

Fundamentals of language Acquisition

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Week 02

Lecture 08

Lec 8: Other variables: CPH and ToM

Hello and welcome back. Today, we will start with Lecture 3 of Module 2. So far we have looked at a couple of theories with respect to language learning and language acquisition. Today, we will start with the other variables. As I mentioned in the previous lecture, after the theoretical positions, the most important theoretical scaffolding has been discussed. Now we need to look at some more important variables that are also quite crucial with respect to all the debates and controversies regarding how we learn language.

There have been many such things put forward, so we will be able to discuss four of them. We will start with the critical period hypothesis and the theory of mind today, and in the next lecture, we will talk about joint attention and body schematics. So, of course, this is not an exhaustive list, but this is where we will make a beginning, and as we go ahead with the course material, as and when required and relevant, we will discuss the other things, other variables that come up. So, let us start with the Critical Period Hypothesis.

Now, the critical period hypothesis primarily states that there is a critical, or rather a significant, time window within which one must learn a language; beyond this, language learning may not be optimal. That is the primary crux of the matter, but now let us see how it is positioned and within what broad idea it is positioned, and so on. So, before we get into the critical period hypothesis, let us understand what the critical period itself is. Now, the critical period is a time window; very interestingly, it is a very short time window in the early part of neonatal or postnatal life. So, immediately after birth, there is a very small temporal window given to many animals in which they need to fine-tune certain innate capabilities.

So, that is what the critical period is. So, specific experiences are crucial for the development of certain skills. This is a domain-general sort of understanding. So, there can be many such skills, as we will see. So, for many other less complex nervous systems, animals that have less complex nervous systems, behavioral repertoires, such as foraging and fighting strategies, are developed by intrinsic developmental mechanisms and are in place early.

So, what we mean by this is that many animals, and every animal, has its own intrinsic capability.

So, the birds need to learn how to fly in a very short span of time. Similarly, certain animals of prey, you know the predatory animals, need to learn how to hunt within a particular span of time. That time window might differ from one species to another, but there is a time window that is the most important part here. Similarly, there is something called imprinting.

So, for many birds. That is the imprinting of their parents happening very, very soon within a very, very short time window after birth in postnatal life. So, nervous systems are not only applicable to higher animals with more complex nervous systems, but they are also applicable to the less complex ones. So, the nervous systems of complex animals are influenced by particular circumstances, and these experiences are crucial for the development of those innate qualities. So, even if you are born with it, a tiger is born with the capability of hunting, or a lion is born with the capability of chasing and hunting animals of prey.

But until and unless they are exposed to that experience, this will not really work out; that is the idea. So, imprinting in birds, as I was just saying, happens in a severely restricted time window in the early postnatal period of life after hatching. In fact, this has been utilized in a very interesting way in some parts of China where they use a certain variety of goose as a pest control mechanism. So, rather than using chemical pesticides, they use geese in their field to eat all the pests. And so, what happens is that because the time window for imprinting is very short, rather than having the mother goose present near the hatchlings, a certain kind of stick colored in a particular way is placed.

So, when the hatchlings are first able to see, they see that stick and consider it to be the mother. And as you all know, ducks and geese have the habit of following. So, the mother will go in front and all the chicks will follow. And so that is the exact mechanism that the farmers use there. So, the farmer will have the stick in his hand, and he will move ahead, and all the chicks will follow.

So, that is how he takes them into the fields. So, imprinting has been utilized in a very novel way by the farmers there, but this is the concept of imprinting. So, a very, very short time window after they have hatched is when they have to imprint; whatever they see at that time, they consider to be their parent. Now this idea: so what is the crux of the matter? The crux of the matter until now is that in the animal world, we see a critically important time window within which the members of the species must master those skills. Now, during that time, two things come together: the innate capacity, an innate inbuilt system, which in turn works in tandem with the experiences that are given.

So together, they develop the skill. Now, if that time window is missed, somehow that skill will not develop; that is the idea. Now, taking these to the human language acquisition system, Eric Lenneberg presented his very important theory of the critical period hypothesis. The idea, according to him, was that the onset of language is marked by a peculiar language-specific maturation schedule. This is from his 1967 work.

So, since language learning is innately guided, the critical period hypothesis is very strongly based on the innateness hypothesis that language is an innate capacity, just like the hunting capacity of

larger animals and so on. So, because this is innate, there must be some sort of critical time window for us to master that; that is the idea. So, that is why he says since it is innately guided, we already have the mechanism inbuilt, this must follow a certain kind of maturational stage. And then he bases his theory, which is mostly based on the brain maturation hypothesis and the stages of maturation of the human brain. So, he has a very solid foundation there because his understanding is that hemispheric specialization takes place during this particular period.

So, why is this critical period there? Because that is when the hemispheric specialization is happening. So, what is hemispheric specialization? Hemispheric specialization, or what we can also call behavioral laterality, and so on. Basically, this means that certain brain areas become specialized for specific kinds of activities or skills in humans. So, in our case, language is supposed to reside in the left hemisphere. So, left hemispheric specialization for language happens during that time.

We are not born with the lateralization intact, but this is what happens during those stages, and that is what is equivalent to the critical period as far as Lenneberg is concerned. So, what he says is that because the brain is maturing at that time, lateralization is ongoing at that time, the child's brain is flexible. So, that is why you are able to pick up those, or let us say, master those skills. Now, his evidence comes from various findings in that area. The most important point of departure is that, unlike many other species, the human brain continues to grow after birth.

This is the most important, most crucial thing here because the entire theorizing is based on that simple concept. So, the human brain continues to grow after birth until the next few years. It is not a very short time; it takes a few years for the human brain to mature. And because of this, it is possible that during that time the maturation stages will be unfolding, and that is why it is the critical period. So, as a result, hemispheric lateralization continues throughout childhood.

So, one of the accounts of this process is that there are many theories as to how it happens. One of them is called the equipotentiality hypothesis. Now, this hypothesis primarily states that in the case of humans, the two hemispheres are similar with respect to language when they are born. So, there is no language-specific specialization immediately after birth or at birth, so to say. So, this means that each hemisphere is equally capable of acquiring the processes that are responsible for language.

It is only later that the left hemisphere matures into a specialized language center. So, we are not born with a specialized system; both hemispheres are equally capable of having the processes, you know, acquiring the processes, and during those maturational stages, the left hemisphere gets to master that skill. That is why the CPH, which is the critical period hypothesis, is considered to be one of the best-known versions of this hypothesis. So, there is an almost direct one-to-one mapping between the equipotentiality hypothesis and the critical period hypothesis because they both say almost the same thing. So, the critical period hypothesis can be considered in that light.

Now, Lenneberg's theory drew support from data of brain-damaged patients. During those days, most of the data that we have from the brain with respect to language localization or any other kinds of functions, primarily language, came from patients' data. It was not common in those days for

normal, healthy individuals to undergo various kinds of testing, which is, of course, common now because we have advanced technology to do that; at that time, primary data came from the patients. So, the data of brain-damaged patients is what Lenneberg primarily used. He showed that age had an impact on recovery after any kind of brain damage.

So, if the brain damage particularly happens to the left hemisphere, it leads to significant, maybe even permanent, language impairment. So, one of his key findings was that children typically tend to recover their linguistic skills. However, adults find it nearly impossible. So, in the case of severe brain damage to the left hemisphere, children recover their capacity to speak faster in most cases than adults, depending on the nature of the damage, of course, but in the case of adults, the chances are very low. So, this was one of his major arguments that it is because the child's brain is still maturing.

It has still not, you know, become rigid; it has not become all fixed. That is why it is work under construction sort of. So, they are still able to overcome the difficulties. So, in fact, post-brain damage or surgical removal, the function of the left hemisphere can be taken over by the right as well if the child is young enough, as there have been many findings that have shown that. However, the same will not happen for adults; in the case of adults, the language loss might be permanent.

Another set of evidence comes from the particular condition called crossed aphasia, where damage to the right hemisphere causes language deficits among children. So, this is why it is called "cross." So, if the right hemisphere gets damaged, the left hemisphere's language capacity gets affected. So, these points toward the claim that the brain is not yet lateralized. So, that is a lot of give and take that is still there between the Again, there was another finding, quite an important one, by Dennis and Whittaker in 1976 that found that children who had the entire left cortex removed had more difficulty learning syntax compared to those who had the right cortex removed.

So, you can see there were a number of findings with respect to brain damage and post-damage recovery among children versus adults. Also, what happens if the entire left hemispheric cortex has been removed, and so on and so forth. So, various kinds of findings led Lenneberg to believe that language learning can happen best during that time when the brain is still maturing. And they can know that as a result, it is resolute enough to overcome all these various kinds of difficulties. But then that was '67, '70; this finding was '76 and all that.

So, in the 60s and 70s this was fine, but later findings have pointed out various issues with these claims. The most important criticism was the methodological issue, as well as the number of samples, because how many patients' data will you get, how many people will turn up with the exact kind of brain damage, and you know, so that you can compare, and so on and so forth. So, the sample size has been one critical issue; another was the methodology applied, and so on. So, there have been controversies, but nonetheless we still have some cases where we do find evidence that kind of corroborates the claim of the critical period hypothesis. Now, there are other kinds of proof as well.

The most famous cases are those of Genie and Isabelle, as any textbook will tell you. So, the case

of Genie is quite famous. She was locked in a room without any human contact till she was 13. She grew up in a particularly abusive household, where nobody was allowed to talk to her by her father. And she was locked in a room tied to a chair and that is how she lived for 13 years of her life.

So, when she was rescued by the officials, she was not speaking; she had no language and did not learn any language at all because, of course, nobody was speaking to her, and she was left to be on her own entirely. So, after rescuing her, there was a lot of effort to teach her the language, and there are some reports that she did learn some words and so on, but largely she did not really master the language as well as her age-matched controls. So, the idea that the primary finding in this case of Genie was that she never learned language properly. Of course, for a few years, scientists were given access to her, but later that was denied. So, we do not know what happened to her after that, but as far as we know, she never mastered language.

So, even when there was a bit of a claim that she learned the language, that is also controversial because not everybody agreed on the degree to which she learned. Now, she was discovered at the age of 13, which is much beyond the age of the critical period that Lenneberg talked about. By the way, though it is very difficult to pinpoint a particular age, it is kind of agreed upon that the critical period lasts until puberty. So, pre-puberty and puberty were around that time. So, 12, 11, 12, 13—that is the age bracket that Lenneberg and others talked about.

Of course, there are many findings that also point towards a slightly different age bracket, but there have been many disagreements on that, largely puberty. So, this Genie is not her real name; it was a name given by others. So, Genie was discovered at age 13, and she did not learn the language that is our main component here. Now, compare this to the other case of Isabelle.

This is a similar kind of case. She was imprisoned in a dark room until the age of 7. Her only human contact was her deaf and mute mother. She also had no language skills. She had a very low IQ, and she could make some strange noises, and so on. So, when she was found, she was thought to be deaf and mute like her mother, as she could only make some noises.

She had extremely low IQ and had a mental age of about one and a half year old. She was seven years old, but her mental age was that of a one-and-a-half-year-old. However, as opposed to Genie, Isabelle showed much better signs of improvement during training. So, she was also given training, therapies and, after some time, she did catch up and learned the language. The success of Isabelle, as opposed to Genie, is presented as strong proof for the critical period hypothesis because Isabelle was discovered before the critical period was over, meaning that she was discovered when her brain was still maturing and hence could be taught.

But on the other hand, Genie had crossed that age, and that is why she did not. So, there are various such claims, and this is not only about Genie and Isabelle; there are many other cases. Feral children found many in many other places in the world in India as well there was a particular case, there was another case in France and so on and so forth. In most cases, of course, they become part of legends. So, we do not know how much of it is to be believed, but largely there is an agreement that most cases of feral children they never learned to speak.

And as a result, they seem to be providing very strong evidence for the critical period hypothesis. Now, since we can go on debating the age of brain maturation and where the critical period ends, that is one domain. Now, let us move on to what happens after lateralization. Fine, lateralization happens; specialization of certain domains within the brain occurs. So, is that rigid after that age? Is there no way to alter it, and how far do we take it? That is another domain of critical evaluation.

So, upon maturation, language dependent on the auditory vocal loop is found to be represented in a particular cortical region. Vocal auditory loop, as in spoken language. So, the language that is spoken after maturation is considered to be localized in the left hemisphere, primarily in certain areas, certain critical cortical regions. Now, the same cortical regions are also found to be representing language for native speakers of American Sign Language. So, not only the spoken language but also sign language has been found to be localized in a particular area in the brain.

So, this means that there is some sort of rigidity with respect to language localization in the human brain. So, that means this points to the fact that left hemispheric specialization is a characteristic feature of language itself in its abstract form and not a byproduct of sensory motor factors. So, sign language is one modality, while spoken language is another modality, but at an abstract level, at a higher node, the abstract knowledge system of language is represented in a particular region of the brain. So, this kind of talks about a certain amount of rigidity in cortical arrangement and developmental patterns. Now, while this is fine and true to a large extent, recent findings in neuroscience also point towards a remarkable amount of plasticity that is part of the human brain.

So, this is called neuroplasticity. These are recent findings, of course, from the last few decades that have posed serious questions regarding the critical period hypothesis. Most of the findings have come from the brains of vertebrates. So, proof from humans includes some very important and interesting studies, like the ones reported by, for example, one by Sadato et al.

(1996). What they found was that this was a landmark study. They found that blind individuals, who were asked to discriminate braille dots, had significantly higher blood flow compared to sighted controls in the visual cortex. So, what is the most important variable here is the case of the visual cortex. Now, let us remember a few things here. Of course, we will take it up later in the brain and language segment in much greater detail. But when we talk about the language areas in the brain, what are we basically talking about? We are talking about Broca's area and Wernicke's area.

These are the most important ones. So, Broca's area is responsible for articulation. Speech, as I am speaking, involves my Broca's area. Wernicke's area is used for comprehension, but apart from these two, there are many other areas. For example, the visual cortex is involved in processing visual information. The visual cortex is significant, very significant, for our language processing.

So, visual language processing, the visual form of language that we process, comes into play in the visual cortex. Similarly, we have both the sensory motor cortex and the auditory cortex. So, these are the domains that are together called the language areas in the brain. Now, when you are

processing language, when you are processing visual language, your visual cortex will be activated. So, when I am reading, let us say when I am reading a book, anything written activates my visual cortex because that information goes through my visual apparatus, and the processing starts there.

Now, this particular study looked at blind individuals. So, blind individuals automatically mean that they are not using the visual cortex for its original purpose because they are blind. Now, the finding shows that even when they are asked to discriminate braille dots, as in when they are using the tactile sensation, the visual cortex gets activated. Now, this is a remarkable finding because it means that the visual cortex, whose primary job is to process visual information, can be activated by tactile information as well. So, this was taken as a very important finding in support of neuroplasticity: that the brain can modulate itself according to various kinds of factors. So, in this case, the visual cortex is taking up the additional job of processing tactile information.

So, this is one. There are many other findings as well. So, in the domain of language, research has also proved plasticity with respect to learning languages. Another important finding around the same time by Talal et al. showed that extensive training in rate-modified speech and temporal discrimination for language-learning-impaired children resulted in their learning language. So, even if they have crossed the so-called critical period of learning. But if you modulate your teaching mechanism by adjusting the rate of speech and temporal discrimination, this can result in the children learning language better.

So, the children who suffered from language impairment and learning impairment could learn language by using this method. So, this is another finding. And then there is another; there is one more by Vargha Khadem et al.

1997. They reported a particular case called Case Alex. Now this was about a boy, a small boy, a little boy. He had a particular syndrome that caused him to fail to develop language throughout his childhood. His comprehension was stagnated, so he could not produce speech; both comprehension and production were severely compromised. His comprehension was stagnated at an age equivalent to 3 to 4 years. Now, however, he went through a medical procedure called hemidecortification, which involved surgically removing the left hemisphere at the age of 8.

5. After the age of 9, his anticonvulsants were removed. Once all these processes were over, after age 9, he suddenly started to acquire speech and language, and he did remarkably well for his condition. So, this suggests that language can be learned with the residual abilities of the right hemisphere if the inhibitory effect of the damaged left hemisphere is removed, even at an advanced age; advanced age, as in for a child, for a child learner, 9 years is quite late. So, even at that stage, if you are removing the left hemisphere, which is damaged, the right hemisphere might be able to take over, as was proved by the case of Alex. So, there are such findings, and there are many more which, as I said, I will take up in more detail later. Now, how do we explain something that is almost commonsensical: that it is more difficult to learn a language at a later stage as opposed to children? Children learn languages effortlessly.

So, there have been many new explanations for that. One of them has said that probably it has

much more than the critical period. It is not just the brain's maturational stages. It is not just a time window, but there might be many other factors coming together. And creating the model situation. So, some findings, of course, suggest that the critical period might not hold in a completely domain-general way and is not entirely applicable for all language purposes.

But certain kinds of linguistic features might suffer more in terms of critical period as opposed to others. So, what this means is that you might be able to master a language largely, for the most part, barring a few particularly slightly difficult grammatical constructions. So, there are some findings regarding that as well. With respect to the critical period hypothesis, we will be taking it up later in another segment because there have been a lot of studies in terms of second language acquisition and how far the critical period hypothesis holds for second language acquisition.

So, we will come back to it. But anyway, this is another explanation. And yet another explanation has been put forward, which is called the fundamental difference hypothesis, that primarily says that all children are born with universal grammar. However, after a certain age in adulthood, universal grammar stops being operative. So, it is not primarily about language specialization in the brain; it might be, but it need not be the only reason. Another reason could be the universal grammar with which we are born and that might stop being operative after a particular age. So, these are various ways of explaining why the critical period may or may not hold.

Now, let us move on to yet another important domain of understanding, another variable that is very critical for learning language, which is called Theory of Mind. Now, what is the theory of mind? This is a very important prerequisite for developing socio-cognitive skills. This includes developing a sense of others' thoughts and intentions; consequently, it helps in creating our responses. So, the basic idea here is that humans are not born with the understanding that people have unique beliefs and thoughts.

This is the most important notion here. The unique beliefs and thoughts mean that each individual is capable of having his or her own unique belief system, and we might differ from one another. So, this is something; this is not innate; this is a learned behavior. You learn it; you know through experiences in your early childhood that what I am thinking may not be the same as what another person is thinking while looking at the same situation. This is arrived at through various developmental ladders that children go through.

There are many components that have been proposed with respect to the theory of mind. How do children understand that? That I have a mind, thoughts, beliefs, and all that, basically, I have a mind that takes care of my thoughts, that takes care of my beliefs, and as a result of this, there is a certain set of behaviors that are unique to me. Similarly, the same set of behaviors and thought processes can be present with respect to another person. This is at the very root of our socio-cognitive skills. For us to be able to function normally in human society, this is a fundamental notion, a fundamental building block of our behavior.

And then how do children arrive at that? The idea is that it has many components. The first and foremost component of it is attention and the notion of attention and intention of others, as well as

the imitation of others' mental states. So, the first stage is attention. Children learn very early that looking is not just seeing, but also a tool to be used selectively to gather more information. Recent findings show that very small children are capable of modulating the attention of others in their environment, primarily their parents, especially their mothers. They know how to get attention, how to modulate their attention, and get them to attend to the child himself or herself.

So, infants have been found to be using this mechanism with their parents for getting attention. Infants as early as 7 to 9 months of age are capable of understanding attention from others. The development of social skills is an important predecessor to developing a theory of mind. So, Simon Baron-Cohen is the person who has been one of the most important scholars in this domain. So, basically, what we are saying here is that attention as a mechanism is something children figure out very, very early in life.

In fact, later findings talk about even 6 months or even less when children figure out that when you are looking at something, you are not just seeing it but you are attending to it; that fundamental understanding develops very early. And that is what they even start to use in order to get by. This stage is followed by acting. Knowing that people act on what catches their attention, this is at the root of goal-directed behavior.

And, this behavior is dependent on intention. So, you are looking at something. Intent, for example, a child looking at a toy means that he or she intends to have it; if they want to take it, they want somebody to help them. So, what will they do? They will start crying or something so that they can catch the attention of the parents, who will in turn give it to them. So, they have not only figured out in the very early stages of life that the attentional mechanism exists, but they can also act on it; that is the idea. So, people can have varying intentions and therefore different behavior. Imitation is also often understood to be another important component in developing a theory of mind.

This is something that has been discussed with respect to the pretend play that children typically indulge in. Very often you will see that they pretend to be the teacher, and they will make the other friends pretend to be students. So, pretend play is a very important landmark in their developmental trajectory where you know they have figured it out. So, the theory of mind is already in place because they know how a teacher thinks or how a teacher behaves. The teacher behaves in a particular way because they think in a particular way, and they can imitate that.

So, by being able to imitate, we consider them capable of figuring out the teacher's theory of mind. So, basically, the theory of mind is written like this: T O M. The theory of mind refers to the ability to attribute mental states to oneself and to others. The idea that others have intents, beliefs, pretensions, knowledge, etc.

, and that these can be different from one's own. This is the fundamental idea of the theory of mind. In the normal population, this grows by the time humans are about 5 years old. However, in the case of atypical children, this is a little late. So, whether it is ADHD or autism spectrum disorder, TOM development occurs a little later. So, there is a delay of TOM, which is often a very significant aspect of their cognitive delays.

So, having TOM entails that others have beliefs, thoughts, etcetera, and mental states cause behavior. This difference may result in different behavioral outcomes. Hence, having a theory of mind helps us predict others' behavior. This is another very important aspect of the theory of mind you can predict. So, once you know that this is how the other person probably thinks and that this will result in this kind of behavior, you can predict. This is an innate and potential ability that also requires social and other experiences to be fully developed.

Now, this is the fundamental aspect of it, but how do you know whether a child has acquired the theory of mind or not? So, whether a child is developing normally can be ascertained from various factors, such as language, social behavior, and so on. Theory of mind underlies the social cognitive aspect, the socio-cognitive aspect, and thus is an important landmark in the development of children. One of the most important tests of theory of mind is called the false belief task. This task is designed to elicit whether a child can show his or her understanding of false belief. So this is one of the most important and commonly utilized games that is used with children to figure out if they are able to pass the false belief task.

Now, this was initially called the Sally and Anne story. So, the story goes like this: So, there are two characters in this story. There are Sally and Anne. This is Sally's basket.

This is Anne's box. And Sally puts a red ball into the basket while Anne is standing there. Sally goes out of the room and leaves Anne alone. And then after Sally moves out of the room, Anne moves the red ball from the basket to the box, and then Sally comes back. This is a scenario that plays out for the child. It could be in a picture format, an animated format, or any other format you can use to engage the child.

Once Sally is back, she wants to play with the ball. At this point, the experimenter will ask the child a question. The question will be where Sally will look for her ball? Now the child knows because he has seen that the red ball has moved from the basket to the box, but Sally does not know. Now at this point, if the child says that Sally will look for the ball in the box, the child has failed the test, but if the child says Sally will look at it in the basket, the child will have passed the test. Why? What is the false belief here, then? The false belief here is that Sally will falsely believe the ball to be still in the basket.

So, the child is at that stage able to dissociate herself from Sally. The child herself knows, but she will not impose her knowledge on Sally. So, she is able to dissociate between the character and that is the idea. So, theory of mind comes into play here 'I know Sally is a different person, and Sally does not know what happened that I have seen, but she has not'.

'So, she will still look for the ball in the basket'; that is the idea. There are two assumptions. So, change now, there is this very interesting thing about the theory of mind: children tend to pass the test at 4 years of age, whereas they fail it at age 3. So, until around 3 years of age, children typically do not pass this test; after 4, in almost all cases, children pass the test. But why does it happen that way? In the normal population, all children perform in a similar way. Of course, atypical children

do not, but otherwise, yes.

So, what is the reason behind this? There are many theories put forward. One of them is that the change depends on the child's language development. This has to do with language. So, which aspect of language is it? The mastery of grammatical rules for embedding tensed complement clauses and so on. So, this is a time when this seems to correlate with the child's development regarding the complex syntactic properties of languages.

So, embedding, you know, complex clauses and so on. So, once you have been able to understand sentences like "I saw the man who came to the market where I went to buy groceries," you know, like this, when you go on. So, you have understood the complex grammatical rules, the subject-verb agreement, and so on. So, that is the time when you are also able to pass the theory of mind test; that is the idea. But recent findings do not support this link between understanding sentence complements and theory of mind reasoning.

Young children who do well on syntax and semantic tasks are still found unable to pass the false belief task. So, it remains kind of constant that at age 4 they will, even if the child masters the syntactic task before that age, still not pass the false belief task. Another theory is that it has been attributed to the development of strengthening inhibitory processes and pragmatic skills, or basically a general-purpose executive control mechanism. So, the executive function in humans also develops in stages. So, this has been understood to go hand in hand with the theory of mind. So, the time when executive control mechanisms are slightly, you know, more or less in place is when the theory of mind is also mastered by children.

So, these are the two most important theoretical aspects. And so whatever the theory says, it seems that a child's performance on story-based theory of mind reasoning depends on the child's early exposure to conversations that teach them that people have beliefs that can differ from their own. What are we arriving at? Even if we may agree or disagree with respect to the syntactic complexities having anything to do with the theory of mind. There is an agreement that has emerged over a period of time now that syntactic complexities may or may not hold, but what is critical for the development of the theory of mind is the child's exposure to language per se, or more crucially, conversations around him. Why is that? Because human conversations typically talk about other people, right? So, we all know that theory, or that idea that lesser mortals talk about people, and higher mortals talk about ideas, and so on.

So, this holds; actually, this holds true for most of us. So, when we converse, when we discuss, when we talk about others, we primarily talk about other people. So, when we talk about people, we talk about their beliefs, we talk about their behavior, and all that. So, that becomes an indirect source of information for ratifying the idea of theory of mind in children. That has been a very important theoretical standpoint with respect to how children develop.

So, exposure to conversations about other human beings is the idea. Now, this idea has not been put forward in a vacuum. A very important data source for this comes from studies of deaf children. Now, these studies are based on two different kinds of backgrounds for deaf children: those from

a sign language environment and those from a verbal language environment. It has been reported that deaf children from deaf families perform at par with age-matched hearing children, the age-matched control group which consists of hearing children. However, deaf children from hearing families showed a significant delay in the theory of mind task that has been reported.

There have been many studies, but one of the first was by Brenda et al. in 2007. Similar findings have also emerged lately; one of the most recent findings was in 2021. They have carried out similar experiments on Thai-language speakers. So, similar findings have been reported in many other countries, cultures, and languages. So, the primary finding is that deaf children from deaf families typically seem to have a normal sort of theory of mind development.

However, children who are from hearing families do not. Why is that so? The idea is that the theory of mind in children from sign language environments is influenced by their early exposure to others' conversations because they are also deaf and mute, so they will be conversing. So, the child's access to other people's conversations is possible in a signing environment. However, in families where other people are speaking, the speaking individuals are using the vocal auditory loop of verbal language, and the child has no access to it because the child is deaf and mute. So, they have no access to that use of language, that conversation in which you talk about other people.

As a result, they do not develop a theory of mind. So, the findings have consistently shown this particular pattern that there is a delay with respect to this. Now, this is, of course, the area that is still developing; there are still studies being carried out in many places, but this is where we are today. So, mental states cannot be observed directly, nor is there any simple correlation between mental states and observable behavior. Hence, one valuable way to learn about the elusive content of the mind is to listen to how people talk about the mind. So, research in developmental psychology suggests the importance of verbal communication for developing a theory of mind, and this is what has been corroborated by the findings on deaf and mute children.

A similar correlation was also found in samples of both healthy children and children with autism and other types of developmental disorders. So, this is about the theory of mind and its connection with language. So, this is where we end this lecture. In the next lecture, we will take up the idea of joint attention and how joint attention shapes social cognition in children, as well as another recent domain of knowledge called body schematics and how that contributes to language acquisition among children. Thank you.