

Fundamentals of language Acquisition

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Week 07

Lecture 035

Lec 35: psychological and neural aspects of SLA

Welcome back. We are in Module 7. So, today we will have the last lecture of Module 7. In this lecture, we will discuss the psychological and neural aspects of second language acquisition. While doing that, we will also look at some theories. Psychological and neural aspects, we will basically look at how these theories, these positions or perspectives, contribute to second language acquisition.

So, typically we have looked at the linguistic aspect and others until now. Now we will have the other side of the story. So, psychologically, as in how language acquisition is viewed from a mental perspective. When we talk about the mental, we talk about not only the psychological but also the neural.

So, that is why we are looking at the psychological and neural aspects of SLA. And some theories we will look at, as always, are the theories I will be mentioning with very brief ideas about those theories because of the paucity of time. And then we will move on; lecture module 8 will also cover SLA. So, we will carry on with the same kind of discussions there as well. So, to start with the psychological and neural aspects of second language acquisition, what do they deal with? Now, the moment we say "psychological aspect," we are primarily looking at the processing stage because mental processes are viewed from the perspective of some kind of mechanism, some mental functioning that takes place in the mind.

So, whatever we do, all kinds of mental functions are essentially processes. So, that is how psychology looks at it. So, processes as in there is some amount of you know some kind of a dynamic interrelationship between the input and the output. So, you have the input, and then there are some processes that happen, and then you have an output; that kind of structure is what we are primarily talking about. So, when we are talking about the neural aspect, we are talking about the functional localization in the brain of the second language processes that include both the acquisition and use.

So, these are the two things that we will be primarily looking at. So, I have listed these here. So, functional localization of languages in the brain, by which we mean the localization of both L1 and L2. Since we are talking about L2 SLA here, how does learning a new language change or tinker with the brain structure, given that L1 is the first language to be acquired? So, it already has its brain areas, you know, kind of finalized, fixed, and lateralized already; then how does it differ from the L2? That is what we are primarily concerned with here. Then the processing of two or more languages not only involves the distinction between L1 and L2 but also all the successive languages, which may be L2, L3, and so on; do they differ among themselves? So, these are the areas, and then whether the first and second languages, or later languages, are independent of each other or somewhat fused.

So, these are domains that have been looked at over a few decades as far as SLA is concerned. So, what are those domains? Primarily, what is functional localization? Looking at it from a neural perspective, what is the functional localization? How are they different from L1, and are they related to L1, as well as to each other, or are they separate? So, these are the topics that have been discussed and studied at length; the literature is very rich in this domain. Now, the current understanding is that because we will not be getting into all the nitty-gritties, they are neither completely fused nor completely independent. So, there is a bit of mutual give-and-take, but it is also not entirely fused. There are some domains that are separate, and some domains that are slightly different.

We have discussed in another module the possibility that language is actually made up of subsystems. Language is not a single homogeneous system; it has subsystems. And we looked at it from the child language acquisition perspective, where we discussed that some components of language are probably more open to interdependence, whereas other domains may be independent. So, that is where we stand today. Now, let us look at it a little more in detail.

Now, we have already seen that bilinguals are divided into various groups depending on a number of factors. So, the first factor that we already discussed is childhood bilingualism versus adult bilingualism. So, depending on when the second language is acquired, the human population can be divided into either childhood bilinguals or adult bilinguals. We have also seen that within bilingualism, specifically childhood bilingualism, we can make further distinctions; early bilinguals are simultaneous bilinguals, while late bilinguals are successive bilinguals. So, this part has already been taken care of.

So, we will not talk about it again. So, these two things have already been discussed. So, we have already talked about simultaneous and successive as well as childhood and adulthood. Now, let us look at the mental organization of the two languages. Now, this discussion is not exactly new.

It goes really far back in time, all the way to the time of Osgood, when they talked about compound-complex and compound-subordinate as well as coordinate bilinguals. So, the idea was that the debate started with the question of how the two languages are stored in the human mind. At that time, they were talking about the mind. So, not in terms of the brain. So, where in the mind is the organization of these two languages that bilinguals learn? Are they stored in the same place, stored separately without any mutual give and take, or organized in a hierarchical manner? And if it is hierarchical as in the L1 because it is already in place, then are we using a mechanism where we access L2 via the L1? So, depending on these three possibilities, the bilinguals were divided into three groups: coordinate, compound, and subordinate.

So, coordinate is the one where bilinguals have two languages parallel to each other; they are independent, while compound is when they have two systems fused together. So, one storage that can be accessed via different languages, and this is also, if you recall, what we have already talked about regarding the interdependent hypothesis and the separate development hypothesis. So this is where you have interdependent hypotheses, which kind of correspond to compound bilingualism, and then you have subordinate bilinguals, where one language is accessed via the other. So typically, this is L2, and this will be L1. So, L2 will be accessed via L1 because L1 is already in place.

This is something like learning L2 via L1, which is very common in many schools where you show a particular item and try to teach the name of that item in the English language, using the mother tongue to make that connection. So, that kind of thing. Now, these older

divisions, you know the previous distinctions, can actually overlap with the later distinctions that we have already seen. For example, subordinate bilinguals will be more or less comparable to late bilinguals because it can, but not always. So, if you are learning your second language later, then the chances of accessing L2 via L1 become higher.

Similarly, you can also know that there is interaction between compound and early proficient bilinguals. So, if you are an early bilingual, you learned your second language pretty early in life, then the chances of you having a single sort of storage system are much higher. So, this is where we have some parallels with compound bilingualism. In fact, there is a whole literature on these regarding how these, you know, are not really fixed categories. For example, a very important theory in this domain of bilingual access is about how the storage, you know, takes place and how we access the conceptual storage.

So, there are these two levels: we have conceptual storage, and we have the lexical domain. So, depending on your proficiency level, a beginner learner, let us say, can access the conceptual storage via L2. As proficiency increases, the L2 also has direct access to the conceptual storage. So, based on this idea a very influential theory called RHM was proposed revised hierarchical model. So, we are not going there just to give one idea about how these categories are kind of fluid; as the bilingual learner becomes more and more proficient, the equation changes.

So, it is possible for a person to go from subordinate to compound bilingualism for the same person. Now, these are why we are discussing these things because this is not only about the way the person speaks the L2 but also because there is a direct correlation with the neural structure with respect to the bilingual speaker. So, because of the brain's behavior in terms of brain behavior. So, this is where the neural part is more evident, as you see that bilingual language processing has a very distinct neural signature as opposed to L1 language processing. So, brain functions show subtle differences in language processing based on all of these variables, and as I just said, all these variables are not very fixed; they can shift here and there depending on various factors.

For example, depending on age, let us say an age range around what time it is, not a fixed age; at 3 years, you see one kind of neural signature, and at 4 years, another. No, it is a range. So, if you are an early bilingual within this age range versus a late bilingual within this age range, do we see different kinds of neural signatures? Yes. So, that is what the main point is here. So, depending on the age range when the second language is learned, it might engage different parts of the brain while processing.

Similarly, the level of proficiency also has a very significant and interesting interaction with the different areas of the brain. We will not discuss it in great detail here because this

topic has been extensively discussed in another module. So, we will leave it for that module. Now, let us move on to the psychological theories of learning. Psychological theories, of course, there are a number of theories, but as far as SLA is concerned, we will only focus on three: information processing theory, connectionism, and complexity theory.

We have also discussed connectionism before, so we will briefly go over it. So, let us start with information processing as a theory. Now, information processing theory primarily depends on these three components: input, central processing, and output. So, what do we mean by input? In psychological terms, input basically refers to perception, any kind of perception. So, whether it is visual perception, auditory perception, or tactile perception, depending on how your sensory organs are taking in the input from the environment, that is basically what the domain of perception is.

Whatever you are taking in as an input, whatever is coming into the system, that is the input, and then that input, remember our stimulus-response behaviorism theory. So, input is part of this theory as well, but it is not a direct input-to-output kind of mechanism; we also have something very important in the middle, which is our central processing. So, depending on the kind of input that you receive. Depending on the kind of central processing that is engaged and the interaction between these two, we have a certain kind of output. So, it is a complex process rather than a direct input-output stimulus-response system.

I am telling this because it might come to your mind that we have talked about input and output before, but here is the crucial difference. Now, in terms of language and SLA, the input will be linguistic input. So, whatever you are seeing or hearing—seeing, as in reading, let us say—a large number of linguistic inputs in today's world also come through the visual channel. So, we read books or whatever different kinds of road signs; from road signs to books, a lot of data actually comes in through the visual channel and, of course, auditory. So, all of that input for SLA, whatever the child is exposed to or the adult learner is exposed to, will be considered to be the input because there is no filtering; it is just there; you are in the middle of a linguistic environment.

So, all of that qualifies as the input. Then comes the central processing in terms of language, specifically the processing of linguistic components. Now, how do you process that information? That is where the most important part is, and that is what we will also discuss, along with the output. Output can be in psychological terms; it can be many things we are, because we are talking about language here, so we will stick to language production. So, production is either in speaking or writing.

There are two ways of producing language: speaking or writing. So, this is the structure.

Now, mental functions can be understood in terms of information processing, as we just saw. So, any mental function, including language, has these components. So, the input level generally covers the perception of different types, and then you have the processing, where the main work happens at the central processing level.

So, at the processing level, what happens is that there are complex layers of interconnected mechanisms that are dealt with. Now, in terms of language, that complex interconnection will have to do with various not only language-internal factors like various structural properties, phonology, morphology, syntax, semantics, and all that. But there are also many other factors, for example, the socio-cultural factor, the background, the person's psychological state, and so on. So, all of that you know interacts with one another, and that is why the processing level is the most important layer. So, when we learn anything according to this theory, we break down the complex matters into simplified, you know, let us say, pockets of simple tasks.

So, if we have to learn the stages of syntactic operations, we should probably start with a simple operation first. How do we create a, you know, how do we use auxiliary? Once we have figured out the use of auxiliaries in the English language, it is easier for us to move on to the next level of creating question sentences and so on. So, this is the idea behind this theory. So, we start with a simple task and gradually move up hierarchically to the more complex tasks. And as we go to more complex tasks, what basically happens as far as IP is concerned is that we go from one kind of processing to another kind of processing.

So, processing, when you say processing or the mechanism, is not, you know, again, a one-size-fits-all kind of structure. There are two kinds of processing in the human mind. They are called automatic processing and controlled processing. Automatic processing is largely involuntary, or let us say, subconscious.

You do not really notice. For example, if you have been making tea every morning, it becomes an automatic process. You know where the pan is, where the sugar is, and where the tea is. So, you do not really look for the tea or look for the sugar, and then it becomes a pattern. That is what we call automatic processing. Similarly, a good driver does not really need to look at everything in the road.

There are certain things that are already taken care of and are already understood. So, anything that you have been that you have mastered over a period of time becomes an automatic processing. For example, for teachers like us, teaching becomes an automatic

process. We do not really, of course, prepare the course material, but how to teach the nitty-gritties of delivering the lecture becomes an automatic thing. The other part of the processing is what we call controlled processing, which is voluntary and requires you to consciously pay attention.

So, allocating selective attention to the task at hand is a crucial part of controlled processing. So, whenever you do something new, let us say I start learning tennis tomorrow, I have no idea how tennis is played apart from watching it on TV. So, the moment you are on the court, you need to know things; you cannot just be an observer anymore; you are a player. So, you need to notice everything in the rule book you may have already read; now you have to notice how it actually plays out. So, that is what controlled processing is; any new task that you do requires controlled processing.

So, whenever you learn a new language, it also needs controlled processing. So, the proficiency going from initial learner to high-level learner, or let us say proficient learner, low proficient to high proficient learner, is basically a journey from controlled processing to automatic processing. So, not only are we talking about the processing that happens between input and output, but also about processing as a mechanism; we need to go from, or we do go from, a controlled voluntary attention-intensive process to a more automatic sort of process, and only when you have taken care of one part. So, the simple task, once you have mastered it, you can go on to the next part. Gradually, through a hierarchical structure, you go from one level to another, and you automatize the whole process.

So, that is the idea. This has already been discussed. So, now let us come to the input and how it has been seen. In SLA, the input for the processing mechanism to work is anything that the learner is exposed to, any kind of language input, whatever kind of language input that qualifies. Then the learner needs to actively engage attention because this is a new language for them; this is more of a voluntary thing. So, when they are learning, this is applicable only for SLA, by the way, not for simultaneous. So, they have to actively engage attention to certain parts of the input, and the basis for this priority is that we need to prioritize what to learn first.

Our brains work differently depending on who the person is. So, there is an interaction between the process and the person as well, but for now, let us stick to the input. So, when we have the input, what we do is prioritize certain structures. Let us say I speak language L1 and I am now exposed to language L2, which is similar. So, what I will do is what my mind will do; I know that once you realize from the input through statistical learning by

looking at the pattern over a number of contexts, which is something we have already discussed.

So, once you have realized that certain things are common between my L1 and L2, I do not need to pay attention to that; it automatically progresses to the automatic stage. Now, I will focus on certain aspects that are slightly similar but also slightly dissimilar. So, let us say 30 to 70 distinctions. So, I will focus on that. So, I will prioritize that aspect of the language of my L2 to process, and once I have figured that out, I will go on to the other one.

So, there are theories about how we prioritize. There are many theories, but here we are following Schmidt's theory, where he talks about the frequency of encounter, perceptual saliency, and instructional strategies, because often L2 is learned in a tutored environment. So, the instructional strategy. Individuals' processing ability as well. So, not every learner is the same. All humans are different in their capacities and their strategies for learning.

So, that is also a factor. Readiness to notice particular items related to the hierarchy of complexity and task demands is essential. So, these are the factors on the basis of which theories have been proposed as to how we prioritize the input. Then comes our processing, of course, so language learning and use is a layered process. We start with the components, simple components that gradually move forward.

So, basically, it is going from controlled to automatic. Now, one important thing that is part of this theory, the IP theory of language acquisition, is that there is a restructuring that happens. So, with your initial input, you have created a kind of abstraction of the language, and then, as more and more input keeps coming, there is a restructuring of your internal grammar that is very important in this theory, and this restructuring is not exactly linear. So, you do not make 1 and 1, 1 and 1, 2 like that; it is not simple. So, if this restructuring happens in a layered way. It is a complex kind of structure, so how do we know this? This is most visible through the U-shaped form of learning.

This is common in many kinds of learning, including SLA. What U-shaped learning basically says is that in the initial stages, you seem to get the grammar correct. After some time, you tend to go all wrong; you create incorrect grammar and poor production, and then you come back to proper grammar. So, that is called U-shaped learning, and this is something that is taken as one of the proofs for the multidimensional sort of restructuring that happens. This change takes place, and I quote, "partially discontinuous plane along which there is a regular, systematic, systemic reorganization and reformulation." So, first you get one kind of grammar, then a new kind of input comes in, and accordingly, you

restructure

and

reformulate.

It takes a little bit of time, and eventually, you get the entire grammar correct; that is the main idea. So, restructuring is a very important component. Output is also important within this theory; why is output important? Output is important something because when we have this vocal auditory loop-based language, when we speak, it also becomes a kind of input for ourselves, not only for others but also for ourselves because we hear ourselves speaking. So, when you hear yourself speaking, you notice the errors; that is an important thing about learning a language. So, you notice the problems, the gaps, and then you eventually correct yourself.

So, this gives you an opportunity to self-correct. And then you also realize which information is relevant and where more attention is needed. Hence, output is not just the final product; it is also input for your eventual correction because this development is continuous. So, this is why output is also important, and by using output ultimately, we will use output only as data for any kind of experimental studies. What do we see there? What we see is that L2 of fluent speakers has a higher recall time for both vocabulary and grammatical items compared to L1. So, even if you are a highly proficient bilingual, your L2 proficiency is very high; even then, your recall time is longer than your L1.

Not only that, even with that, even within L2 proficiency becomes an indicator of automaticity. So, it becomes for L1 it becomes automatic. But for L2 to reach that automatic stage takes a really long time, and even after you have become very proficient, you might still not be able to match up to L1. However, there are other kinds of proof as well because continuous use is another factor.

So, reverse dominance is also a very interesting finding of recent times. What happens is typically L1 will be stronger than L2, but let us say you have changed places; you are no longer staying in the place that you used to, as you have moved out of your native place and into an L2 environment. Consequently, if you do not use your L1 very frequently anymore, it is possible for your L2 to become dominant and L1 to become less dominant, in which case the result will be the opposite; that is the case of reverse dominance. But anyway, that is another domain of bilingual processing. Now, psychological theory not only talks about how this learning happens but also about the order of the acquisition. Remember, we have talked about the order of acquisition throughout this course as to why we see the order that we see in the case of SLA; also, in the case of acquiring a second language, this psychological theory provides a processing-based understanding.

What is the processing-based understanding? Learners' acquisition of grammatical structures follows a developmental sequence, as we have already seen in other cases, but in this case, the sequence reflects how learners overcome processing limitations. So, as you take care of one level of processing, you move on to the other. Simultaneously, you move through the grammatical stages or the developmental stages of the L2. So, learning is dependent on mastering the processing operations. So, once you have mastered processing level 1, let us say the auxiliary as I said, and that part is taken care of, you move on to the next stage.

So, it is basically about mastering processing difficulties rather than being based on any kind of internal rule as proposed by universal grammar. So, based on IP theory's notion of constraint on limited capacity, why is there limited capacity? Because our controlled processing needs a lot of attention, attentional allocation is very high for controlled processing; as a result, we cannot attend to a large number of things equally well at the same time. So we need to optimize. Now, how do we optimize? This is how we optimize.

We take care of one problem and then move on to another. So, to quote Clahsen, for example, linguistic structures that require a high degree of processing capacity will be acquired late. So, we optimize by taking care of the simple tasks first and then move on gradually to the higher level. And when we have reached the higher level, the higher level also has smaller, simpler components. So, in those simpler components, let us say it has 10 components; 5 have already been mastered.

So, we will now take care of the remaining 5. So, basically, the development of SLA and the development of second language knowledge are based on mastering those layers of processing that are required. And this capacity for these structures, for example, syntactic structures, depends on the extent to which their underlying relations are preserved in output. So, how much output are you able to give, and then he mentions hierarchy. So, you go from the canonical order strategy to initialization and then to the subordinate clause strategy and so on. So, basically in syntax, there is a pattern through which we go in terms of processing.

Then another theory is, of course, that of connectionism, a very important and influential theory, and this approach to learning has many similarities with IP theory, from an IP perspective, because the idea is that the entire learning mechanism is internal; it's based on

processing. But here the focus is slightly different; the focus is on the gradual increase in the strength of association between stimuli and response. So, this is based on the different pathways that we create. So, depending on what we are learning, we have different representations in the brain, and gradually, through use, those connections, those pathways become strengthened, and as a result, we learn. So, there are nodes in the network, and the connections between them become stronger over a period of time, and that is how you learn.

So, learning here in this theory is basically a change in the strength of these connections, not in restructuring. So, that is the difference between IP theory and connectionism, even though they share a lot of similarities. We have discussed this RMM model elsewhere in the course. So, again, we are not going into detail here.

RMM model, as in the Rumelert-McLelland model. We have discussed it in connection with comparing it to nativism and how they are similar and how they are different. Let us move on to complexity theory. Complexity theory is, again, you know, part of a number of theories that are called by different names: dynamic systems theory, complex systems theory, chaos theory, and so on. This idea of this theory came from the natural sciences and is also used for understanding second language acquisition.

It was first used by Larsen Freeman. So, the fundamental idea of complexity theory is that languages are complex systems with interconnected components and stages of learner language. Interconnected components we have already seen before include various kinds of phonological and morphological systems. So, this means that all of them, while language development is happening, do not take care of phonology first and then morphology; even though the course is structured like that, we talked about phonology first and then morphology, but learning does not happen like that. Learning happens among them in an interdependent way. So, you, the learner, whether a child or an adult, have a lot of interaction among those structures simultaneously.

That is what this theory primarily states. So, these components become more and more structured and organized, and this structure does not arise out of any underlying grammar. So, this is the difference between complexity theory and universal grammar. These regularities are not rule-driven. There are no mechanisms for such top-down governance. So, it is not because the eventual development is not dependent on the underlying grammar or universal grammar, but rather the connections between them and how they represent the dynamics between different levels of language, as well as the dynamics of those with language use.

So, when we use language in real life, there are many other things that also come in. So, socio-cultural practices, the person himself, and so on. So, the salient features of this theory are important because it differs from both linguistic and psychological accounts; the salient features primarily are the dynamics of internal and external factors. So there is dynamism between the internal and external factors. So different kinds of effects of communicative functions, the structural relationship between L1 and L2, intentions and acts of learners, and a host of other factors.

So this is what we mean by internal and external. Internal, as in the learner internal, language internal, as well as the outside social influences. So, all of them work together in a very complex interaction; thereby, we learn language. So, that is complexity theory. Last but not least is the learner variation. So, learners also differ because we have just seen that complexity theory takes into account learner variation.

Many other theories also take into account that learners also play a very important role. So, we have already seen the factors of age. So, when you talk about learner-dependent or learner-centric functions, age is an important factor that has already been taken into account. However, all of these other factors are equally important. Aptitude; not everybody is equally adept at learning a new language, or even if they are, maybe somebody is good at learning the sounds, somebody is a master at learning the grammar quickly, and so on.

So, aptitude is a very important factor. Motivation, we have seen the ideas of motivation sporadically before, such as cognitive style, personality, learning style, and so on and so forth. So, it is not only the age, not only the aptitude; these are not, again, independent of each other, nor exclusive of each other. They can also, for example, if you are a young person learning a language, but your learning style is such that you take a lot of time to learn, then it will not work. On the other hand, a person who is much older but has a cognitive style and learning style that are more conducive to learning a language faster than he will learn faster.

So, there is a lot of interaction even within the learner-oriented perspective as well. So, how do we arrive at these strategies? How do we know what the strategies are? Typically, we use self-report techniques. So, we will ask learners to self-report, like, "What do you think?" What did you do when you were facing a problem? Let us say that in the Indian

context, Hindi has grammatical gender, which many eastern languages do not have. So, Bengali does not have; Assamese does not have. So, this is a bottleneck for Bengali and Assamese learners of Hindi, as the grammar with respect to gender goes totally bonkers.

So, question that we ask them will be. What is the problem that you faced? How are you tackling this problem? What is the strategy that we use? What do you think are the barriers for you to learn? So, that is what you call self-report: asking the learner to report what the problems are and how they strategized to overcome those problems, or whether they could or could not, and if not, why; and so on. Many various kinds of questions can be asked as to how they do this. That is one. So, they are asked to report the strategies, for example. Also, sometimes they are asked to keep a journal or record, even if they are not telling the experimenter; they can keep a journal or a record of various kinds of grammatical constructions or discourse strategies that the learner has used.

For children, observation is helpful because, unlike adults, they can understand what the learner is thinking or trying to do; therefore, it is easier to use the observation method with children. As a result of which, the observation method is often used for children. And they also use something very interesting, which is called self-directed speech. Children talk to themselves. So, when they are learning the L2, there have been many reports, for example, by Saviile-Troike in 1988, where they talk about how the child is narrating to himself or herself what is happening in the L2.

Okay, this is how it is done. Now, I will use "S" to make a plural, something like this: children talk to themselves. So, this is another thing that has been recorded and studied. So, yet another study on another technique is called the playback technique. What happens in playback technique is the learner working on the L2 tasks because many researchers use some kind of task to arrive at the difficulty that the person is facing. So, while they are performing the task in their L2, the entire process will be recorded, and that record will be played back to them, and then they will be asked in their L1 what was happening.

You know you play back the recording of the task performance, and then they will have to narrate in L1 what kind of method they used. So, see, we are doing this: you had a grammaticality judgment task in L2, and this is how you progressed. So, what exactly were you doing? Please tell us in your mother tongue; you can tell us in your L1.

So that is another method. So, what are the methods? For children, it is easy to use observations. So, the observation method is used for children. For children, self-talk is also used again. Similarly, there are these playback techniques, and for adults, there is self-report that is more often utilized. So, these are the methods that we use in order to figure out what strategies learners are using, and in fact, these are used as input for language

teaching methodologies as well across various kinds of pedagogical practices. To sum up what we have discussed in this module is the neural and psychological aspects of second language acquisition.

A neural aspect is how learning a second language has a direct correlation with the different kinds of neural signatures. We did not go into too much detail because it has already been taken care of in another module. Then psychological theories of SLA, like information processing theory, connectionism, and complexity theory, also take into account the learner's perspective, which is very important because the learner is an active agent in the entire process. So, we looked at the strategies used by the learners and how we know what those strategies are that have also been discussed.

So, this is where we wrap up Module 7. In Module 8, we will continue discussing second language acquisition, taking various other factors into consideration. Thank you.