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 week I am talking to you about the issues of language control in bilinguals and multilinguals. Let's move ahead and discuss this in some more detail.

Now, as discussed in the previous lecture, one of the common perspectives about language control is the view that the two languages of a bilingual exist as separate subsets within a bilingual's memory system. Remember that I mentioned that all the words belonging to my first language are strongly interconnected with each other and cluster within the mental lexicon as a separate subset. Similarly, all the words from my L2 will be strongly interconnected together and will organize themselves as a cluster within the mental lexicon. So, my mental lexicon, given that I know two languages fluently, could consist of a subsystem that consists of Hindi words and items and another system that consists of English words and items.

Now, this is basically the assumption that some of the earliest literature, you know some of the earliest studies in bilingualism research has actually subscribed to. Early studies of either language switching which were conducted by say for example Kolers in 1968 or Macnamara in 1967 and several years later, basically bought into this idea of the fact that these things are, you know, the two languages exist as separate subsystems and they basically sought to investigate the same through their experiments. For instance, bilingual participants in these early language switching experiments were actually expected to move in and out of these language subsets based upon the instructions given by the experimenter. This shifting in and out of language subsets was supposed to be effortful in comparison to the task at hand for monolinguals where no such shifting is actually required. Now, see if a monolingual knows just one language, let's say I am a monolingual of Hindi or I am a monolingual of English, if I know just one language, I do not need to switch into, you know, Hindi or out of Hindi into English to express myself, you know, given the intention to speak.

However, as a bilingual, suppose you give me a task to speak, you know, five words or sentences in, let's say, about, you know, about any topic, let's say to describe my vacation in Hindi or English, I would basically need to switch, if I choose to speak in

Hindi, I need to basically switch into Hindi out of English that I am speaking in right now and basically continue to speak in English to express myself for, you know, whatever length of time. Similarly, I would, if you give me the task that now you have to speak in English, I would, given that I am speaking in English, I would basically have to still keep out, switch out of Hindi and continue in English in order to express myself, you know, effectively. Now again, so the idea is that you need to appreciate the difference between the tasks at hand, even both for production and combination between bilinguals and monolinguals. This switching into and out of language subsets, therefore, was considered effortful and basically that it would incur some kind of cost in terms of either, you know, longer response times or more errors when people are doing this versus when they are asked to continue within that same language subset, it should be, you know, it should not take that much time. So consequently, the researchers that were engaged or employ, were employing the language switching experiments in the early days in the 1960s, as we saw, you know, earlier, basically predicted slower performance on trials where the participants are required to switch languages as compared to trials where the participants were required to, you know, not switch languages and continue naming in the language of the previous trial.

Additionally, these researchers actually assumed that the involved switches basically, you know, were being accomplished through mental switching devices. So for example, an input switch and an output switch, wherein these switches were expected to determine the selection of appropriate language subset for speech production and also for comprehension. So the idea is that, you know, switching into and out of languages is difficult and for that reason, they have imagined or hypothesized in, you know, a device called a switching device, an input switching device or an output switching device, when I have to, you know, basically shift between the two languages. An input switch would allow me to, you know, basically switch into understanding whatever I am reading, whether in Hindi or in English and an output switch where I am sort of controlling how I am, you know, speaking in either Hindi or English, so for production and comprehension respectively. Now in some detail, while switching out of one language subset and entering into another was indeed considered effortful, subsequently staying within a single language subset once people have switched into that was assumed to be automatic and effort free.

So the idea is that when you are not switching, you are basically, you know, just letting it be an automatic decision and the system sort of goes on and keeps doing its task repeatedly, then as opposed to when you are actually required to switch on alternate trials, it would take a lot of effort because you have to switch in and switch into and out of a particular language on every successive trial. So this is one of the basic underlying assumptions, you know, with respect to the language switching tasks that were being

done. Now another assumption that was tested in these early studies was that the input switch actually operates automatically, whereas the output switch operated under voluntary control. So input switch basically because I have no control on whatever language I am being exposed to, say for example, as an interlocutor, if you are speaking to me in Hindi or English, I don't have any control on that. And therefore, irrespective of how you speak to me, or which language you speak to me, actually, I it is I will just automatically adapt to whatever input I'm getting given that I know the languages you're speaking with.

On the other hand, when I when the output is required, when I have to produce an output, then I can actually choose to decide, oh, I intend to speak in Hindi now, or I intend to speak in English, which are two of my languages. Now, this idea was actually motivated by the notion, as I was saying that individuals do not have any control over linguistic input, they can obviously control the output language. Interestingly, other researchers such as Grainger and colleagues, for example, have interpreted these initial impressions from, you know, the original language switching studies done by Kolers and Macnamara and colleagues, as that shifting into language switches on a particular language and switching out of a given language switches off that particular language. You know, it's it's it's a sort of a binary that they had and they have interpreted and they basically say, if I'm switching into speaking something, I have to switch on that language so that I can continue, you know, naming a given object or a digit in that language, versus if I'm switching out of a language, I need to switch it off and switch on the other language. Now, this binary assumption obviously is hard to reconcile with the research studies we have been seen so far in the previous two chapters, which actually talked about co-activation of both the languages during comprehension and production that we have discussed so far.

Another alternative possibility could be that while the elements from the non-target language may be co-activated, as these studies suggest that we have seen in the previous two chapters, their activations could basically be ignored by the language control system. So you need not switch on or switch off a particular language, but even if the, you know, items from the two languages are, you know, active, you may ignore their activation and continue with reducing in the target language. This possibility, in some sense, seems to be reasonably alright with the earlier proposals and also some of the recent work as well. And we look into the, you know, this in a bit more detail as we go forward. Now, the initial studies from Macnamara and colleagues, you know, were actually, they actually sought to examine the output switching mechanisms.

However, the same was not possible because, you know, the kind of stimuli that they were working with, they're typically working with word triads, which did not allow, you

know, the individuals to actually look at, oh, when are they switching out or when are they switching in, whether they are using an input switch, whether they are using an output switch or both of them are being used at the same time. So it sort of did not allow them to make these, you know, tease apart the effects of the input switch and output switch. And therefore there was not a lot of clarity on that matter in some of these earlier studies. However, one of the studies conducted by McNamara and colleagues in 1968 was able to prevent this confound by actually using language neutral stimuli with their participants. They use digits instead of words.

The study specifically allowed for testing whether the output switch actually operated under voluntary control as they had initially hypothesized and also allowed for the comparison between language switching, you know, across and switching within the same language. More specifically, Macnamara and colleagues used a digit naming task wherein French, English bilingual participants actually named blocks of, you know, digits in just one of their languages or switched between languages within a block of trial. Say for example, as I said, there could be a monolingual block for French and English, or there could be a mixed block wherein they would be required to name the digits either in French or in English and so on. That in one type of block, the switches could actually be anticipated. So they followed a set pattern and participants, once they are through the initial few trials can actually anticipate, oh, I have to, for example, you know, switch on every third trial or every fourth trial and so on.

And so they could be prepared for handling these switches. On the other, in the other type of block, what happened was that these switches were totally random and participants could not actually anticipate or predict when they were required, when they would be required to switch between naming the digit in French or in English. Now, if the output switch were actually under voluntary control, as the initial hypothesis goes, the authors reasoned that the switching cost would be minimal in the predictable condition, because if it is actually under voluntary control and I am already being able to predict the pattern of switching that is coming in, I would be able to prepare my system for handling these switches. If I am able to prepare my system for handling these switches, the idea is that obviously there will be not a lot of switch costs because before the switch comes, I've already prepared my system to handle that switch. In that sense, there will be less or no switch cost observed at all.

However, if the switches are not predictable, even though the system is, you know, under voluntary control, it would incur a huge cost because I am not going to be able to predict how is this really going to happen. Say, how am I really going to, you know, switch into, let's say, French at one trial or English in the other trial. So this is a very important theoretical point that they were trying to actually test through this initial

experiment. So the authors compared the language switching condition with the condition where the participants were required to switch between two tasks performed using the same language. So on one hand, they have to use different languages to do this, so digit naming in French and English.

And on the other hand, they're actually using a task switching scenario, which is going to be completed using the same language. So basically you can see that the design is allowing the authors or allowing the researchers to compare between task switching in one language on one hand and task switching or language switching between two languages. All right, so in this task, in the second task, the participants were either required to name all the digits within a block and adding one to all the digits presented within the block or switch between naming just the presented digit or adding one onto it within the same language block. So I could either name if the digits are being presented two, three, four, five, I could just name two, three, four, five in French or I could basically need to, you know, if two is presented, I say three, if three is presented, I say four and so on. So either I'm adding and naming or I'm not adding and naming, but the naming is still happening in the same language in French or in English.

Now, this was referred to as the digit switching condition and was included actually, as I was saying, to tease apart the effects of language switching and simple task switching. You can see what they are actually thinking. You can see that the researchers are actually trying to differentiate or figure out whether language switching is a specific task to the language system or is it a task similar to any kind of switching that we do on a daily basis in different kinds of scenarios. Now, the results actually showed larger response times per a digit naming trial in the language mix block as compared to the single language block. So there was indeed some kind of switch code that is being incurred and which basically implies that in language switching is indeed an effortful thing and incurs a cost in terms of increased response times and maybe more errors.

The authors interpreted these results to be consistent with the language subsets account of the bilingual memory. All right. So they're basically saying that, yes, see people are taking so much time to switch into and out of languages because they have to switch out of one language subset and into the other language subset. So the first part of their theoretical position is actually being confirmed. Now, the more interesting part is the second aspect of these results that I'm just going to talk about.

Interestingly, when the switch patterns were regular, so in a predictable switching block, the participants average response times were just 0.21 seconds longer in the language mix block as compared to the unilingual block. But when the switching patterns were irregular in a, you know, irregular mixed block, then their response times were actually

0.39 seconds longer in the language mix block than in the, you know, unilingual block. So basically what we are seeing is while language switching is indeed incurring a cost, it is incurring a much higher cost when the switches are unpredictable as compared to when the switches are predictable.

So this difference between a predictable and unpredictable switches basically confirm the researcher's hypothesis or aligns with the researcher's hypothesis of the output switch actually being under voluntary control. So you can see by this very neat experimental design, the experimenters are able to confirm both of their initial hypotheses. Now moving on, there is also, I mean, you can, you know, zoom into the results and talk a little bit more about them. During the digit switching condition, basically the same kind of switching costs were observed. So for example, in a predictable switching condition, the cost was 0.

22 seconds and in an unpredictable switching condition, the cost was 0.39 seconds as opposed to 0.21 and 0.39 in the language switching task. Now this was interesting because from this result, the researchers could actually conclude that language switching seems to require no psychological skill and I'm quoting from the paper as cited in De Groot that language switching seems to require no psychological skill but peculiar to bilingualism, but rather a skill which is equally applicable to all kinds of switches and all kinds of, you know, large number of operations in which persons are asked to switch modes of response rapidly.

Now while this is interesting and, you know, it sort of makes some sense, the authors have not really, you know, elaborated a lot on their reasoning behind this conclusion. For example, how are the, you know, if the two kinds of switches are exactly alike, what are the implications for general switching task as compared to, you know, language switching task and so on. But we'll leave it at that and we'll come back to this discussion a little bit later. Now in another study which was conducted by Macnamara and Kushnir, they actually assayed investigating the workings of the hypothesized input switch. So far we were seeing research that was looking at the output switch and whether it is under voluntary control or not.

In another experiment, Macnamara and Kushnir in 1971 are seeking to investigate the workings of the input switch. Once again, they are testing French-English bilingual participants in two experiments. Now in one of these experiments, the participants were actually made to silently read blocks of sentences in which true and false unilingual English sentences alternated with, you know, true and false English language mixed sentences. And the participants' task was actually to judge whether these, you know, sentences were true or false. You know, sentences were like turnips are vegetables versus

turnips aren't vegetables.

So you see a bit of French is mixed in English. And, you know, both these statements are true. Whereas horses smoke potatoes versus horses smoke pommes de terre, which both of these statements are obviously false. But the first sentence is, you know, pure language, pure English sentence, whereas the other sentence is, you know, language mixed sentence. Now an important manipulation here that was basically included was that the pattern in which the unilingual English and mixed sentences actually alternated.

The pattern could be either fixed, so, you know, English sentence, mixed sentence, English sentence, mixed sentence, and so on, or the pattern could be totally random. Now what are they actually looking at here? If the input switch does indeed operate automatically, there should be no effect of this irregular versus regular kind of switching, irregular order versus regular kind of switching order. And language switches in the language mixed sentences should basically be equally fast or slow in both of these conditions. This is the first experiment.

Moving on to the second one. In the second experiment, they simply replicated the first one with just the auditory presentation of the stimulus. So it's the same experiment, wherein, you know, English sentences and mixed language sentences are coming and they have to judge the true and false sort of these sentences. But while the first experiment presented these sentences visually, the second experiment presents these things auditory. Why did they choose to present these auditory? They chose to present the stimuli auditory in the second experiment so as to discourage the participants from repeating these sentences aloud to themselves. Because if they are repeating these sentences aloud to themselves, they might be, you know, engaging the output switch.

And then again, it would become very, very difficult for experiments to tease apart whether the observed effects are coming from the input switch operations or output switch operations. So this is again a very clever tweak that they have done in order to be able to, you know, speak more clearly as to what kind of switch is being observed and how. Now, the results showed again that language switching does indeed incur an observable cause in terms of response times. However, in this experiment, interestingly, the fixed alternative, the alternative condition actually resulted in longer switch times than the random alternative condition. Now, interestingly, the authors actually do not talk a lot in detail about this particular finding.

They actually bank on the first finding that language switching does indeed incur some kind of cause and they sort of move ahead and they sort of brush aside this particular finding. A more important point that they are obviously trying to make here is that

language switching is effortful, whereas sustaining the same language across a bunch of trials is not. Now, these early results that were reported by Macnamara in 1967 and Macnamara and Kushnir in 1971 were later reevaluated and questioned. For instance, say for example, Grainger in Beauvillian in 1987 and Soares in Grosjean in 1984 actually questioned the interpretations of the switch cause in terms of a language switch. In more detail, just sort of, you know, diving slightly deeper into this, in more detail, Grainger in Beauvillian used the visual lexical decision task with French-English bilinguals, whereas Suarez and Grosjean presented unilingual or bilingual spoken sentences for their Portuguese-English bilingual participants.

Employing these two different tasks, the researchers were actually able to replicate the main findings of the early studies that switching incurs cause in the response times, but they had slightly different explanations to give. So, Grosjean actually rejected the interpretation of the switch cause in terms of the hypothesized language switch on account of inconclusiveness of its origins. Remember, in the first and the second experiment both, the experimenters Macnamara and colleagues have not really, you know, elaborated in a lot of detail about where these switch cause are actually coming from. They have not really hypothesized a particular mechanism rather than just the input and the output switch that they have actually theorized. So, where did this hypothesized language switch happen? How does it really exert its influence and so on has not been, you know, described in detail and therefore Grosjean sort of rejects this whole idea.

Interestingly, on the other hand, the main reason for Grainger in Beauvillian to reject this language switch notion was their assumption that language not in use is switched off or deactivated. So, Grainger in Beauvillian basically did not really, you know, agree with this proposal that when you are switching out of a particular language it is switched off or deactivated. And again, this is probably in line with some of the previous results that we have discussed across the chapters, you know, on production and comprehension. Let's look at this in a little bit more detail and let's see, you know, how people are trying to explain this. Now, in later work, Grainger offered two theoretical explanations for language switching cause.

One was the bilingual interactive activation model which we have discussed in a lot of detail in some of the previous lectures. The other model was the bilingual activation verification model. Now, the bilingual activation verification model basically assumes the existence of separate lexicons for bilingual two languages with word representations from both the lexicons responding to word input. Following the initial activation, the model searches through these activated nodes of one of the lexicons for an exact match with the input representation. So, suppose you are presenting me with an English word.

I have two different lexicons, a Hindi lexicon and an English lexicon. Based on how I sort of, you know, read the features and the patterns and convert from the, you know, orthographic to the phonological form and so on, I will eventually end up searching my English lexicon. Now, if the English lexicon provides an exact match for, let's say, if you presented a word caterpillar here, if it provides an exact match, I will be able to speak it or understand it and so on. Suppose the word that you have presented was a Hindi word, let's say kamla or kamal or something like that, then when I am, you know, doing this whole analysis and I am sort of searching for the English lexicon, I will not get that. I will need to switch on to the Hindi lexicon and search for it again.

So, all trials where, you know, a kind of a switch is required, I'll basically, they, you know, be required to go through these two lexicons and if, you know, on the switch trial because, so one of the very important things here is that on subsequent trial what happens is the search would first initiate in the lexicon that presents a match on the previous trial. Okay, so for example, if you're presenting English, English, English, English, English, then I will continue searching in the English lexicon, presenting faster results and so on. However, if you're presenting English, English, English and Hindi, then on the Hindi trial, I will first go through the English lexicon, obviously not find a match for it and come back to the Hindi trial. So, in this way, the switch trial, which is the English to Hindi switch trial here, will return, you know, a slower output, you know, slower response time, higher response time, as opposed to a non-switch trial where I have been actually going through English, English, English or Hindi, Hindi, Hindi, Hindi.

So, this is something very, very important. Now, Soares and Grosjean also chose a serial search explanation of the switching cause, just like I was explaining with the bilingual, you know, activation verification model, but they embedded the same in Grosjean's language mode theory. I'll talk about Grosjean's language mode theory in more detail later, but just to sort of give you a brief, you know, preview into that, the language mode theory actually proposes that there is a base language and a guest language, wherein the base language is supposed to be contextually the most appropriate and hence most active, whereas the guest language would need to be activated. So, when I'm switching into other language, I will need to activate that language. Okay. And given that it is not the base language, it might involve some effort to activate that language.

So, Soares and Grosjean actually assumed that in terms of a search for a lexicon for a match of a presented input, the base language would be searched first and only if the base language lexicon does not present a correct match, the search would move on to the guest language lexicon. Again, you can see how this might account for the language switching performance and language switching results. And this is what Soares and Grosjean actually used to explain the results of the initial language switching studies as

we've seen. So, just to summarize again, I leave these slides blank so that you can make your own summaries, but just to give you some pointers of this, we have seen that this idea of the organization of a bilingual, you know, two lexicons into different language subsets is indeed a plausible one with some of the earlier studies actually supporting this. However, while organization of the bilingual mental lexicon is one idea, how does it really, you know, explain the performance of bilingual participants across these tasks that have been used is another matter and is something that is open for debate. Thank you. I'll see you in the next lecture.