Psychology of Bilingualism and Multilingualism
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Hello and welcome to the course introduction of the psychology of bilingualism and multilingualism. I am Dr. Ark Verma from the department of cognitive sciences at IIT Kanpur. In this lecture I will begin to talk about the aspects of language control in bilinguals and multilinguals.

In the last few lectures we have seen that bilinguals have two active language systems both in terms of production and comprehension. Now this leaves our bilinguals with an added responsibility of controlling inputs from these two slightly disparate slightly distinctive linguistic systems who are constantly active and competing for selection for production or also for competing for being mapped on to the meanings during comprehension tasks. How do bilinguals accomplish that? Because if you look around you will find that bilinguals are extremely adept at doing this task. They are extremely adept at managing interference from their two languages.

Say for example I am a Hindi English bilingual but I am speaking in English without a lot of interruption from my native language which is probably my stronger language that is Hindi. Also if you are speaking to me in either Hindi or English which are the two of my languages I don't think I should have a lot of problem in understanding whatever you are saying to me and mapping whatever is being said to either of my two languages. Now this is a peculiar situation that occurs with bilinguals and does not happen with monolinguals. With monolinguals also in respect of formulation if you remember the Lebesgue model that we have discussed earlier in this course now there are obviously decisions to make but the decisions are to be made within the candidates of the same language. Say for example if you want to express a concept like anger I may have several lexical candidates that can express the concept of anger to various degrees.

However the problem as I said sort of multiplies when I am talking about anger when I am intending to talk about anger and I have two languages at my disposal. The typical scenario that would result would be that I would have words from both Hindi and English that would you know attempt to express the topic that I want to talk about but I will have to choose which language is most appropriate for the given context in which I want to express this. So how do bilinguals actually accomplish this? How are they able to manage the interference from the non-target language while being able to speak fluently in the

target language just as I am doing? Also another question that we need to sort of take into account is that how are they able to comprehend, how are bilinguals able to comprehend at once words phrases or sentences from both the linguistic systems never wondering which is which. This is basically going to be the flavor or the question in consideration in the next three or four lectures of this week where I will be discussing various aspects of how this problem is actually solved with bilinguals. Now researchers have opined that these tasks are actually managed through a complex functional system that has been referred to as the language control system and which is responsible for allowing bilinguals or which enables bilinguals to adapt to the specific requirements of the listeners and the context of their conversations.

Also this allows them to manage their two language systems selectively but adeptly. You know and I have been saying that bilinguals are expert in handling their two languages on the fly given different kinds of communicative scenarios and so on. So how does this language control system actually do that and what are the properties of this language control system? This is indeed something that we should you know worry about when we are taking the course on bilingualism because this would sort of tell us that whatever we have read so far in terms of you know on the chapter on comprehension or the more recent chapter on production we have seen evidence after evidence that both the systems or say for example if we are talking about a multilingual three or four kind of three or four linguistic systems are constantly competing with each other for participating in both production or comprehension tasks. How does this language control system that we are talking about enable the bilinguals to manage this effectively? Let's dive deep into this. Now if there is indeed such a system of language control it has been suggested by researchers such as De Groot that the first requirement would be that say for example I have two lexical systems in my head I know Hindi and I know English the items the individual items of these lexical systems must be in some sense identifiable.

So the idea is that words from Hindi and words from English must be tagged in a particular manner and assimilated accordingly in a bilingual repertoire basically saying in more simple words that my language system if there is an indeed a unitary one should be able to know that which words belong to what language. So the language control system and also you know the property of a particular language system should be that it should be able to determine which of the stored units in the in our mental lexicon belongs to which linguistic system. So for example first the first requirement is that words should be tagged they should be say for example if the word is sabe or Kayla or Papeeta they should be tagged with an H for example hypothetically or hypothetically speaking or words like papaya, banana and you know grape must be tagged with an E for the system to be able to sort of you know and they must be in some sense embedded in separate linguistic repertoire so say for example words all words of Hindi together and all words

of Hindi English you know together so some kind of organization is required. Now once that kind of organization has been achieved or can be achieved the task of the language control system actually becomes that it should be able to determine which word which input representation can be mapped to which lexical system or which lexical subsystem. So for instance one of these one of the proposed ideas in this direction is that individual elements from each language are actually categorized into separate networks with strongly interconnected members of the same language group together almost as a delineated subset of bilingual memory.

So what we are trying to say here is that you can imagine a bilingual memory as consisting of two subsets one of Hindi one of English in my case for example and all the words that I know of Hindi are organized in one pool and all the words of English that I know are organized in the other pool depending upon which language I'm planning to use or trying to use in a given circumstances you can pick the I can pick or the linguistic system or the control system can actually pick accordingly and allow me to express myself in that language. Now more precisely the idea is that elements of this mental subset that we are talking about the Hindi mental subset or the English mental subset could actually be connected to each other through co-occurrence or through mental association how are these things connected together we were talking about organization in the previous slide how does this organization come about now this organization may actually come about through through these words occurring together again and again say for example when I'm speaking Hindi I'm speaking words of Hindi together and they are sort of being linked together through co-occurrence or through mental association because what I am trying to do is I am trying to understand words of Hindi in terms of Hindi and words of English in terms of English basically eventually leading to the items belonging to a particular language getting strongly interconnected with each other in a bilingual memory since obviously as I said they are often used together in phrases and sentences and so on now in individual lexical items embedding within one of these languages would certainly help to determine its language membership because it is connected in a particular way it belong it is organized in a particular way so in so in that sense in each link each lexical item from my mental lexicon can then be identified for oh this belongs to Hindi or this belongs to English and so on further the said organization into subsets can actually happen at the level of language membership as well as within a given language at the level of phonemes or phonological or orthographical forms of whole words so this way the language system that exists will be able to identify and clearly categorize individual lexical items based on where they sort of belong to or which linguistic subset they are actually belonging to now an alternative proposal to this is the is the idea that language membership can actually manifest through the systems of through the existence of what are called language nodes within the bilingual memory system say for example one node for each of the bilingual language say for example you

we have discussed some of these models in production and comprehension earlier where you've seen that where the level of feature is common in the level of sounds is there and say for example you are discussing the bimola model in the previous lecture so the features is common to both the languages but the level of sounds and the level of words is actually language specific so this would obviously you know help bilinguals to sort of classify and categorize the elements of these elements of the two languages separately now if all individual lexical items and orthographical phonological forms of these items are connected to the specific language mode they would obviously be easily easy to identify and retrieve when we are needing to sort of exercise them or produce them in some manner also language membership could be determined by the connections between these lexical items and between and you know their connections with items of the language node so yeah the idea is that a language node will be connected to all the lexical items within a particular language subset finally a third proposal alternative proposal about such an organization has been put forward by Poulisse and green who say that a lemma representation of each individual lexical item probably can even can specify its membership through the kind of language tag that we're mentioning now three of these proposals describing a bilingual lexical system are actually not mutually exclusive and can even be thought to coexist within the you know a language organization of a bilingual let's look at this in a bit more detail now the different views about bilingual language control that we are discussing or you know we are proposing can basically be discriminated from each other on the basis of four theoretical dimensions that have been proposed by de Groot in a book on language and cognition in bilingual multilinguals the the first factor here is the scope of control now the idea is that these views of how the bilingual you know memory or how the mental lexicon of a bilingual may be organized could be in the sense of how they practice control on the given linguistic system the nature of control may either be global that affects all the lexical items or local that it affects lexical items selectively for instance global control basically refers to the fact that all the individual lexical items in a within a linguistic subsystem are affected by the language control system in a sense that it may be able to activate or inhibit all the elements of this linguistic subsystem at once say for example if I want to speak in Hindi I should be able to suppress all the lexical items of English at once or if I'm speaking English I should be able to suppress all the lexical items of Hindi at once on the other hand when we are talking about local control the idea of local control would actually refer to the idea of language control in the sense that you know language control should be able to exercise in influence on very specific or selective individual lexical items in a given lexical system the other factor that de Groot says is might be important for us to consider is the direction of control now these different views that we have been discussing about the organization of the bilingual mental lexicon could also differ with respect to the direction in which the language system a language control system is supposed to operate for examples there are two very prominent hypothesis in this

direction first is the hypothesis of proactive or early control which basically says that proactive or early control actually may manifest in a way that individuals that when say for example an individual intends to speak in a given language say for example in this current setting I am intending to speak in English the language control system should be able to prepare all the lexical elements in English and increase their availability for selection through a system of pre-activation at the and at the same time decreasing the availability or propensity for selection of all the individual lexical items of Hindi which obviously might interfere when I am trying to speak to you or trying to deliver this lecture in English so this basically would be a concept of proactive or early control another proposal about the direction of control that has been put forward in research is the idea of reactive control now the idea of reactive control is that the control system can operate on the outputs of the two language systems rather than preparing and you know proactively ensuring that what is delivered and what is not it would basically start reacting to whatever the output the linguistic systems are bringing about and this could this would basically try to prevent the items from the non target language say for example in this exact in this specific situation the target the non target language is Hindi so the language control system should be able to you know prevent the items or the outputs from the non target language which is Hindi at this moment from appearing for selection when I am trying to speak or you know from being assigned a meaning when I am trying to understand what somebody else is speaking to me so direction of control either proactive or reactive is also very very important and we will see in the future lectures as to how both of these manifest in order to enable control you know for bilinguals now the third very important component that De Groot points out is that the for systems of language control is that whether they sort of you know affect the overall language system basically the overall unitary language system or it basically exerts control through the outputs of the language system so the idea is whether it prepares the overall system or it just lets the system be you know and let's the system come out with particular outputs and only acts on the output so the local locus of control is also something that is very very important another very interesting aspect is this aspect of source of control what is this source of control now source of control is basically how does you know this issue of control emerge how does this language control system gets roped in or triggered now the source of control could be either internal or be endogenous or it could be external or exogenous in what looking at this in more detail when I'm talking about the source of control being endogenous the idea is that the system would trigger itself let's say from an intention to speak in a particular language where when I'm trying to speak in English I am consciously or let's say I'm automatically presenting an intention to the system to suppress the non target language which is Hindi at this current moment or the source of control could be completely exogenous for example depending upon what I am reading from let's say these slides or a teleprompter would basically you know and if that is switching languages it is first coming English or Hindi and so on it should basically the

locus of control should they would then be exogenous that depending upon whatever input I am getting say for example if I'm reading in Hindi it should basically try and suppress the item from English from interfering and when I'm reading English it should try and suppress the item from Hindi from stepping in so the four items that you know the four parameters that De Groot has actually pointed out are in that sense very very important for us to understand how these systems of language control might actually influence or enable bilinguals to sort of exercise or manage control between the two languages or three languages in case of multilinguals four languages to you know from interfering with each with each other and so on now in the next slide or say for example from here onwards let me try and sort of you know look at a particular paradigm a very prominent paradigm in you know language control research that has been used to examine and investigate how individuals or our bilinguals actually manage their performance of you know speaking or understanding in the two languages now this paradigm is commonly referred to as the language switching paradigm and it has been one of the most commonly used paradigm by researchers who have been interested in investigating you know issues of language control in bilinguals both in terms of production and comprehension in experiments using this language switching paradigm typically participants are asked to produce let's say the name a picture or an object or a digit in one of their languages at a time as specified by the instrument by the experimenter and then on the next trial they may be asked to switch to producing the name of the object or the digit in a different language say for example I could be presenting you pictures on the screen to name in Hindi you know one after the other and suddenly I say okay now the success from the next picture onwards you have to start naming in English and sometimes this could have you know blocks all in Hindi at once and all in English at once or it could be a mixed block where you have to on successive trails switch between producing Hindi and English and so on so this is basically what the language you know what the task in the language switching paradigm is actually about now if the participants has not switched their languages on a successive trial that particular trial within this task is known as a non switch trial or if and if the participant is required to switch their language of production in the next trial it will be referred to as the switch trial and so there are these two types of trials which are very very important similarly in terms of comprehension participants may be presented with stimuli in one of the bilingual languages and the simile on the next trial may stay the same or you know change depending upon how the experimenter is actually manipulating the presentation of stimuli now how in in a language switching paradigm you will tell the participants that oh you have to name this particular picture in Hindi or this one in English or the you know you have to press you have to basically decide while you're comprehending you know you have to decide about whether this particular word is a Hindi word or an English word so there are both kinds of you know perception based on production based experiments in language switching so it becomes very very important for researchers to

be able to tell and prompt their participants to switch languages as and when is required by these researchers for this reason experimenters have actually resorted to using different types of cues some visual some auditory to signal the participant as to whether a given trial is a switch trial or a non switch trial typically when I have been when I have seen a lot of this research and even conducted some myself participants actually use colored cues you know colored outlines or you know some kind of patterns sometimes a beep sound etc to actually tell participants that oh if the picture is outlined with the green color you have to name it in Hindi if it is outlined with red color you have to name it English and so on so in this way you can you know even once the participant is doing the task you can actually tell them that okay now you have to name this in Hindi now you have to name in this in English and basically you sort of let them switch through languages across you know the entire block of experiment now as I was saying the block typically language switching studies have employed a block design wherein first there is a monolingual block where say for example if I am doing a language switching experiment with Hindi English bilinguals typically what I would do is I would create a block of trials or pictures say for example that have to be exclusively named in Hindi and the participants would know that and then I will create a block of trials where the participants have to name the pictures in English and that will be another work so we are typically have two pure blocks one Hindi monolingual block and the other English monolingual block and then the critical block here is the mixed block wherein participants as you as I told you just now will be queued to you know decide whether the particular picture has to be named in Hindi or English in successive trials so you have a monolingual block which is a non-switch block and you have a mixed block which is the switching block all right and the pattern of switches in the mixed block or the switching block can also be sometimes random or sometimes regular say for example you could basically say that every third picture has to be named in English and all and the initial two pictures have to be named in Hindi so you can start with Hindi Hindi English Hindi Hindi English and so on or you can basically have a very random sort of a pseudo randomized or randomized pattern of asking person to switch in production so you can do that you know you can do do the same while you are doing a lexical decision or a comprehension based task now an important dependent variable for the language switching paradigm that researchers actually calculate because now we have described the task we should also look at what kind of results these tasks give so typically you know the dependent measures are response times and accuracies but the important variable or any important aspect of analysis that is involved in these in the language switching paradigm basically is the switch cost what is the switch cost which cost is traditionally computed as the difference of reaction time between a non switch block and a switch block now it can either be you know done globally or it can be done locally which I will just describe you know in a moment so typically it has been seen that partisans are relatively slower on the you know on trials where they have had to switch

the language as opposed to they are relatively faster when they are speaking in the same language on successive trials now there are two ways as I was saying of computing or calculating these switch costs either you can calculate the switch cost locally at every single point where the switch is being made or you can basically calculate the switch cost globally basically by subtracting the overall reaction time from a mixed block for all switches minus all non switches so both ways researchers have actually used this so while there may be different ways of calculating and computing switch costs according to De Groot important advantage for computing these switch costs locally is that it would allow the research or allow the you know experimenter to compare the switch cost incurred by a switch to L1 on the one hand and a switch to L2 on the other hand because if you are just clubbing all the switches together and comparing them with all the non switches on the other hand you basically get oh how much time does it take to switch versus how much time participants incur when they are not switching but something of critical interest for bilingual researchers has been that how much time does it take for a participant to switch into their L1 or and how much time does it take for them to switch it to their L2 or L3 or L4 also which is possible you know depending on the kind of participants you are using and the kind of you know research questions that you have posed interestingly some studies such as Meuter and Allport in 1999 which I will discuss in more detail later actually have shown that the cost of switching into L1 as may be asymmetrical as compared to the cost of switching to an L2 so obviously when you see that you know the switching cost to L1 and L2 are not similar it makes a lot of sense for us to be able to compute the switch costs locally another very important caveat of measuring the switch cost has that has been pointed out is that the switch cost when you're measuring them globally is actually confounded with mixing costs now how do you demonstrate this you basically look at all the non switch trials in the mix block and you look at the part you know let's say all the all the Hindi trials in the mix block and all the Hindi trials in the pure language block which is the monolingual block and when you compare this you will basically see that what emerges is what is called a mixing cost typically participants will take a bit you know more time to respond even in their dominant language when it is in a mixed environment rather than when it is a non mixed or a pure language environment and that is also something which is very very interesting because it has been proposed that when participants know that they do not have to switch between languages they are sort they said they actually find themselves setting into a proper rhythm of naming in in the same language let's say Hindi Hindi Hindi Hindi Hindi or English English English English English and that basically allows them to sort of follow go along with the task inertia no suppression or activation of the non target languages it is required however on the other hand in the mix block what happens is that they sometimes suppress the L1 and activate their L2 and on the other times they have to activate their L1 and suppress their L2 and basically both of these languages are you know highly activated because you don't know which language you have to name in so

because of all of these factors there is a lot of competition and lot of cost incurred in terms of time in a mixed block so mixing cost is something obviously very very important that you have to keep into mind when you are actually looking at the data coming out of a language switching experiment also there are few potential limitations to the language switching paradigm that you know language switching behavior that basically is tabbed through this language switching paradigm now the way I have been describing that how people you know in some sense administer this language switching task is let's say by pseudo randomizing it or by you know asking the queuing the participants that oh you name the green in Hindi and in line with the outline with the red in English is basically that these switches that we are seeing here are actually unnatural you know they are not genuine imitation of the language switches that typically occur in bilinguals are operating in normal circumstances suppose I am a bilingual for example I mean as a matter of fact I am a bilingual in and when I am talking to people I may switch into and switch out of a particular language which here for example I may suddenly start speaking in Hindi if I know that the person is you know capable to understand Hindi and switch into English if I know that the person is capable to understand English so in those instances you will see that the switching is voluntary and the switching is in in that sense that much more you know natural if I may use the word whereas in these experiments the switching that is induced is actually experimental control and it is not natural and therefore whatever results and explanations we actually get out of these language switching experiments may not be highly ecologically valid so this is again one of the drawbacks of the language switching paradigm also the type of language switches that we observe in the language switching paradigm or language switching task if I may call it that is that these are you know typically out of context we are basically asking people to name objects or digits you know in isolated fashion we are typically I mean mostly we are not asking them to speak long sentences etc which is basically totally out of context and very unnatural so that unnaturalness of the task in itself also is bound to incur some cost for the individual and again makes it more and more difficult to you know interpret the findings from such a task and basically be able to generalize them to understand the behavior of the bilinguals again while there are these limitations of this language switching task it has been used extensively for over two to three decades and has been one of the more popular tasks that has revealed a lot of insights about the behavior of bilinguals to summarize I would just say this is a blank slide so I just you know wanted to you know for you to take a pause and summarize it for yourselves but if I have to give out pointers for a summary for this lecture you can basically see that it is it is a you know genuine problem for bilinguals to manage their two languages from interfering with each other both in terms of production and comprehension and there indeed must be some kind of a language control system that is required that allows and enables bilinguals to do this how does this language control system look like how does it actually enable this and so on are questions that we will delve into deeper and further in the next lectures

interestingly there are experimental paradigms like the language switching paradigm that are available to us for you know looking at the predictions or operations of this language control system as I am you know as I am talking about it and also to sort of reveal a lot of insights about bilingual language behavior thank you I'll see you in the next lecture.