Fundamentals of language Acquisition

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Lecture 020

Lec 20: Dual and Single Route Models

Welcome back. We will start with Lecture 5 today. Until now, we have looked at various theories and theoretical positions with respect to the word and rule method, as well as the connectionist model. We also looked at the past tense debate and discussed the blocking hypothesis. We have looked at the majority of the most important fundamental ideas within the field of morphology as far as child language acquisition is concerned. Today we will wrap up this module by discussing the dual and single route model and the production of inflection.

Production, as in how children start producing their inflectional morphology, what the first ones are that they start with, and how it changes over time, over a period of time. I will be able to give you some small glimpses within this lecture. Dual and single route models, we also have some part of it that we discussed before when we discussed the word and rule model and compared it with the connectionist model. So this is in the same line, but this is another way of looking at the same debate and discussion; hence, we are looking at it separately.

So, the dual route model is also the word and rule model because it is dual: one route is the word, and the other route is the rule. So, we can talk about it as having two routes: route 1 and route 2. Route 1 could be the lexical route, which means that some words, for

example, the irregular words, are part of a lexical list. List of words that include the irregular forms of the past tense is also listed here. On the other hand, we have route 2, which is the grammatical route, which means that the child has the rule in place because it is part of inherent grammar anyway.

So, once they figure it out and once it has been tested and analyzed on the input data, that is the other route through which they create various forms, like past tense forms, not only past tense but others as well, as we have already seen. So, these are the two ways for the children to arrive at a particular form, maybe past tense or other kinds of inflections, various kinds of inflections. So, there are two routes, and hence it is called the dual route model. Now, route 1, let us look at it a little bit more in detail. Now, route 1 is for producing the irregular words because we have already seen irregular words; for example, "walk" becomes "walked," but "go" does not become "goed"; it becomes "went.

" So, these are irregular words in the English language, and on this basis, we had a discussion on the past tense debate in the English language in detail. So, this is what we are getting back at producing irregular words that are part of route 1. So, these irregular forms are learned and stored in memory as lexical entries as they are. So what do we mean by "as it is," and then what is stored? When we say this is stored as a lexical entity, what we store is not just one thing; we store the meaning, we store the pronunciation, and we store the usage. So all the information about that lexical entity is stored in the lexical list that we have.

These are the words listed. So when we need to use them, we retrieve the words from memory. If it is possible. Now, there might be a slight problem because sometimes we may not be able to, I mean the children may not be able to retrieve it immediately given the situation. So, there are two ways here, as well.

So, either you retrieve it directly from the memory as it is, or there is another way. If the correct form is not stored, then we seek help from friends. We have discussed these phonological friends before as well. So, phonological friends are similar-sounding past tense forms, let us say. So, these are stored.

Let us say the past tense of "throw" is not stored; the child is not, or even if it is stored, the child is not able to retrieve it. Then what they what their mind does is it looks for another form which is similar and which might be stored provided it is stored then it with the child will have an easy task So they will just copy the you know the system and they will follow the rule, follow that kind of a route. So if 'threw' is not there, then they will take help from the past tense form of blow, which is 'blew'. So they will be able to use the word "threw"." So blow becomes blew, and throw becomes threw; that kind of thing.

So, route 1 gives you two options: either direct access to stored form or access through analogy with the phonological friends. So, if this is the similarity, then this could also be utilized for, let us say, entity number x. Now, route 2, which is the grammatical form that we have also discussed before, refers to the rules for forming the past tense in the English language, the present continuous tense in the English language, and so on. So, these are the rules that you already have. Now, if you want to arrive at a particular tense marking, aspect marking, or whatever.

Then you just apply the rule to that root form. So, as a result, these are not stored as lexical items. So, you do not need to store them, basically. So, they are created by applying the morphological rule on the root word. So, we retrieve the verb stem from memory and then add the suffix.

So, we retrieve the verb memory, like, say, for "walk," and then we use the rule that you already know, and then we create the past tense form. So, this is how we go. So, this is supposed to be a very productive way of creating words, a productive way of getting to the complex morphological structures, and that is why it has been called a mental production line. So, that puts words together at the time of speaking. Just as when you are about to speak, this kind of a mechanism happens behind the scene and thereby you have your words

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So, these are the two kinds of routes that the dual-route hypothesis discusses. Now, we have already seen that we have used the terms over-regularization as well as over-generalization. This is a persistent problem concerning children acquiring morphology, at least in the initial stages. So, they tend to overgeneralize. So, the rule they have learned, they will be applying to every other possible verb.

So, why does it happen? We have seen that we have discussed this before as well with respect to the past tense. So, we will go over this very briefly. So, how does the dual route hypothesis explain overgeneralization or overregularization? So, this has the following explanations. Because, first and foremost, the irregular words need to be learned separately, remember they are part of the lexical list. So, if they have to be memorized as it is, each word, then this is going to take them some time.

Or at least they have to have some of the phonological friends, even if the entire list is not there yet; but at least some of them should be there in order to function as the similar-sounding friends or the phonological friends. Now until that happens, obviously none of these things happen overnight. So, when this till this happens children apply rules because that seems to be the easier way out. So, this is how the dual route hypothesis explains overgeneralization: the irregular forms are to be learned separately. Hence, until that happens, we are using the rules.

So, that is one. And then, when the irregular forms are learned but the child fails to retrieve them from memory, this is another case where there might be the use of overgeneralization, the use of the rules where they do not apply. Now there are many studies that have found proof of this theory, or let us say they support the hypothesis. One of the more well-known ones is by Marcus et al. So, they have found in their study that children start to make overgeneralization errors at almost the same time they start to use regular past tense endings. Regular past tense ending means the /-ed/ ending.

So, which is the rule-based past tense formation in the English language. So, as soon as they start to use the rule-based form, that is also the time they start to overgeneralize. So, this neatly falls within the hypothesis that before they have learned the irregular forms as lexical entities, they will use the rules. So, this is something that supports this, data supports that idea. Over-regularization errors were also significantly more common for low-frequency irregular verbs.

This is also something that the dual route hypothesis takes care of: that frequency does play a role. So, the high-frequency words will be learned faster; low-frequency words will be learned later, as a result of which the errors will be more in low frequency. So, that is again a support that you receive from this finding. The errors were fewer with words that had similar-sounding friends. Again, another hypothesis that the dual root suggests is that you take help from the phonological friends.

So, if you have phonological friends, the errors will be fewer. So, that is also supported. So, the main three propositions of the dual route hypothesis seem to be supported by the findings. Not only this particular study, but there are many other studies that have found a similar kind of result. But that does not mean that there are no problems; there are problems, and they have been put forward as well.

So, for example, one particular issue is that the defaulting to one particular inflection does not seem to always work. What does this mean? In many languages, for example, in English, the past tense marker is only /-ed/. There are, of course, irregular forms, but in terms of the rule, that is /-ed/. Now, here it is easy to say that until they learn the irregular form, they will continue to use /-ed/. Now what happens in languages where there is more than one marker for one particular purpose? There might be more than one marker for past tense, there might be more than one marker for plural, and so on and so forth.

In that case, what will happen? Will they default to only one, which is the expectation, even if you have more than one marker? The defaulting will be on the most commonly utilized, that is, the majority of the time, whatever you use for the majority of the time. That is what we will expect them to do. However, it does not always work that way. Some languages, for example, German, have more than one plural marker. So, there are these two markers in German that both mark plural.

Now, children were found to overgeneralize more than one of these, and they were using the /-s/ and the /-sa/ marker more often than the /-en/ marker. So, the /-s/ marker is not even the majority marker. So, the theory does not seem to quite answer this because there is more than one marker, and the theory does not specify which marker would be preferred as the default marker until the irregular forms are learned. So, this is one case from German. Similarly, Polish children were found to overgeneralize all three.

So, Polish has three possessive markers. So, possessive markers are used as in "my book." So, you know Ram's book like that. So, por Raj's house.

So, these are possessive markers. So, in Polish, there are three ways of marking possession. So, the genitive singular inflection, for example, can be marked by these three types of inflections. So, the same idea of the genitive marker in the case of the singular form. So, there are three possible inflections, and what they found was a similar kind of thing: that all three possessive markers were overgeneralized. So, there was no defaulting to one particular inflection that the children followed; that was one problem.

Problem number 2 was that the errors were not trivial; the errors were quite high. Because the dual route hypothesis does make some room for error, some problems arise because the children are still figuring out the irregular forms and all that, but they do not predict a very high error rate; of course, error rates are expected. So, initial studies reported very low error rates, say 3 percent or something. However, some other researchers looked at the errors, you know, one by one individually, and then they found

that though, on average, it might be, you know, towards the lower side, individually, if you look, then the errors are pretty high. So, a number of studies have pointed out that sometimes the children's inflectional morphology errors are around 50 percent or even more.

Now, this is quite high even taking into account the error margin the hypothesis allows for . Finally, the phonological friends are said to help avoid errors. So, when you do not have, if you have not yet memorized that particular irregular form, then you look for the phonological friend and you get by. So, basically, phonological friends are there to help, not to hinder, but some studies found that the phonological friends might be hindering other rule-governed phenomena. For example, one particularly important study reported that the past tense rule can be sensitive to phonological similarity.

So, if you found this to be a very interesting study with a methodology that was quite interesting, you may look up the paper. So, they used a four-way difference, taking into account both of these variables: the phonological similarity and the rule, and there was a four-way distinction that they created in the stimuli. Thereby, they showed how children, actually how the past tense rule, was also sensitive to phonological similarity, which should not be happening. The hypothesis does not leave any room for this kind of problem. It is only supposed to help in the case of irregular words.

So, these are problems with the dual route hypothesis that have been pointed out. Now let us move to the single-route hypothesis. This hypothesis, again, if you recall, we have discussed it in connection with the connectionist model by Rumelhart and McClelland, which is called the RMM model. So the RMM model talks about only one route, one single route. So, this is a similar route, which is route number 1 for our dual route hypothesis, which is the lexical root.

So, what this basically means is that there is no need for a rule to be there in the first place. All the forms are stored as lexical entries, past tense forms, or whatever forms they are, whether they are irregular or regular, and they are directly retrieved in the finished form. So, when the retrieval fails similar sounding words come to the rescue like the older one. So, you do not need to learn the rules to apply to a certain kind; you will look for the root and then apply the rule to the root to get your relevant form. That is not how this theory proposes; it says that all entries are lexical entries.

The most interesting part of this hypothesis is that all past tense forms are stored in this way. Now, whether they are regular or irregular, all are there in the lexical storage. Now the demonstration of this came from a computer program, which is also something we have discussed before. So the program was created in such a way that they did not give

any input of a rule there. Only some inputs were given without, so without any kind of a rule.

So, the words are there, and the system has to learn from the given words how the past tense form works. So, the system was found to learn and produce the past tense without any grammatical rules. Word stems were fed into the system, and it associated them with the sounds of their past tense. So, it was because this is a connectionist model based on the association of phonological forms across words. So, they figure that the system determines the past tense of whichever verb.

So, the model generated phonologically based links between words; that was the hypothesis, and the model seemed to work perfectly in line with the hypothesis. Data in real life, particularly with respect to children, do reveal that children associate phonological properties while inflecting for tense. So, the model also answers other questions about the overgeneralization of errors and delays. However, there is some very interesting criticism coming from the Pinker group. So, one of the most well-known criticisms comes from Pinker and Prince (1988).

They put forward many issues, but among them, three issues stand out. So, for example, their first problem was that the model was created by cheating in the input system. So they said that the model was given different inputs at different stages, thus cheating their way to the results. So the results were arrived at because the input was given in such a way that it would give you that kind of result; it was not very honest, that is one. Second, of course, it is a long discussion; it is a rather lengthy paper.

I encourage you to go read it; it is very interesting and very well argued. But this is the gist of the matter. So, they say that the input is the problem. The way the input was created and the stage at which the input was given is what resulted in what we see as the output. So, secondly, the model cannot explain the minority default behavior; minority default is what we discussed in terms of the German language, where the inflection that is not the most common one was defaulted on; that is where the children defaulted, taking it as the default system.

So, that is called a minority default. So, minority default behavior cannot be explained by this particular theory and also no explanation for homophones. So, this is another problem because why homophones are important is that the entire theory is based on phonological association. So, the system is associating words with their past tense forms. So, the word-to-word connection is based on the sounds in the phonological part. So, homophones will automatically be a big contender for the same position.

So, how the system takes care of this is also not very clear. So, these are the most important criticisms of the single route hypothesis. So, this is about the dual and single route hypotheses with respect to learning inflectional morphology. So, these are debates that need to be looked at from the perspective of the papers themselves. There are a number of papers you can look up. So, today, as a result of all of these debates and discussions, both the single route and dual route models have been updated many times.

As a result, many of these criticisms have been factored into the newer models. So, now we have the situation that is, of course, better because most of the criticism that Pinker and his group had has also been taken into account in the later models of the single route hypothesis. So, of course, the latest models have many of the things taken care of; that is what our single and dual route model is about. We will complete this lecture with some examples of children's productions of inflections. Of course, that is what we have been discussing, but from a theoretical perspective.

Now, let us see what kinds of morphemes they start with and gain some insights into them. So, let us start with grammatical morphemes. Children's first attempt at using grammatical morphemes, like determiners in English, is sporadic. Initially, they do not use it everywhere. In fact, some scholars have pointed out that they seem to use a kind of neutral vowel, the 'schwa,' which is a sort of sound or a syllabic 'na' sound.

So, you know I am not sure whether they are actually using it as a determiner or if they are just using it as a kind of placeholder. So, this is how they start the use of grammatical morphemes. In the case of English, it has been studied with respect to determiners. It is not clear when, even when they are using the schwa sound or an "na" sound before the noun, whether it is a determiner or not.

They also use the same kind of sound in the case of prepositions. So, one example I have provided here. So, 'nn there' so you do not know whether it is you know 'in there', 'on there', or it is simply a placeholder. But this is how the grammatical morphemes with respect to the English language tend to appear. Around two and a half to three years, they are able to use "the" and "a" like adults. So now the determiners are properly shaped in pronunciation, and they are able to start using them, but the appropriateness of the usage takes a little bit more time to be perfected.

So, for example, they are found to overuse the definite form where the indefinite form would be appropriate. So, for them, even though they start using it at 2 and a half or 3 years, perfecting the usage takes a little bit more time. As many studies have pointed out, these are older, but there are newer studies with a similar kind of finding. Number marking again in English. So, plural markers are among the earliest grammatical

morphemes to be acquired, and this also coincides with the vocabulary burst around age 2.

But their comprehension of plurality again takes a bit of time. So, they start using it just like the determiner or the preposition; this also involves number marking. However, for them to understand plurality, the concept of plurality is often based on the additional information in the phrase. For example, those cats, two cats, like this, are apparently not very helpful for them to understand the aspect of plurality very clearly. Inflectional morphemes, using, for example, noun inflection and verb inflections, noun to noun, noun inflections to noun, and verb inflections to verb, first and foremost require them to understand what a noun is and what a verb is. So, we have discussed this elsewhere; the distributional properties of child-directed speech seem to help children in parsing continuous speech into what is a noun and what is a verb.

What is a noun in the beginning? The idea of a noun is very clear, very simple. The meaning and form are correlated. So, nouns are objects, nouns are people, and verbs are actions like that. So, it is a very simple and directly correlated kind of mapping.

So, meaning and form are directly correlated. So, as a result, children assign preliminary meanings to unfamiliar terms using this method. But from 3 to 5 years, they are able to use nouns and verbs in the respective meaning category, infer part of speech information from inflections used with nonsense syllables, and are generally consistent with their use of inflections. These three are very important learning stages because they are initially dependent on the lexical entry itself. But for them, it takes a little bit of time to generalize and to abstract the idea of noun inflection to be used with every kind of noun. It is not as if they have to memorize each and every noun and each and every verb like that.

So, they arrive at this idea a little later than 3 years of age. And then around that time, they are also able to infer part of speech meanings, such as the noun and the verb, and depending on the inflections that are utilized, they are able to point out the object in real life. So, this has been studied using nonsense syllables, and they are also generally consistent with their use of inflection. So, they figure out what is to be used where, and they get the flow. So, in a rather well-known study, which is a follow-up study of Brown, we have referred to many times in this lecture and in this module. So, in a follow-up study from Brown, one particular study used nonsense words and pictures to elicit their comprehension of inflection.

So, they are using nonsense words, and they have attached that nonsense word to the unfamiliar object that the child does not know. So, basically, by using a novel form and meaning mapping, they were trying to see if, through the use of inflection, the child is

able to point out the signified object. So, they heard the nonsense word and picked up the correct unfamiliar object for both the singular and plural cases. So, these are some examples of the stimuli that were used. So, "Do you know what a _____ is?" This dash could be any of those nonsense words, and then, "in this picture, you can see a _____.

" So, again they are familiarizing the child with this kind of term and then asking, "Can you show me another picture with a _____ in it?" So, now the child has to figure out that this word, with an inflection, for example, here we have this "a," now they have to understand that they have to connect it with the noun that this refers to; it is not a verb that we are talking about. Similarly, for plural markers as well, 'do you know what____'. Here you have an "s," which is a plural marker, so again, it has to point to the plural object that is in the picture. So, this is how they found out that children are able to determine from the nonsense words, from the kind of inflectional morphology used, which is a noun and which is a verb.

 In the use of inflections, they tend to be selective. For example, both in the case of verbs and in the case of nouns, they start very carefully, let us say. So, that is what we mean by "selective." So, in a study on English-speaking children, what they found out was that they tend to use /-ing/, which is the progressive marker, with activity verbs like "run." Now, the verbs in the English language have been categorized into different types. So, activity verbs are one kind; then there are achievement or accomplishment verbs, and there are stative verbs—you know, all kinds of things.

 So, the children were found to use the /-ing/ marker predominantly or selectively with activity verbs like "run," but they were not using it with other verbs like "break" or "build." These are also verbs, but they are of a different category. These are called accomplishment or achievement verbs. They were not using the /-ing/ marker with these verbs.

 Similarly, they also did not use /-ing/ with stative verbs like "want" and "know." So, then, thus, children—very young children—are found to be able to differentiate verbs into categories. So, only action verbs are selected for use with the /-ing/ marker. This is probably because we have discussed this elsewhere as well. This probably happens because, in the initial vocabulary of children, initial dialogue or initial conversations with children typically focus on the here and now, whatever is happening there. As a result, more words like playing and running, which are all action verbs, are more common in the child's vocabulary as well as in child-directed speech.

 Probably, that is the reason why they tend to use /-ing/ only with those verbs initially. Of course, over a period of time, they change, but this is how the beginning happens. And

similarly, a similar kind of selective behavior is also found with nouns. For example, there were very interesting studies, including a cross-linguistic study as well. So, Latvian, Russian, Polish, English, and other languages have been studied.

So, what did they find? A couple of studies that I have reported on here. So, initially, they use initial inflection, focusing on each noun. Focusing on the noun, what the noun is, and accordingly how they will use it. So, they have not arrived at the rules yet. Once they start to understand the rule that is the meaning, for example, let us say the case marking.

So, this is how this particular noun can be used in a case-marked position. So, for example, the knife; I cut the apple with a knife. So, in some languages, there will be an instrumental case marking applied to the word "knife" because "knife" is the instrument in those cases. So, in these languages, what they found was that once the child has understood the case marking and has been, you know, they understood how the meaning of the case marking works, they tend to use those words only with those case markings, not without them. So, for example, instrumental nouns are nouns that can be used instrumentally.

So, instrumental nouns were used only with instrumental-case marking. Similarly, locative nouns like school and kitchen were used only with locative case marking. Plural marking is limited to nouns of pairs or groups, such as shoes and blocks. So, you know, kind of a fixed way of looking at it initially, selective way; this is what we mean by selective use of noun morphology as well. So, once you figure out the case marking, which is the case in these studies—case marking or plural marking—once they figured it out, then they were using them only like that, not in any other way.

So, this is how children start learning these kinds of markers. Similarly, the acquisition of agreement is another interesting domain as far as our inflectional morphology goes. So, there were many studies again—many cross-linguistic studies. In a Spanish study, for example, Spanish children as young as 3.7 years were seen using gender marking inflection   correctly.

Because Spanish has grammatical gender, children were found to use those inflections correctly. Children acquiring French were observed to pay attention to both number and gender marking on nouns around the age of 2. So, you see, from a cross-linguistic perspective, there is hardly any fixed age bracket where a particular kind of inflection will appear. Of course, this is dependent on a number of factors, which we have again discussed in another module. For example, how unambiguous the language is, and so on.

So, Spanish children learn to use gender marking inflection at 3.7 years, whereas French

children learn both number and gender at age 2. Subject-verb agreement marking on verbs, however, appears a little late; that is because verb and verb inflections are typically later than the noun and noun inflections. Probably, that is how it happened here as well. However, data from English suggests that their full comprehension of subject-verb agreement appears around the age of 6 years.

So, you can see how varied the data from different languages is. So there is a cross-linguistic difference in the acquisition of different agreement markers. And then, of course, they have to discover the word classes. So whether it is a noun class, a noun, a verb, or whatever. There are many theories within this context.

Again, there is some theory of syntactic bootstrapping, as well as semantic bootstrapping. Syntactic bootstrapping theory says that children are born with built-in word classes. So they do not need to learn it. These are some of the basic universal traits.

So, every language has nouns; every language has verbs. So, this is how this is what they are born with. So, as a result, this is not a big problem. On the other hand, semantic bootstrapping theory says that children arrive at word classes through conceptual categories and by using distributional properties. So, across contexts, across conversational contexts, across situations, children see the distributional pattern of certain words, and from that, they figure out what is a noun and what is a verb. Of course, mapping them to the concepts. So, computational models have been used to look into this as well, and often the results from these modeling studies have shown that it is possible to extract nouns and verbs in terms of word classes through distributional analysis itself.

So, you do not really need them to be inbuilt; you do not need them to be inherent. You can, children can, so if the model can learn, children can probably also learn. However, we have also discussed this at length in a separate module. Roughly, this is what the entire module is about. So, to sum up in this module, we looked at some of the foundational aspects of acquiring inflectional morphology by children.

Relevant theories have been discussed. So, we have discussed theories as well as some important constructs. For example, important debates like the past tense debate, the blocking hypothesis, and all of that. So, everything has been discussed briefly. So, relevant theories and some of the foundational aspect and we also looked at the trajectory of the acquisition. So, in a nutshell, this gives you a very brief overview of the acquisition of morphology as far as child language acquisition is concerned. So, with this, we wrap up this module. Thank you very much.