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 at IIT Kanpur. In this lecture I will be talking to you about the correlation of bilingualism and multilingualism with memory. We are going to discuss what are the different configurations of memory that have been thought about with respect to bilinguals given that they have two fully developed systems of language, two fully developed lexicons and words of two languages which are coexisting within the same person. Now one of the very crucial mental faculties that is implicated in bilingualism is memory.

More specifically since bilingual and multilinguals have two fully developed lexical systems it is certainly interesting to know as to how they would organize the word forms and word meaning information in their memory. Also questions could be asked about how does retrieval work given that for each concept they would have multiple candidates from within the same language and from across the languages as well. Now one of the first attempts at understanding language organization in bilinguals was made by Weinreich in 1953 where he makes the distinction, a very important you know theoretical distinction between two levels of representation in bilingual memory. The two important aspects in the description were the signifier or the mode of expression which denotes the word level or the lexical level and the signified which basically denotes the meaning or the semantic level representation of the concept denoted by a word.

For example if you look at the picture of an apple and if you look at the word apple, the word apple is the signifier and the concept of the apple is actually the signified. So the word apple signifies the concept of this fruit apple. Similarly, the word shape signifies the concept of this fruit shape. In bilinguals this is basically a very interesting mapping to see because there are two signifiers and one signified possible or say for example there are multiple signifiers possible and with a single signified. Now three types of bilingual representations were proposed in Weinreich system.

First is the coordinate system. The coordinate system, in the coordinate system the cognitive architecture for the two languages would be independent both at the signifier and signified levels. So there will be a signified and signified first language and there will

be signifier and signified for the second language and the definitions of the two words from the different languages would also be essentially deemed to be different and would represent meanings that are unique to the respective language. For instance, as a Hindi English bilingual the word pustak and book may mean different slightly different things to me and would be associated with different language specific information. On the other hand the compound system proposes a single or joint signified and two signifiers for the bilinguals two languages.

Thus for an Hindi English bilingual the concept of pustak and book the two signifiers will be linked together to the same signified that is the you know mental representation of a book. So this is another very interesting way of looking at how memory will be organized in bilinguals. On the other hand in a subordinate system what you would imagine is that in a bilinguals memory the words or the signifier from the L2 will be connected to the signifier from L1 and this signifier from L1 will actually be connected to the semantic conceptual representation. So technically for a word from signifier or a word from L2 to be able to reach the signified or the mental concept it will have to go through the L1. Basically you could think like you will have to constantly translate from your L2 into L1 in order to understand what that word means and in order to provide access to the semantic conceptual system.

Now in posing these distinctions Weinreich was the first to distinguish between lexical and conceptual levels of representation. However more importantly he actually postulates a memory structure where in L2 learners must progress through a series of stages before they become fully functional in their two languages. Interestingly as the bilingual gets more and more proficient in their two languages the organization of the memory would change progressively as well. For instance to become a fully functional bilingual L2 learners would first need to link every word of L2 to the translational equivalent of L1 and establish the relationship with the concept. So basically you need to start with a subordinate level to go to coordinate and compound level eventually as with increasing proficiency in L2 happens.

Now this interesting distinction that binary has made between the coordinate and compound bilinguals in the sense that this distinction incorporates the modifications of the bilinguals memory structure based on how and where the two languages of a bilingual technically you can see that the subordinate level is the slightly lower level or initial level of learning and L2 but coordinate and compound levels are two qualitatively different levels although technically they are serving the same function. For instance, if you look at the structure of the system whether it is a compound or a coordinate system it would actually depend upon the context of L2 acquisition. So what basically we are seeing is whether a bilingual will have a compound system of memory organization or a

coordinate system of memory organization it would basically depend upon where and what circumstances the L2 has been learned. Now as a person learning that say for example as a person who has learned that L1 which is Spanish let's say in Mexico and the L2 which is English in the United States would be likely to develop a more coordinate representation system where the mappings between signified and signified will be very different in Mexican and very different in English and these two systems will not really interact too much with each other. However the same organization can also arise in scenarios where the L1 is learned at home and the L2 is learned at school or at work and there again you can see that the signifier and signified are actually developing fairly independently of each other and they are not linked and therefore leading to a coordinate sort of a representation.

In other words when each of the different languages is learned in different places taught by different people under different circumstances these differences become the basis of the distinction between these the manner of the organization of memory. In contrast if the individual learns the two languages in a situation in which both languages are spoken simultaneously by the same people in the same context then the individual learning individual would be more prone to developing a compound structure because both these signifiers have actually been linked to each other as well as they have been linked to the signified. So learning an L2 through direct association or by associating every L2 word to L1 translation equivalent would actually give rise to this kind of memory configuration. Now looking at this theoretical distinction that has been made between the coordinate and compound bilinguals more closely let's look at the pros and cons of this kind of model. Firstly as a general model of bilingual memory this theory actually implies that during language learning bilinguals actually encode linguistic information in a context specific manner how am I learning this information where in what context I am learning this information and also where and how this information has to be used and therefore this information will actually be stored in a manner according to which it was learned.

So any differences or similarities in that exist during the learning process would reflect in the nature of the concepts themselves and would reflect in the organization of those concepts in the bilingual memory also. For example, abstract words and concepts that are more likely to inhibit to exhibit language specific characteristics with respect to their usage and overall meaning are typically encoded in a coordinate fashion. Say for example if you are learning the names of emotions etc in your first language you probably learn them independently of your second language without a lot of interaction between the two. Other words such as cognates which are common across the two languages and share orthographic semantic representation across the languages will be encoded in the semantic memory in a coordinate fashion regardless of when and where the learning process has taken place. So you can see the manner of learning or as well as the manner

of I mean the content of what you are learning decide how the eventual memory organization would actually shape apply.

Now in this context the coordinate and compound destruction could actually be useful when a bilingual memory configuration is described based on the degree of semantic overlap between words across languages. So when you are talking about languages which are very similar to each other say for example Dutch and Deutsch so you know the language that is spoken in German Germany versus the language that is spoken in Netherlands as well as you know parts of Belgium which is Flemish they have a lot of overlap between each other so if there is a lot of overlap amongst the words of each languages then you can basically you know expect a sort of a compound kind of an organizational memory because all of these words are automatically connected to each other. However, this model becomes slightly more difficult to defend as a general model of bilingualism because the you know it does not really talk to us a lot about how you know about how L2 is learned and organized especially in cases when the bilinguals could actually achieve higher proficiency levels in their L2 and then L2 actually becomes the dominant language. Now this could be the scenario that you know a lot of us would be going through because a bunch of us would have gone to English medium schools starting you know when we started school and eventually due to our place of work or our you know line of education the medium of education that we have been imparted with English somehow becomes the more dominant language as opposed to Hindi, Tamil, Telugu, Bangla and so on because more often than not we are speaking in English rather than in our first language. Now interestingly studies supporting this coordinate compound distinction that do not really provide a lot of evidence in this you know in support of the same may basically be telling us about the you know underlying differences in the nature of representations as well.

Let us look at this in more detail. So another way of looking at the compound coordinate bilingual distinction by shared was by hypothesizing shared versus separate memory organizations which actually has been a very influential view with respect to organization of bilingual memory. According to this view, bilinguals either organize their two languages into a single shared memory store or into two separate memory stores where each of these languages are organized differently. You can remember some of the earlier models like the BIA where you had two separate language notes which actually were linked with words of that same language. Now typically experiments that have followed this line of inquiry have made participants learn bilingual word pairs such as house, casa or monolingual word pairs such as home, house which were and then when they were later tested either through a free recall method or a recognition task and in some cases they were also asked to generate these word associations.

Now experiments that actually demonstrated language differences during retrieval were taken as an evidence for the two memory support system, two memory organization system whereas failure to remember was taken as an evidence or failure to remember these language pairs was taken as an evidence supporting the one memory system because if there is one memory the two spaces would sort of mix with each other and will be more difficult to recall whereas if they are two separate memory system then house and casa will be actually they will not interfere with each other and remembered much easily. Interestingly both these models have you know the shared memory model and the separate memory system model have actually garnered some empirical support for themselves and if you can and if you sort of you know take a step back and see this this entire mixed results actually prompted the researcher to conclude that bilinguals neither had separate nor shared memory systems exclusively because information that was encoded in a very language specific way could also be accessed by both the language system. So in some sense it could be somewhere in the middle and typically what we have to assume is that information that is learned through either language system is still accessible through a common conceptual store to both the languages. Now since we are reviewing different types of you know possible memory organizations for bilinguals another one that we could talk about is basically you know the system where you're talking about bilinguals in terms of processes rather than the nature of representations. Now according to the processes view the mixed results that are obtained with respect to bilingual memory are primarily because initial studies fail to take into account the task demands.

Now the argument was that the evidence for one or two memory systems hypothesis actually depended upon the types of tasks that were employed in these studies. So if you take a particular kind of task you will see evidence for single memory system if you take another kind of task you will see memory evidence for a dual memory system or a shared memory system. Now for instance recall tasks that was sensitive to semantic and conceptual processes would yield results consistent with shared memory modeling and those that were sensitive to perceptual and lexical processes would yield results that favored the language specific or two memory model. Yeah so the dual coding model basically postulates the dual coding model basically postulates independent memory stores for bilingual different languages although these storage systems may be thought of as interconnected. So the L1 memory L1 verbal system would contain language information relative to L1 and the L2 verbal system would contain language information related to the L2.

These verbal systems are highly considered highly specialized for processing linguistic information and for generating speech. Now the model also makes a distinction between concrete and abstract logos that you saw in the figure just now and these abstract and you

know concrete logos can be thought of as lexical representations that derive their meaning from contextual connections to both verbal and non-verbal representations. Further although the verbal systems are relatively independent you see that you saw that they are linked by the V1 V2 connections which can be thought of as mapping of the translation equivalence in the two languages. Also according to this model the translation equivalence and synonyms are more likely to share a common image representation however shared images across the languages are more readily available for concrete than for abstract words. Remember I was talking to you about that you know abstract concepts emotional concepts etc are less translatable to each other and therefore they might not have you know direct correspondence between translation equivalence but for concrete objects say for example bottle and book etc the you know there is a higher possibility of having translation equivalence which are mapped together to the same signifier to the same signified.

Now both these verbal systems are supposed to be connected to the common image system which is highly specialized in processing spatial perceptual or visual information concerning non-verbal objects and events and for generating images for such events. So if you are basically seeing some new experiences this image system will able to generate images for this and these images or the mental representations that govern these images would resemble the perceived objects and scenes that they represent and they will be correspondingly mapped to the different verbal systems. Moving on while the image system can function independently it is also connected to both verbal systems we have V1i and V2i links and consequently the verbal and image systems are able to mutually influence each other. So the concrete logarithms from the L1 verbal system basically is able to influence the activation of the translation equivalent in the L2 verbal system and in other words you can see that the verbal and image systems may influence each other in such a way that verbal activity in either of the systems L1 or L2 can be influenced by the image system and can influence the image system vice versa. So this is how the conceptual organization of memory would work if you are seeing something and an image of that is generated the image can actually prompt verbal candidates in both L1 and L2 systems or it could happen that this prompts you know candidate in a neural system and which would in you know by virtue of its connection to the L2 system will prompt a candidate there as well.

So depending upon whether the bilingual structure is coordinate or compound or depending upon L1 and L2 language experiences the image system would actually contain language dependent images or language you know specific images across the two different verbal systems. Such an organization has actually been able to account for a bunch of findings in the bilingual experiments showing language dependent effects among bilinguals learning their L1 in their own home country and L2 in their second

one. For example, one of the effects that this bilingual dual coding approach accounts for is the bilingual concreteness effects. According to this concrete words are recalled or process faster than abstract words because of the virtue of inter inherently high imagery using which they can be encoded using the verbal and image systems for a total of two codes. So if I'm showing you a picture of an apple or a bottle or a box it has a very high imagery it can basically you know generate images very quickly in the image system and correspondingly generate verbal candidates from both the verbal systems very fast.

That is why the concreteness effect actually says that concrete words will be recalled faster in bilingual both languages as opposed to abstract words. Another finding that the bilingual dual coding theory can account for is the between language memory effect. Now in this finding what happens is memory retrieval for remembering is much better for conditions in which participants are asked to study bilingual word pairs for example love and amor in English and Spanish respectively than for learning conditions in which participants are asked to study these concepts in monolingual way say for example love and love and amor and amor separately. The model basically explains these effects on the basis of the fact that bilingual word pairs are very likely to benefit from multiple multiple codes say they will have a code in the L1 memory system L1 verbal system as well as the L2 verbal system and both of which will be mapped to the image code as well. So and monolingual word pairs are less likely to benefit from multiple codes because they will have a single code and therefore between language memory effect will be much more stronger and words that have you know words that have candidates in both verbal systems will be recalled faster and better.

Another effect that is you know very well explained by the you know bilingual dual coding approach is the picture superiority effect which can be explained on the basis that bilingual dual coding account that pictures are remembered much better than words as measured by consequently you know conceptually driven tasks they would generate very quickly generate the image images for both bilingual and multilingual and they would basically be able to reach to both more verbal systems or a single verbal system as per the demand and therefore pictures will be much easier to you know name as opposed to words. Now moving on from the bilingual dual coding approach let's look at some of the hierarchical models of bilingual memory. Now these models of bilingual memory actually assume a structure where in the bilinguals actually organize their languages in two in separate lexicons and one conceptual system that is shared by two languages. At the lexical level the bilinguals two lexicons representing each language are separate and they contain information specific to each language. However the conceptual system is shared and it contains general abstract information about the world that is language independent.

So two kinds of you know hierarchical models can be talked about. First is the word association model which proposes that a bilingual memory architecture wherein bilingual two languages interact at the lexical level based on translation equivalents. According to this model the bilinguals L2 is subordinated to the bilinguals L1 and everything needs to be first translated to into L1 and L1 is the connection that can only reach the conceptual store but not from L2. You can see the figure here you can see that this is the word association model where you can see every word from L2 needs to be first translated to L1 which has direct access to or direct connection to the conceptual or the semantic store. However there is another model which is the concept mediation model which you can which you can see that both L2 conceptual L2 lexical store and L1 lexical store have direct access to the conceptual store which as I said is language free.

So the concept mediation model actually assumes that the bilinguals two languages operate independently from each other much like in the coordinate distinction that we were talking about from Weinreich and more importantly both these lexicons are imagined as operating independently from each other but they are both connected to the conceptual memory store. So according to Potter and colleagues the native and non-native languages of a bilingual would operate independently so that words are not associated interlingually so translation equivalents are not connected to each other but instead words in each language are associated directly with the non-linguistic conceptual system which can sort of link the words from both languages if the signifier if the signified is one and there are two signifiers. An important aspect of these models is the assumption that the L2 lexicon would be much smaller than the L1 lexicon which is because a bilingual is supposed to know more words in their native language than in their second language. Again this is a reasonable assumption and therefore this model sort of makes a lot of sense. Now according to Potter and colleagues initial findings the experimental studies supported the concept mediation model as opposed to the word association model.

Potter and colleagues suggested that words of a second language were actually associated with words of a first language by a common conceptual store and not by direct association between vocabulary models because if you have to translate everything from L2 to L1 it would actually make the speed much slower and it is much easier for a top-down thing to happen that the words from L2 are connected to the conceptual store and then from the conceptual store they are connected to the candidates of L1. So other evidence actually suggested that the word association model described a bilingual structure corresponding to bilingual at very early stages of L2 learning wherein actually they associate every L2 word with a translation equivalent and in contrast the concept mediation model actually described a bilingual structure that corresponds to bilingual with high proficiencies in there both in their L1 and L2. So you can see why which of the

models is more plausible or you can basically say that one of the models is more plausible at an early stage of bilingual learning and the other model is more plausible at a later stage of bilingual learning. Now another more important finding that were demonstrated using bilinguals was that they translated faster from their L2 to L1 than from their L1 to L2. Now this translation asymmetry actually held for early and advanced bilinguals and neither the word association or the concept mediation model could completely account for this pattern of results.
So all in all, Potter's bilingual hierarchical models actually provide a relatively clear and sound theoretical alternative to the then prevalent single memory or two memory systems that were talked about you know in the dual coding approach and other approaches. However, the proposals that bilinguals organize memory at different levels that is lexical versus semantic was actually first conceived of by Weinreich and the critical distinction between the single and signified actually is very critical in some of these later models as well. Moreover, Potter's word association and concept mediation models are actually reminiscent of Weinreich's subordinate and compound bilingual models you know respectively which if you are following the lecture attentively you would have seen already the links between the two. Now whereas Potter's concept mediation model represents a logical and natural structure of bilingual memory representation, the compound bilingual structure actually reflects more of a learning strategy emphasizing the manner in which the bilingual two languages are learned. So there are these qualitative differences however although they seem very similar.

The word association, the subordinate bilingual structure on the other hand, hypothesize similar learning process and similar memory organization in early bilinguals. Now just to go in more detail, this model actually proposes that the configuration in which wherein the bilingual lexicons are biodextric connected as we saw the lexical link represented by the solid arrow from the L2 to L1 is stronger than the L1 to L2 link depicted by the broken line to reflect the way that L2 was learned because L2 was typically learned on top of L1 and not in the other way round. So following that during L2 acquisition bilinguals do associate initially every new learned word in their L2 with their equivalent word in L1 forming a lexical level association that remains active and strong throughout. Thus for a Spanish active native speaker where whose L2 is English translating into Spanish translating from Spanish to English would actually be much faster than translating from English to Spanish because every L2 word is mapped onto its L1 equivalent but not vice versa. Now according to the revised hierarchical model the bidirectional conceptual links between the lexicon and the conceptual store are there.

Now these strong conceptual links actually exist between the L1 lexicon and the conceptual store represented by the solid bidirectional arrows which we just saw. Now this relatively stronger connection actually denotes the special status of L1 or the native

language in associating word concepts because say if you are a sequential bilingual and we've talked about this in the past lectures as well you would have acquired your understanding of the word you have acquired so many concepts in the first language and it has happened much more solidly while the brain was maturing and so on and therefore these connections will be very solid and they will stay till the end as opposed to you know slightly relatively weaker connections in the L2 which you probably have acquired later if you are a sequential bilingual. However just to sort of highlight this might not be the case if you have learned both the languages as the same at the same time and you are a simultaneous early bilingual. Now that's basically what follows so the conceptual links between the L2 lexicon and the conceptual store are depicted by broken broken lines by directional arrows and therefore are supposed to be relatively weaker reflecting the bilingual inability to directly access the words you know access the conceptual store from the words from the L2. Again you basically don't have to get lost in a lot of jargon but just see how is a bilingual learning the two languages and how is their learning of the two languages going to impact the organization of their memory.

Now further access to the conceptual store from the L2 would actually be faster and more efficient via the L2-L1 link rather than from L2 to conceptual store link because this link slightly would appear weak and even for bilinguals with highly you know high proficiency levels in L2. In the original study Kroll's would actually tested Dutch English fluent bilinguals and asked them to perform backward and forward translations on categorize and random list. The authors actually sought to investigate whether translating categorized lists which involve conceptual processing would interfere with slow with or slow down forward translation as compared to backward translation which assumed to be unaffected by semantic variables. So basically you would have lists of fruits and animals and you know tools or you could have a random list which contains all these kind of things. If you are going through categorized list you are probably going through the conceptualized store and then doing the translation.

If you are going to the mix link then you are not being able to discover any this any discernible pattern and you will basically go through the L2-L1 link and then to the conceptual store. So this is basically what is happening. However, when you're doing backward translation it would be expected to be faster than forward translation in the randomized list condition. Now the results actually favored both these hypotheses. Forward translation was inhibit indeed influenced by the change in semantic context of the list and it took longer to translate the categorized list of words from L1 to L2 than to translate then to translate randomized list of words from L1 to L2 you know because of those links.

In contrast no difference in background translation backward translation was actually

found across the two lists. However, for the randomized word list condition backward translation was significantly faster than forward translation as predicted by the revised hierarchy model. So you can actually see that when the L2 words have to go through the conceptual store via the L1 they are actually faster than when they have to go through the directly to the conceptual store. Now the revised hierarchy model is also supported from experiments supporting reporting asymmetrical cross-language priming effects. Now what is cross-language priming? Cross-language priming is actually a phenomena in during which a word in the L1 say for example Guerra is responded to faster when it is preceded by a related word let's say you know through some association or semantic relation in the L2 piece for example or a direct translation which is translation priming in the L2 for example war then when it is preceded by a non-related or non-translational equivalent so cat or gato.

Now in general cross-language priming is actually obtained but only if L2 target is preceded by a related rather than an unrelated L1 prime in translation priming and cross-language priming. However, no cross-language priming is actually obtained if the critical prime is in the L2 and the target is in the L1 for translation priming and associate priming. So you would basically see that this asymmetric priming effect is observed and this basically suggests that accessing the L2 target from the L1 prime is conceptually mediated because it is achieved via the conceptual store which is the locus of semantic priming effect. In contrast accessing the L1 target from the L2 prime actually takes place only at the lexical level and therefore produces no significant cross-language priming. Notably contrary to the predicted asymmetries in the backward and forward translation these effects are differentially sensitive to the lexical and conceptually driven effects and some findings actually suggest that both translation directions involve conceptual access and are sensitive to semantic processing.

So there are these you know mixed explanations that are emerging. Similarly, reliable cross-language priming effects have also been observed for the L2 L1 to L2 and L2 to L1 language directions in the translation priming and cross-language associative priming. Also the hypothesis that during the earliest areas of L2 learning access to conceptual memory is primarily mediated by the strong lexical links between L2 and L1 lexicons due to the relatively weak conceptual links between you know has also been called into question. So again while we see that some initial studies support you know the postulation of the revised hierarchy model there are also results that call these you know predictions of the model into question. For example Altarriba and Mathis were able to show semantic interference effects for novice learners of an L2 and therefore concluded that both lexical and conceptual links are formed at the very beginning stages of learning a new language and it does not have to go through the L1 translation equivalents.

All in all the revised hierarchy model is relatively limited and lacks clear mechanisms to reflect the dynamic nature of the interaction between a bilingual two languages especially between you know especially with respect to you know dynamic tasks such as translation and priming etc. However, the revised hierarchy model's success has been in its simplicity and its ability to generate testable research hypotheses which have been you know employed and tested for several decades after the proposal of this model. So this is all that I wanted to talk to you about in this lecture I will see you in the next lecture with more information about the relationship between bilingualism and other cognitive functions. Thank you.