Do the Hard Things First? Treatment of Morphology and Syntax

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- [Amy] Once again welcome to the speechpathology.com webinar today presented in partnership with the American Board of Child Language and Language Disorders. Today's event is Do the Hard Things First? Treatment of Morphology and Syntax. And our presenter today is Dr. Amanda Owen Van Horne. She obtained her clinical master's at the University of Texas at Dallas and her doctoral degree at Purdue University. She studies the morphology and syntax and children with developmental language disorder. And most of her current work is focused on the treatment of these children. So we're very pleased to welcome her here today to talk to us. Welcome, Amanda.

- [Amanda] Hello. I'm gonna just make sure everyone can hear me again since we were doing, having a little trouble with audio there. So yeah, I'm gonna be talking to you about Do the Hard Things First? Treatment of Morphology and Syntax. And before I start I wanna make sure I've done my disclosures. So I draw salary from the University of Delaware, NIH and NSF funded research projects also support my salary and I'm receiving an honorarium here. I'm a member of ASHA and some ASHA SIGs, and I contribute to a website called dldandme.org, and so I focus on children with language impairment and I'm gonna use the language developmental language disorder to talk about children that might be called specific language impaired or expressive and receptive language delay or disorder in the public schools just so that we sort of know who I'm talking about.

At the end of this course you should be able to describe the challenges related to tense aspect that kids with language impairment face, describe semantic and phonological properties of tense and agreement morphemes that are associated with selecting easy or hard targets, and then explain rationales and treatment methods for thinking about easy first and hard first treatment targets as well. So just to kind of get us started, when I think about language therapy, part of what I think about is, what are we providing to the child. And so children hear language in their everyday life, and when we start to provide therapy we're either providing more language to them to try and

help them learn language better or different language to the kids to help them learn language better. And so I wanna talk a little bit today about both what are the strategies that we can use to provide more therapy, and what are the strategies that we can use to change the way we provide input to maybe make it a little bit easier for the kids to learn from that input. So when I think about more, and I think about it in the context of grammar, I think about four major strategies that support kids in that early language learning period when they're not quite ready for really structured therapy, when they're not ready for a rules-based approach or approach that involves metalinguistics, and that's auditory bombardment, observational modeling, syntax stories, and enhanced recast therapy.

And for each of these I wanna give you both the rationale and then the details of the strategies, because I think it's a little bit easier to think about how are these the same or different or what are they doing if we've thought about specifically why are we doing each one of these strategies and how do they work. So, when I start with auditory bombardment I think about this as being one of the lowest pressure ways that we can provide intervention to kids.

Elena Plante just recently published a study with some of her students looking at auditory bombardment as an adjuvant or as an extra thing that's added on to other kinds of therapy and it seemed to be a highly effective approach to treating language therapy, so, or treating language goals. So the rationale is that just like in speech sound disorders or phonological disorders we're gonna give you this really intense exposure to high quality accurate models. We want the kids to hear the sentences over and over again so that they can pick up on that language pattern and we want those sentences to be correct sentences. They're not necessarily matched with meaning or telling a story, we're just giving the kid lots of models. And the way we do this is we read potentially unrelated sentences to the child so that they hear the structure. In Elena's paper she read 25 sentences and it took about three minutes to read the sentences to

the kid. The child passively listens or does some sort of activity that sort of holds their attention minimally, like, coloring or holding a Play-Doh ball or a Koosh ball or something like that. and what she found is this is best provided after the kid has had a chance to produce the targets in therapy, but that it can also be a good helpful way to get the kids started before you've provided therapy. Observational modeling is taking the idea of auditory bombardment and sort of stepping it up a notch. and so in addition to providing this really intense exposure to high quality models we're gonna start to pair that with meaning. So you might do it in such a way where you use a toy to act out a situation. So you might have like a little Mickey Mouse doll or something, and the Mickey Mouse doll jumps over a chair or hops up and down, or does some other action that you act out for the kids.

So you're showing the kid what the sentence that you're about to read means, and then you describe the situation that you just did using the target form. So if I was focused on past tense I would make Mickey hop up and down and then stop so that he was finished hopping, and then I would say to the kid, oh look Mickey hopped. And about every fifth or sixth one, instead of saying, oh look Mickey hopped, I would provide a contrastive model.

Oh he hops, uh, I mean, he hopped. And I would intentionally make a mistake and self-correct, so that the child could then engage in comparison and realize that it's that the -da on the end of hop that actually adds the meaning that we're most interested in. Observational modeling has been around for a long time, Larry Leonard first described it in 1975, unlike some of the other strategies I'm gonna to talk about though, it doesn't seem to have a huge evidence base, but people seem to think it works and it fits with other strategies that we use for language learning like priming, like auditory bombardment, like syntax stories. I think the key thing here is that instead of just providing the models you're matching the model to a meaning and it's a very visual kind of meaning so that the kid can pick up on what the meaning is without having to

comprehend anything more than just the sentence that you said. Syntax stories provide another way of intensely pushing information in for the kids. Syntax stories were described by Finestack in 2006, but they've been used for a long time and work by Marc Fey, and work by Larry Leonard, and work by Steve Camarata. And again, we're looking at this intense exposure to high quality models in meaningful contexts. When I think about doing syntax stories I think about reading a short unillustrated story in which the target structure occurs at a really high rate at least 25 times.

Usually, I would read the syntax story before providing recast therapy, and I would do that as a way of priming or supporting access to the structure, so that then when we start doing recast therapy the kids already a little bit ready to learn, already has that structure kind of ready to go in their brain. Usually, I find that I can't use commercial stories for doing this, I have to write my own stories. Because commercially available stories don't use the target structure that I'm trying to teach often enough for me to use a commercially available story. The good news is, at least what we do in research doesn't involve illustrations, we just read the story, the kid listens, again, a Koosh ball, Play-Doh, coloring, something like that.

And so you don't have to go to a lot of work but you do have to have a little bit of creativity to put together a 10 to 30 sentence story that's gonna hold a child's interest for a few minutes. The most common way to provide more input, and I think the one that we all learned about in school is called recast therapy. I've added the word in red enhanced in front of the word recast therapy because again Meyers-Denman and Plante in 2016 provided this really nice way of kind of boosting the effects of recast therapy. In general, the rationale for recast therapy is that we're gonna try and follow the child's attentional focus. So whatever the child's focused on we're gonna follow and use that content and that context to talk about something. The child says a sentence and then we say a sentence back to the child that reuses sentence elements that the child has already said. And because of that prior activation of the sentence

elements we see that there's reduced working memory load, and that perhaps this immediate repetition allows the child to really engage in that comparison process that I just talked about with auditory, or I'm sorry, with observational modeling, and to put the focus on the target element, so the child can really attend to the contrast that you're setting up. The thing we do know is that then it's also still part of this intense exposure to high quality models in a meaningful context that's making it work. If I think about actually doing recast therapy with a child, I think about holding my target structure in mind and trying to get the child to say a sentence that provides me with an obligatory context for the target structure. That target sentence, that platform utterance from the child might be imitated, it might be elicited, or it might be spontaneous. And we used to think that it mattered.

We used to think that you really needed a spontaneous utterance from the child to meet that goal of following the child's attentional focus. That said, some work by Hassink and Leonard in 2010, suggested that that doesn't matter anymore. We can use any utterance from the child no matter how it was elicited. Once the child produces that utterance related to the target in some way, then you want to ensure you have the child's attention that's part of the enhanced part of enhanced recast therapy, and restate the utterance so that it includes the target structure.

So if I was doing past tense again and the child said, oh, he rolling there, I might say, yeah, the boy rolled on the ground. And I'm gonna kind of emphasize that, I'm gonna ensure I have the child's attention and then I'm gonna put that past tense on the end there. It's really important that we focus on one target structure at a time. Recast therapy works when it's focused stimulation, not when it's general stimulation. And it's also important that we provide a high rate of recasts. The general recommendation in the literature is that we're providing a recast a minute with really high intensity and that we're looking for a dose of about a thousand exposures. Now I wanna highlight what that means. And I put the title here, says a lot more, because I realized that if I was

practicing in the schools this would be a really heavy lift for me to achieve, the dose that I'm asking for. So we know that in order to achieve a gain of about a standard deviation, you need around 10 to 20 hours of therapy with recast of a rate of about one a minute. If I'm hitting the recast rate of one a minute and I see a kid for an hour a week then I can expect to see gains in about 15 weeks. It's a lot of therapy to provide. It's a little bit impractical amount of therapy to provide. But you can see how if either you're not recasting as often or if you're not providing as much therapy, the dose falls off really fast, and so you really have to be pretty consistent. I'll also say that from my own experience I only hit this recast rate when I'm keeping track of what I'm doing. When I'm keeping a little tally sheet next to me about how many recasts am I providing.

The last thing about enhanced recast therapy that I want to call out is this idea of making the input variable. Now that takes us down the path of the next thing, which is different input. So I'm gonna kind of hold that thought but I want you to know that when Elena Plante publishes on enhanced recast therapy, her three enhancements are, ensure you have the child's attention, provide a high cut rate of recasts and make the input variable. And that kind of takes us down to the next thing, which is thinking about how to make the input different. Because it's such a heavy lift to get recast therapy to work or to get any kind of language therapy to work, we have to think about whether kids just need more exposure to the same kind of input that every other kid hears, or do they need the input to be a little bit different in some way? If we tweak it, can we make it so it's a little more accessible, a little bit easier for them to see the patterns, a little bit easier for them to incorporate in the learning process. So to think about that I wanna think about how we select the verbs or the words that we're gonna use, and we think about doing two different strategies. One strategy that seems to work is increasing the variability of the words that we pick, and another strategy that seems to work is picking the targets specifically with the idea that we're trying to get the kids to generalize to new contexts. So not just picking the easiest thing next but actually picking the things that sort of stretch the kids so that they might generalize to new

things. In both of these cases, this requires that we come into a speech therapy session with a little bit more intentionality, a little bit more pre-planning, but it's not impossible. In each of these cases, I'm gonna give you a vocabulary example and I'm gonna give you a grammar example. And I know the webinar is focused on grammar but I think for some of these examples it's a little bit easier to hold on to the vocabulary example and then think about how it applies to grammar then the other way around.

So I hope that by giving you two examples I'm giving you more variability and you might be able to take this out and generalize it to some new context outside of the ones that I'm suggesting here. So if we think about vocabulary instruction the example that I'm gonna give you for exemplar variability has to do not with how do we pick the words that we teach but how do we pick the materials that we use for teaching kids the words. So my colleagues at the University of Iowa, Lynn Perry, Larissa Samuelson, and some of the students in that lab taught typically developing kids with very small vocabularies, 12 new words. So these were kids who knew fewer than 10 words at the start of the study, and half of the kids in the study learned 12 new words using very similar exemplars, and half of the kids learned 12 new words using different exemplars.

And then they measured whether or not the kids learned the target words and I'm gonna like peek behind this curtain and say they do learn all the target words and then they tracked the kids word learning over time by having the parents complete the MacArthur-Bates CDI every week. So just to illustrate what this exemplar idea looks like, the question wasn't, did the kids learn the word bucket? All of the kids in the study learned the word bucket but some of the kids in the study learned the word bucket using three different examples of a bucket that were very similar examples. And some of the kids in the study learned the word bucket by being exposed to very different examples of what a bucket is. And so the question was, was it easier or harder for the kids to learn? In one case, did they just learn the words better? And then how did that support their general word learning? I naively would have thought that kids in the

similar exemplar condition would learn the word better because it would be easier to see and figure out, oh, this is what a bucket is. And that kids in the variable examplar condition might not learn it very well, but that's not actually what happened. So again we have our variable exemplars of ball, our similar exemplars of ball. Kids were tested at baseline. Let's see if I can use this pointer. Kids were tested at baseline and you can see the two groups are not different here at baseline, the variable condition group and the tight condition group are not statistically different here, they've jittered the dots just a little bit so that you can see that there's two lines there but really it's the same line. So for three weeks they tested the kids just over and over on the CDI. And then they started to teach the kids new words.

And so during this next period, this next six week period, the kids learned words like ball and bucket and half of the kids got those variable examples, and half of the kids got similar examples. And then they kept following the kids, and what they found was that at the end of the follow-up period the kids who had seen the variable exemplars were better word learners than the kids who had seen the tight exemplars. And so increasing the variability of the examples you pick for teaching the target word improves the ability of kids to then understand something about what makes a word a word. How do words label categories and then they're able to apply that even into vocabulary words that are not a part of the training condition.

Similarly with grammar we might think about that in terms of how we do that enhanced recast therapy. So Elena Plante had kids come into the lab for recast therapy, there was a low variability condition and a high variability condition. Everybody came in for 30 minutes a day, five days a week for five weeks. Everybody got 24 recasts per session, so the overall dose was the same, and everybody used play based activities for learning the words. So it was something that was very naturalistic, very interactive. But half of the kids only heard 12 unique verbs during their therapy session, and half of the kids heard 24 different verbs during an individual therapy session. What they found

was that in fact the therapists were pretty good at sticking to the requirements for using either low variability or high variability verbs in their therapy session. So the low variability verbs, overall, the clinicians used around 100 different verbs. So on any given day they use 12 different verbs, and then over time over the whole five weeks they use just over 100 different verbs. In contrast for the high variability condition, again, over the five-week period, we saw that on any given day they used 24 different verbs, but that if you added up all the different verbs over all the therapy sessions we were closer to 175 different verbs.

So the therapists were able to vary the number of verbs that they provided in the therapy session pretty easily. When we look at what that means for change and accuracy, what we see again is that for the target morphemes, the morphemes that they were trying to teach in therapy, the kids were the same at pretest, they also had a second morpheme that they identified that they didn't teach during therapy that control morpheme was also not significantly different between the two groups at pretest. So gray means low, pink means high, so the same color scheme is carrying over. And we're looking now at percent correct use after change following five weeks of therapy. In the post-test period what we see is that the kids who were in the low variability condition did get better.

They are actually significantly different than they were at pretest. But, the kids in the high variability condition got even more better than the kids in the low variability condition. And we know that that is working because again the control morphemes don't change at all. So the morpheme that they weren't trying to treat that was just there, they documented it at the beginning, it was still about the same level of performance at the end. So this would suggest that using highly variable verbs paired with a particular morpheme can lead to better learning in terms of grammatical learning. So one strategy to make our language different when we're thinking about teaching kids something that might make it easier for them to learn is to increase the

exemplar variability. You're teaching words, think about changing up what are the examples that you use so that you show the whole categories. If you're thinking about grammar, what you really wanna think about is not, are the verbs different but rather you wanna think... Let me try this again. Somebody's asking a question that I think is a useful one. We don't really wanna think about the contrast between the verbs, we wanna think about using 24 or more different verbs, lots of different verbs. So you might for instance in the low variability conditions say, walk, run, hop, jog, hike, climb, fish, swim, drive. I'm running out of words, you kind of have to pre-plan these, read, and sleep, that's 12, I think. And then if you wanted to get to 24, you would use all of those 12 verbs plus another 12 new verbs. And the idea here is just that they're hearing lots of different examples.

For exemplar variability, one of the things I think about is if you were learning to tie your shoes and you only learned with one type of shoelaces you wouldn't be very good at tying a bow tie when you had to tie it say on the back of a dress or a bow in a hair because you've only learned to tie with one kind of material. In the same way when we're teaching the grammar example we're looking at just stretching it so that they hear -ed or they hear -ing on the end of a lot of different verbs, and so that's what we're really thinking about with regard to exemplar variability.

A different strategy is to select examples to promote generalization. This is a little bit trickier to think about because we really have to think about whether we understand what causes change in the language of typically developing kids. And so again I'm gonna give you a vocabulary example and a grammar example, and hopefully by putting them together they're helpful. I'm gonna say that in both of these cases for both the vocabulary example I'm gonna talk about teaching the shape-bias. And in the grammar example I'm gonna talk about some kind of linguistically nitty-gritty things around tense and aspect. And if I'm not being clear, you can go ahead and pop a question into the Q&A and I'll try and pause and re-explained something or give a

better example. I think the hardest part for me about doing a webinar is that I can't see nodding heads or like furrowed brows, so I don't exactly get the feedback that I'm used to getting for knowing whether I'm being clear. So if there's too many questions I won't address them, but if there's one or two clarification questions I will try to address those specific questions related to the topic. So vocabulary example, teaching the shape-bias. So the shape-bias is basically this idea that in children's very early vocabularies, rigid things with the same shape tend to have the same name. So bottle thing, if you call something a bottle, bottles tend to be bottle shaped, and chairs tend to be chair shaped, and tables tend to be table shaped. And that sounds like a super obvious thing to say until you realize that there are actually things that aren't like that. So for instance, shampoo isn't shampoo shaped, right?

So for deformable things, things that can change their shape, it's the material that drives the name that we give it. But for things that hold their shape it's the shape that drives the thing, the name that we give it. So the shape bias is something that kids figure out pretty early, and part of what drives the word burst in young children is the fact that they go, aha, I understand the shape-bias, and now I only need to hear a word once or twice before I'm like, oh, that word goes with that shape. Boom, I know what to call that thing. Kids discover the shape-bias from input statistics and they get this really nice boost from learning this property of words.

So we're gonna ask, can we induce the shape or the material-bias and kids? And if we can, does learning one of these biases help them become better word learners? Again, Larissa Samuelson, a colleague of mine from the University of Iowa did this work, and she taught very young, typically developing children either shape-based nouns or material-based nouns. So kids learned words like bucket or pear, or they learned words like frosting or wax. In each of these cases half of the words the kid learned were things that you could eat, and half of the kids the words the kids learned were things that you could not eat, because a lot of the material-based nouns are things like

frosting or pudding or milk and so they're just like interesting in a different kind of way. In each case, they were either organized around shape or they were organized around what they were made out of and the kids all learn new words. So the question is for the kids who were in the shape-bias condition, can we cause them to like have that aha moment where they discover the shape-bias? For the kids who are in the material-bias condition, can we cause them to have that aha moment where they discover the material-bias? And in either case, if we can teach them that, does it make them become better word learners? Do we see that same separation that we saw with the tight versus the variable condition where the two groups start to pull apart and they start to actually like be better at learning words not just learn the words that we taught them in the lab. The way the testing trials work is a little bit funny because no matter what condition you were in you would get a test trial where someone would give you a novel word. This is a merf. And then they would ask you to find another merf.

And if you thought that words are organized on the basis of shape then you're gonna pick, find my thing here, if you've learned, if I say this is a merf, find another merf, you're gonna pick the green one if you think merf's come from shape. On the other hand if I say this is a merf, find another merf, you're gonna pick this one if you think merf's come from the stuff they're made out of, right. And so remember, let's see if I can back up here, remember that half the kids learn based on shape and half the kids learned based on material. So we would predict that the kids who have been learning based on shape would pick the shape one, and the kids who have been learning based on material would pick the material one. And in fact what we see is that kids who were in the shape-bias condition whether they saw a solid thing or a non-solid thing, they tend to pick the stuff that's based on shape. And kids who are on the material-bias thing tend a little bit but not significantly to pick the stuff that's based on what the thing is made out of. And the kids who hung around and didn't get any training at all stay right at chance. So we're able to induce the shape-bias and kids in the lab but it's less clear that we're able to induce the material-bias in the lab for kids. We can cause kids

to have the aha moment for shape, but it's not as clear that we can cause kids to have the aha moment for material. That said, the material-bias kids were more likely to pick based on material match than the kids that got no training at all. So they were different from the no training kids. There we go. So, can we induce the shape or the material-bias in kids? The answer to that is yes for the shape-bias but it's not clear for the material-bias. And one of the reasons why that might be is that when you go out into the real world something like 95% of the words that kids know at this age are organized by shape, so they learn about the shape-bias in the lab and then they go into the real world and they get more extra shape-bias from the real world.

That's not true for the material-bias. If you learn about the material-bias in the lab and you go out into the real world there's not that many words that you're gonna hear in the real world that bring in the material-bias. So for me this highlights the need for what we do in therapy to be different, but not that different, it still needs to line up with what kids hear in the real world. Then we can also ask, does this help them become better word learners? And again, this is the training, like did you learn the words that we trained you and how do you do with novel words. And then just like with the other group or with the other graph that I showed you, we have, how did the kids do at pretest? All the groups were the same on the MacArthur-Bates CDI.

How did the kids do at post-test? And then, how do the kids do at a one-month follow-up? The red line is the kids who are in the shape-bias condition. The dark gray line is the kids who were in the material-bias condition. And the light gray line is the kids who didn't get any training at all. So you can see again that once we start to focus on what's the general word learning principle, then the kids start to take off, they understand that words are organized by shape. So you could imagine that if you organized words for teaching kids with very small vocabularies new words and you wanted to teach them general word learning principles, you might start by teaching them the shape-bias and then you might expand to think about teaching them things

about how big as a category using those more variable exemplars and you might see some of this sudden expansion of vocabulary that takes off a little bit outside of the, the therapy room. So, does it help them become better word learners? Yes, to the shape-bias. Learning 12 words prompted generalization of the shape-bias principle and accelerated word learning. But not really for the material-bias, and at this point it's not clear if it's because the kids didn't learn the material-bias or because the material-bias wasn't actually a useful principle for them to learn. What about selecting examples in grammar that promote generalization? That's a little bit trickier to think about because what does it mean to promote generalization of past tense, or what does it mean to promote generalization of understanding -ing? And so, for this one I'm going to talk about a study that I did, it's published in JSLHR, and it looked at whether selecting the target words that we use to teach past tense can help to promote better generalization for kids.

We might start by thinking that one way to go about teaching kids words might be to use really simple verbs that are phonologically easy to inflict and that use really common event semantics that are associated with past tense, and I'll unpack what those two things mean. And so that might be one approach that we could take. If we're thinking about phonologically easy to inflect verbs, we can think about what happens to the verb when we stick the morpheme on the end. So if we take a verb like play and we put -da on the end of it, we've made the word a little bit longer, we've given it a final consonant but we haven't actually changed very much about the word. It's still just a vowel consonant, there's no consonant cluster there, it's pretty straightforward. On the other hand, if we move through a list of words and so we go from something like played to something like colored where there's a little bit more of a combination there to fished, now we've got a consonant cluster, to jumped, now we have a really complex consonant cluster, to rested, where you have to add a whole syllable. You can see that these verbs become increasingly phonologically more complicated. Adding clusters, adding whole syllables, that's a little bit more work for the kids. Similarly, we can think

about the way that kids go about doing pattern matching. So if you're a kid who's trying to learn what's the pattern for past tense? How does past tense work? And you hear a word like rest. Now you could think, oh rest, I need to add -ed on the end of that to make rested, right? But you also could think, hmm, I know a different word, I know a word named mess, and mess turns into past tense by adding d to the end, messed. So maybe you get confused and you backwards form that and you think the root is res instead of rest, right. So you can see where if a kid is looking for what's the pattern, I don't really know what makes past tense, I'm just gonna pay attention to what the pattern looks like that we have words in English that might be a little bit confusing about what's the past tense. Weigh to weighed is one word, but wade, let's see if I can point with the pointer instead of my pointer.

Weigh to weighed is one word, but wade to waded is a completely different word with a completely different meaning. And so these things might be difficult for the kids too. So we can think about phonological complexity as having two parts. One is, consonant clusters, number of syllables in the word, just how hard is the production accuracy of the phonology. But also how easy is it for me to recognize that this word has been inflected for past tense, and both of these things can contribute to picking a word that's easy or hard in the area of phonology.

Now, I think it's really important to say that if we're taking a list of words that we think our kids know and it might be a whole long list of different kinds of words that we're picking for different reasons, and then we're trying to organize them into easy or hard words, we might find that for past tense it works one way. Here are extra words that have simple coda's, that have medium complexity coda's and that require adding a whole syllable. And this is the kind of words that if they end in -t or -d or -id then it's confusing for the kid, was that word inflected or not? If I have a word like nest or rest, ones inflicted and ones not. And how do I know which ones inflected and which ones a completely new stem? So the pattern matching thing is a little bit tricky. But if we look

at say third person singular s, then which words get organized as easy, medium, and hard changes, and the things that are associated with pattern matching have to do with -s, -z, and -iz, instead of -ta, -da, and -id. So it's a little bit of a different problem space as you change from past tense to third-person singular. I'm gonna pause for a second and I just wanna look at the questions because I feel like this is an important piece and I wanna to be sure that I've given good examples. Wade is not, so someone asks, would I say that wade is the most phonologically complex when it's inflected?

And I think that person is asking about this here. It's not that it's got more coda complexity, it's that at this point when the child's trying to decide, do I need to put something on the end of that word or it's already marked, it's a little bit confusing for the kid. And so they're trying to figure out what's right and what's wrong for adding, and whether I should add another inflection onto the end. It's not about the spelling, it's about the pronunciation, and it's about, thinking about how the, how a combination of the addition of additional sounds here makes things more complicated or whether or not they've already figured out what the pattern is and they can identify the pattern. Okay.

So, that's sort of the linguistic background and we might start by thinking that picking easy things, picking the things that have the simpler code of complexity and aren't confusing at all in terms of pattern matching would be the easiest things to start with first. When we think about prototypical event semantics then we're thinking about something a little bit different. We're thinking about picking verbs on the basis of how well the verb itself matches to the ending that's on the end. So tense means when did the event happen relative to when I'm talking. So if I say, I am swimming, then you assume that I'm swimming right now while I'm talking about it. If I say I swam, you assume that it's finished. Aspect has to do with event duration, how long is the event. So swimming is an event that you tend to do over a period of time, it doesn't happen super fast, right. It happens, you know, you're swimming for a while, you swim laps in

the pool, you swim in the ocean, you're at the beach for the day, swimming tends to be an ongoing event. On the other hand, other kinds of events tend to be more completed. And so we separate out lexical aspect, what's the duration of the event based on just how long the event tends to take from morphological aspect. Information that gets added based on the morpheme that you're adding to the end of the verb. And that's a little bit of a different way to think about pulling apart the way words work. English is funny, it's different than other languages. So it's different than Spanish or Hungarian or these languages because it mushes tense an aspect together into the same grammatical marker. So if we have a sentence like he is or was jumping, we're able to see these things pulled apart. Is and was provides the information about tense, and -ing provides the information that jumping is an ongoing event. On the other hand, if we have things like jumped or jumps, that's where we start to see that mushing together.

- Ed tells us that it happens in the past, but it also tells us that the event was completed, that was it finished. And -s tells us that something is happening in the present tense, but it also kind of tells us that the event happens over and over and over again, habitually, that it's a regular event. And so because they combine tense an aspect they can be a little bit tricky for kids to crack into. It can be a little bit tricky for kids to figure out do I add -ed when it's a different speaking time, or do I add -ed because something was finished or completed even if it's just now being finished or completed? One of the ways that I think about these prototypical event semantics is to think about when I hear a word like fell what do I imagine, or what comes up first in the Google image search? So when you look for the word fell you most often see things where the person has already fallen. They're on the ground, the event is finished. When I see a word like dropped I most often see events that are like the cookies that are already on the ground, not where dropped is like midair dropping. And with closed we most often see cases where the word, the thing is completely closed already. The contrast of course is falling. If you hear falling, you know, he was falling. You tend to

imagine sort of the Wile Coyote falling down the cliff going forever and ever, or the superhero falling from the hotel building, and in fact those are the kinds of images that come up first on Google Image Search. This camera is a better example of dropping then of dropped. And for closing, it was very hard, I couldn't actually find a good picture of closing that was an image that reflected the ongoing nature of closing. And so you can see that for some of these kinds of words if you think about how the world works we tend to see that things are completed and that we talk about completed events in the past tense and it has to do with the way the event is structured, certain events tend to be more completed events.

When we think about third-person singular -s and the habitual nature, it's also possible to see that by contrasting verbs that tend to show up with -s on the end and putting it into a different grammatical form. So you say things like he wants ice cream, but it's kind of weird to put that into ongoing a telic aspect, he is wanting ice cream, that's weird. He is owing me money. She is knowing the boy's dad. She was detesting broccoli. Those are all sentences that should feel odd to you. And they feel odd because somehow we're mixing up the, the tense and the aspect together in a way that's not usual.

It's possible to say all of those sentences but it's not usual. So when people talk to kids, Li and Zhao surveyed what do people say to kids, and when people talk to kids they tend to say ongoing or activity verbs. Verbs like coloring, playing, swimming, they tend to say those in -ing form most of the time, 65% of the time they say these verbs that are about activities in the -ing form. And they only occasionally say those verbs in past tense or third person singular -s forms. They tend to say events that are completed or telic events Telic is the fancy linguistic term for completed. They tend to say completed events in the -ed form more often, and they tend to say stative or habitual events like knows or likes or detests in the third person singular more often. Again, it's not that you can't use all verbs flexibly in multiple forms, it's just that there

tend to be patterns about how we talk to kids and therefore about how kids talk that focus on these patterns. This affects accuracy, so kids are also more likely to be accurate with stems that end in vowels and that are completed events when we're trying to get them to say past tense. And they're least accurate with words that are ongoing in nature and where the stem ends in a consonant for past tense. And this lines up with recommendations from Brian Weiler who suggests, hey, we should really focus on selecting words for teaching that use prototypical event semantics and phonologically easy stems in order to promote accuracy. And so that's a developmental approach or an easy first approach to teaching words, or teaching past tense markers.

When I was doing some reading about this I learned that typical kids initially produce the markers that they know with verbs that match on the aspect of the verb. And it's only when they start to hear the word in a different form like hearing likes as liked that they start to decompose the word into its constituent morpheme. That's when they take it apart and they realize, hey, -ed actually adds meaning to this word, it doesn't just reinforce what I already know about the word. The same if you heard jumped as jumping or wants as wanting. At that moment the kids sort of has this, aha, I know that this morpheme does something extra.

And that's the point at which we start to see really rapid generalization on the part of typically developing kids. So, that got me to thinking that maybe the right answer isn't picking the prototypical events, and maybe the right answer isn't picking the easy verbs, maybe we should be picking the hard things instead. Maybe by picking the hard things we help the kids to see that when you add -ed to the end of rest, hey, that added information. When we use something like falling instead of fell, hey, that added information, and that motivates the kid to then try to use the grammatical marker. So the second hypothesis is maybe we should use non-prototypical words and phonologically hard to inflect verbs as our teaching platform. So we designed a

morphology intervention where some kids went stair step up through easy verbs then to the next hardest verbs, then to the next hardest verbs and so on where easy was defined as verbs that were completed and easy to inflect phonologically, and hard was defined as verbs that were more complicated to inflect, and that were more ongoing in nature. And some of the kids started with those same verbs at the edge of the circle and gradually worked their way down the stair step or towards the center of the circle. Again it's important to realize that the verbs at the center of the circle just like the shape-bias are the verbs that they're hearing in their everyday life. So these are the verbs that are getting reinforced in their everyday life, and these are the verbs that it's unusual to hear in the past tense when you're just a kid going about your daily life. So we asked, do kids assigned to easy first or hard first condition make faster progress in therapy?

Do they make greater gains on the verbs we taught them? And do they make greater gains on other verbs that we didn't teach them? We had nine kids in the easy first condition and seven kids in the hard first condition, that's just how randomization worked, and the groups were pretty evenly matched overall. Half the kids started with easy first verbs and worked their way up, and half the kids started with hard first verbs and worked their way down. So every kid was exposed to all the possible verbs but they just started in different places.

And then we check to see whether we were able to provide intervention well to everybody. Just like what I was saying before, we use some sentence imitation, some observational modeling, syntax stories and then recast therapy. And so those were the more, how are we getting more information into the kids. And we check to make sure that both groups heard the same total number of recasts and that both groups heard the verbs recast an equal number of times. It was harder for the kids in the hard first condition which is always depicted in red to get as many recasts as the kids in the easy first condition because they just didn't know the verbs as well, so it was harder to

get a platform utterance. And so then we asked, did one group make faster progress than the other? And the disappointing answer was no, the kids didn't progress from one list to the next list by getting the words right any faster in the hard first condition where they started with list six, or the easy first condition where they started with list one. Some kids were jackrabbits and moved right along, some kids were turtles and kind of poked around, but it wasn't different across the two conditions, they were equal. Then we asked whether one group was more accurate at the probes where we were asking kids to produce target verbs, the verbs that we taught or verbs that we held out as untaught. And in both cases we saw that the kids in the hard first condition were better at post-test at the target verbs than they were than the easy first condition, and that was true both for verbs we held out and for verbs that we directly taught.

I'm gonna skip this next point in the interest of time, but what I'm gonna say is that we did some, just being sure that it was really about them generalizing and what we saw is that it was the verbs that we never taught that showed significant differences even though this looks like it's different, it's not significantly different which is always a bummer. And it was the verbs that we didn't teach where we saw the particular gains that we were looking for.

So, hard first kids were more accurate on target and generalization verbs than easy first kids, this was only on verbs that were never taught during the treatment, and fidelity was good but it was especially good for the structured parts of therapy, it was harder to be good at providing therapy in the hard first condition for the recasting. So why is hard first effective? Hard first might be effective because kids recognize how morphemes work, they figure out how to take the morpheme apart and that they know that it adds extra information to the word, but it also might be that we added more variability to their input by using really unusual examples. So if you're constantly hearing jumped or liked, words in a past tense that you don't normally hear in the past tense then you might also just be getting more variability in your input overall. We're

expanding the variability because we're providing extra information that goes beyond what they might be hearing in their everyday life. So when we think about different we want to think about different in terms of how we select the words we use in therapy. We might wanna increase the variability, this is certainly the easiest one I think to do. Or we might want to select the words we use to help the kids see a general principle about how words work or about how grammatical markers work, and that requires really deep understanding of how words and grammatical markers are learned by kids and what prompts that change. So just to remind you, these were the more strategies and we've talked about different strategies, and so more and different is what makes language therapy work in my opinion. And I have references at the end but I'll leave it on this slide for taking questions. And I don't know, I think we maybe have like five minutes for questions.

- [Amy] We do, yes. I just wanted to ask you, Amanda. So as far as you know like the state of the current evidence, it sounds like you have some good preliminary evidence that treating in a more complex fashion or harder things first is more effective but we don't have as much research as we need, which is, which seems like the always the answer which is we need more research. And so as far as being able to implement this what would you say the biggest--

- [Amanda] I've actually thought about that a lot, and I think the biggest challenge for implementing it is figuring out what those general principles are for each specific grammatical marker and figuring out how to promote generalization. And that's something that I think might, it's really like an entire lifetime of a research program. So it's a little bit tricky.

- [Amy] There's so many aspects and complexity, right?

- [Amanda] Right. That said, I do think that we can think about the fact that when we're doing language therapy it's not just enough to provide more of the same thing that the kids are getting in the real world, that we actually wanna think about how do we prompt that child to make broader change. And the examples can vary depending on the child or the marker, but we wanna be actively thinking about how do we promote generalization. I actually think Elena Plante's work on variability might be the easier thing for the average clinician to do because it's easier for me to just keep a tally mark of did I use 24 different verbs. And maybe by using 24 different verbs we're going to expand so that we've covered some of those hard verbs and the kids are getting exposure to those hard verbs. If I'm trying to do the hard verbs though when I pick the wrong verbs then I might feel a little bit frustrated. The paper that I referenced provides a complete list of easy verbs and hard verbs for past tense. We're in the process of doing that work for doing third-person singular -s, and I don't have any other references at this point for other kinds of hard things. I will say the hard first stuff has good reference. In aphasia they use it for teaching syntax and phonological disorders, Judith Gierut's work supports it, Edwin Maas is using some of these principles for working with childhood apraxia of speech. So I don't think it's quite that preliminary, it actually seems sort of like a cross-cutting principle that seems to be working, but working out exactly how to implement it as a practicing clinician I think it's tricky.

- [Amy] Sure. It sounds like we have, we have several people asking similar questions, and I think they're wondering about specifically for kids with developmental language disorder. Would you say that the idea is they tend to have problems with all of this stuff, right. Tense and aspect and agreement.

- [Amanda] Yeah, what we see is that kids developmental language disorder struggle with tense and agreement markers across the board in all languages, and we see that they struggle with it all the way up into like early high school. And so you can see weaknesses across the board, it just changes from being spoken to being written, but

it's all in there. In English, especially, just like tense and aspect are mushed together, tense and agreement are mushed together. So we can't say third-person singular present tense without talking about third-person and singular. So we that agreement in tense and agreement in aspect are all just one giant mush, and so we really have to think about how to teach in a way that stretches kids to see again that adding the morpheme adds that information on to, to the word and so then they can see how the patterns work.

- [Amy] Okay. These kids in English probably omission of morphemes, the morpheme question is what they have the most trouble with.

- [Amanda] Yes.

- [Amy] Got it. Someone just had an interesting, actually there were two people that made the same interesting comment when you were talking about shape-bias versus material-bias, and with the example about merf, they commented that how the question is worded might influence how they would select their answer. And if you said this is a merf they might be more apt to go with a shape or a thing, whereas, if it was worded without the article--

- [Amanda] Yes, without an article.

- [Amy] If it just said, this is merf, that sounds more like a material, and they might choose based on that. I thought that was an interesting observation.

- [Amanda] Super interesting question that has had, I love it because it highlights why grammar is so important for word learning and why we can't blow off grammar and be like, well we just need to know the content words, because grammar gives us information that helps us learn the word, so I love that question. I do know that there's

been quite a lot of work on how the actual question is worded, and I might have messed it up in transferring from the article by my colleagues to the slides as to exactly how they worded the question for the novel items, I know they were super careful about that. And I know it even matters not just whether you say this is merf, or this is a merf, or this is some merf, but also if you say find more merf, or find another merf, or find another one, or find what's just like it, that there's lots of different ways to ask those questions and it does change the result. I think the critical part for the takeaway message is that the kids who were in the shape-bias condition and the kids who were in the material-bias condition were asked the questions in neutral ways and we still got those differences. And so even if my translation to my slide kind of messed it up, it translates reasonably well across from one to the other.

- [Amy] Got it. All right. Well we are gonna have to wrap it up here.

- [Amanda] Okay.

- [Amy] I know that there are some questions that we were not getting to but we kind of ran out of time. There was lots of interesting discussion and more work to be done as always. But thank you. Thank you very much for sharing this work with us and some really interesting concepts about how to approach, how to approach treating these kids. Thanks to everybody for your patience. I'm sorry for my little audio problem at the beginning, I think that got us a minute or two behind, but I hope that everybody has a good weekend that we see you at another webinar before long. And thank you very much again, Amanda, for being here with us today.

- [Amanda] Yeah, I am seeing one comment about there being other questions that we don't have time for. And I'm absolutely willing to either chat on social media, so I use Twitter and so my Twitter handle is @telllab T-E-L-L-L-A-B. And my email address is ajovh, so it's my initials, @udel.edu. For the general questions, if you use Twitter I'd

much prefer to answer them on Twitter because then I can answer a question publicly and people can see the answer and I don't have to like answer individual emails repeatedly. But I'm glad to try and answer a more detailed or a more specific question on Twitter or over email.

- [Amy] Gotcha. Did I get your email address correct--

- [Amanda] Yes, it's correct.

- [Amy] All right, perfect. All right. Thanks, everybody. I will go ahead and wrap it up here, I appreciate everyone being here today.

- [Amanda] Yep, thank you.

- Bye.

- [Amanda] Bye-bye.