

## **Fundamentals of language Acquisition**

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**Lecture 056**

Lec 56: Language and cognitive function: dependent or independent? SLI

Hello, we are starting module 12 today. So, until now, we have focused on language development and language acquisition, covering various domains from phonology to syntax and then communication. We have also looked at second language acquisition through various factors such as age and input with respect to childhood bilingualism, adult bilingualism, and so on. Today, we are starting the last module of the course. This module will focus on atypical development. Atypical, as in apart from the normal population of normally developing children, we are looking at the language disorders and language delays of a few kinds, not all of them.

We will focus mostly on those that are better researched, better known, and for which we have literature, and that are more studied in terms of language-related disorders or language-related delays; those will be our focus. So, the roadmap is somewhat like this. Starting with language and cognitive functions, the main question we are asking here is: is language acquisition an independent method, a module-specific process, or an interdependent kind of development where language acquisition is also dependent on other modules? So, of course, we have discussed many of these things, but atypical language development is yet another domain that has enriched this debate over a period of time; hence, we will start with that question, and then we will take up various kinds of disorders and delays. So we will start with, say, specific language impairment, or SLI, and then we will follow up with other kinds, like Williams syndrome, developmental dyslexia, autism spectrum disorder, and Down syndrome.

Then we will also talk about some of the interventions, and of course, the last lecture will wrap up this entire course. There we will have some concluding remarks; we will sum them up. Each module, I will sum up what we have discussed and what the take-home lessons are; and then, of course, we will sign off with some of the latest trends in this domain. So, let us start with lecture 1; as I just said, we will focus on the question of whether language development and cognitive processes are linked or separate. What do the data from the various kinds of disorders tell us? Where are we with respect to this kind of data? This is where we will try to see certain disorders in which sometimes only one of the two faculties is specifically obstructed or affected, but in some other cases, on the other hand, we will see more of an interdependent sort of processing.

For example, the language disorder will co-occur with another kind of cognitive disorder. So, one by one, we will go through all of them. But first, let us set the stage and look at what we mean by atypical development. So far, we have discussed language development in different stages through various kinds of linguistic parameters. Then our entire focus throughout the last 11 modules has been on the language of typically developing children, who are also called neurotypical children. So, children who develop normally, i.e., typically developing children, with the typical milestones, as far as age is concerned, will have achieved, and that is the scenario within which we understand how language acquisition takes place. So, there are also some data points that have informed us about differences in terms of cross-linguistic studies. So, in the English language, some of the theories hold more true for English but not as well in many other languages that we have also seen.

So, there are some slight differences in cross-cultural and cross-linguistic scenarios. Similarly, individual differences can occur within the same language because every individual is different. So, their growth trajectories might also be slightly different from one another, but largely the reason we always talk about a range is because of this very factor: individuals may differ. But overall, the entire community might be falling within the same age range in terms of their growth, cognitive development, language development, and so on. However, there is also a group of children whose number is actually not that small; their differences seem to fall outside that range.

They are not, you know, minor differences between different members of the community, but their differences fall widely outside this range. So, these are the people whom we refer to as atypical children or children who are suffering from some form of developmental disorder or delay. So, that is the population on which we will be focusing

in this study. Now, how do you know who is atypical and who is not within the normally developing range? So typically, there are many test batteries, and discussing them is not within the scope of this course, but there are many test batteries used for diagnostic purposes. So, using those diagnostic tools, some children will be placed in one bracket or another.

So, the typical procedure goes like this: the target group will be matched with two separate, typically developing control groups. Control groups consist of those who do not have that problem and do not exhibit any language learning or other cognitive deficits. So, they are the target group. So, the target group will have two control groups: one group will be age-matched, which is a chronological age match. So, when we talk about age, we will discuss two kinds of age: chronological age and mental age.

So, chronological age might be 10, but mental age can be, let us say, 3 years old. We have seen the case of Isabelle, for example, when it was found that she had the mental age of a very small child. So, mental age and chronological age may not always coincide. So, that is why this is used for diagnostic purposes. So, one batch will be matched by chronological age, and another batch will be matched by mental age.

Now, these groups are, of course, derived from various standardized tests. Based on the comparison between the target group and the CA group, as well as the target group and the MA group, there are different kinds of possible outcomes. For one, the target group might show an impairment compared with the chronologically age-matched group but not with the mentally age-matched group. So, they might not be at par with, let us say, a 5-year-old child from the target group who may not be doing as well as the 5-year-old normal child, but they might be doing well with, let us say, a 2-year-old child who is age-matched and mental age-matched. So, in this case, when the gap is only with the CA but not with the MA group, the individuals in this group will be considered to exhibit a developmental delay in this ability.

They are not entirely off; they are simply a little bit delayed because they are matching the mentally age-matched group. So, that is why this first case will be considered a case of developmental delays. However, it is also possible that the target group will not match the control group in either case as well. So, when the target group shows an impairment compared with both control groups, such as the CA and MA groups, the target group is considered to exhibit developmental deviance or atypicality. So, when they do not match even the mentally age-matched group, that is when the problem is a little bit more severe; that is when they are said to be within the developmental deviance group or to be atypical children.

Now, this is one of the methods that is kind of a classic; it has been used for a long time, but over time, these methods have been questioned and newer methods have been proposed. One of the new methods is called the developmental trajectory, or the growth model. This is an alternative to the classical model. In this model, the idea is that the entire theory is based on the concept of developmental trajectories or growth models, where the aim is to construct a function linking performance to age and specific experimental tasks. So, it is not a blanket sort of terminology, but based on various kinds of experimental tasks, they will decide the kind of functionality that the child is capable of.

So, as a result, they will assess whether this function differs from the typically developing group and the disordered groups. So, creating function-wise based on functions, they will create certain kinds of experimental paradigms, and then they will check on that. So, this is more of an overview over a period of time. So, how do they change throughout their growth and so on? So, that is a different and comparatively new model that has been proposed. Of course, there are many debates surrounding this, but we are not going there. So, what are the types of disorders? What are the types of delays that we have? Broadly speaking, they can be of three types. There are many others, but broadly, these are behavioral, neurodevelopmental, or emotional disorders. In the case of each of these kinds of disorders, not always but in some of them, language abilities are also affected. So, there are some behavioral issues that will affect language. There are also some neurodevelopmental disorders in which language learning will be affected.

Similarly, there are certain kinds of disorders that are emotionally dependent and where language can also be affected. But there are other cases in which language is not affected. So, there is a connection between language and other kinds of mental disorders. And in some cases, the disorders may persist well into adulthood. So, some of the disorders may not last for an entire life; they might fade away in adulthood, but some of them may last longer.

Let us look at some definitional issues and what we mean by neurodevelopmental disorders. Neurodevelopmental disorder, which was previously called mental retardation, is defined as a neurodevelopmental disorder. This disorder is basically a set of syndromes affecting the central nervous system; that is why it is called neurodevelopmental. So, when various aspects within the central nervous system are affected, there are various kinds and degrees of cognitive deficiency or cognitive delay, and a lack of adaptive behavior; that is when we term it a neurodevelopmental disorder. So, because of certain kinds of issues with the central nervous system, which are reflected in cognitive disorders and a lack of adaptability, and so on. That is what we call NDD for short. So, which kinds

of disorders are included in this? There is a variety of disorders that are grouped together under NDD. For example, intellectual disability, developmental delay, autism spectrum disorders, cerebral palsy, attention deficit hyperactivity disorder, Down syndrome, Williams syndrome, and so on. So, these are all grouped together as neurodevelopmental disorders. In the initial stages, discussions of NDD included blindness and epilepsy, which were part of it, but later they were removed. According to the Bishop, the term neurodevelopmental disorder is used in two main ways. One encompasses all the conditions affecting children's neurological development with known genetic or acquired etiology. So, when the conditions affecting the child have a known history, for example, some kind of genetic or other types of etiology, then this is one type. The other type would be conditions with multifactorial etiology in which certain aspects of neurodevelopmental areas are selectively impaired. So, there are two types: certain kinds.

So, for example, in the first case, you have fragile X syndrome, Rett syndrome, Down syndrome, cerebral palsy, and so on. The second condition is that you have ASD, ADHD, and other conditions. So, the first case is that the conditions will affect children's neurological development with a known etiology. In the other case, it is a multifactorial scenario where certain aspects of neurodevelopment are selectively impaired; not everything is impaired. Now, these are certain kinds of manuals from which these definitions come that are responsible for indicating which category includes which kind of disorders. So, the most commonly utilized one is called the Diagnostic and Statistical Manual of Mental Disorders (DSM). So, according to the DSM-5, this is updated every few years. So, in the 2013 version of the DSM-5, they classified ADHD, autism spectrum disorder (ASD), intellectual disability, communication disorders, and so on, all as neurodevelopmental disorders. So, typically, the common thread among all of them is that when we define neurodevelopmental disorders, we say that they include all of these. However, as we go ahead, we will see that there is a lot of overlap in symptoms as well as cognitive deficits among many of these disorders.

It is not very easy to make an airtight compartment between, let us say, autism spectrum disorder and ADHD. So, there are many interlaced factors that are responsible; as a result, one of the most common threads among these is that they are multifactorial in origin and have a steady course through maturational stages, unlike post-puberty psychiatric disorders. So, there is a steady course. So, there are stages through which these disorders develop. Post-puberty psychiatric disorders are a different kind of disorder that we are not discussing here. Then the slow early onset of neurocognitive

deficits will reveal itself very slowly; typically, though not always, it affects males more. Most of the time, it is the males who are affected; not always is there a one-size-fits-all, but this is a general trend. Now this is the overall NDD category, but let us look at our main agenda here, our main focus, which is the language disorder. So, the same DSM-5, which is provided by the American Psychiatric Association, includes these features of language disorders from their perspective. So, the early onset of symptoms and persistent difficulties in language acquisition may affect both comprehension and production, but not to the same degree. For example, we have already seen that in typically developing children. Comprehension always precedes production, and for a particular time window, comprehension is always, you know, done better; they do better in comprehension tasks as opposed to production tasks. That difference, that asymmetry, is seen in some of the disorders as well. However, on a broader level, both comprehension and production will show deficits, and how can we identify the particular areas where we see this? These are characterized by a reduced vocabulary, limited sentence structure, and discourse impairments. So, even for example, taking turns or taking a cue and, you know, contributing to a dialogue or even starting a dialogue or responding to a dialogue, everything alongside various kinds of grammatical domains might be open to being affected.

So, that is when we call it a language disorder. Now, there are primarily two types of language disorders; of course, there are many, but for our purposes, we start this lecture with the question of whether language disorders and cognitive disorders always go hand in hand. Our language, and this will in turn take us to the question of modularity versus the interdependent kind of structure. So, keeping that in mind, we will talk about two kinds of impairments here. One reason is that the language deficits occur together with a known biomedical condition. So, a language disorder is not the only thing that the child is going through; the child also has a well-known or well-diagnosed biomedical condition. In this case, the situation will be that it is part of a more complex pattern of impairments. It is in the sense that the language disorder in this case is part of a more complex and larger pattern of disorders. This condition is typically called a differentiating condition. So, in that case, the label will be "language disorder associated with X," X being whichever biomedical condition the child has.

So, this is how it is defined. So, when the language impairment occurs alongside some other kind of biomedical condition, we call it a language disorder associated with it. For example, children with ASD have language-related delays and disorders. So, in that case, we will say "language deficiency" or "language delay" in autism spectrum disorder, like that. So, X is the known case. These differentiating conditions include intellectual disabilities as well as autism spectrum disorder. The autism spectrum is called a spectrum

because it is not a pointed condition; there are multiple aspects, and it represents a graded sort of disorder. Some children might suffer more, while others might suffer mildly or to a lesser degree, and so on. So, it is a spectrum; that is why it is called the autism spectrum disorder. In some cases, language learning deficits can occur in the absence of cognitive, neurological, or environmental causes without any apparent reason. For example, the primary language disorder known as specific language impairment is.

Specific language impairment has been studied for a very long time. And it actually became quite important; it became a turning point in the nativism versus nativist argument about language, the modularity of the brain, and so on, because it was connected with one particular mutation of the gene that we discussed in the first module while talking about evolution. SLI connected with FOXP2 was used as a very important theoretical position on the evolution of language. Anyway, the first published work on developmental language impairment dates from the 1800s with Gall. Initial reports were provided by neuroscientists and psychologists who presented case studies.

Initially, there were case reports from psychologists and other medical practitioners. So, they would often give a report on the children with seemingly normal cognitive abilities and concurrent language-learning deficits. So, this is where it all started, all the way from the 1800s; normal cognitive abilities and concurrent language learning deficits are how it was initially reported. Eventually, it got the name specific language impairment, and recently this name has also been changed; now it is known as developmental language disorder, or DLD. Nonetheless, this disorder basically refers to a disease that seems to have nothing to do with cognitive problems or deficits. So, there are different approaches to studying language disorders. Let us look very briefly at the different kinds of approaches that we have. So, as I was just saying, the finding of SLI marked a very important turn in the understanding of language and cognitive processes, their interrelationship, and so on. So, the nativist perspective states that. It is a set of genes that specifically target domain-specific modules.

So, a specific gene that we will see eventually is FOXP2, and certain kinds of mutations in the genetic code affect certain kinds of domain-specific modules as the end products of epigenesis. So, certain aspects of language-related processes are affected by certain kinds of genetic mutations; that is the idea of the nativistic scope. So, for example, a syntactic module, a morphological module, or a more narrowly pre-specified module for, say, canonical linkage rules in grammar exists. So some specific grammatical property might be targeted by some specific genetic issues; that is the nativist approach, as a result of which we call this a domain-specific issue. However, many questions have been raised regarding whether the deficit results from damage to a domain-specific starting point at

the cognitive level. There is no consensus on this; however, there are many supporters of this view. On the other hand, we also have something called the cognitive hypothesis. If you recall, we talked about Jean Piaget's stages of cognitive development in children. All children go through certain specific pre-specified stages. So, starting with the sensorimotor stage, they build upon that initial sensorimotor information.

The input that they receive, on the basis of which they create certain schemas in their minds about the world and their experiences, and then language comes in and gives it a name, some sort of label for those kinds of categories that they create in their minds. So, those stages are stages of cognitive development. So, in the sensorimotor stage, an important milestone is the concept of object permanence. This is what he calls object permanence, which basically refers to the idea that objects have a continual existence and do not cease to exist if they go out of view. So, if you have a child who is playing with two toys and one toy is taken out of her view, it is not as if that toy has ceased to exist; it is still there. So, the continuity of existence is an idea that develops around the time of the sensorimotor stage, in the very beginning of the first stage. Similarly, another important concept, which is called alternative viewpoints, is present. Typically, this is seen in psychology through what is called the conservation tasks. So, the understanding of the same thing may have different kinds; you can look at the same issue from different perspectives, even a concrete thing from different perspectives. The most commonly utilized task that children typically go through is when water is poured from a short, wide glass to a tall, thin glass, both having the same volume.

So, when you transfer the water from the short glass to the tall glass, the amount of water remains constant. However, it appears that in the second case, there seems to be more. In fact, there are many videos on YouTube and other places where you will see that Starbucks does this exact trick. So, their medium glass and larger glass actually play on this particular kind of dimension. So, these are two important concepts that children acquire in early childhood: the idea of object permanence and the concept of conservation. So, based on this, the idea that language development actually needs these important milestones to be achieved, and on the basis of this, the cognition hypothesis was put forward. So, the idea is that language needs certain cognitive precursors in order to develop. So, until and unless some basic cognitive architecture is in place and certain basic ideas are formed, language will not be able to come in. So, that is why you need a language. So, the development of object permanence and conservation is necessary for vocabulary development, which is one of the domains that have been studied extensively.

So, in short, this theory says that language development is dependent on overall cognitive development, which is the opposite view of the nativists, who say that language

development is a very specific kind of module that might be affected by a disorder, a specific genetic mutation, or something of that sort that affects a specific kind of grammatical issue. There are some other models as well to study language disorders. So, one of the older models is called the single cognitive-deficit model. This model guided many of the early works on both the cognitive and genetic causes of developmental disorders.

And they would typically look at the relationship this way. So, they will look at localized brain regions and the resulting cognitive deficits in a one-to-one match. So, a single deficit and a single outcome—that kind of thing. So, a single problem, one particular, let us say, an injury to the brain in a particular area, can cause one kind of language disorder. You know the one-to-one mapping of that sort of cognitive deficits and developmental disorders and the relationship between etiologies and developmental disorders. So, that was the kind of viewpoint that the single cognitive deficit model took.

So, for example, they would hypothesize that a single autosomal dominant gene causes dyslexia. So, for every possible disorder, dyslexia is another language-related disorder. So, for every possible disorder, there has to be a single origin that was the idea. However, over a period of time, this has also been updated, and the newer version of this, the more updated version, is called the neuroconstructivist hypothesis. This is basically a multiple-deficit model. So, the idea was that many findings from psychological, neuropsychological, and cognitive science pointed to a symptom overlap. As I said at the beginning, in some cases, disorders might have overlapping symptoms or even cognitive overlaps in certain conditions. That, alongside many other discoveries in the intervening periods, gives us the idea that there are probably multiple types of deficits that could result in different kinds of disorders and that there might be a lot of intermingling among them. So, advances in understanding the complex genetics of behaviorally defined developmental disorders have also been helpful. So, for example, dyslexia, autism, ADHD, and all of these may have some overlapping symptoms, sometimes with overlapping cognitive deficits as well.

So, as a result, we now know that many of these diseases are multifactorial in origin. So, that is where the neuroconstructivist hypothesis comes in. So, with this background in place, let us now look at whether we have a dissociation between cognitive and linguistic disorders. We will start with SLI, which stands for specific language impairment. So, how independent is language from other cognitive capacities? Let us look at specific language impairment, which we briefly discussed some time ago.

So, a specific language, linguistic, deficit alongside otherwise intact intelligence is the

hallmark of SLI. So, linguistic deficit but on the other side intact intelligence. So, this means that SLI cannot be connected to any other kind of mental problems; that is the idea. So, somebody said that "as if I quoted that grammar developed in total isolation from the rest of the growing brain.

" That is how surprising this disorder can be. So, there are differences among researchers regarding what they claim the specific deficit to be. So, their inability to make canonical links between grammar and semantics exists. Similarly, feature blindness has been proposed for these issues. So, the specific kind of problem is linguistic, but overall the problem is not of any other kind, such as cognitive, neurological, or anatomical.

This was to be called SLI before, and in 2017, the proposal was to call it DLD. So, the child will be diagnosed with SLI if he scores two standard deviations below the age level in a series of language tests. That is how we arrive at the tag of SLI. So, there are those tests on the basis of which, if they score below two standard deviations from the average, then they will be considered to be falling in that category. So, there is no mental retardation, there is no other kind of perceptual motor deficit, no nothing. So, common features of SLI across subjects include various types of problems; not every patient exhibits all of them, but these are common types.

So, language will show unexpected patterns and remain below age expectations, and then the most important, probably the most important criterion is inflectional morphology, which will show a lot of issues. So, variations of symptoms across subjects will range from not all of them, but the acquisition of words, particularly verbs, is very difficult. Verbs are difficult for normally developing children, as well. So, this is something you see. Mild phonological deficit disorders can be repetitive, receptive, and expressive, and they can even persist into adulthood. So, the etiology of SLI is not known; it has been observed in many studies that it may even run in families. As it is most common to find children with language-related speech disorders like reading and spelling in a family with a child with SLI, as opposed to a family where nobody has SLI. So, if you have an SLI patient in the family, the chances are higher that other children will have other kinds of language-related disorders; that is the main point. So, these are some statistics that we have.

Many studies have provided support for the genetic basis of this theory. In fact, that has been one of the most important outputs of the literature in this domain for a very long time. One of the most interesting pieces of research was carried out on twins. So, twins as

in monozygotic and dizygotic twins. So, twins are used for this study because they share the same environment. Now, in the case of monozygotic twins, they share the genes too, but dizygotic twins do not share the same genes; they have separate kinds of genetic structures.

So, dizygotic twins are typically similar to other siblings. So, that is why comparing monozygotic and dizygotic twins will give us a very clear understanding of whether the problem is genetic or environmental. So, if it is a genetic problem, then monozygotic twins of SLI children will have higher chances of sharing the disorder than the dizygotic ones. On the contrary, if the environment is responsible, then dizygotic ones will also show the same problem. But findings typically show that monozygotic twins share the disorders.

That is why the idea of SLI having a genetic underpinning is very strong. At the same time, the FOXP2 gene mutation was also found. Since I have discussed FOXP2 in detail at the beginning, I will not go into detail again. FOXP2, a certain kind of particular mutation of the FOXP2 gene, was found to be present in all the members of a family who had SLI. FOXP2 was first discovered when many members of a single family were found to have SLI, and that is how it was connected to FOXP2; the disorder was connected to FOXP2.

So, the main question that automatically arises is whether it is a modularity-based problem. Does it mean that there is a specific kind of disorder because the language disorder is very specific, there are no other cognitive disorders, and it also seems to have a genetic underpinning? So, the automatic conclusion might be that it is a modularity-based issue. Is that so? So, this has been studied a lot. So, some claim that it affects local aspects of grammar, like the future tense. In fact, many of the tense markers that take inflection have been reported to be affected. Others have claimed that such children are weak at computing subject agreement or structure-dependent relations, etc.

So, there is yet another view that says the grammatical weakness seen among these children actually arises from a perceptual level deficit in the domain of auditory processing. So, these are the three different hypotheses that have been proposed. These are the areas where they typically have problems. So, obligatory expression of tense and expression of agreement cannot represent structure-dependent relations, inflectional features, and the auditory processing system. Inflectional features often connect to the expression of agreement and tense marking. So, that is one major area. So, this is where we will complete Lecture 1. In lecture 2, we will carry on the discussion; we will see many other features of SLI, and we will also discuss Williams syndrome, another disorder that seems to point towards modularity. Thank you.