Bilingualism: A cognitive and psycholinguistic perspective

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Module - 06
Part - 02
Lecture - 14

Lexical processing: different experimental paradigms: comprehension and production

Hello and welcome back. We are in module 6. We have been discussing about the how the language processing studies, language processing experimental paradigms have changed over time and we started with 1950s and from 1950s to 70s the kind of growth, the kind of different trajectories the discipline has taken we have already seen.

And then we also saw that by 80s things many many of the ideas were concretized and the paradigms were in place and how reaction time studies became more and more popular with the advent of computers and availability of computers in large scale and. So on.

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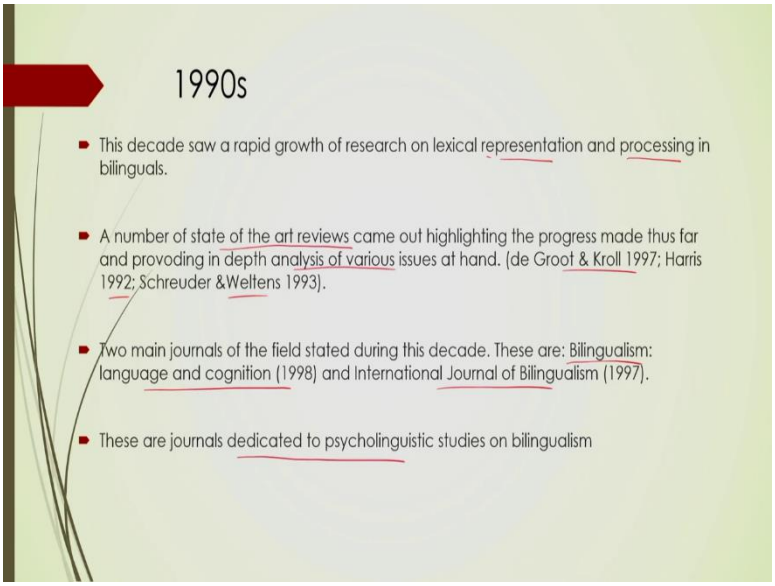

So, now let us move on to the 1990s. So, after the baseline was put in place to 50s to through 70s and then through 80s, 1990s saw a very rapid growth as you can expect because now the entire paradigm has been set, the research questions have been finetuned, the methods have been put in place, the tools are also available now. So, as a result of all

of these, the 90s saw a quite an explosion of research in terms of lexical; both lexical representation as well as processing.

When we talk about processing, we cannot avoid representation as well. So, in both of these domains, in bilingual language processing literature saw a very rapid growth. So, also a number of there; this this was also a time of um stock taking in some sense. So, there were lots of reviews that came up during that time quite many of them were very important and we still refer to them.

So, many of the state of the art reviews that highlighted the progress, the various changes that have taken place in the previous decades, then that came out in during this time. And also, this provided in depth analysis of various issues, so what is the way ahead, what are the problems that stood at that point of time both in terms of theory as well as in terms of methods, task selection, stimulus creation, so on and so forth.

So, all kinds of important issues within bilingual language processing, dealing with both representation and processing were brought out. Most important of them are few are few that I have mentioned here. Groot and Kroll's one is also quite well known. So, at the same time there were all there were few new journals that came out during this time, which even today they are among the best journals in these domains. So, one was Bilingualism: Language and Cognition which came out in 1998 and International Journal of Bilingualism.

These were very two very important developments during these time and as of as things stand today bilingualism language and cognition as well as IJB are among the top tier journals in the field which regularly publishes high standard research in these domains. So, this is how the dedicated journals in psycholinguistic aspects of bilingualism actually started in the 90s. So, focuses primarily on psycholinguistic research in these domain.

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Now, on research front this area as I said this saw a rapid growth. So, this output now what are the areas within which the output can be quantified one is diverse paradigms, different kinds of paradigms were adopted. The theoretical sophistication is another hallmark of this time because after we have seen a lot of developments, lots of changes in terms of findings, in terms of tasks and so on.

So, lot of theoretical sophistication was also achieved by this time. And as a result of all of these lots of new phenomena were also unearthed we will see them now. And once you have newer questions, newer phenomena that can that was discovered obviously, there are new questions that emerged.

So, from very simplistic, very a generalized findings from the 1950s through 70s 80s and in 9 by 90s the simple questions of cross linguistic priming became a very nuanced and very complex domain, which has multiple levels of dynamics across different types of parameters or variables.

For example, proficiency was one variable, kind of task was one variable, the number of overlap was another variable and so on.

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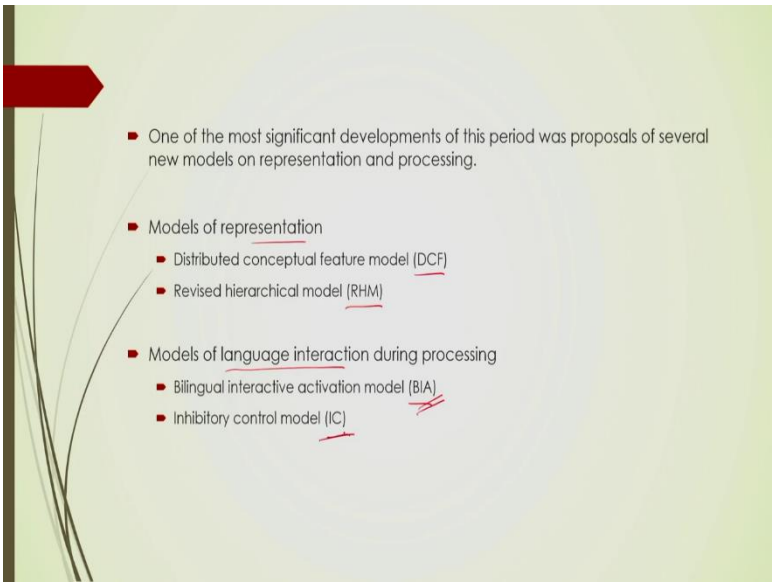

So, we will just look at one few of them. Another was of course, the when we talk about theoretical sophistication, we talk about the few models that came out during this time, many of these we have already discussed in the previous segment. But so, we will just quickly go over them.

So, proposals of new models, both in terms of representation as well as language interaction during processing. Models of representation, this is distributed conceptual feature model as well as RHM which we have discussed before they came out even at this time. And models of language interaction during processing, this is bilingual interactive activation model and also there is inhibitory control model.

These out of these four, the three have already been discussed. So, we will not get into the details we will discuss inhibitory control model in a while. So, these are the four very important models that came out representing different domains. So, both representation as well as processing. Processing in terms of bilingual in terms of BIA this deals primarily with comprehension whereas, IC model deals primarily with language per bilingual language production. These were the these were the primarily the models that came out at this time.

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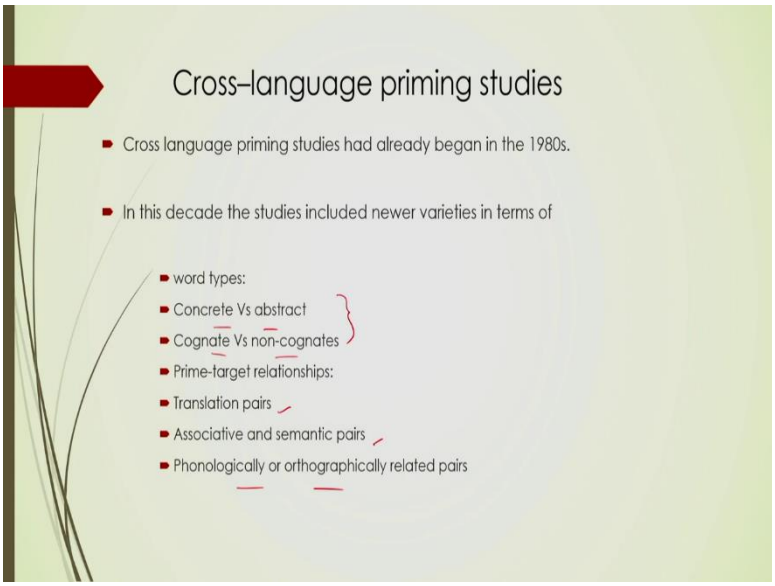

Cross-language priming studies were already there in place when 1990, 1980s they had started. And by now there were a lot of layers to that understanding that started emerging and as a result of which, they had trend new trend emerge where new newer varieties were incorporated into the study.

So, newer types of stimuli that were used, different kinds of what types were used for example, concrete versus abstract words and how they; what is the interaction between these two types, similarly cognate versus non cognate and these are the different kinds of word types that were utilized for using for creating the stimuli.

Similarly, the relationship between the prime and target was also manipulated at various levels one of them was translation pair, then there was associative and semantic pair we have talked about translation pair where one word there are two words that will appears in succession and the task would be to recognize the second word, which is also called TE recognition translation equivalent recognition.

Meaning the whether the second word is a translation of the first word, that is translation. So, that is an example of translation pair. Similarly, there is associative and semantic pair, how are two words connected. When we talk about translation pair, we are talking about lexical level connection. But when we are talking about associative and semantic pair, we are talking about conceptual level connection.

So, are the words semantically connected like Apple and Pear are connected semantically, because they both belong to the same semantic field of fruits that is semantic pair. Associative pairs are those words that are not part of the same semantic domain, but somehow, they are associated they are typically co-occur, often they come together in an utterance or in a conversation.

Similarly, the other kinds of connections could be phonological and orthographic connections. Sometimes words are written in the similar way, sometimes they sound similar and so on.

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So, all these various as you can see, there are much further, much finer nuances that are now beginning to get investigated in terms of bilingual language processing. At every very small level that to from starting from the nature of the words to the different levels of connection between the words. Similarly, there were also comparison across tasks.

So, there were not any more sticking to only one kind of task, but the same subject and the same stimuli set were used for different kinds of tasks. So, lexical decision task versus semantic association task. So that you could see one could see find out and where exactly is the difference and the similarity lying, but what kind of finer aspects of processing that we can unearth.

Similarly, participants differing on proficiency level as I mentioned earlier also. Proficiency level difference has been a very important variable in bilingual language processing literature and then prime duration as well as the gap the between the stimulus and the target. The that gap has also been utilized.

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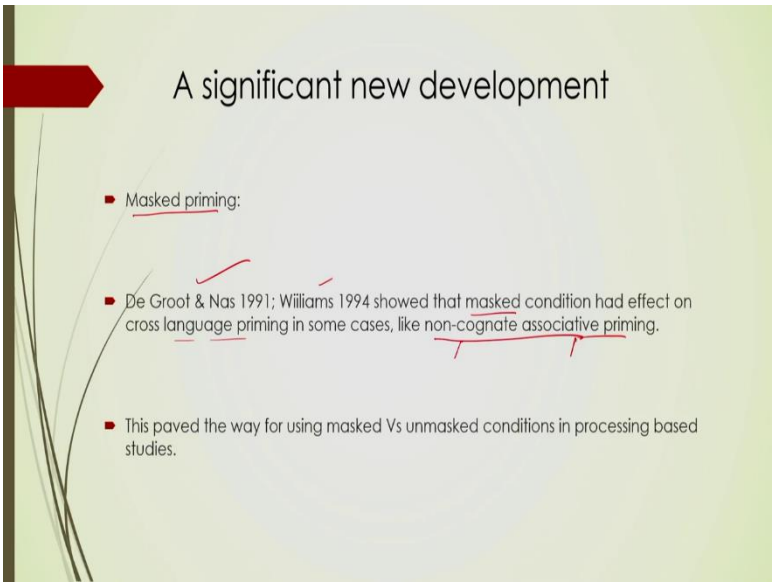

So, myriad types of variables and parameters started getting into getting incorporated into the research design. A very significant new development in this time is also that of what is called masked priming. We discussed masked and unmasked kind of task. So, this made a grand entry around this time. One of the most well-known studies is by Groot and Nas 1991.

Similarly, that of Williams. So these studies showed that masked condition has an effect on cross-language priming in certain cases. So, now you see that because now which they have incorporated, now the researchers have incorporated so many finetuned variables into it.

Now, we can see, how at what level one condition may or may not have an effect. So, for example, masking can have an effect; however, in non-cognate associative priming. So, this is the semantic relate; this is the relationship between the words and this is the kind of the word pair. So, they have to be non-cognate.

So, this is one important finding in the 90s as a result of which a lot of studies using masked versus unmasked paradigm started.

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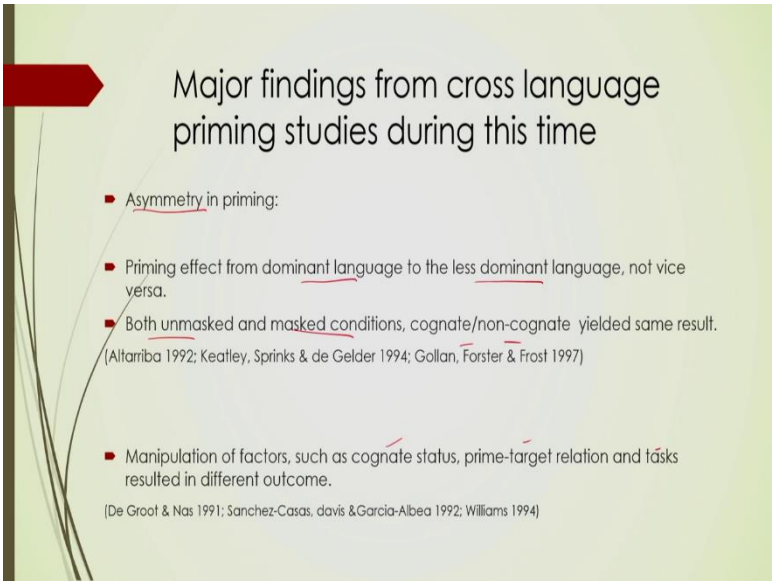

Lots of processing based studies started using masked versus unmasked paradigm to see, where do we see the impact and where we do not see the impact of the prime on the target. So, the mask comes in between the prime and the target and to what extent the masking has a has a role to play to either to facilitate or to inhibit that influence is what the studies tried to find out.

One important finding from these from the studies on mask priming and other kinds of priming studies was that, the priming actually there is an asymmetry in priming. What does it mean? This means the priming effect from dominant language to the less dominant language was found it was quite common to find the difference.

However, that influence; however, the reverse was not always found. Meaning that if your prime is L1 and target is L2 chances of having an influence is very strong here as opposed to when the reverse happens. So, dominant language, however, it is may not always be L1 may not always be the dominant language. So, there again you have another set of you know variable there.

So, often it is quite possible that your L2 becomes dominant and L1 recedes to the less dominant status, that is also possible. So, the finding suggest that in both unmasked and

masked condition cognate, non-cognate condition. In all of these condition the same kind of result was found, that is dominant language to less dominant language there is an effect. However, the reverse and this this was checked in both unmasked and masked condition, cognate and non-cognate word pair.

Then there were other kinds of factors that were brought in by other group of researchers who did not find the same kind of result. So, manipulation of many factors, including cognate status, including and prime target relation as well as tasks. So, everything remaining same, if the task is different often the results also differed. So, this is; these are the two kinds of findings with respect to cross language priming studies that happened during this time.

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So, a lot of work actually happened this is literally the tip of the iceberg, but the references are all there for anybody who is interested. In the 2000s the all of these were carried forward in the 2000s also and the same kind of the same kind of studies are going on, but at a even more fine level.

And one important factor in 2000s is that a lot of work are also accompanied by neuroimaging studies and other brain mapping various kinds of brain mapping studies. So, that we have data from both the behavioral experiments, as well as from neuroimaging data.

So, masked priming as a studies have become quite complex now and there are many many variables built into it having many layers and differences of course, also have been found with respect to lexical and semantic priming. So, there are difference differences that have emerged in various domains. We have already seen cognate versus non-cognate, associative versus semantic and then you also have lexical versus semantic priming.

Asymmetry as a result has remained a very important issue to be resolved and work is still going on. Similarly, there is an asymmetry in switch cost as well that has been a very important, another very important domain to study that has seen a lot of output during the 2000s. Switch cost asymmetry, the idea of switch cost and then in what conditions the we do we find switch cost and are the switch cost same in both directions.

If the if they are not what causes that and sometimes there is also an absent switch cost, meaning there is no switch cost. So, what is happening there? So, these are the various nuances within switch cost asymmetry. Similarly, we also have priming asymmetry.

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So, these studies have been carried forward in into the 2000s and the work is still going on in various of these domains. So, this was in a nutshell how the research into in the bilingual language processing have evolved through the decades. So, starting from 50s till 2000, 1950s to 2000, we have now have a brief idea about the research agenda and within this time. Now, let us just look at some important findings in all of these domain discussed.

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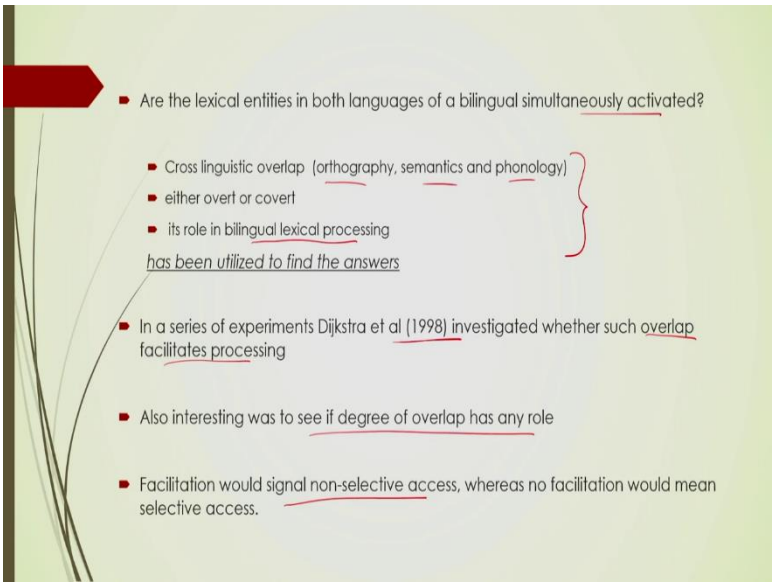

We will not be able to of course, discuss all of the studies because the field is really vast, but we will try and look at the most important findings in in most of these domains, let us say. So, the primary question that we started with this this module we started with what, we started with the question that question of whether bilinguals' both languages are represented in the same place or are they kept separate. If they are separate, do they interact and what is the nature of that interaction and so on.

So, baseline of this entire thing is are the bilingual's two languages simultaneously activated and that seems to be the findings so far, but how do we know that. So, how we know that has come about from a number of studies for which typically looked at words, word pairs who have some sort of overlap. Overlap as in terms of orthography, semantics and phonology. So, cross linguistic overlap meaning two words, let us we since we are talking about lexical processing. So, we are looking at the word label processing.

So, when we have cross linguistic overlap, we mean there are two words that are from two different languages and they could be similar. They there might be some overlap on the basis of some features, sometimes an individual feature, sometimes more than one feature. So, depending on what kind of feature we are looking at that could be orthographic similarity, there could be phonological similarity, there could be semantic similarity and so on.

Sometimes the similarities are overt, sometimes though they are kept covert they are not really brought out in the open, but the design is created in such a way that we are still looking at the overlap. And looking at the by creating stimuli out of this kind manipulating this kind of overlapping structures across languages what basically we are trying to find out is, how they impact bilingual lexical processing.

For example, if two words are similar in terms of orthography do they, does it facilitate or does it inhibit processing in one of the languages. So, the one of the most when well known and kind of a sort of a landmark study by Dijkstra, 1998 investigated whether this kind of overlap facilitates processing. Because if there is there is an overlap that and the conceptual storage is the same, then there should be facilitation that is the idea.

So, another question that he was trying to find out is not only whether overlapping has a facilitation effect or also, but also what kind of what is the degree of facilitation, what is the relationship between the degree of overlap and the resultant facilitation, is there is there an impact or is it if so, what kind of impact. So, that is basically what they tried to find out.

So, the idea was if we find facilitation, then this would signal language non-selective access. Remember we go back to our language selective versus non-selective access hypothesis, there were some proof on both side of the of the theoretical position and then later on we came to a revised hierarchical model, which says that at the conceptual level there is an overlap, there is a same storage, but at the lexical level there are differences.

So, this takes us back to that position. So, if we find, if the words are similar in some way either orthographically, phonologically, semantically then there should be some amount of facilitation.

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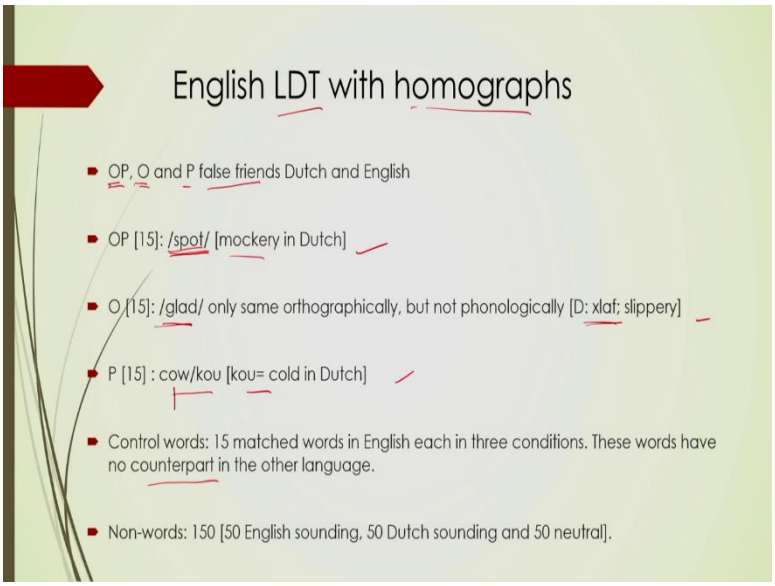

And if we do find facilitation that will take us back to non-selective hypothesis. If we do not find facilitation that means, each of the words are is accessing the conceptual storage separately, meaning non selective, selective hypothesis will be proved. So, the study had many parts there were many experiments.

The first one was with homographs. So, this was an LDT Lexical Decision Task, which we have already discussed. So, they used various at as we just saw that the different degrees of overlap was being investigated. So, in order to get there, so what they did they found false friends. Homographs are also called false friends.

So, they had words that overlapped on both ortho O stands for orthography, P for phonology. So, where some words that were similar in terms of both orthography and phonology meaning, they were both written in the same way and they sounded similar. Sometimes they the overlap was only on orthography, sometimes the overlap was only on phonology.

So, by dividing the stimuli in this way in into three way categorization they could show, what individual overlap in individual level as well as when the overlap was a little more in terms of degree of overlap. So, when you have overlap on both the features. So, as a result we have three like the types of words. For example, this is a word that exists in both Dutch. This was a study on Dutch English bilinguals.

So, the word spot is written. So, in terms of orthography they are written like this spot in both Dutch and English. Similarly, they sound the same. So, it is sound for the same in both English and Dutch. However, they mean different things, it means mockery in Dutch.

Now, when we have only orthographic mapping is this, it is written like this. So, glad is glad in English. However, in Dutch the pronunciation is very different, its not like nowhere like English. So, there is the mapping is only on the orthography. They are written in the same way.

And similarly, there is mapping there is overlap in terms of phonology, in terms of sound. So, the words they are written differently. So, cou cow versus kou, they sound like the same cow, cow. But it means the is cow, the animal in English, but it means cold in Dutch.

So, in all of these cases, they are all false friends because they do not mean the same thing. They appear similar, but they are not same. They do not refer to the same object. However, there are gradient overlapping of phonological and orthographic features. So, these were the words and the task was a lexical decision task. They had to find out if the given stimulus is a word or not.

As a result, all of these were used and there were also control words, which were not false friends, meaning these words were they had no counterpart in the other language ok. And they also had similar, they are they were otherwise similar to these and then they were non-words, so this was the stimuli set.

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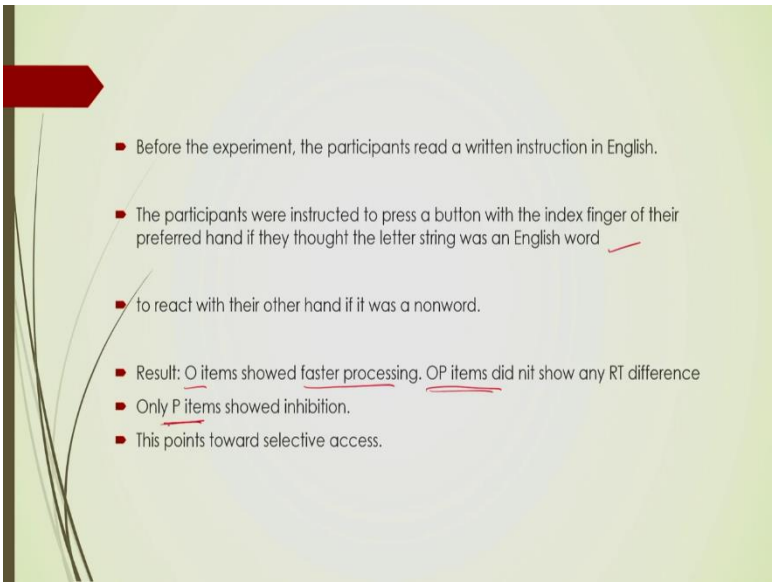

Because this was the entire task was done in English language. So, in order to not to interfere with that instructions were also given in English. And this is how they had to react. And so, the results were, they found that when they were orthographic overlap, they this showed faster processing, meaning orthographic overlap had facilitation.

When they had overlapping in both O and P, these items did not show any reaction time difference. And only phonologically similar items also showed inhibition. So, basically this had a quite a mixed result and over all the authors claim that this showed selective access. Because phonological representation works at a very different level, we will see that little much later.

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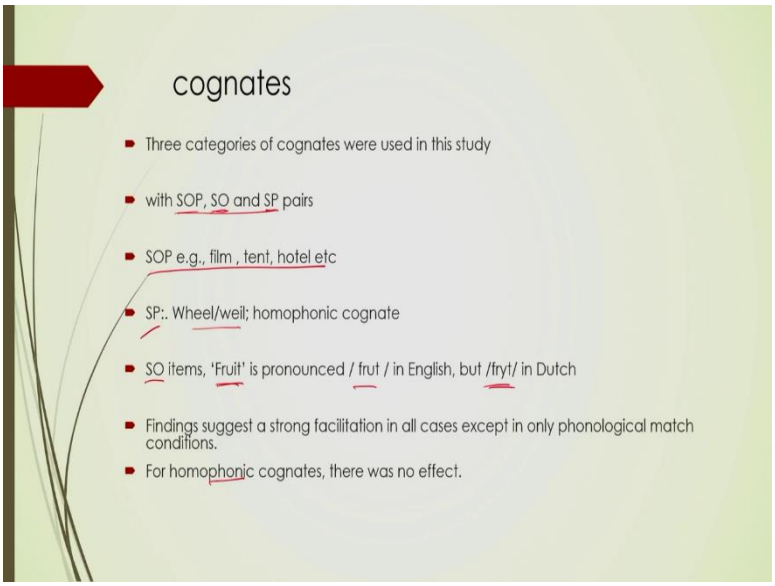

And the same study also had another experiment using cognates. Now, what are cognates? Cognates are words that are same across both languages. So, they look similar and they mean the same thing. So, semantic property is important here in the homograph, in the interlingual homographs, the or homophones interlingual homograph and homophone or together they are called false friends.

So, false friends though they are called false friends because they are not the same thing, they are different things. Cognates on the other hand are real friends, in the sense that they are the same words. They are they refer to the same object in the real world. Now, interestingly even in this domain they had a gradation within the in terms of overlap.

So, they had SOP, S stands for semantic. So, they had semantic, orthographic and phonologically mapped cognates. Similarly, there were cognates which overlapped only on S and O and cognates which overlapped on S and P without O. So, let us look at some examples first. SOP when they have full overlap meaning they look the same, they are written the same way, they sound the same and they mean the same thing.

Words like film, tent, hotel etcetera. And then they had words like this, it here the semantic overlap is there as well as phonological because they sound the same. Will, this is how they sound in both English and Dutch. However, they are not written the same way. As you can see the spellings are different. The so, orthographically they are different.

Similarly, S O cognates these are all cognates. So, similarly S O cognates fruit is written like this in English, but they are pronounced differently. So, here there is a mapping on a semantics as well as on in orthography, but the pronunciation is different. So, pronunciation in English and Dutch for the word fruit are very different.

So, but these are all cognates having different degrees of overlap right. So, we have seen different degrees of overlap in false friends and now we are looking at degrees of overlap in cognates. Findings here however, show a very strong facilitation in terms of cognate across the languages. However, in homophonic cognates meaning this, there were no effect.

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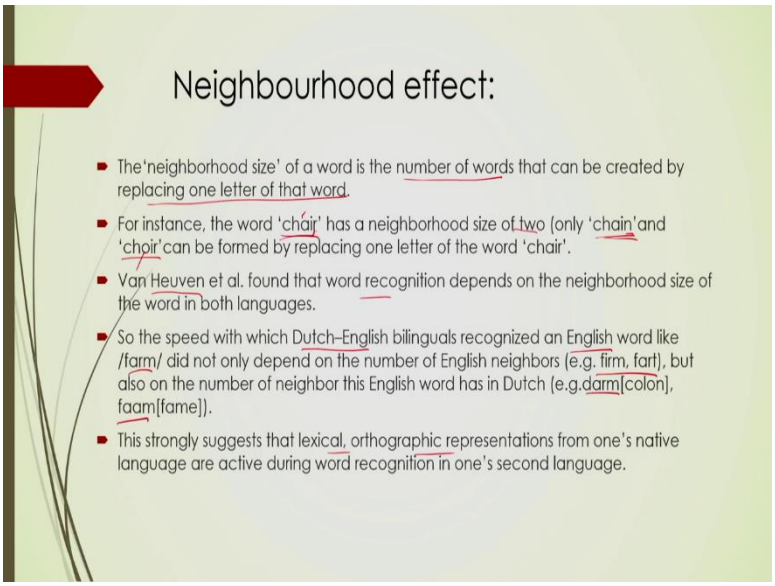

So, in both cases in terms of both false friends as well as cognates, the phonological mapping did not yield much of a positive result. However, in otherwise in case of cognates, there was a robust facilitation effect. And this stands as a very important study in terms of cognate processing.

Another domain that has been studied within this larger area of lexical processing is the idea of neighbourhood effect. Now, what is neighbourhood effect? Neighbourhood size, neighbourhood effect is basically the number of words, number of words that can be created by replacing one letter of that word.

For example, the word chair has neighbourhood size of 2 because you can manipulate. If you can just take out one letter from the word chair, you can and may replace it with another letter, you can have another completely different word. So, if you go on manipulating like this, how many words do you end up with? That is the neighbourhood size.

So, this this is one word, so if you remove the R from there and you replace it with N, you have chain in place of chair and then the you can also have replacing the vowel A, you can replace with O and it becomes choir. So, this is called neighbourhood size of a word. So, this is another domain that has been; that has been studied Van Heuvan for example, found that word recognition depends on the neighbourhood size of the word in both languages.

So, not only the neighbourhood size of the word in one language, but across languages in case of bilingualism of course. So, the speed with which Dutch-English bilinguals recognized an English word like farm did not only depend on the number of English neighbourhood words, English neighbours, but also the number of Dutch neighbours it had. So, even in Dutch there are lots of neighbourhood size also included Dutch in this case.

So, basically the point is that, the larger number of neighbourhood size you have that will have an impact on the processing. Not only in the language in which the word was presented, but also in the language which you were not currently using; in this case it was Dutch. So, this suggests that lexical orthographic representations from one's native language are active during the word level processing.

So, basically this entire study was done on English language, Dutch-English bilinguals, but the study was done in English. So, critical manipulation was the cross-linguistic mapping on various aspects. So, in this case neighbourhood effect, neighbourhood effect they also included words that had Dutch neighbours as well as English neighbours.

And they found an impact of the number of number of neighborhood words that even that L1 had, which automatically takes us to the point where we can easily say that the native language is having an impact on the non-native language processing.

Remember this entire study was done only in English. However, the way that the connection is established between the English language words and the Dutch words had been found to have an impact.

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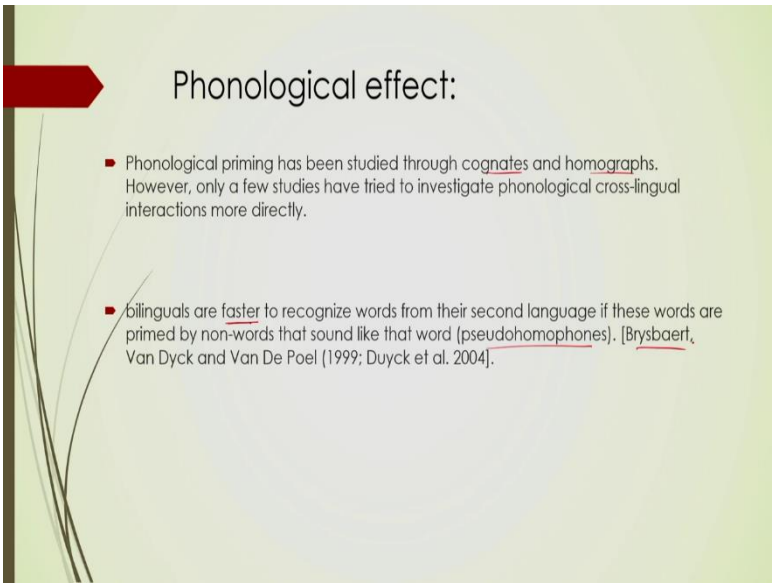

So, this naturally takes us to the then this is the a proof for non-selective hypothesis. Similarly, phonological effect have also been studied from phonological priming they have been studied through cognates, as we have already seen cognates and homographs both. But studies in this domain are comparatively less.

Some studies show that, bilinguals are faster to recognize words from their second language, if these words are primed by non-words that sound like the that word. Basically, this is called pseudo-homophones. Pseudo-homophones are those homophones, that are actually non-word. Quite an interesting study by Brysbaert and his group.

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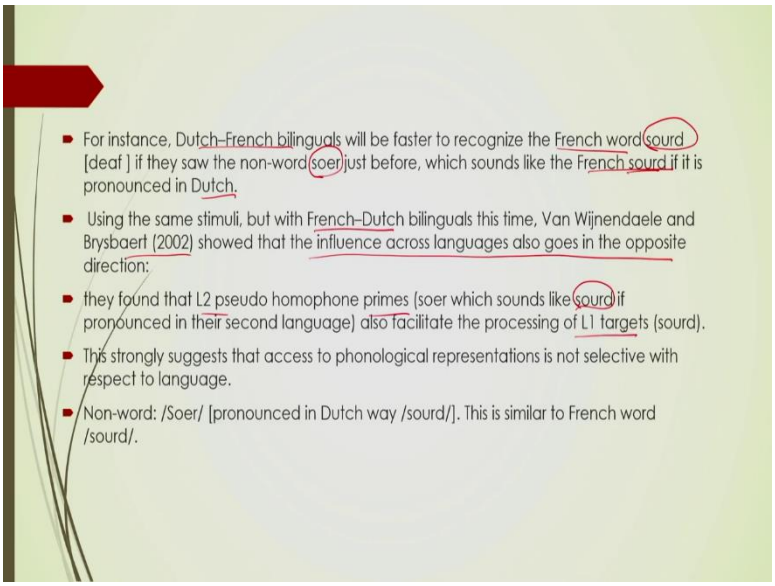

So, what they did, this was also a study on Dutch first language speaker. So, this was a Dutch-French bilingual group. They found out that there will be faster to recognize the French word Sourd, if they saw the non-word just before which sounds like the French Sourd if it is pronounced in Dutch ok.

So, the critical thing here is that these are Dutch-French bilinguals. The study was done in French, how and it was preceded by non-word. So, lexical decision task. So, non-word having, non-word as a prime and then they had a French word to process. However, that non-word, which is non-word in French, but if it is pronounced in Dutch it sounds like a word in Dutch.

It sounds like the French word, if pronounced in Dutch. So, basically pseudo-homophones have an impact on processing the second language. The same stimuli you was also used by on a group of bilinguals who had the reverse languages. So, this was a French-Dutch bilingual other than Dutch-French bilingual and they found that the influence across languages also goes in the opposite direction.

So, this works both ways. So, pseudo-homophones when pronounced in the L1 sounds like a word in L2, there will be facilitation, which is quite an interesting found finding. They also found that L2 pseudo-homophone prime which sounds like sourd if pronounced in their second language that will facilitate their processing of L1. So, basically this works in both ways.

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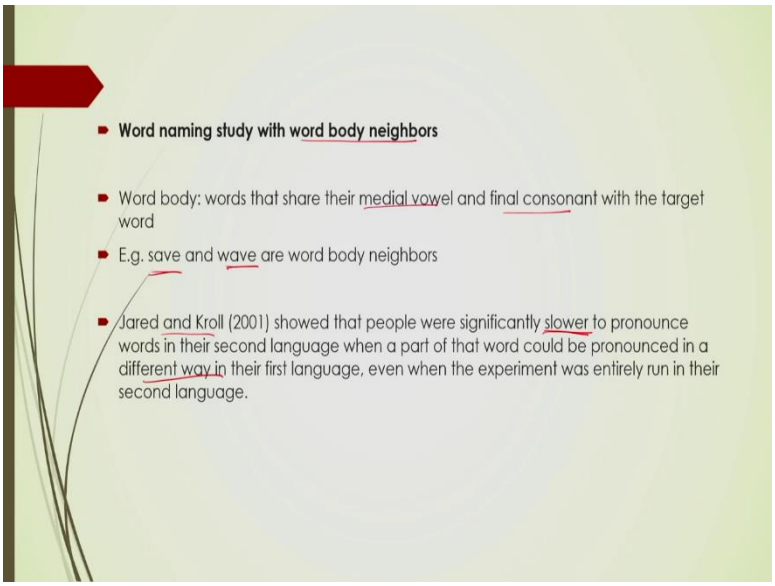

Similarly, there are studies in word naming studies with, what is called word body neighbours. There is another kind of mapping. You can see there are basically what we are looking at here is, cross language priming and that priming can have different levels of overlap in terms of homograph or homophone. Similarly, cognates then we looked at neighbourhood. They are all they are all mapped right. They are all there is all kinds of overlapping that are being mapped here and studied.

Similarly, we even looked at pseudo-homophones. Now, we are taking this forward to look at word naming in word body neighbours. Now, what is word body neighbour? These are word body save and wave are word body neighbours. The definition of this is words that share their medial vowel and the final consonant.

So, basically the second part of the word, if they are similar except the first consonant. This is what is a word body, the similarity. So, Jared and Kroll 2001 study showed that people were significantly slower to pronounce words in their second language, when a part of that word could be pronounced in a different way in their first language. So, the study is on second language. Part of that word however, has a counterpart in their first language, but the pronunciation differs.

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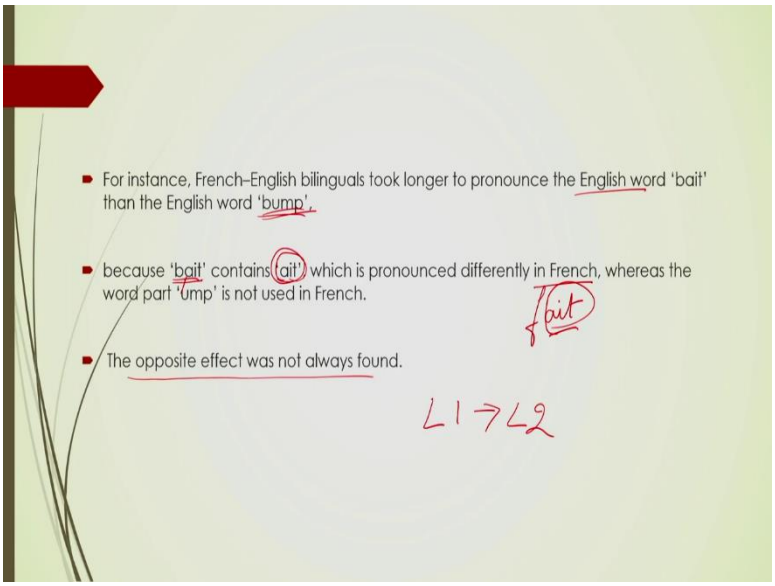

Very interesting study, so they had words like bait in English. And so, this has this part English has this part called ‘bait’ so, the you leave the b because we are looking at word body. So, the first vowel and the second consonant right. So, this is the definition. So, medial vowel and the final consonant. So, medial vowel is a here and the final consonant is t. So, the word body needs this part.

Now, this word body across language is what they were looking at. So, French-English bilinguals, they were looking at English word bait. However, they found out that they took more time to pronounce word like bait, but not in case of words like ‘bump’ like b u m p bump.

And the idea and the reason that was put forward is that, that in the their because their first language is French and French also has a word like this and it also has; so this is you see word body neighbour. These are word body neighbours across languages. However, the problem here is that this is pronounced differently. In French, this is not pronounced like bait, this is fai.

So, the pronunciation because it is different. So, that had an interfering effect in pronouncing the English word. Remember, French was not used in the experiment. This is only the manipulation was that these subjects were first language speaker of French. However, English was their second language and the task also was in English.

They did not find similar problem with words like this, which had no word body neighbour in French. So, this is another interesting finding with respect to cross language mapping overlap in various domains. However, they did not find opposite kind of impact, meaning the first language was not found to be impacted.

Here, the impact was only from L1 to L2. And this we will find in many cases, there is an asymmetry. This is what is the prime cross language priming asymmetry. So, the priming in this case is not always possible in the other way. So, if you have French words to pronounce and they had an word body neighbor in English language that did not affect the French pronunciation. However, English was affected because L1 had these words.

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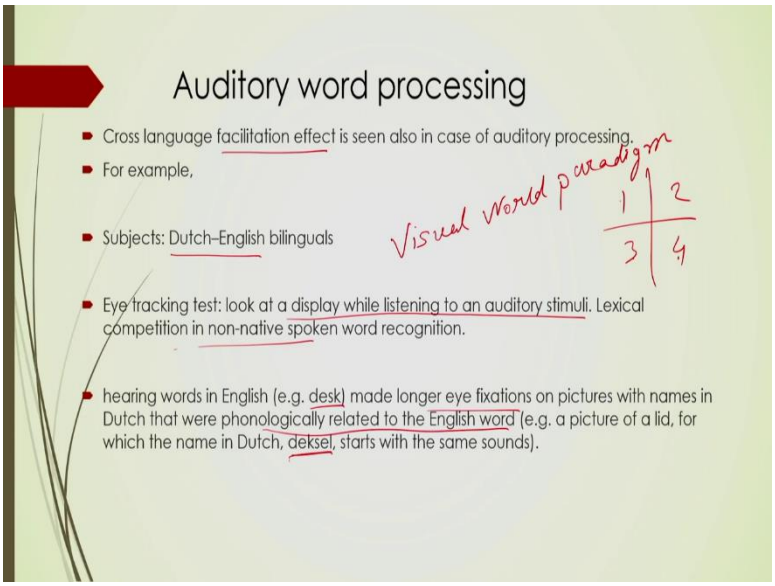

So, this is another interesting area. Now, till now, we are looking at visual world word processing. Now, we will move on to auditory word processing. In case of visual word processing, what happens? The words are presented visually, on a computer screen most of the time. So, you look at it and then the processing follows.

So, you under you, you comprehend or you produce whatever. In auditory word processing, the stimuli is presented through auditory mode. So, they the same kind of logic, same kind of paradigm was used here also trying to see, if cross language facilitation is visible in case of auditory word processing as well. Subjects again were Dutch-English bilinguals. This was an eye tracking study and this they looked at a display while listening to an auditory stimuli.

Let me tell you a bit about eye tracking study here. Eye in eye tracking study, what the paradigm used for language research is what is called visual world paradigm. Visual world paradigm is a paradigm, where the subjects listen to an auditorily presented stimuli while looking at a display. So, simultaneously, most of the time simultaneously.

So, even listening to an input, while simultaneously looking at a display. Often, this display will be some pictures. There will be a grid of grid like this. So, there is one picture here, one picture here, one here.

And so, 1, 2, 3, 4 like this. And then depending on where on the screen, your eyes go and fixate is what is taken as the output data. So, you as you listen as the auditory stimulus unfolds, your eyes will scan this screen, the display and try to find a match most of the time. So, this is what is visual world paradigm all about.

So, in this particular study, they were looking at a display, while listening to an auditory stimuli. Now, they found that lexical competition was there in non-native spoken word recognition, meaning the competition was found in case of English. English is because it is the second language of these people. That is why it is non-native language and this was a recognition study.

So, hearing words in English, for example, desk made longer eye fixation on pictures with names in Dutch that were phonologically related to the English word. For example, what they had was, as they listened to words like desk, d, e s, k in English desk, they had various pictures on the screen. One of those pictures was that of a lid. Now, lid is called deksel in in Dutch right.

So, the word is not present, the picture of that, picture that would represent that word is present there. Now, when they listen to desk, the eyes will go to deksel. You see the connection, this is quite a far-fetched connection. The picture is there. Now, you know the Dutch name of that picture is deksel and now deksel is similar in phonologically similar to the stimulus desk in English. Hence, there was a matching, so they were looking at that picture, even though this is not what they heard ok.

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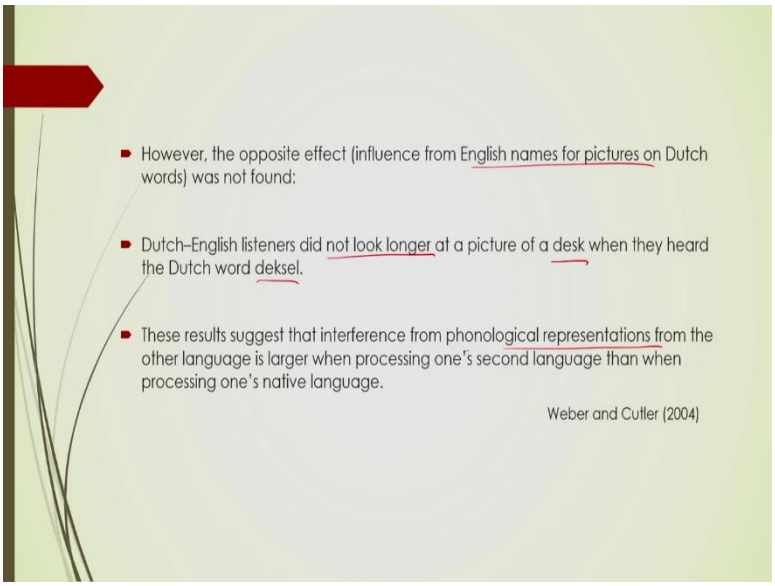

Because they start with the same sound. So, however, the opposite effect, influenced from English names for pictures on Dutch was not found right. So, Dutch-English speakers did not look longer at picture of a desk when they heard the word deksel. So, basically, what this means is that the represent here even in this kind of studies, even in this eye-tracking study in using visual world paradigm the effect is seen from the dominant language to the non-native language, but not the other way around.

So, the impact of L1 on L2 is stronger, but rather that than that of L2 to L1. So, L1 does not get affected much by the L2 representation. So, so this suggests that interference from phonological representations from the other language is larger, when processing one's second language.

So, this asymmetry is found in large number of studies using different kind of tasks and different kinds of paradigms. You will still find this kind of an asymmetry that L2 gets affected by L1 in different kinds of scenarios.

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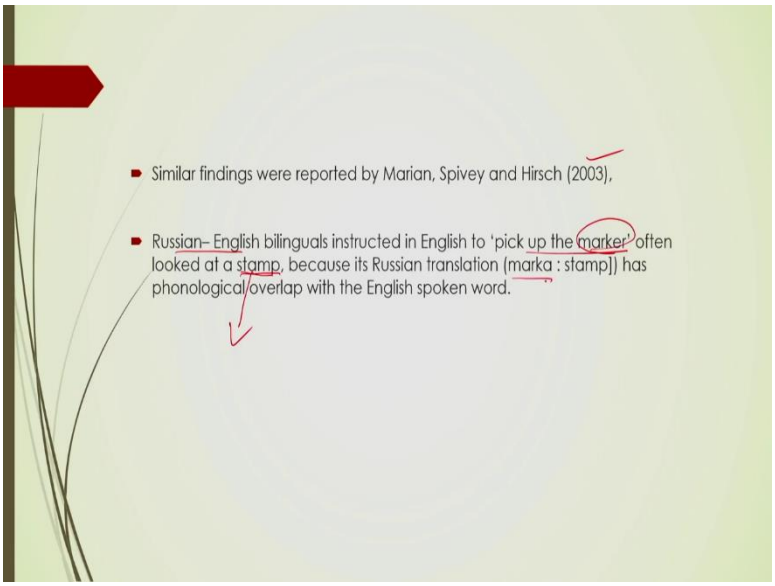

Similar kinds of findings are also reported by other researchers using in in this particular study, this was Russian-English bilinguals and they were instructed in English to pick up the marker, when they hear they were hearing this sentence and they looked at a stamp.

Again, the similar kind of thing, they were listening to auditory stimuli, while looking at the display of various pictures. The picture of stamp got higher fixation, fixation as in the participant looked for longer time, the eyes stayed there on that picture for longer duration. So, that is fixation. So, they looked at the picture of a stamp, when they heard the word pick up the marker.

Now, this word marker and this stamp, what is the connection? The connection is that stamp in Russian is marka. So, you see this is the this is again the same kind of long distance connection across languages, even then you will see that kind of an impact. Because the picture of the stamp is called marka in Russian and hence this is a phonological overlap with the English word marker. Hence, you find that effect.

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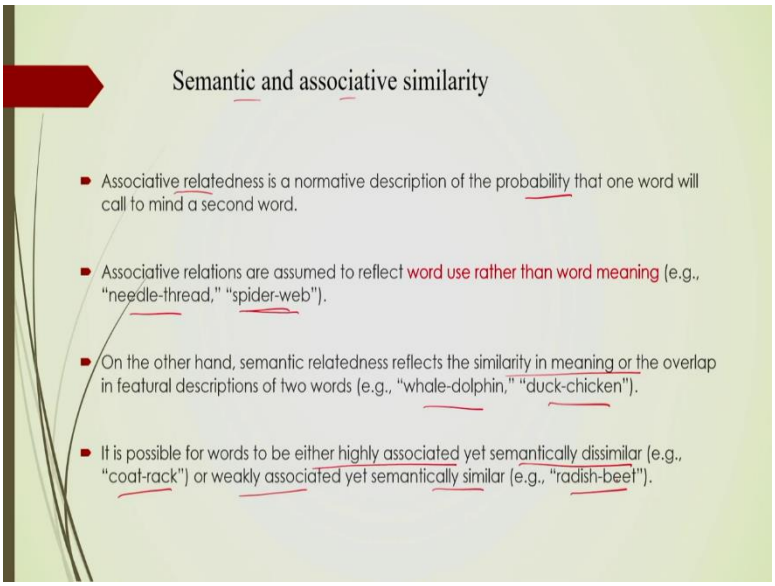

Now, let us move on to semantic and associative similarity. You have seen all kinds of similarities till now, now we will move on to associative. So, what is associative relatedness and what is semantic relatedness? Let us just find out that first. Now, associative relatedness is a description of the probability that one word will call to mind another word.

It often happens, we talk about you know cup and plate, they are not the same thing, but they all they often come together right. And then similarly, the spider and web, needle and thread, coat and hanger, these words are associatively related. What do we mean associatively related is that use of one word quite often, very often activates the other word because they come together in in terms of language use.

So, even though they do not share any other feature, they are not part of the same semantic category. However, they typically co-occur in a conversation or at least in the real life also. So, spiders often go along with web and so on. On the other hand, semantic relatedness reflects the similarity in meaning or the overlap, feature overlap.

So, whale-dolphin, duck-chicken, they are semantically correlated. They are same in terms of either features or in terms of meaning and so on. So, these are the two kinds of association that we will now look at. It is possible for words to be either highly associated yet semantically dissimilar or weakly associated yet semantically similar, right.

So, you have two kinds of features, you have association associatively related versus semantically related and then you mix and match you get all these kinds of possibilities. So, words, coat and rack are semantically vastly dissimilar, however they are very highly associated. Similarly, radish and beet are semantically associated because they are both root vegetables, but they never, they very very rarely they co-occur, right.

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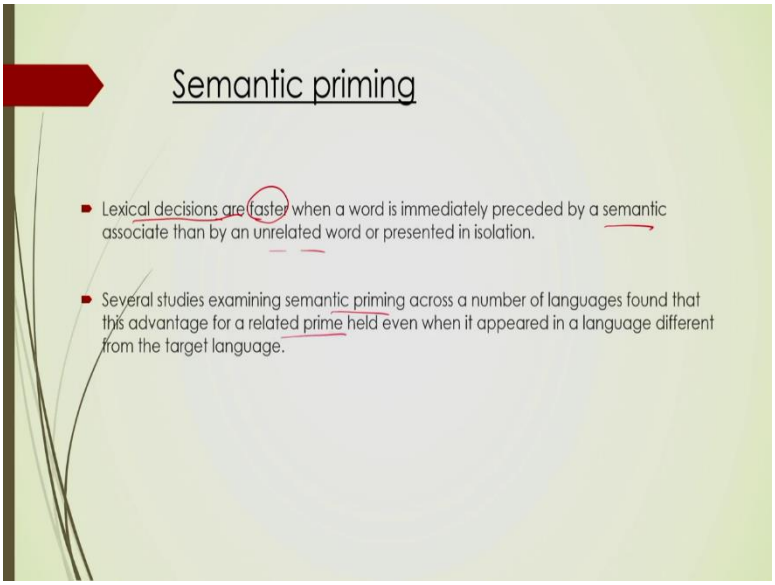

So, keeping this in mind, now let us look at semantic priming, studies using semantic priming, what we find is that semantic priming, over semantic priming as in when there is an overlap between the stimuli and the target in terms of semantics.

So, what the findings suggest is that lexical decisions are faster when a word is immediately preceded by a semantic associate than by an unrelated word. Simply put, semantically related words are processed faster. So, if your prime and target, so if you have we have seen this before also.

Bread and butter, if you if you bread and butter are associatively related, but if you also have a semantically related bread and; let us say pizza or bread or burger or something like this. So, they will be processed faster. If there is already a member of that category, you have already looked at. So, if the prime-target pair, word pair are connected semantically, then the target will be processed faster.

That is what majority of the findings suggest. Now, several studies examining semantic priming across number of languages found this advantage for a related prime ok. And that priming, this effect is found not only in within language condition, but also across language condition.

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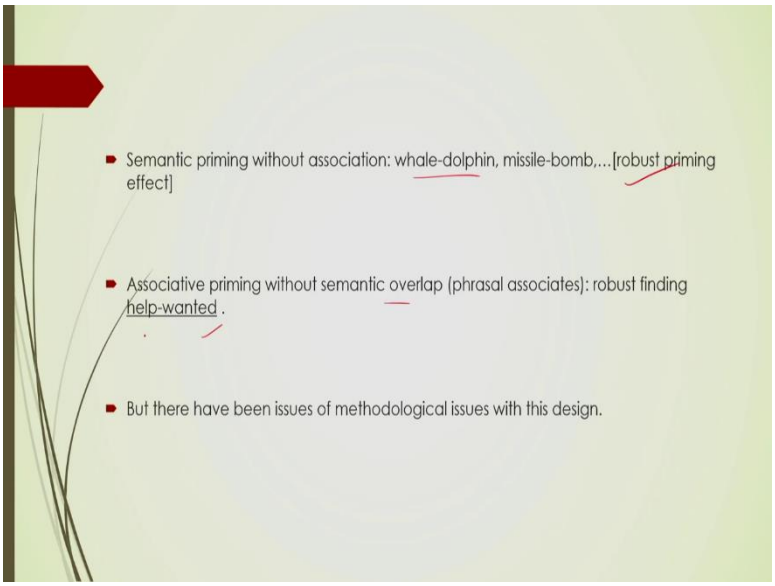

So, bilinguals' both languages, if you have two words in prime and target using the within the same category, but across language, you will see the same kind of priming. So, semantic priming without association, etcetera, we will find robust priming. Associative priming without semantic without semantic overlap also we find robust finding for like help and wanted and something this.

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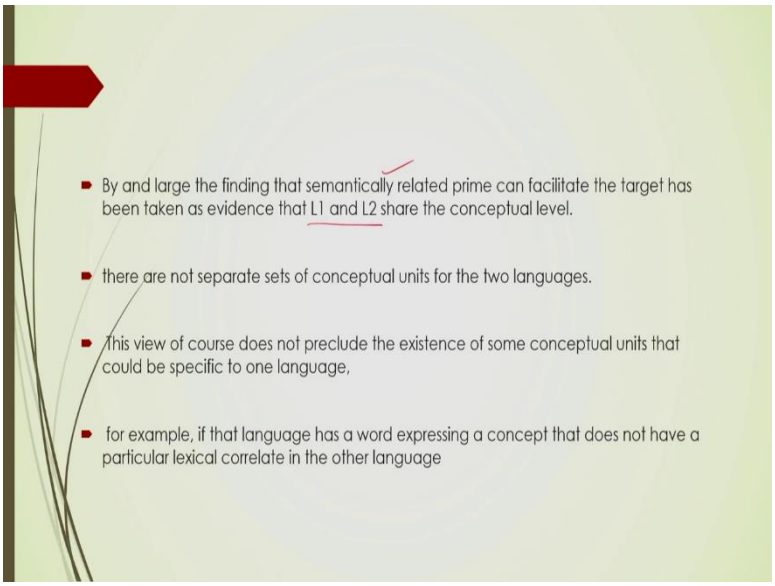

But there are some issues, sometimes we find the in case of associative priming, we do find the proof of facilitation quite often, but there are; there have been issues within that domain. That typically with task related issues and if there are different tasks, sometimes we do not find the result.

But by and large the finding is that semantically related primes can facilitate the target. And as a result, we can safely say that L1 and L2 share the conceptual level. So, there is at the conceptual level, there is only one set of only one stock, even though lexical level there can be differences.

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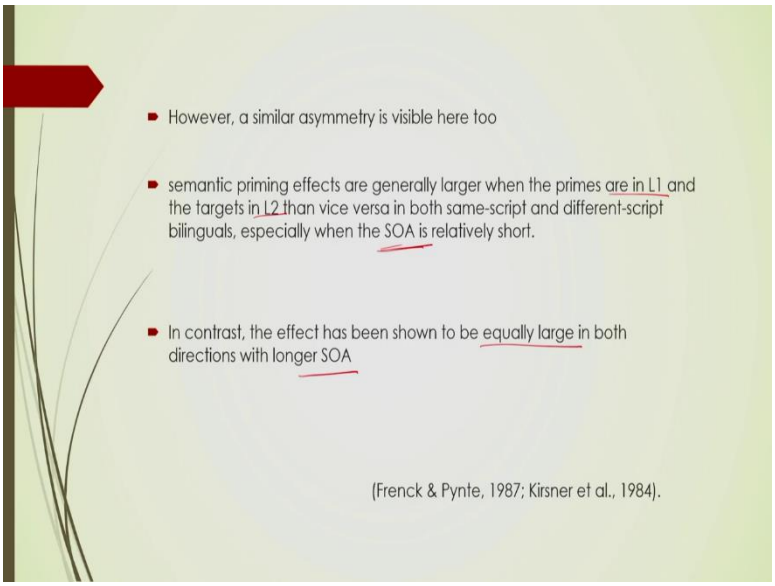

So, similar asymmetry; however, is visible here too. Semantic priming effects are generally larger, when the primes are in L1, targets are in L2 than the other way around ok. So, this is another interesting thing. Now, that we have found in almost all the studies that prime is.

So, lexically connected words, whether at orthographic level, phonological level, we have seen different kinds of findings. But one thing has remained almost constant which is the asymmetry and that same asymmetry we find even in terms of semantic priming.

Though the priming effects are quite robust; however, there is an asymmetry, whether it is from L1 to L2 or L2 to L1. And this is another important thing here is that, the SOA stimulus onset arrival, this is basically the gap between the two. So, that also has been found to be having an impact.

And in contrast, the effect has been shown to be equally large in both directions with longer SOA. So, if the SOA is different between stimulus and between target and prime, then that there will be different results.

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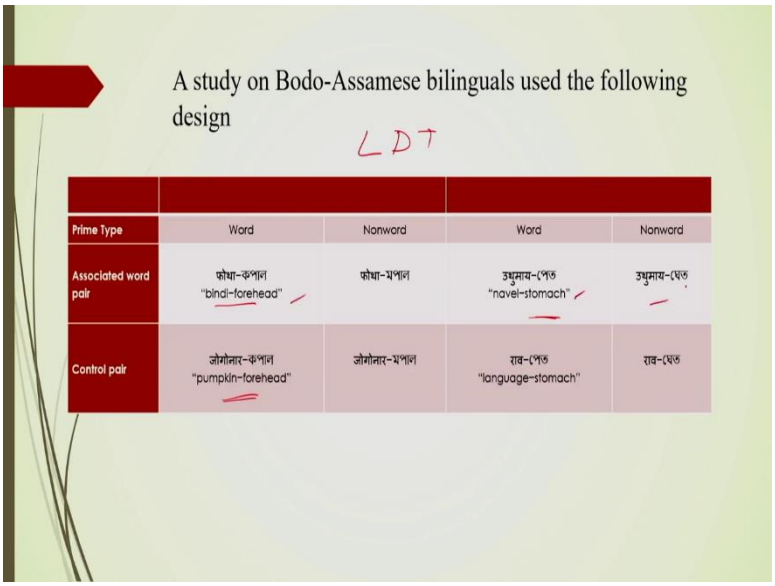

So, keeping the SOA short will have more impact, having a larger SOA we will have less impact. One study that we carried out on Bodo-Assamese bilinguals had this kind of a this kind of a design. So, the words, this was an LDT again, lexical decision task. So, these were the pairs. So, bindi-forehead and then the this was in across language across languages like this photha-kopal.

And similarly, you had another kind of whether there was an association or not. So, bindi and forehead go together, they are associatively connected, but you pumpkin and forehead are not associatively connected. So, these were the control pairs when there was no association. However, there was this and they also had non-word because this was a lexical decision study.

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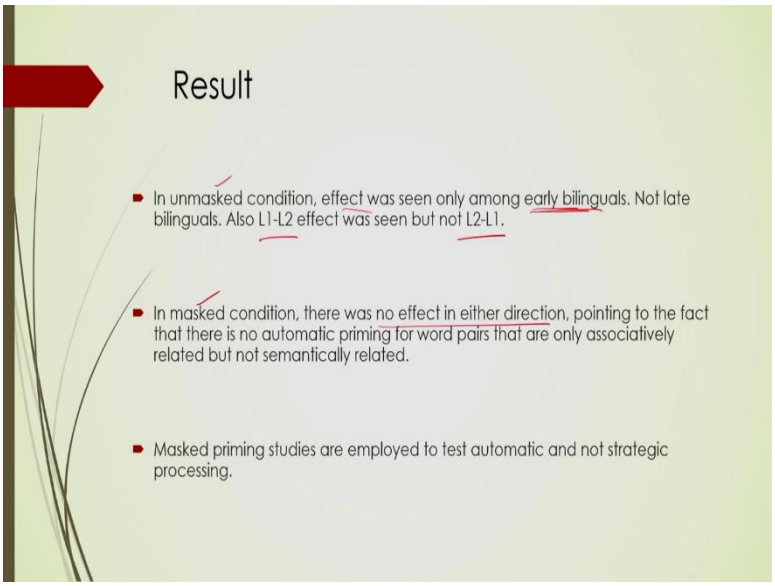

So, but this was an, this study was carried out in both masked and unmasked condition. The in unmasked condition effect was seen only among early bilinguals, not late bilinguals. Also, L1 to L2 effect was seen, but not L2 to L1. So, similar kind of finding that have been reported by many other researchers were also found here.

However, there was another interesting addition here that there was difference between the early bilinguals and late bilinguals. In masked condition; however, there was no effect in either direction. So, if we use mask between the prime and the target in case of associative priming, they would not find any kind of impact.

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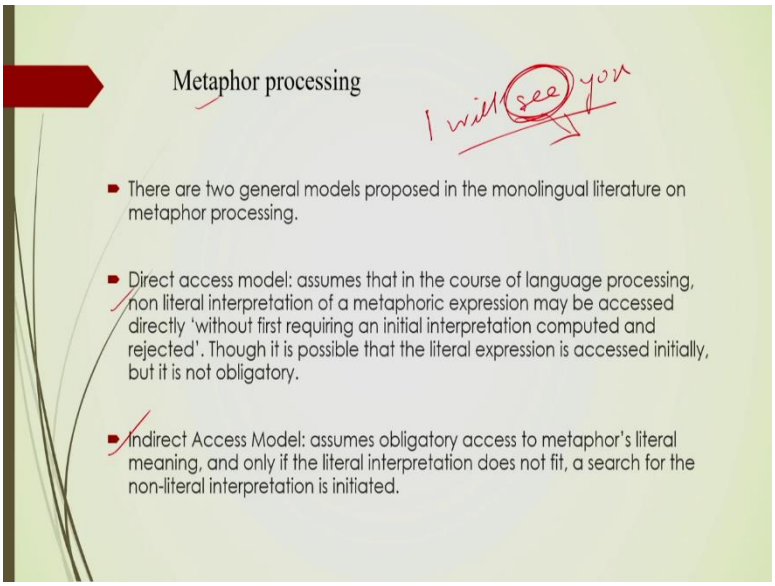

Masked primings we have already discussed before. So, we have till now, we are talking about normal language processing, similar simple language, day to day language processing. Now, we can take this a little one step ahead and look at how figurative language is processed. Figurative language within figurative language we are looking at metaphor here.

So, in metaphor literature, metaphor processing literature, there are two different models. One is called the direct access model; the another is called indirect access model. Direct access model talks about that, when you process a metaphorical language, metaphorical word or metaphorical expression in either any kind of, whether its an idiom or a metaphor or a simile or whatever, there are; there is this direct access, one does not need to go via the literal interpretation.

For example, it's quite common to say, I will see you. This is not a simple sentence of that the person is going to sit and watch another person, but here this this is a metaphorical usage of the word 'see'. So, this basically means, you know I will some sort of a revenge or something some wrongdoing has happened and so, he will avenge that, this is.

So, now, when we see; when we look at a sentence like this and we are faced with a metaphorical expression like this, do we interpret this as first we check out whether this here the see means actually seeing, looking at something or does it mean different,

anything does it mean something different. So, how does this metaphorical processing works?

One theory says, the direct access theory says that, no, we do not need to go via the actual word 'seeing' to understand this. We can directly understand the metaphor as it is with without any help taken from the literal sentence. The other side of the theory says that, the second theory says that, no, we need to go via the literal sentence and then see if that makes sense when it does not, then we go and look at the second meaning.

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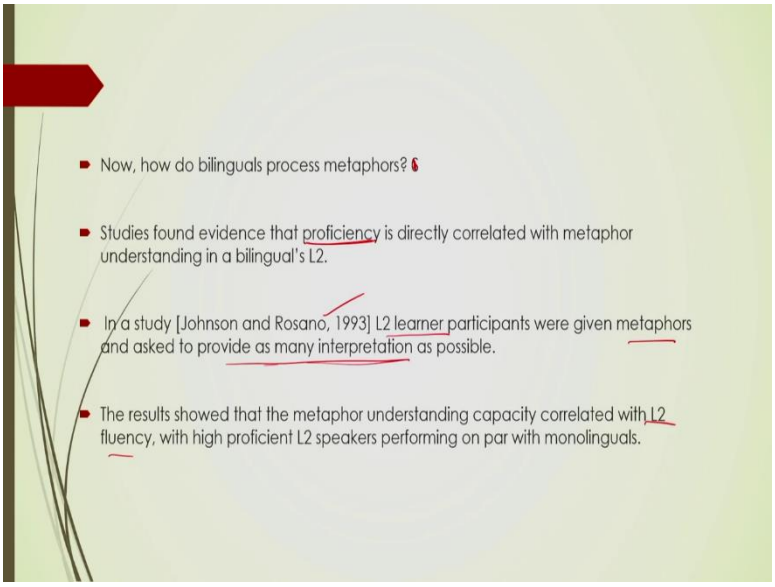

So, these are the two theoretical positions that have been at the backdrop of metaphorical language processing in second bilingualism also. So, the main question is, how do bilinguals process their metaphors? Now, one important factor here is again that proficiency in the L2 has been found to be directly correlated with the metaphor processing, metaphor understanding and processing in L2.

So, one of the studies that looked at the proficiency as a variable found that L2 learner participants could interpret much better way in a, much better way if the proficiency was higher as opposed to lower proficiency. So, fluency was correlated with the understanding.

The task here was they were given metaphors and asked to provide as many interpretations as possible. This is this expected because the proficiency in L2 means, proficiency in understanding non-literal usage of the language as well. So, this is one finding.

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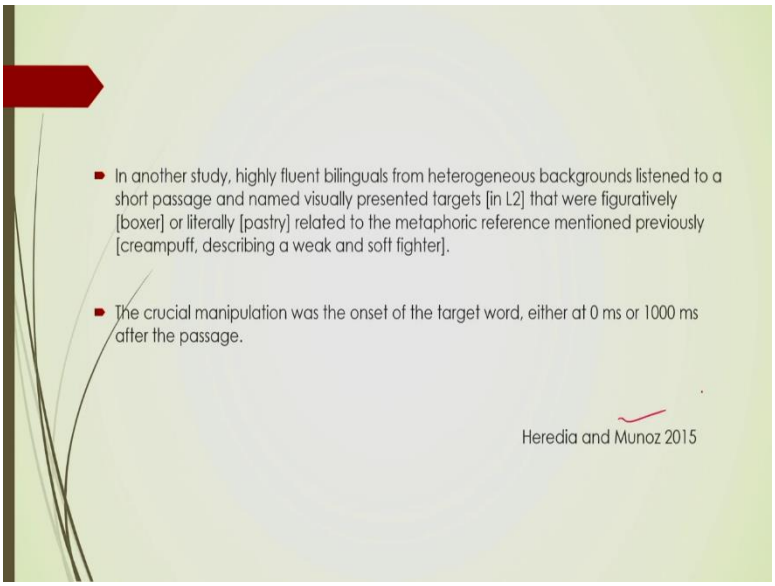

In another well-known study on metaphor processing, bilingual metaphor processing, they had this kind of a auditory stimuli.

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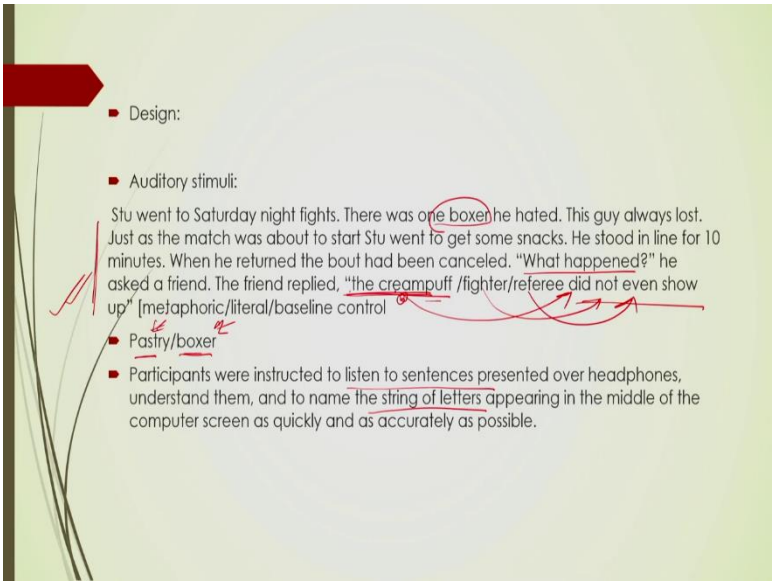

So, they this was sort of a conversation that the people were, people listened to. This is the story, there were many stories like this. So, there was a passage which talks about in this particular case, there is a talking about a boxing bout. So, they went for a Saturday night fights and there was this guy, who always lost, the one boxer who he hated because this boxer was a rather an incompetent person and he never won, he always lost and so on.

And then in between he goes to get snacks and comes back and then the show has been cancelled. Now, here is the crux, what happened? he asks. The friend replied, the cream puff did not even show up. So, what they created was the manipulation here was there was this story which ended in three different ways. One way was the cream puff did not even show up. In another version of the story, the fighter did not show up and in and yet another version, the referee did not show up.

So, in the first case, the cream puff did not show up. This is taken a metaphorical and look at the whole scenario. The cream puff here referring to the boxer who always lost, right. The fighter did not even show up is a simple literal way of looking at it. And referee, when you use referee, this is a control condition, this is a baseline condition which does not; its not what they were looking at.

Now, after that, there were so, the instruction was to listen to the sentences through headphones and then name a string of letters appearing in the middle of the screen. So, after they have listened to the story, a word appears and they had to read it aloud. Now, there were various words, pastry, boxer and so on.

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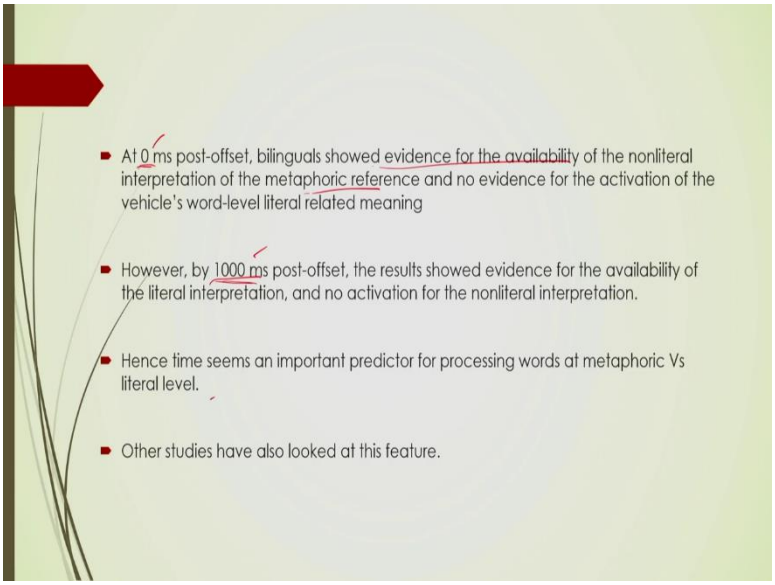

Now, you see, the manipulation was here, when.so the connection between cream puff, the sentence, the way the sentence was presented, the cream puff did not show up and then presenting pastry after that and presenting boxer after that, right.

And the so, do you. So, if you have listened to cream puff, do you take longer time to process pastry or longer time to process boxer? If you process boxer faster; that means, you have already mapped on the mapped cream puff on the boxer. That means you have understood the metaphorical, under metaphorical reading of the sentence or if you are connecting these directly to cream puff and then you will be taking less time for pastry, this was the understanding.

Another manipulation was here the time that they gave. So, there were two, there were gradations of the time. So, at 0 ms so immediately after listening to this passage, they were presented with the words at and then they had many in between and they also had 1000 millisecond post offset. So, after that they have finished listening to the sentence and then after that 1000 millisecond passes and then the target object appears.

Now, results actually differ depending on the kind of time they gave that is the SOA effect. So, bilinguals showed evidence of the availability of non-literal interpretation, when it was presented immediately after that immediately after the sentence. So, if it is; if it is presented quickly in quick succession, metaphorical representation was processed. However, if you give them more time, they process the literal one.

So, in the first case, if in this case the boxer will get preference, in the second case the pastry will get in preference. Hence, time is a very important factor. Time as in the time that you give between the stimulus and the target. That we have seen before also and that holds for metaphorical processing as well.

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So, these are the various domains within language processing literature in terms of comprehension. Bilingual language processing in terms of comprehension. Now, let us move on to the production studies.

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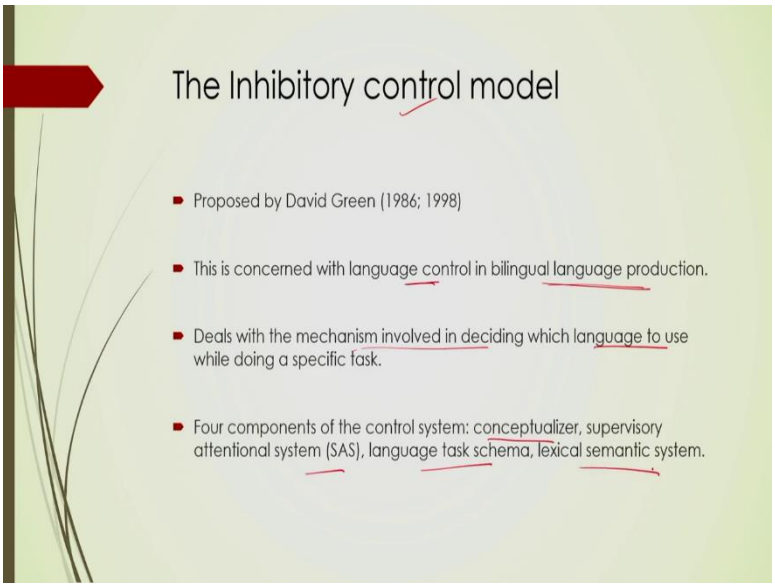

So, we have processing includes comprehension and production as we have already seen. Now, when we talk about production, there are various models. Now, we have already seen the models of comprehension before and representation and comprehension. Now, we will move on to some models within production study.

One of the, one of the most influential model is inhibitory control model or IC model proposed by David Green. Now, this model is concerned with language control, when bilingual language production happens. Why do we even need a control? Because let us go back a little bit to the introduction to this particular segment. Where we saw; where we discussed that when a bilingual speaks or they understand, we do not see any amount of you know time lapse when they speak, go back go back and forth between languages.

Even if you are a bilingual and there are sometimes code switching and code mixing, there is no time lapse happening. Which means that the second language is, second language as in the language that is not currently in use is always active to be utilized, that is one. Now, that begs another question, if the other language is equally active all the time, we have also seen the idea of language mode in the introduction.

So, that means, that both languages of a bilingual are simultaneously active. That means, if you are sticking to one language while producing; that means, that means you are inhibiting the other language. So, right now if I am speaking only in English, but my other languages are also active; that means, that I am suppressing those languages from interfering into my English language production. This is why we need a model.

So, what causes, what helps us? Of course, there is a there is an amount of inhibition in, inbuilt into the system of a bilingual. How does that work? This is the exact question that this model tries to answer. So, what kind of control process does a bilingual put in place while they produce language when they speak, so to say.

So, this, basically this model deals with the mechanism involved in deciding which language to use, while doing a specific task right as I said right now. So, right now I know I have to speak only in English. So, I do not allow my other languages to interfere. Now, this model has is based on a control system, which has many components. He calls them conceptualizer, supervisory attentional system, language task schema and language lexical semantic system.

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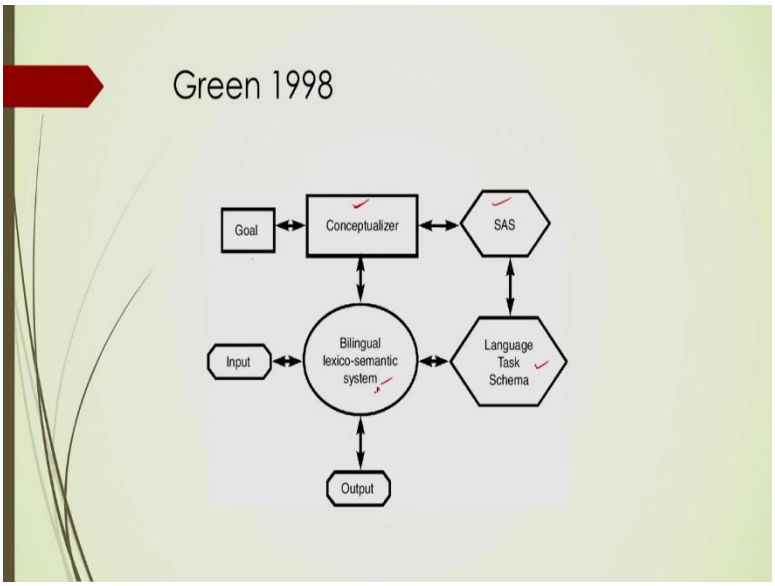

This is how the model basically looks. At the root of it, there is a conceptualizer and then this in turn, in is interrelated with the a attentional mechanism and then there is language task schema and then finally, this comes to lexico semantic system. And thereby you have an output.

Now, it this all these things are connected to the goal. So, right now my goal is to speak only in English language. Hence, I have to choose first the conceptualizer, then go through this entire process. And finally, come here, choose my language, the words lexical entities and then give an output only in English language.

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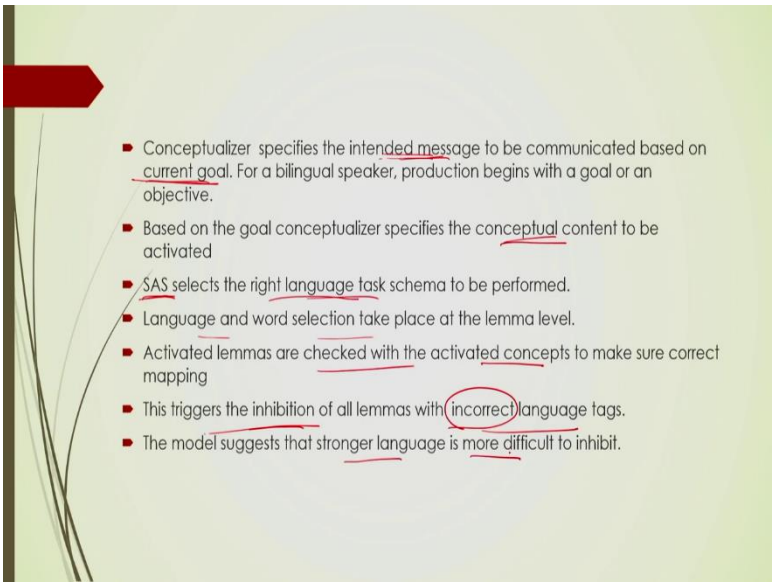

So, let us look at them step by step. Conceptualizer specifies the intended message. What is it? What concept should I imbibe into the words? That is the first step or before you speak, right. Before you speak internally, you have to realize what is my goal right now. What is the that goal does not only refer to what, but also where you are, right.

So, the same topic can be discussed differently using different different types of language variation, register or you know jargon depending on the context and the participants in the conversation, right. So, all of these are taken into account at the conceptualizer level. So, the intended message is picked up and then that which is to be communicated based on the current goal, this is very important.

So, if I am trying to make this entire understanding language processing, if I am talking to a friend let us say, I will be using a very different jargon, I will be using a very different way of talking let us say. So, my conceptualizer my intended message will have a very different coding system. So, here my coding is based on the intended message and the current goal.

Now, based on this, then we have the conceptual content is picked up and then SAS we have already seen the attentional system, they will select the right language task. This goes to the attentional mechanism, as to which language schema has to be utilized. So, every language has its own structural properties. Now, we need so, there is a mapping on from the concept to the language and that goes through the filtering mechanism of SAS and then

language and word selection happens at the lemma level where the language tag is applied, ok.

So, language tag. So, conceptualized concepts going to the SAS picks up the words at the lexical level and then these activated lemmas then are checked with activated concepts are they matching on not and then finally, the output. Now, these triggers an inhibition of all lemmas with incorrect language tags. This is where the inhibition thing comes in, this is where the control mechanism comes into picture. And this is one of the most important factors of the IC model.

So, this suggests that this model also has an inbuilt idea that the stronger language is more difficult to inhibit.

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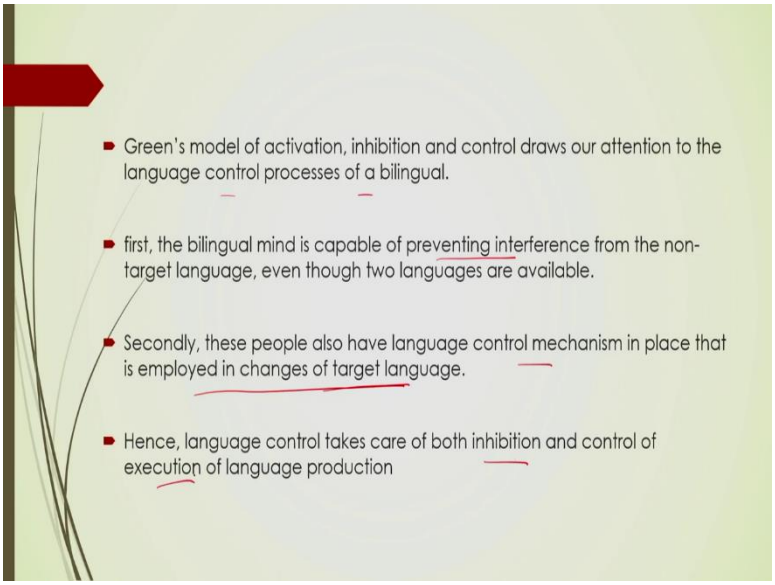

And that is exactly why we see the asymmetry. So, this model of activation inhibition and control draws our attention to the language control processes of a bilingual. What appears to be effortless, what appears to be instinctive, what appears to be pretty normal actually has this as per this model has this kind of a four layer system into place.

So, as a result, the bilingual mind is capable of preventing interference from the non-target language even though the two languages are available. Secondly, the people also have control mechanism in place to control mechanism place that is employed in changes of target language. So, right now if I have to change from English to Hindi or to any other

language, Tamil, Telugu, Malayalam or whatever, that also needs some kind of control right.

Now to suppress English and to bring that up. So, all of these are based on some kind of a switch which we which we call control mechanism. So, as a result, this control mechanism is at work for both inhibition as well as for execution of the language task.

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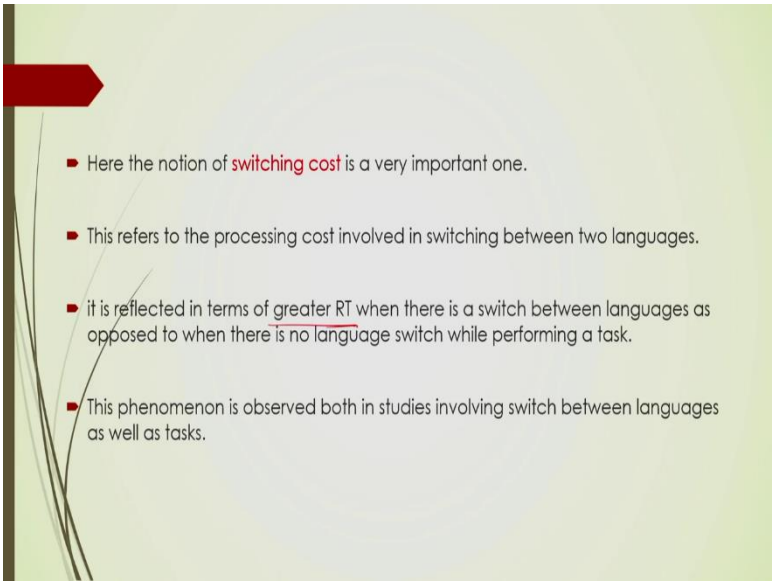

And that is exactly where the idea of switching cost comes in ok. This is a very important idea in terms of language production, switching cost basically refers to the processing cost in terms of switching between two languages. When you switch language from language A to language B, versus language B to language A, there is a cost involved meaning, there is a time difference that you take reaction time difference.

So, the this is reflected in terms of greater RT when there is a switch as opposed to when you were speaking in only one language. So, to give you a simple example, let us say right now I am speaking in single language only in English, but if I have to name objects in two different languages Hindi and English switching between Hindi and English, my time taken will be much longer compared to as I am taking now.

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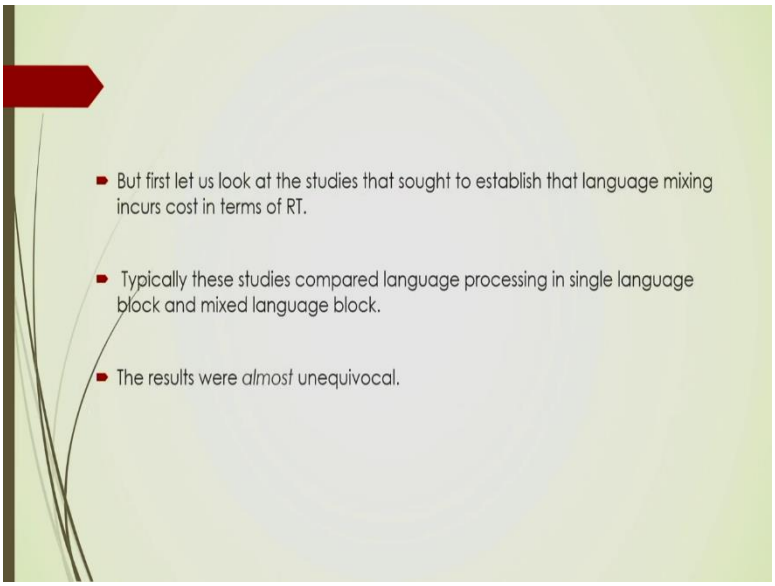

So, this is the switching cost. Before we get to the switching cost. So, we will let us look at some studies.

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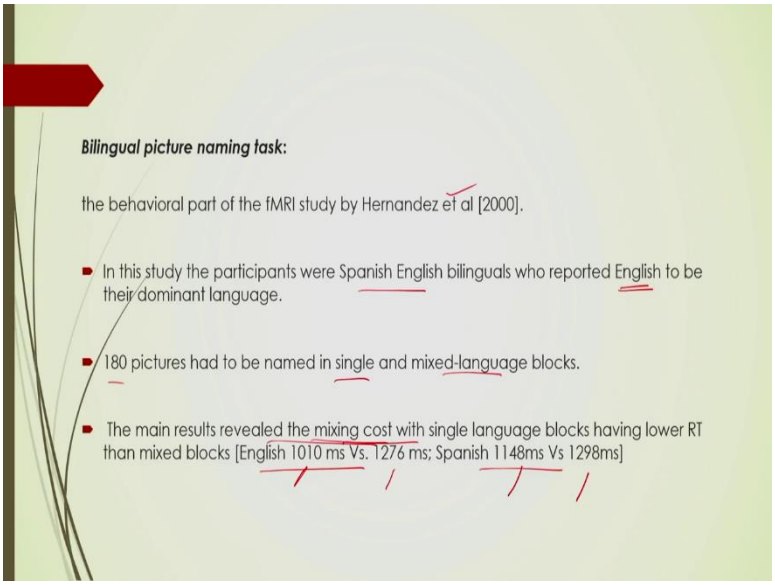

So, bilingual picture naming task, this is this report is taken from Hernandez 2000. This is part of a study that where he also used fMRI. So, he this was a Spanish English bilingual group they who had English as their dominant language. So, English though it was L2, second language, it was their dominant language, L1 was not dominant ok.

This was a picture naming study in single and mixed language block, in order to check the switching cost. The main result of the study revealed that mixing cost was reported in in term as opposed to say switching cost. So, mixing cost was seen in both English and Spanish.

So, this is the Spanish single language block RT and this is mixed language block RT. Similarly, Spanish monolingual and Spanish mixed block RT. So, in both the first language and the second language picture naming took longer in case of the mixed block as opposed to the single block.

So, what they did was, they named the pictures in both English and Spanish. And in both cases English was named in single language block, as well as in a mixed language block. What happens in a mixed language block is? In a mixed block the pictures are named in English some in English some in Spanish like that and based on some cue.

So, now how long do you take to speak in English in that block versus how long do you take to speak in English, name the picture in English, in the single block is the difference that is measured, right.

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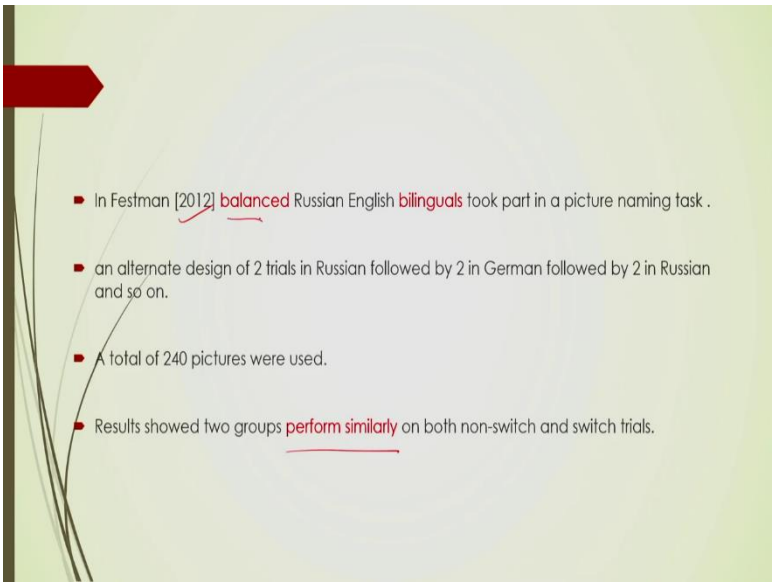

So, and they found a mixing cost in that study. Yet another study they found they used they had balanced bilinguals, Russian English bilinguals, again a picture naming task and they found them to be performing similarly. Meaning there was no switch cost that was

reported in this study and this has been tied to the idea of balanced versus unbalanced bilingual.

Previous study had the subjects were more proficient in their L2. English was the dominant language; however, this was a balanced bilingual study.

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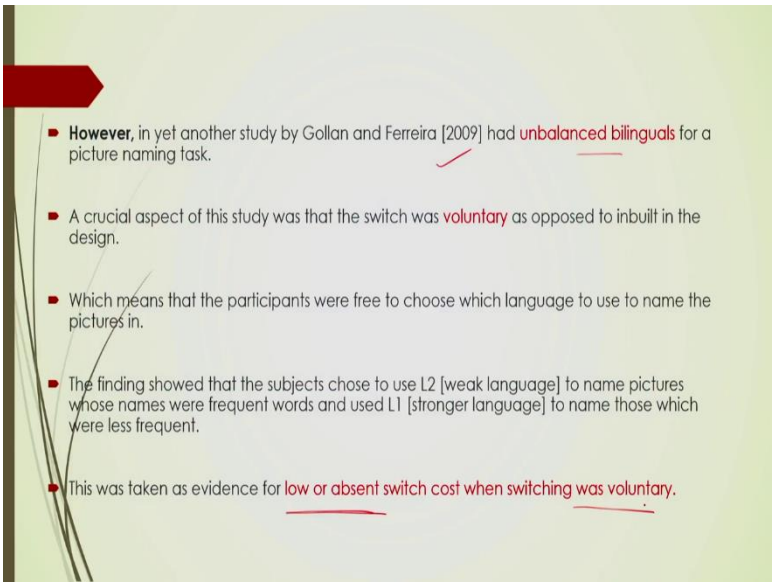

Yet another study by Gollan and Farreira they have they also had unbalanced bilinguals for a picture naming task again, but here the crucial manipulation was that switch was voluntary as opposed to inbuilt in the system. So, as a result the participants were free to choose when to switch or not to switch. And they found that is they did not find any switch cost. So, very low switch cost or absent switch cost. So, this is again was tied to being whether the switching was voluntary or involuntary.

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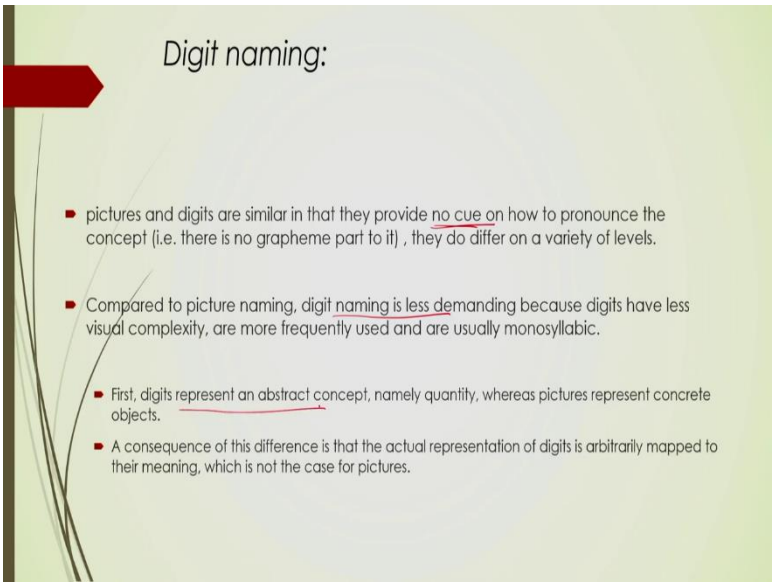

So, when the when the switching is inbuilt in the design meaning you are forced to switch, then you find cost, but in terms of free switching, as you voluntary switching you do not find the cost. So, these are the different types of finding within with respect to picture naming. Another area within language production is digit naming.

Now, digits and pictures are heavily used because of certain interesting properties, pictures and digits are similar in some sense, in some sense because they are they provide no cue on how to pronounce the concept. This is the concept itself in some sense, they refer to the 'what' part of it right. So, picture of a tree is what is it that tree, but you it does not give any overt clue as to how to pronounce it.

So, the phonology, orthography all of these things are missing there. Its only the concept, only the semantics. However, there are some differences between picture naming pictures and digits. So, digit naming is considered less demanding, because they have less visual complexity as opposed to pictures. And digits represent an abstract concept.

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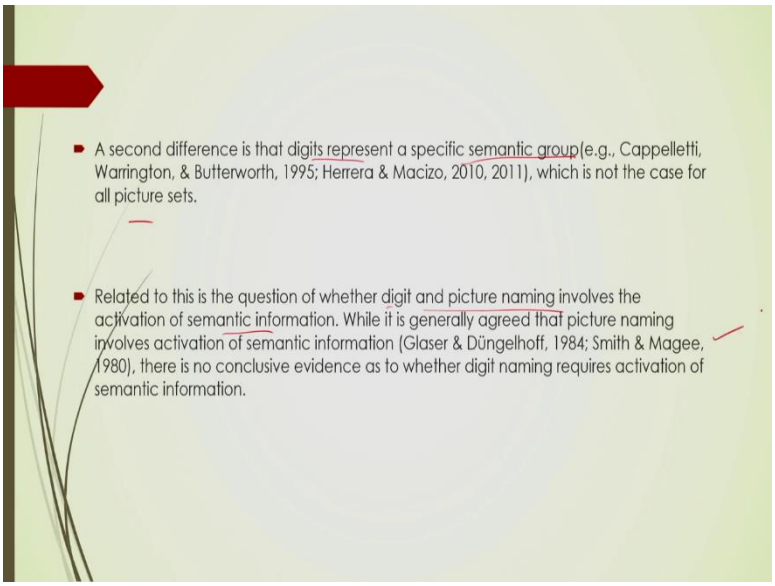

But pictures typically will have a concrete concept, because that is how you are that is why it is possible to picture them. Second difference is that digits represent a specific semantic group, which is not the case for all picture sets. Picture sets can be you know mixed, but digits are whatever, no matter what digit is it, it is still part of the same semantic group, right.

And a connected idea is the question of whether digit and picture naming involve the activation of semantic information. This has been this has been investigated in great detail by many researchers.

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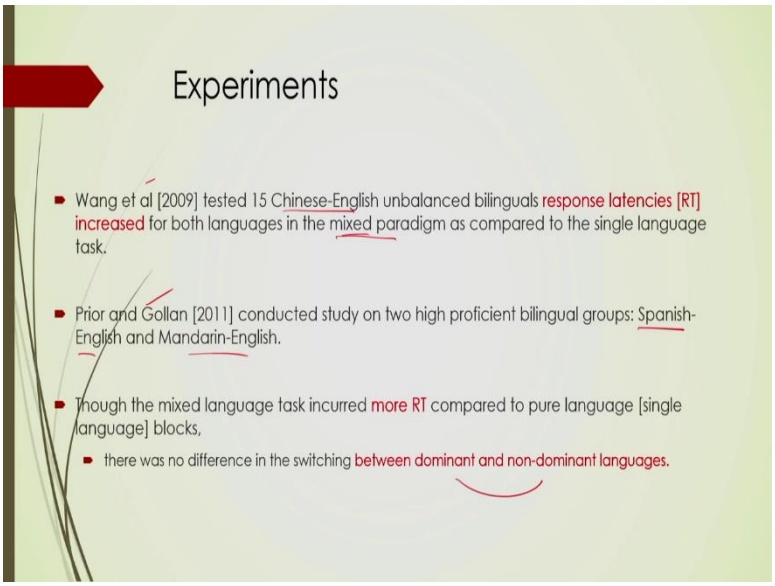

In any case, the let us move on to digit naming experiments. So, Wang et al in 2009 tested for a 15 Chinese-English, unbalanced bilinguals and their response latencies increased in both languages in the mixed paradigm. So, we are looking at switching cost. So, in terms of; whether it is a single language task versus it is a mixed language task, a picture naming showed us that typically they will have a mixing cost involved. Similar findings are reported for digit naming as well.

So, in digit naming mixed paradigm had longer reaction time as opposed to single language. Again, Gollan's group conducted the study on two high-proficient bilingual groups, two groups Spanish- English and Mandarin-English. They also found that mixed block did incur more reaction time compared to pure language or single language blocks. However, they did not find any difference between dominant and non-dominant languages.

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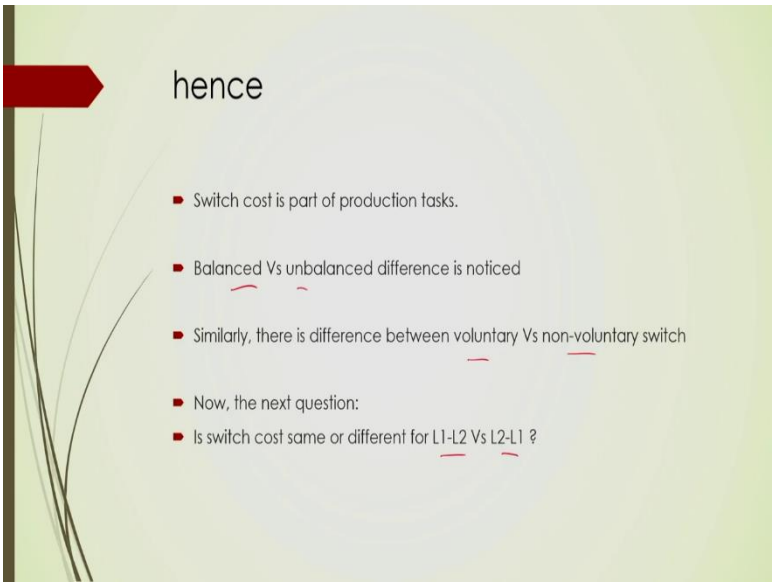

So, the switching did not really dependent, depended on the dominance factor. So, now we can safely say that switch cost is a an integral part of comprer production studies, whether it is picture naming or digit naming. If you have a mixed group typically you will have switch cost. However, there are some exceptions.

So, balanced by where are those exceptions, balanced versus unbalanced bilinguals is one domain where you can find some differences. Similarly, differences will be on the voluntary versus non-voluntary switch conditions.

Now, the next question is, switch cost same is the switch cost same for L1 to L2 or L2 to L1 is there at the same or is there an asymmetry in this case also. So, this is something we will take up in the next segment of this part and we will also include sentence processing in the part 3 of module 6.

Thank you.