants indicated that he must be turned over this is correct because turning e over we directly test the rule.

So, if there is not an even over the other side the rule is you know falsified and the rule is broken. So, if there is an e then there must be an even number. So, there is an odd number if there is an odd number on the other side kind of does not know; however, another card also needs to be turned over to fully test the rule.

(Refer Slide Time: 17:21)



Which one 4 46 percent of the participants suggested that four would also need to be turn over. Now the problem here is that if a vowel is on the other side of the card this is consistent with the rule, but if a constant is on the other side, turning four will not be able to tell us anything.

So, it is kind of trying to lead you astray here. If you turn four and if there is a constant on the other side the rule does not really tell you whether that there is no consonant on the even number. It just tells you if there is a e if there is an vowel, then the other side should be even numbered. So, as shown in the figure only 4 percent of Wasons participants came up with the correct answer, that this second card that needs to be turned over is s7. Turning over 7 is important because revealing a vowel would disconfirm the rule when to turn 7, if you see a vowel there then the rule is broken and the rule is test.

So, what we are actually looking for here is the falsification principle what we are trying to do is we have to find one instance at least that falsifies the rule. So, if you want to test a particular rule, it is necessary to look for situations that would falsify the rule rather than confirm the rule or tell us nothing about the rule.

(Refer Slide Time: 18:38)

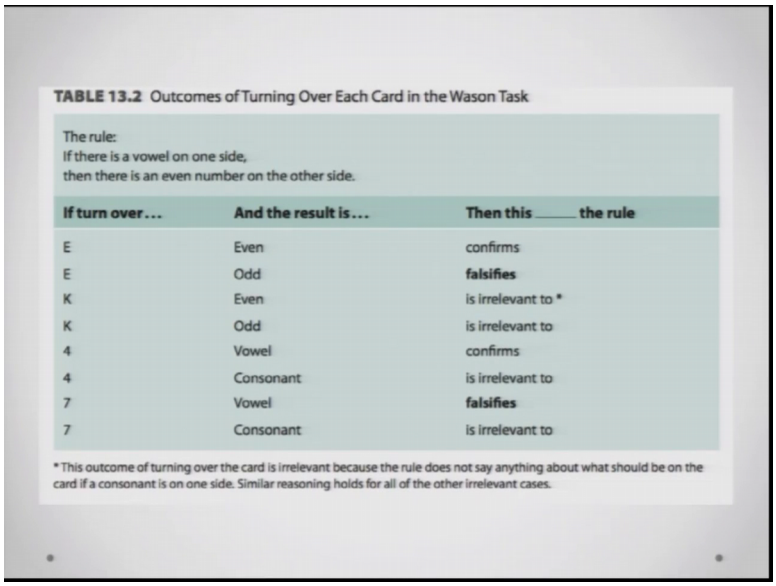


TABLE 13.2 Outcomes of Turning Over Each Card in the Wason Task

The rule:
If there is a vowel on one side,
then there is an even number on the other side.

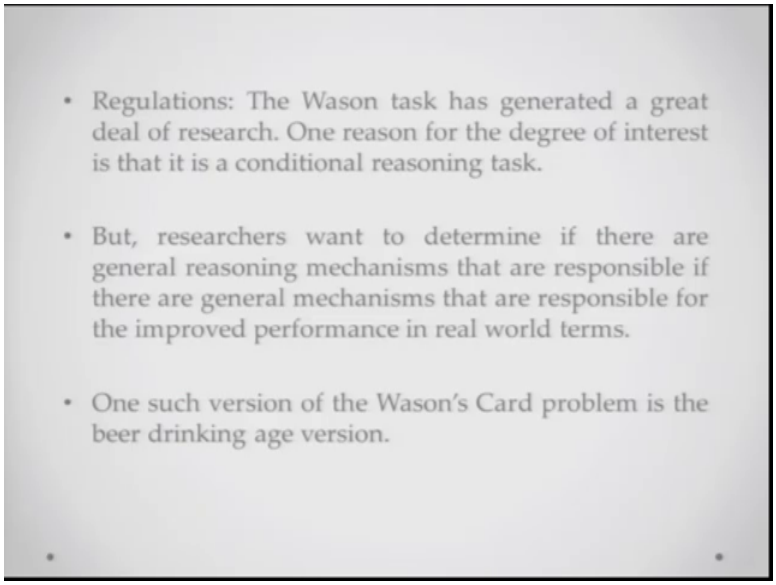
If turn over...	And the result is...	Then this ..... the rule
E	Even	confirms
E	Odd	**falsifies**
K	Even	is irrelevant to *
K	Odd	is irrelevant to
4	Vowel	confirms
4	Consonant	is irrelevant to
7	Vowel	**falsifies**
7	Consonant	is irrelevant to

* This outcome of turning over the card is irrelevant because the rule does not say anything about what should be on the card if a consonant is on one side. Similar reasoning holds for all of the other irrelevant cases.

Here is the different kind of scenarios that are there, again borrowed from goldsteins book and they say there are only 2 conditions that will test whether the rule is getting

falsified. If you turn over E and find odd or if you turn 7 and find a vowel. So, this is one of the ways how conditionally reasoning would work.

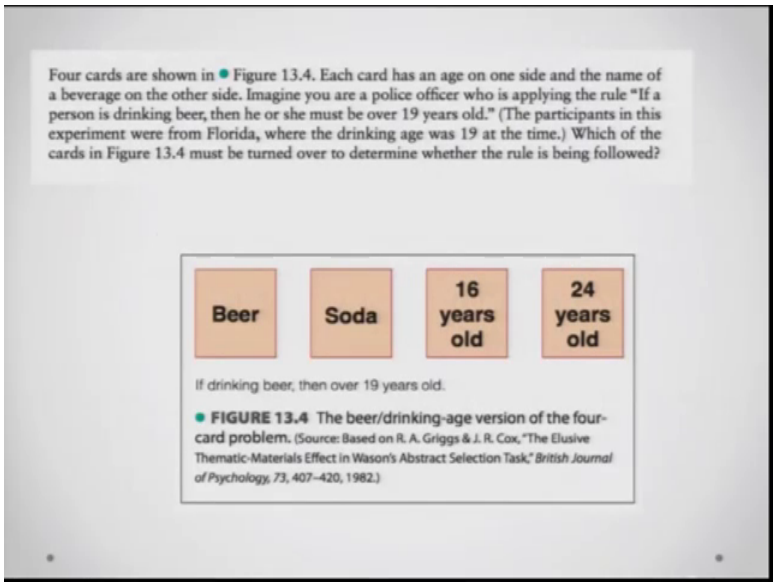
(Refer Slide Time: 18:58)



Moving on you saw that people are in some sense following these rule kind of things. So, if you talk about regulations. So, the Wason task basically had generated a great deal of research and you know one reason for the degree of interest is that, it is a conditional reasoning task and people who are interested in knowing about different aspects of conditional reasoning.

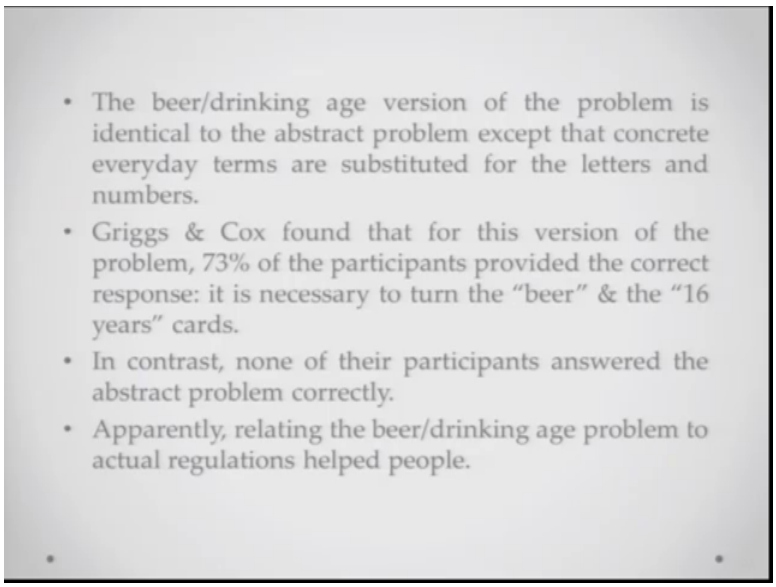
So, researchers basically they wanted to determine, if there are general mechanisms that are responsible for improved performance in real world terms. If conditional reasoning works better with real examples one such versions of the Wasons card problem is the beer drinking age version.

(Refer Slide Time: 19:36)



So, I will show you the problem now. So, the idea is the rule is if drinking beer you must be over 19 years old now there are 2 age cards and 2 drinkers. So, there is a beer card, as a soda card, there is a 16 year old card and a 24 year old card. Now you have to check which is the easier thing. You will see that people a lot of people easily detected that beer card must be turned over or the 16 card probably must be turned over.

(Refer Slide Time: 20:06)



Let us see the beer drinking age version of the problem is basically identical to the problem that you know except that concrete everyday terms are substituted for the letters

and numbers. You know the task we were talking ek 47 we have actual things here. Now Griggs and cox use the version of the stars and found a 73 percent of the participants provided the correct response.

It is necessary to turn the beer card and the 16 year cards, both of which check for the falsification of the rule in contrast none of the persons answered the abstract problem correctly you know the same ek 47 problem was given to these people, none of them could actually answer that correctly apparently relating the beer or drinking age problem to actual regulations help people because there is an actual regulation we know which restricts alcohol drinking in these particular countries.

So, probably what they were doing is they were relating this actual regulation with the conditional rule here, and that is why they were able to solve this problem better using the real world example even though they could not solve the abstract example.

(Refer Slide Time: 21:10)

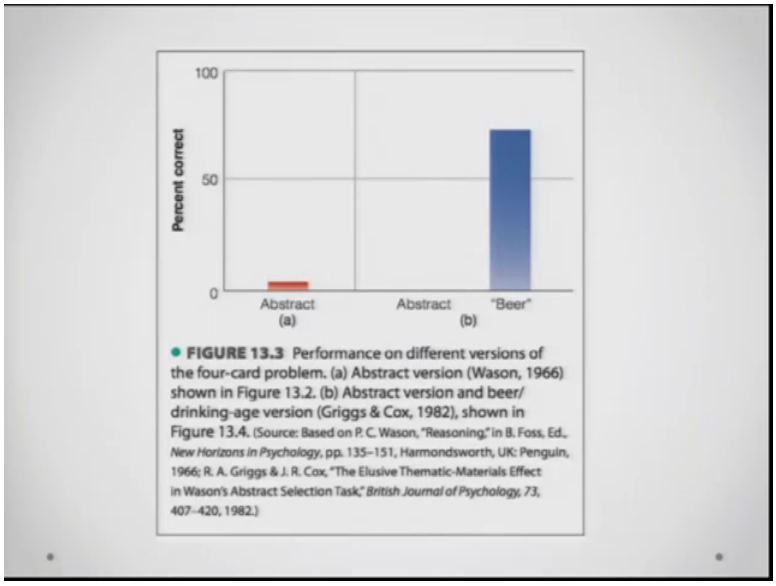
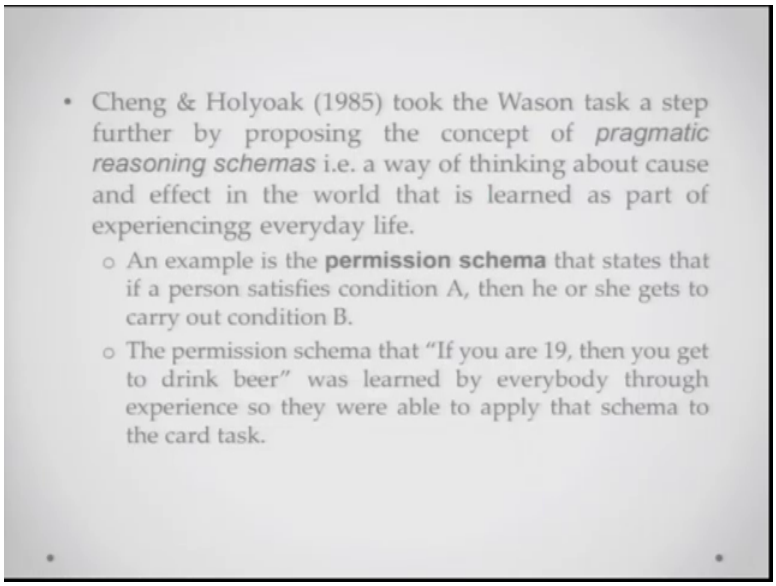


FIGURE 13.3 Performance on different versions of the four-card problem. (a) Abstract version (Wason, 1966) shown in Figure 13.2. (b) Abstract version and beer/drinking-age version (Griggs & Cox, 1982), shown in Figure 13.4. (Source: Based on P. C. Wason, "Reasoning," in B. Foss, Ed., *New Horizons in Psychology*, pp. 135–151, Harmondsworth, UK: Penguin, 1966; R. A. Griggs & J. R. Cox, "The Elusive Thematic-Materials Effect in Wason's Abstract Selection Task," *British Journal of Psychology, 73*, 407–420, 1982.)

So, here is the finding. So, you see none of the people could actually solve the problem with the abstract rules, but a good 73 percent of the people could solve the beer age drinking problem.

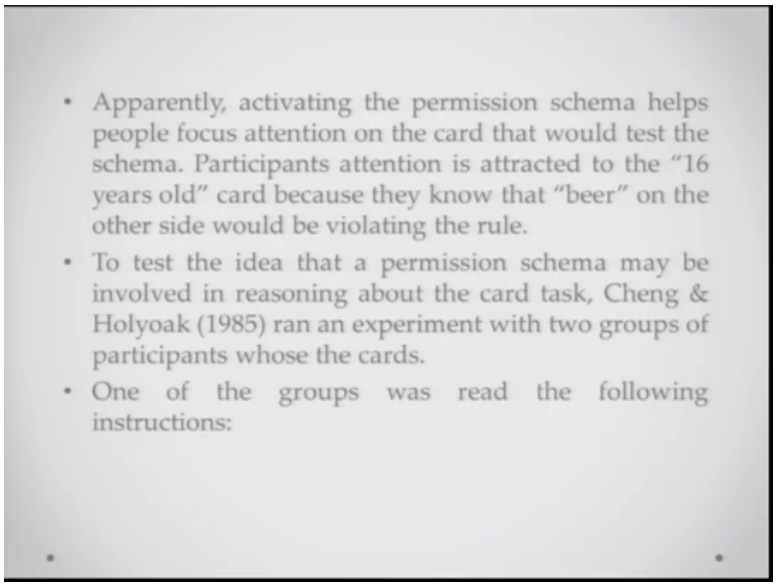
(Refer Slide Time: 21:20)



Now, taking this task slightly further Cheng and Holyoak they took the Wason task a little bit further and they basically proposed the concept of pragmatic reasoning. So, the idea is that the way of thinking about cause and effect in the world is learned as a part of experiencing everyday life. So, you know how you go about your life in the world, how you observe events are around you, how you see that things are happening in the world around you, that is basically going to you know give you an aspect of what is called pragmatic reasoning; what really happens in the world ok. So, your reasoning is not really based on you know hard logic if x then y, it is basically based upon knowledge of whether really y happens if x is then you know.

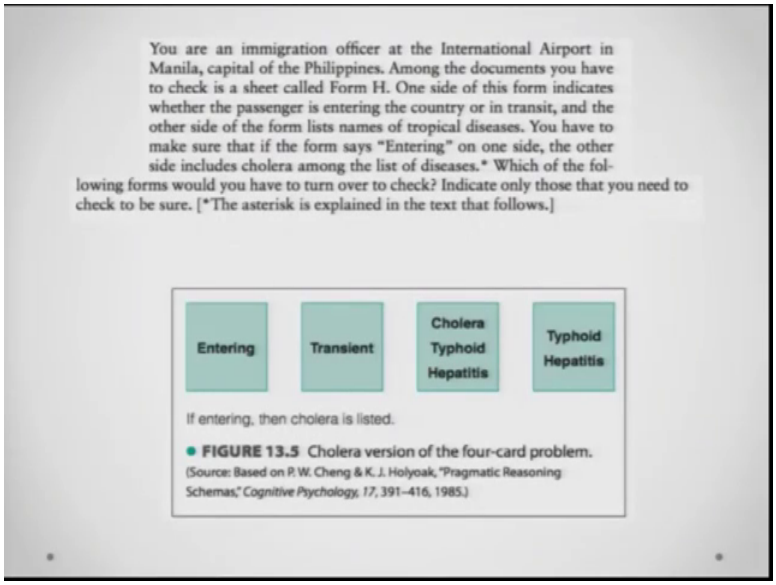
Things about suppose for example, you know there will be a fine if you are not wearing a helmet. Now somebody would know that you know it is also sometimes there that even if you are not wearing an helmet you might get away without giving a fine. So, this is basically the kind of adapted this Wasons card for a sorting problem to a different thing, and they came up with what is called a permission schema. What is the permissions capable camera is a rule that says that, if a person satisfy his condition A then he or she gets to carry out the condition B ok. If aged this much then drinking is allowed something like that. The permission schema that if you were 19, then you get to drink beer was learned by everybody through experience. So, they were able to apply that to the card task and that is that is how here the link is being made.

(Refer Slide Time: 22:51)



Apparently activating the permission schema helps people focus attention on the card that would test the schema. So, they will automatically go to a scenarios that would basically test and falsify this, because you know this is a real world problem. Participants attention is automatically attracted to the 16 years old card, because they know that beer on the other side would be violating the rule. To test this idea that permission schema may be involved in reasoning about the carters, Cheng and Holyoak again ran an experiment with 2 groups of participants. You see what kind of cards they were presented with one of the groups read the following instructions.

(Refer Slide Time: 23:26)

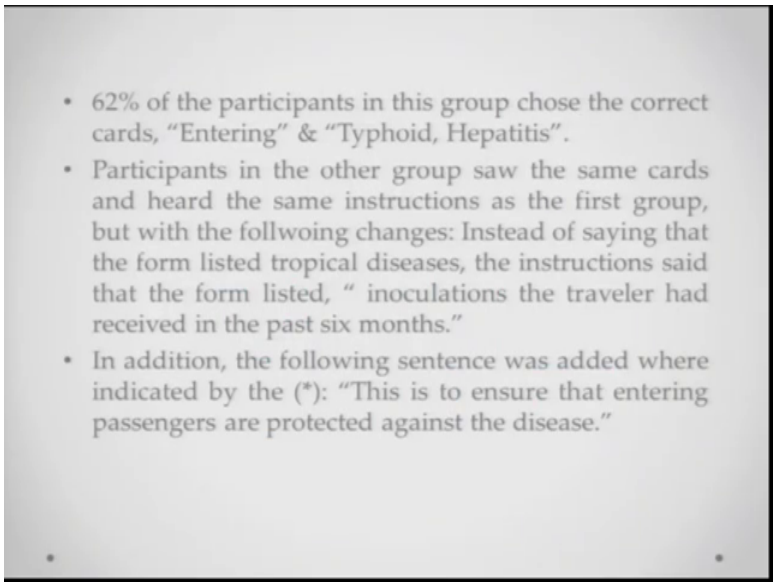


So, the cards are entering transient cholera typhoid hepatitis typhoid and hepatitis. So, 3 diseases 2 diseases in entering or transient, and the rule is if entering then cholera is listed.

So, basically and the instruction is this is the scenario, the instruction is you are an immigration officer at the International Airport in Manila that is the capital of Philippines among the documents you to check is a form called H, one side of this form indicates whether the passenger is entered in the country or is in transit. And the other form lists the names of tropical diseases, you have to make sure that if the form says entering on one side.

The other side includes cholera among the list of diseases, which of the following forms would you have to turn over to check. Now again these are card these are cards or forms and you would turn over to check whether somebody is entering or is in transit. It is very easy here because this is a pragmatic task to this check, either the entering card or the cholera typhoid hyper hepatitis card.

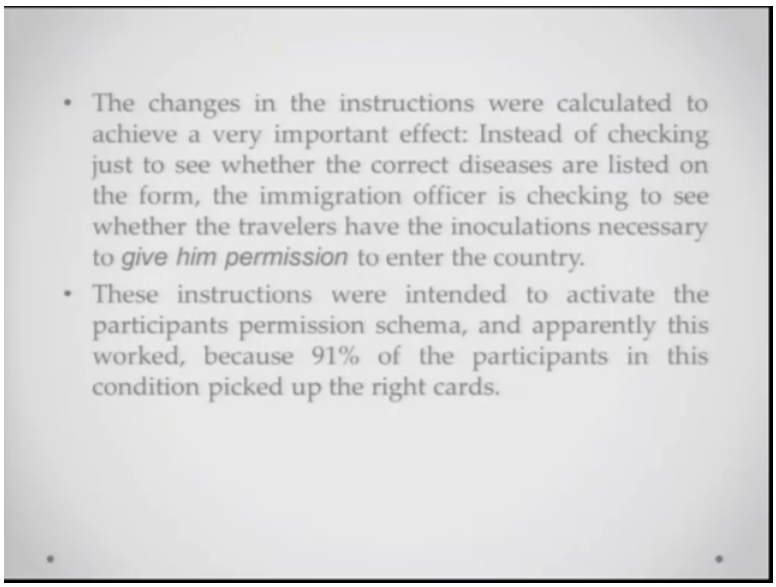
(Refer Slide Time: 24:28)



62 percent of these participants in this group chose the correct cards. Entering and typhoid hepatitis entering other side cholera must have been listed typhoid hepatitis then entering should not be there.

Participants in the other group saw the same cards there is another group and heard the same instructions as the first group, but with the following changes. So, there was some more instructions putting. Instead of saying that the form listed tropical diseases the instructions said the form listed inoculation that the travel had received in the past 6 months. So, some kind of vaccinations must have been received in addition the following sentence were added, this is to ensure that entering passengers are protected against the disease. So, this is again some more information is added.

(Refer Slide Time: 25:10)



The changes in these instructions were calculated to achieve a very important effect what was that? Instead of checking just to see whether the correct diseases are listed on the form, the immigration officer is now checking to see whether the pyre whether the travelers have the inoculations necessary to give him permission to enter the country. These instructions were intended to activate the participants permission schema and to apparently and you know apparently, it was found that this works because 91 percent of the participants as opposed to 62 percent earlier, participated in this condition and they picked up the right cards.

So, you see how invoking the real world example, how invoking the pragmatic reasoning or the permission schema a concept is helping people to do reasoning much more easily as compared to the abstract reasoning things.

(Refer Slide Time: 25:59)

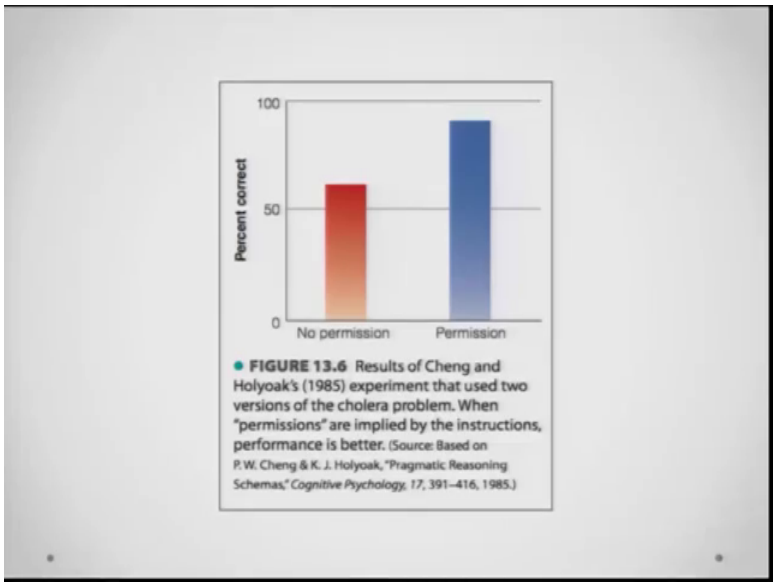
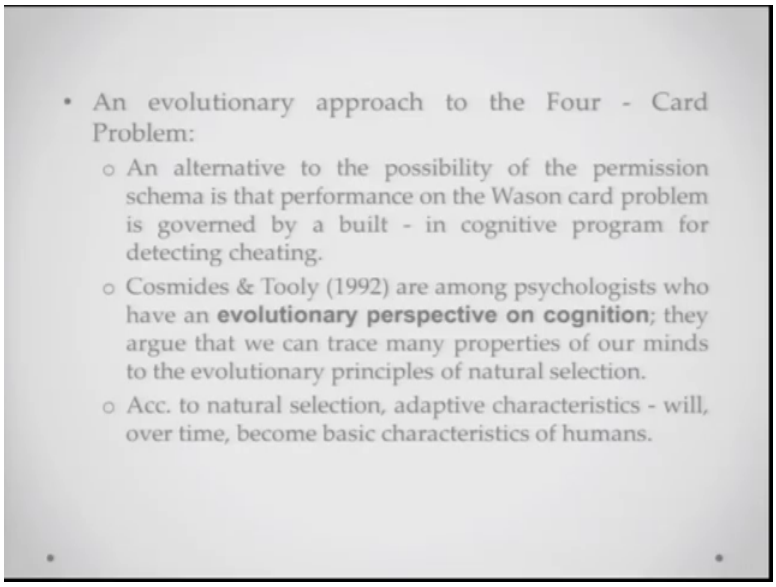


FIGURE 13.6 Results of Cheng and Holyoak's (1985) experiment that used two versions of the cholera problem. When "permissions" are implied by the instructions, performance is better. (Source: Based on P. W. Cheng & K. J. Holyoak, "Pragmatic Reasoning Schemas," *Cognitive Psychology, 17*, 391–416, 1985.)

So, this is the results of the Cheng and Holyoaks in 1995 experiment.

(Refer Slide Time: 26:04)

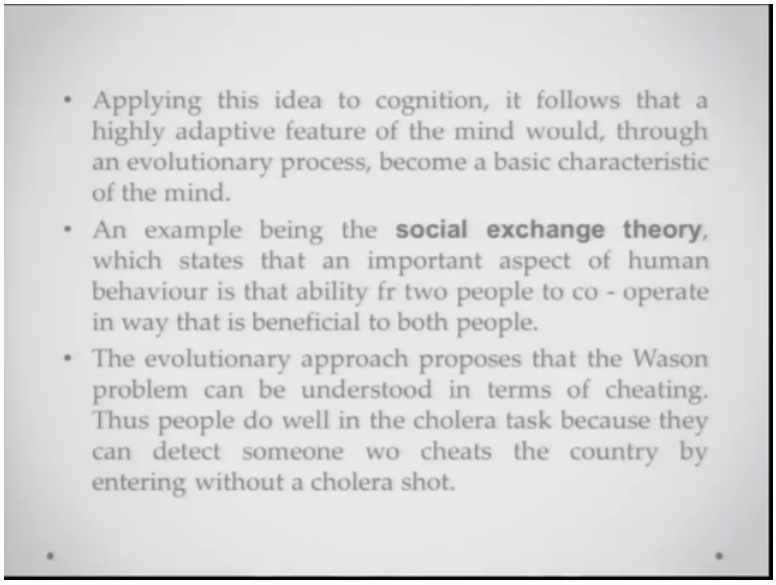


Now, people have also thought about an evolutionary approach towards solving this four card problem. The alternative to the earlier a possibility that, we are talking about is the fact that performance on the Wason card sorting problem is governed by what is called a built in cognitive program that kind of detects cheating. You know that kind of detects every time you are going to violate a particular rule. So, Cosmides and Tooly there are 2 one of the 2 evolutionary psychologists who have an evolutionary perspective on

cognition, they basically argue that we can trace many of the properties of our minds back to the evolutionary principles of natural selection you know, only those things would have survived only those things would have stayed on with us across centuries that would have helped us to survive and propagate and come to the next generation.

So, according to natural selection adaptive characteristics like will overtime you know adaptive characteristics will, over time become basic characteristics of humans. Because these things have survived generations and generations, these things will become almost embedded in our psyches.

(Refer Slide Time: 27:08)

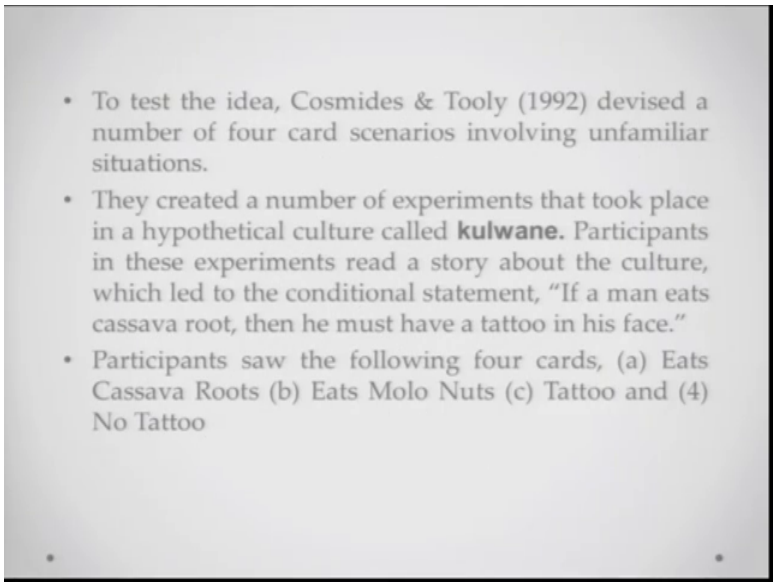


So, they have tried to apply this idea. So, if you apply this idea to cognition it follows that a highly adaptive feature of the mind would through an evolutionary process, become a very basic characteristic of the mind. So, anything that we have now should have been useful for us to survive through the ages.

Let us take an example; an example is the social exchange theory. Now the social exchange theory says that an important aspect of human you know behavior is the ability for 2 people to cooperate with each other, in such a way that is beneficial to both of the people. If only one of them is getting benefited then it is not evolutionally very useful you know one of them will die out and the other way and as soon as they realize that you know I am losing in this bargain, they will stop cooperating. So, what cooperation do exist they should be benefit to both parties. So, evolutionary approach proposes the

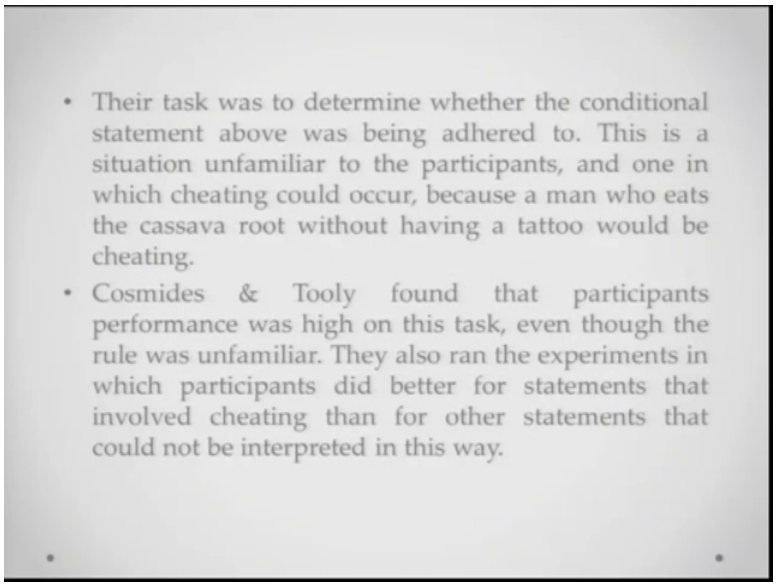
Wason card sorting problem can be understood in terms of cheating thus people do well in the cholera task, because they can detect someone who treats the country by entering without a cholera shorts that is probably that what is helping and not the permission schema.

(Refer Slide Time: 28:11)



So, let us see they test they wanted to test this idea. So, Cosmides and Tooly what they did was the device number of four card scenarios, involving unfamiliar situations. Now no real world problems, but unfamiliar situations not the abstract ones unfamiliar situations which they would not know of, but seeming like real world problems. So, what they did was they basically came up with a hypothetical culture called Kulwane and they said participants in these experiments you know were told to read a story about that culture, which led to the statement that if a man eats a cassava root and he must have a tattoo in his face this is the rule. Participants was seeing four cards Eats Cassava Roots, eat Molo Nuts has a Tattoo does not have a Tattoo.

(Refer Slide Time: 28:58)



Now, they were asked to test this. And the task was to determine whether the conditional statement was being a adhere to whether it was being followed or not. Now this is a situation which is completely unfamiliar to the participants you know you compare it with a beer and a drinking problem or you compare with the immigration problem, these I mean this condition because it is hypothetical is not really known to these people earlier ok. So, Cosmides and Toolys Tooly; however, found that participants performance was very high on this task even though the rule was completely unfamiliar. They also ran experiments in which participants did better for statements that involved cheating, than for other statements that could not be interpreted in cheating. So, they kind in a cheating sort of a manner.

They kind of manipulated how much the rule was being manipulated was violated. If it was being violated that amounted to cheating versus if it was being manipulated that did not really amount to a lot of cheating. So, this is basically what they kind of find from here is, that maybe this kind of reasoning detecting you know the violation of rule which is not really beneficial to both parties can lead to particular problems.

So, we saw here that you know reasoning basically works in a way that is evolutionary also. So, very significant and it follows particular characteristics also reasoning works much better in real world scenarios as compared to abstract scenarios. This is all from me

on reasoning we will continue with the late lec next lecture and we talk about decision making.

Thank you.