

Sentence Diversity in Toddlers at Risk for SLI

Okay, there we go. So we're gonna go from the... the cellular level into a very close-up look at some of the behavioral data that I've been gathering over the years on the early transition from words into first sentences, and the development of tense and agreement, or the sentences that set the stage for that.

Here are my financial disclosures. I will be talking, presenting work today from several different grants that we have collected over the years. And I have no nonfinancial disclosure to make.

So the goals for today's talk is to really introduce some new measures that we've been working with to introduce you to our measures of subject diversity, verb diversity, and a combination of subject-verb diversity. We have been trying to develop this term, or to refer to this as measures of structurally specific lexical diversity, as opposed to global measures of lexical diversity. I'll then move into reviewing some developmental expectations for sentence diversity in early language development. Really in this period from MLU of about 1.5 to 3.0, and then I'll present some evidence, some that we've published, and some new insights that we have about a sequence of treatment targets for really strengthening the representation of sentence, and with the representation of subject in early grammars in particular. The rationale for this is to really promote the early sentence foundation for children with SLI, for children with DLD, and other neurodevelopmental disorders who really seem to struggle with this transition from vocabulary into early grammar.

Alright, so, why study sentence diversity in children with specific language impairments? Well we certainly all know that grammar is a hallmark difficulty for preschool children with SLI. And we're focusing on the sentence, because the sentence is the most basic unit of grammar. And by studying children who develop language very slowly, we can discover how sentence development unfolds frame by frame, and identify if children with SLI have unexpected difficulty at any point in the sequence. I'd like to kind of underscore that typical language development is a little bit like a horse in motion. Meaning that the intricacies of how its mechanics work are sometimes really hard to see if it's moving too fast. And so over the course of my career, I've kind of moved back and forth between looking for sequences in children with SLI, and going back and testing to say does that sequence hold up when I look at typically developing children, and moving to earlier and earlier periods of grammatical development.

Alright, so a little bit more on why sentences. Well from a linguistic perspective, we know that pronoun, noun, and verb are categories that recur in all of the world's languages. And that the subject predicate structure of the sentence exists in all world languages. So from this perspective, looking at sentence and how sentence develops gives us a more universal approach to looking at early grammar, something that can be measured in all languages and in all dialects. And, the other reason to look at sentences

is because the ability to speak in sentences allows children to express their needs and to comment about objects and events in the world around them. So this is really what our goal is, is to speak in sentences. So let's see how children get started.

So why are we looking at diversity in particular? Well there's really psycholinguistic foundations here. So, we have argued that the more de—variety that children display in these specific structurally defined positions, the more flexibility that's showing us. In other words, that children are being able to produce these sentences or structures using their underlying grammar, rather than relying on potentially memorized forms, okay. So the more different words we can put in the subject or the main verb position, the more abstract or strong and flexible the grammar is. 'Kay. We also know from our work on input and the work of others, that lexical diversity in the subject position and in that verb position in adult input has been shown to facilitate children's development of sentences as well as their use of grammatical morphemes, m'kay. So the sentence foundation gives rise to analyzing these additional language specific structures in the input around, uh, in the input provided to children.

Alright, so how do we operationalize these measures? When we're looking at structurally specific lexical diversity, we're looking at it now in simple sentences alone. So we've really focused on only single clauses, and we're looking at the number of different pronouns and head nouns that are in the subject position of a single sub—sentence type. Active, declarative sentences. So we're not looking at children's productions of questions, yes, no, or WH, that have any movement in them; we're not looking in imperatives, we're looking at subjects in active declarative sentences. And the same is true when we're looking at verb diversity. Verbs that are showing up in active declarative sentences with overt subjects in that position. And when we measure sentence diversity, we're looking at the unique combination; so how many different subject-verb combinations young children are producing. M'kay.

So just to give you a flavor for what that looks like in development, I'm gonna use my pointer here. M'kay. So this is just an, uh... visual illustration of the way in which sentence diversity grows over time. So this is an example from a typically developing toddler from 24 to 30 months of age. And what you can see here is this is an I subject, and it is being used with a number of different verbs. The size of the font here is indicating the number, the frequency of times children use that subject. So you can see "I" is actually growing over time. Children are using lots of I subjects. Here you can see the number of different words in the subject position. And so down in the bottom here, we have third person subjects, some are pronouns like He and It, and some are actually nouns like Horse, Sheep, and Piggy. One of the things that I want you to see is the subject, the number of subjects is growing over time, as is the number of verbs. But the verbs are growing in that verb position, the main verb position, more rapidly than the subjects are. The other thing that you'll notice is that different verbs are connected to the subjects in the beginning period. So you have "I" with different verbs than what you have third person subjects with, 'kay. And with development, what we see is the flexibility of using those same verbs with more and more different subjects. M'kay.

Alright, so, how did our study of... the way in which these sentences develop lead us to identifying some developmental expectations for sentence diversity? So certainly the ability to produce sentences develops rapidly during the third year of life for typically developing children. However, what we see in our literature, in terms of developmental milestones, tends to emphasize utterance length instead of sentence structure, mokay. So here are some examples. Puts 3 or 4 words together. So sentences of 2 to 4 words, uses 2 or 3 words to talk about or ask for things. Or a question, does your child make sentences of 3 words. Mokay. so those emphasize length. And while length is a good indicator for the general public, it's not ideal for clinical practitioners who are charged with supporting early grammatical development, because it may lead us to lengthen utterances rather than to develop increasing levels of structural complexity. 'Kay. So we wanted to try and establish some expectations for how sentence diversity changes over time. Oh, let me go back to utterance length versus sentence structure. So here's just some examples that I use when I'm talking with clinicians. A forward utterance like 'Mommy, more juice please,' is 4 words, right? But it isn't a sentence, okay. On the other hand, "I sit," "It fit," "Tower fall," right, these are child-like telegraphic sentences. They're only 2 words long. But each one of them is a sentence made up of a subject-verb combination. Okay. So length isn't everything. And what we're interested in is how children start to develop these different kinds of sentence types rather than just growing longer utterances of the same sort of repetitious variety. Okay.

So what else do we know when we look at the developmental expectations? We see most indications of sentence development described in terms of basic SV and SVO sentence structure. Subject-object, subject-verb, and subject-verb-object. And if you go into the... deep data on early grammatical analysis methods like developmental sentence scoring or LARSP, you'll see indications that the average toddler is producing both of those sentence types by 24 to 26 months, and almost all of these children are producing these kinds of sentence varieties by 30 to 32 months. Okay. But, these analysis methods are not paying attention to the lexical diversity within those basic sentence types, mokay.

So when we apply this approach, structurally specific lexical diversity, we went into 3 longitudinal archival databases to apply this measure to a sample of 63 developing toddlers. Some of the databases followed children from 21 to 33 months, another from 24 to 36 months. All of the children in this graph had typical grammatical abilities at 36 months, at 33 or 36 months of age. And what you can see here is we are holding constant the amount of time these children are interacting in a parent/toddler free play session. So all of this data is based on 30 minutes rather than 100 utterances, mokay. And so what we're looking at is actually a rate based measure. So how rapidly are children generating diverse sentences in a controlled amount a time. And what you can see between 21 and 24 months of age, is that kids produce very few sentences, right? They're only using about one different sentence combination every 10 minutes or so, mokay. However, around 27 months of age, we see a big jump in the rate, okay, so that's where the average child should be able to produce SV and SVO sentences. They also are producing different, more diverse sentences. So about one new sentence combination every 2 minutes. And by 33 months, it's about one every minute. Okay.

So, children who are producing the same kinds of sentences over and over again, can increase their MLU, but may not be increasing their diversity. Okay.

Alright, so here's a graph that shows differences between those 63 typically developing toddlers, and 24 children who we would identify as at risk for specific language impairment. So the difference here is that these children had measures of grammar at 33 or 36 months of age that were below one standard deviation on the mean for the, on the in, index of products of syntax or on the test of early grammatical impairment at 36 months of age. And what you can see here, the error bars indicate 1.25 standard deviations above and below the mean for the typically developing kid for each group. But what you can see at 27 months of age, is that the average child who's at risk is about one standard deviation below the mean for the typical kids. And by the time we get to 33 months of age, the average child in the at risk group is more than 1.25 standard deviations below the mean for typical kids. So already we're beginning to see real differences in the sentence foundation between children who are developing typically and children who are at risk for SLI. Now of course the error bars on for the children who are in the at risk group, they're very large. Right? And so what we know is there's still a lot of variability in that group, and there is quite a bit of overlap between some of the slow developing typical kids and the children with an SLI profile who have better outcomes. 'Kay.

Alright, so moving on. This is a paper we published in 2018 that kind of laid out our understanding of how sentence diversity was expanding, by taking a deeper dive into the kinds of subjects that children were producing, McKay. And so the way to read the figure on the left, or right, excuse me, is... that down here we have divided a sample of 40 typically developing toddlers, these are all children at 30 months of age, into 4 different quartiles for MLU. The group here that is in the lowest 25%, so the lowest 10 children, had an MLU of about 2.1, and the low middle group here had an MLU of about 2.5, which is average for children at 30 months of age. So if we just kinda focus on these slower developing typical kids, let's pay attention to the kinds of subjects they're producing.

So the orange part of the stacked bar chart, these are "I" sentences. So children are producing sentences with an I subject. Now of course some of the kids are making pronoun case errors and using "me" instead, like "Me eat." But the orange, notice that isn't changing a whole lot across these different levels of language development. The blue in the stacked bar chart are third person singular subject types. And you can see that that's expanding quite a bit across these different levels of grammatical development. And then in the next 3 levels, these are "you" subjects, second person, and plural subjects. First person plural, and third person plural. What I can tell you about all of the children, all 40 children in this particular sample, is that in 30 minutes of parent/toddler free play interaction, all of the kids were producing at least 10 different subject-verb combinations, and all of the children were producing subjects across at least 2 subject types. So the primary ones are again, first person—oops. First person, singular, the orange, and third person singular, the blue. McKay. So this is how subject types are expanding.

This led us to lay out more of a developmental sequence focusing on how to expand subject types as a way of setting the stage for building stronger, more flexible early sentence types. So based on our analysis of these, especially the slow typically developing toddlers, what we argued is that when we're trying to diversify sentences, we need to first focus on expanding person. So helping children to establish that contrast between first person subjects, and third person singular subjects. And if you think about this, the way in which we're going to start to get the agreement system going in the language is to have a contrast between these different subject types. So this is really essential.

The next phase is to really increase the subject diversity. So after we have the first/third person contrast, the only way in which we can get more and more and more flexibility in that subject position is to increase the number of subjects that we can put in that slot. And the only way to really expand that considerable amount is to be able to put nouns in that subject position. So at this point, we want to increase nouns as subjects, and the other thing that became very clear as we mined the data is that this is also the period of time in which kids are really working out pronoun case, right? and that makes sense because as the system is growing and we're getting contrast in sentences, we do see the first beginnings of that tense and agreement system starting, and so is case coming in on top of that, 'kay. And then, at the very, very last stage, if you remember back to the figure, the plural subjects come in at the very end. And interestingly, the plural subjects are awarded more points in developmental syntax scoring. We've known this for a long time. We seem to have forgotten it, right? And so, this last step here is to expand number, increasing the number of plural nouns that are in that subject position, and that'll also propel kids towards using more of a case marked plural pronouns. Mokay, does that make sense? Mokay.

So, when we looked at then these typically developing kids, we also were able to really dig down into some of the children that were in the same database who were struggling with grammatical outcomes at 3 years of age. And so in a perspectives paper, we did an analysis of some children using some case applications to really look at what they were doing. So what you have in this chart here, is again, the means for those 40 kids from the paper I just spoke about. And what the mean number of unique subject-verb combinations with the first person sentences are, and the mean for third person, and what this 1.25 standard deviations below is. And what you can see here, is that if we think about this in sort of a, a norm referenced approach, that would say that the tenth percentile is roughly two different subject-verb combinations with third person subjects by the time kids are 30 months of age. If we think of it more in a criterion referenced approach, what we saw was that 90% of our typically developing kids were producing at least 3 of those subject-verb combinations with third person sentences.

When we look at the kids who are struggling, one of the things that we notice is that they are having more difficulty with the third person subjects, mokay. And so if I can highlight these two kids that we wrote about in more detail in the paper, one of the things I want you to notice is that their MLU's are quite long, especially Child Two. The MLU is 2.62.

This is actually above the average for 30 month old children. So how is this child getting such long utterances, and having such limited use of those third person subjects? So let's zoom in on that child, and some of the sentences.

Alright, so here's a listing of all of the subject-verb combinations that the child is producing. And my numbering here is showing you that there are a number of sentences in which the child is producing "I want." Mokay. "I don't like tacos." "I see you." "I need this." These are all examples of I subjects with state verbs. My color coding here, these are, the orange verbs are actually process verbs in which the direct object is undergoing some kind of change. You can see that he's omitting obligatory direct objects with those kinds of verbs. We get all the way over here, and we finally find some intransitive verbs. Some intransitive verbs that only require the subject in a subject-verb kind of sentence type. And one of the things that you also see is that there are very, very few third person subjects, despite quite long sentences. Okay.

So, this child is kind of in that mild to moderate range of grammatical development at 3, not terribly severe, but still struggling, given the amount of language that he's using. But let's take a look at another child at 30 months of age. So this is a child who's not combining words as regularly. And one of the things you also see is again, several sentences that have "I want," right, and all of these are she said "I want that," "I want clown," "I want bubbles," "I want baby," right, this repetition. Mokay. She's got some of those transitive process kinds of verbs. The good news here is even though she has very, very few sentences at this point she's not combining, she has the beginning of that third person contrast. So we can move into the developmental sequence of treatment targets that I had mentioned before. 'Kay.

The one other thing I should highlight, is notice that these are the only simple sentences she's producing, and she's talking a lot. This is in 40 minutes with 363 complete and intelligible utterances. Mokay, she's talking a lot, right? Alright, now here's another—oh. And these are the readiness indicators for really, that she should be able to produce more third person sentences, at least when we look a tour slow, typically developing kids who have good outcomes at 3.

Okay. So here's another child. This child is... 36 months old at this point in time, and again, combining words very regularly. So approaching the end of Brown stage one, transitioning into Brown stage two. Again, lots of complete and intelligible utterances, and very, very few sentences. 'Kay. So what do we notice here? Again, we start with the "I want" kinds of state verbs. "Me need this," "Me like that," "Me see it." We get some transitive process kinds of verbs. We see omission of direct objects again. What's missing? Absolutely no third person subjects at this point in time, okay. And he's 36 months of age. And so at this point, he's showing an IPSyn score, 3 standard deviations below the mean. Okay. Now one of the things I would also point out is the IPSyn doesn't have, doesn't look at all at anything other than the appearance of subject-verb, and subject-verb sentences. Subject-verb-object sentences. So a child who says "I did it," and "I want that," would score all 8 points on those early kinds of sentence structures. Okay.

So the other thing I think is noteworthy about him; again he has all the readiness indicators to produce third person sentences, but is not. He's got many of these I sentences. This is a, a little guy who had been in a community based early intervention since 17 months of age. Mokay. So 17 months, this entire period, and he's still not able to produce third person subjects.

Okay. So what have we learned from looking at typically developing toddlers who are developing slowly, and then children who are at risk for SLI who are at developing at different rates of development? We have learned that toddlers at risk for poor grammatical outcomes at 36 months of age, have limited sentence diversity, and especially with third person subjects at 30 months.

It seems to me that the later the emergence of third person subjects, we actually elevate risk for persistent SLI. And this also connects to the work that I've done on the emergence of tense and agreement. If you don't get third person sentences going, it's gonna be impossible to get the tense and agreement system really going, because copula is in third person singular tense, are the first morphemes to come in. Mokay.

So; so this made me really think about what is it that we need to do in our interventions to get third person subjects going. Right/ I, it's clearly much more difficult than we might anticipate. Alright? And so the question is, is the emergence of diverse third person subjects influenced by the complexity of the predicate?

Alright. So, now we're gonna move into looking at some new evidence, and some new ways of looking at this transition. So this is an exploratory question. I'm just gonna show you some raw data rather than doing any kind of statistical analyses, just to kind of get you a feel for the direction in which we're going in some ongoing research right now. So is the emergence of diverse third person subjects influenced by the complexity of the predicate? Here's our hypothesis; that noun-subject diversity will increase in a developmental sequence, and the developmental sequence, we'll all recognize it is very familiar. But what are these kids doing in our old friends, our semantic relations from Brown stage one, entity location, and entity attribute? Right? Are those nouns appearing; are we getting more diverse nouns in those early semantic relations prior to getting them in one argument intransitive verb context, and before those two argument subject-verb objects? Mokay. And if so, then we really need to think about not just can children produce entity location and entity attribute, but how many different nouns can they put in those semantic relations, and think about that bridge into sentences with verbs. Okay.

So, we went back into the archival database that I have on slow typically developing, and children who were also late talkers. And I'm only—I coded the data for these kids at 30, 33, and 36 months of age. The children here are separated into 3 different outcome groups. So the outcome groups are based on IPSyn scores at 36 months. The first group I'm gonna call low average, and in fact, their IPSyn Z scores are from .01 to -.99. 'Kay. So, really slow average kids. the mild to moderate delay group have IPSyn Z scores

between 1 and 2 standard deviations below the mean, and what I'm calling the severe delay group, or at really risk for persistent SLI have IPSyn Z scores between 2 and, more than 2 standard deviations below the mean.

But what I really wanna point out is in this group of kids who ... were really recruited to just be late talking toddlers at 24 months of age, look at the discrepancy between the lowest child in the mild to moderate, and the kids in the severe groups. -1.81 to 2.73. There's something very different about that group of kids with persistent risk. Okay. And then we coded 40 minute parent/toddler play interactions and decomposed this into subject types and verb types.

Okay, so now we're gonna move into thinking about predicate complexity in a, in a somewhat different way. So, this is... a new way of thinking about the complexity of predicates in single sentences and single clauses. And this is work following first phase syntax by Ramchand, and Matt Rispoli has written a tutorial in JSLHR, really looking at this from a developmental perspective.

And here where we're going to start is that entity location or entity attribute is the simplest kind of state predicate, right? So here I'm gonna call it a copula context, it might be a little bit more familiar for all of us, in thinking about these are places where we were just talking about an entity in a particular location or in a particular state. When we add the verb to it, what we're adding is a process by which that entity, the cow in this case, changes location, or changes its state, okay. And then a third layer of complexity that we can put again into a single clause, is that we can add an external causer that initiates that process by which the entity moves into a particular location, or changes its state, okay. So these are 3 layers in which we have different levels of semantic complexity, and they interface with different levels of syntactic complexity, okay. So here's just a couple of other examples. We can think about a child who might say "Hat off," so that's entity location. A little bit more complex is adding that intransitive verb like "come," and the child says "Hat came off," or "Hat come off." A much more complex single clause, "He pulled the hat off." Okay. Or in the example of entity states or entity attributes, "Hands dirty," "My hands got dirty," "I got my hands dirty." Okay. So all of these are simple sentences, but they have different levels of complexity.

Okay, so what are we coding now? What we're coding is, how children's early entity location and entity attribute semantic relations appear or emerge, and what the level, what the types of subjects are. So is it a pronoun subject, or is it a noun subject in that position? 'Kay. At the second level, we're looking at the addition of intransitive verbs, 'kay. So some of you may remember in the late '90s, Leslie Olswang and her colleagues identified that children who had more intransitive verbs in the single word stage were the ones who made the transition, okay. So, we need to figure out what is the role that this intransitive verb is playing, so we're looking at those. And one of the things to notice is that these intransitive verbs, that argument in the subject position can take on different kinds of thematic roles. So sometimes they are agents engaged in an activity, like the "The baby is sleeping," or they can be, the... experiencer of... a particular state. And so there's diversity in that particular category. And then the third level, we are actually

coding for the difference between process verbs, so that external causer that initiates the process, and we're also looking at the difference in transitive states, where there's actually no process, dynamic process that's unfolding. But for purposes of this presentation today, I'm just gonna collapse these into a transitive category.

Okay. So let's take a look at, let me orient you to this figure, and to some of the moving parts in this graph. So the first thing to notice is that this top group is the group of children who are slow typically developing. And what I'm showing you here is just that these kids are producing sentences. So these are first person sentences, I subjects. And what you can see is the kids have lots of sentences with a range of different verbs. So this is 30 months, 33 months, and 36 months. And so what the slow typically developing kids prefer are transitive verbs with I subjects, mkay. And this is very similar, comparable to the... 2008 paper data that I showed you.

Now here's the group that has ma—moderate delays at 36 months of age. And what you can see is that the same pattern holds, but we see a much more developmental increase across that period of time. And in the bottom group, these are the kids with severe delays at 36 months. Again, by 36 months of age, we see that they have many different verbs that they're combining with I subjects. So they produce sentences.

Now let's look at their noun-subject diversity. Again at the top are the low average children. Alright, what do you see here? We see a different type of predicate that's being used with, with noun-subject diversity. So in order to do a noun, right, it's a third person subject. And what we see here is that the copula context, the number of different nouns in copula context, and with intransitive verbs, is relatively equivalent for the kids at 30 months of age. It's possible that we missed the period in which copula nouns and copula contexts were advantaged because we started a little bit too late with the slow typically developing kids. But what you see is a much later emergence of noun diversity in those transitive kinds of subjects. Or with the transitive verbs, excuse me.

This is the data for the mild moderate group. Again you see far fewer nouns even with the copula contexts. But by 36 months of age, you're starting to see 2 and 3 different types of nouns in that subject position. And for the kids with the most severe delays, we see very, very limited subject diversity, with nouns, even at 36 months of age,, 'kay. Now you might be saying well what about with pronouns? Are they able to use pronouns? Well, what we can see actually here is the increase in the developmental trends do indeed seem to show up more so with pronouns. And part of the reason why those slow typically developing kids have lots of different pronoun subjects at 36 months of age, is they're developing the pronou—the person al pronouns, right? And so the most common pronouns here are It, This, and That, but also He, She, and They are starting to emerge.

This is for the mild moderate group. And what I wanna point out is that across all of the copula, the intransitive and the transitive context, the group of kids who are in the mild moderate range are starting to look a lot more like the low average kids in terms of their subject diversity. But the severe group; the severe group is still very, very limited. At 30

months of age, none of these kids had any nouns in that entity location or entity attribute relationship. They're averaging still only about one at 36 months of age, even with the pronoun subjects. And one of the things I just wanna underscore is that in this group of 7 children, 3 of the kids still had absolutely no nouns or subjects in the subject pos—nouns or pronouns, third person pronouns in the subject position, okay. And that seems like it's pretty... much more challenging than what we had really appreciated.

So to kind of wrap that up, diverse noun subjects appear in copula context, and within transitives, before they're appearing with transitives. I think that's a trend that we're seeing. And this seems kind of noteworthy in light of the number of different transitive verbs, in particular the kids are already producing with I subjects. Right/ It's, they have, they know what that verb category is. And in addition, the third person subjects were not only rare, but completely absent for 3 of the 7 kids at risk for persistent SLI, at 36 months of age.

So, what is this leading us to think about in terms of breaking into sentence diversity? Well, some of you have seen this figure before when I try to talk about developmental steps and kind of trying to get kids to the language specific aspects of the grammar that they're trying to learn. And so, I really started first working out with what does it take to get English speaking to tense and agreement, right? And what we knew is they needed these diverse childlike sentences to get there. To have a childlike sentence, we needed to really build that verb lexicon, because it was this important interface between the vocabulary and the sentence types. And obviously they needed words. But I think what I have come to really appreciate, especially when we're thinking about the transition for children at risk for persistent SLI, is that while we're working to build the verb lexicon without subjects, going in, coming down, we also need to think about building a representation of a strong subject position without verbs, okay. And you might be saying, yeah, we knew this; we knew all about semantic relations. The challenge I think is that when we follow Brown stages, and think about semantic relations and MLU 1 to 2.0, well what happens next? Well, we get led to thinking about morphological development in Brown stage 2, because that's where plural and progressive and In and On come in, right? Well the point would be, there's a much more unified way, if we start to think about the complexity of these predicate types, to get from this verb step, which is actually verbs and subjects alone, before we go to verbs and subjects together. And so what we're really trying to work towards then, is thinking about how to move from semantic relations into diverse sentence types in a way that builds through developmental sequence.

So in conclusion, the sentence focused framework that we've been pursuing really emphasizes the continuity from words through early semantic relations and into diverse sentence types. It recognizes the diverse sentences as the foundation for the subsequent development of morphology and for morphosyntax, rather than emphasizing it at that early point in development. And by targeting sentence subjects in a systematic developmental sequence, we hope to promote the transition to sentences for toddlers at risk for persistent SLI, and for children with other neurodevelopmental disorders. And this is really the focus of the work that I'll be doing, or that I'm currently doing with my

colleagues Meg Roberts and Ann Kaiser, who's here, in trying to apply this developmental sequence in a clinical trial with children at risk for DLD.

I just wanna thank all my collaborators. Students in the lab, past and current. Oh, and I thought I had another thank you slide, but thank you so much for your attention.
(Applause)

Q: Hi, my name is Katrina Nicholas, I'm a assistant professor at Cal State East Bay. I'm here with my mentor Dr. Mary Alt. I just wanted to say thank you for your wonderful talk. I feel like this is great evidence for verbs as being the gateway to, to beginning to use sentences. I noticed for the treatment recommendations, one of the readiest, one, uh, readiness criterion listed was to start, so start therapy was that the child have 20 verbs or more. And I wondered what your thoughts were for how to use this approach for children that have fewer than 20 words. So, instead of going from the verbs to the sentences, how do they get from the words to the verbs? So how could we use this approach for that?

PAMELA HADLEY: Yeah, that's a great question, thank you. So what we have been doing for children who have fewer verbs is actually on this sort of step framework, we've been thinking much more about building the early location predicates, and the early attribute predicates. And in particular, I've also looked that these kids at persistent risk for how many of those words they actually have in their vocabularies. So the early location words, In, On; Up, Down; On, Off; not, they don't have all 6 of those at this point where typically developing kids would. We're also interested in really building the core vocabulary for attributes. Things like... Open, Close; that can be adjectival as well as verbs, right. for Wet, Dry; that are adjectival but can also become verbs. So Open, Close; Dirty, Clean; Empty, Full; because kids like to pour things. And what's; oh, and Hot, Cold; right? and so, we really see that the, the way to kind of build this sequence is to really expand those predicate types so that they can go into the entity location, entity attribute. And then I guess the other piece is that we're really, from there, rather than adding onto entity location, we're adding in. So the idea of adding in Go, Come; Go and Come which are those directional intransitive verbs, and Get, which is the become type of intransitive. Thanks.

Q: Thank you.

Q: Hi, my name is Kimberly Jenkins, and I'm a postdoc at the University of Texas at Dallas, and I'm here with my mentor, also Dr. Raul Rojas. And my question, this question relates to how early sentences are produced in children's language, based on a psycholinguistic pers, uh, perspective. So considering how early sentence, sentences have been ses—suggested to be produced from a psycholinguistic viewpoint, how might the development tr—trajectories of sentence structure differ for children with typical language development versus those with specific language impairment? And specifically, just kind of along that line of thought, for example, would it be expected that children with specific language impairment may demonstrate a protracted use of sentences primarily comprised of the highest frequency? **(Um-hm)** Subject-verb

combinations. And then in turn delayed use of the sentences produced by grammatical encoding.

PAMELA HADLEY: (Laugh) Okay, let me . . .

Q: I know it was a lot.

PAMELA HADLEY: (Laugh) Alright. So let me try to... restate the question. So your question is how would we try to promote... diverse sentences when kids with specific language impairment may rely more heavily on those, those memorized chunks. Yes?

Q: Or, um... also just based on... so I know in the initial part of your talk, you framed it in the psycholinguistic perspective. **(Um-hm, yeah)** And so just kind of, based on that perspective, what might be the differences we can expect to see . . .

PAMELA HADLEY: yeah well, so I think the; that's a great question; thank you for that. So one of the things that we have recognized is that what happens in typical parent/child interaction is that we tend to stay in what I call the I/you space, right. And that I/you space becomes a place where typically what kids are expressing are their wants and needs. and so some of the things that we try to do is to shift that I/you space, into the third person space. We've called it Toy Talk, to kind of get away from the "I want" "I need" talk, and more focused on the world of objects, and commenting on events in the world. And the reason I think it's so important is that I think children who have weaker language systems will rely on the strategies that have, are well practiced for them. And so much of what we see in interaction is "Do you wanna," "Are you gonna," and that's what the kids are giving back to us, right? And so, what I believe children with specific language impairment need, is more exposure to the rare things in language development. So they learn high frequency things well, but they struggle because the low frequency things aren't present enough or concentrated enough. And so what we're trying to do is push them into that third person space, which tends to be a much rarer kind of structure. And so I don't think they learn differently, I think they need a more concentrated focused exposure in the pieces of language that are rare and more challenging.

Q: Thank you.

PAMELA HADLEY: Sure.

Q: Hi, my name is Natalia Camacho and I'm a first year doctoral student as well, at the University of Texas at Dallas with Dr. Rojas. And my question has to do with your assessing sentence diversity subsection. **(Um-hm)** In your article. And it stated that the subject-noun phrase and the predicate or verb phrase are stated as the essential building blocks in sentences of all languages around the world. And while there's no (inaudible word) here on this statement, there are however, highly inflected and pro drop languages. **(Um-hm)** For example, such as Spanish, where you don't always need to have the subject-noun phrase or the verb phrase since they are encoded. I mean so the subject-noun phrase as it's encoded in the verb phrase, such as the who or the what or the how

many. So how would this then impact the assessment of the sentence diversity metrics for languages other than English that don't always require this noun phrase, and is there potential follow-up? And furthermore, what recommendations do you have for clinicians if they're looking to work with this metric?

PAMELA HADLEY: Sure. That's; thank you for that question. So in fact, some of our work on sentence develop diversity has been inspired by the fact we have international students who speak Spanish and who speak Mandarin in the lab. And so we've come to view the way in which children are developing the pronoun system as sort of equivalent to pro drop in Spanish, okay. And in fact, the way in which; so, those are elements that indicate strength of flexibility with the grammar, right? And so in fact, where we're using pronouns we think of pro drop. So if the child is using a verb without a subject, but the agreement marker is there, that would be evidence of a sentence for that child speaking Spanish. Okay? So that... so we've actually been playing with different ways of calculating it. Also, my students will tell me that when they're speaking to young children, they're gonna use the sentence subject to make it transparent, particularly for kids who have lower levels of comprehension, in order to make it much more referentially transparent. And similarly, where we're tryin' to go with our interventions is to talk about using these noun subjects in places where you are, where something is comment worthy, where it's new, where an object has moved, or an object has just changed state. And those would be the places where it would be very natural to use that noun across those different languages too.

Q: Thank you.

PAMELA HADLEY: Sure.

Q: Hi.

PAMELA HADLEY: Hey.

Q: Um, my name is Sabrina Horvath. I'm a postdoctoral fellow at Purdue University. I'm here with Arielle Borovsky. I'm gonna go back to this question of verbs. **(Laugh)** I know; I know you're not surprised. Um... but I was wondering if you've given any thought to kind of that intermittent stage. You talked; if you're tryin' to increase sentence diversity, really focusing on that subject. But the role of maybe the robustness of the representation or the... the complexity of the syntax involved. I know you're looking at subject predicate, but does that matter when the verb has an obligatory object or two objects, and what that might be in terms of therapy goals in particular?

PAMELA HADLEY: So I'm, I'm not sure I'm gonna answer your question directly. But I'll tell you what I've been thinking about the most in terms of verbs, And that's like, um... and maybe if I can go back to this little figure. **(Pause)** So, when we're looking at the early kinds of verbs that start to develop with lots of different subjects, you can kind of see the spokes are with Go and Come. So here... we've got lots of different 'Horse and sheep go.' We've got 'Baby go,' 'Danny go,' 'It go,' 'Waffle go.' Go is

everybody's best friend, right, 'cause you can "go" in lots of different manners. And so one of the things that... that I'm thinking about more is how do we use Go and Come as these directional verbs, and then begin to think about how we go in a particular manner. Right? So if the, the "Baby goes in," well, they're gonna crawl in, right? If the "Cow goes in,:" the cow's gonna walk in later. And if the "Ball goes in," it's gonna roll in. And so actually thinking about those general all-purpose verbs as a starting point, and using the locational particles as a way to really strengthen the, the introduction of the more semantically specific verbs later. Does that make sense?

Q: Thanks.

Q: Hello, my—Hello, my name's Ian Morton, and I'm from Vanderbilt University, and I'm here with my mentor Krystal Werfel. And my question was actually very similar to Kimberly Jenkins' question, so I'm hopin' to do a little variation on it. So, **(Laugh)** does the utilization of the second route of the (inaudible name) model that you talked about, pose a unique challenge for children with SLI? And if so, and this is the part that I'm particularly interested about, could you speculate where the major difficulties emerge in the encoding process for children with SLI? Do you believe that it's at the like lexical selection stage, at the grammatical encoding stage, or both?

PAMELA HADLEY: Well, I think what; so in terms of grammatical encoding, I think that kids need practice producing sentences. And that's kind of why we've looked at rate of sentence diversity, not just how many in 100 utterances. So I think of grammatical encoding as something that has to strengthen, right, and that the ability to insert different lexical items into those basic syntactic structures, just requires lots of practice doing it. And so the more that we can push them in ways to encode different lower frequency words, both nouns and verbs, into the sentence structure that they already have a basic foundation for, that that's what's going to make it become more automatic over time. And if they stay in that "I want" space, they're not gonna get practice with grammatical encoding. And the grammatical encoding needs to strengthen in order for them to have a real flexibility later on.

Q: Great, thank you.

Q: Hi, I'm Sean Stalley from, I'm a PhD student at South Alabama. I'm here with my mentor Dr. Rispoli. My question's actually a little related to Ian's question. I was wondering if you could talk a little bit about what kind of knowledge is said to be impaired when we're talking about lower sentence diversity. So if we look at that one child that, uh, the o—the only third person subject that was exhibited was "Him eating," the structure is there, the grammatical structure is there. So are we talking about there's a, maybe a, impairment or deficiency in lexical or semantic knowledge, or is it like a learning issue? What would you think that it is?

PAMELA HADLEY: Well, so, if I could; when I'm thinking about these very, very early basic building blocks, I think these are really the deepest universals of language development. And so I actually believe that what children with SLI struggle with more,

are the language specific elements of the grammar that they're learning that vary across languages. So what I'm looking for is how do we strengthen the sentence foundation, those most universal aspects. And so I think they just need more experience with those very, very basic foundations. This is not something that we see them having long term difficulty with. The idea is to move this part of the foundation forward sooner, so that they can use a strong and diverse sentence foundation to be able to sort through the language specific pieces of aspect and tense and case and agreement down the road. Does that make sense?

Q: Uh, yeah. So, would; like, kind of continuing with that then. So we're talking about language specific... structures and things like that. So would you; would that be something like, oh, well you have to learn, you have to gain the lexical knowledge to get there? Or is it you kind of have the . . .?

PAMELA HADLEY: Well I think the more diversity you have in those lexical pieces, (Um-hm) right, in the lexical categories of noun and verb, the better able you are to sift through the input that's being presented for detecting the patterns that are language specific and more irregular.

Q: 'Kay, perfect, thank you.

PAMELA HADLEY: Mokay, sure.