Lecture 28

Cognitive Processes in Reading

Welcome to the course, introduction of the psychology of language. I am Ark Verma, from IIT Kanpur and we are running in the sixth week of the course, talking about reading. We've talked in the last two lectures about, some basic definition of reading and a little bit about eye movements, in the last lecture I talked to you about, two theories or two particular models of eye movements and two kinds of theories that were possible. In today's lecture, today's lecture I'll kind of give you a very, very brief account of what are the processes that might go into reading.

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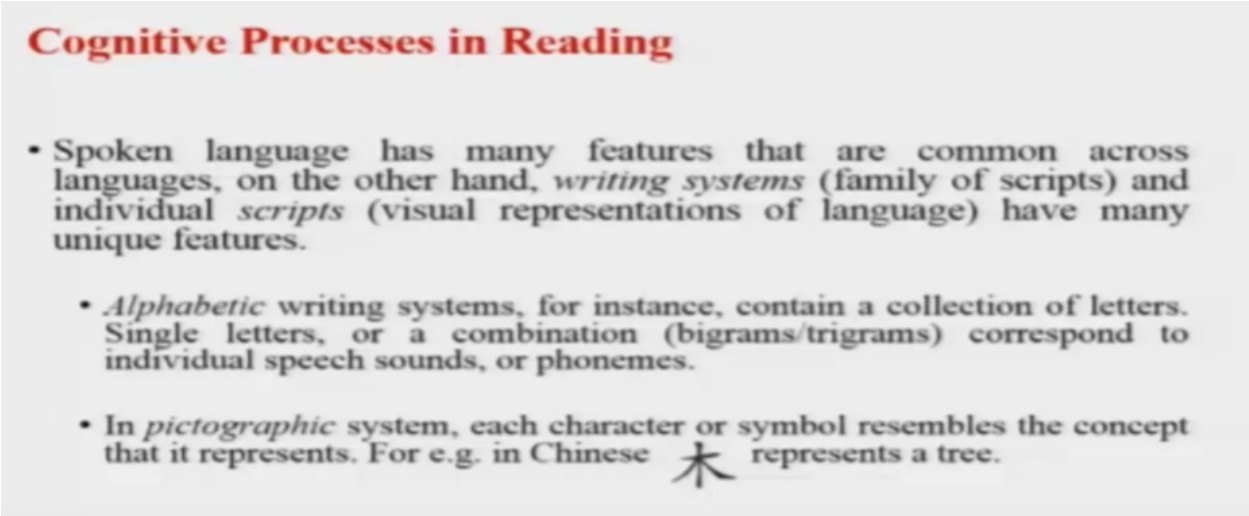

So, one of the first things that, you know, you need to take into account, when you're talking about reading, is that you have to consider, you have to take into account, their writing systems. Okay? So, there are different kinds of scripts: that encode information in a different way and that information has to be kind of deciphered, in a particular manner. Okay? So, spoken language for that matter has many features in terms of you know phonetic features and so on: that might be common across the languages. However, the writing systems or family of scripts a for example, there a you know, the Brahmi script or the you know Romanic scripts and so on. Basically have some commonalities and within that, then there are individual scripts: that have unique features. So for example, they could, they're also script families, but also, individual scripts that have certain unique features. So, in order to be able to read successfully, speak readers for example, sorry, the reader has to master the unique features that, his or her script has to offer. Okay? Broadly say for example, there are alphabetic writing science systems, say for example, the one that is used in English, it contains basically a collection of letters or a single letters or a combination of letters, the combination letters could bi grams and trigrams, usually they're single letter as well and these basically correspond, to particular speech sounds, particular sets of phonemes, say for example, a is a and b is ba and so on. Okay? And say for example, you have oh, why is it oi and o you is it ooh and so on. So, you have single letters, mapped onto perilous sounds and you're gonna have bi grams or trigrams, match two particular kinds of sounds. On the other hand you have the pictographic writing system, say for example, where, in say for example, in Chinese or Japanese, where say for example, each particular character or each particle assists symbol, resembles a concept that it represents you for example, for Chinese this, this symbol right here, represents a tree, you can see that this symbol actually resembles, the

tree itself so that is why? This kind of writing systems are called, ‘Pictographic Writing Systems’. There are other kinds of scripts called, ‘Logographic Scripts’.

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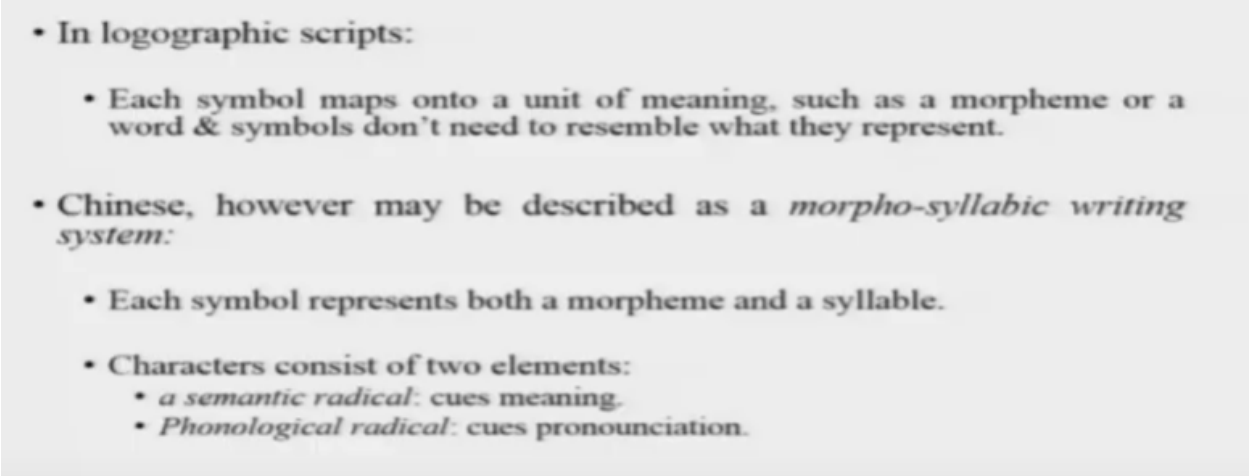

So, in Logographic Scripts, what happens is? That each symbol, maps on to a unit of meaning, such as a morpheme or a word and then symbols here don't really need to resemble, what they represent, these could be any kind of symbols, but the symbols, each symbol kind of carries, a slightly larger, amount of meaning that is compressed onto it, it can resemble, an entire morpheme or an entire concept at and in just one symbol. Okay? Chinese however, is basically a combination, of these things and Chinese is therefore referred to as a morph or syllabic writing system, because in Chinese each symbol, both represents a morpheme and a syllable. Basically a Chinese character, consists of two elements, a semantic radical that kind of gives you a clue about the meaning of that, symbol and a phonological radical that kind of tells us, about the pronunciation of how this is going to be pronounced, both of those things are there, still safer so we kind of looked into these three four different kinds of writing systems and we kind of talked a little bit about how, they are different from each other. But, they are largely, a lot of similarities, between how we process these writing systems or how you know, broadly residing systems might be organized.

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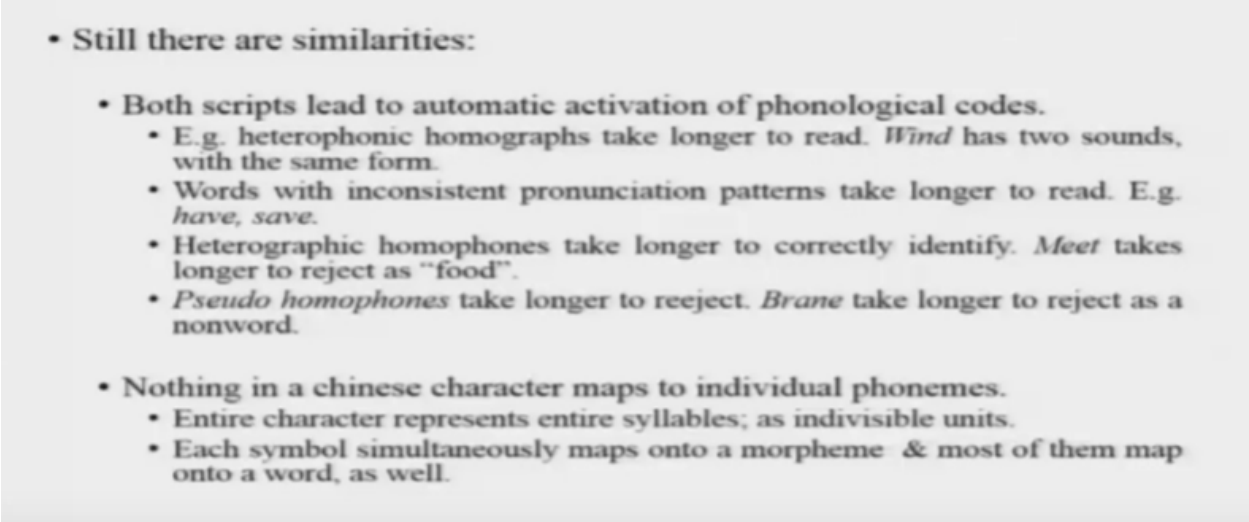

Say for example, both kinds of logo graphic script, pictographic scripts basically, certainly leads to activation of phonological codes. There are things like hetero phonic homographs, basically written in the same way, but pronounced differently: that is hetero phonic homographs, they take longer to read because you do not really know, how to you know, sound them out, say for example, the word wind, can also be sounded as wind. Okay? With the same exact, the same form and you have say for example, inconsistent, pronunciation patterns of particular words say for example, have and save or read and red. Okay? And then you also, have hetero graphic homophones, written differently but, sound the same say for example, meet, meet takes longer to reject, as a food item, because people if they're just, processing the sound portion, sometimes will find it slightly harder, to recheck they might kind of think of okay, is this a spelling mistake or something. Okay? And then you also have sudo home phones, which also takes longer to reject and sudo more phones are basically, not real words, but, basically that resemble, the sounds of actual words, say for example, the word brain here, the way it is written BR a n e, sounds you know, like an actual word that is brain, BR AI n and that is why? It might take, slightly longer to reject, as a non word. So, these are some of the things, which kind of occur, commonly across multiple scripts. How interestingly, nothing really in Chinese script kind of maps on to individual phonemes, as I said, it's a more for syllabic script, it either maps onto morphemes or syllables, entire character basically can represent entire syllables, as indivisible units. Say for example, pat, there is no character for P a and T there is an entire character for pat itself as a syllable, I'm just giving an example. Each symbol, here simultaneously also maps on to morpheme and most of them map onto a word as well say for example, player. So, they can be an entire, mask symbol that can represent play and amour and you know and say for example, another character will be added, to it, to make the you know, entire thing the player. Okay? So, phonological and the semantic radical both, will be there say for example, maybe on the character that, represents play, you can add a particular radical and make it, player or playing or playful. Okay?

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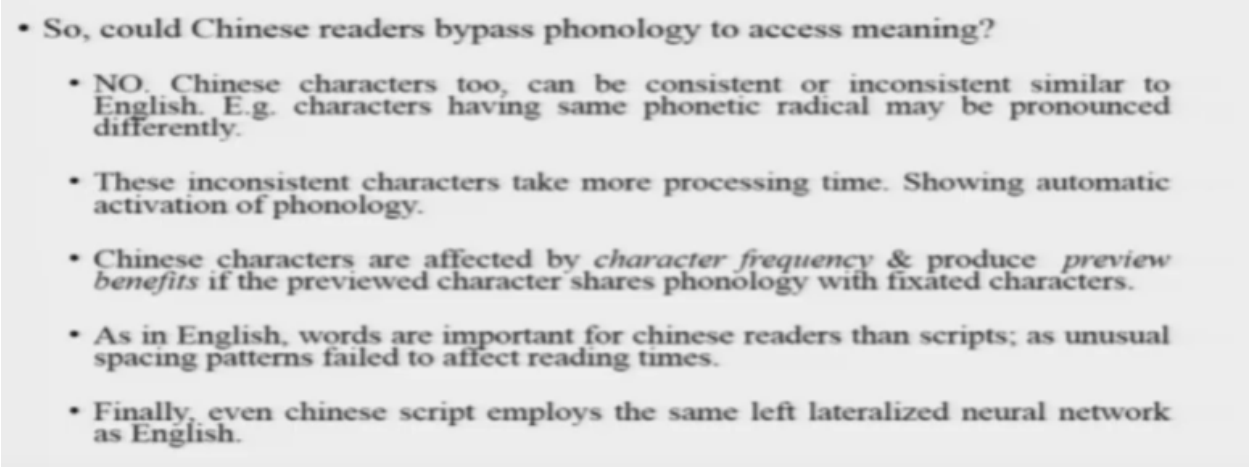

Now, given this you might ask, whether Chinese readers, do not really, need to activate any phonology. Say for example, for an English reader, to read cat or Pat a bat or say for example of a play, they have to kind of go from a symbol that represents P and the symbol that represents L and a and Y and then kind of convert, each of them into their sounds, so that they can read the entire word play, for Chinese suppose if there's just one character: that represents play, you can, you read that character, you get the word play, you do you need to convert, the symbol into phonology, into sounds: that is the question. Actually, not really, so they do not really, they do not really bypass, the grapheme to phoneme conversion thing, Chinese characters to needs to be say for example, converted from the character form to the sound form and this conversion can be consistent or sometimes inconsistent, in similar ways and as in English say for example, have and save and read and read and those kind of things. Character say for example, having the same phonetic radical, may also sometimes be pronounced, slightly differently. These inconsistent characters, that is why? Take more processing time and also in, in some sense if you test, current that's mean tested across experiments, shows, automatic activation of phonology and okay. Also Chinese characters are affected by character frequency and they produce also, similarly as English, preview benefits, if the preview characters share phonology, with the currently fixated characters. So, you know, the phenomenon, of reading across different scripts, broadly is still very similar to each other, as in English in Chinese as well, words for, words that are important for Chinese readers, rather than scripts you know, so words are important for Chinese readers as say for example, as compared to symbols. Finally also, even in Chinese script, basically the Chinese script also, employs the same, literalized neural network as in English, so part of the processing is happening in the left, and part of the processing is happening in the right. So, exactly the same neural network is also you know, it recruited in reading Chinese, as compared to as reading English. Now, however bilingual Chinese English readers basically, show a slightly higher, right hemisphere,

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- Although,
  - Bilingual Chinese-English readers show right hemisphere activation to process chinese script.
  - Can you suggest WHY?
    - The Chinese script may be viewed as "pictorial representation of words", hence it makes sense for the right hemisphere to play an important role in processing of the visual forms and also representing visuo – spatial information.
    - Chinese readers, therefor, both native and L2, show significant activation of right hemisphere.

activation, when they have to read Chinese as compared to when they have to read English. And it can be asked, why does this really happen? Basically because the Chinese script, may be viewed, as something that is a pictorial representation of words, sort of in some sense, because the symbols is slightly complex and hence that's why? And because they're symbols are you known, so much more visually complex, it kind of makes sense, for the right hemisphere to kick in and play an important role in processing of these Chinese characters. I mean we know, for a fact that, the right hemisphere does, the visual processing part much, in a much better way is, much more adept at it and that is why? The more complicated the characters are, you can expect that there are more say for example, you know processing more involvement, of the right hemisphere, in processing Chinese characters. So that is why? They would basically you know, recruit the right hemisphere networks also, in order to read Chinese script. So that's why? Chinese readers, it has been found, both native Chinese readers and those who've learned Chinese, as a second language, they show significant activation, of the right hemisphere.

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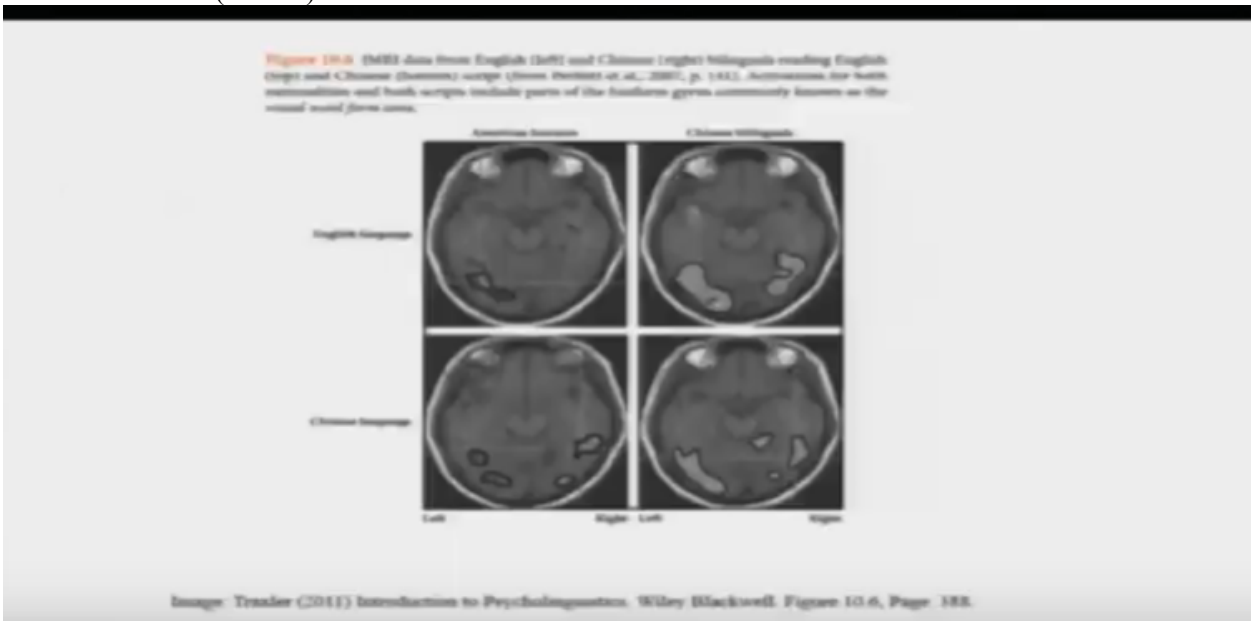

You can see this, there is this FMRI data, from basically, the study from perfect child's Perfetti increased 2007, you can see in American learners, the English language activation is kind of more on the left side,

whereas when they're reading, Chinese language their activation is on both sides, left and the right. Chinese bilinguals, you'll also see, activation on both sides of the hemisphere, basically saying that, when they're reading Chinese script they, they will kind of recruit, both the left and the right hemispheres, sort of in equally sure fashion.

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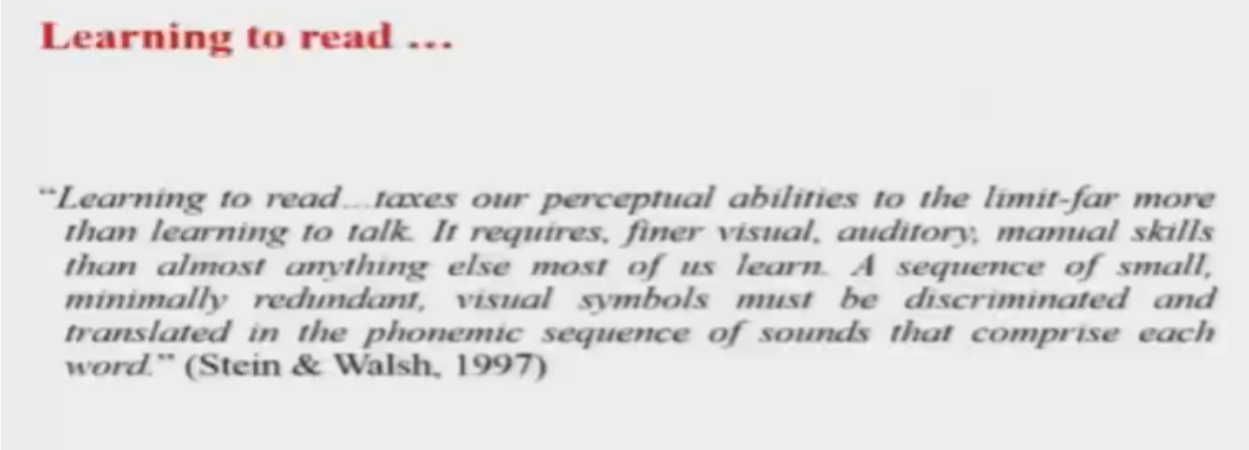

Now, that was a little bit about scripts, now let us kind of try and understand, what involves? What is it that, you know in what is involved in reading when you're kind of talking about going from sound, from letter to sound and so on. Now, say there's another quote, in Traxxas book, from stein and Walsh, basically learning to read. So, learning to read it says, learning to read, taxes our perceptual abilities to the limit far, to the limit, far more than learning to talk, because reading is as I said, it's an is unnatural you are kind of deciphering, a lot of compressed meanings out of these graphemes. It requires finer visual, auditory and manual skills, than almost anything else: that most of us actually learn, is a sequence of small minimally redundant visual symbols, must be discriminated and translated in the phonemic sequence of sounds: that comprise issuers. So, let me just kind of read it a little bit more slowly. First, learning to read taxes our perceptual abilities to the to the limit, it kind of you know, is a very heavy, perceptual job, because you're doing this, simultaneously on the fly in very quickly. Second is, it requires finer visual, auditory and manual skills, say for example, you are you know, reading these very, very complicated symbols, you are converting, them to sounds and you know, it's in that sense, a very sophisticated exercise. Also, there is so much information: that is contained, in these minimally redundant small very, small visual symbols, which you have to analyze and concatenate with each other, in order to get information. Okay? And this information is, what this information is you're translating this, into phonemic sequences. So, you're translating this bunch of letters, into a phonemic or sound based sequence: that is how say for example, for reading cat, you have to kind of translate from C AT ka and ta, have to be combined, in a sequence, one after the other in the right order you know, in order for you to really, get to the word cat. And this is fairly difficult, we kind of understand it the complexity, in this a lot of times, but if you really look at it, there are a lot of mental processes that are going on here, in a coordinated fashion, in order for you to be able to read, all of what you know, you have to read so cat, caterpillar all of those kind of things. Now, what does it really take to convert the grapheme to the phoneme? What is it? You know that the brain really, must do in order for you to be, able to generate a sound based representation, from an entirely visual, representation. Okay?

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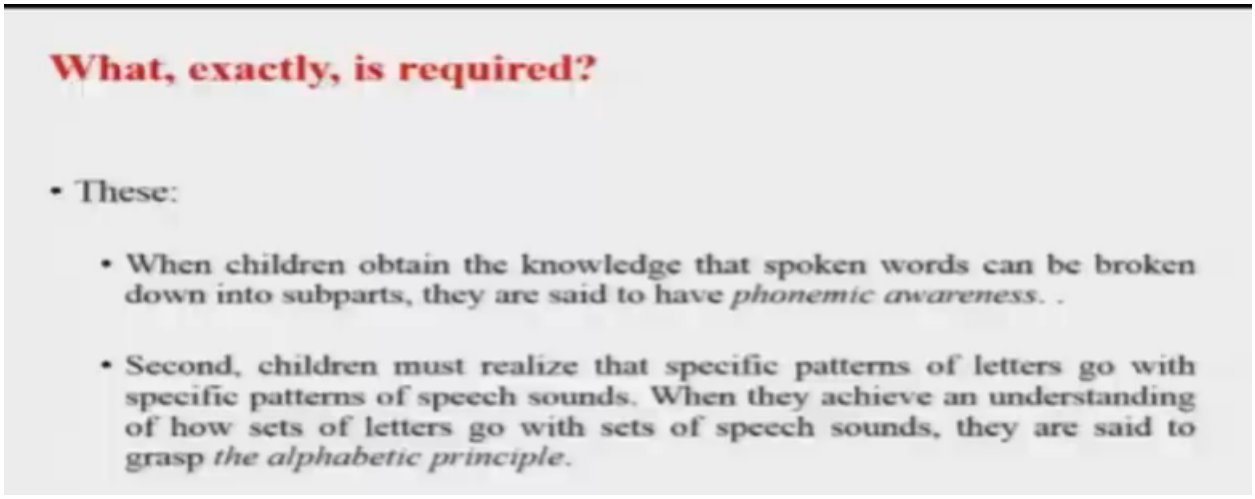

Let's, look at that, when children obtain the knowledge that spoken words can be broken, down into subparts , say for example, play can be broken down into Pa, la a and, and, a, an Y, PLA and why, what does it really? You know, what is it really that the child needs to learn, how does a large word, can you know, can be broken down into a smaller you know, letters and then those letters combined faithfully, to lead to large word back again that, connection is, what we have to really understand? Secondly, the children must also you know, realize and learn pretty quickly: that specific patterns of letters go with specific patterns of speech sounds, say for example, M AI D, is also made and ma de is also, may say for example, oh why is, oh it's a boy and you know and all of these different kinds of combinations children, when they're beginning to read, this is what they kind of have to pick up, this is one of the most important skills, for the children to pick up: that specific combination of letters will be pronounced, in a specific way. That is something that is very, very important and when they achieve this understanding, when they achieve an understanding of how, the sets of letters go, with specific sets of speech sounds, then bought they're then basically, they are supposed to have mastered, what is called the, 'Alphabetic Principle'?

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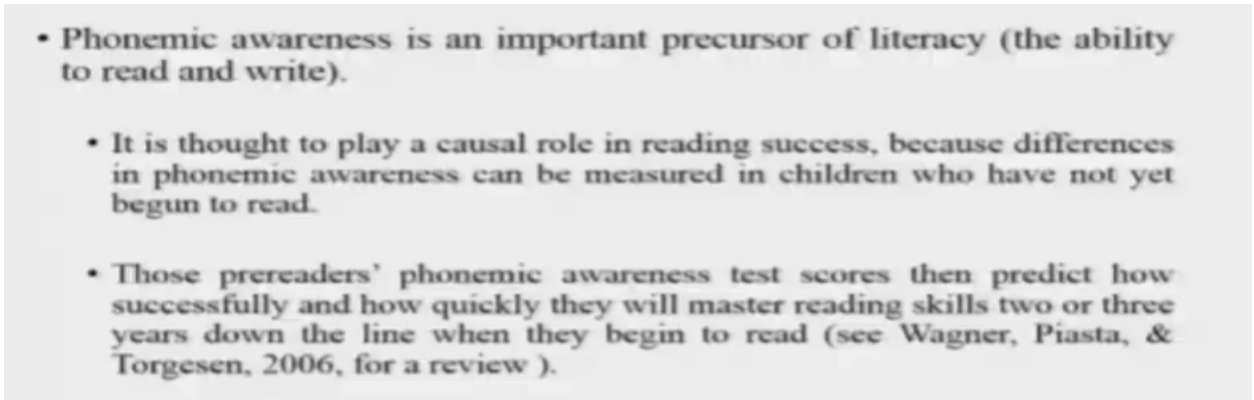

Now, phonemic awareness, is basically an important precursor this, this is basically the, the skill that we are talking about phonemic awareness, knowing that a particular set of letters represent a particular set of

sounds. So, this phonemic awareness, has been found to be a very, very important precursor to literacy or the ability, to read and write. Unless you kind of have mastered the alphabetic principle and you kind of have a sense of how particular letters, can be combined to read to particular sounds, you will not be able to successfully, learn to read or write. Now, this is also thought, to play a causal role in reading success eventually, predicting. So, one of the things that people have been doing for, so long is, to test individuals children's and phonemic awareness and that has been found to correlate, well in children say for example, in the overall success of the child in learning to read, somebody, some children who have high phonemic awareness, turn out to be excellent readers, some children who have, very low phonemic awareness, turn out to be you know, poor or moderately, skilled readers. So, phonemic awareness is thought to play a causal role in reading success, because differences in phonemic awareness, can be measured in children who have not yet, even begun to read. So, so even before you begin to read this kind of the ability, to make contact between you know, sounds and how the sounds can be broken down, you know, how sounds can be combined, is, is supposed to be very, very important. Now, these pre readers, those who've not been exposed to script, but, still their idea that they can break down complex sounds, into smaller sounds, tests course this pre readers phonemic awareness test course have been as I was saying, shown to predict, how successfully and how quickly, they will master, reading skills two or three years down the line, when they begin to read, when they are exposed you know, to alphabets, I mean they're exposed to the, how their script, represents the sounds of their language.

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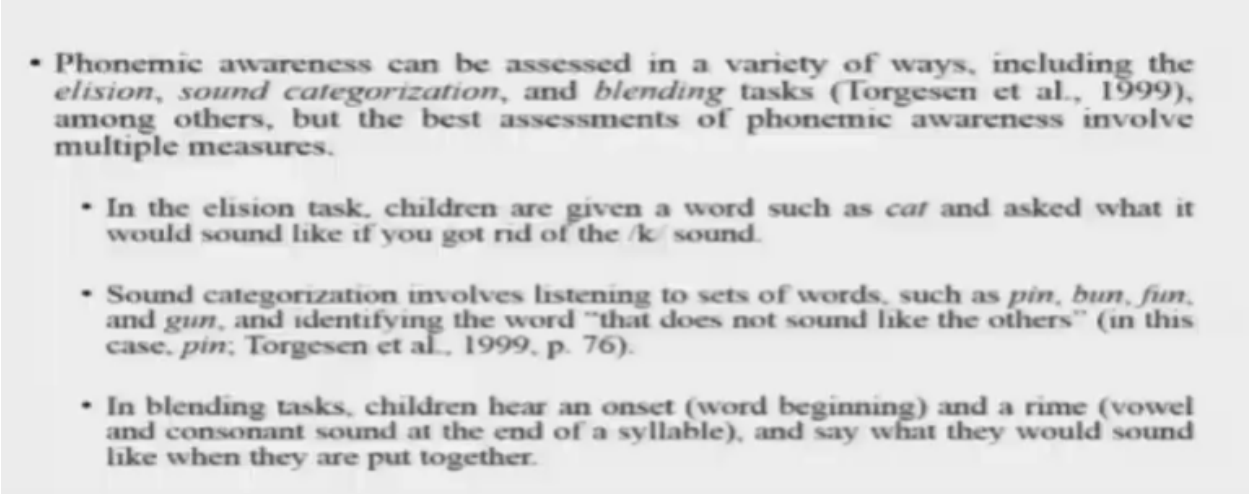

Now, also this whole you know, business of phonemic awareness, can be accessed in a variety of ways, for example, there are many tasks that help us judge, how good the child is in you, you know in the phone in the, phonemic awareness area, say for example, there are illusion tasks, sound categorization tasks and they are blending tasks. So, what happens in the elision task, is that children are word, are given words such as cat, bat, mat, rat and basically they're asked to pronounce back the word, by deleting certain sound. So, I can give this word to a child say, cat, tell me what cat will sound like? If the sound cur is not there. So, the child should be able to tell me, at. Okay? Similarly sound categorization, in sound categorization basically, children are made to listen, a set of words, such as spin, been, a pin, bun, fun and gun and they are basically asked to identify, the one sound, out of these four or five which is the odd one

out. So, pin, bun, fun, gun, so you have the child should be able to tell me that, pin is not going with the rest of the sounding words. So that appreciation of how the sounds are, in the blending task what happens is that? Children are basically made to hear onset worst word, beginnings and you know the rhyme, there are nucleus and the code about, the constant is the sound at the end, of the syllable. And basically they are supposed to blend this and say , what will come out? Say for example, ka and at, what will come out? If we combine this, so the child should be able to say cat, another combination part. Now, it has been shown.

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- Children's composite scores on tests of phonemic awareness are strongly correlated with the development of reading skill at later points in time.
- Children who are less phonemically aware will experience greater difficulty learning to read, but effective interventions have been developed to enhance children's phonemic awareness, and hence to increase the likelihood that they will acquire reading skill within the normal time frame (Ehri, Nunes, Willows, et al., 2001).

That children's tests on composite scores of phonemic awareness say for example, children scores on this you know, multiple tests on the phonemic awareness task, have been found very, strongly correlate with the development, of reading skill and you know, at later points in time. Say for example, if you tested a child at the age of two two-and-a-half before, he's been exposed to script and then later, you get some scores in terms of phonemic awareness task, elision you know, substitution, categorization, deletion, all of that and then you later kind of mash these course with their reading performance in at grade one, level of great two level, will we find that they are highly, highly correlated. So, in that sense, one of the things you could know, is that phonemic awareness, is one of the fundamental, abilities that are required, for by a child in order to learn to read. Children as I was saying earlier, who are less phonemic aware, will experience greater difficulties in learning to read, but, effective intervention has been shown, you know that it can help in developing children's phonemic awareness and hence, it would increase the likelihood that they will eventually, acquire reading skills. So, for example, this is now also being used as diagnostic measures: that you kind of measure, every children, in every child's phonemic awareness, kind of get this course, if you see: that the child is lagging, behind the phonemic awareness task, you will change, you can train the child on these phonemic awareness task, as the phonemic awareness, scores increase, eventually the child's you know, a performance in terms of reading, also increase or say for example, you are already, remedying, the fact: that the child, will end a child we know, not really suffer, with respect to learning, to read later. But, then okay, it is it's not really very straightforward, it is difficult, in a sense: that the child you know, has to master these you know, phonological skills, say for example, it also kind of has a little bit to do with the orthography, some orthography is are transparent, some orthographies are slightly deep and by deep basically,

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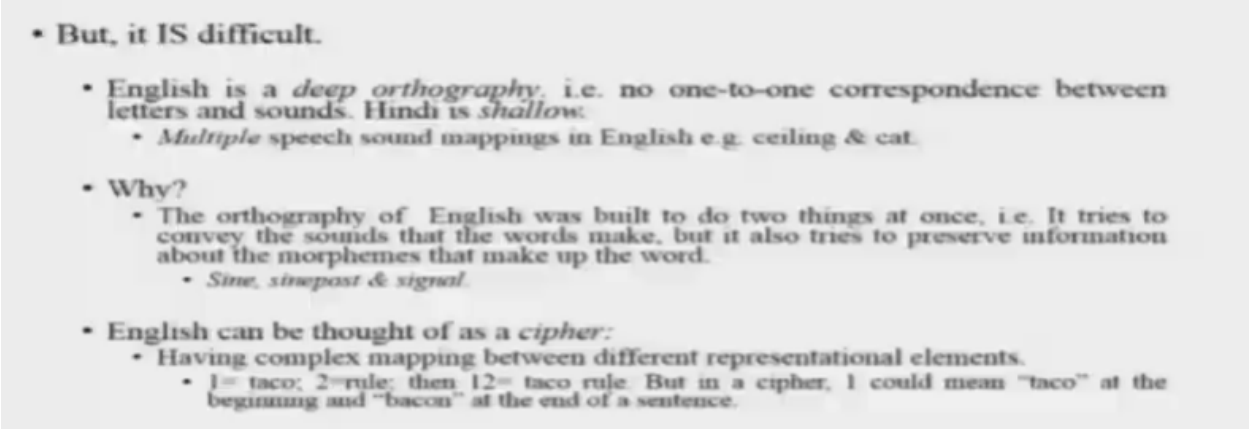

I means that the correspondence between the letter and the sound is not exactly one. Say for example, in Hindi, for that matter all those who are speakers of Hindi, the correspondence between you know, this what you write? And what you, what does it sound like? Is almost you know is exactly, when it is direct, what you read? What you write? Is exactly how it sounds like, whereas in English, say for example, their words like psychology or honest and say for example, bouquet, you write something you, you write BOQUET and you just read it as bouquet and psychology say for example, you write PSYCHOLOGY and you read it as psychology so, the P is silent. So, in that sense, by these examples, we can kind of see that, English is a deep orthography, whereas Hindi is a shawl a shallow orthography and the depth of the orthography kind of makes it easier, one case or difficult in the other, for the child to you know, understand the phonological you know, makeup, of the language and the phone you know, and the phonemic awareness scores kind of you know, might follow the same trend. So, yeah! Why is it that English is, is a deeper or a more difficult orthography, let us say, the thing is that, the orthography of English was basically designed, to do two things at once. First as it tries to you know, convey the sounds of the that the words make, but it also, tries to preserve information, about the morphemes that make up the word, say for example, how is it? How is say for example, so sign signpost and signal you know, so basically, the way these are written, sort of kind of also, give you a clue about how, morphemically, they are organized how say for example, what are the morphological make up of the word? In, in that sense, from that perspective English can be thought, of as a cipher, CAS, CIAPHER and basically we says: that it basically has a complex, mapping between a rule, between different representational elements. Say foe example, one is equal to taco, and two is to rule, 1 2 should be taco rule. But, in cipher, in nothing like English, one could mean taco at the beginning and bacon, at the end of the so for example, you know many in, many words say for example, read and read or have an save, the same alphabets and sound differently: that's what happens in a cipher? The same configuration of letters can actually, you know, sound very differently, in different kind of configuration that's why? It is a complex, phonemic rule, and it kind of takes some you know, mastery, some kind of learning is required to actually you know, finally grasp this. So, then we sort of see that, it is slightly difficult, as far as reading English is concerned, as compared to Hindi for that matter. So, how what is the way to remedy this? One of the ways that, teachers across the world have been trying to do, is that they have been trying to teach children, things like system phonics. Okay? Things basically like the idea,

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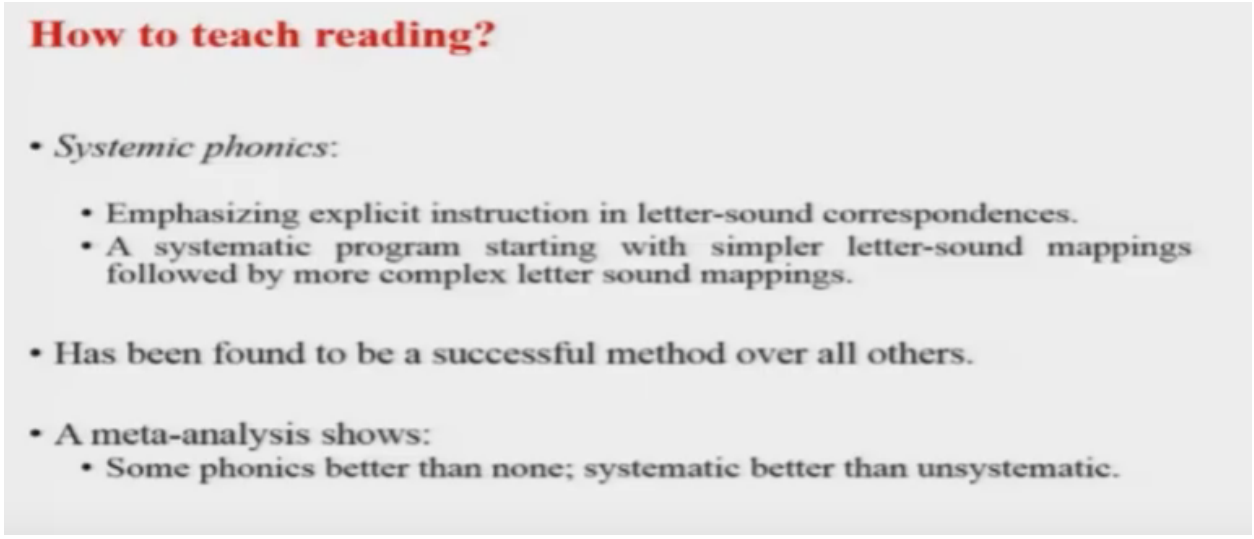

is that the emphasize explicit instruction, in letter-sound correspondences, I mean, I can kind of tell you this say for example, you know, there are there's this whole phonic way, of learning, reading if you go out to schools today and if you have young ones around you, if you look at the first level reading books, the entire system is very phonologically, you know, base and phonologically organize: that and the belief is that if you kind of train children, in these basic letter-sound correspondences, it will eventually help them read better. I mean there are so many, you tube videos available: that kind of now, try and attempt teach, these children about this letter and sound correspondences. And if there's a systematic program that kind of starts with to teach these simple letter sound mappings and then later followed by complex letter sound mappings, it can be a very, very helpful you know, skill for children to learn, which eventually, kind of you know, feeds into their reading performance and then feeds into it overall intellectual and academic development. And this has been found to be successful, method or another or a variety of other kinds of methods that have been used, by you know, teachers and educators, to help children learn to read quickly and without a lot of errors. A meta-analysis also shows; say for example, that some phonics, some phonics methods, have been found to be better than, others also more systematic started, teaching of phonics has been found to be better than you know, just teaching them randomly, so that also, has been found.
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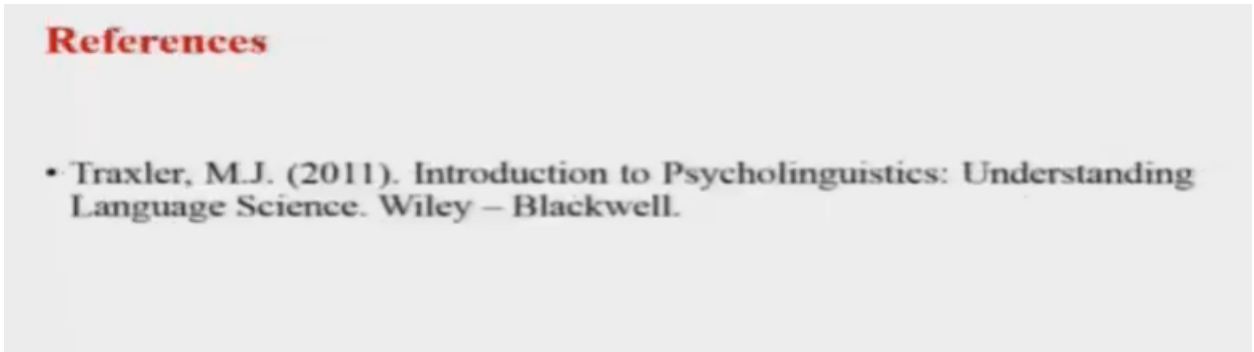

So, this all from me about, some of the processes that go in reading. We'll talk about another aspects of reading in the next course. Thank you.