The Psychology of Language
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Lecture No 19
Bilingualism

Hello friends, welcome back to this lecture number 19, which is supposedly the last lecture in the series. Obviously, the 20th lecture will be a review lecture where we will review whatever we have done up till now in this particular course on The Psychology of Language. Now, what we are going to do in this lecture is we are going to pick up from where we left off in lecture number 18, which was when we were discussing bilingualism.

It is an interesting phenomena where people can speak two languages or they are proficient in two languages. So we were looking at what is bilingualism? We were also looking at how does the bilingual function, how does the bilingual brain functions and in addition to that, what are the possible advantages and disadvantages of being a bilingual? And not only that, but also looking at several psychological and societal factors, which go hand in hand with the idea of bilingualism.

Now, what we will do today, so in the last class, we probably looked at the bilingual brain and we also looked at a little bit about the introductory part of bilingualism. Today, what we will do is we will look at the cognitive structure of bilingualism and also look at how does this bilingual ability help us in educating bilingual students or what kind of advantages that bilingual have over monolingual. So that is definitely what with the subject matter of this lecture.

But as you have been doing before, before we jump into finishing bilingualism or dealing with the last part of bilingualism, let us take a little step backward and do a small revision of how we started, where we started and where we are now. Now, we have been doing this in many lectures, just because we wanted to make a continuity, so that you know the context in what the present lecture is and how we have arrived at this very place.

So, we started off this course by first looking at what is language? What is the meaning of language and how it is this different from communication? We were interested in defining

the psychological aspects of language, but before looking at the psychological aspects and language basically is psychology. So, using the psychological cognitive processes language is produced.

So the two main systems or two main achievements of the human mind is one is cognition, the other is language. So language uses cognition. And so it is an inherent part and that is why you have a field called psycho linguistics, because those psychological processes leads to language. So, what we will be interested in is looking at what is language and for understanding what is language, we need to start out by looking at what does language serve as a purpose of.

Also looking around us we see very complex languages. So, what we wanted to do is look at very basic languages. So, we started off by looking at the most minimal form of language, which is called animal communication system. We looked at what is an animal communication system and what are its basic properties of an animal communication system and different types of animal communication system. Some classic examples, for example, the honeybee waggle or the call of the vervet monkey.

So, this kind of systems we looked at and we looked at characteristics of such a system. Now, as I said, the animal communication system is a very basic system. So, we moved on from there to looking at what is the human language like. So, we started off by looking at the formation of the human language. And we started off studying how the phoneme, which is the basic speech sound make up the morpheme, which is the word form and then moving up to the level of the words and tense discourse and so on and so forth.

So, basically the tree of how the human language actually progresses or how it is structured. Ad also doing a little bit work on what are the syntactic rules of language and what are the grammatic rules of language. From there on, we focused on something called the evolution of language, we wanted to check how language evolved, we looked at the continuity discontinuity theory, we looked at evidences from the Foxpro gene and several other evidences.

We looked at, which gave us an idea how the human language system would have evolved. And lastly, we looked at some fossils, we looked at those evidences which are present, which

suggests that how the language would have come. So, we looked at the idea of how pidgin, which is a form of language or the proto language, which is the ancient great, great grandfathers of ours would use, and how these led to the actual development of the language.

So, with this aim, on with this knowledge of what is language and what is its scope, we moved on to the next section, where we looked at how a scientific language study of languages to be done. So, we started out by looking at what is scientific method. Now, the aim was to look at how our scientific study is done, so we started out by downloading of what is a scientific method like, what is the meaning of scientific method.

And so, we looked at all the process of reduction, induction, we looked at how theory is built, a hypothesis is built and so on and so forth. And we added on to it by looking at what are experimental design. So what kind of designs can be used, we looked at within subject design, between subject design, full factorial design and other parts of how language study or an experimental design, an experimental study of language can be done.

That is what we were doing. Next, we looked at those behavioral measures, that is used or that is collected for making an interpretation of language studies. And obviously, the two important dependent variables of interest are latency and accuracy. So we looked at what how latency and accuracy is measured in any language study, and what does it mean in respect to several language studies.

And lastly, we looked at how the language and brain interact. So the different techniques of measuring brain patterns while producing languages and what regions of the brain are related to languages. Now, remember doing this particular chapter, we were including some studies, some classic studies from the psychological field, and they have been pointing out which study fits where and how does it explain what we were doing at that point of time, in that particular section.

Now, obviously, once we had some idea of how a study of language is done, and what is language and what are its constituents, and how does language evolve and those kinds of things, the next obvious question was, how language is produced, and how languages perceive. So how the production of language happens and how the perception of language happens. Now, most basic form of language is the spoken form of language, and so we

focused on to the voice, the spoken form of language.

We started out by looking at how spoken words are perceived, spoken language is perceived, and there we concentrated on the idea of auditory perception. We looked at how airways which are spoken out, or sound produced through the vocal track, how they travel through the air, the medium air and they reach the ear, and how does this perception actually happen, what are the basic properties of waves, which carry the words with them or the sounds with them.

We looked at the idea of the amplitude frequency, and so on and so forth, and also looked in detail a little bit into the structure of the ear. So how does the ear look like and what is the role of the ear in all this auditory perception. Next, we focused ourselves into something called a speech stream. So we looked at how does the speech stream look like, when we speak and this speech is converted into electrical signals or into a spectrogram, which is a display of the movement of the airwaves.

The movement of the sound waves in the air, what does it reveal? So, we looked at the spectrogram and we found several interesting patterns. For example, the idea of consonants and vowels and the idea that speech is continuous in nature, the idea of **(()) (09:17)** and fricatives and so many other things to be looked at. Once we had an idea of how the speech stream looked like and how it is transmitted and perceived and what are its characteristics, the next obvious thing was looking at how does speech development happens.

So we looked at the societal attachments, we looked at babbling, we looked at mother ease, and all these forms of evidences, which gave us some idea of how speech would have developed. And lastly, we looked at some theories of speech perception. Basically, comparison in three theories, we started with the motor theory, we looked in detail into something called the auditory framework theory and lastly we also introduced the idea of direct realism, which is another theory of speech perception.

Now, once we had some idea or once you have a clear of how speech is perceived, the next obvious role was to look at how speech is produced. Now, if you are able to hear it, you arre also able to produce it, you are also able to generate it and that is what we were looking at. So we are looking at how speech is produced and here we looked at the idea of the vocal

track, the mechanism of the vocal track and the production of speech.

How the vocal track, the vocal apparatus, they produce basic frequencies, overtones, up tones, how these frequencies get converted into the sound waves, which travels through the space and is perceived by the ear. So, we looked in detail into the idea of vocal track and the production of speech.

Next, we focused on to those areas of the brain, which helps in production of speech, which helps in articulation because, speech production has two parts, one is the blowing of the air from the mouth, the next word is the articulatory movement that the muscles do. So, this is controlled by the brain. So, obvious interesting idea was to look at those brain regions which control or which modulate speech production.

So, we looked at those brain areas, particularly the Wernicke and Broca area, and how do they let this production of speech happen. We looked at models of speech perception, we focused on the computation model diva, the feedback feedforward model and other models of speech production, which gave us an idea of how speech is produced both as a behavioral model and as a computational model.

And lastly, we looked at the development of speech productions and how speech production develops in young adults is what was the concern in this particular section. Once we have an idea of how speech is perceived and how speech is produced, and we also have an idea of what is language and how studies on language is done, we moved on to the next thing, that was the word. Look at any speech, look at any language, the central component of any language is the word, because word explains concepts, it explains ideas.

And so, the obvious thing to study here was what are words and so we looked at what are words, we looked at the anatomy of a ward, we looked at different kinds of words, for example, the functional word and the content word. We also looked at how does word symbolizes a particular idea or a particular concept and a construct. So, we looked at those things and how symbolism of word happens. Next, we went on one by one, looking into first how words are learned.

So, how does the word learning happen? We looked at the S curve, how word learning is

slow in the beginning in a child's life, but slowly it accelerates at some point of time and then plateau's around six years of age. So, we looked at that phenomena. We also looked at how several other properties in the neighborhood density and those kind of features help in learning words. Then once the child is able to learn a word, how does it store it? That was what was the next interest.

And so we looked at how words are stored in the mental lexicon and how does the mental lexicon and the cortical lexicon, they store word in terms of the spreading activation theory or in terms of the semantic networks, which are there. And then lastly, we looked at the word retrieval, how does retrieval of what happen in terms of recognition and recall of a word and in terms of pronunciation and symbolism of a word. So that is what we did. We looked at how word is recognized and how word is interpreted.

Words alone will not make any meaning, single word is something which does not make communication or it does not lead to language. One word, like boy or dog, they do not mean communication, because communication is exchange of ideas between people. And so the next thing was looking at how words are put together to form something called sentences. Because sentences generate meaning and these meanings are what is transferred between people.

So we looked at obviously, what is the structure of a sentence, what are the syntactic structures of a sentence, how sentences are formed and what rules govern sentences. Next, we looked at how comprehending of sentences is done in children, how does children learn the syntactic rules. So how the sentence can be broken down into its noun phrase and verb phrase and then again the noun phrase into subject and predicate and all those things that we were interested in.

Next, we were looking at the comprehension of sentences in small children. So, in terms of how the dual theory of sentence comprehension is there, the idea of late closure and the idea of minimal attachment helped in learning the syntactic rules for sentence construction or sentence comprehension in small children. Once we we had some idea of how sentences are comprehended by smaller children, the next obvious thing was looking at sentence production.

How sentences are produced by small children and there we looked at, in terms of sentence production, we looked at the ideas of how visual attention and scope and the vertical and horizontal flow of information, all those things combined together to give us some idea of how sentence production actually helps in production of sentences in children. And the last thing that we were interested in is looking at syntactic rules. How do children learn syntactic rules.

And so we focused on something called the primacy of meaning, sentence acquisition models and incremental building and all those proof, which give us some idea of how the child learn those rules to form sentences, correct sentences and correct sentences with meaning. Now sentences as I said, will help you put words together to give some meaning, but day to day talking is not just producing sentences, day to day talking is called discourse, where people exchange ideas between themselves and so discourse generally is are two types.

We have something called the narratives and we have something called conversations. So next interest was looking at how these discourse really work. So we looked at conversations what are conversations? Conversations is a part of discourse in which many people speak one after another and they exchange ideas. And so the first step what we were interested in is looking at how does discourse function. We looked at anatomy of a conversation and how tongue construction in turn identification happens in the conversation.

Next thing that we were interested is of course, the second part of discourse, which is the narrative, in which one person speaks and the other listens to it. We looked at how narratives are different from discourses and we looked at the idea of story grammar, which gives us some idea into how these narratives would have formed and what are the rules of forming a narrative or processing of a narrative. Then we looked at the idea of anaphora, which is basically a replacement to the main idea as in using a pronoun.

So how anaphora and inference, anaphora helps in inferencing meaning from sentences in a discourse. And lastly, we looked at the development of discourse ability in children's. How does this discourse ability happens in children in terms of post-speak gestures, conversational talking time. So, we looked at some disorders, children some kind of childhood disorders and that threw us some light onto how conversation ability develops in children. We also looked at **(()) (17:42)** and the idea of Gricean maxim in order to look at how discourse flows through

children.

Next, we were interested in looking at reading and writing and so two important things which the brain does not have by default, which is reading and writing. Reading and writing something which is new and which has been acquired by the brain. So we started looking at what are the basic writing systems in the world. We focused on three writing systems of all world, the logograms, we looked at the syllabary system and we also looked at the alphabetic systems.

Next, we focused on these writing systems and how these writing systems complement, comprehend each other, and how the brain understands this writing symbols and how does it make meaning out of it? Next, we were looking at cognitive process in reading, how does reading progress? And how does eye fixation, **(()) (18:33)** cards and those things actual help in reading.

We also looked at development of reading skills, how does development of reading skills develop in children. And lastly, we looked at the cognitive processes in writing. So what are the various cognitive process in writing and how various cognitive processes for example, attention, memory, and those kinds of features actually help you in writing things. And lastly, we are where we are, so the last thing that we were doing is looking at bilingualism.

Now, bilingualism, as by definition, means that a person or an ability to speak two languages together. So let us do a quick recap of what we did in the last lecture and then we will continue from where we had left.

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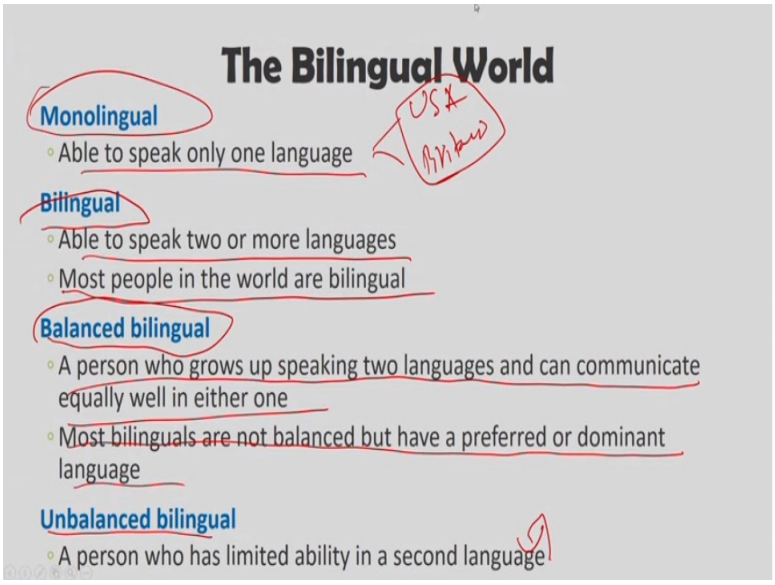

So, we looked at two kinds of people, the monlinguals and the bilinguals. Monolinguals are the ones who can speak one language and the bilingual being the people who can speak more than two languages. We also looked at the idea of unbalanced and balanced bilingual. Balanced bilingual are the same people who can actually speak two languages and in a balanced way, whereas we have the unbalanced bilingual, who is proficient in just one language and not proficient the other one.

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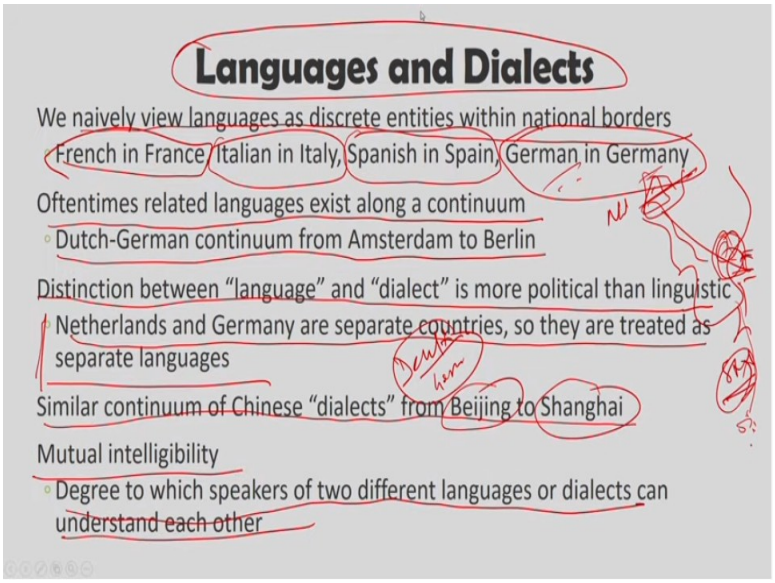


Figure 9.1 Map of Europe

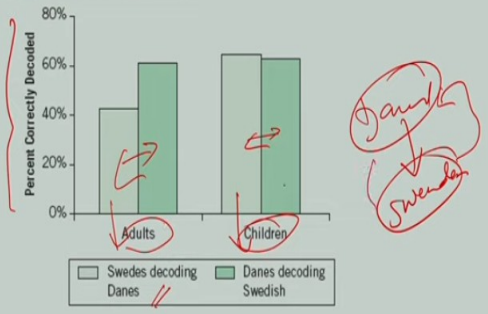
Although there are clear-cut political borders in Europe, the linguistic boundaries are blurred.

Figure 9.2 Map of Major Chinese Dialects

Although mainland China is a single political unit, its people speak a dozen mutually unintelligible dialects.

Figure 9.3 Mutual Intelligibility of Danish and Swedish

Swedish adults have more difficulty decoding Danish than Danish adults do Swedish. However, Swedish and Danish preschoolers perform equally well at decoding the other language. This suggests that implicit social attitudes influence the Swedish adults' performance.



We looked at how languages and dialects are interacting and what does language and dialect

mean and so here we looked at the map of Europe and how these different languages are spread across Europe to show you how dialects change across the languages.

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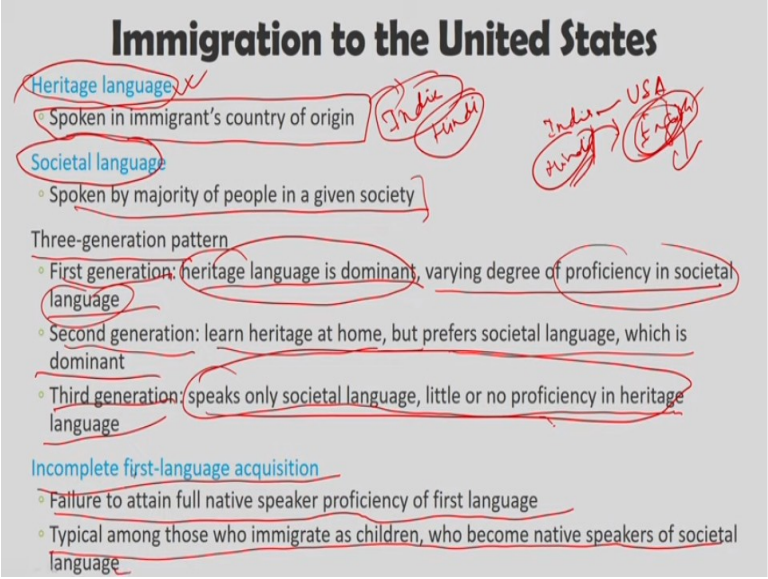

We looked at how one person migrates to new country, how does he make use of his heritage language and a societal language, how does he differentiate between heritage language and societal language? So, for example, if I were to go to the United States and going from India, my heritage language will be Hindi and my societal language will be English, because everybody will be speaking in English. So, how does these things really matter?

And how across generation, the first generation, second generation, and then the third generation, how these heritage language and societal language compete with each other to score over one another.

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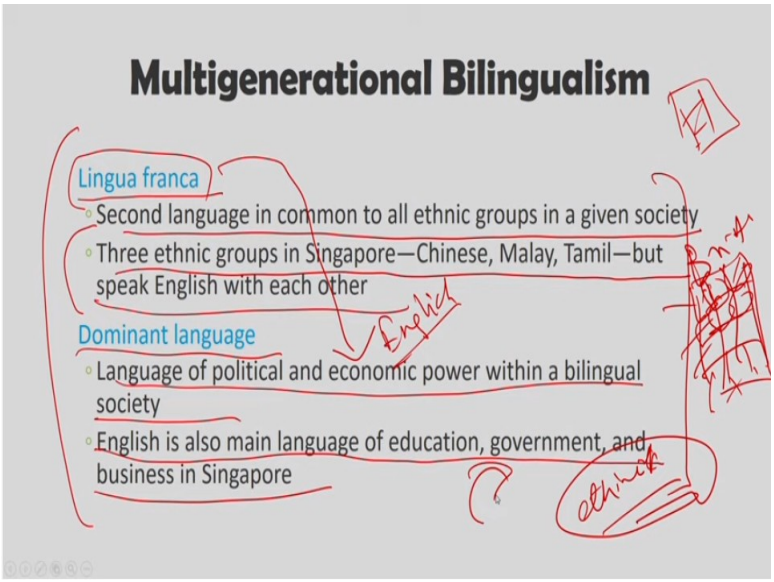

We looked at how incomplete first language acquisitions really work. We looked at multigeneration bilingualism, for example, the lingua franca in dominant language, properties of bilinguals.

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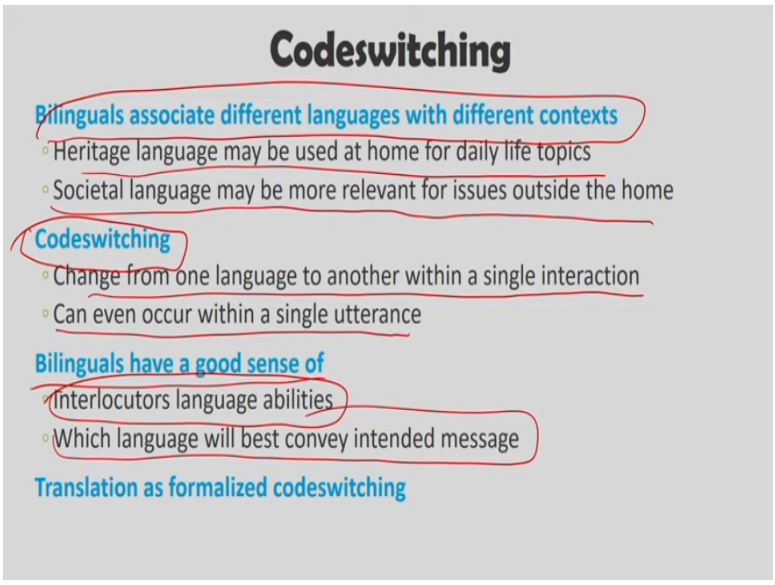

An interesting phenomena we also focused on was something called codeswitching, which is codeswitching is basically changing from one language to another within a single interaction. So, we started looking at what is codeswitching and what does codeswitching actually tell us about bilinguals. And what does code coaching actually lead to, so they lead to better good sense of interlocutor abilities.

And so also codeswitching also demonstrate that the person who is doing the codeswitching, the bilingual who is doing it, he has a better ability to look at which language to use in

particular kind of communication.

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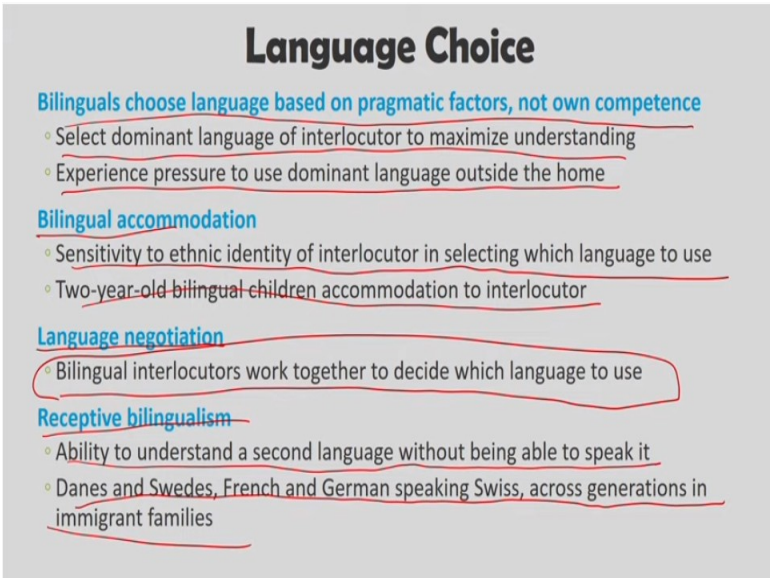

We also looked at how language of choice is done by bilingual and how bilingual accommodation language negotiation and receptive bilingualism really work.

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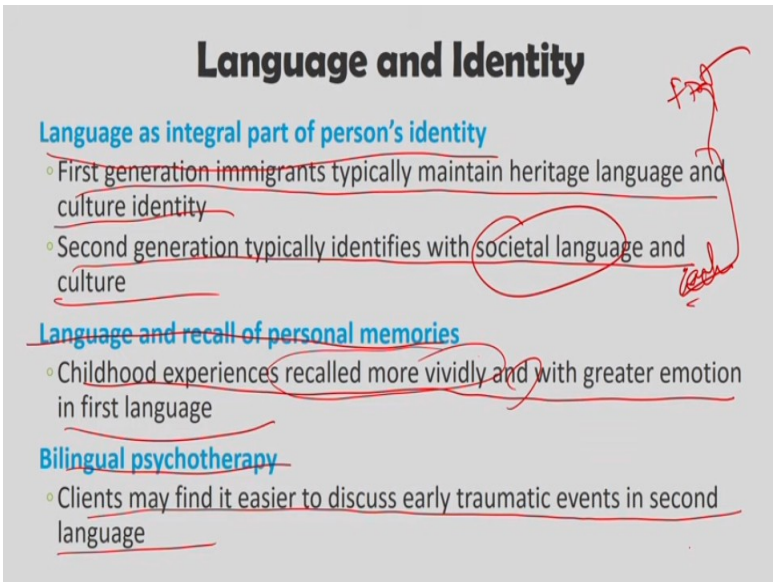

We focused on how language and identity are combined together. So, how language becomes an integral part of person's identity and also language and recall of personal memories in bilingual psychotherapy.

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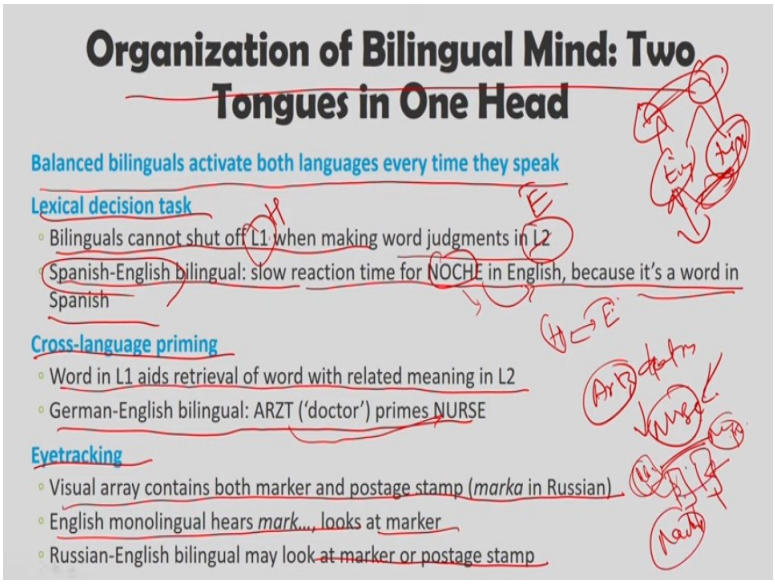

We looked at how the bilingual mind is organized in terms of lexical decision task in terms of the cross language task. So results from these tasks say that so bilinguals do not shift between languages, what happens is, both the languages, both the modules of language get activated at the same time. And so, we proved this by using the language design tasks in cross language priming task and eye tracking task.

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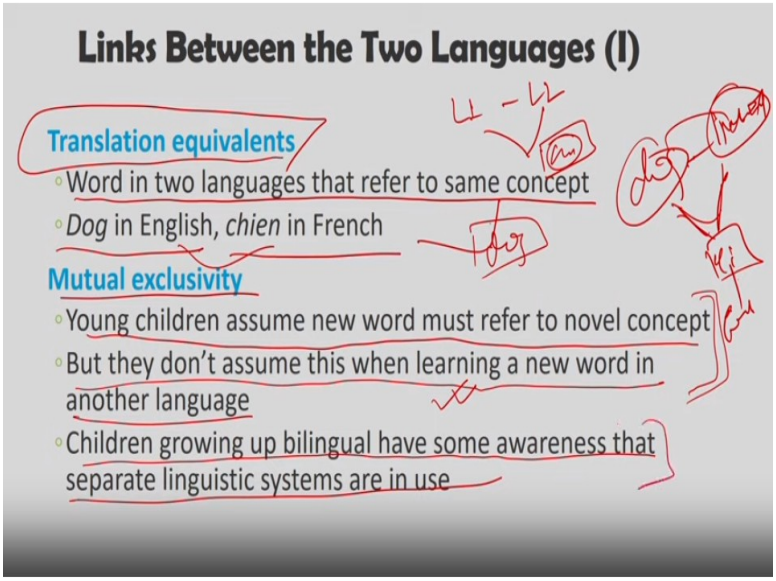

So, we also looked at something called transitional equivalents, words in two languages. What is the proof that the two languages are there and so transitional equivalents and mutually exclusivity actually proves that both areas of the brain or both modules, both the languages get activated in the bilinguals when using it.

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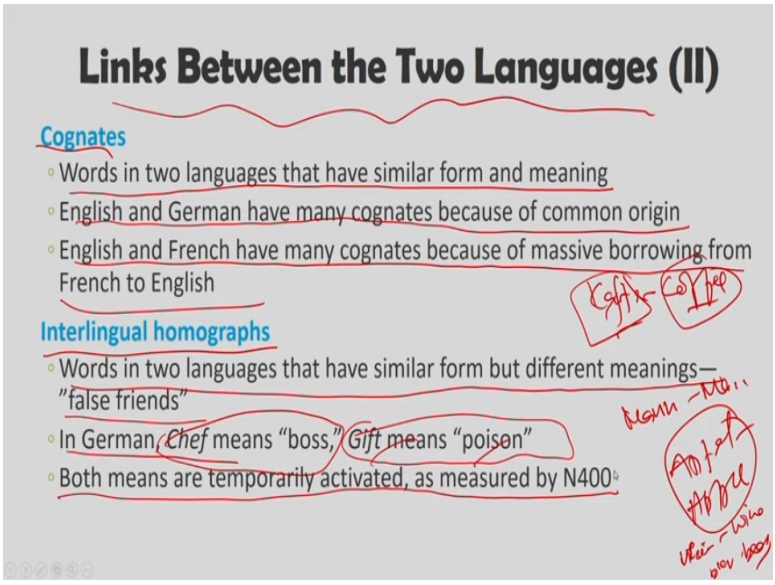

We also looked at what are cognates and interlingual homographs, which again provide evidences to the fact that bilinguals activate both the languages at the time of processing a language related task.

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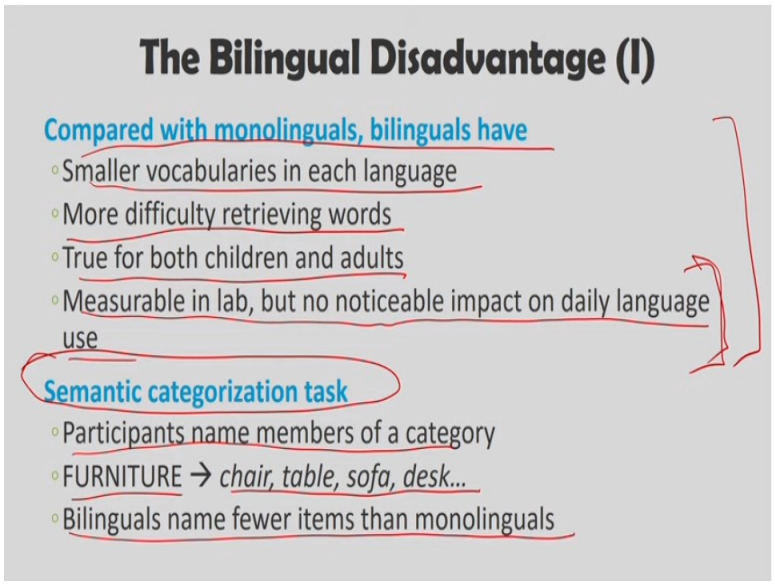

We looked at bilingual disadvantage, so what is the disadvantage a bilingual could have, we looked at how compared to monolingual, bilinguals have smaller vocabularies and more difficulty in retrieving words. And we also looked at how semantic categorization task provides an evidence to this kind of thing.

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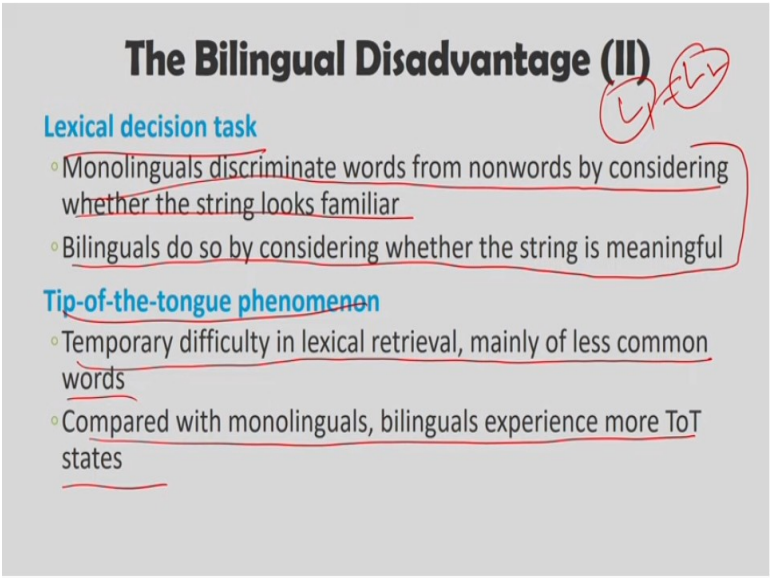

We also looked at bilingual disadvantage in terms of lexical decision task and the tip of tongue phenomena, which is a solid evidence on to the disadvantage that bilinguals have in comparison to monolinguals in terms of language use.

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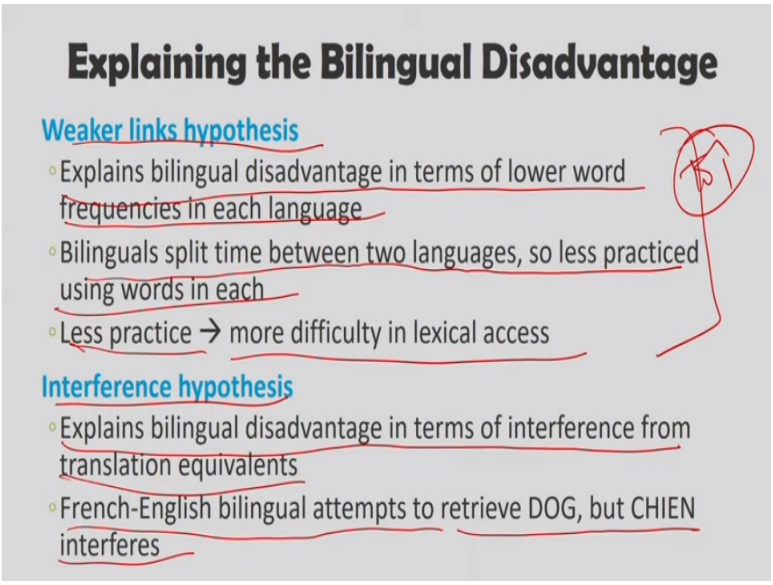

Now explaining the bilingual disadvantage, how do we use it? How do we explain this disadvantage? We explained it in terms of weaker link hypothesis and the interference hypothesis.

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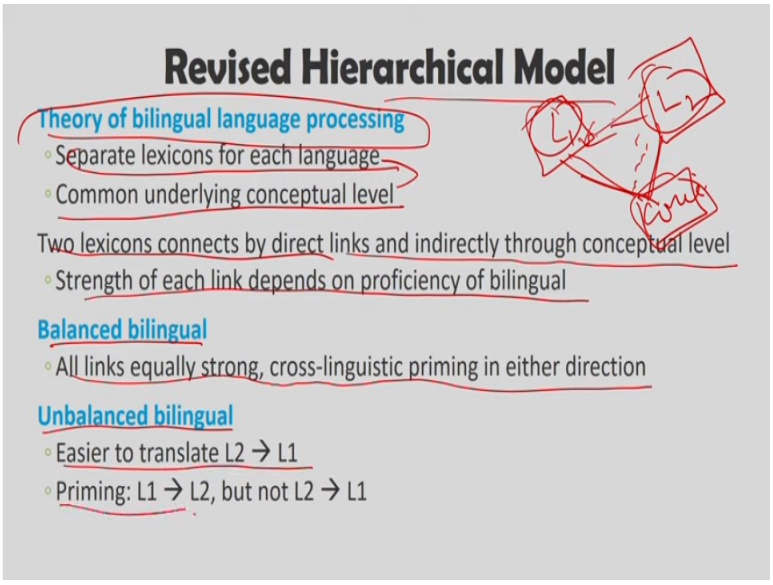

And through the revised hierarchical model, we prove how separate lexicons are there for different languages in the bilingual mind.

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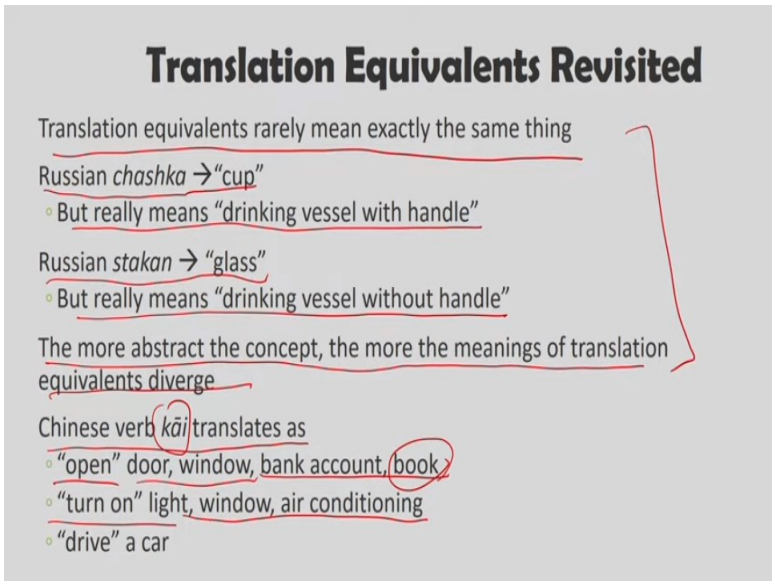


Figure 9.5 Chashka or Stakan?

Even translation equivalents for common objects often have non-overlapping meanings. Compare the English words *cup* and *glass* with the Russian words *chashka* and *stakan*.

Sense Model

Theory of bilingual language processing

- Takes into account fact that most words have multiple meanings
- These meaning do not fully overlap across languages

Priming activates all senses, or meanings, of a word

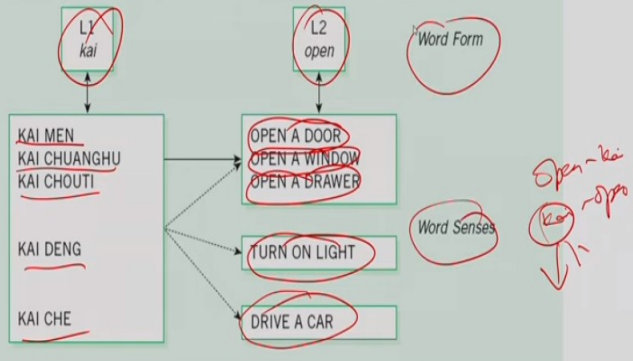
- But cross-linguistic priming depends on shared senses between translation equivalents
- L1 → L2 priming less likely because bilingual knows fewer L2 senses
- Bilinguals faster at translating concrete words (more overlapping senses) than abstract words

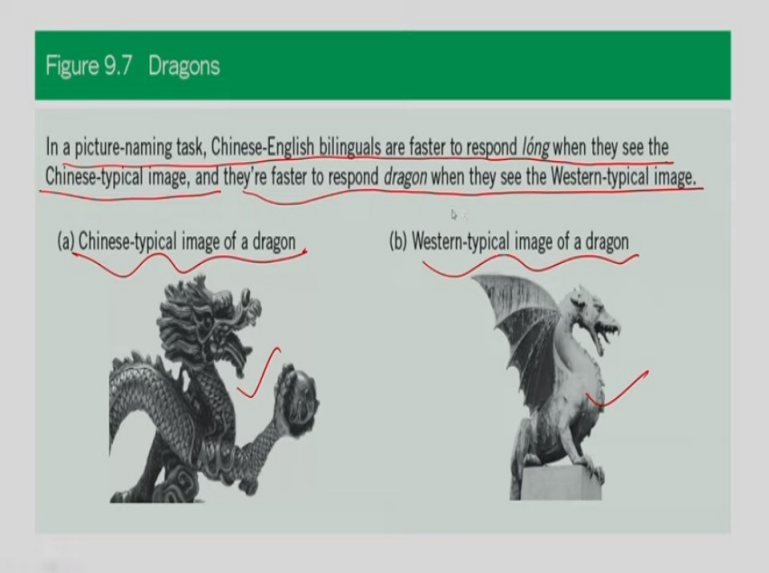
Picture naming task: Chinese-English bilinguals named

- Chinese-typical pictures faster when responding in Chinese
- Western-typical pictures faster when responding in English

Figure 9.6 Sense Model

According to the sense model, translation priming from L2 to L1 is strong because all L2 senses map onto L1 senses. However, translation priming from L1 to L2 is weak because only a few L1 senses map onto L2 senses. The model predicts that, for a native speaker of Chinese, priming for *open-kai* should be stronger than that for *kai-open* because *kai* has other senses that don't map onto *open*.





We also looked at transitional equivalents and how these ingredients and sense model, they provide us a little bit idea about the bilinguals.

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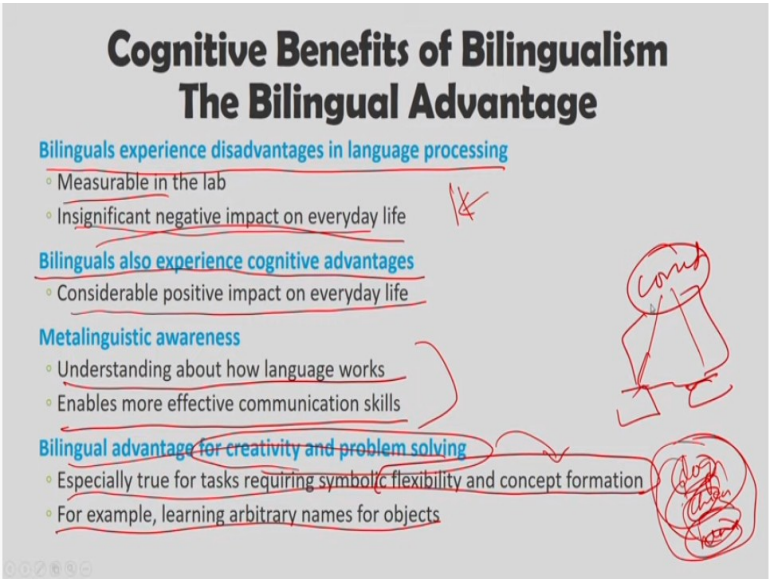

Now today's class, what we are going to do is, we have a shorter class today and that is why quite a lengthier review, that we will just focus on to the cognitive benefits of bilingualism and the bilingual advantage and lastly, we will look into the second language acquisition, how the second language acquisition really functions. So, what are the benefits of being bilingual or what could be the possible benefits of a bilingual person.

Now bilinguals experience disadvantage in language processing, it can be measured in terms of the lab or insignificant negative impact on everyday life. Now compared with monolinguals, the bilingual children display something called heightened metalinguistic

awareness. So, bilinguals, this disadvantage as we as we saw it can be measured in terms of semantic categorization task, it can be measured in terms of the lexicon decision task and bilinguals have some kind of problem or some kind of a disadvantage over monolinguals.

But the impact of such a negative impact or the effect of such a negative impact is very less. Also bilinguals also experience something called cognitive advantages. So, despite the fact that bilinguals, they have certain kind of negative impact or certain kind of negative benefit of being a bilingual, they also have certain cognitive advantage related to it. The positive impact on everyday life, so, they can switch between languages also they can understand which language to express experience or express themselves.

Now, as I said, which is compared to monolinguals, bilingual children display something called heightened metalinguistic awareness and so, what is metalinguistic awareness, it is an understanding about how languages work to make efficient choices regarding how to communicate with other people. This is one good thing about bilinguals, bilinguals are very good in understanding something called metalinguistic awareness, which is understanding about how languages work.

Now, since they know both the languages, they know the working of both languages and this working of both the languages, the idea of working abroad the languages enable them to communicate effectively. A monolingual will have limited word to communicate, but a bilingual will have multiple words on multiple essences, multiple types of sentences to communicate, and so better communication can be achieved by a bilingual.

Now, bilingual advantage for creativity and problem solving. Now, not only does bilinguals, have something called meta-analytic awareness, a number of studies have found that a bilingual advantage for task involving creativity and problem solving is also been reported. This is generally true for those tasks requiring symbolic flexibility or concept formation. For example, we can see that bilinguals are better than monolinguals at learning arbitrary names for objects.

Now, since bilinguals, they learn two different names for the same concept. And so they can tolerate arbitraryness at a greater length and so they are very good at achieving arbitraryness as or tolerating arbitraryness. And so, they have this advantage for creativity and problem

solving over the monolinguals, because they know two words from the same, or two concepts or two explanations for the same concept. So, especially true for task requiring symbolic flexibility in concept formation.

As I said, since two words or two different processes are used for performing the same concept and so task involving symbolic flexibility or concept formation, the bilingual will always have an advantage. What will happen is that he gets two different languages or two different name for the same concept and so, that will make him tolerate not only ambiguity, but also be better than monolinguals, because monolinguals can express something in only one way.

So more the better kind of a thing. For example, learning arbitrary names for objects. Now, the thing is that dog and chien if a person who is bilingual or trilingual, he learns three names for the same object or the same concept, which is the dog. Now, he can tolerate ambiguity more, why because for the same dog he has learned three names **(()) (27:52)** three names for the same dog and so, he can tolerate ambiguity more and he can learn arbitrary names more.

Also problem solving, because different approaches through learning are there and so his problem solving ability will be much better.

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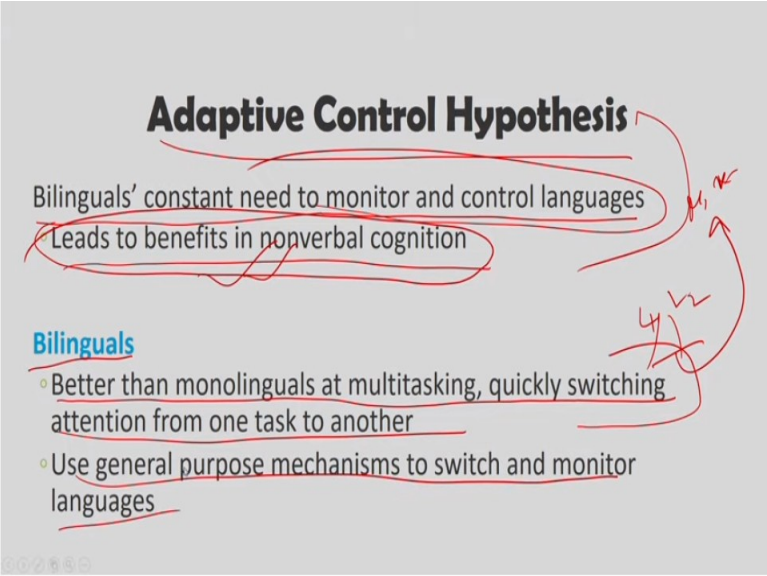

Now, bilinguals, adaptive control hypothesis, bilingual's constant need to monitor and control languages, they lead to the benefit in a nonverbal communication. Now, what is adaptive control hypothesis? Now, bilingual experience joint activation, whenever they use a

language. So, whenever a bilingual is using a language, both the language modules in the brain, they get activated, and so they need to be carefully monitor the language that they are using in order to avoid intrusion from the other language.

Now, when a bilingual is speaking in one particular language, either being first or second language, both the regions of the brain are activated and so what happens is there could be cross talking between them and so, he has to constantly monitor both the languages so that he knows what to produce, what sentences to produce, and what content not to produce. And the data controller hypothesis basically is a proposal stating that bilingual constant need to monitor and control languages leads to benefits in nonverbal communication.

So, this idea that this constant monitoring of control languages lead them to benefits in nonverbal cognition and this is called the adaptive control hypothesis. For example, if you look at bilingual they are better than monolinguals in multitasking, which involves quickly switching attention from one cognitive task to another. Now, in very simple words, it appears that bilinguals use general purpose mechanisms as they switch from language to language and so, the constant practice they get in the linguistic realm carries over to other perceptual and cognitive features.

Now, since bilingual can switch very easily between languages, the same mechanism gets shifted into in terms of perception attention, and so, other cognitive mechanisms have benefited by it as well. Bilinguals, so better than monolinguals at multitasking, quickly switching attention from one task to another that has been form and so, how it happens since they are changing languages from L1 to L2 quickly, the same effect can be transferred to now memory and attention and so on and so forth.

Now, there are three use of a general purpose mechanism to switch and monitor the languages.

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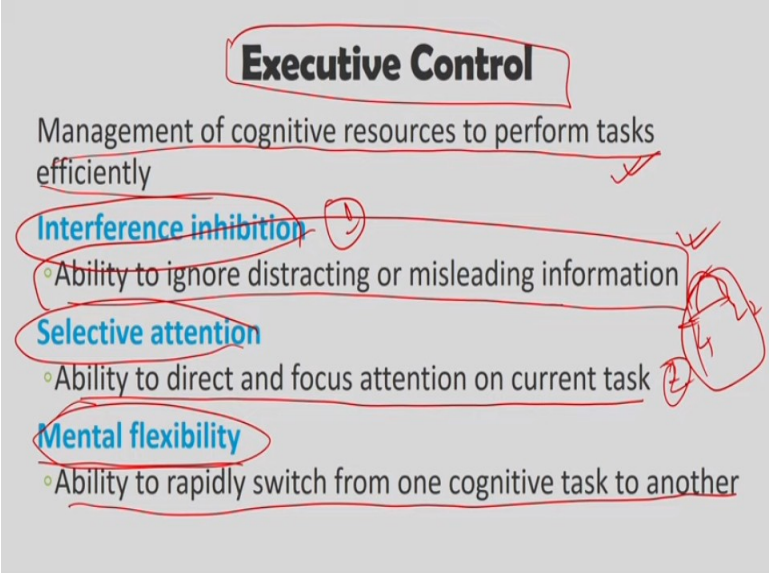

Now, the idea of executive control or the idea of how the language interpretation or the language teaching happens in bilinguals. Now, the management of cognitive resources to perform task efficiently. Three cognitive processes underlie the bilingual advantage. The bilingual advantage is whatever advantages we have just discussed the bilinguals have over monolinguals, now, these are controlled by three cognitive processes.

The first is the ability to ignore distracting or misleading information, the ability to distract or ignore distracting and misleading information is the first ability or the first cognitive process and this is called interference inhibition. Now, also the second ability, the second cognitive process, which lead to the advantages of bilinguals from a multilingual is called selective attention.

Now, from a very early age, bilingual horn on their skills of inhabiting interference from unattended language and this is called selective attention, which is the ability to direct focus attention on the current task. Now, since they are able to monitor and also selectively monitor which language to use and which not to use, they have to use a lot of their attention and this is called sustained attention and selective attention.

And so, this is another process that is a part of the benefit that bilinguals have and the third thing to look at is something called mental flexibility, which is, since bilingual need to take into account pragmatic factors such as which language is appropriate in a current context, they are also highly practiced at selecting something called selective attention. So that is what we were discussing.

Also mental flexibility, what is it? It is the ability to rapidly switch from one cognitive task to another. Now since bilinguals change between L1 and L2, as both of them are active, this leaves them to do this switching in other cognitive task also. This is the ability to rapidly switch from one cognitive task to another. So, they can switch from memory tasks to attention tasks from an attention task to some other kind of tasks and they can do this quick switching.

How does it develop? It develops from the idea of the bilingual advantage from the idea that mental flexibility is there and from the idea that they are switching between the languages. The three abilities are components of a larger system, which is called executive control, which involves the management of cognitive resources to perform the task efficiently. So, this is what the executive control is all about.

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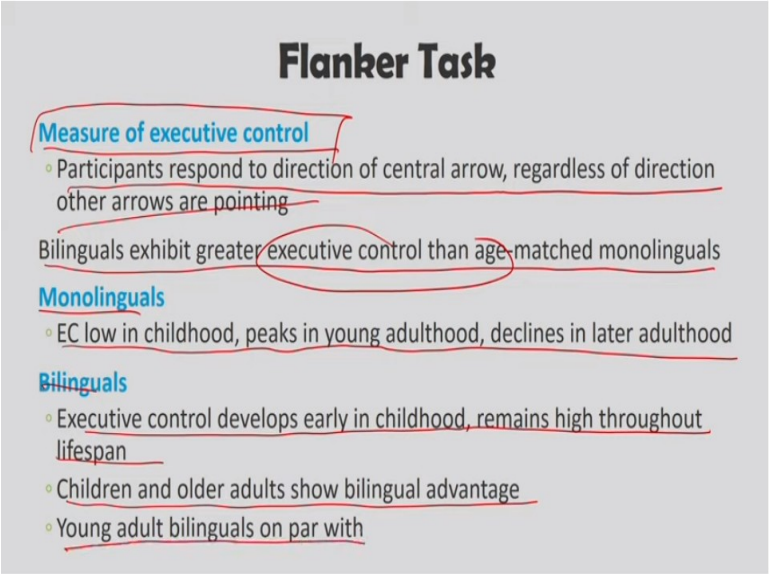

Now, how do we measure this executive control? The measures of executive control can be done in terms of something called, the Simon task and the Flanker task. We will look at flanker task first. Of course, in the Simon task what happens is, it is an experimental procedure that requires participants to respond to color for stimulus, regardless of its location. So, there will be a couple of stimulus, which will come in front of the subject. And so, it will come in any direction from the central viewpoint that the subject is looking at.

The subject has to quickly point out the colour of the stimulus and what has been found, it has been found that bilingual they show less reduction in speed during the incongruent trials

compared to monolingual. So, there will be congruent trials where the left or the right wherever it is, and the color and the key is in the same format and in incongruent trails, it will be in a different format, it will be in a different type and so you have to press the button.

So, in Simon task, in incongruent trials, where the fit is not there between the button press and the color, in those cases, the bilinguals show less speed reduction. Another interesting way of measuring this bilingual or executive control in bilinguals is in terms of the Flanker task, it is a measure of the executive control. Now, participants they respond to direction of a central arrow regardless of direction of other arrows, which are pointing.

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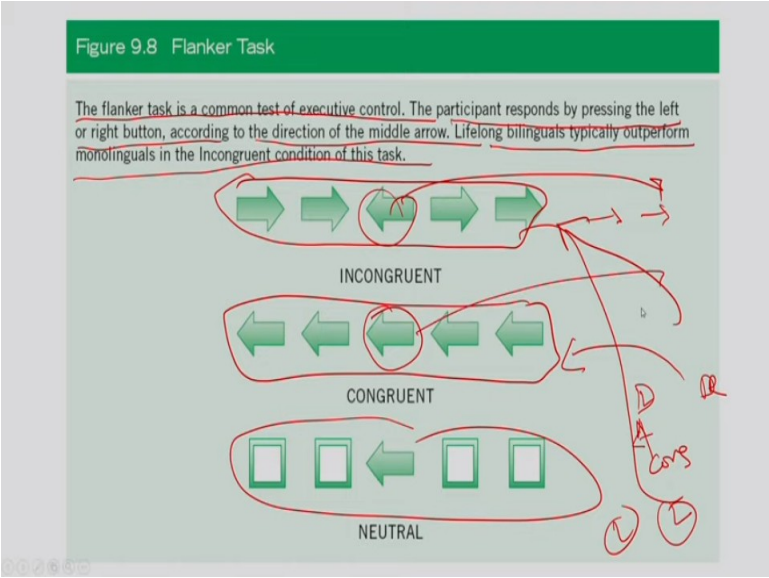

So, we have a system like this and so, we have these kind of arrows which are there. So, the subjects are required to look at these kinds of arrows. Bilingual they exhibit greater executive control, then age match monolinguals. It has been founded bilinguals, they perform better in this type of task, than monolinguals. So what happens is, that this is the task which is the incongruent trials, the arrows will be in the same direction and so you will have two button, left button and right button to press.

Now, suppose you are shown this, lets us start with this in the congruent trials, suppose you are shown this, what you have two presses, where is the middle arrow pointing. And so middle arrow is pointing towards left and so you have to press the left button, this is for the concurrent trials. Now, for the incongruent trials, you look at it, most arrows are in this way, but the middle arrow is pointing towards the left, and so your button press has to be the left.

So this is what it is and it has been found that the bilinguals, they haven a slight advantage over monolinguals in this kind of a task. They have greater executive control, monolinguals EC low in childhood, peaks in young adulthood and declines in later adulthood. So, for monolinguals, what happens is the executive control is very less in childhood, but then it peaks in adulthood and then by the time they are adult or later adult, it starts declining for monolinguals.

But for bilinguals, what happens is, the executive control develops early in childhood and remains high throughout the lifespan. So for monolinguals, this executive control that have been talking about, the control of three process, selective attention, the process of selective attention, the process of mental flexibility and interference inhibition. These developed early in childhood and they continue with them throughout the adulthood.

Children and older adults show bilingual advantages, both adults and children show this bilingual advantage. Also young adults bilinguals are par with. So this is how the Flanker task looks at and this is the neutral task and so you have to press the left button. This is the congruent task and this is the incongruent. The flanker task is a common task for executive control, the participant responds by pressing the left or right button according to direction of the middle arrow.

Lifelong bilinguals typically outperform monolinguals in the incongruent condition so they are faster in responding to this one than in this one, in terms of monolinguals and bilinguals.

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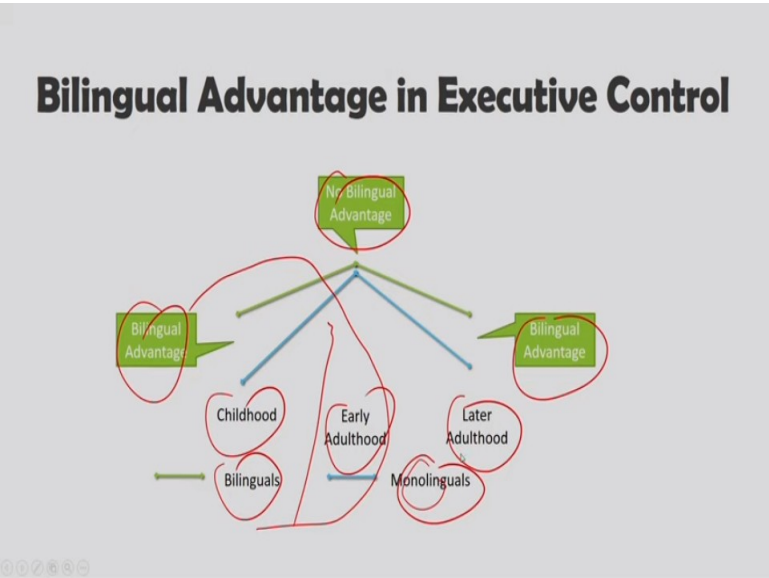

Bilingual advantage in executive control, so no bilingual advantage, bilingual advantage, bilingual advantage. Childhood, adulthood and later adulthood. You will see bilingual, you will see monolinguals. In bilinguals, both in childhood and early adulthood you have this advantage. Also in later adulthood, there is advantage but in monolinguals, you do not see this advantage happening.

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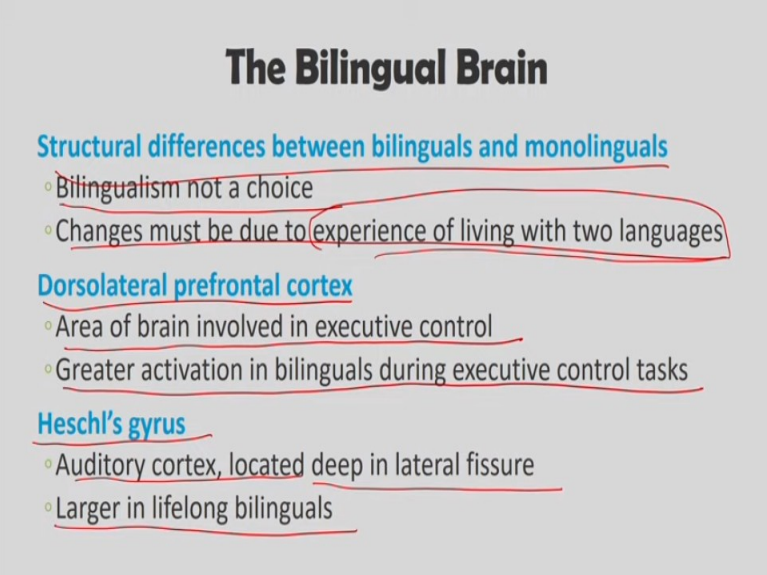

Now, let us look at the bilingual brain. How does it look like? There are structural differences between the bilingual and the monolinguals in terms of the brain structures. For example, bilinguals is something which is not by choice. Now, the changes must be due to experience of living in the two languages. The bilingual brain is not very different structurally, because bilingual is not a choice kind of a thing.

The changes which happens in the brain structure is because due to experience of the living with two languages and that is why the bilingual brain is a little bit different. Now main areas of interest for the bilingual brain is the dorsolateral prefrontal cortex. Now, this is the area of the brain, which is involved in something called executive control.

As we saw that the executive advantages in bilingual children and so, obviously the region of the brain which controls this executive advantage, which is obviously the dorsolateral DLPFC and the frontal cortex, both will have some kind of advantage. Now, so greater activation in the bilingual during executive control task.

Now, the executive control task, which is like the Flanker task or the Simon task is given, you

have greater activation in the DLPFC, which is the dorsolateral prefrontal cortex of the bilinguals, than in the monolinguals. Also, there is something called the Heschl's gyrus. This is an auditory cortex, so in terms of auditory perception in terms of auditory stimulus, the auditory cortex located deep inside the lateral fissure and larger in lifelong bilinguals.

Also the Heschl gyrus, which is another area of the brain, which is related to auditory perception in the auditory cortex. This you find that in the bilinguals, they are larger, and they are larger for all the life which is the there. Since the bilinguals have to hear two voices right, two different languages. And so this auditory cortex or the Heschl gyrus is too deep in the bilingual, the advantage in terms of bilinguals over monolinguals.

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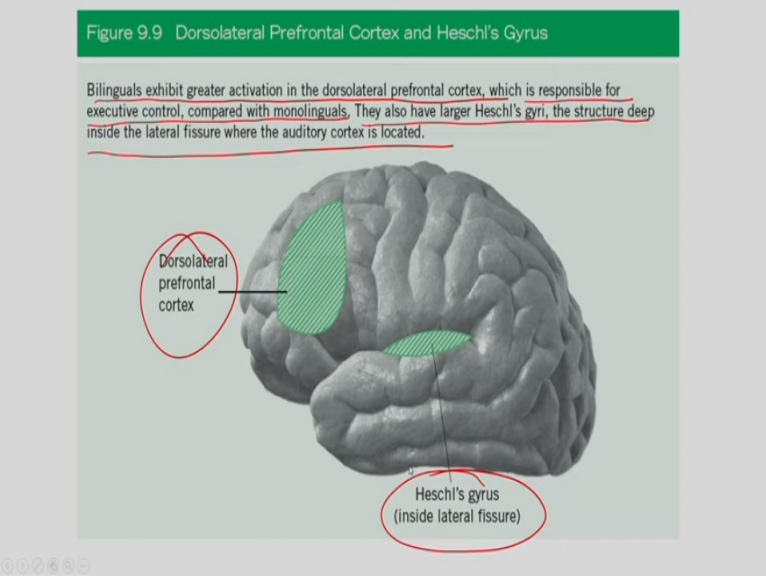

And you can see that bilinguals, they exhibit greater activation of the dorsolateral prefrontal cortex, which is responsible for executive control compared to the monolinguals. Also they have larger Heschl gyri, which is the structure deep inside the lateral fissure in the auditory cortex is located, this is my dorsolateral prefrontal cortex and this is my Heschl's gyrus which is inside the lateral fissure.

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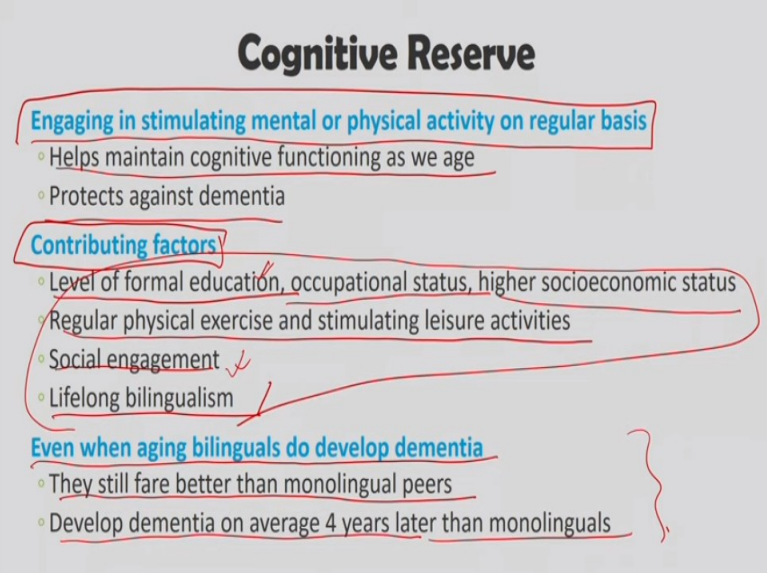

Now, cognitive reserve. What are cognitive reserve first of all? Now the saying, use it or lose it, applies just as much to your brain as it does to any part of body. So if you do not use certain parts of the brain or if you do not use certain part of the body, you will lose that part. And so this saying goes with that. Now ample research supports that the notion that engaging in stimulating mental or physical activity on a regular basis, it helps in maintaining cognitive function, as we age and protect us against dementia.

There is a lot of research which says that the more we use our brain, the more we use our bodies, the lesser the chances of us getting into dementia, because those brain areas when it is strained when it is used when it is function, they lead to lesser and lesser chances of dementia. A number of factors contribute to this cognitive reserve, including level of formal education and occupational status, which typically leads to higher social economy classes and better high health overall.

So basically, engaging in stimulating our mental physical activity on a regular basis leads to heightened cognitive resources. It helps maintain cognitive function as we age. The more activity that you do, more stimulating activities that you do, or physical activities that you do, the more the brain is used, the brain is brought into action and the more the brain is brought into action, the higher the chances that you will develop any kind of dementia, any kind of problems, it protects people against dementia.

Now, what are the contributing factors for this kind of for a lowering or increasing of cognitive reserves? One, the level of formal education, the more educated you are, the higher

the chances that you will get into discussions with friends and discussions and more engaging discussions and higher chances of a brain active. Occupational status, what kind of occupation you have been, if it is a manual labor job, it is a daily routine job, then there are very less chances that you will get engaged in some kind of a simulating work.

Academics, they get into more kind of a stimulating job, and they have higher cognitive resources. Higher socioeconomic status, obviously, this is to do with how better you are fed or how better your health is, and the status, or the kind of friends that you have in your society or social economic status, that will tell the cognitive resources. Also regular physical exercise and stimulating leisure activities has a role to play in cognitive resources.

The more regularly you do exercises, the more the brain gets interpreted, or used, the neurotransmitters and other hormones which are there in the body, they get used up more and more. And so there is more activity, the more the activity in the brain, the more it is being used, the more it is being used, the less of the chance of you falling into any kind of a problem.

And the more stimulating your leisure activity, watching a TV is not leisure activity, more stimulating leisure activities, crossword puzzles are doing Sudoku's and these kind of things involve your brain. The more the brain activity is there, the more the brain is being used, the higher the chances that you will have better health, mental health, and you will have better cognitive resources available. So remember those old age parents that we have, they have better memory than us and that is how, why because they did not trust Google.

The problem with us is that we have Google and so we search, but these people, they do not trust Google and so they use their brains. The more they use their brains, the higher the chances that their memory is better and so they have higher cognitive resources. Also social engagement, how much engagement do you have socially? Nowadays, people are getting more and more, I would not say antisocial, but out of the social convention and due to this what is happening is, people are not meeting with each other and not exchanging social ideas.

And because of that, what is happening is that you do not have this cognitive resources, ideas are not exchanged, people do not think over and so you have lesser cognitive resources and so lifelong bilingualism or lifelong bilinguals have higher cognitive resources then other

people. Why because in each cases as you can see, the formal education has to be a little bit good and also the social engagement has to be good, because bilinguals use both languages so they are into two societies at the same time.

And since their engagement is higher, their cognitive resources is going to be higher. Now even when aging, bilinguals do develop dementia, still they fare better than monolingual peers. So it is not that bilinguals do not get into dementia as they age, but the chances are that they are far, far better than monolinguals. They fare better than monolinguals in terms of getting dementia and they develop dementia over, on average, four years later that monolinguals.

So, in terms of language use or whether language has any role to play in dementia is clearly been established here that monolinguals in comparison to bilinguals develop dementia if they have to develop it, four years earlier than what happens in bilinguals. So bilinguals have this advantage over them.

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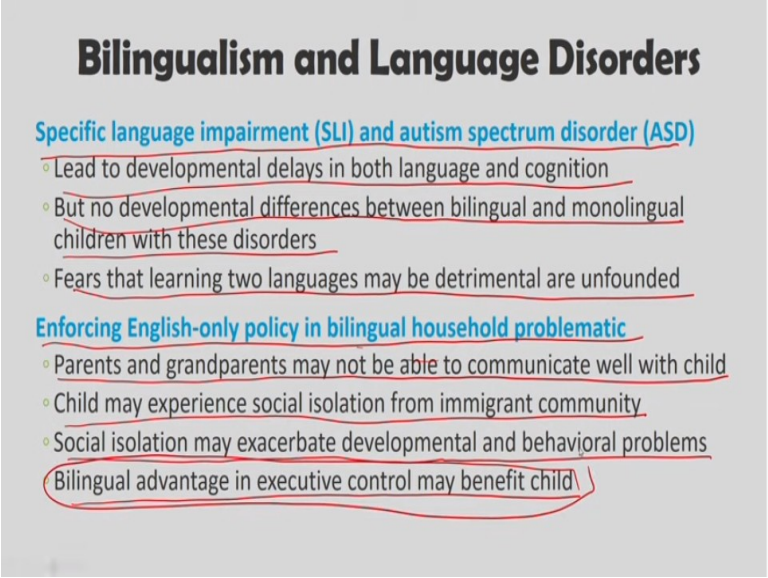

And also bilingualism in language disorder. Now it has proved the specific language impairment SLI and autistic spectrum disorders. Now, they lead to developmental delays in both language and cognition. But no development differences between bilingual and multilingual children within these disorders. Now, we wanted to test whether these specific language impairments and the autistic spectrum disorder, if they have any kind of bilingual and monolingual disadvantage.

And so, as we know, both of them are developmental disorders, it has been found that no developmental differences between bilingual and monolingual children with these disorders, fears that learning two languages may be detrimental and unfounded. So that is one of the things to be looked at. Also, enforcing English only policy in bilingual household is problematic.

If we look at a bilingual family, where English is the societal language and the heritage language is some other language where they have migrated from, enforcing the English only policy in this house can be actually problematic, because what will happen is the bilingual will not be able to produce their own language and talk in their own language, so their language will be dead. Now parents and grandparents may not be able to communicate with the child.

Now, if this happens, then what will happen is, the parents and grandparents who are coming from the heritage language, they will not be able to communicate with the first generation or second generation children. Also child may experience social isolation from immigrant community. Now, when he goes to the community from where all of them would have migrated, there will be a difference because he is using the societal language and not using the heritage language.

And so he will find himself in social isolation or cut off from his own community. Also, social isolation may exacerbate developmental and behavioral problems. So this can also happen. This social isolation can lead to developmental behavioral problems, and bilingual advantage in executive control may benefit the child. So if the child is bilingual, this executive control can actually benefit the child in some ways, that is the only good news to be looked at.

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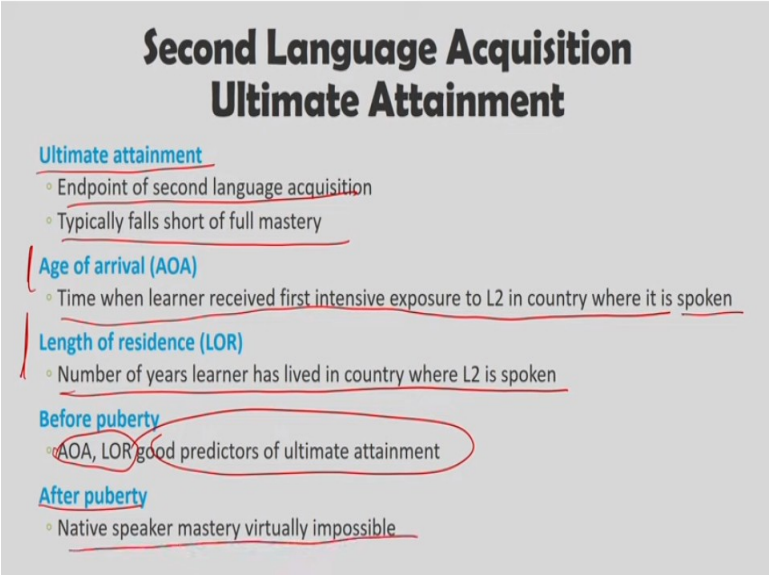

So once we know what are the advantages of bilingual, let us quickly look at the second language acquisition and whether there is a discrepancy or whether there is any kind of evidence with the fact that children learn second languages faster than adults, let us test this hypothesis first. So there is something called ultimate attainment and what is it? It is the endpoint of second language acquisition and it typically fall short of full mastery.

Now, it is widely believed that children learn languages faster than adults. Now, this scenario has some truth to it, but its reality is far more than complex. As I said, it is not that real, it is not that true, although children have some advantages when it comes to learning languages, adults can master the second language, right under the right conditions, giving the right conditions. So we are talking about something called ultimate attainment and what is it.

Now adult immigrants tend to learn some amount of new language and then reach an endpoint of the second language acquisition that typically fall short of the full mastery. Now, if an immigrant goes to a new community, and he starts learning the second language, there is a point after which there will be no learning happening, there will be an endpoint to the second language acquisition and that will be just below the full mastery of the second language, acquisition.

And that point is called the ultimate attainment. This is known as language learners ultimate attainment. So, how can we redefine this, it is individuals, vary widely on how successful they are at learning a second language, which is ranging from basic survival level to a heavy accent to nearly native speaker proficiencies. Now, the most difficult aspect of second

language mastering is its pronunciation.

As a general rule, those who learn the language before puberty, they develop native or near native proficiency in the second language, while those who learn the language after puberty, they will speak with a foreign accent, even if their ultimate attainment is very high with all other aspects. So, the more before puberty you learn the second language, the better chances that you will gain the accent, but if it is not, then the primary accent, the heritage accent sticks on to you.

Now many contractors contribute to the ultimate attainment of a second language learner, but two are very important to us, or two are to be discussed, one is called the age of arrival and the second is called the length of residence. Now, what is age of arrival, it is a time when learner received first intensive exposure to the second language in a country where it is spoken, that is one thing and the second is the length of residence, which is the number of years learners have lived in the country where the L2 is spoken.

Now, regardless of the age of arrival, it takes many years to master a language. Now, if before puberty, AOR and LOR good predictors of ultimate attainment. If it is before poverty, we are looking at, then the age of arrival and the length of residence will have some prediction or will nicely predict whether you can attain the second language, you can get the ultimate attainment and get the right pronunciation and accent for the second language.

But after puberty, if you start learning the second language, native speaker's mastery is virtually impossible.

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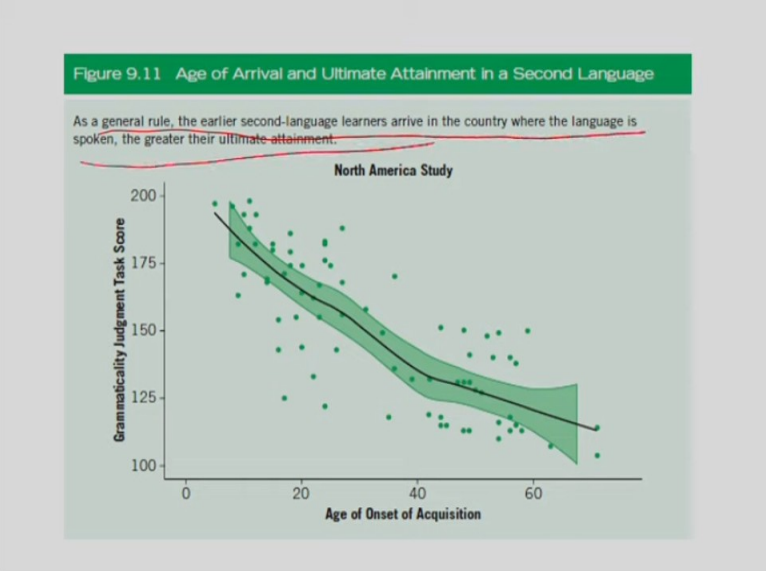

So, puberty is the baseline at which this particular thing has happened. Now as a general rule, earlier second language learners arrive at a country where the language is spoken, the greater the ultimate attainment and so this is what the curve talks about.

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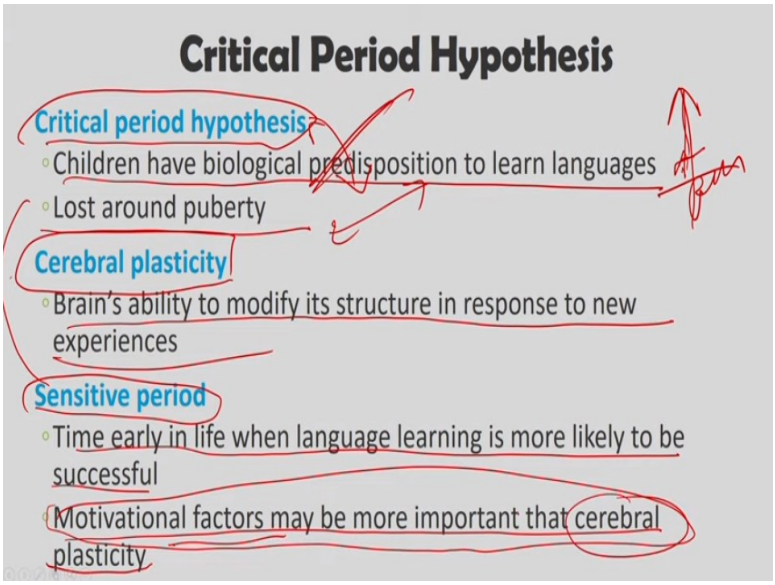

Now, there is something called the critical period hypothesis and what it is? The effect of age of arrival on the ultimate attainment in second language acquisition provide evidences for something called critical period hypothesis. So that age of attainment is related to the critical period hypothesis with does it say? This is the idea that children have a biological predisposition to learn languages and they lose it after puberty.

So critical period hypothesis what is it? It is the children have biological predisposition to learn languages and which is lost on puberty. So the critical hypothesis says that puberty is

the critical period. Now, before it, you can learn a language nicely. So this is my puberty. And if you cross this puberty, then the chances of mastery is very less. Now, critical period is generally accounted for in terms of cerebral plasticity.

So how does this critical periods are accounted for, what is the reason for this particular puberty being the baseline of how you learn or not, this has to look at in terms of something about cerebral plasticity, referring to the brain's ability to modify a structure in response to new experiences. Or after puberty, the cerebral plasticity of the brain goes away and so that is where the problem is.

Cerebral plasticity accounts for the bilingual advantage in executive control. Now after a certain period, the brain becomes less plastic, and learning is more difficult. Now, puberty does not present a clean break between those who and those who cannot learn a second language. And so we have another important aspect, another important variable, which is called the sensitivity period.

Now, this observation has led researchers to reconceptualize the critical period, as a sensitivity period, though the critical period has been reconceptualize as something called a sensitive period and so what is it? It is a time early in life when language learning is more likely to be successful.

Motivational factors may be more important than cerebral plasticity. So this sensitivity period, which is the reconceptualization of the critical period, it says that it is a time in life and learning languages is a successful thing is more likely, or people have more success in learning languages. And so, the reason for this sensitivity period, the definition of, or what makes this sensitivity period effective, is the motivational factors and less of the cerebral plasticity. So it has nothing to do with cerebral plasticity, it has to do with motivational factors.

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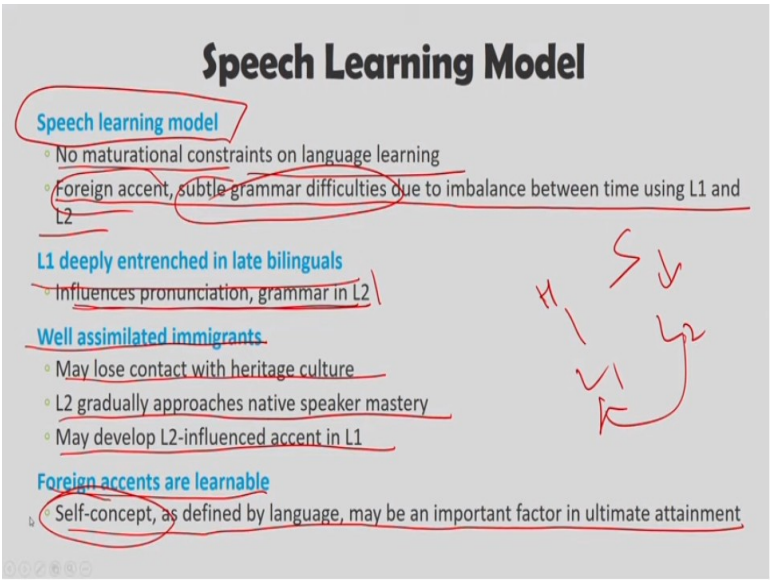

Now, there are something called, there is something called the speech learning model. So, what is it? Now, the critical period hypothesis emphasizes age of arrival as the most important factor in determining ultimate attainment in a second language acquisition. Now, some researchers have focused on the length of residence factor making the proposal for a foreign accent is the result of an imbalance between the amount of time spent using the first and second languages.

Now, according to the language learning model, the speech learning model, there are no maturational constraints on language learning. Now, what is the speech learning model? It says that there is no maturational constraints on language learning. Language learning has nothing to do with maturational constraint, it has to only do with something called when do you arrive? So, foreign accent subtle grammar difficulties are due to imbalances between the time using L1 and L2.

How much time you have been using this as L1 and L2 and that is the main reason how your foreign accent and subtle grammatical difficulties arise. Also L1 deeply interested in later bilinguals, influences pronunciation and grammar in L2. So, a number of observations provide support for speech learning model, first is immigrants who assimilate well into their new society and maintain relatively little contact with the heritage community often eventually develop pronunciation of the second language that is close to the native speakers.

So basically L1 deeply entrenched in late bilinguals influences pronunciation and grammar of L2 also well assimilated immigrants may lose contact with the heritage culture. So, if you are

well assimilated immigrant and you have stopped using the heritage language, you may lose contact with heritage culture, L2 gradually approaches, because L2 is the second language that you learn and L1, this is my heritage language and this is my societal language.

So, L2 gradually approaches native speaker mastery and may develop L2 influence accent of L1 and so, this will give the accent of this. Foreign accent are learnable. Self-concept as defined in many languages, may be an important factor in ultimate attainment. So, it has also been found that, this self-concept maybe reason or self-concept may be a factor in understanding how a foreign accents maybe learnt.

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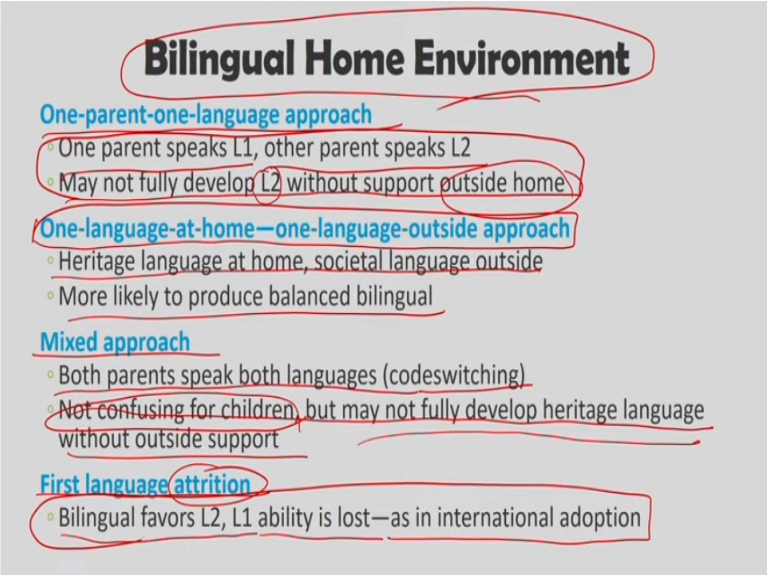

Now, this bilingual home environment. Now, another interesting thing is how does the home environment of bilingual families are there and what kind of evidences are there or what kind of bilingual environments are there and how they help in development of bilingual children. Now, so there are many types of bilingual environment home environment, the first is called the one parent one language approach. So, let us suppose that we have a bilingual family and so, both the parents speak different languages.

Now, how should the child be brought up? One approaches using the one parent one language approach in which what happens is one parent speaks L1, the other parent speaks L2. May not fully develop L2 without support outside the home. And so, in this case, this is one way approach. So, if you want to develop L2, you have to have support outside the home and then only you can develop the L2, the second language.

We can also have something called the one language at home, one language outside approach, this is the second approach which is there. We can have both parents speaking their own languages and children interacting with these both parents, but here if you do not have support to one of the languages, then you will not be able to develop this bilingual proficiency.

The other way to look at is one language at home and one language outside approach, which is using the heritage language in the home and using the societal language outside. Heritage language at home, societal language outside, more likely to produce a balanced bilingual. So, if you use one language at home one language at somewhere else, in the society, this produces more off balanced bilingual and sometimes we use something called the mixed approach.

In the mixed approach, what we tend to do, is that both parents speak both languages, which is called codeswitching. Now, in the mixed approach, both the parents are speaking both languages, they are switching between languages, several concepts are being switched up, several concepts are being transferred into. And so this is another way of looking at the bilinguals, not confusing for children, but may fully develop heritage language without outside support.

It is not confusing for children in this case, the mixed approach is not at all confusing for children, but may not fully develop the heritage language without outside support. Now, what will happen is there are difficulties in the heritage language. The parent would not explain it, he will switch his code for the child to understand the concept in a different language.

And so, in these cases, what will happen is, the true identification or the true heritage language the child would not learn. So, in this cases, until and unless the child has some kind of an outside support for his heritage language, he will forget the heritage language. That is one thing to look at. And first language attrition. In this case, what will happen is, attrition is basically forgetting the first language. So bilingual favors L2, L1 is lost, L1 ability is lost as in international adaptation.

So, if you have something like this, if you just start taking the second language and slowly,

slowly forgetting the first language, what will happen is L1 will slowly go away, your heritage language will actually go away.

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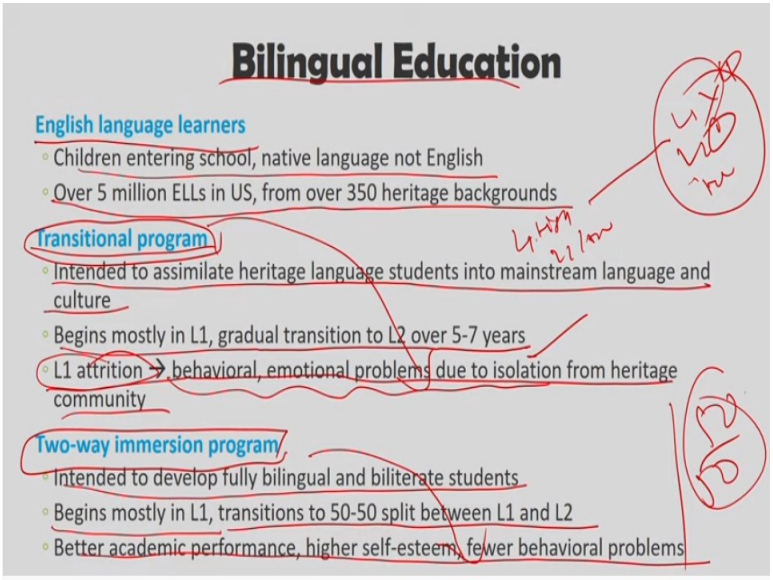

Lastly, let us look at a little bit about bilingual education. So, English language learners, children entering schools native language is not English. And so, we have to teach them English. Over five million years in the US, over 350 heritage backgrounds are there. We can use something called transitional program for bilingual education, intended to assimilate heritage language students into mainstream language and culture. Begins mostly with L1, gradually transitions to L2 over five to seven years.

L1 attrition behavioral emotional problems due to isolation from heritage community. Now, in translation program, what happens is initially the very basic, let us say, somebody has 80% Spanish and 20% English. So initially, in class 1, 2, 3, etc., what will happen, the concepts will be taught more into Spanish and less from English concepts are there and slowly it will be pushed to a point of time, where only English concept are used and the Spanish concepts are gone.

This is called the translational program and so what happens is here the L1 attrition, Spanish will go away and because behavioral emotional problems will arise from isolation to the heritage language. There is something called two-way immersion program are also there, in which what happens is, at the mastery level, at the higher levels, both languages are used 50-50. So intended to develop fully bilingual and biliterate students, mostly begin with L1, so here teaching starts with L1.

Now transition to 50-50 split between L1 and L2. At higher languages, at higher classes, what will happen is, there will be a 50-50 split, so you will use 50% time, or 50% of the concepts in language one and 50% of concepts in language two. And so, that is the attainment which is there. Now, better academic performance, higher self-esteem and fewer behavioral problems. So, if you use transitional program, you have more problems.

Here what happens is you start with the L1 high and L2 low and move to a process where L1 is gone and L2 is only remaining. So L2 high and L1 low. Now, in this case, what will happen is, you will have all these problems and L1 will go away, but if use the 50-50 split, both the languages will still be there. And so these are techniques of using the bilingual education or teaching bilingual children and making them educated in both languages.

So, what we did today, in today's class is, we just made an extension from where we left off in the last class. We looked at something like, the cognitive benefits of bilingualism, in the last class, we looked at disadvantages. So in this class, we focused primarily onto the advantages of being a bilingual. So, what are the advantages of being a bilingual.

We looked at what is adaptive control hypothesis and the idea of how executive control, the use of selective attention interference inhibition and mental flexibility, they provide some kind of advantage to the bilinguals. We also looked at Flanker task as a measurement of bilinguals and how the bilingual brain is organized. We looked at what is cognitive reserve and how this cognitive reserves actually help the bilingual more than the monolinguals.

We looked at the second language acquisition, how does second language acquisition actually can be mapped in terms of ultimate attainment, the age of arrival and length of arrival. And we look at how puberty has been defined as the cutoff point, after which, these language shifting language acquisitions would master. And then we looked at the critical period hypothesis and sensitive period, how these define how language is learned, or bilingual languages are learned.

We also looked at the speech learning model and we looked at how the bilingual home and bilingual education can be provided to bilingual children. So this friends, is the last lecture, in this particular series on the psychology of language. When we meet next, what we are

going to do, is we are going to do a thorough review, a one full class one hour review, onto all those that we have done in this particular course on The Psychology of Language. And so, till we meet at that point of time, and we do these discussions, it is goodbye and thank you.