Transcript

SUSAN ELLIS WEISMER, PHD, UNIVERSITY OF WISCONSIN–MADISON

HELEN: It is really my pleasure to introduce the first of our afternoon speakers, Susan Ellis Weismer from the University of Wisconsin. Now, what's true, what's common across our 4 speakers this afternoon is that they did not, unlike the 3 of us this morning, start out as autism researchers. And… Susan's best known prior to the last 5 to 10 years or so, for the remarkable work that she has done illustrating the nature and mechanisms involved in specific language impairment. And I think she brings the kind of work that she has done on SLI, turned her attention to autism, and brings a, a very complementary perspective to the other research that has been done on trying to understand the nature of language, language development in children with autism. So with that introduction, I'm delighted to welcome Susan who will be speaking on executive function abilities in school age children with autism. (Applause)

SUSAN ELLIS WEISMER: Thank you very much for that lovely introduction. And I'm really glad that Helen, uh, set it up that way, because I was telling other people oh, I feel like a poser at this. You know I'm not an autism person, I'm a language disorders person (Laugh) and I just happen to be studying children with autism spectrum disorder for the last 10 years or so. But I'm delighted to be here; I really wanna thank Helen, and I wanna thank ASHA and, and I… C, uh, DCD, and… um… everyone who's helped to put this together. Um… it's so… much of a treat to learn and talk to everyone, um, and to be able to really concentrate and focus on an area that, um, everyone's passionate about. So, um… I'm very excited about that. Let me get on with my disclosure statements.

First of all I have a job. Um, (Several people laugh) secondly, I do receive grant funding from the NIH. Um, I'm a member of the NIDCD, uh, Advisory Council, and, um, I was compensated like the other participants, uh, for, um, participating in this symposium. Um, I'm a member of ASHA as well as other organizations, and, um, I am a member of the program committee this year, but we didn't have anything to do with organizing this. So I didn't invite myself. (Some people laugh) Oh, and these are the specific, um, grants that have helped to fund this particular work. I do have other grant funding, but they're not relevant to what I'm gonna be talking about today.

So there is a session handout that was uploaded, and as part of that I included a detailed outline along with 2 pages of references that are, uh… integrated in, in, or really sort of put into different topics, so that you can get an idea of, of some of the… exemplary papers that you might take a look at. And if your paper isn't there, I'm really sorry. It just, it's just illustrative of some of the great work in the area.

Okay, so let's dive in. Executive functioning really is an umbrella term for a set of cognitive processes that let us control behavior. And we know that executive function or functions, are made up of many different processes, and these are related but yet separable processes And this has been shown over a number of years of, of research with both typical and atypical populations.

While we don't necessarily agree on the particular cognitive processes that are involved, there have been a number of large scale studies, um, using latent variable analysis for example, to try to look at these subcomponents of executive function. And… in the literature a number of researchers would claim that the core components of executive function include inhibition, task shifting, and updating working memory. Then these core executive functions, along with other cognitive processes make up, and combine in different ways to make up higher level executive functioning, including things like planning and organizing, and problem solving kinds of skills.

Now we know that executive function is critical for learning and for academic success. Also for emotional self-regulation, for achieving social competence. So there are many areas, a wide array, array of areas in which executive functions are critical. And one of the studies that I just put on your handout, that is one that I like to use to illustrate this point is by Moffitt and Colleagues, um and this was published in the proceedings of the National Academy of Sciences. And this study, they followed a thousand children from early on to age 32. And they found that a, a gradient of self-control or inhibition predicted some really important life outcomes, including physical, um, wellbeing, personal finances, and criminal, um… criminal, what do you wanna say, offenses. (Laugh) Yeah, criminal behavior. Um… and that was at age 32. So… that's, that's pretty important stuff.

Um… when I was getting ready for this talk, I came across a blog by an autistic individual, an adult, who was saying how important deficits in executive function were in his life. And so I just pulled out this one quote where he says "I consider my executive functioning difficulties one of the most disabling aspects of my being autistic. These struggles manifest themselves in a number of different ways, all of which are extremely frustrating." 'Kay.

So we know that various studies have shown that children on the auspe—autism spectrum, um, have… difficulties in one or more components of executive function. And again, these areas and the studies that I've listed are just meant to be an illustration.

Now we also have some studies that have failed to find deficits, and it's really important to look at those as well. Um… and we see that there are also inconsistencies in terms of which particular subcomponent is most problematic for kids at which age, and, and so forth.

I would argue that the inconsistencies that we see across the EF data, the EF literature, um, have to do with these 3 factors, and I'm sure many more. Um, but these are the ones I really want to focus in on and I'll be talking about a little bit more in the research that we're doing now. Um… task issues. Uh, lots a different tasks are being used to try to, um… to try to… uh… get at the particular constructs or the, the subcomponents of executive function. Also the comparison or the match makes a huge difference. And of course, you've heard a lot about participant heterogeneity, and I don't need to tell this crowd anything about that. Um, so, all of this to say yes, we have evidence, but it's a little bit murky out there about exactly what is going on in what aspects of executive function. And we know that this is an important skill, but yet it is, in many kids at least on the spectrum, it's a problematic area, and one that they need to work on. Having said that, I do want to just be clear about my position and my interest here, is that overall I don't think that the research literature supports the notion of an executive dysfunction account of autism. That is executive dysfunction sy—cannot… cannot explain all of the different kinds of

phenotypic characteristics that we're seeing in this group. And there's a lovely chapter by Pellicano that lays out this argument and the evidence. And it's not just for the executive dysfunction account, but also for theory of mind, and weak central coherence. So basically any single of, of the 3 main contending cognitive, um… theories of autism, the single deficit theories, um, really they aren't working, (Laugh) 'kay. So you might say okay, well um, why is she up here? What's she talking to us about (Laugh) executive function then? Uh, she just shot herself in the foot. Um…well I, I did tell ya I'm a language disorders researcher. And, um, so I'm interested in looking at this possible link between language and executive function. 'Kay. So just hang in with me.

There are both theoretical and empirical reasons for looking at this issue of whether or not there's a link between executive function and language ability. The theoretical, uh, ex, or reasons, stems from a leading developmental theory of, uh, executive control by Philip Zelazo and colleagues, referred to as the Hierarchical Competing Systems Model. And according to this model, language in the form of inner speech, is purported to help to manage executive control, such that it allows for information to be held longer in working memory, it allows for, um, conscious reflection and consideration.

There's also… so that's, that's the big empirical claim. I mean theoretical claim. There's empirical evidence of this association between executive function and language, um… in both typical and atypical language development. So let's start with the typical language development. Um… I've just listed a couple of, of studies here. Um, the one by, um… Ibitson, and… Currval White (Note: I think she means Iversen and Currval White), I'm sorry if I'm saying that wrong. Um… for example, uh… looked at 5 year old children, typically developing children, and they looked at the relationship between a grammatical task, a past tense task, and a Stroop measure. And they found that… the, the measure of, uh… inhibition, the Stroop task, was, uh… uh, a significant predictor of individual variation on the grammatical performance task. And in fact, um… that measure was… uh, better than age or vocabulary at predicting in the grammatical task.

Also, if we're looking at this possible link between language and executive function, we know that, uh, there are groups where they have deficits in language, and we also see that a number of the children have deficits in executive function. So, there's some work here in the area of specific language impairment, that we might draw on to compare to what's going on in the area of ASD.

So getting into the, the work, um, looking at, uh, this language executive function link, certainly we're not the first to look at that or to be interested in that. Um… and the prior findings have been somewhat mixed. Um… for example, Joseph et al, in 2005, failed to find any significant correlations between, uh, their measures of, of language and executive function in verbal school age children with ASD. However, the other two studies that I have listed here did find, um, some correlations. Um, or actually, uh, the ability to predict language skills from EF skills. Uh, so for example, um, the Akbar et al Study, found that, um, updating working memory, uh, was a significant predictor of, uh, language as measured by standardized language measures in, in their kids. But they didn't find, uh, that significant association for some other components of executive function. 'Kay. Um…

Oh, I forgot my own. Um… (Laughs) woops. We've done a couple things too. Um… in, in some of our own prior, uh, work we've used experimental language tests rather than standardized, uh, language measures, and have shown a link between language and certain, uh, components of executive function in school age children with ASD. The first one was a study that we looked at where we had a lexical decision task, and we had actually matched the kids on vocabulary level to the typically developing kids, and when we did that, we didn't see any significant group differences on the EF measures themselves. But nevertheless, the same executive function components, that is working memory and task shifting, predicted performance on the lexical decision task for these kids with ASD, children with SLI, and the typically developing group. So we saw the same pattern of predictors across those 3 groups. And in fact, both working memory and task shifting contributed unique variance to the prediction of, uh, the performance on lexical processing, and, it was the… both for accuracy and reaction time. So it was a, a fairly robust kind of finding.

In another study we looked at just the component of working memory, um, as far as our EF task. And, uh, we, were using a grammatical judgment task. And again there, when we matched on a number of different variables, um, we didn't see overall differences in working memory for the kids. However, individual differences in nonverbal working memory, uh, significantly predicted sensitivity to, uh, more for syntactic errors that occurred early and late in the sentence for the children with ASD, and late in the sentence for the typically developing group.

Okay. So, when we, uh, started this research project, and I should say that this is collaborative work that I'm doing with Margarita Kaushankaya, whose area is really bilingualism, and, uh, so we were interested in this language EF, uh, association, but from very different perspectives. Um, and I was interested in the children with language disorders. Um, so when we started this work 5 years ago, um, we thought well, um, we really are interested not only in, in looking a little further at this language executive function possible association, but we're also tryin' to… um, see if we could, um… untangle some of the issues that seem to be, uh, a problem in earlier studies of executive function. And, one thing that we know is that there are a lot of different tasks out there being used to measure the construct of executive function. And, um… there also is this issue of, of task impurity. And what I mean by that is that no single task is going to utilize just the particular construct of interest, right. (Laugh) Um, so you have to… deal with that as well. Um… and… finally, we, we knew that, um… some of the tasks we were looking at in the studies had verbal components, and you really don't wanna say well what's the association with language if your task has language in it. So we tried in our study to pull out as much of the linguistic load, uh, both the language in the stimuli as well as language in the instructions. Um, so that we could look at that a little more cleanly. And as a shorthand, I'll be talking about this as nonverbal EF tasks, and I'll show you what I mean in, in a minute. But I fully acknowledge that it may be impossible to really have nonverbal kinds of tasks. 'Kay.

What we also did, um… here was we, we took our, the 3 core, um… executive function components, we, uh, administered two different tasks that had been used widely in the literature, to try to, um, tap into that particular construct, and we gave all those to the, the same kids. Uh, then we were, um, besides having sort of done the, the theoretical driven (Laugh) kind of perspective, we went in and we did latent variable analyses to look at the particular way that things fell out as far as… um… the behavioral responses from each of the measures. Those of

you who have administered executive function tasks, you know that there are a lot of different indices, and you can kind of pick and choose. And, what we didn't want to do was just to look for the significant effects okay. And so we needed some kind of principled a priorie way of going through this, and deciding, okay, these are the indices we're going to use, and we're just gonna stick with those and use those and, and see what we get. And that, um, a description of sort of that, uh, more methodological piece, that latent variable analysis approach is recently published in JSLHR.

Um… we… also in this work were, and we still are, struggling with this, and I'm, I'm… uh… I think it would be a great thing to talk about a little more, is the matching. Matching, comparisons, what do we put in our statistical model? I think it really depends on what your research question is, and what you're trying to find out. Um… so we were, we were very cognizant of that. And, finally another thing that we wanted to contribute to the literature was to try to give some kind of insight about the directionality here. Um, what's driving what? Is it EF driving language, is it language driving EF? We didn't see a lot of that in the literature. Um, yes of course, everything drives everything, but, um… it, it, the, the reason this was really important was because the… predictions and the assumptions are very different from the bilingual literature and the language disorders literature. So the bilingualism literature is saying oh, all this experience with multiple languages and task shifting and inhibition and so forth, leads to these bilingual advantages, right? On the other hand, you have the language disorders group saying oh no, I think it's, it's that there are deficits in aspects of executive function that are leading to the language problem. So… we're trying to get, um, at least some preliminary evidence. And what I'm gonna show you and, if I get, uh… to it today is, uh… very preliminary evidence, but I think it's important to start trying to pick this apart more. Both from the perspective of understanding mechanisms, as well as intervention implications.

Okay. So, from the… research that I wanna talk about today, here were our questions. Um… the first question was simply, do school age children, uh, with ASD exhibit deficits on these nonverbal, uh, EF tasks? And we're gonna start with just a basic age level comparison, and then we're gonna add other, um… child characteristics into our model. Second question is about the association with language specifically, um… for the ASD group as a whole, and then… broken down by language status. And finally, uh, our question about the direction of influence, and this is just with a one year follow up.

Okay, so here are our kids. Um, and these are 9 year olds. You can see that for this group of 71 TD kids, and 48 ASD kids, um, that they are only age matched here in this sample. Um, and that they differ significantly on all other aspects that we've looked at here, including nonverbal cognition, uh, maternal level of education. Um, we used, I'm calling this social communication from the SCQ score from a autism screening score, and core language from the self–four. 'Kay. And, as far as diagnosis, these kids were older when they came to us. Uh, we do have another study where we are looking at toddlers, and, uh, word learning and so forth, and there we do our own diagnosis. We use the ADOS and the ADI, and do a whole workup with sort of multidisciplinary workup. Um, but this we used community diagnoses, along with that same experienced psychologist, uh, doing the CARS, and, um, confirming the ASD diagnosis using the CARS.

Alright. So here are the tasks that we decided on. We had two tasks that were supposed to be representing each of our executive function constructs. Uh… so inhibition, was the flanker and go/no go. Shifting was local/global task, and the dimension card sort, and then memory, the octating working memory was the n-back tasks, and of course Eblacks task. Okay. How many people are familiar with these tasks? Okay, some of you. Alright. So, I'm gonna give you a real quick run through, and then you can ask me more questions about the task. But all of these were visual tasks. We, we had practice items and so forth, where we gave them as much, uh, visual cueing as possible to get rid of all of the language part. And they were all presented just as, um, computer games to the kids. And administered on E-Prime. So the flanker task, the job here for the child is simply to press a button to indicate which direction the center object is facing. And you have… this would never occur all in one trial, but each, uh, trial is either a neutral trial, a congruent trial, or an incongruent trial. Okay. So you can see all the little fish swimming, everything surrounding the middle fish is congruent. And then in the incongruent, you've got the one fish who has her own set of ideas, and is going the other direction. Mkay. And incongruent is always harder for everybody. 'Kay.

Um, the go/no go task, here it's just a simple, um… press the button when you see all of the Go shapes, and then we train them to inhibit from pressing the button when you see the No Go shape. And it's a ratio 3 to 1, so you get them goin, pressing, pressing, pressing, oops can't press; press, press, press, can't press. 'Kay.

Moving on from the inhibition task now to the shifting tasks. Um, the local/global task, is one where you ask the child to shift back and forth identifying shapes at a local level or a global level. And so you can see at the local level we have a bunch of little circles, and at the global level, we have a, a triangle, right? So this would be an incongruent item, because two shapes at the local and global level are not the same. 'Kay. And some of them it would be like little triangles making up a big triangle. That's easier.

Alright. Uh, the dimensional change card sort task. Here the job for the child is to sort between different dimensions. So the first dimension being color, and the next dimension being shape. And then at some point during the game, they, you mix up, and they have to go back and forth between color and shape. And we adapted the NIH toolbox version of Zelazo's, um… uh… dimensional change card sort, to take out the linguistic cues. So, while he would say color, and you know cue the child verbally, we did this bit where we have these color blobs, (Laugh) to denote that now the rule is color, and then we have these grayed out shapes. And that seemed to work fine. They caught on after the training.

'Kay. Um, the, moving now from shifting into the two, um, memory tasks. Um, we used the n-back task, which is very commonly used on, in psychology. And, um, the job here is for the student to, uh, say yes or no, as to whether the… shape, this abstract shape that they're seeing, matches the one that came either just before it, or one trial before it, or two trials before it. This is hard folks. I don't know. I mean you know especially this time a day, we wouldn't all do very well on that. (She and some others laugh) Um… and, if you notice, the, the shapes are ones that have been used for I don't know, 40, 50 years in the psychology literature, and shown to be very difficult to verbally label.

'Kay. And finally, of our memory tasks, we had a Corsi Blocks task, and here's what happens, is that these boxes light up in a particular order, and the span of the number of boxes goes from 2 to 9 in our task, so it keeps getting longer and harder. Then the child sees a blank grid, and they have a, a touch screen computer, and their job is to replicate that in the same, the same blocks, and in the same sequence. 'Kay. And so what you get there for a score, rather than a percentage score, is you get a capacity score on this task. And… that is defined as, um… the span where you get 2 out of 3 trials correct. The highest span. 'Kay. So those are our tasks. Are you with me?

Okay. So, for those of us who don't have real good memory, this was my first question. (Laughs) So you can, uh, you know, there's been quite a little interval in between there. Um, so the, the first question is, when we do take out the language and we, we have these totally, or not totally, but somewhat nonverbal tasks, are the kids still having problems on these? And the, overall answer is yes, they are. Certainly compared to age matched comparisons. Um, and so what you're seeing here are called Beeswarm Plots. Um… and… uh… the top two across, the top row are, are two, um, inhibition tasks, the middle are the shifting tasks, and… the bottom row are the, uh, working memory tasks. Um, on the left, you'll always see the data for the ASD group, and then on the right, the TD group, and you can see that the, uh, filled in dot, which is the mean for each a the groups, you can see a higher mean score for the TD controls than the ASD group for each a the tasks. The only one that is, um, not statistically significant, is the, um, go/no go task up there. Um… and all the little dots are the individual kids.

So in doing this work we're, we've, been very interested not only in just what do we see for main differences, for overall for the group, but we're interested in… how much the scores range in the individual variation and so forth.

So next let me show you some, uh, density plots. And density plots help us to visualize the distribution of, of data over a continuous interval. Um… and, so… um… the density plots here, what you can see in green are the kids with ASD, in the orange, those are the typically developing kids. And you can see that, at least for the flanker task, we have quite different distributions of data. Um, the peaks of the… um, tensity plots, show you where the values are concentrated. Along the, the distribution there. 'Kay. Now, the go/no go tasks was the one remember where they… were not significantly different, and look at the distributions, they overlay quite nicely, and the shape of a distribution is, is quite good. And by the way, the, the reason I'm showing you density plots rather than histograms, is because, uh… of the advantage that the density plots have in actually showing distribution shape, and I wanted to, to point that out.

Okay for the shifting task, here again, we can see the differences in… the, the range and, and, the, um, distribution of scores, the shape of the scores, uh, of the, um … distributions here for the two groups. Um… by and large, our… uh, typical kids of course are shifted to the right for the higher, uh, scores, and, sometimes you see this real concentration of scores peaking, uh…almost at, at 100 for the TD kids.

And finally the working memory. 'Kay.

So, um… next what we did was to say okay, that was our age comparison. No surprises there,(Laugh) the kids with, uh, ASD do worse. Alright. Now, the next thing that we did was to run a series of regression models where… uh, each of these trialed variables, was entered as a predictor for each of the different executive function tasks, and… um… we ran 3 of them individually, and then at the end we ran them all combined into one, uh, model. We then, uh, saved the residuals from those regression analyses, and used independent T tests to just compare whether or not there were still differences remaining after you account for each of these child characteristics. Mkay. So, if you look at nonverbal cognition, um… you can see that once we put nonverbal cognition in to the model, um, we accounted for half of the task differences. And in particular it helped us to account for difference in hi—inhibition. Um… but it did not help us count, uh, uh, account for switching differences in the group. SES really did nothing in this. However, our groups admittedly were fairly high in SES, so we didn't have a huge disparity there, in terms of SES in this study. Um, when we did the social communication scores, um, that took care of all of the differences across the group. Um… so it was really seeming to be, not just a difference in, um, nonverbal cognition or something concomitant with the autism diagnosis, but it really was, uh, had something to do with more of the core features, um, that was, uh, diffi—causing difficulties on these tasks. We saw the same thing of course when we put social communication and the other two together, um… into our, our model.

Now here's what I'm, I'm showing you now. Again these are density plots. And I'm just gonna go through and, not show you all 6 tasks, but each of the, um, components I will show an example. On the left that's a density plot for the age comparison on the flanker. And on the right we have the density plot for the residuals, for the flanker task when we control for all 3 of the variables. And the reason I'm showing you all 3 is, we did get a little better fit, to the… um, overall distribution shape when we used all 3, than just social communication. 'Kay.

And just to show you the other areas, same thing for shifting. You can see those shapes moving together. And again for working memory.

Alright. So quick conclusions for the school age kids, um… with ASD once you match them on just age, you see clear deficits on these nonverbal executive function tasks. We find that nonverbal cognition, um, does account for, um, some of the differences, particularly in inhibition. Um… SES really didn't play much of a role. But social communication differences seemed to be, uh, the name of the game there.

Alright. Getting on to our second question. And somebody's gonna have to… give me time 'cause I forgot to press the button you told me to press. (A few people laugh) Whoa! Okay, we're gonna go really quick. Um… so, association between language and EF. Um… was it 5? (Yes) Okay. Um… first of all, for the ASD TD comparisons, well I can show you this really quick. Um… what you're seeing here are, regression lines, and this is where we are, um… conducting, uh, linear regressions, looking at predicting EF based on, uh, language skills, either receptive or expressive off of the Self Four. Uh, so a standardized task here. The green lines are, uh, the children on the autism spectrum, the orange lines are the TD kids. And you can see several things from the lines. One is the length of the line shows you how widely disbursed (Laugh) the scores are. Um, in this case. And we know about the fact that some kids have a lot of structural language problems, other kids don't have as much. So we see the scores really

ranging very, uh… very widely there. Um… the steepness of the slope, shows you the association. So what you're seeing here is that for… uh… the autism group as a whole, there's significant relationships in both receptive and expressive language, um, for our executive function tasks. Here this is the flanker. Here's the card sort, for shifting. We see the same kinds of thigs again. We don't always see the TD kids, having a significant association. But the kids with ASD, there was pretty much of a, a clear pattern here. 'Kay. Receptive expressive. And this one was only receptive. Okay? Which is why I'm just showing you that one.

So, what happens though when we break these kids down into 3 groups instead a 2 groups? So we do, the ASD group by language status. And what we used as our operational definition, was the, the kids with ASDLI, needed to perform more than 1.25 standard deviations below the mean, on the core, standard score of the self. Okay, so that… I think would be something we could kind of agree on, as, yes, they were having language problems, you can see on the bottom line there, 64, compared to the other scores.

Alright. So this is our go/no go task which showed no relationship when. For our two group comparisons, alright. Language EF was not significantly related for 2 groups. But when you break it down into 3 groups, you see something different going on. So the blue line are the kids with ASDLN, language normal, the green, are the kids with language impairment on the autism spectrum. And the red are the TD kids. So we see those kids clearly breaking apart. Here we see the same kind a thing where we see a very different profile for the ASD children with and without structural language deficits. 'Kay.

And… again, here, uh, the… for the… ASDLN, that's significant, not for the LI kids. And so forth. (Laughs)

Alright. So for question 2; yes, we see a significant association between… uh… both receptive and expressive language and executive function on all 3 components, when we're just looking at the whole group of children with ASD. Um… but we also know that we see very different patterns when we break the ASD group down into language subtypes, and we're only seeing in that case, associations with executive function for receptive language, not expressive language; we lose that.

Alright. Um… given the time, I am going to… skip the slides a tad, but I'm gonna come to the final conclusions for ques—uh, question 3. What we saw was no evidence at last, um, for using a standardized language measure, that language was predicting executive function. 'Kay, we didn't, we didn't find any evidence of that. We found very modest, what I would call trend kind of, um, evidence that executive function, particularly receptive language was predicting—I'm sorry. Executive function was predicting, yes, receptive language a year later. 'Kay. Did I say it right? Um, and what I mean by trend is the… in terms of significance levels, we were going from like .4, .5, .6, .7. You know we were just right around the, the significance level there, but it was nothing very impressive. 'Kay.

So, I'm gonna wrap up. There's a lot more to do with that last piece of predictability, and our, our findings are, are still very preliminary; we're still working on those, and hopefully we'll come up with some better, um, indices for really looking at that carefully.

Take home messages. Alright. Executive function we know has a profound impact on our academic, our social/emotional, our vocational outcomes, uh, for all of us. Um, and that includes all of the children on the autism spectrum. Um… as a group, um, the children with ASD did show, uh… difficulties, they showed deficits, on these nonverbal executive function tasks. And… while, uh, nonverbal communication. Uh, sort of helped to explain some of those differences, accounting for social communication deficits, uh, really seemed to eliminate almost all of, of what we were seeing as, as deficits on executive functioning.

Um… there was a clear association between nonverbal executive function and language ability for these school age kids. Um, but we saw the subgroups, uh, pulling apart, so that there were different patterns of relationship, uh for the kids with and without structural language deficits.

And, uh, finally, I, I think that just to, um… give a little pitch for the whole directionality notion, even though it was kind of a bust in these preliminary findings that I, uh, shared with you, I think it's, uh, very important to think about this, as I said not only from a mechanism standpoint, but from the standpoint of, um, some of the interventions that, um, have been undertaken. So, I uploaded, um… the one, um, Kenworthy, uh, article. I don't know if some of you read that. It was an RTC, um, executive functioning in children with ASD. Um… and showing, uh, positive benefits, um, in various areas like academic preparation and so forth. What I'd really like to see in some of those training studies, is more language and communication measures as well, so that we understand what is the, the real link there, if there is one. And on the other hand, one of the uh… articles that I, I put in your handout is by Dobal and Zelazo 2016. And that was a language training study. And that was where they worked with typically developing kids, but on contrastive words. Um, and they found that doing that, they got, um, increases in inhibition. And so that would be really interesting I think to try to apply to some of our kids on the spectrum as well.

Alright, thank you very much. (Applause)

MARGARET: Alright, thank you so much. We are going to take questions from our research mentors here, travel awardee, I know he's workin' on it, but thank you. We're gonna take questions from our research mentoring pair travel awardees. We probably don't have time for too many, but who's got the first burning one? Ah, that way.

MAN: Sorry.

MARGARET: That's okay, I had 3 lunches, I think I can walk.

Q: Hi. Jacob Feldman, Vanderbilt University. Um, I'm sorry if I missed this, but can you clarify how you dichotomized the language groups?

SUSAN ELLIS WEISMER: Yeah. Um, we… looked at their performance on core language on the Self Four, and the ones with language impairment were more than 1.25 standard deviations below the mean. And the others were above that.

Q: Thank you.

SUSAN ELLIS WEISMER: Sure.

Q: Hello, My name's Pumpki Su from Vanderbilt University. Thank you for a great presentation. I have a question about, I especially appreciate how we talk about the bilingual advantage in, uh, executive function, and the deficit ex—executive function in language disordered, uh, population. I'm just wondering if you look, if you have looked a bilingual children with autism, and how like what you think would happen in their executive function. Would they just cancel each other out in some aspect? (Some people laugh) Or, uh, would, how would they interact with each other in a more complex population?

SUSAN ELLIS WEISMER: yeah. Um, we've tried that. But the review panels didn't like it. (Several people laugh) Um, (Laugh) sorry. What can I say? Um, we've particularly wanted to do that in our area with Spanish/English bilinguals, drawing on Chicago and Milwaukee, and so forth. Um… yeah. We, we thought it was an important kind of, uh, clinical issue because it's a growing clinical concern. Um, and… uh… that there are interesting theoretical issues to delve in there too. No I don't think they would just cancel each other out. (Laugh) Um… but, I, I do think that, um… there may be a little bit of resiliency. There may be a protection factor in some aspects, in certain aspects of, um… maybe, uh, switching costs. In particular.

MARGARET: Okay, I think we have time for one more question. Dr. Yoder.

Q: Hi. Really interesting talk. You probably know that in the area of reading, there's been kind of an, in a sense, an analogous stream of research. And one a the things that's coming out in that work is, this distinction between global versus local theories of let's say cognitive deficit. So for example, I, I understand why you tried to take language out of the EF tasks, when you're looking at this. But in terms of the treatment, it seems like EF treatment with language might be more likely to affect language than a global idea of EF affecting language. What are your thoughts about that?

SUSAN ELLIS WEISMER: Oh, absolutely. Yeah. (Laughs) I agree with you totally. (Several people laugh) I mean I, yeah. If I were doing a treatment study I would… do the, something with language. I would do it in the context where I want it to happen, and not try to go with nonverbal. This is totally… um… this is sort of core deficit, looking at characteristics, it's not about treatment. Yeah.

MARGARET: Wonderful. Join me in thanking Dr. Ellis Weismer. (Applause)