**Indian Institute of Technology Kanpur**

**National Programme on Technology Enhanced Learning (NPTEL)**

**Course Title**
**Basic Cognitive Process**

**Summary**

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Hello and welcome to the lecture series on Basic Cognitive Processes, I am Dr Ark Verma from IIT Kanpur. In this course we have been talking about various cognitive functions for the past 8 weeks, in today's lecture will try and summarize what we have done over the past 8 weeks and also I have Ranjith with me who has been the teaching assistant for this course and has been helping you out with all the queries and questions you had, and all the assignments and the solution that we had over the last 8 weeks.

So before I go on to Ranjith and take some of the questions that you have sent let me try and summarize whatever we have done in this course over the past week. We will also add some points, ask Ranjith to share his experiences about doing cognitive science. Now we began this course in the first week by talking about what cognitive psychology is, by doing do we need to do cognitive psychology, how is cognitive psychology different from other branches of psychology?

You are talking about the fact that cognitive psychology per se is more concerned with the mental functions; it is not really concerned with larger behavior, social attraction and those kind of things. Cognitive psychology basically focus on explanations that are rooted in the mental functions, we have been talking about and we have seen some of the major mental functions that we have that the brain, the kind of instantiates and we have been talking about mental functions like perception, sensation, memory and attention.

Now it is interesting if you see that we began our discussion with first situating where cognitive psychology actually comes from. Cognitive psychology is an integral part of a larger interdisciplinary subject called cognitive science wherein we are actually taking all of these questions if we deal with in cognitive psychology but from a inter disciplinary or multidisciplinary perspective. We began our journey in this course while talking about the brief history of where cognitive psychology actually comes from, we have discussed how did it evolve with philosophy, what were the antecedents of the thought that actually led to cognitive psychology.

We spend a fair amount of time talking about behaviorism and talking about what consequence behaviorism had on psychological thought in the $19^{th}$ and $20^{th}$ century and we talked about the fact that behaviorism at one point in time wanted psychologists to only talk about things that could be measured, that could be overtly observed but people reasoned that if you are going to give any explanation about behavior, if you are going to talk about or describe a human behavior in the sense you would need to talk about the black box.

The behavioral strategy probably believed that there is a stimulus and there is a black box and there is a response, we are in cognitive psychology more concerned about what the black box is, how does it function, what are its various components, how they are connected and in a sense we are going to be talking about the functional aspects of behavior. So this what we did in the beginning lectures, in the first week when we were talking about the brief history of cognitive psychology, then we slightly moved on to more foundational assumptions on the theoretical assumptions wherein you know we are situated in cognitive psychology.

We talked about things, about you know the mass and levels of explanation, we talked about modularity, we talked about theoretical under pending on which you kind of you know situate the whole enterprise of cognitive psychology. Interestingly and I hope you would remember that we have a media sense that cognitive psychology is an exercise in the abstract, we are not really concerned with the neural under pinning's per se because that is a neuroscientist's job, we are not really concerned with artificial intelligence parallels.

We are not really going to create machines here but what we are going to do is to get a abstract but full description of how each of these cognitive function are instantiated, how they are being used to explain human behavior. One of the beliefs, the central beliefs in cognitive psychology you might have seen during this course is that mental functions are the core explanations of all kinds of human behavior and if you remember even in the first classes or in the introduction lecture I talked about the need of optimizing behavior, the need of actually breaking down larger chunks of behavior whatever they may be into smaller components.

You would realize if you are doing this that any more complex or sophisticated form of behavior that you might want to talk about can be broken down into these atomic components, these atomic components generally turn out to be these mental functions or based or rooted in these mental functions which some of which we have studied in this course, others we will study in the second portion of this course. Now we have been talking about issues like modularity also and modularity is a very interesting concept in cognitive psychology that was kind of helps us to study each of these cognitive processes slightly independently, if you remember what Gerrit Goetze said.

He said that a modular system is a resistant to damage because if you have a large you know program and you want to study aspects of the program it might be better if those programs, if that program has been written in particular modules. If you have to make a change that is if there is an error or there is a bug you can actually go and edit that particular module, you do not really need to rewrite the entire program.

That was one of the aspects of modularity that we were stressing upon and if you see how cognitive psychology or studies in cognitive psychological structures we are in some way actually talking about these different mental functions. However I hope you would have noticed that in all of these lectures that we have done and in the cognitive function that we have covered we have also made a conscious effort to show you how these cognitive functions are interconnected with each other.

When we began with perception we also talked about how perception is linked to attention or how perception mediates attention. When we did talk about attention we also talked about how attention is connected to both perception and action and how does the mix of these three cognitive functions helps you act and interact with the world around us. So those are some of the theoretical standpoints we have taken in this course and I hope you would have realized that is a very important thing to do wherein you will understand that how a particular cognitive function does not really exist in isolation.

The concept of modularity is basically you know a concept for convenience to study them and also say for example to understand the role of each of the cognitive functions independently. In the second week we were talking about various approaches to cognitive psychology, we were talking about the cognitive science approach, the artificial intelligence approach, we were talking about the neuroscience approach and we were discussing amongst ourselves that how these different approaches basically bring out their own unique perspectives to study the problem.

And the problem is basically how the mind is working you know, cognitive psychology or cognitive science both of them at some point as described as studies into the mind, you know what is the mind and that brings me to a very interesting thing that there is this concept of mind and body and there is this great philosophical discussion on mind what you did listen, we have specifically not really gone into that debate quite a lot because that would probably be outside the scope of this course but one of the things I could say is from the perspective of a cognitive psychologist, you would not really you know specifically worried about whether there is a mind or whether say for example how the mind is instantiated.

You are basically you know more interested in cognitive psychologist in the functional architecture of the mind, okay, we assume that the mind might be composed of these mental functions and we are also interested in studying how these different mental functions are instantiated, how are they invoked, how do they lead to behavior and all of this you can assume that basically is happening within you know what you might want to call mind.

So there will be a interesting debate you know in philosophy and say for example in evidence of cognitive science varying you might want to take this discussion deeper and further and talk about whether there is anything called mind or whether the concept of mind is necessary to uphold or not. We have also in some little sense talked about neuropsychology and the importance of studying disordered beans, that is why we capped off the lecturer with, we will be capping off this entire lecture into series by talking about disorders of attention and perception and disorders of memory.

As in one of the earlier lectures I was talking about it is important to study the damaged brain, it is important to study a particular disorder of cognition because that gives us the idea of how cognitive function or a series into these different cognitive functions do a good or a bad job of explaining real life scenarios wherein we are actually seeing that the system is broken down and we are actually able to see where the deficits in the brain lie and there say for example you know you can help these people, you can help come up with theories.

Come up with you know rehabilitative practices that can be helped these people to live their lives in another meaningful way. Now when we talk about the brain and I have already mentioned that, that the cognitive psychologist is not particularly worried about the neural correlates of whatever cognitive functions we have been talking but in practice a cognitive psychologist, the second question you would ask after giving the functional architecture is how is this implemented in the brain?

You know that is one of the reason why cognitive neuroscience works very closely with cognitive psychology and therein what we are going to try to do all the time is trying to describe a functional architecture of the brain or the mind in terms of specific cognitive functions but also side by side asking the question that how are these cognitive functions you know initiated in the brain. Say for example you talk about memory and we have talked a lot about the regions of brain that are involved in different kinds of memory, so once you are talking about memory it becomes slightly important.

It is probably just the next question which you asked that you know which are the areas in the brain wherein you know memory is stored, or say for example again is memory stored in any specific area of the brain, I hope you would know by now it is not, but which are the areas involved in you know creation of acquisition of human memory, binding of those new episodic memory into semantic memory and those kind of questions can be asked about all the cognitive functions. Also we talked about brain areas which are involved in attention processes, brain areas that are involved in perception.

For example we spend a lot of time on visual perception, we also spend some time on auditory perception, we will you know now and be asking these questions to ourselves. Now this is what we did in the first two weeks, third week we you know spend some time in understanding the research methodologies in cognitive psychology. I will tell you why it is important to understand the research methodology in main subject.

It is important because everything that I have been talking about you know as far as the cognitive functions are concerned, all of those data all of those inferences have basically been coming out of particular experiments, We have seen for example if somebody says that there is you know three networks of attention, alerting, orienting and innovation networks or executive networks it has come out of decades of work by particular scientists who have done experiments, these experiments have been replicated across labs wherein you can you know with a certain degree of confidence say that these are the particular cognitive function.

And these cognitive functions are basically instantiated in the brain in this particular way, both the description of cognitive function and the linkage of the cognitive function to the brain have to be done by following specific research methodology, So we talked first about the basics of research methods generally from a psychologists perspective because as not sure you know the kind of background all of you would be coming in from, but then we moved on to talking about research methods and research methodology which are specific to cognitive psychology.

A lot of the research methodology that cognitive psychologists use that typically with the help of some of the tools, say for example an fMRI ECG or pet etcetera are also used in the field called

cognitive neuroscience. What they are doing is they are now measuring the activity in the brain when the brain is actually involved in these specific cognitive tasks. So you kind of travel and make that link from demonstrating that this is the nature of the cognitive function.

Say for example priming occurs and then you kind of go and tell people that you know, I know that priming occurs but I also know that priming occurs in this part of the brain so my claim is rather strengthened and it is in that sense it was necessary to talk about these you know behavioral and other kinds of experimental methodologies. Also if you would have noticed that we have made a specific effort of mentioning a lot of experimental studies in the material that I have presented throughout you know this course on different topics, be it objective cognition, be it aspects of memory, be it aspects of attention etcetera, and most of these experiments basically are actually you know the information that you would like to take away, that you would like to take home with you.

Also at some point I will try and mention about the examination factors that are important for the examination. It is important for you to remember these experiments, it is important for you to say for example if you are put into academic argument about something have this idea of where this experiment was conducted, where is this fact coming from and more of not the fact is coming from a series of experiments which somebody did in a particular lab, and you generally would like to quote that person while talking about that particular phenomena.

So also one of the reasons for covering these different research methodologies was that when I am going to later talk about these different cognitive functions and facts about these different cognitive functions I will be quoting a lot of these studies which you would have seen in the material. These studies, how they have been done, I have already explained in the research methodologies section, so after I did that we started with again sensation and perception, we talked a little bit about psychophysics which is basically about machine sensations.

We also talked about the interesting methods of a signal detection theory wherein talked about how you know you can evaluate the presence or absence of a signal in a probabilistic manner. We did both those kind of things. We moved onto visual perception in the second week wherein

we were examining different theoretical approaches for perception. We began with talking about the physiology of perception, the visual operators that there is, we talked a little bit about what representation means.

Now when you talk about perception and we this is something very interesting is that the perception is that perception is basically in some sense the representation of the external world you know after that sensory information that again is transuded into the currency of where the you know how the brain communicates with each other, say for example we talked about how the light is converted into a neural impulses of the optic nerve or sound is converted into auditory impulses at the ear at the end of the auditory nerve.

So we are talking about how these you know basic inputs from the environment be it a vision or sight, be it vision or hearing or taste or smell are converted into neural impulses, so we were talking about those kind of things and then we moved on to approaches of a section. We covered three major theoretical stand points, we covered Gibson ecological theory of perception at david mass2.5 d theory of perception and also we talked about the constructive and other theories of perception that were there.

Now the idea of really you know surveying these two or three theories of perception was to actually bring to you how the different you know theoretical stand points have new perceptions. You already probably remember that Gibson said that you know perception is not a passive act, perception is when the individual is actively involved in interacting with the environment, perception is for action, it does not lead to action per se, it is action and you would have seen while by the end of the discussion on perception we talked about perception attention and action things like way finding and you know things like interacting with objects and we talked about object recognition theory and stuff.

We have found that this is a very interesting and important approach to perception, also we talked about approaches say for example Davis mars2.5 d approach to perception wherein how does a person you know from the sensory input builds 2.5 dimensional representation of the

world and then converts it from viewers representation to the objects and when you are finally constructing the three dimensional view of the world.

So those things are also theoretically important, I hope you kind of gained something out of it and you could appreciate how a very simple thing that for the most part take for granted that you know that you can see colors and objects and motion and you know all these in depths and all these things almost automatically there are again and there is a spirit in to construct psychology that there are these little, little competitions that need to happen, these you know large team of representations that need to be build up because of visual understands.

So for example if you are not really passively seeing something whatever you are seeing the sensitive information is being transfused and then that is you know going to the occipital area and then to the association areas where you are connecting the perceptual input to the memory and the knowledge that you have about world and to the action possibilities like affordances. And that is basically something that should give you a complete or more holistic understanding of the process of perception.

Now when you talk about perception there is too much in this world to proceed, there is too much information that you know that the world presents to us and one has to in that sense be able to select and to be able to unselect some of this information. That is almost all the time too many things happening around but you cannot focus on all of them at the same time, so you need to either select something that is important and that is what you will be engage with the visual simulation or auditory stimulus or maybe something right.

Thus in your head which you want to know you decide I want to focus on this part at this point of time and not the other parts, so that is basically achieved by this process called attention. We have talked about attention in a lot of detail, we have talked about say for example aspects of selective attention, we talked about divided attention, we talked about theories of visual search there and we have basically seen through our discussions on these particular topics that how is attention.

You know what kind of a role attention plays in modulating your interaction with the world, modulating the kind of input that you are receiving in the world, also it tells you say for example if you remember me mention and broadband modules and you know theories of attention that it is not that what you are not really actively attending is completely gone, you might be processing some of this.

Say for example if you are talking about attenuated model of attention so you are talking about things that may be you are privatizing something attending in much more detail, other things you might not be attending in that much detail but you still process in that in some sense so the shadowing task we are talking about the dichotic listening, the paradigm served as a very good mean served as a very good experimental method to demonstrate the people can attend you know or can be conscious of something, say for example the voice change and the gender change and those kind of things of information in the unattended area or something that you are typically not attending, pursuing.

So that is important that is you know that was a lot of discussion that we did and all of this basically led us almost to the fourth and fifth weeks and then we came to the final sixth week wherein we have talked a lot about, you know we are predominantly doing attention and then we kindly shifted our attention to memory and we have seen some of the basic models of memory, say example ad sense and shifting model we talked about sensitive memory, short memory and long term memory and while that was a useful model we also talked about the working memory which is complement to the short memory.

We talked about how working memory is different from short term memory. Now the overall concept of working memory is that which basically tells us that memory is also not really a passive store, it is not really something you know it is not really like a shell you put something there and stays there for sometime before it is traveling to the long term memory. So we talked about say for example how is working memory an active component which you know helps once select specific information by use of central processes or central executive processes and you know allocate the attention that might be needed to even carry out two tasks at the same time.

So you talked about visual spatial sketchpad, we talked about the phonological memory and talked about the control process, we also talked about the buffer at some point in time and this complete model by Allen Bradley which has also undergone a variety of revisions tells us that even memory in that sense may not be considered a passive process. Earlier information process during base models were basically taking different components of memories, different components of memory as asterisk as that were rather passive wherein information goes, stays there for sometime then once the time is done it enough rehearsal is later it is received it goes from the sensitive to short term memory and short term to long term memory.

The concept of working memory however is different in that sense and told us that it is not like that, we are actually constantly engaged with the information and we are kind of making decisions of responsible action in a vision etcetera at this point in time, and then we came to memory. We also started talking about you know different aspects of a very long term memory say episodic memory, semantic memory, we also talked about what is the difference between explicit and implicit memory and we learned that implicit memory is something very interesting.

It is something you cannot talk about but you can say for example you know show it by performance, say for example you may not be able to talk about how you learned to ride the cycle but you can really ride a cycle and show me that you know how to ride a cycle. We were talking about say for example influences that people have in life, say for people have in their behavior things like priming, things like classical conditioning.

Classical conditioning, we know classic learning paradise but classical condition basically leads to what is called an implicit memory, the influence, the association you would almost automatically make and you will stick to those influences for long time, so we talked about these aspects as well, We talked about the fact that how does for example how does one understand everyday memory, say for example we were talking about autobiographical memory that is basically the memory you talk about when you are thinking of memory.

So those are the kind of things you know we have been discussing, what is autobiographical memory, autobiographical memory is memory about yourself and how is it you know easy or

difficult to talk about autobiographical memory that is typically things you would know. So if an experimental who wants to test your autobiographical memory becomes that much more difficult. So all in all we talked about you know sensational memory, long term memory, short term memory, we talked about episodic and semantic memory, we talked about autobiographical memory.

We also spent a large part of one of the most recent lectures talking about the errors in memory. Now that is an important aspect because we have say for example for the most part of people assume that their memory is infallible memory, their memory is correct and you know it is always if they have something in the memory it is you know correct most of the time but if you, when you see the lecturer of on everyday memory and memory errors you would realize that it is a pretty simplified statement to make and memory, completely fallible memory is known to variety of errors.

Source attribution errors are one of the major kind of errors that happen and because of these source attribution errors and also errors say for example faulty use of attention when you are talking about things like weapon focus or say for example you know faulty use of stereotypical things, the misinformation effect we have talked about, one has to realize that memory is a constructive process, okay.

Whenever you are trying to pick up something from long past you are in some sense inadvertently adding some of your own expectations and biases in the narration, there is a flow that says that when we start a whisper at one end of the room by the time it actually reaches the other end of the room the information is completely changed. If that is something that can happen you know almost in the instant what would be happening of things that you have you know you have been just narrating just out of your memory.

So we have been talking about the fact of that as well. After we did talk about all of these cognitive functions and their particular importance's we have also in the last week talked about disorders, we talked about unilateral spatial neglect, we talked about in attention blindness, we talked about chain detection, we talked about blind sight, we also talked about visual agnosias

and we also talked about disorders of memory, you know organic and psychogenic amnesia. We talked about ante grade and retrograde differences, we talked about amnesia that could be because of temporal lobe surgery, frontal lobe lesions or you know could be a result of an electro conversion l therapy treatment.

So we have basically also gone into the space wherein one finds that there are interesting effects like synesthesia which is basically an interesting aspect of perception when a person can have multiple sensory experiences with the same stimulus so hearing a letter can induce perception of the color and that is amazing in the sense that you know you could realize that how this particular process is happening.

We also saw in one of the studies that actually the people who are hearing the letter, the synesthetes, they actually experience activation in the region before of the brain which is basically the one that experiences color. So those are interesting things to know about, those are interesting aspects to know how does this particular theory work and how does this particular theory go into you know explaining and doing a good job of explaining why these things are happening.

The blind sight was one interesting example that even though because of the stereotactic damage there are areas of visual field that are completely lost but still people are being able to see, say for example if not see but people are still being able to locate light flashes in those regions. Now there are particular theories about these particular disorders but it is interesting in the sense to know that a lot of that explanation still remain and that is typically what the research in cognitive psychology is about.

We talked about also aspects of visual agnosia wherein the sensory assess were completely intact but the person does not detect, the person is not able to identify the objects, we talked about unilateral spatial neglect which is typically a disorder of attention because the sensory processes are intact and even when you know grab the attention of the participant in the heavy field that he or she has been neglecting over a period of time a participant can report seeing that.

So if you remember the experiment wherein the researchers asked the participants to describe a particular landmark from one end to the other end they could eventually describe the landmarks on both sides, even on the neglected side when the end was changed. So those were the details that would help us and I hope you know it would have fascinated you how these disorders manifest themselves and how the theories of perception, say for example we are talking about perceptional disorders or attention disorders or memory disorders.

Now what you have to do immediately is to you know to pick up all those theories which we have studied in the earlier lecturers and try and apply those theories to understand these particular disorders, that is typically the exercise one would expect you to, that will typically be the take away that you know one would expect you to really have. So we talked about all of these things, I think that I have summarized slightly broadly whatever we have done in the course of this last eight weeks.

Before I go to Ranjith and before I start talking about the questions that you might have raised, one of the thing that is interesting was to point out it that you will be having your exams objective question papers for exams of this. It is necessary and that is something I would like to point out that you have gone through not only the theories but also the experiments wherein say for example you know different kind of facts have been illustrated. So for the most part if you are preparing for an exam it is necessary to really know the facts and really know the experiments wherein those facts have come out.

Because that is what is your academic knowledge, you might have just learned something and you might have something, you might have some facts but unless you can corroborate that by mentioning a particular kind of literature that is not really going to help a lot. So this is pretty much what I have to say about the course, I am hoping that you would have enjoyed the course, I am hoping that you would have understood something about cognitive psychology and you have gained some understanding of cognitive psychology.

You might feel free to email me personally on my iitk email address that is arkverma.iitk.ac.in . If you have any queries or if you have any questions even later about cognitive psychology, if

somebody wants to pursue cognitive psychology we have already a PhD program in cognitive science here, we will also be having a Masters program in the next year onwards, so if you have any kind of queries or questions you might directly email me and I will be happy to respond to those questions.

I will move to Ranjith and I will ask him some of the questions that you have raised over time and we will quickly have a small discussion on the fact and I will try to attempt to answer those questions one, so the first question I am going to ask which is given to me by the students is, how can we talk about feelings like joy, happiness and sad without giving a reference to the physical entity, this was mentioned in one of the lectures and we need a bit elaborate review.

Answer: So this is interesting because this is pretty much the questions that was you know invoked while we are talking about the foundations of cognitive psychology. What I am saying at that point of time is that from the cognitive psychology perspective you can be content in talking about the experience itself, obviously the experience is you know in some way related to something, say for example you are not happy in isolation, so you are happy with respect to a particular stimulus or you are sad with respect to a particular stimulus and that is something which say for example you know is of descriptive kind.

But as a cognitive psychologist what I am interested in is not really what makes you happy so much but how it makes you happy and what are the brain processes that are happening which are leading you to experience these emotions. Say for example somebody feels sad or somebody feels happy and there is you know in typical cognitive psychology there are studies wherein people experiment with different kind of stimulant, for example they talk about there is international effective picture database wherein people present happy faces and sad faces and happy images and sad images.

They measure how are people reacting to that, what it is going on in the brain, say for example there could be behavioral responses and it has been shown in research that people respond to happy faces much faster than they respond to sad or disgusted faces. So there is lot of research in this but the explanatory perspective in cognitive psychology is not really tied to the stimuli that is

indicating happiness or sadness, it is basically tied to the level at which this can be understood and the level at which a cognitive psychology base explanation will operate is basically how are you experiencing happiness.

What is it in your brain that is leading to happiness, also the functional architecture, say for example what leads to say for example perception of certain things like happy or sad and those kind, what are the basic building blocks of somebody feeling happy or sad, that is very much what a cognitive psychology perspective would be. Question 2, so how is it different from the behavioral perspective?

Answer: If you talk about behavioral perspective, the behavior perspective would be that they will not really be interested, that pure behaviorist stance will not be really be interested in understanding what the, you know what is to feel happy or sad. The behavioral stance will be what are the stimuli that make you happy, what are the stimuli that make you sad and then a systematic manipulation of those stimuli to achieve a particular kind of you.

That is pretty much a behavioral stance, for example for this whole concept of operant conditioning wherein you learn something on the basis of a positive rewards and you know do not stop doing something if there are punishments associated to it. So the behavioral stance is typically giving a stimulus and achieving a behavior while the cognitive stance is somewhere in the middle so after you see the stimulus and before you do a behavior what is it happening with you in terms of you know what all is going on in your mind, in the mental processes.

Also what kind of you know reactions are going on in your brain, so this is basically the difference between the behaviorist view of let us thing like emotions and things like say for example you know the behaviorist part. By the way emotions as a topic will be covered in the second version of the course which will be offered in January with the title introduction to cognitive psychology, advanced cognitive process and that is what I will be talking about, emotions in much more detail.

Question 3: Going with the same question one of the twins has quoted, so I mean the question, we are starting with the stimulus control, kind of objectifying the theory of life. That is the question they are asking, objectifying the mind. Answer that is one of the things, see that is where if you will listen to the lectures you know that we have done, say for example in the foundation of cognitive psychology section that is what I have tried to impress, that the whole point of behaviorism.

Say for example you know logical behaviorism per se says that you should not talk about anything that is un observable in behavior. So the whole point here is that, you know the whole point of objectifying, so for example what since stands on particular mental function what could be so deterministic that it would say that for example if you can predict human behavior as per a set of your laws then you can actually you know predict human behavior in terms of you know.

As any physical function, as any physical or you know chemical reaction but the thing is that coming to the objectification of the mind, the point is that cognitive psychology is not really concerned with objectifying the mind per se, okay. There is an argument to that aspect and I will touch it very soon but the whole point is that we are not really concerned with the stimuli and the reaction; we are concerned with what is going on in the head.

Now what is going on the head is happening in abstract space and when you understand mind and you understand you know a body you have this idea that mind is an abstract space, now how is that abstract space instantiated. You cannot by virtue of giving stimulus space or stimulus b and stimulus d and getting reactions A B you know enough talk about what is going on in the mind so in that sense you cannot objectify the mind it is not really going to be working with physical laws pursue so what you will be doing now coming to the objectification of the mind is one of the theories that comes after say for example things like reductionism and eliminate materialism.

So if you are going in that line then say for example I think pretty church land mentions that if you have completely understood how each of the mental functions is instantiated by neural communication if we have completely understood how the brain is build up how each of the

neurons are connected to each other and how the activity in these sets of neurons leads to particular mental functions then you might not need you know that whole concept of mind pursue than you don't really need the mind as a construct then you can start talking about the brain and continue this is the brain which is doing this and not the mind.

That is basically that will probably be the at most objectification of the mind when we are in the field able to understand the complete functioning of the brain just to tell you that we are too far away from that we are kind of in the process of understanding the function of brain in the process of understanding how the function of brain can instantiate the mind but there are huge gaps and I think it will take quite a long time to make this connection and to achieve you know successful let us say objectification of the mind

Question: By the way, we are studying the mechanism which is underlying these mechanism we can implement more with artificial system example robotics actually the science for us if we find to objectify or if we really study the mechanism underlying the process I mean we can't even objectify the whole mind pursue question will be the person didn't refer in what context what is so we can't conclusively say whether he told that objectify mind is wrong or correct.

Answer: See objectifying mind is not again is not really a valuable judgment it is basically about whether you can do it or not and my answer is probably routed in that sense that may be you can objectify the mind at some point of time but if you remember the last slide of foundation lecture I said even if you can objectify the mind pursue even if you can say that whatever mind is it is just neural activity.

Now we understand the complete brain the fact is as cognitive psychologist we are still interested in something that is abstract the functional architecture say for example take an example of a machine take an example of a computer pursue you know all the hardware you know how each of the components of the mother board are assembled in all of you know the hardware in all in its detail.

But its say for example you don't really talk about the software always by talking about the hardware say for example you say I have typed something you do not really say that you have pressed this particular key which has given this particular signal and letters reached, you know that is how this symbols be appearing on a webpage so the whole point is that a psychologist we are really concerned in the functional part so much not really in the objectification of the hardware components

Question, the classical question which is studied in philosophy of mind may be this course is how to point but the question arises is mind body interaction answer, again the classic case of mind body interaction something could be very similar to you know or probably closely answers could be given from both philosophy but again I was mentioned pretty church land about this whole concept of reductionism or eliminative materialism is the fact is the closest instance of mind body interaction that one could get is basically through the brain.

And how the various actions you know neuro chemical electrical actions that are electro chemical reactions that are going in the brain are instantiating the mind there are theories say for example there was a book by Raja Penrose. And I have sometimes mentioned it where in say for example there are now feels like quantum neuroscience and where in say people are trying to understand even things like consciousness or from a slightly physical perspective, for example the action of the neurons is leading to a consciousness rather physical sort of way so in that sense there is obviously mind interaction but is that necessarily a dualist thing is something you know I would reserve my word.

For example there is been a lot of discussion on this in a classical philosophy modern philosophy as well even philosophy of mind so if somebody is interested in these kind of questions i think philosophy of mind and there are lot of books in philosophy mind if a kind of explore that people like dual chambers and others have written about it a lot and those could be the material that you would read and where in you we get I do not know answers but you will get some information about these kind of questions there. Ranjith, we can go in the perspective, this is an outstanding question.

Answer one of the thing about this course and we sometimes discuss it is that this whole concept of cognitive science where does cognitive science as a field comes in and cognitive science is basically you know all of these questions that you are asking as a cognitive psychologist primarily a lot of these questions probably do not fall in the preview of cognitive physiology all if see do not have clear answers in cognitive physiology do you have clear answers in neuroscience.

Do you have clear answers in cognitive psychology, do you have clear answers in neuroscience or philosophy in computer science, for that matter it is also debatable also what happens is a field like cognitive science, that is basically an intellectual things attempts to look at these questions from all of these various perspective and try to where if at close answers if it is not really you know again the solutions are not yet.

But things like cognitive science are rather helpful in elaborating the factor illustrating these are multidisciplinary questions that are not questions might ever be answered within one of these disciplines itself so the concept is as you already know is that as you pick up all the unsolvable questions from these various fields.

And if you try to look at it or try to say example for in cognitive psychology we have been talking about we are taking the help of cognitive neuroscience all the time cognitive neuroscience is taking help of cognitive psychology by following the same kind of paradigm all the time you are put in some philosophical questions say for example somebody who likes to do computational modeling.

So in computational modeling you are basically using principles in you know parallel competition and you are using computational models to understand that is a lot of work is going on in computer vision, there is lot of work going on for example in developing models of human decision making process there is a lot of work going say for example in creating models of specific cognitive functions models of memory and models of attention models, of reading words, all of those things are basically efforts you know trying to solve this problem not even says solve but understand this problem in know from these different perspectives.

Question this question is from us background that how does this course benefit for him from his point of view? Answer so how this course is benefit somebody, let us say user interface design kind of background one of the things is whenever you are talking about a particular user whenever you are talking about designing a particular product that is going to be used by your by human users human clients what are the things is it means certainly help to understand how the person you know think how the person mental processes operate.

Say for example, I could give an example of one of my seniors who is working in IIT Hyderabad and at that point of time I have been working on a project on software company who had commission then to design their web pages and you know one of the things that those people would want to do is that see were in you know which are the areas of webpage where the users are looking into it ,so which areas say for example if you are placing the home button where should you place the home button where in the user finds its more convenient to use.

So I think what you would want to measure here is how is the user interacting with my product be it a webpage be it a particular utility device or something and what are the factors that you can use to know to measure the user experience. See for example if I remember correctly what they was doing was they was using eye tracker to actually scan you know the page as to where the user was looking at any point in time and how this you know looking at this different aspects of the webpage you know, and the difference say for example if the home buttons are at top right corner or at top left corner there are ways to measure which is more difficult or easy for the user so these kind of feedback are taken by user designed or user interface design companies all the times in designing these variety of work.

For example even if you want to design a dashboard of a particular car there is a basic architecture that is going to be the same but how would you place, say other kinds of buttons or other kinds of functionalities which the user will find you know easier to deal with Ranjith for all these theories of attention you know the happiest moment which you had seen overcome movement where they are paying attention.

Answer: Exactly you can use the knowledge that we can shade in this particular course, say for example theories of attention theories of perception how eye movements scan the particular place and all of these will help you to understand which you are giving a visual modality thing, how it is going to help the person understand a particular thing. Ranjith this is the end of questions.

IF this is the end of question I invite Ranjith to talk about his experience. Ranjith has done his Masters in cognitive science from CBC, Allahabad, now he is a project staff in one the projects I have involved in. I will just try and ask him to explain his experience about doing cognitive science in the past four years I think he has been involved in.

Ranjith I completed my under graduation in electrical engineering so in that I had a course on artificial intelligence, so that time I had insight by the term, it is called that these are all biological insights algorithm when they talk about some algorithm of artificial intelligence is that time. I have been interested by the question that what biological insights kind of algorithms but I thought the background will be a constraint to pursue something called neuroscience, and that time I am even aware of that course for cognitive science and later I was persuaded by IIT in Madras and from there I came to know there is an inter disciplinary field which address all the questions of you know-mind brain.

And which are in treat before so this is the this is the way that need to basic cognitive science and later how it helps me to enhance my own knowledge level before cognitive science and after cognitive science i came to know think of a complete shift in mind, how I thought about discipline. So we had a compartment wise knowledge which we have discussed in before inter disciplinary multi disciplinary so these concepts are not aware to me before I thought engineering is separate, science is separate, arts is separate.

So when I studied cognitive science in this I want to address my own question to pick up knowledge from whatever, from discipline linguistics you know philosophy from artificial intelligence and neuroscience and this will be give a different perspective of tackling of your own question, how this multiple discipline will help you to address your own question so my

mental talk of compartment life is knowledge something else engineering or something else science, something as arts this is chatted in the beginning when we started cognitive science.

Professor: So what was that made you particularly curious about let us say human behavior or the human brain and did you get any answers, why you are doing cognitive science and you are doing still doing a research how does that you know help and how does that not? Ranjith so I actually, when people come to cognitive science I come with the classification we are going to predict human behavior or how the mind operates or I am able to detect how people are thinking.

We can typical to say which to make for you know psychology you know read mind and where people can study mind. So I also have the same thought when it is after perusing while perusing the study it is like a complete drastic difference in you know that we cannot do this so that more questions before coming so now the questions are increased actually that is.

Okay, we will finally come to the end of this now and I hope, now I will thank Ranjith for his input and his help with the course and whatever queries you had he had answered then help them and used to talk them in talk to me that these are the questions that people asking and I am trying to also help him through this thing and he was the main person communicating with you through emails and everything, to the assignments, solutions and those kind of things and so I will thank Ranjith for this course and I hope that you had a good experience participating in the course.

I hope a lot of you will be participating in exams and you will take away something from the course that will increase in cognitive psychology and say for example you know a broad field like cognitive science question announcement, we are all on Skype. So today I am trying to take questions which you already sent, but there will be a Skype session that I would be hosting on 18th September at 7 p. m which is basically I am in, I will be having a Skype session and all of you can participate in that and send in your questions live, and we can have some of the discussion like we had today directly to you at point of time, thank you.