Fundamentals of language Acquisition

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Lecture 023

Lec 23: Theories of word acquisition

Hello, we are starting Lecture 3 today. In lecture 3, we will look at various theories regarding constraints as well as various assumptions, and so on, with respect to language learning, specifically in the domain of word learning. So, what do we actually need to start learning words? Till now, we have seen the problems the child might face in terms of the reference problem and the extension problem. So, now we will look at what researchers have proposed regarding taking care of various kinds of problems that the child might face. So, a number of theories based on different kinds of principles has been proposed. In terms of their points of departure, we will call them by different names.

So, there are innate linguistic biases or properties. Similarly, there are non-linguistic factors, socio-pragmatic factors, and attentional learning accounts, and then finally, we will look at syntactic bootstrapping. So, these are the main theories. Now, again due to the paucity of time, we will be able to go through only the main aspects of these theories and also some evidence in favor and some evidence against the theories in order to give you a broad outlook on what each of the theories is all about.

So, first and foremost, we will talk about Markman's constraints, which are one of the most well-known ones in terms of word acquisition. So, Markman talked about constraints. Now, what is a constraint? Constraint does not really mean a kind of limitation, but it is sort of a control in place, for example. So, when they are learning words, they should not have, you know, endless possible references for a single word. There must be some sort of control process put somewhere for them to understand how the word maps onto an object and thereby onto a concept.

We have already seen that infants learn their first words around the age of 1 year, plus or

minus a month or so. So, if measured by production, we discussed in the previous lecture that in terms of production language, the word "production" occurs a little later compared to comprehension. Which is attested by various findings all over the world. So, if we go by production, it is one year; if we go by comprehension, a little earlier—that is the time when children start to acquire words. Now that is why the period between 12 months and 18 months sees a very rapid developmental shift.

So, one year to one and a half years, that is the phase; those six months are a very important developmental stage. So, babies must be utilizing some rules to justify this naming explosion; that is what Markman calls it, naming explosion, because within those six months, children learn to name a large number of words. Large, as in for their age. So, 50, 60, sometimes even 90, has been reported. So, the rate of acquisition of words would be impossible if they considered all possible hypotheses each time they encountered a novel word.

This is what Markman said. So, there has to be some sort of mechanism in place to minimize the number of possibilities. You cannot have a very large amount of possible referents. So, this is where he brings in the idea of a constraint. So, this was part of his very important publication from 1994.

So, innate constraints—what do we mean by innate constraints? Before we go to the linguistically innate constraints in terms of language, let us first understand what a constraint is and where he borrowed this idea from. So, he says that this idea is taken from the domain of ethology and they use it in the sense of a probabilistic bias that provides a good first guess. So, there are, let us say, 20 possible referents for a particular candidate word; the constraint or the probabilistic bias will reduce the number of possibilities to 5, let us say. So, that is what it means to provide a good first guess. So, the first guess would be maybe one of these two, one of these three kind of things rather than one out of 20.

So, for example, he quotes Gould and Merler's study on bees. So, foraging bees must learn the color of the flower that gives a specific kind of nectar. So, depending on the flower, the nectar's characteristic features change. So, the bees must learn which one gives what kind of nectar. So, as a result, what they have found is that purple is often the default value for them.

So, purple is one of the first things that they will look for. So, in a field of flowers, they will first go to purple, let us say. So, that is how the theory was put forward. So, it does not mean that the other colored flowers do not have nectar, but given a choice, they will always go to purple first and then try the other ones, which means learning the other values will take some time and will be different from the default ones, primarily because of the time it

takes; because if you already have some constraints in place, it helps to try that out rather than the new ones. So, that is the idea from which Markman has been inspired.

So, this idea in the background he proposed linguistic constraints theory. We will call them linguistic constraint theory 1 because we also have another set of theories which we will call constraint theory 2. So, constraint theory came out in response to constraint theory one and the criticism that it faced. So, now since new words can potentially map onto any aspect of an event, are we innately biased to consider some meanings before others? That is what the innate constraints, that is, innate linguistic constraints, talk about. Since there are a number of opportunities, is there some sort of bias or constraint that helps us narrow it down? So, these constraints are particularly important for babies because the lack of adequate syntactic knowledge will make it difficult for them.

So, for example, when we talked about Daniel Everett, he was trying to base whatever he was learning on his world knowledge, on his understanding of the syntax of the world's languages and so on. There was something to fall back on, but babies do not have it. So, as a result of which constraints might be a very good source of a very good potential source of information. So, in other words is that there any constraint that would put some limits on the possibility. So, to take into account this idea, he has proposed three kinds of assumptions; these are called assumptions: taxonomic assumption, whole word assumption, and mutual exclusivity assumption.

These three are part of his list of constraints. What does taxonomic assumption mean basically? It means that while extending the mapping of a word to a referent, the extension can happen only to members of the same taxonomic group. You all know about taxonomy; it is always hierarchically organized. So, let us say there is a category called furniture. Within the category of furniture, you have tables and chairs; within chairs, you again have various kinds of chairs.

So, starting from the lab chair to the office chair to the study chair, and you know, even the rocking chair, there are various kinds of chairs, similarly, there are various kinds of tables. So, within that, each of these levels will be one particular layer of the taxonomic hierarchy. So, that is what it means when the child learns a word; let us say the child learns the word for cat, then they will be able to extend the meaning of that word to all other members of the category cat, not going beyond the category or the taxonomic hierarchy to all animals and various other kinds of possibilities; that is the taxonomic assumption. Then comes the whole word assumption. So, a learner should assume any new word refers to the entire object rather than its parts.

So, when you are learning the word "table," it refers to the entire table rather than just its

surface, legs, or whatever. The third one is the mutual exclusivity assumption. So, learners should assume that objects have only one name. So, as a result, if you have already learned the word "table," and now there is another word that comes in its vicinity and is used at the same time or in the same environment, then it should be taken to mean something else, maybe about the table or something that is happening around the table, some kind of relation with the table or whatever, but not the table. that is mutual exclusivity.

So, if you have already learned one word for one object and you are learning another word in a similar environment, then you should assume it refers to something else. So, that is the idea. So, let us break it down a little. So, taxonomic assumption basically refers to the fact that labels are attached to things of the same kind. So, object labels to objects of the same kind, colors to similar kinds of colors, action terms to similar kinds of action terms, and so on   and   so   forth.

In fact, children from 2 and a half years to 3 years expect labels to refer to similar things, which is already a well-known finding. So, the important question is: do children, when they are in that naming explosion phase, which is before 2 years, actually utilize that kind of assumption during those 6 months between 1 year and 1 and a half years, which is what we see when they grow up? So, for that thing to be in place in two and a half years, does it start during the naming explosion? That is the idea. So, are they utilizing the naming assumption or not? Many experiments have been carried out; for example, one of the very first in 1989 showed that very young children tend to sort things taxonomically, even in the absence of a label, which means even in the absence of words or names, so to say. So, the children in the study were really young, 16 to 31 months of age; even the youngest one showed the ability to sort things in terms of taxonomic order. Another study by Markman and   his   colleague   looked   at   three-year-old   children.

The procedure was like this: there were two phases in the experiment. The first phase involved showing them an object and then labeling it with a novel word, not its actual name, but a novel word that the child does not know. For example, a picture of a cow is shown, and then they were told this is a Dax. Now, Dax is a non-word; it does not refer to anything, but in this case, the novel word was paired with a known object. Now, in phase 2, half the children were asked to 'find another dax,' and the other half of the children were asked   to   'find   another   one.

' No, no labeling was provided here. So, because of the first phase, they are given a label and the referent of that label. In the second phase, they were asked a prompt question to find me another DAX. In the other case, the other group of children did not have that level; they were simply asked to find me another one. What they found out was that before they found out where they would find them from? So, there was a list of things, and there were

a number of objects from which they had to pick; they had to choose.

So, those objects were organized; they had thematically related objects as well as taxonomically related objects. So, the objects were already there; they did not have to find them out on their own or were already given. So, thematically related, which means that, for example, milk and grass, etcetera, are thematically related to the object cow; that is why it is called thematically related. They are part of the entire gamut of understanding what it means to be a cow. And on the other hand, they also had taxonomically related objects like pigs.

So, this is how the experiment went. The result was that the children asked to find another dax were more likely to choose objects that were taxonomically related. For example, they chose pigs and other animals more often than those children who did not have the label mentioned in the question. So, this proved that children are biased to extend the new word to taxonomically related objects, which is a taxonomical assumption. On the other hand, the second assumption is the whole word assumption, which means that during this naming explosion, children prefer to name or refer to whole objects.

For example, one instance that I have quoted here is from Woodward 1992. Babies were presented with two screens, one playing a dynamic substance, something like lava, that was in motion. So, it is a substance; it is not an object. Objects are discrete; substances are not discrete. So, in this case, they had given a substance in motion resembling lava.

On the other screen, there was a static object. Now babies prefer to look at the substance, meaning that the whole object is not salient. In this kind of scenario, something that is moving as opposed to something that is static, you know, it is just sitting there, which is an object; the child's attention was focused primarily on the moving substance, which meant that an object without a label is not a salient thing in the environment. But in some trials, what they did was have the babies hear a label, and they do not know what the label refers to. So, while they were watching those two displays, they heard something; they heard a name, sort of.

And in this case, they showed a preference for the object, and this was taken as proof of the baby's preference for whole object discrete entities when they hear a word. So, which means that when you have a label, you prefer the whole object rather than a substance. Another study also found a similar kind of result even though they did not really start out looking for the same kind of evidence. Here, their hypothesis was different; they wanted

to check whether babies map labels onto whatever is consistent in the environment. If something remains consistent, babies will focus on that rather than on something that changes.

So, to check that they had two kinds of stimuli. One was a consistent object with varying motion. Let us say the lava was moving in different kinds of configurations, or it had consistent motions with varying objects. So, the motion remains similar, but the objects keep changing. What they found out was that there was a developmental shift from 8 to 10 months to 13 to 15 months.

So, in the initial phases, babies focused on whatever was consistent. So, be it movement or the object, whatever is consistent, they were focusing more on it. However, the older children tended to focus on whatever the object was. So, there was a shift of attention from whatever is consistent to the object. So, this was taken as proof of the whole word assumption again.

So, there is a problem: if babies focus only on whole objects, they might be at a disadvantage in learning parts of the object. How do you then tell them, how do you then teach them, or how do they learn the parts of an object after they have learned the whole object? Now, this was taken care of by the theory called the mutual exclusivity assumption, or hypothesis. So, mutual exclusivity basically refers to the idea that children prefer to stick to only one label for one object. So, one object, one name per object; that is the kind of mapping they would prefer. So, if you already have a name for an object like "table," as I said, then the other words spoken in this presence will be referring to anything else but the table.

So, there was an interesting experiment on this in 1988. Three-year-old children participated in this experiment. They were shown a pair of objects, one familiar and one unfamiliar. They used something called a radish rosette maker. It is a sort of tool that is used to make a rosette out of radish.

So, that is an unfamiliar object for the children, but the cow is a familiar one. So, that is how they were shown one object that is known, another that is unknown, and they were asked to 'show me the fendel.' Now, "fendel" is a non-word. So, of course, this is what they

wanted to check: whether this will apply to the children, to cows, or to cows. The children obviously chose the novel object because they probably know about cows.

So, if they already have the word for "cow" in their mind, they know that this is a cow. So, the novel object, novel word has to map onto the novel object that is, even if there is no reason or rhyme as to why that should be called fendel, but because this is novel, the object is also novel. So, let us map them one to one; that is the idea. And this is taken as proof of mutual exclusivity. Similarly, when shown a picture of a fish and asked which is the dorsal fin, they pointed out the fin, not the fish.

So, in this experiment, they also showed the fish to the child, who already knows about fish, and then they pointed out whether it is the whole fish or just this part, which is the dorsal fin. Children correctly point out the fin because they already know. So, these are the three assumptions that Markman has provided, but there are other assumptions as well. For example, the shape bias, the function bias, the noun class bias, and so on. So, the shape bias talks about the bias for children to label objects of similar shapes with the same name.

So, things that look similar will get the same names. That is the shape bias. The function bias discusses the bias with respect to the function. So, the things with the same function will be called the same, right? So, noun bias talks about the fact that there is a universal constraint that says children find nouns easier to learn compared to any other kinds of words, let us say verbs. So, that is why you see a greater number of nouns in the initial vocabulary of the children. So, that is a noun hypothesis, noun bias, and then there is, lastly, a pragmatic principle of conventionality and contrast.

Conventionality, as the name suggests, implies that the children assume there is a conventional form that should be used in a language community. Which is what you grow up learning: children in a particular community will grow up learning that this is the convention of using this particular word, and this will be different from one community to another. Similarly, there is the idea of contrast which both of these have been given by Clark in his 2003 work. So, contrast talks about how similar it is to mutual exclusivity; any difference in form also means a difference in meaning—that is the idea. Now, all these different kinds of constraints exist; though there is some proof and some experimental evidence for their existence, there are also many criticisms.

There are many. So, for example, the interpretation of the results itself has been discussed. So, for example, Markman and Hutchinson's results could also be interpreted in terms of the shape bias. Children tend to extend names to objects that share the general shape. So, what they talked about in terms of, you know, the taxonomy or the whole world hypothesis

could also be seen as a shape, as evidence of shape bias.

Secondly, innate constraints may not work for all languages. For example, certain languages, such as Korean and Japanese, have children who learn action words first more than nouns. So, it is very common; for example, in Japanese, it is very common to drop the noun. So, only the verb could be used as a full sentence. For example, this is possible in Indian languages; also, in Hindi, you can say 'ja raha hun' rather than saying 'mai ja raha hun'; it is fine, as you understand who is going. Or in Bangla, for example, we do not even need the "raha hoon" part; we just simply say "jachi.

" So, that already tells you who is doing the action of going. Similarly, in Japanese. As a result, in this kind of language, verbs become more prominent compared to nouns, making it possible for children to learn verbs more than nouns in the initial phases of their lives. The third point is that relying too much on constraints may actually hamper the child's understanding of words and concepts that match. For example, we have provided many instances of the dog, with the mother saying that this is a dog. So, for example, we go back there; a girl has a pet dog named, say, Bheem.

The name Bheem does not preclude the child from understanding the word for animal. The same animal is Bheem, but it is also a dog, a mammal, and many other things. So, there it should not be, if we constrain the child from learning all the other levels for the same animal, then it is not going to help the child very much in life, and that is not how children really grow up speaking. So, they do learn, which means there is an issue there. So, mutual exclusivity constraint as a result will put a constraint in the way for understanding these various layers of meaning.

Every object can belong to various layers at the same time. So, the dog may be a pet dog or a domesticated dog; it can also be a member of the dog family, and so on and so forth. So, this was the first part, as I said, constraints theory part 1. Now, this is where we come to the constraints theory 2. Now, this is also called the developmental lexical principles framework. This was proposed in response to all the criticism that was raised against constraint 1, Markman's constraints.

So, this was proposed by a different group altogether in 1994. This framework proposes six principles of word learning. These are organized into two tiers. So, each tier has, you know, a few principles, and then after the first tier of learning is over, the second tier gets activated; in some sense, it gets activated. So, the two tiers—tier one has principles that are proposed to be innate, and these are necessary for the first phase of word acquisition.

And that is also the phase where children make a lot of errors. So, overextension,

underextension, and all these various other problems are part of this phase of learning, and this is when we are basically sticking to all those innate constraints. Once that phase is over, tier 2 takes up. And this is where this tier is helpful in creating a refined and more sophisticated constraint, leading to fewer errors. So, in the beginning, they are trying on the basis of the innate constraints, and after that, the second layer gets activated. So, tier 1 has these principles: the tier principle of reference; reference we already know that the word stands for objects.

The principle of extendibility states that words do not necessarily refer to only one single object; they can extend to the members of the entire category and so on. Principle of object scope: words refer to objects primarily; if not, they apply to actions and events. So, the scope of the entire world. Then, once that part is done and understood, of course, children will make mistakes, but the fundamental things are in place, as somebody calls it; they have, you know, the fundamental learning has been taken off, then they will be going for the second part, which is the more refined part. So, this is where they take care of all the errors; this is where they kind of fine-tune the understanding.

So, these principles in tier 2 also have three principles. Principle of conventionality; this refers to the language-specific properties. So, in one language, for example, in Korean, we have already seen that there is no direct mapping of concepts like "in" and "on" as in English. Rather, they map it in terms of tight fit and loose fit.

So, that is conventionality. So, that is learned in tier 2. Then the principle of categorical scope, perceptual similarity is no longer adequate. Now, children learn that words label taxonomic categories, first at a basic level and then at a superordinate level. And then, of course, the novel name, nameless category principle, children at this stage assume that a novel name refers to an object that does not yet have a name. So, whatever has a name we have taken care of; now a novel name comes in, and now we have to, that means it refers to a novel object. This is how this particular theory discusses the two tiers and how the two tiers function.

Now, there are some supporting evidence as well as some contradicting evidence. We will look at the supporting evidence first. Now, this theory primarily addresses two main issues. One reason is why children seem to obey the constraints while learning words. We have seen that they do obey those constraints.

So, this theory says that they obey the constraints when they are in tier 1. And then they are also capable of ignoring some constraints when they are in tier 2. So, this theory takes care of both possibilities. So, evidence from some innate universal biases has been

reported. For example, English and Spanish children were tested on whether the difference in motion verb structures makes them behave differently.

Now, what is a motion verb? Motion verbs are verbs that denote movement. Movement may be by a human agent or by other agents, but it is movement in space. So, he entered the room versus he went into the room. Now, in terms of canonical structure, English and Spanish have different kinds of motion verb structures. English is a satellite-framed language, and Spanish is a verb-framed language. Now, which means that in Spanish the main root verb of the motion verb denotes the path information, whereas in English the main verb denotes manner information.

Now, this is something that the children grow up learning: what they wanted to check is this fundamental difference between these two languages and whether it has any impact on the way they pay attention to non-linguistic tasks. So, the results showed that they were sensitive to changes in both the paths and the manner of motion. So, a very interesting experiment; the reference is given here, and you can read it for the entire story to know. But then we also have critics; there is some evidence against this theory. So, cross-linguistic comparisons showed that, depending on language structure, children paid attention to certain aspects of the event.

So, in the previous experiment, we saw that irrespective of the language structure, they looked at the same thing; they were sensitive to the same kind of situation. The opposite view comes from Choi et al.'s study on Korean versus English. They saw that the Korean children paid attention to the distinction between tight fit and low fit, whereas the English children did the opposite. So, in summary, we can say that the initial universal bias theory has both supporters and critics, and the debate is certainly not settled.

However, in recent times, there has been a shift of attention from searching for bias, what kind of bias it is, and whether it is universal or not; that kind of focus is not very strong anymore. Now there is a new way of looking at the whole issue, and the focus has shifted to more general cognitive mechanisms, as it may not be only a language-specific problem. It may be a part of the general-purpose cognitive mechanism that all children have and the way it develops across populations. So, learning language words and being able to map the words to the concepts and denotations might be part of the general all-purpose cognitive mechanism.

So, that is where the focus has somewhat shifted. Of course, the studies are still going on in linguistic bias, but a new domain has also opened up. So, we will discuss this development in the next lecture. Thank you.