**Psychology of Bilingualism and Multilingualism**
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**Week - 04**
**Lecture – 16**

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 this week we are continuing to talk about speech production in bi and multilinguals.  Now an interesting question pursued in bilingual speech production research has been whether  it is language selective or language non-selective.  Remember that bilinguals have two known languages and it is a puzzle as to how they can speak  in one of the two languages without an interruption from the other language.

We have seen in the model of Leveld that the chronology of speech production requires basically involves a number of steps starting from conceptual preparation to lexical selection  to selection of lemmas to morphological encoding, phonological encoding and so on.  Now the fact of the matter that we are going to discuss in today's lecture is whether  some or all of these processes are carried out for both the languages of the bilinguals.  Say for example whether at the level of lexical selection the speech production process is  language non-selective basically meaning whether lemmas from both the languages will be selected  or let us say whether in the instances of grammatical or phonological encoding the selection  process is non-selective which basically implies that words from both these languages are going  to be grammatically encoded and phonologically encoded.  Alternatively we are also going to delve deeper into the fact that whether the activation  is there but selection is only done for the specific language.

So these are some of the things that we are going to talk about in these next lecture.  Coming back to the question whether bilingual speech production is language selective or non-selective which basically means that whether the speakers activate the steps of speech  production that we saw earlier in a language selective way or in a way that the steps of  speech production take place for both of the bilingual languages.  Now a bunch of studies have used the experimental paradigm called the picture word interference paradigm to investigate this.  In this paradigm typically a picture is accompanied by a distractor word and the influence of  the distractor on the picture naming performance is actually measured.  The idea is that there should be some kind of a relationship between the picture and  the distractor that would in some sense moderate the performance of the participants                naming                                the                 picture.

Let us look at this. Here you can see this picture is drawn from Sa-Leite and colleagues in 2023 paper. You can see that on one hand there is a picture of a table with a word chair on it which is a semantic relative of the word table. So it is a semantic relationship between the picture and the distractor word whereas on the other hand the picture of a table has the word maple written over it where you can see that there is a phonological relationship between the word table and the word maple. So here the word maple is a phonological distractor whereas in the earlier case the word chair is a semantic distractor.

Based on whether you are using a phonological or a semantic distractor the naming performance times of participants will vary and that should be able to tell us something about how the process of chronology of speech production is taking place. However this gets even more tricky when we are talking about bilinguals because the word chair could be semantically related to the word table in English but I can use another word which is semantically related to the word table but its translational equivalent let us say in Dutch or Hindi. I could have written maize over it for example while making it Hindi. Now in a study by Ehri and Ryan in 1980 it was demonstrated that English Spanish bilinguals actually named pictures more slowly in both of their languages if a word from the non-target language was imposed over the picture as compared to when a neutral distractor was imposed which basically means that some activation from the non-target language is capable of interfering with picture naming times in the target language. Similarly in another study by Magiste and colleagues with German Swedish bilinguals with having various proficiency levels in Swedish the same interference effect was observed.

However in this study a curious fact was that the size of the interference effect actually depended upon the participants relative proficiency in the two languages. The stronger the non-target language the larger the interference effect which sort of makes sense. Suppose I am trying to you know name a picture in English but my stronger and more dominant language is Hindi you could expect more interference from the word if you know from the non-target language if it is superimposed on a picture. Just like I was saying if I were to write maize over you know this picture maize being my non-target language and you know my dominant language as well will probably cause more interference in me speaking out the name table. Now let us look at this a bit more closely.

Let us try and find out the locus of interference in these picture word interference studies. Now broadly if you see in the monolingual version of this task the researchers have looked to investigate the various processes of lemma selection and phonological encoding by manipulating the type of distractive words that are presented with the picture. As I said you could use semantic distractors, phonological distractors, maybe

you know distractors who are relatives, neighbourhoods and so on and so forth. Also what they do is that they vary the time elapsed between the presentation of the picture and the distractive word. They could both be presented simultaneously which would be the zero SOA condition.

The picture could be the distractor could be presented earlier than the picture which would be a negative SOA condition and the distractor could be presented after the picture which would be a positive SOA condition. You have seen this picture before so I guess you are understanding what I am trying to say. Now across various studies that have employed this picture word interference paradigm both visual and auditory distractors have been used. The main dependent variable being the latency or the time of picture naming and the time between the onset and which is basically the time between the onset of the picture and the onset of the response of the participant. Overall 5 different types of distractors have typically been used in the picture word interference paradigm.

Now let us look at the different types of distractors. So for example, I am showing a picture of a table and I am writing the word table on that so it will be the identical condition. I could basically write a word semantically related to the picture just like we saw. I have drawn a picture of a table and written chair over it. A word phonologically related to the picture basically I wrote I draw a table and I wrote maple over it which is which shares you know the phonological code with the word table or I could basically use a word or distract a word which is phonologically related to a word that is a semantic relative of the picture.

So for example, this would be a phonological semantic condition. Say for example, if I draw a picture of a table and I write the word raise, now raise is phonologically similar to the translational equivalent maze alright and finally that the you know the type of distractor that is being used as control in most studies is the unrelated picture. Say for example, I could use something like a present when I am writing when I am showing the picture of a table. Typically semantic distractors have been shown to slow down the picture naming response whereas phonologically related distractors have been shown to facilitate the naming response in these studies. The former effect has been attributed to the competition between the lemmas of both the picture and the word and basically which is supposed to or which probably slows down the effect and it is basically and the amount of this interference is moderated by the difference in time of the presentation and the distractor.

Typically it is best when the distractor precedes the picture that is in the negative S-Y condition. The latter that is the phonological facilitation effect has been attributed to the boosted activation of phonological elements that need to be coded for naming. Also

these facilitatory effects were obtained best when picture and distractors were presented either simultaneously or when the picture was presented slightly earlier than the distractor. You can see in this figure from De Groot's book that for semantic interference you will need to present the distractor word slightly earlier than the picture so that the meaning encoding of that distractor happens slightly earlier and it coincides with the meaning encoding of the picture. Similarly for phonological facilitation you need to present the distractor slightly later so that the phonological encoding of the distractor coincides with the phonological encoding of the picture.

So just to sort of repeat this for you, the locus of these effects needs to be understood in the context of the steps involved in picture naming or in word reading as in distractor naming. For instance picture naming starts with the perceptual analysis of the picture followed by the activation of the conceptual nodes and then follows to phonological encoding and so on whereas the distractor word naming basically starts from phonological encoding and then moves upwards towards conceptual activation of nodes. So it is basically two effects which are moving in opposite directions, alright. So the point at which these two things coincide would decide the nature of the interference effect. For semantic interference that is why as I said the distractors will need to be presented slightly earlier so that their conceptual activation coincides with the conceptual activation of the picture and for phonological facilitation the distractor will need to be presented slightly later so that its phonological encoding which is the first stage here activates with almost the last stage of the picture's encoding which is its phonological encoding.

Now let us look at some bilingual studies in the picture word interference task. One of the key studies conducted by Hermans and colleagues in 1998 who used the distractor methodology to examine whether bilingual word production is in fact language nonselective. Basically they sought to investigate whether if bilinguals are asked to name pictures in their L2 the representations of the translational equivalent in their L1 also become activated or not. Say for example you are asking me to name a bunch of fruits in English do their Hindi names are also, do their Hindi names also get activated while I am trying to name these pictures in L2 that is precisely what their investigation question is. Further if these are activated suppose the Hindi names are getting activated the authors were also interested to investigate whether the activation of these translational equivalents stops just at the level of lemma selection or it goes all the way down to phonological encoding.

The participants of Herman's and colleagues study were Dutch English bilinguals highly proficient in English although their dominant language was Dutch. Each picture was to be named in L2 English let us say for example a mountain and they were presented with

an auditory distractor which could be one of four types. It could be valley which is a semantic relative to the word mountain, it could be mouth which is a phonological relative to the word mountain, it could be a phonological relative of the Dutch translation. So for example the mountain in Dutch is referred to as berg and basically you can have the word bench which is a phonological relative to the word berg and completely unrelated to the picture name for example present. Now they conducted two experiments with varying SOS for example in one of these experiments distractors preceded the onset of the picture by 300 milliseconds so it is a negative SOA condition or 150 milliseconds which is a negative SOA condition again with 150 milliseconds or the distractor in the picture coincided with the distractor coincided with the onset of the picture so SOA is 0 or the distractor followed the picture which is SOA plus 150.

So there are four conditions SOA minus 300, SOA minus 150, SOA is 0 and SOA plus 150. Now an important point the critical difference between the two experiments was that in one of these experiments all of these distractors were actually English words so the pictures are to be named in English and the distractors are also English words whereas in the other experiment the distractors were all Dutch words. Now the pictures have to be named in English but the distractors that are being used are Dutch words. This way the second experiment could actually provide us a chance to test the hypothesis about whether the semantic cohort activated by the picture actually includes the Dutch translational equivalence and also semantic neighbours of the Dutch translation equivalence.                Now      let      us      look      at      the      results.

The experiments with English distractors showed a facilitation effect of the phonological distractors. So for example the word mouth was you know with the presence of the word mouth the picture was named slightly faster in all four SOA conditions suggesting that the phonological encoding of the pictures name already starts during an early stage of lexical access. The semantic distractors as expected showed an inhibitory effect except in the condition where the distractors followed the picture. Again remember this is in line with what we were discussing earlier. Now interestingly when phonological distractors phonological translational distractors were used for example bench for Berg it slowed down picture naming much like the semantic distraction but only when the distractor presentation coincided with the picture.

So at SOA 0 implying that there is at least some degree of co-activation of the pictures L1 names happening. Remember these are Dutch English bilinguals. Now the authors interpreted these results as the evidence of the fact that language you know production in bilinguals is non-selective and this effect according to these guys could have been more robust but was slightly smaller because there are pronunciation differences between Dutch and English. For example Berg is pronounced very differently than bench and

therefore maybe not so much  phonological overlap was there.  So since they had to run the second experiment with only Dutch words and as Dutch words shared  you know Dutch phonological translation certainly shared more phonology with the Dutch names of                                    the                                    pictures.

 Let us see what really happens.  So in the second experiment phonological distractors exerted an inhibitory effect except in the  SOA plus 150 condition.  Interestingly this time the effect of the phonological distractors disappeared in three   of the four SOA conditions.  This probably was because now the overlap between the Dutch phonological distractors  and the pictures to be named in English was even lower and therefore the phonological  facilitation could not really play a part.  However in this experiment as well the effect of the semantic distractor was found providing  evidence that the semantic cohort activated by the picture also included lemmas from the  participants L1 which is the                translational                equivalence                in                Dutch.

 So it tells us basically now if you look at these experiments it tells us basically that  at least when you are engaging in picture naming and when you are sort of accessing  the conceptual nodes related to that picture.  Suppose I am showing you the picture of a pen when you are trying to name this picture  maybe its translational equivalence or its name in the first language are also getting  activated to a certain degree.  So when I am looking at the pen the word column is also probably getting primed in my head  and it has become available for selection.  Now considering these results Herman and colleagues discussed three types of production models.  So remember we did the levels model in one of the previous lectures and we also talked  about the fact that levels model is a discrete two stage  model  where  every  step  sort  of  finishes    before  the  next  step  can  start.

 We  also  very  carefully  talked  about  spreading  activation  model  where  the  flow  of information  is in a cascaded way.  So for example when activation starts at the top some activation does trickle down towards  the lower steps as well.  So for example when you are  actually  doing  the  lemma  selection  for  a  particular  concept    grammatical  and phonological encoding of that concept has already started to a certain extent  in the lower stages.  Now looking at the results of that we have seen so far Hermans and colleagues basically  talked to basically tried to reconcile these results with three types of models the discrete  two stage models, the unidirectional cascade models or the interactive activation type  models.  Interestingly the authors concluded that the results of the study did not fit the  predictions    of  any  of  these  you  know  production  models  completely.

 However the results did indicate as I was saying that at some point during picture naming  in the weaker L2 the pictures translational equivalent in the L1 is also activated alright  which basically implies or what we can take from here is that bilingual word

production is certainly language non-selective although the evidence could not really tease apart whether the system is non-selective at the level of lemma selection or at the level of phonological encoding. So while we have some sense or the fact that when you are trying to speak in your first in your second language may be parallels in the second language parallels in the first language are also activated but we are not very sure that at what stage this is happening. Is this happening at the level of word selection basically at the top stages of levels model or is it having at the level of morphological encoding or is it happening at the level of phonological encoding and therefore we you know so need to really dive a little bit deeper into these studies and see for ourselves what is the evidence look like. An interesting caveat from Herman's and colleagues study was the fact that words from the non-target language were also competing with lexical notes from the target language during preparation for production. Now contrary to this proposal Costa and colleagues have actually argued that while there may be activation in the non-target language system, but not all of it will actually compete for selection for production.

So basically what they are saying is that it may be the case that the words from the non-target language are activated which is alright, but they are saying that it is not necessary that these are also you know competing for selection for production. They may be activated they may be highly available for us, but they do not compete in the same way such as the you know competitors within the target language will compete. Remember every word has semantically related words in their own language, they have synonyms etc and all of them certainly compete for production when you are doing you know when you are basically at the level of lexical selection alright. So Costa and colleagues basically propose that the selection process for lemmas may be language selective and that only activated words from the target language compete for selection and further production ok. So this is a slightly nuanced sort of a stance on this particular process.

The idea as I said that they put forward is that although elements from both the target and the non-target language can get activated during word production. Suppose if I am showing you a picture I have given you a topic, but only lexical item from this target language. Say for example, while I want to name this picture in English and that is the instruction, for production only competitors from English will compete although that competitors from Hindi may still be active. So the production model that you know is put forward by Cauce and colleagues remember that they sort of shunned away the concept of lemmas basically postulates discrete semantic notes, lexical notes and sub-lexical notes. So lexical notes which basically contain the phonological code and sub-lexical notes basically the components of sounds.

Now wherein each lexical note represents a word's complete phonological form, so that total phonological word and each sub-lexical note represents a part of the word's

phonology. Say for example, in case of the word cat, lexical note will represent the whole word cat, but the sub-lexical note may represent ka, aa or ta. Now in such a model what really happens is once there is activation at the semantic level it reaches down to the phonological notes wherein the whole words are there and then further down to sub-lexical notes where each of the sounds are being assembled. So ka, aa, and ta are getting assembled. This is precisely you can see here, this is how this model is happening.

So basically what you can do is you can have semantic notes, you have lexical notes and you have say for example sub-lexical notes which are also getting activation. Remember that there is a slight difference between these two here because these two words are cognates, the sub-lexical notes are common to both these words. Here because these are non-cognates only one of the sounds from you know the target language is common to the non-target language. Now to delve slightly deeper into this, Kosta and colleagues carried out a study employing the word picture word interference task as we have been talking about. In their study the participants were highly proficient Catalan Spanish bilinguals who had to name the pictures presented in their L1 which was Catalan.

The distractors in this study were presented visually rather than orally implying that the visual distractor will first activate phonology only indirectly because it will need to go through the semantic note and then come to the phonology part and you know they activated which are activated orthographical, lexical and sub-lexical notes. Consequently the SOA range suitable to test the above theoretical distinction between the discrete two stage model and the unidirectional cascade mode of speech should be slightly different between studies that present visual versus oral distractors. Remember when you are presenting visual distractors let us say you are you know presenting words they need to be converted to sounds and then to meaning whereas if you are just presenting oral distractors they directly go to the meaning. So there is one extra step when you are presenting visual distractors than when you are presenting oral distractors which basically means that the SOAs that you are sort of manipulating negative or positive or coincided will be slightly different from studies that will use visual as well as auditory distractors just repeating it so that it is clear. Now a new feature of this study from Costa and colleagues was that it added a new type of distractor condition that is the identity condition.

Now what is the identity condition? Remember that we are talking about if the picture is of a table and I am writing the word table that is the identity condition that works best in the monolingual condition. What they also had in instance was that say for example in Catalan and Spanish the Catalan word for the picture table is taula whereas the Spanish word is mesa. So in one condition they can have the picture of a table and the Catalan

word taula and in another condition they could have the picture of the table and the Spanish word mesa. Now the researchers sort of began testing this assumption that the most highly activated lexical node is selected from the set of activated lexical nodes in the target language and that the ease with which a target node is selected depends upon the level of activation among the non-target competitors. So however active the non-target competitors is the more difficult it will be to select the activated target node.

Now Costa and colleagues actually hypothesize that for bilinguals activation at the semantic levels of representation may activate lexical nodes in both the languages. Remember we have seen evidence to this effect in the last you know few minutes but only the activated lexical nodes of the target language may be considered for selection which is what these guys have been saying. So what did the authors do? They divided the question of whether bilingual word production is language selective or language non-selective into two parts. First do or not activated semantic nodes transmit their activation to lexical nodes in both languages. So you could have an answer as to yes or no and if they do, do the activated lexical nodes of both languages compete for selection or does the selection only consider the activated lexical nodes of the target language.

So this way you have two very discrete questions and we will see the evidence in favor of either. Now in this context if you note the identity condition specially when you are presenting the you know picture of the word table and presenting the Spanish mesa although the participants have to name this in Cattle and Taula basically may provide us a way to answer both these questions okay. Let us look in detail. Now for instance if the participants are able to switch off the non-target language completely no effect of presenting a distractor in the non-target language should emerge alright. This should happen if picture naming time in the identity condition and in an unrelated you know control condition were the same in identity when cross language thing is presented.

On the other hand a difference in picture naming times between the identity condition when a non-target thing is there, non-target language word is used and an unrelated condition would suggest that there is a degree of co-activation of the lexical nodes in the non-target language. Moreover if such a difference actually exists the direction of the effect would reveal the nature of the selection process alright. So for example the language specific non-specific selection hypothesis would predict slightly longer times in the cross language identity condition than in the unrelated condition whereas the language specific selection hypothesis would predict slightly shorter time in the identity condition than in this unrelated condition. What really turned out? The same can be demonstrated with reference to the figure.

Let us look at this. This is basically what I was talking about. So for example if

presented the picture of the word table and you basically put the word MESA and you put the word Taula. Now the thing is if you are doing language non-specific lexical selection then both the lexical nodes of Taula and mesa will get activated but if you are doing only language specific selection then the word Taula will only get activated. So again sort of just describing it for ease. If the lexical node activation is language selective a picture of table will first activate the corresponding semantic nodes and from there the lexical node representing the cattle and Taula but not the lexical node you know representing the Spanish MESA will get activated.

In a language selective activation account therefore the cross language identity distractor MESA may activate the corresponding semantic nodes but it would not be transmitted to down to its phonological nodes. Alternatively it may also happen that the processing of the cross language identity distractor is totally blocked because the system is moving forward in a language selective manner. If on the other hand lexical node activation is language non-selective then the both the picture and the cross language identity distractor MESA will first activate their corresponding semantic nodes and from there the lexical nodes representing both Taula and MESA will get activated and both of their on both of them will send down their activation to the phonological modes. However, if the selection process is language non-selective both these highly activated nodes will be considered for selection. Non-target MESA will act as a strong competitor in the selection process and it will slow down the naming response.

In contrast if the selection mechanism is language selective that is only if it is considering activated lexical nodes in Catalan it will not suffer from delay because of the fact that the Spanish MESA is also highly activated. Let us look at the results. The data from their study actually agreed with the prediction that assumes language non-selective activation followed by language non-selective activation and language selective selection. Picture naming times were shorter in the cross language identity condition than in the unrelated control condition. The fact that no null effect of the distractor type was obtained suggests that lexical activation is language non-selective, but the fact that they observed a facilitatory effect and not inhibitory is consistent with the idea that language selection is lexical selection is language selective.

So basically what we are trying to say here just to sort of you know soften this whole thing out is that when you are looking at a picture of let us say a table or a chair or another fruit what you are doing is you are activating the corresponding semantic nodes in let us say your target language English, but also semantic nodes in the target in the non-target language Hindi. But as you are going down and you are selecting basically you are doing lexical selection for production then even though the nodes in Hindi are activated you are actually considering for selection only the activated nodes from

English. So for example if there is a word table maybe its competitive semantic related nodes are chair you know and other types of furniture. But it will not compete with the corresponding semantic nodes from the non-target language that is Hindi. So indeed even a strongly activated lexical node in the non-target language in their study does not slow down processing and only the activated lexical nodes in the target language were considered for selection.

That is all that I wanted to talk to you about with respect to you know the picture word indifference task and what we have learned from this you know lecture is the simple fact that when we are starting to name things bilingual language production is you know non-selective in the sense that there is certainly activation in both the target and the non-target language. However when we are moving ahead with lexical selection and phonological encoding more it is highly probable that only the words from the target language are considered for further selection. Thank you I will see you in the next Session.