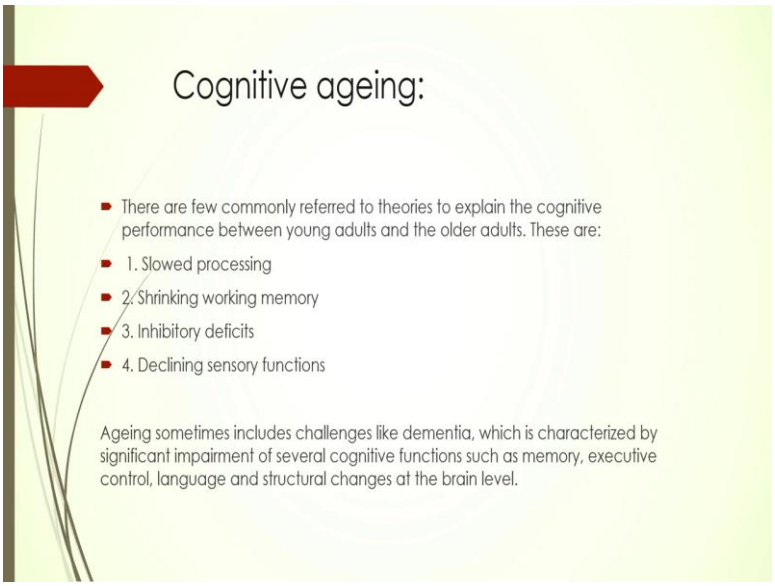
Bilingualism: A cognitive and psycholinguistic perspective

Dr. Bidisha Som
Department of Humanities and Social Sciences
Indian Institute of Technology, Guwahati

Module - 07
Part - 03
Lecture - 18
Cognitive reserve, new developments

Hello and welcome back.

(Refer Slide Time: 00:30)



We are talking about the Cognitive Effect of Bilingualism. As in how bilingualism can have an impact on the way we deal with a various kinds of incoming stimulus and how we are capable of inhibiting the goal irrelevant cues.

From that perspective, we have looked at different kinds of tasks that build in those kind different kinds of conflict and thereby we have looked at how conflict monitoring and conflict resolution by utilizing inhibition of various types is more salient, is more common to find among bilinguals as opposed to monolinguals.

And then now we move on to cognitive aging in terms of various kinds of decline that we see, cognitive decline that we see among elderly population. So, in terms of when we compare between adults and older adults as in elderly population, we see certain amount of decline in various cognitive capabilities.

Their processing speed goes down, their memory starts to shrink, then there will be inhibitory deficits and also various sensory functions also decline. This decline includes decline in language capacities also quite often, if not always quite often language decline in linguistic capacities accompany these.

So, as a result we see onset of Alzheimer's, Parkinson's and various other such diseases among the elderly population. So, when we when somebody is suffering from Alzheimer's or Parkinson's, sometimes dementia, language getting affected is a very common sign. Now, this is quite common, this is nearly universal that cognitive decline accompanies old age.

Now, throughout our lifetime, the brain goes through various kinds of changes finally resulting in decline in old age. So, that is common and understandable. However, it seems there are certain cases when the cognitive decline can be thwarted to some extent if not entirely stopped or in other words cognitive decline may not affect every person in the same way. Sometimes even though the brain has gone through its usual course of action going through neurodegeneration at an advanced age.

(Refer Slide Time: 02:56)

However, the patients may not always show the results, the resultant behavioral changes so to say, resultant behavioral decline in our in linguistic decline and so on. So, there have been various studies to find out what exactly are the components, what are the contributing factors towards one, to have the cognitive decline, second, to have the

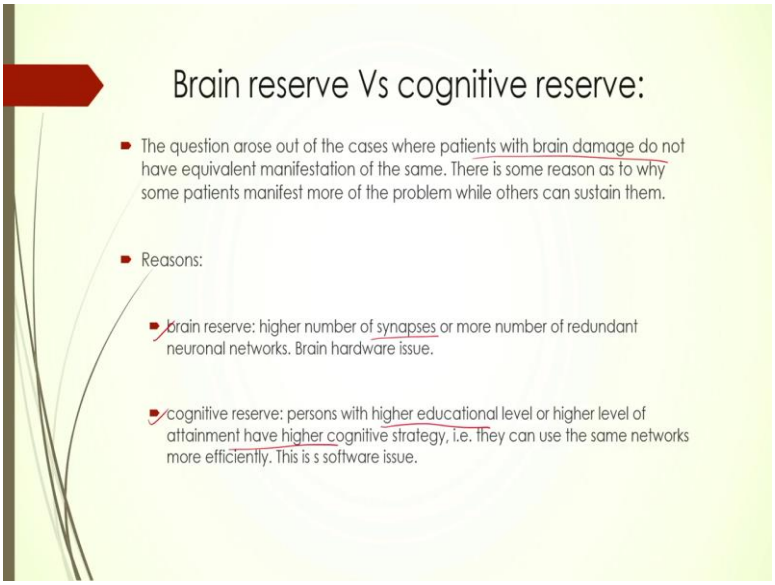
manifestation of the cognitive decline, what are the factors that could be understood to be contributing factors.

So, one study of this type goes back to all the way to 1981 when they looked at patients suffering from dementia and Alzheimer's and they found that there possibly are some kind of social connections to Alzheimer's and dementia. One study particularly on Chinese older patients that was based on 5000 patients found out that education probably could be an important predictor. They connected the education level of the participants with the onset of dementia.

So, higher the education level, lower the chances of being suffering from dementia and Alzheimer's and so on. So, manifestation is the key word here. So, whether or not you have a neurodegeneration, but whether that will manifest in some kind of a visible disorder is what is the core focus here. And that is somehow connected to education that is what the study on Chinese older population found out.

In some cases, in some patients, Alzheimer's was discovered only in autopsy, meaning that those people did not manifest any sign of Alzheimer's during their lifetime. However, on autopsy it was found that their brain did have all the components that typically are associated with Alzheimer's.

(Refer Slide Time: 04:54)



So, there that means, there is something else that is happening. So, it is not a direct connection, direct one to one mapping between the brainy neurodegeneration and the manifestation of the diseases. There is some kind of a filtering mechanism that probably helps in some cases.

So, what are those mechanisms, what probably could be happening? There are two main theses in this domain that talks about what probably stops some person, some elderly people from manifesting those telltale signs. So, the damage do not basically, all the patients with brain damage do not manifest the disease similarly.

So, the two theories primarily deal with one theory deals with the brain reserve, the idea of brain reserve, the other theory deals with cognitive reserve. We will not dwell too much on the brain reserve; we will just see what it means. So, the brain reserve theories propose that some people, some individuals have higher number of synapses or let's say, they more number of redundant brain networks, redundant neuronal networks. That is basically taking to us to the structural properties of the brain.

So, some people might have higher number of synapses, higher number of networks which comes to their rescue when the need be. So, that is basically an hardware problem, hardware issue, that is called brain reserve. On the other hand, there is the theory called cognitive reserve.

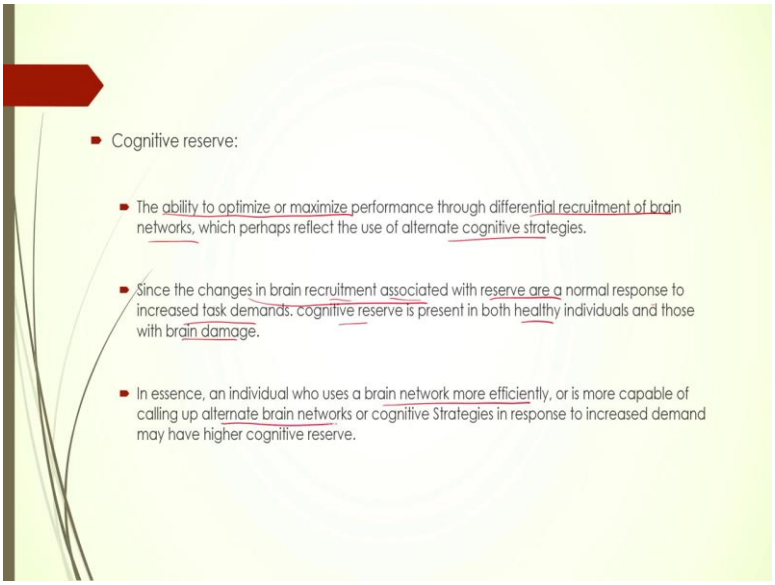
Now, cognitive reserve talks about the software issue, as in how the same networks can be trained to do difficult things, to do difficult challenging tasks is what cognitive reserve is all about. So, the people with higher educational level or any kind of higher attainment typically are found to have higher cognitive strategies.

What this basically means is this takes us back to the idea of spillover effect. Anybody who has, you know who goes through their life using their brain to solve challenging cognitive problems, their brain their brain's network differently, their brain their neuronal networks fire differently, they have different kinds of connections created and their different strategies to solve different problems. So, that is what basically is cognitive reserve all about.

So, typically you will find this among people who are, who have some amount of high attainment in any domain of high achievement. So, any domain of high achievement

automatically presupposes that your brain has been busy solving numerous problems within that domain itself, numerous complex problems and only when you face challenges and solve them do you come up successful. So, success has a repercussion at, in terms of your cognitive reserve. So, this is a primarily cognitive, a software issue with respect to a cognitive apparatus.

(Refer Slide Time: 07:55)



So, now let us look into in more detail about cognitive reserve. So, what does it do? When we say that a person with higher educational attainment or higher attainment in any other domain like music or any other sports and so on. What happens? What happens is this, they fine tune the ability to optimize or maximize performance of different neuronal networks through differential recruitment of brain networks, right.

So, this reflect in the use of alternate cognitive strategies. Basically, meaning that we train when we expose ourselves to difficult task demands, our brain neuronal networks are challenged and as a result of which two things probably happen. One is we can use different networks to solve similar kind of problem or we can use the same task for different kinds of problems.

So, basically a lot of rewiring happens. So, we are able to and as a result of which those people are able to maximize or optimize their, the network that they have at their disposal. Now, this is nothing new, this is not anything new that we are talking about, this has been already there. So, changes in the brain recruitment happens throughout our

life that is almost common knowledge because as we go through life facing different kinds of challenges, brain simultaneously changes.

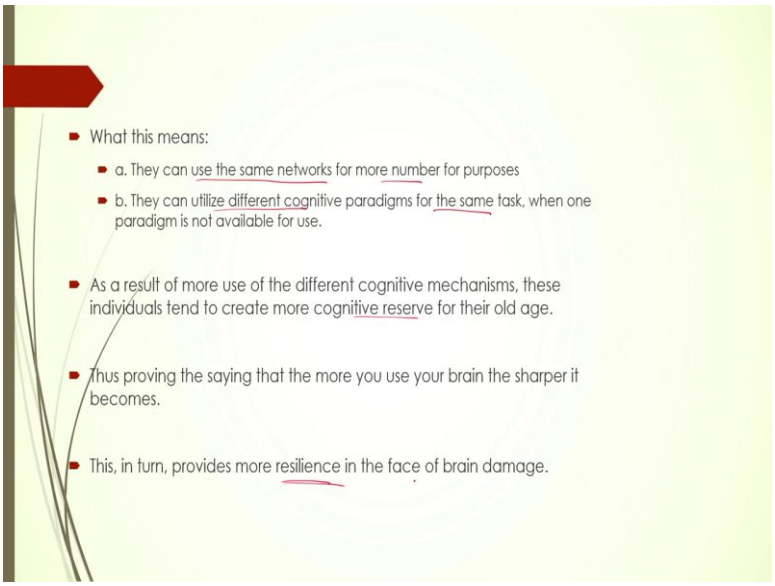
So, brain recruitment associated with reserve and normal response to increased task demands, any kind of increased task demands will have a response system from the brain. And as a result of which there will be changes. So, this reserve is present in both healthy individuals as well as people with brain damage that is a given that is already the premise.

Now, in essence an individual who uses a brain network more efficiently or is more capable of calling up alternate brain networks or cognitive strategies in response to high demand may have higher cognitive reserve. So, this is basically what goes on behind the scene, when we see somebody practicing music for years together or somebody exercising for years together or facing different kinds of challenges in even in games of various types.

For example, you take the case of football or rugby or cricket or all of these are strategy dependent activities. And one needs to constantly have a feedback system in your brain depending on what the other players are doing. So, you need to update. So, this kind of this is this is exactly where the difference between a good player and a bad player is.

So, because of these different strategies to put in place over a period of time, this is what happens. So, these kind of people they use brain networks more efficiently and often they can use alternate networks for the same kind of purpose.

(Refer Slide Time: 10:56)

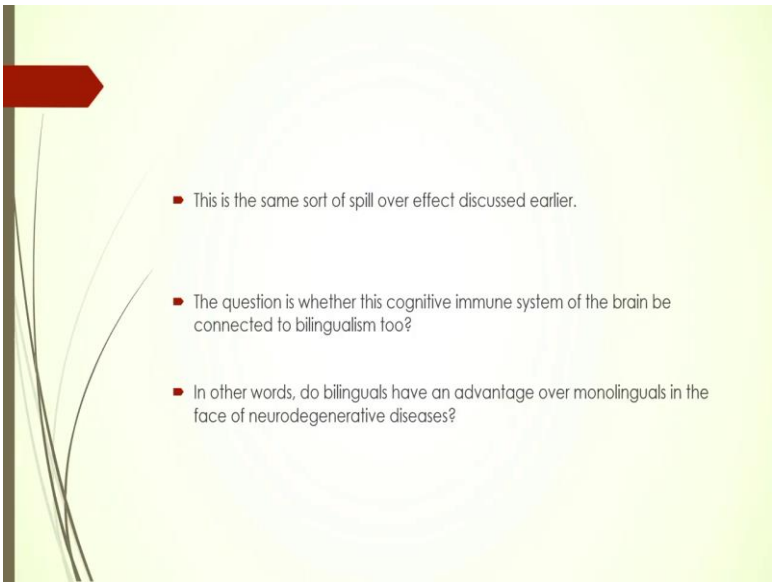


And various kinds of this fine tuning of this mechanism. So, to finally, boil it down to two main points, this cognitive reserve typically means that using the same network for more number of purposes and utilizing different cognitive paradigms for the same task, right. So, this is basically what it all means. Now, as a result of more use of different cognitive mechanisms, these individuals tend to create more cognitive reserve for their old age.

Because if you have continuously done this kind of challenging task all your life, you are basically creating cognitive reserve for your old age. Now, as a result of which this creates some amount of immunity in terms of cognitive immunity. So, which will help you in term in the face of brain damage.

As we all know in childhood if you play in different you know I just go out in the out in the open, outdoors and play in the outdoor, the more a child's immune system is exposed to different kind of stimulus, the more the child's immune system will be strengthened. It is something like that; it is something similar to like that. So, they the more challenges the brain faces, the more the immune system will get strengthened and the more it will in turn be provide, it will provide resilience in face in the face of brain damage.

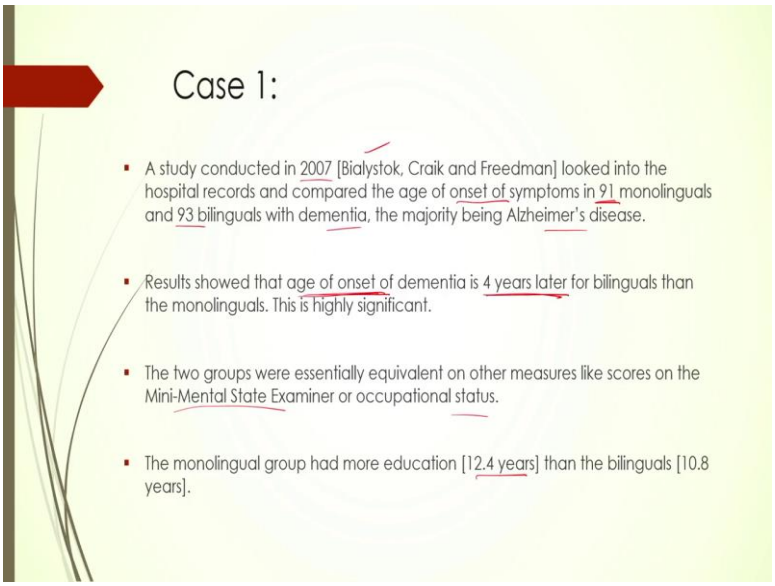
(Refer Slide Time: 12:19)



So, this is probably what happens or what has been happening for various kinds of those patients who have not manifested the disease. So, this is basically the kind of spillover effect we have talked about earlier. Now, the question is can this kind of cognitive reserve be connected to bilingualism too? Is bilingualism also an equally challenging task that is probably that could contribute to having higher cognitive reserve.

Now, we have already seen that many elderly participants in different different task conditions have done better than younger bilinguals who are equally proficient. So, we already have seen that elderly population do have a certain amount of control mechanism at their disposal. Now, we want to see whether that kind of control mechanism in terms of reserve also has an impact in against or some kind of immunity against the different kinds of neurodegenerative diseases. So, this is what we are trying to see now.

(Refer Slide Time: 13:23)



Now, there have been various studies on this by different groups of researchers, we will talk about a couple of them here. So, one particular study in 2007 by Bialystok's group, they looked into the hospital records and compared the age of onset of symptoms of there are 91 monolinguals and 93 bilinguals with dementia and Alzheimer's disease.

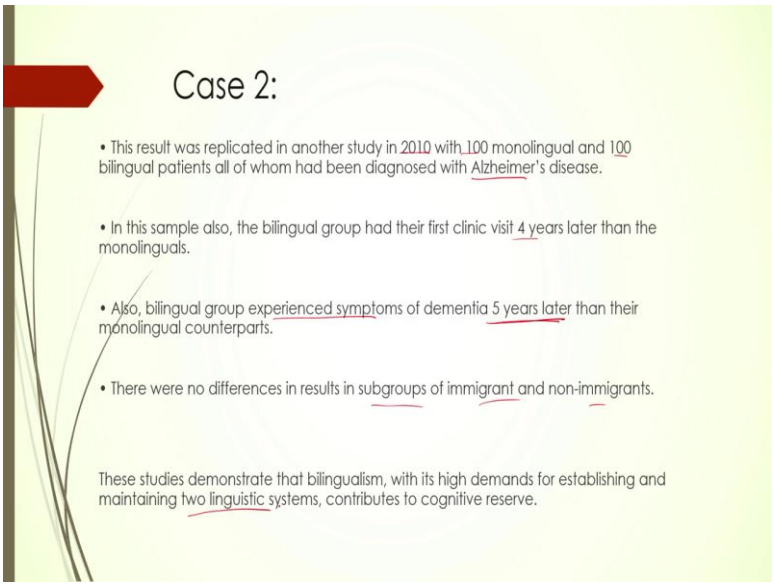
So, basically now the problem one issue let me clear before we get into this more is that typically this kind of patients, the Alzheimer Parkinson's, dementia patients, most of the studies have been dependent on hospital records. So, when they visited the hospital after they had been for diagnosis.

So, when they have been diagnosed, when they was their first hospital visit is what the focus has been in this study. They found out and the comparison was between 91 monolinguals and 93 bilinguals who all suffered from dementia, majority from Alzheimer's disease. So, the results showed that the age of onset of dementia is 4 years later for bilinguals than the monolinguals.

So, on an average the bilinguals had reported a later onset of the disease as opposed to monolinguals who had reported an earlier onset of the same disease. Now, the gap is in this particular study the gap was found out to be 4 years which is quite significant. The two groups were otherwise essentially equivalent on other measures like mental state examiner, occupational status and so on. Because those things need to be controlled so that they are not contributing variables.

So, the finding in this case is that bilingualism probably has an impact, probably has a some amount of immunity in the face of mental cognitive disorders. Another interesting thing in this particular study was that monolingual group had higher number of education also in comparison with bilingual groups. So, even though the monolinguals had higher education the bilinguals were showing better immunity in the face of Alzheimer's and dementia.

(Refer Slide Time: 15:42)



In another study there was this study in the during 2010 with 100 monolingual and 100 bilingual patients who had all of whom had been diagnosed with Alzheimer's disease. In this sample too the first clinic visit by the patients were had shown a gap of 4 years. So, the monolinguals visited the clinic 4 years earlier than the bilinguals. And also, bilingual groups experienced symptoms of dementia 5 years later.

There is a slight difference here between when you start experiencing the problem versus when you visit the hospital in this is not same in every country, in many European countries or in the US and other places like that their hospital visits are typically earlier compared to the same patients let us say in India or other Asian countries. So, that is one. So, hospital visit is one, another is when you start experiencing the problem.

So, in this study they have they have also taken into account the when they started when the patients started experiencing symptoms of dementia. And they found that same kind

of difference. So, experiencing dementia started 5 years earlier for monolinguals compared to bilinguals and the hospital visit or clinic visit was also different by 4 years.

However, there was no difference between subgroups of immigrant versus non-immigrant. There was no difference on this count. So, these studies demonstrate that bilingualism with this high demand for establishing and maintaining two linguistic system probably contribute to cognitive reserve.

(Refer Slide Time: 17:24)

So, lifetime of practicing bilingualism seems to have an impact in these domain too. So, now we have seen a lot of areas within different kinds of mental functioning starting from children, childhood to adulthood to elderly population and on various parameters bilingualism seem to have a positive impact.

(Refer Slide Time: 17:45)

However, the story only begins here and it gets a lot more interesting because there are lots and lots of disagreements. While on the one hand we have a large number of available empirical data that suggest a positive impact of bilingualism in terms of executive control, inhibition, working memory and so on.

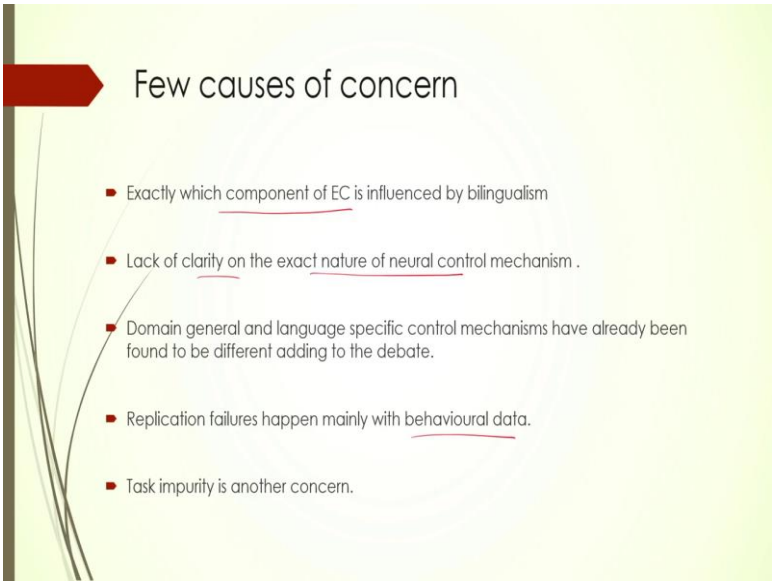
(Refer Slide Time: 18:07)

Basically, in various domains within the higher order intelligence. However, there are also studies that did not find the same kind of benefit. The basic idea here is the basic

difference here is that there have been studies, there have been replications of those studies who have found the advantage, but the replications fail to find the advantage.

So, there have been some studies that reported null result and some studies that reported an absolutely no advantage whatsoever. In fact, there have been some studies that even have a correlation of negative, there have been a negative correlation as well.

(Refer Slide Time: 18:49)



So, a number of studies have come out in late in last about 8, 9 years. One of them was starting with 2011, a meta analysis came up, came out by Hilchey and Klein. And following that there have been a number of studies and taken together they all have raised a number of issues with the findings and these are some of them that I have pointed out here.

So, there are very many issues, issues with respect to participants, issues with respect to task designs, issues with respect to the population, issues with respect to various other kinds of mechanisms that are all part of the previous studies. So, one of them is which component of EC is influenced by bilingualism is not clear.

So, while we know that there have been findings, positive findings in terms of working memory, in terms of other various other domains, but there has been a lot of data that also show that not all of them can be verifiable. So, in some studies you find the positive correlation, another study you find a negative correlation. So, that today's is the question

as to which aspect of executive control actually mimics a bilingual's handling of the two languages.

Typically, the findings have suggested that because bilinguals handle two languages simultaneously at various levels of conflict, hence there should be a direct correlation between executive, various executive control mechanism. But many of these studies fail to explicitly say as to which part of executive control is a direct replica of a bilingual handling his or her two languages. That is exactly where the one of the problems is.

So, the components of EC is one important issue that has been raised. Another is on the clarity on the exact nature of neuronal control mechanism. Neuronal control mechanisms have been found to be na getting some amount of positive impact. However, there are questions on that too. Now, in today's time when we have much finer neuronal brain mapping mechanisms, there are many questions, new questions also that have been asked.

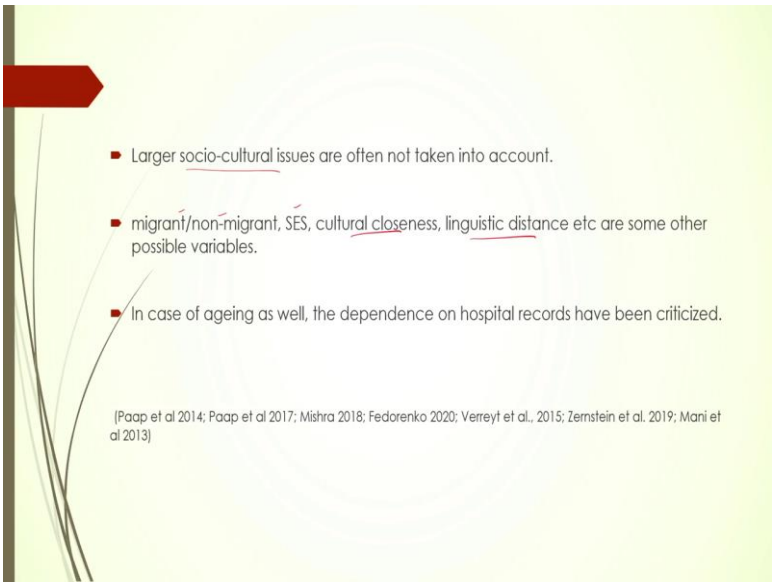
Similarly, there are new findings that have pointed out that domain general and language specific cognitive control areas in the brain probably are not the same areas. Earlier, the idea was that large area in the prefrontal cortex are responsible for both domain general cognitive control as well as linguistic language control functions.

But now new findings have pointed out that they that may not be the case. In fact, there are proposals that there are two different areas which lie side by side which are near to each other, but they are not the same area. So, that is also adding to the debate. And another thing, one more point is that replication failures typically happen most of the time with behavioral data.

So, behavioral task like Simon and ANT and various other task more disagreements have been found in the experiments that have used behavioral experiments rather than in the neural in the brain mapping mechanisms. Though there are disagreements there too, but larger number of replication failure have come from behavioral experiments.

And then of course, there is task impurity. So, there are finer nuances within each task as to how much of that task design actually targets the control mechanism. So, that is again a very important issue that has been pointed out.

(Refer Slide Time: 22:38)



Larger socio-cultural issues are also a new variable that have been pointed out many by many researchers. Last few years have seen a new social turn in psycholinguistics research, social turn as in researchers are now beginning to look into the socio-cultural background of the population in order to take them into account while processing various kinds of stimulus.

So, the psychological studies or psycholinguistic studies of various kinds of language control mechanism have started to take into account the social variables. So, that is another thing that was not considered before. So, within the social variables, there are many issues that have now started being looked at. We talked about the Swedish Iranian and Iranian Kurdish and Iranian Persian population; Iranian Turkish population and we saw how migrant non-migrant difference has come out.

Similarly, differences have also been pointed in terms of socio-economic status. So, one has to keep that as a control. So, socio-economic status can also prove to be an important variable. Cultural closeness is yet another. So, whereas, we find a lot of difference in terms of lots of impact of the incongruent condition in case of Chinese English bilinguals, the same kind of impact in incongruent condition is not probably possible in language groups that are culturally close.

Then linguistic distance is yet another factor, again going back to the Iranian study where they found that when the language pair are linguistically close, the results are completely

different when compared to when the language pairs are different, linguistically different, structurally different. So, there are so many other areas also that have now come up as a probable confounding variables.

And in case of aging as well, in case of cognitive aging as well, the newer studies have pointed out that hospital records probably may not be a very reliable source of data that because the entire study is based on hospital records and interviewing caregivers and so on, probably there are more objective methods that are necessary.

So, there have been all of these different criticism, different types of criticism that have been levied on the bilingual advantage theory. And as a result of which we now have a lot of new way of looking at these things, the this effect.

(Refer Slide Time: 25:15)

In case of children, though the results are more or less more or less universal, there are less problematic data, more often than not, there have been more agreement in the case of child child's data. However, there are still some who did not find the same effect. One of them is Anton an Anton, 2014 study, which did not find the same kind of bilingual advantage for children using an ANT, that is Attentional Network Task.

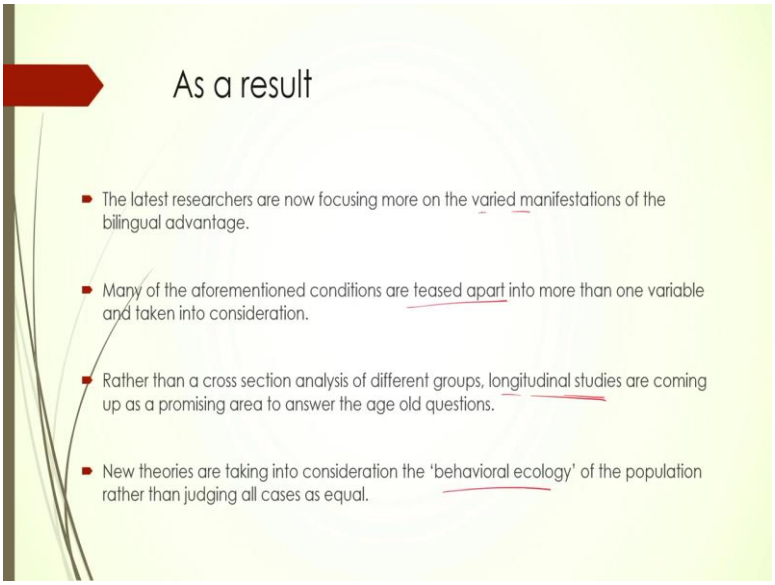
And last, but not the least, a number of researchers have also pointed out publication bias. A meaning publication bias is part of any academic discipline. Publication bias basically refers to the tendency of a particular kind of finding to be published, whereas,

the contrary finding may not be published. So, up till there are studies which have, there are meta studies meta analysis that have pointed out that after 2014, more studies have been published that have not found the impact as opposed to before that.

So, there before 2014, there was a number of studies came out and all of them seem to be showing the advantage. Now, if you look at it, look at the finding from the lens of publication bias, you know that the only the positive results were published, negative results were not published. So, these are some of the criticisms, some of the problems that have been pointed out in last few years, starting 2011 till today, last 10 years have seen a lot of debate and disagreement in terms of the bilingual advantage theory.

Now, though that does not entirely negate the idea that bilingualism, because the positive results are also results, they are also valid results. So, are the negative results, right. So, positive, going from positive results to the negative results with null result in between all of them are valid results. Then if all of them are true, then what is happening? What is happening is probably that you need to look into a lot more number of finer variables than we have till now looked at.

(Refer Slide Time: 27:23)



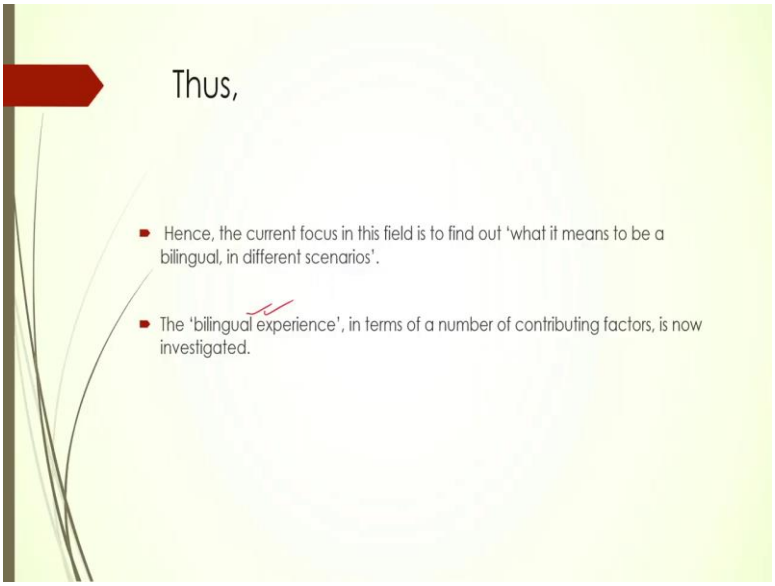
Now, as a result of all of these, latest researchers are now focusing on varied manifestations of the bilingual advantage. Many of these aforementioned conditions are now teased apart into more than one variables. Bilingual population now can be divided into bilingual, migrant bilingual, non-migrant population, bilingual population differing

on SESs, bilingual population differing on cultural closeness, linguistic closeness and so on.

So, the one idea of bilingualism can now be broken down to five different types of bilingual. So, that is what we mean by that firm, former conditions are now teased apart into more than one variable. And rather than a cross-section analysis of different groups, longitudinal studies are also now coming up in a big way to see whether we can check the gradual impact of bilingualism on a population which starts from being monolingual to bilingual and do we see accompanying changes in their various kinds of cognitive control mechanisms.

So, now new theories are coming up and that takes into account the behavioral ecology of the population.

(Refer Slide Time: 28:39)



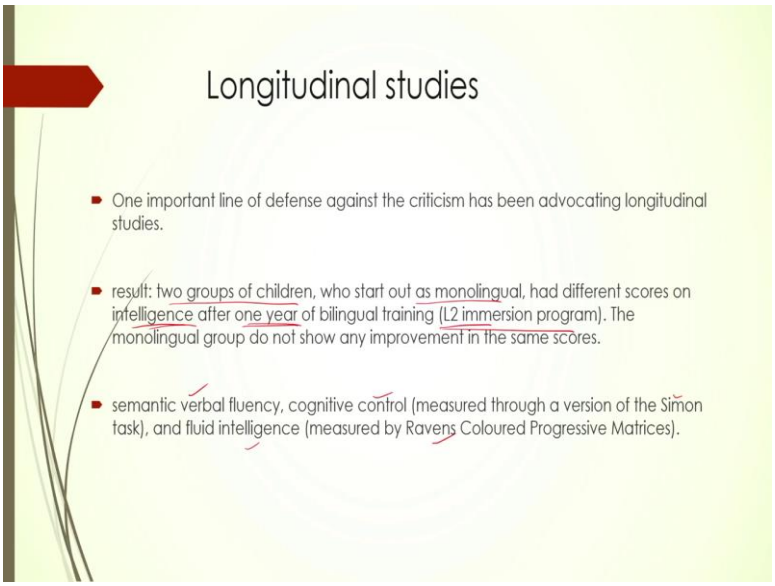
Behavioral ecology as in the experience, total experience of the bilingual participants that are taken into consideration. So, what kind of bilingual, what it means to be a bilingual in different scenarios? For example, in the state of Assam, Bengali-Assamese bilinguals are one group. Now, if we compare Bengali-Assamese bilinguals executive control mechanism with that of Assamese- English bilinguals, probably we will find different results. We will not be able to establish the same kind of findings.

So, that, but does it mean that the idea is not right? Probably not. Idea probably is right, but we are simply comparing apples with oranges. So, that is exactly what the new domain of research is all about that we should take into account bilinguals in different scenarios and compare them within that scenario rather than across in rather than a cross-sectional way. So, the bilingual experience is what is now coming under focus pretty t quite heavily. It is now being investigated under various in various kinds of scenarios.

(Refer Slide Time: 29:46)

So, the new areas as a result of all of these controversy, all of these debates, the new areas that have come up, new areas of research that has come up, one of them is longitudinal studies, then looking at the language use and the language switching context, ok. And then distance between languages, cultural setting, WEIRD versus non-WEIRD group, they are not weird in any way. This is just an abbreviation; we will look into it shortly.

(Refer Slide Time: 30:15)



So, these are some of the areas. So, in terms of longitudinal studies, there have been some studies that have taken place already and many others are going on. Now, one study have looked at two groups of children who start out as monolingual and then had different scores. This is study is basically a study that checks children's development over a period of time.

So, they all start out as monolingual, have different levels of bilingual training and as a result of which they check their scores in intelligence. So, they had one year of a bilingual training the within L2 immersion program. L2 immersion programs are a very focused and immersed program where the where the children will be trained in second language throughout. So, content as well as medium all will be second language. So, that is the very strenuous training in L2.

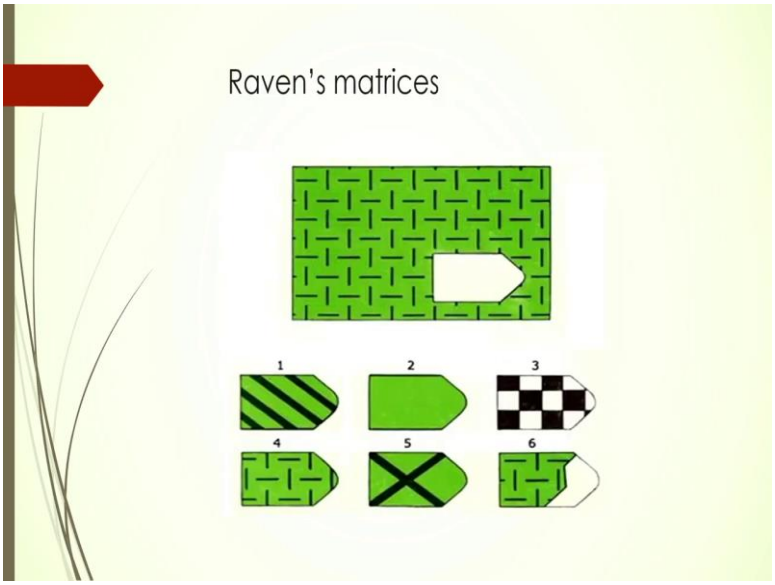
So, this children went through, one group of them went through, 1 year of L2 immersion program, the other group did not. Now, the comparison between these two groups showed that they scored differently on various scores of intelligence after 1 year. So, both groups started as monolingual. One group continued to be monolingual, the other group had one year of training in L2. So, becoming bilingual and within that 1year period at the end of 1 year, they had different scores of on intelligence.

So, various domains were found to be affected. One of them is semantic verbal fluency, cognitive control that they checked through Simon task and fluid intelligence, which was

checked through Ravens progressive color matrices. So, there are all these tasks that were used for these children and those children who went through a bilingual training, who became bilingual over a period of 1 year started to show better performance on all of these tasks.

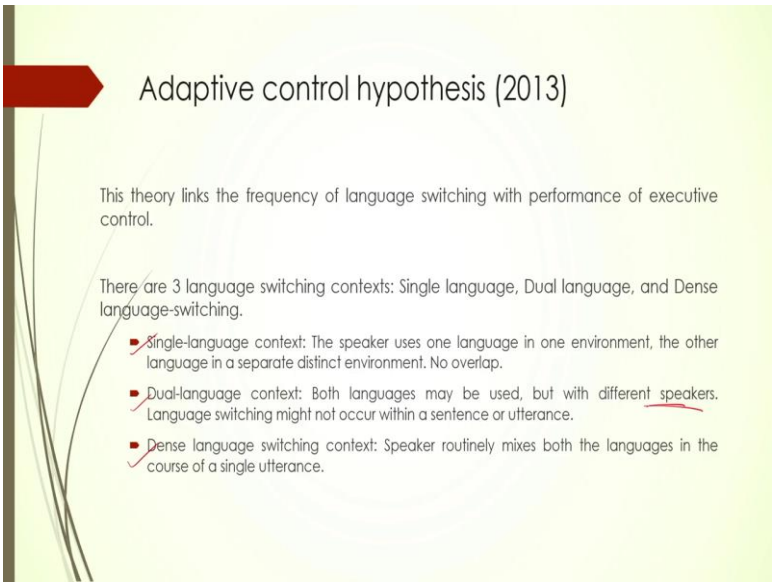
So, this is a very important study. And there are many other studies that are being that are going on right now.

(Refer Slide Time: 32:24)



Typically pointing towards similar kind of findings. So, this is an example of Raven's matrices. This is the logical kind of studies as to what which of these pieces will get into, will fit in here. So, this is an example and it goes progressively more difficult with each trial. This is a very common task of intelligence, common intelligence task, used for children.

(Refer Slide Time: 32:48)



And a very important theory that has come up in the recent time taking into account this bilingual experience is that of adaptive control hypothesis that that came out in 2013. This theory links the frequency of language switching with performance on executive control. So, this theory takes it as a baseline that being a bilingual itself does not guarantee executive control mechanism, a higher executive control among bilinguals.

What probably is playing a role is the behavioral aspect of the bilingual language use, which basically is about this language switching frequency. How often the bilinguals switch their languages? Because if you switch the languages only then there is a chance of having higher control mechanism being put to use. So, there are three switching contexts that the theory proposes. One is single language context, then dual language context and then dense code switching context.

Single language context according to the theory says that the speaker uses one language in one environment. So, one language one environment persons when the people are bilingual, the participants are bilingual and they do use two languages, they do switch between two languages.

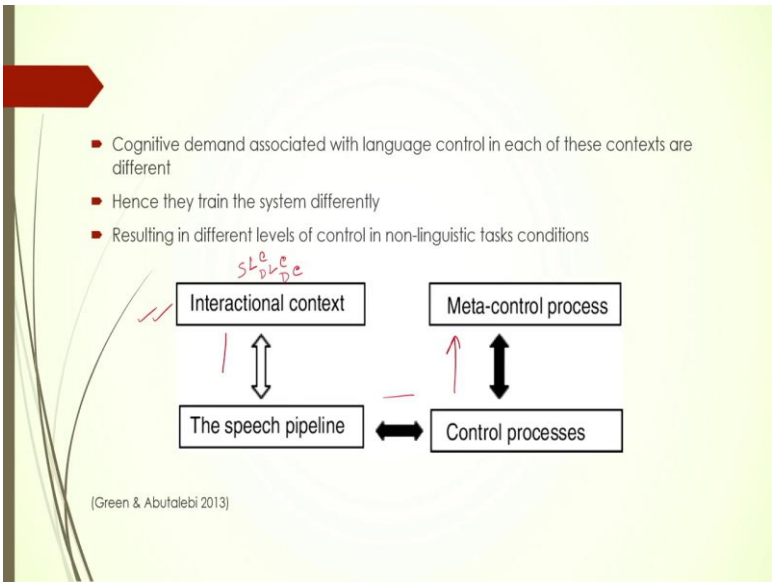
However, there is no overlap. Each language is used in his own particular context. So, one language at home, one language outside and so on. So, this is a very simple affair and this is called single language context. The other is called dual language context where both languages can be used, but with different speakers.

So, language switching here is not dependent on context, but it is dependent on speakers as to who the conversation partners are. So, it is not dependent on area, but on different different participants. So, switching may not occur within a sentence or an utterance. What happens in this case is that one has to be constantly alert for any cue in the environment on the basis of which one might need to change.

And then one that there is the dense code switching context. Dense code switching context is speaker routinely mixes both languages in the course of a single utterance. Dense code switching context is a one where which we typically find in most Indian cities, urban areas where we switch between the local language and English quite fluently.

Absolutely, there is there is no rhyme or reason actually. That is it is not dependent on anything, it is just the way that people speak. So, the two languages are both are useful for any kind of given context. Hence, there is a very simple smooth going back and forth between these two languages. So, that is called dense code switching context. Now, these kind of three language switching contexts actually have different amount of demand on the cognitive control mechanism.

(Refer Slide Time: 35:44)



This is the figure that this theory proposed that theory shows this Green and Abutalebi's theory adaptive control hypothesis. So, this is the interactional context. This is where the single language they are written like this SLC, BLC and dense code switching, ok. So,

this is the interactional context depending on these three kinds of interactional context this will affect your speech pipeline as in what you speak depends on the context. And then this in turn trains the control processes which ultimately leads to meta control processes, strengthening of the meta control processes. So, this is how it goes. Interactional context affecting your speech output, that kind of mechanism affecting your cognitive control processes which in turn strengthens your meta control processes.

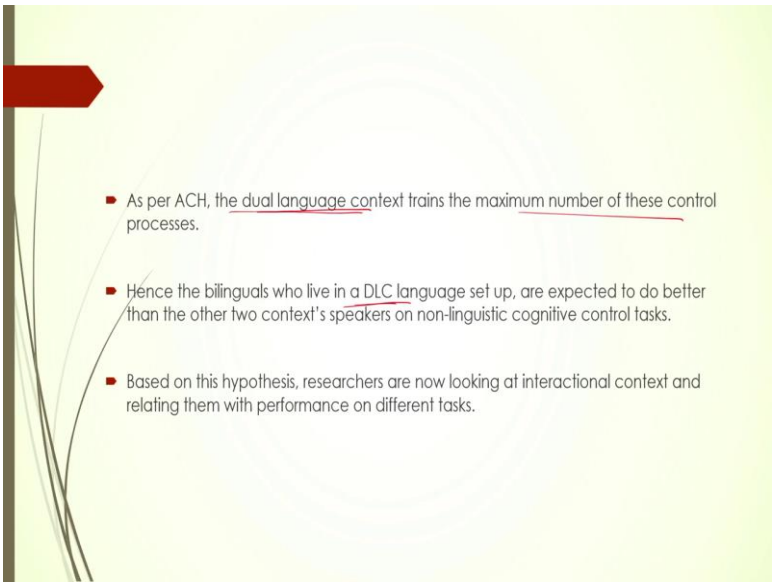
So, different different kinds of international context in terms of language switching leading to different levels of non-linguistic cognitive control.

(Refer Slide Time: 36:47)

And so, what is that cognitive control that we are talking about? Green and Abutalebi gives 8 types of cognitive control processes. These are the eight types, goal maintenance, to opportunistic planning. And then he shows how each of these linguistic language switching contexts can train each of these different kinds of cognitive controls.

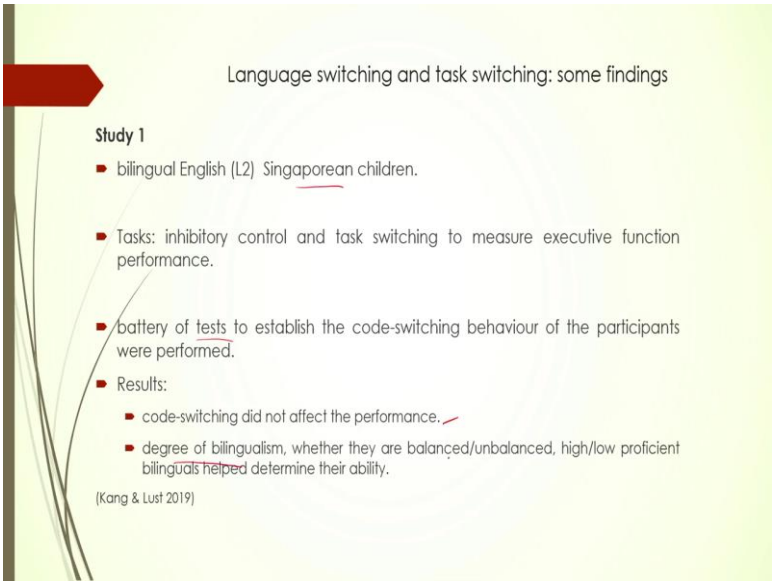
So, within the larger domain of cognitive control mechanism, their Green and Abutalebi brings out eight different aspects and each of those aspects can be trained differently by each of those three different language switching context. So, to summarize in as per this ACH, the dual context trains the maximum number of these control mechanisms. The dual language context trains the maximum number of these control. So, out of this 8 almost 5 or 6 are trained by the dual language context.

(Refer Slide Time: 37:24)



Whereas for single language context, only a few control mechanisms are trained and dense code switching also similarly trains only a few of these control mechanisms. As a result of which what happens? Bilinguals who live in a DLC language setup are expected to do better than the other context speakers in non-linguistic cognitive control tasks. Now, based on this hypothesis, researchers are now looking at interactional context as a variable and checking this out with performance on different cognitive tasks.

(Refer Slide Time: 38:15)

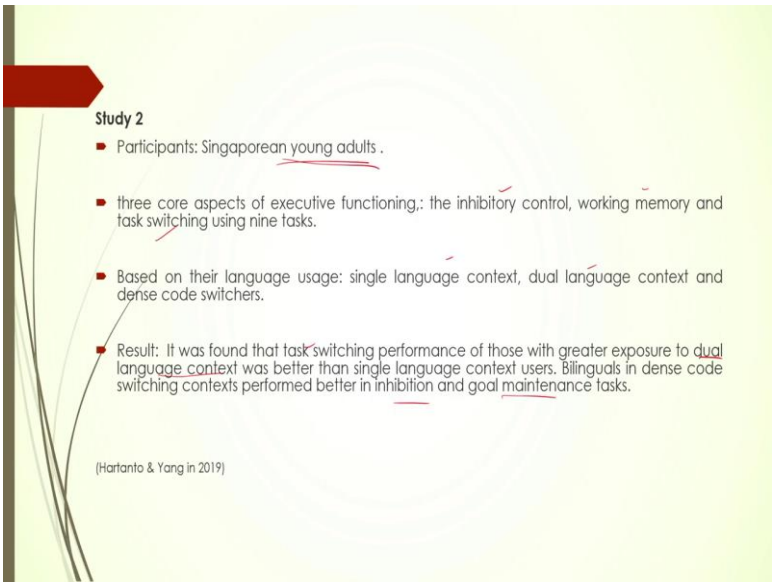


There have been a number of studies. So, we will talk about only a few of them, which are recent and they have looked at different populations. So, study one has looked at Singapore, bilingual children from Singapore. The tasks were inhibitory control and task switching on to measure how executive function mechanism turns out in terms of the language switching context.

So, a battery of course, tasks. So, they were also tests were also designed to establish the code switching behavior of the participant. However, the results showed that code switching did not affect the performance. So, code switching context did not have any correlation with their performance as per this particular study.

And that however, the degree of bilingualism whether they are balanced, unbalanced, high, low proficient bilinguals, these were found to be determining factors in this particular study carried out in 2019. So, the bilingual children, they were different in terms of both code switching practices, language switching practices in their language used context as well as they were different in terms of whether they were high proficient, low proficient, balanced, or unbalanced bilingual. Code switching context did not seem to affect their performance.

(Refer Slide Time: 39:36)



In yet another study, they again on Singapore, young adults this time, they found out that they have also used tasks on inhibitory control, working memory and task switching. All together they used 9 tasks. And they also devised a very a new language history

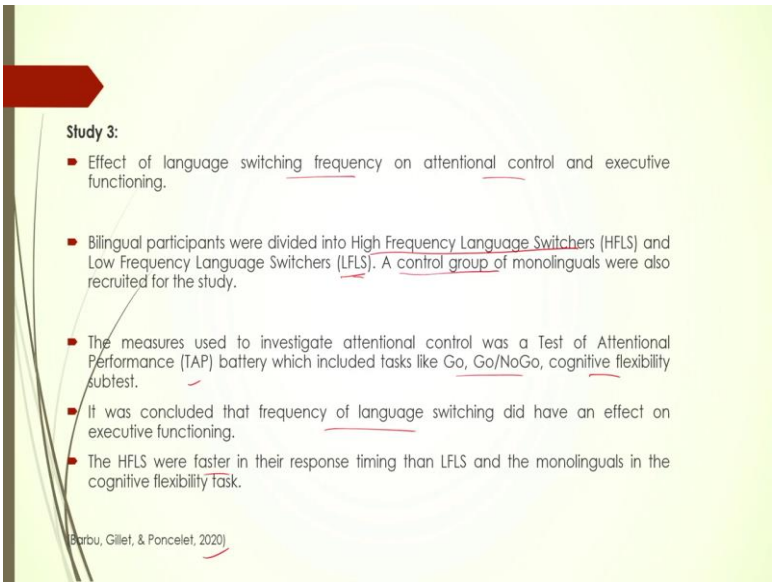
questionnaire, language usage questionnaire that takes into account the language use in different kinds of contexts.

And out of that and then the contexts are calculated. It is mathematically calculated to put participants into single language, dual language and dense code switching contexts. So, there are so there is this questionnaire and there was there was this set of 9 tasks. What they found was that task switching performance with greater exposure to dual language context actually was much people with dual language context background were actually doing better, found to be doing better in task switching.

Any all the task that required them to have a task switch and this was better than the single language users. And bilinguals in dense code switching context perform better in inhibition and gold maintenance tasks. So, this study finds a fine tuned much more finer level of control mechanism with respect to all the three language switching context.

As a result of which this Hartanto and Yung study in 2019 have now been replicated in many other places also. And that questionnaire that they have created is also now being used by many other groups.

(Refer Slide Time: 41:16)



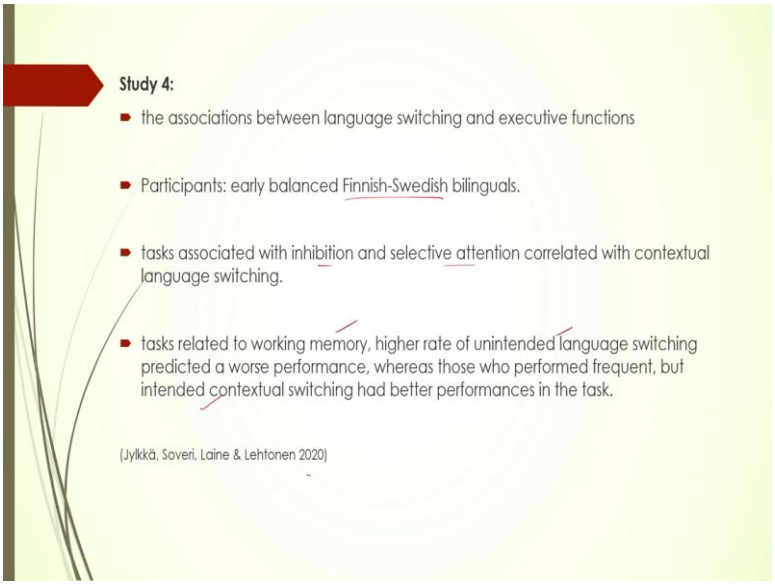
Study 3 will a was carried out in 2020. They have looked at the effect of switching frequency on attentional control and executive functioning. They used a different questionnaire altogether different mechanism to divide the participants. They used a task

which because of use using which they created this high frequency language switchers and low frequency language switchers groups. So, two groups and they have devised on this the basis of a questionnaire and they also had a control group of monolinguals.

The measures used to study the attentional control was test of attentional performance TAP battery, which had go no-go cognitive flexibility subtest. There are all these different tests that they have used. It was the study found out that the frequency of language switching did have an effect on the executive functioning.

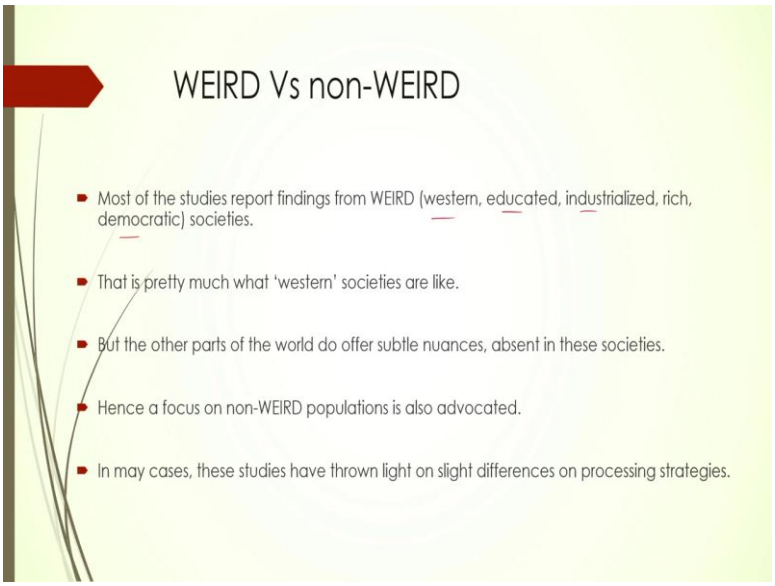
The high frequency switchers were found to be faster in there in the tasks on in the cognitive flexibility task as opposed to the low frequency. So, overall barring one study the other studies have found out that language switching if the bilinguals are in a context where they have to switch frequently between two languages based on different kinds of cues which is the dual core switching context. They are found to be doing better in different kinds of executive control related tasks.

(Refer Slide Time: 42:48)



Study 4 again 2020 this study was on Finnish-Swedish bilinguals. They had task associated with inhibition and selective attention and task related to working memory higher rate of unintended language switching predicted worse performance, right. And whereas, those who performed frequent, but intended contextual switching had better performance in the tasks. So, this is the finding in these domain so far.

(Refer Slide Time: 43:17)



And then we have the WEIRD versus non-WEIRD sort of population. Now, WEIRD versus non- WEIRD populations have were pointed out by researchers recently that most of the findings in psycholinguistic studies majority of psycholinguistic studies had the participants from western, educated, industrialized, rich and democratic societies which is kind basically what most western societies are.

So, typical find typical studies will have university students as participants in those studies who take part in lieu of course credits. So, the majority of the studies, majority of the results are representative of the of a subset of western society's population. Now, this has this has repercussions, this cannot be generalized and on the entire population of the whole world, the world has different kinds of societies, different kinds of population with all kinds of nuances in built in different societies.

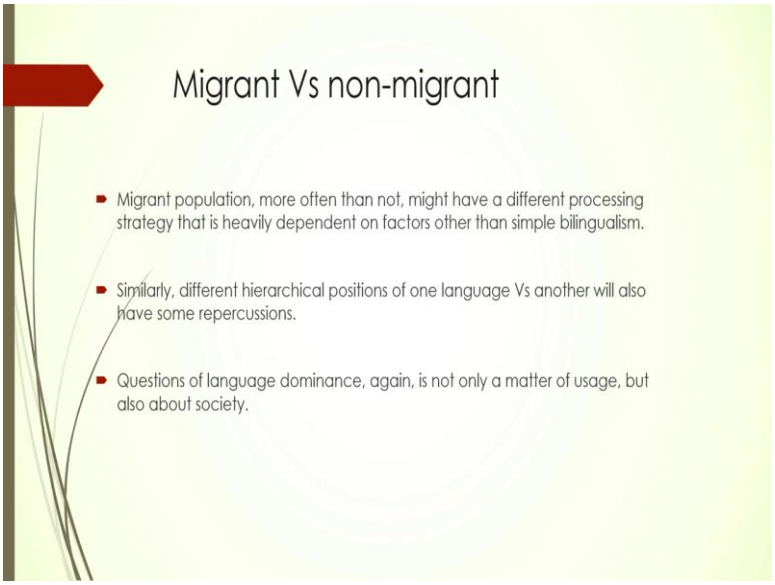
So, how can a small group's performance be you know mapped on to the rest of the population. So, as a result of which now there are there is a call for looking at populations from non- WEIRD countries as in the non-western, non-rich, non-democratic and you know all these different kinds of countries there are a lot of variants.

For example, countries like India can offer a lot of important insights of bilingual language control as well as bilingual's control on executive functions. Countries like India where multilingualism is the norm, in western societies till very recently monolingualism was the norm, bilingualism has become more common only recently.

But in countries like many Asian countries, African countries multilingualism is the norm, even today it as it has been for years for hundreds of years.

So, there are bound to be differences. As a result of which now many studies are coming up with this kind of participants in mind and we are now beginning to see different kinds of results that challenge the earlier findings.

(Refer Slide Time: 45:32)



Similarly, a new, recent phenomena of a large scale migration into western countries have given rise to the another domain of study within bilingualism is that of migrant versus non-migrant population. Majority of these bilingual population in the western countries are migrants.

So, when we look at let us say Chinese-English bilingual. Those Chinese are not native Chinese of the place or you know Spanish-English bilinguals or in the more recent times let us say Ethiopian-English, Ethiopian speaking may different varieties of Arabic and English and so on. So, there is there are differences here so, migrant non-migrant difference has to be also looked at, that is again yet another domain that has come up.

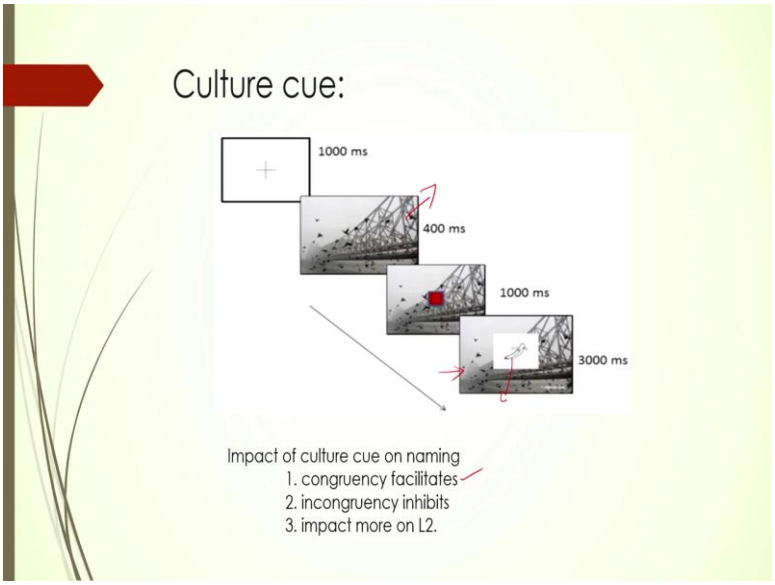
(Refer Slide Time: 46:21)

So, we will conclude this part, this section with some recent finding from India keeping all of these various new variables into account. So, some studies investigating cognitive control mechanism in different bilingual populations have looked at the role of culture cue, culturally specific cues on the language control as well as executive control mechanisms.

So, culturally specific cues are very interesting domain of research that have found out that in the culture specific cues have an has a negative impact on language production. So, Chinese-English bilingual studies have shown that if the participants see a Chinese face and they have to use English language, produce English language there is an impact.

So, incongruent cultural cues affects their L2 more significantly as opposed to L1, but the incongruent conditions do have an impact. This is one domain that has been replicated in many in couple of Indian studies. In one case, the Bengali-English bilinguals were studied and they found similar impact.

(Refer Slide Time: 47:32)

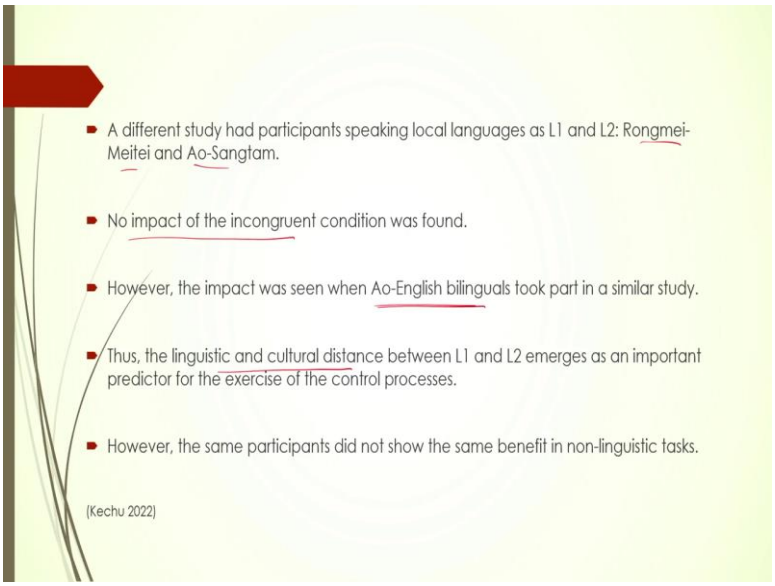


So, this study was like this. This is what they used this is a prime this is the picture of Howrah bridge and they this was a production study. The prime here was a culture specific cue. So, there are different pictures that were there in the background and the study was a production studies the a picture will appear and the participant has to name, name the picture.

The all the while the cue the prime remains in the background. In some cases, the target language is English, in some cases the target language is Bengali and they found an impact of the incongruent conditions. So, congruency it had facilitating effects.

So, when the picture, the picture and the language to be used were the same then belonging to the same culture, there was facilitation, when there was an incongruency there was a negative impact. And the impact was also found to be more on L2. This is in lined with the Chinese-English studies that we have talked about.

(Refer Slide Time: 48:37)



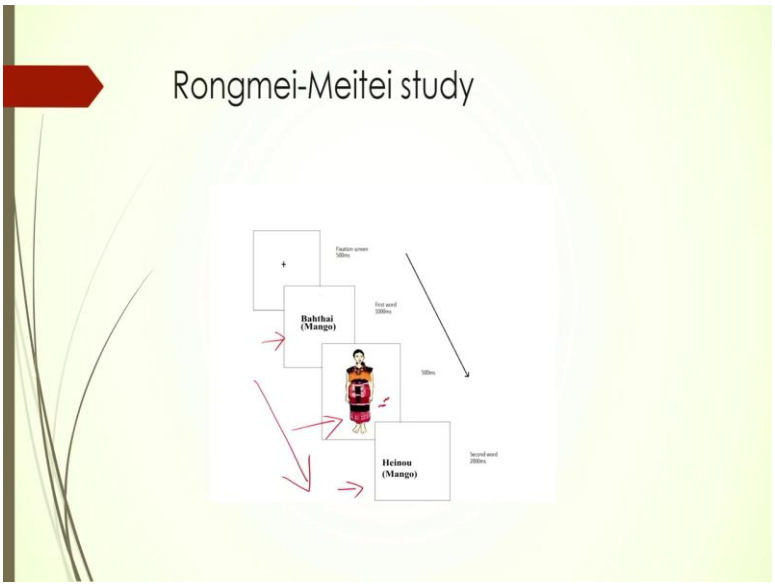
However, there have been other studies also that looked at similar kind of priming, that using cultural specific culture specific cues and try to see how culture specific ces affect language control as well as other executive control mechanisms. However, now these studies have found different results that there was no impact found of the incongruent condition on the language output.

There were some studies carried out on Rongmei-Meitei and Ao-Sangtam bilinguals. Both of these groups are in north east India and the interesting difference in this study is that from the previous study is that both of these languages are local languages unlike earlier Bengali-English. So, English is not a local language. However, Rongmei- Meitei and Ao-Sangtam both all of these languages are spoken in the nearby region.

So, both are all of these are indigenous languages; all of these four are indigenous languages. And here we do not find this study did not find any impact of the incongruent condition. However, when the researcher looked at Ao- English bilinguals, if to see if it is about the language pair or it is something else, they actually found impacts the similar way that the Chinese-English as well as the Bengali English population showed.

So, it turns out the probability that linguistic and cultural distance between the language 1 and language 2, between L1 and L2 of the bilinguals are important issues to look into. So, the same participants will do not show impact of incongruent condition in L2 when the languages are indigenous, but they show the impact when the L2 is non-indigenous.

(Refer Slide Time: 50:26)

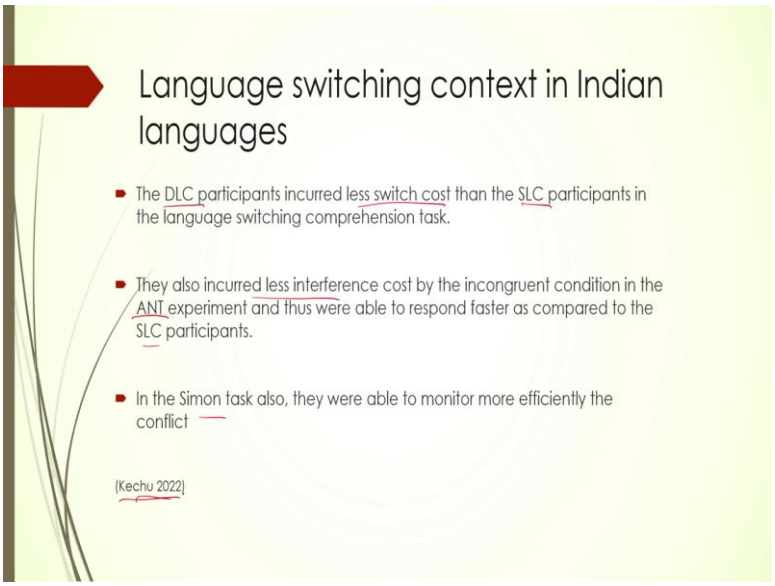


So, one of these studies, the Rongmei-Meitei studies did used the culture specific dresses. In the north-east India, all of these the in this study was carried out in Nagaland. So, in Nagaland and Manipur, the in the north-east most of these indigenous communities, the indigenous groups have their specific dress.

So, this dress has this is specific to each of the tribes. So, the dress will have different patterns, different color, mapping and so on. So, which is unique to only that culture, only that group. Hence, this study used the dresses on cartoonized pictures of humans and one particular study used translation equivalent recognition. So, the first word was in L1 and the second in L2 and vice versa. And there was this cue that comes in between.

Sometimes this was Rongmei dress, sometimes it was a Meitei dress, this particular is a Rongmei dress. Now, this the study looked at how much the in the prime that dress impacts the language output and they found there was no significant impact. So, incongruent cultural incongruent conditions did not have any inhibition on the output.

(Refer Slide Time: 51:42)

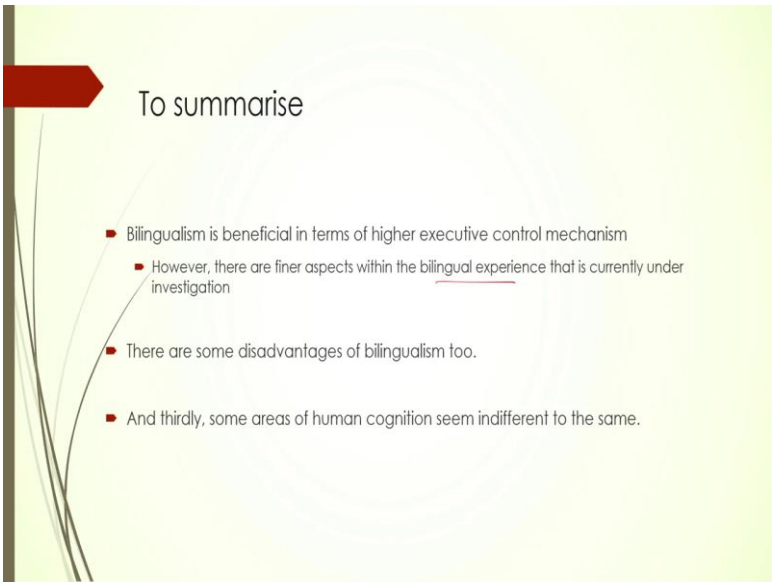


The study also looked at language switching context and its impact on executive control mechanisms. So, what they found was that dual language context participants incurred less switch costs than the SLC participants. So, this is in line with the other findings where we where bilinguals who live in the dual language context are showing finer control on the executive control mechanism.

And this study also found that they will incurred less interference cost in the incongruent condition in ANT as well and were able to respond faster than the SLC participants. So, basically overall this study found that the dual the DLC participants had much higher executive control put in place as opposed to the monolingual as opposed to the single language context participants.

So, this these are some of the recent Indian studies that have looked at these issues that have been that have been put forward by researchers all over the world. And the research in these domain is only beginning to take shape with different kinds of participants. However, we see that once we take into account differences in cultural larger cultural social context into the when we build them into the design, we do see different kinds of results.

(Refer Slide Time: 53:10)



So, to summarize bilingualism is beneficial in terms of higher executive control mechanism in certain cases. However, there are some finer aspects within the bilingual experience that is now currently under investigation. So, we do not completely negate the bilingual advantage. However, we need to look at the finer nuances within the bilingual, the behavioral ecology of bilingual experience.

And that is where we probably will have better answers as to why some bilinguals do show the advantage whereas, some bilinguals do not. And as we have just seen some of the Indian studies are now beginning to look at those nuances at different levels of whether depending on cultural closeness, linguistic closeness and language switching context. There are some advantages of bilingualism too.

There are some studies which have found bilingual disadvantages of bilingualism. Primarily in case of language related issues of vocabulary size and grammaticality and so on. And thirdly, there are some areas where there are no difference at all. So, areas of human cognition which seem to be indifferent to bilingualism.

So, to in a nutshell, bilingualism has a good, bad and indifferent results. So, here we come to the end of this particular segment. There are references at the end which one can look up for all of these papers that we have discussed.

Thank you.