Psychology of Bilingualism and Multilingualism
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Hello and welcome to the course introduction to The Psychology Of Bilingualism And Multilingualism. I am Dr. Ark Verma from the Department of Cognitive Sciences IIT Kanpur and we have been talking about critical period and age of acquisition effects in the first language in the previous lecture. Today I am going to extend that discussion towards learning a second or a third language. Now, if you look around if you look at the you know the way our society is now constructed in 2024 a lot of us a lot of individuals actually have this opportunity to learn a second language very very early in life. You know all of us including myself or a bunch of people have actually had this ability to learn a second language which is typically English for a lot of us across India by going to an English medium school. You know whether you are in the north the Hindi belt as they call it or in in the south typically the second language that people learn is by way of going to school very early in life.

So, our schools typically start around 2.5 to 3 years of age and once the child starts going in that school the medium medium of instruction is English. So, what basically does is it allows us to acquire English very very early in life for a second language. Also I mean English need not be the second language for everybody for a lot of people it could be let us say you know it could be Tamil versus Telugu, Tamil Kannada etcetera etcetera depending upon their familial and you know social situation.

The idea is that a lot of us actually have an opportunity to learn a second or a third language very early in life, but again this is not been the case always this is not been the case forever and for a lot of people it has been observed that their opportunity to learn a second language if they have not gone to let us say an English medium school typically comes slightly later in life. You know I know a lot of people who migrated to a different country and learned a second language at a much later age in life. So, for example, I was living in Belgium and I had a bunch of friends who had migrated to Belgium after selling their farms etcetera and they arrived in Belgium and the second language they were learning was interestingly not English, but Dutch because you know Flemish actually Flemish which is spoken in the parts of Belgium that I am talking about. Now the idea is due to these kinds of things let us say education, occupation or immigration a lot of us learn a second language much later in life whereas, a lot of us learn a second language much earlier in life. Is the quality or the overall proficiency that one would attain in both

of these cases going to be different is and you have seen you know how things go in simultaneous versus sequential bilinguals.

There are a you know a bunch of changes that you already experience there is a bit of a delay when you are talking about sequential bilinguals for mastering their both of their you know mastering the phonology of both their languages and so on. But if we move further from there and if we try to see that overall how well does an individual end up picking up a second language or a third language later in life. So, this is basically what I am going to talk about today that is learning a second language late in life difficult and if it is difficult how is it difficult what are the you know characteristics of these difficulty and are people able to you know come over them and surmount them. So, that is the reason precisely why you know a bunch of researchers have studied the idea of acquisition effects for second language acquisition and you know they have discovered several interesting insights for the same. I will begin with a base study of Johnson and the Newport in 1989 who actually were looking for testing evidence for the critical period hypothesis for second language acquisition.

Remember we talked we have been talking about the critical period hypothesis in the previous lecture when you are talking mainly about the first language learners. But there can also be a similar version of this hypothesis for second language learning as well and there are two versions of this hypothesis that have some sort of a bearing on how will individual eventually fare when they pick up a second or a third language going forward. So, the two versions of these hypotheses are the exercise hypothesis and the maturational state hypothesis. The exercise hypothesis basically says that early in life humans have a superior capacity to acquire languages, but if this capacity is not exercised that is if the first language is not picked up very early and in a normal manner then what would happen is because of this delay in first language learning they will also have you know impoverished second language learning later in life as well. This is what is called the exercise hypothesis.

The second version of this hypothesis is referred to as the maturational state hypothesis where it is proposed that early in life humans have a superior capacity for acquiring languages, and this capability keeps on declining with the maturation of the brain. So, here even if you have learned the first language earlier or later does not really matter the ability to pick up a language later in life is anyways on the decline and for older people it will basically mean that learning a second or a third language at a you know at a older age is certainly going to be very very difficult. Now, if you look at both the versions of this critical period hypothesis you will find that they actually make different predictions for second language learning. More specifically while the exercise hypothesis predicts that if an individual has acquired the first language early in age the ability to pick up a

second language sort of stays throughout the life and they can at any point in time they want pick up a second or a third or a fourth language because their you know ability to learn language has been exercised while they were learning the first language. Now, the maturation state hypothesis says something different what does it say? It says that despite or regardless of the fact whether an individual has picked up a first language or not very early in age the ability is on the decline.

As I was saying you know while closing the last slide the language learning capacity is typically on the decline and will continue to decline with age as a consequences of the maturation changes in the brain all right. So, these are the two types of or the two variations of the critical period hypothesis that were considered by Johnson and Newport 1989 when they were describing their when they were designing their study. So, they reasoned that in order to prove the maturation state hypothesis they would need to provide evidence that the ability to learn a language diminishes with age decreases over time and there is also a discontinuity you could predict that would happen as a result of the ending of the maturation period of the brain. So, for example, once the brain is matured the there should be a steep drop or let us say a flattened sort of a plateau kind of a thing in the language learning ability of a person. Once the maturation is complete then there should be no more increases in the ability to learn language is what we are saying.

So, they tested these ideas when they were chose to when they were examining L2 speakers knowledge of English morphology and syntax you know different aspects of morphology and syntax like word order, tense information, plural information, determiners, uses of auxiliaries and prepositions etc were test across 276 items which were you know spoken and recorded in audible manner. There were 46 participants in this study some were Chinese, some were native Korean speakers who had migrated to the United States between the ages of 3 to 39. So, you can see that there is a huge variation between this between their coming to the United States which sort of provides us with a nice spread of different times of age of acquisition or different types of being exposed to English and we are testing them for English. So, basically it means that okay somebody who arrived to the US at 5 years of age versus 35 years of age will obviously have qualitative differences in the way they have learned language. They also included only L2 speakers as the you know baseline for baseline comparisons and some you know some of them who had obtained a university degree and had been immersed in English for at least 5 years you know basically just to control that all the participants had reached their eventual final stage of L2 proficiency.

Now, this is interesting because you can see that some of these individuals have you know may have arrived earlier in their 3 to 39 period, some of them would have arrived later in their 3 to 39 period. So, in some sense there is not a uniform time available to

them, but the researchers are actually using this criteria to in some sense limit that okay in their assumption or in their study everybody has had enough time to reach the final stage of their English proficiency because we are testing for English, alright. So, the experimental task involved grammatical judgment for each of the 20, 276 in spoken English sentences presented by means of an audio tape and they basically had to tell whether each of these sentences are grammatical or ungrammatical that is supposed to be the test of a individual's proficiency in language. Remember I was talking about the fact earlier that in some cases people use you know self rated tests of language proficiency, but here we are using a more objective method that okay out of these 276 how many of these sentences you can correctly judge to be grammatical versus ungrammatical. So, the results actually showed a very strong relationship between the age of arrival in the US and their grammatical knowledge you can see it is a very you know it is a significant and a very high correlation of minus 0. 77 wherein it is clear that people who arrived earlier to the United States early in their life basically if they would have arrived 3, 4, 5, 6 years of age they would be performing much better as opposed to people who have arrived let us say 34, 35, 36 and so on. More specifically if you zoom into these results and we sort of discuss it in more detail you would find that the best performance in this task was shown by the people who had the earliest age of arrivals let us say between the ages of 3 and 7 and these people's performance were very similar to the performance of the native English speaking group who had been exposed to English for a longer time. Also interestingly the performance of people who are you know in these older age groups 8 to 11, 11 to 15 and 17 to 39 years of age actually performed much worse than to the native speakers. So, in some sense the suggestion is that people who have arrived after their critical period has passed have not been able to attain native like proficiency of L2 native like proficiency in English. These results if you see on the face of it do support the idea of a critical period.

Now, moving on to the second part whether and how brain maturation impacts language learning basically what Johnson and Newport did was they divided their participants into two main groups one from 3 to 15 years of age and the other from 17 to 39 years of age. The idea is that between 3 to 15 years of age the brain maturation is still going on by 17 to 39 years of age the brain maturation is completed and basically now if you do a comparison you will also see the effect of brain maturation or maturation state hypothesis in these people. Now, did they find the former group the earlier arrivals those who you know fall between 3 to 15 years of age show a much higher negative correlation of 0.87 than the latter group of you know people arriving between 17 to 39 years of age of just minus 0.16 which is in some sense interesting, but it also tells us that it is very very important time at which they arrive to the United States was a very very significant factor in their eventual proficiency of learning English.

Also an interesting result here was that there was much lower variance in the first group as opposed to the second group. So, they were people all of the people let us say out of the 46 let us say 25 people fell in the first group they were all very coherent they were all you know lying very near to each other in their grammatical judgment performance as opposed to the older individuals or the older group which had a lot of variation and we will discuss where these variations might be coming from. Based on these two or three findings the authors actually deduced that their results supported the maturational state hypothesis basically saying that people you know do not have the best of the capability to learn a language after the maturational period of the brain has finished. Now, let us look at this in a bit more detail because there were a bunch of studies which followed up Johnson and Newport study and these studies actually revealed newer insights into this process they looked at this both of them Birdsong and Mollis 2001 and Dekeyser 2000. Both of them sort of created you know replications of Johnson and Newport study, but actually ended up with very different insights let us dive in and look at this in more detail.

So, Dekeyser on examining L2 English speakers with you know whose first language was Hungarian concluded that his data actually agreed with the findings of the original study and in that sense was also in support of the maturational state hypothesis. However, in contrast data from Birdsong and Mollis who tested their native speakers of Spanish pointed out the discrepancies between their findings and that of Johnson and Newport's findings and in that sense they suggested that there could be other factors other than this bounded period or bounded critical period that we are talking about that have consequences on the overall language learning abilities of individuals. Let us zoom in a little bit Dekeyser actually when they were designing their experiment noted three very important points about Johnson and Newport study what are those? Firstly in their study they kept the minimal length of residence of the participants in the US up to 10 years as opposed to 5 years in the previous study because they thought that you know if the minimum length of residence of these people were just 5 years it is not enough time for them to have reached the final stage of their English proficiency. So when they were tested they might still be undergoing the process of learning English and they were probably tested prematurely and given more time they would have reached the final peak. So as opposed to Johnson and Newport's 5 years Dekeyser actually kept a period of 10 years minimum residence period of 10 years in the US to give their participants ample time to have picked up the eventual final stage of English learning.

The second is in Johnson and Newport study the age of arrival has been confounded with the participants age at test taking. It is interesting because what could be implied if you look more closely at the results from Johnson and Newport one would say that some of these test takers were actually slightly older 35, 36, 37 when they were being tested

and that could have impacted their overall performance for example, in terms of slightly diminished attentional skills and you know slightly impoverished other senses that could have been the factors that are actually you know ending in their slightly poorer performance on grammaticality judgment and so on. Finally you know a differential ability to remain concentrated throughout this long test now 276 items is a real long test and for basically some of these people may not have been able to concentrate across the length of the test which is a long 276 items test and because they sort of they were they were lapses in concentration their performance would have been decreased. So Dekeyser basically addressed these things and introduced some vital changes in their paradigm while they were still replicating Johnson Newport study. They increased the minimal length of residence in the US from 5 to 10 years, they corrected for chronological age in the data analysis and they also reduced the test items from 276 to just 200 items.

Additionally they also administered a language learning aptitude test. Now remember I was having this discussion earlier when we just began this course in the first week that there are also factors other than biology and let us say you know normal functioning brain that could actually contribute to how eventually or how well or how proficiently a typical individual can master a language all right. So, that people have talked about things like the aptitude for learning a language as well and this is the kind of test that Dekeyser administered. They administered a language learning aptitude test to test whether the participant had any individual differences amongst them with respect to their language learning abilities. So, somebody who is not really motivated somebody who does not have the aptitude for learning a language irrespective of the time that they had arrived in the US will not be able to master English.

However, somebody who has just arrived, but has a very good aptitude in picking up a language may actually outperform these other person who has arrived at a much earlier time in their lives and so on. So, this they thought would be able to explain the large variability in the data on the second half of the data where we are talking about and evaluating the people who have arrived slightly later in the United States. Let us look at this further. Now, this basically derives from you know what is referred to as the fundamental difference hypothesis first forwarded by Blay and Vroman in 1988 which basically posits that while children are able to utilize an innate language learning mechanism aka Chomsky that allows them to have implicit and unconscious language learning, adult second language learners typically need to resort to explicit conscious learning strategies that sort of makes it easier to them or that sort of allows them to pick up a language ok. So, they typically are relying on their individual problem solving capabilities, their abilities to reflect on the structures of the target language and so on and so forth which would eventually decide how well they are finally able to learn the

language.

Individuals who would be good at these skills you know good at general problem solving capabilities, good at you know adopting the best strategy to learn and so on and will have higher you know verbal analytical skills will eventually pick up language more native language as opposed to individuals who are lower on these skills. Let us look at the results from decades in a bit more detail. In agreement with decades hypothesis individuals who actually you know had better verbal analytical skills amongst the later learners were actually able to compensate for the fact that they arrive late and you know their exposure to the second language happened later in life. These were those few late arrivals who would actually obtain you know very good scores on the grammaticality judgment task and though their scores are within the range of those observed from the early arrivals as well. Indeed if you look at it in more detail among the participants who arrived at the age of 17 or more the correlation between grammaticality judgment score and the verbal analytical score was a significant 0.

33. Again it is not very high, but it is something that explains a bunch of variance here. For the early arrivals before the age of 16 who arrived before the age of 16 actually it was it did not matter whether they possessed very good verbal analytical skills or not their correlation was certainly non significant of minuscule 0.07, but more importantly it tells us that higher verbal analytical skills typically come into play when we are consciously trying to learn a language which would happen if we are having this input much later in life as opposed to when we are sort of picking up language effortlessly nonchalantly because of let us say a species specific language specific language learning mechanism that we are endowed with that we are born with all right. Another interesting finding in the study was that when all the participants were grouped together the case are observed again a very strong negative correlation between the age of arrival and the grammaticality test score minus 0.63 which is very similar to minus 0.

77 that Johnson and Newport had got. Interestingly the correlation here was not significant if the partner if the participants were divided into two groups of those who arrived before 16 and after 16 so minus 0.26 and minus 0.04. So then here now you can see that this result that was being interpreted as being in support of the CPH critical period hypothesis is not as well replicated.

So the absence of this age effect in the group of early arrivals actually in some sense if you look at it constitutes a challenge to the critical period hypothesis as the maturational account of critical period hypothesis would predict finding this very strong negative correlation between the age of arrival and grammaticality judgment scores. This was not the case in Dekeyser's study. Also the hypothesis predicts that the occurrence of specific

discontinuities in the age function can be directly related to maturational change of the brain. So it predicts the mode Z kind of age function which you can see here. The hypothesis if you see typically predicts something like you know what you are seeing in figure A on the top which is the common view of the critical period hypothesis where you will have a heightened period of sensitivity closer to birth which sort of flat reaches it peaks flattens out and then starts declining as the maturational is getting completed.

The stretch Z function basically refers to the ultimate performance the age of acquisition you know to ultimate performance of language learning which is also you know as predicted by the critical period hypothesis. Now this if you look at the critical period hypothesis in this way it basically tells us that you know at some point you know at some early point in life or maybe just soon after birth humans actually have this increased sensitivity to linguistic input that takes a very small amount to reach the peak. It is a very steep curve if you see the first part on the top figure and then it is reach reaches it peak and after some time it starts declining gradually and then flattens out till after the brain maturation is completed. As per this version of this hypothesis if the learner were immersed in this L2 environment within that first period or in the full period of the highest sensitivity native like efficiency can be obtained. However, if acquisition starts slightly later and coincides only in the second part of the peak sensitivity continuing into the stage where sensitivities started to already decline.

Remember I am talking about the peak part and the decline part you know 2 and 3 in on the top figure or it only starts somewhere in the middle phases native like performance will be hard to achieve. So to conclude the critical period hypothesis predicts you know a very specific kind of age function that includes two discontinuities as visualized in you know this figure 2.11 the bottom figure, but interestingly the cases data do not meet these requirements they are not talking they do not account for the or they the data are not able to account for the latter part all right. Given that the participants within that older group differ from one another to the extent in which they have been able to profit from the hypothesized period of high sensitivity. So, it is basically the data is not really being able to or let us say the theory is not being able to explain the observed data from decays experiment.

There are also studies which actually go a bit further in in some sense providing counter evidence to the critical period hypothesis as was presented by Johnson and Newport. One of the interesting studies in this regard was that of Birdsong and Malis and they basically replicated the same experiment by Johnson and Newport using typically the same paradigm, same materials, same stimuli 276 stimuli and so on and so forth. Only difference being was that here the individuals first language was Spanish whereas, in Johnson and Newport if you remember the first language was Chinese or Korean. So

what did the results of Birdsong and Malis show? They could obtain you know the first discontinuity in the in the age function. The shape of the age function as they have observed was was significantly different from the shape of the age function that is in some sense predicted by the you know critical period hypothesis.

You can see here you know the straight line it basically tells us that the first part of the hypothesis is there, but the second part is is not predicted. When you consider it in more when you look at this data more closely you would see that when you know you consider the participants of Birdsong and Malis together they have obtained the exactly the same correlation between you know arrival age and grammatical skills of minus 0.77. However, if you you know delve into a little bit more detail you discover that once you divide the participants into before 16 years of age on arrival and after 16 years of age on arrival the findings actually get reversed which is very interesting because there is a non significant 0. 24 minus 0.24 as opposed to minus 0.87 and you know significant minus 0.69 as opposed to minus 0.6, 0.16 in Johnson and Newport study. So you can see that here in this case the age of arrival is actually being able to predict the grammaticality judgment scores in the older individuals much better than in the earlier individuals which is interesting if you look at it.

So just sort of stepping back and looking at it Birdsong and Malis data actually deviated from those predicted by the hypothesis in three main aspects. First the earlier arrival showed little difference amongst them in terms of ultimate grammatical performance although among them they still differed greatly in the number of years you know their relative acquisition coincided with the period of this peak sensitivity that we are talking about. Secondly an effect of age of arrival was obvious in the group of late arrivals not in the early arrivals even though the L2 immersion of all these participants in this group had started after the closure of the critical period. So remember we are talking about 16 to 39 here the age of arrival is actually you know more coordinated with the grammatical judgment scores than with the earlier ones. Finally it does not seem like there is an end period or to this age related decline in the final performance of the late arrivals implying that the second disconnected continuity that the model predicts is missing in the observed data.

So based on these observations Birdsong and Molis reject the critical period hypothesis and they say that you know it is very difficult to produce evidence in favor of the critical period hypothesis. Now there are three studies I have talked about Johnson and Newport which confirm this data but two studies later which were Birdsong and Molis and Dekeyser actually do not confirm to the predictions of the critical period hypothesis. Another interesting finding from their study was that the incidence of near native like performance differs between the two studies. So the eventual near native like

performance that happens for Johnson and Newport's participants remember these were the people having Chinese and Korean and Birdsong and Molis's participants who were you know whose first language was Spanish is actually very different.

The peaks that they reach are very different. The Birdsong and Malis's participants actually reach a much higher peak as opposed to the peak reached by the Chinese and Korean participants. Why would that happen? And the researchers sort of zoomed in and looked at it and they basically figured that because of the cultural similarity between Spanish and English as opposed to both Chinese and Korean and English on the other hand because Spanish is closer to English and Chinese and Korean together are not this may have caused the difference between the peak performance of these individuals in these two studies. So basically you can see that the structural similarity between these languages or the typological distance as we sometime call it actually also have an effect on how well one is going to pick up or learn a second language. Further you know one of the studies such as one done by Hakuta and colleagues actually showed that final L2 proficiency also depended upon factors like educational level at the time of arrival. You know if you if people who are who arrived at a higher educational level actually or their educational level predicted their eventual L2 learning performance much more than their age of being exposed to L2.

In some sense it says that while critical period may be an interesting you know concept to follow there are also other factors like verbal analytical skills or the overall educational level that actually predicts how well people will eventually learn a given language. There are also other sources of counter evidence to the critical period hypothesis. There would be instances of native like ultimate attainment in late L2 learners. You know if people are super motivated if it depends if their life depends on it if their job depends upon it people who take asylum in different countries people who immigrate to foreign countries they eventually pick up language. I mean you you look around and you will find that they do pick up language very very native like or very good levels of language at a second order you know even though they have arrived very late in that sense.

And this would certainly go very counter to what we have been talking about under the critical period hypothesis. Also a lot of people who are early L2 learners cannot reach native like performance because let us say their aptitudes vary the motivations vary there are other factors and so on and so forth. In conclusion if you look at all of this you would see that while critical period hypothesis does predict this kind of discontinuities in age functions these these age discontinuities do not really materialize in the observed data. We see that only Johnson and Newport's data sort of supported the hypothesis, but not of the other studies that we discover after that. Also the CPH falsely predicts that after many years of using the L2 all early learners, but no late learners will achieve

native like proficiency, but we have seen instances that late learners of L2 also sometimes can reach native like proficiency.

Finally one should sort of consider as a parting note that if there is a period of special sensitivity to linguistic stimulation during let us say some bounded period early in life 3 years, 7 years, 12 years maybe. Other factors like educational levels and structural similarity between the two languages should not matter, but we have seen like in Hakuta study, Hakuta and colleagues study that it does matter. So, in some sense it seems if you look at all of this evidence holistically the critical period hypothesis or this bounded period of heightened sensitivity is not a necessary condition for individuals to learn a second or a third language later in life. Alright and it is based on these kind of you know assumptions or based on these kind of observations Singleton actually opines that the critical period hypothesis cannot be plausibly regarded as a scientific hypothesis either in the strict Popperian sense because it cannot be falsified you know as I said earlier you cannot in controlled conditions keep somebody devoid of language input for any length of time and then see study carefully the effects of such a deprivation. Also whatever you know experiments that are being done and a lot of data that is come out with respect to the CPH does not clearly confirm or support this hypothesis as well alright.

So, good news for people who want to learn a second or third language later in life there is certainly seems to be chance that you can do it if you are adequately motivated and so on and a little bit of a drubbing for you know the biological theories when we talk about that know the critical period hypothesis is the bounding factor as to how or how much an individual can learn a second or third language. So, on that note I end the lecture of today I will start from the next lecture talking about a different aspect of language bilingualism and multilingualism which is more about speech production alright. Thank you.