By the time children are 4 and 5 years old, their language skills are close to their adult form. Therefore, our work with preschoolers involves their interpretations of complex sentences that often have more than one possible interpretation.

Much of this research involves comparisons of children learning different languages in order to learn both about the role of the environment in language learning and about the ways in which children structure their own language. This year we have done research in the United States, India, China and Japan. Here is some of what we've learned.

We hope you find it as interesting as we do, and we look forward to seeing you and your child again soon!

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Let’s say that Bert and Ernie each read Ernie’s book. A puppet, who has been watching, says, “He read Ernie’s book.” Even though there were two male characters involved, most adult native speakers of English know that by using the pronoun “he,” the puppet is referring to Bert and not Ernie. But does your preschooler know this?

The answer to this question will help us place a linguistic rule governing interpretation of pronouns, known as Principle C, into the timetable of child language acquisition. Previous experiments have suggested that preschool-age children do interpret pronouns using Principle C. If we can replicate these results, we then want to see how children react to sentences like “He read every book Ernie’s cousin did.” This type of sentence has a different underlying structure that may allow for a different pronoun interpretation.

– Heather Keels, Audrey Lopez and Stacey Conroy

**METHODS**

**He Who?**

The Truth Value Judgment Task

This procedure involves two experimenters. One experimenter plays the role of a storyteller and the other plays the role of a puppet. The storyteller acts out a story using various toys and props. At the end of the story, the puppet tells the child what he thinks happened in the story.

Some of our puppets are very silly, and some of them are just learning how to listen. Sometimes they get mixed up about the story. The child’s job is to tell the puppet whether he is right or wrong.

We use this task to determine how children interpret ambiguous sentences. Generally, the puppet’s statement about the story can be interpreted in two different ways. However, the stories are designed so that only one interpretation is true. This way, if the child tells the puppet he is right, we know the child got the interpretation in which the statement is true, and vice versa.

We are careful to tell the stories so that under either interpretation, it’s understandable how the puppet could be confused.

**CONTINUED ON P. 3**
In this study, we have been looking at children’s interpretations of sentences like “Every cat didn’t hide behind the sofa,” which has two possible interpretations in adult English. However, adults typically prefer one interpretation over the other, and we are interested in investigating how children grow to adopt this preference.

This sentence can mean two things: either not all of the cats hid behind the sofa (preferred), or none of the cats hid behind the sofa (dispreferred). We present children with a picture, as at the right, where it is true that not all of the cats hid behind the sofa.

The puppy (upper left corner) says the ambiguous sentence, “Every cat didn’t hide behind the sofa,” and the child’s job is to say whether the pup is right or wrong. If a child gets the preferred adult interpretation, he or she will say “right,” because not all of the cats are behind the sofa. If the child gets the dispreferred adult interpretation, he or she will say “wrong,” because it’s not true that none hid behind the sofa.

We’ve done this study with 4- and 5-year-olds, and, interestingly, it appears that the younger children are more likely to have the adult-like preference than the older children. Next, we will begin to investigate why this could be.

– Stacey Conroy

We are also exploring how children interpret sentences with numbers, such as “Miss Piggy didn’t drive two cars that Kermit did.” One interpretation of this sentence is that of all the cars Kermit drove, there were two that Miss Piggy didn’t drive. Another interpretation is that there were not two cars that Kermit drove that were also driven by Miss Piggy.

To determine which interpretations preschoolers can get, we tell a story that makes only one interpretation true. For example, if Kermit drives four cars and Miss Piggy drives two of those cars, the first interpretation is true (there were two of Kermit’s cars that Miss Piggy didn’t drive), but the second interpretation is false (there were also two of Kermit’s cars that Miss Piggy did drive).

In the picture to the right, Tommy fed the koalas with white plates and Piglet fed the koalas with the orange plates. When our silly puppet, Iggy, says, “Piglet didn’t feed two koalas that Tommy did,” the scenario is reversed. The first interpretation is means Iggy is wrong (Silly Iggy! There is only one of Tommy’s koalas that Piglet didn’t feed), but the second interpretation means Iggy is right (Piglet fed one, not two, of Tommy’s koalas).

– Natalie Berger, Cory Perlowitz and Stacey Conroy
Another interesting type of ambiguity arises when negation and a because-clause appear together in the same sentence, such as "John doesn't like Mary because she is rich." Under one interpretation, John does not like Mary, and the reason he doesn't like her is that she is rich. We call this "main-clause negation," because the "not" applies to the main verb, "like." There is another interpretation in which John likes Mary, but the reason he likes her is not that she is rich. We call this "because-clause negation," because the "not" refers to the clause "because she is rich."

In this study, we used a truth value judgment task to test how preschoolers interpret this type of sentence. For example, in one story, Pluto decides not to join a carrot-eating contest because he wants a crayon, which is the prize in a different contest. The puppet says, "Pluto said he didn't join the carrot-eating contest because he wanted a crayon." If the child can get the main-clause negation interpretation, he or she should tell the puppet he is right.

In a different version of the story, Pluto does join the carrot-eating contest, but only because he likes carrots. He doesn't really want the prize, which is a car. The puppet says, "Pluto said he didn't join the carrot-eating contest because he wanted a car." If the child can get the because-clause negation interpretation, he or she should tell the puppet he is right.

Our results were that most children said the puppet was right in the first version, but most said he was wrong in the second version. This suggests that children only have the main-clause interpretation of negation in this type of ambiguous sentence. Further investigation is in order as to why children have only one reading and how adults come to be sensitive to the ambiguity.

– Chizuru Nakao and Takuya Goro
Some of our earlier research examined children’s interpretations of ambiguous sentences like “The girl didn’t peel two apples.”

This sentence can have two interpretations. One interpretation, which we call “isomorphic” (don’t ask), is that the girl has peeled some number of apples other than two. The other interpretation, which we call “nonisomorphic” (still don’t ask), is that there are two particular apples that she failed to peel. We can see that these interpretations are different by creating scenarios in which one interpretation is true and the other is false.

First imagine a situation in which the girl has two apples and she peels one. In such a situation, the isomorphic interpretation is true because the number of apples that she peeled is not two. However, in that scenario, the nonisomorphic interpretation is false because there is only one apple that she failed to peel. Since the isomorphic interpretation can be true when the nonisomorphic interpretation is false, we can clearly see the ambiguity of the sentence.

Now imagine a situation in which the girl has four apples and she peels two. The sentence is still true because there are two apples that she didn’t peel. But now, it’s the nonisomorphic interpretation that is true. In this situation, the isomorphic interpretation is false because there is only one apple that she did peel. Again, the ambiguity becomes clear.

In our previous research we found that preschool aged children speaking a variety of languages have difficulty accessing nonisomorphic interpretations. In the four-apple situation just described, 4-year-old children tend to say that the sentence is false because the girl did peel two apples. That is, they say the sentence is false because the isomorphic interpretation is false. In the two-apple situation, they say the sentence is true because the isomorphic interpretation is true. (Though, for some reason, they never seem to use the word “isomorphic.”)

We wondered whether the observation that children were missing an interpretation that adults easily accessed was due to their really not knowing that the relevant sentences have nonisomorphic interpretations or whether they just had more difficulty than adults in finding such interpretations. To address this question, we conducted two studies in India with 4-year-old children learning Kannada. (Kannada is a Dravidian language spoken by about 40 million people in the state of Karnataka.)

The reason we went all the way to India to ask this question is that Kannada exhibits a construction which seems to make the nonisomorphic interpretation more apparent. The English sentence “The girl didn’t peel two apples.” has two different translations in Kannada:

\[(1) \text{ avaLu eraDu seebu oreyalilla} \]
\[\text{she two apple peel-not} \]
\[\text{‘She didn’t peel two apples.’}\]
Both (1) and (2) are ambiguous in Kannada. Both can be interpreted isomorphically or non-isomorphically. However, (1) seems to fit more easily with the isomorphic interpretation and (2) seems to fit more easily with the nonisomorphic interpretation.

So, we reasoned that if children were ever able to access nonisomorphic interpretations, it would be with sentences like (2). So, we presented stories to children that made the nonisomorphic interpretation true and the isomorphic interpretation false. Then, for half of the children we described the story with (1) and for half we described the story with (2). We found that children who heard (1) said that the sentence was false (because the girl had peeled two apples). But crucially, those children who heard (2) said that the sentence was true and identified the two uneaten apples. We discovered that Kannada-learning children do, in fact, have access to the nonisomorphic interpretation.

The next thing we asked was what kinds of experiences would lead a child to overcome their preference for isomorphic interpretations with sentences like (1). We wondered whether they simply needed more exposure to those sentences or whether other sentences (like (2)) with the same interpretation could play a role in the emergence of nonisomorphic interpretations. So, we told children six stories. In each story, the nonisomorphic interpretation was true and the isomorphic interpretation was false. And, at the end of each story, a puppet said either (1) or (2). Half of the kids heard three sentences like (1) followed by three sentences like (2). The other half of the kids heard three sentences like (2) followed by three sentences like (1). Since we already knew that kids were more likely to access the nonisomorphic interpretation for sentences like (2), we were able to see whether their interpretations of sentences like (1) would be affected by exposure to sentences like (2). In other words, we asked whether experience hearing sentences nonisomorphic interpretations would make those same interpretations available for sentences with a completely different structure.

We found that experience mattered. The children who heard sentences like (1) after hearing sentences like (2) were more likely to access the nonisomorphic interpretation of those sentences than children who heard sentences like (1) first. In just three sentences, we were able to help children overcome their bias towards isomorphic interpretations.

– Jeff Lidz
When ‘Not’ and ‘Or’ Mix

Sometimes a sentence structure that has only one interpretation in one language can have multiple interpretations in another. For example, the sentence, “John didn’t eat the bread or the cake,” has two interpretations in English. There is the more common “neither” interpretation, in which John ate neither the bread nor the cake, and in certain contexts there is a “not both” interpretation, in which John either didn’t eat the bread or didn’t eat the cake, but the speaker isn’t sure which. But a corresponding sentence in Japanese can only have the “not both” interpretation.

Preferred interpretations also vary between languages. When the sentence is translated literally into Chinese, it can have both meanings, but the “not both” reading is the normal one and the “neither” meaning requires specific circumstances.

Previous studies found that children of all three languages were essentially alike in their understanding of this type of sentence, in that they all seemed to all welcome the “neither” meaning and reject the “not both” meaning.

Our series of studies examines whether children do, in fact, have some knowledge about the “not both” meaning. So far, we have conducted experiments with Chinese-speaking children and English-speaking children. We use the truth value judgment task described on page 11, testing stories of two types. In the first type, the featured character has a “positive” goal to achieve, in that he has two things to do (e.g. fixing the bike and fixing the skateboard) and will get one reward if he finishes one thing and two rewards if he finishes both. This resembles the stories used in the previous studies mentioned. In the other type, the featured character has a “negative” goal to achieve, in that he has two things to avoid (not do, e.g. not hitting the rock and not hitting the barrel) and will get one reward if he avoids one thing and two rewards if he avoids both.

A curtain is used to block what happens while the character is trying to achieve the goal. At the end of each story, the curtain is removed. It always turns out that the character gets one reward, so that in both the positive goal case and the negative goal case, it is true that the featured character either didn’t do one thing or didn’t do the other thing (the “not both” meaning), but it is not true that he did neither thing (the “neither” meaning).

What we have found is that many Chinese children and many English children accept a sentence of the type in question as correctly describing the scenario when the story involves a negative goal. This suggests that these children are able to get the “not both” meaning in this scenario. Our studies show that children’s knowledge about the meaning of sentences containing both ‘not’ and ‘or’ is, in fact, more complex than linguists had thought before.

– Chunyuan Jing
The Restriction Kids Don’t Know

The English sentence “A doctor will interview every new patient” can mean either that there is a specific doctor who will interview every new patient all by himself, or that every patient will be interviewed by a different doctor. The second interpretation is curious: It seems that the interpretation does not correspond to the word order of the original sentence, as the paraphrase suggests.

In Japanese, in contrast, the corresponding sentence can only have the first interpretation; that is, the interpretation that strictly corresponds to the word order. Therefore, the Japanese sentence does not appropriately describe a situation where different doctors are assigned to interview each of the new patients. In theoretical linguistics, the semantic property that pertains to the distinction of two possible interpretations is referred to as scope, and it has often been claimed that while English is a free-scope language (as the ambiguity of this sentence shows), Japanese is a rigid-scope language.

We are interested in how children learn the difference between the two languages. In particular, we sought to determine whether Japanese children know that there is no scope freedom in the language. To this end, we carried out experimental studies in Japan, with 4- to 6-year-old Japanese children. In one of our experimental stories, there are three pigs who are invited to eat three different foods: a cake, a banana, and a pepper. The pigs decide to share the foods so that each of them gets to eat something. After the story, Kermit the puppet presents the following sentence in Japanese:

“I know what happened. Someone ate every food!”

What Kermit says is false if it is interpreted as meaning that there was one person who ate each food. That is, under the interpretation that matches surface word order, the sentence is false. In contrast, what Kermit said is true if it is interpreted as meaning that every food got eaten by someone. That is, the sentence can only be seen as true with a free-scope interpretation.

In our experiment, Japanese adults consistently said that Kermit was wrong. However, Japanese children accepted Kermit’s description quite often (about 40 percent of the time). In fact, in another experiment it turned out English adults accept the same sentence in English just as often as Japanese children. In short, Japanese children are more like English adults than like their parents!

This finding poses an interesting problem for the theory of language acquisition. When and how do Japanese children learn that the scope freedom they are entertaining is actually quite restricted in their language? In other words, when and how do Japanese children learn the Japanese version of “Someone ate every food” cannot mean “every food got eaten by someone”? These are questions that we are going to pursue in future research.

- Takuya Goro