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EHDI - PARIS

EYE GAZE IN DEAF BABIES

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>> Good afternoon, everybody!

Hello!

I see we have a nice number of folks attending this workshop, even though it is the post‑lunch workshop. I know some of you might be experiencing a food coma. But I promise I'll do my darnedest to keep you awake. I'm Heidi MacGlaughlin. And you may notice that there are two other names on the slide here, Kim Pudans‑Smith, who unfortunately was taken ill and let me know yesterday when I landed that she would not be able to make it.

She is with us in spirit, of course.

And Beth Hamilton, who a month ago realized her commitments were such that she wasn't going to make it. So I'm flying solo today.

And this breakout is on "Eye Gaze in Deaf Babies."

The question is: Where is their language acquisition beginning? What is happening in deaf babies?

I'll just give people a moment to get situated. Before I begin, I want to know how many people in the room are parents of deaf and hard of hearing children. So parents of deaf and hard of hearing, a show of hands.

Okay.

So I will have some questions for you afterwards. One really important question.

So the three of us came up with this project, Kim, Beth and myself, because two years ago in our doctoral studies we took a psycholinguistics class, and we talked a lot in that class, and that sparked our interest about the theory of mind, thought processes, language, and we wondered what happened in‑utero. So babies who are not yet born, what is happening? Are there thought processes already online? Is there language already online?

It seemed there have been studies out there that suggest that hearing babies, because they have access to audition, have access to those thought processes. And we wondered about deaf babies. Kim has a deaf baby. Beth has as well, and I do as well. So all three of us are mothers of deaf children. And we were thinking about the eye gaze of our infants and what we remembered from those early days was that our babies connected their eye gaze immediately to ours. And that became our research question, led to a lit review, and so I'm going to share with you what we found.

Again, this is about language development. Is it already present in‑utero?

So, as you know, any research project starts with a lit review. We wanted to know what other research had been done, what was the consensus or what was out there. This is a very brief summary of what we found, going back as far as 1952. And what was found was that babies are hard‑wired for cognition and communicative advances. The neurons are ready. The cells in the brain are ready.

And it doesn't matter what sort of language, manual, spoken, whatever, the brain is hard‑wired and ready for it.

And then that brings us to 1980, many years later, people were talking about the biological foundation of language being tied to speech, that babies hear their mothers in‑utero. Mothers are speaking to partners, spouses, whatever, but mostly mothers are speaking. I'm sure those who are mothers in the room probably had that experience of speaking to your bellies. And so that was believed to be the linkage between speech and language. And then in 1986, further research was done. That resulted in the finding that in that third trimester of pregnancies, fetuses tend to prefer the information that they heard at that time.

The technology back then, of course, wasn't as advanced as what we have now, but there was technology used to garner that result.

And then in the year 2000 and since then, our question is, and the question has been: Is audition necessary for the development of visual attention?

And that research by DeCasper and Spence, the 1986 research, which suggested that fetuses prefer information from the third trimester.

So there is a lot of research done on rhythm, patterning of speech, the repetition of speech, so when the infant is born, the same rhythm is there, and children will attend ‑‑ hearing babies will attend to that rhythmic pattern that they heard in‑utero. They will prefer the language they heard. So we wondered, what about deaf babies? If we're not talking to – or babies are not having access to what we say to them in‑utero, will there be a language delay? That leads to further questions and further research that needs to be done.

But this was the starting point from Spencer in 2000. on deaf infants.

You can see there were deaf infants of deaf mothers, deaf infants of hearing mothers and hearing infants of hearing mothers, three different groups to compare and contrast.

And the results...

Is that a child's hearing status does not influence the development of visual attention. The eye gaze, the visual attention of an infant, whether they were hearing or deaf, was the same.

So very interesting finding.

So it doesn't mean you should stop speaking to your infants in‑utero, but there is really no guarantee that speaking to your infants gives them an advantage.

So we started talking to mothers that we knew, right?

So mothers share stories and we wondered if our experience was similar. And I was thinking back to my own experience as a new mother. I couldn't remember if I had immediate eye gaze. I actually just couldn't remember. Did my child look at me right away? I tried to find some old pictures to get at that. And, of course, the baby's eyes were closed in every picture.

I don't know what happened when the baby's eyes were open, but the day after birth, the eyes were open and there was an immediate connection, immediate eye contact.

Here is a picture of Holden. This is a picture of Brett, Kim's son. They're roughly the same age, we had labor the same time pretty much. She said 45 minutes old, he's looking at her, that he had eye contact that early.

So let me ask those of you who raised your hands as mothers of deaf and hard of hearing children, if you can remember, did you have similar experiences?

Did your deaf baby look at you right away with some sort of intentionality?

And it seems like people are saying yes. People are saying they got some.

What about hearing parents of deaf children? Do you ‑‑ did you notice anything different if you have hearing children as well as deaf children? Did you notice anything? Some people say "yes" and some are not sure if they did.

So this is why I wanted to ask you, because as we go throughout today's workshop, that is exactly what we did. We sent out surveys and talked to mothers. And it's a really intriguing question. And the medical community also noticed that this deaf newborns were making direct eye contact. They're like, your baby has such big eyes. Or, your baby seems so alert. What they were really picking up on is the baby is making eye contact from the get‑go. And the medical people, the nurses, the doctors, they recognized something was going on, something is different. They noticed it.

And then when they do the ABR, you know, the baby does seem to be alert.

So this is a recent study from 2017, Reed et al., very recent. And just fascinating findings. What they did is they used pictures, and women who were pregnant and in their third trimester came in to do the study. The pictures, the stimuli were shown to the infants using 4D ultrasound scan. So like I said, the technology is much better today.

And it was done five times. So the stimuli were presented five times, and what they found as a result ‑‑ I'll show you what the pictures look like on the next slide.

So you can see here on the left, three small dots. On the right, it's the same configuration, but sort of... in other words, that's what the baby could see from inside through all of the muscle and tissue. So what we would see is the three small dots but the baby would see like an enlarged blurry dots. And they were either in an upright or an inverted position.

So five times the stimuli was presented ‑‑ and I don't exactly know what the protocol was, but what we wanted to know was, in‑utero, what does this fetus do?

Where... you know, how do they turn their heads? Do they turn their heads to follow item B or item D?

So the upright one or the inverted one?

And you can say the one that is one dot at the top or two dots at the top. And what is your guess? Your guess is they look at B because it looks like two eyes and a mouth maybe?

In fact, that is true.

It's amazing. The stimuli that looks like a face was more compelling.

And you can see that here in the bar graph. So the one that looks like two eyes and a mouth was more compelling for these fetuses. And they would track that stimuli as it moved across the visual field. And they did so more than the inverted image. And then the other question was: How many times did they turn away from the stimuli? And, again, they turned away more often from the non‑facial representation. What do you think about that? What is going on there?

Babies vice president seen faces yet. Fetuses haven't seen faces yet. They don't know what faces look like. Why might they be attracted to what might be a representation of the face? We posit that language is already there, human development is already there. This is a study from 2017. There's more work to do and the technology will continue to advance, so maybe we'll be able to see what is happening at the second trimester.

But this definitely peaked our curiosities. It didn't matter if babies were deaf or hearing, obviously, they're the same.

The eye gaze is drawn in certain ways to certain representational images.

So now I'm going back in time a little bit to 2005 to another study done by Brooks and Meltzhoff. 96 infants in the study. They were hearing. They were separated into 9, 10 and 11 months old. 9 months of age after birth, 10 or 11 months old.

They were separated into groups of ‑‑ by gender, 16 female, 16 male, for each of these different months of age. So there were 96 infants all together in this study. Some would be screened out for various reasons, additional disabilities, other cognitive issues. But it was 96 who continued through the study. I don't like the word "normal," but no one is really normal, right? But 96 who were able to continue to the end of the study.

They were all full‑term babies. So, premature babies were screened out. So it was just ‑‑ they wanted to really get at a typical sample size. They were all normal ‑‑ of normal birth weight. As you know, birth weight is an indicator of many things. And if a fetus is very small there might have been more muscle or tissue that would actually block their ability to see through ultrasound and there were no major birth complications or postnatal hospitalizations.

So this study was they took the infants, nine months, ten months, 11 months, they put them on ‑‑ there was a table separating the experimenter from the baby. There were some toys for them to play with, etc. And then they were taken away, sort of one by one. So when there was an absence of toys and the toys were set up either to the right or the left of the experimenter once they were taken away. So eye contact was established. Rapport was established between the experimenter and the infant.

The experimenter would then close their eyes, open their eyes and look to the right or left, to whatever the object was.

And the question is: Will the infant follow the eye gaze? And it was done ‑‑ there were four trials, and it was recorded in realtime.

And they didn't count any childs where there might have been distractions, like there was noise or mom or dad were in the room talking to them. They really wanted to understand what was happening vis‑à‑vis the eye gaze based on what the experimenter did with their own eye gaze.

So, again, the experimenter closes their eyes, opens, looks towards an object, to the right, to the left, and then there was just an ‑‑‑just opening the eyes and looking to the right or the left without the closing cue.

You have any intuition as to what might happen? Do you think that the infants were oriented more so towards the object when the eye closed cue was given? Or when the eyes open cue was given?

Okay, a couple different answers. Let's see what they found.

Using ANOVA, which is a research software package to calculate the statistics of it, what they found was, in fact, when the experimenter had their eyes open and then redirected to an object, the baby followed. When they closed their eyes, the baby felt disconnected, didn't seem to connect to that.

At nine months old there was almost no change, whether the eyes were open, whether the eyes were closed.

The babies didn't necessarily take a cue from it. However, at ten months of age, they were significantly greater attention to the open eyes cue, and 11 months of age, there was even more attention paid to where eye gaze was going on the part of the experimenter.

Any intuitions as to why ‑‑ what is happening between 9 months and 10 months or 9 months and 11 months? It's a huge communication leap happening between those two months.

There was another study done by Woodward in 2003 that was replicated, these results.

So, again, at 9 months of age, it seems like the infants followed the head movement of the experimenter. So closing the eyes, open the eyes, looking right or left. They're following the head movement. And it didn't really matter whether the eyes had been closed or opened. They haven't really developed the technique of eye gaze or understanding what eye gaze might refer to, but they do seem to be following head movement.

By the time they get to 10 months of age, they are clueing in to eye gaze and acting accordingly. Again, the closed eyes seems to indicate that we have broken rapport. Why should I bother looking to right or left, we don't have rapport anymore?

And then 11 months there's even more comprehension and linkages made between the experimenter's eye gaze and my own eye gaze. There is something worth looking at over there.

So language development is connected to that. The baby is wondering, what are you looking at? Let me look myself. At 9 months, it was like, well...

Again, just a following of the head movement.

Now, of course, many other studies have been done. And it suggests that, in fact, gaze following plays a role in language acquisition. It's a critical foundational step. Which makes sense. If you're talking or signing, it's important, actually, that you get eye contact before you engage in that communication. When you're pointing, it's important your infant or child knows to look at what you're pointing at. So language acquisition rests on several foundational principles. One seems to be gaze following.

So that was a study done on hearing babies. But there are two researchers who have gotten involved with studying deaf infants. And they wanted to see the comparative data.

So more or less the same study was done. I don't know if it was exactly 96 infants and separated by sex in the same way, but 9 months, 10 months, 11 months.

And what did they find?

The 9‑month‑old deaf infant develops gaze following. They're not following head movement. They're following the gaze of the experimenter. Two months earlier than the general hearing population we're seeing that advantage. Why is that? Because obviously visual ‑‑ the visual stimuli is going to be the most important pathway to communication for these children. They're not ‑‑ they haven't been depending on audition. They're depending on visual acuity, so it's all the pathways, those neuronal pathways are set early.

So, if you want your babies to develop ‑‑ I mean, you can absolutely use spoken language, but if you want them to develop that gaze following, you should be using sign language early.

And adding pointing to what you're doing.

So that paper is not yet published, but I'm happy to share it when it gets there. I'll put it with ‑‑ I'll send it to the EHDI folks to post on their website or something. But it's rich, rich data.

So, Harris, in 2000, studied deaf infants of deaf mothers with the question of "What is the function of eye gaze?"

And, of course, it's infants looking at moms to see what they're doing. They're focusing on their hands. They're focusing on their facial expressions. And there is a lot of gaze following among deaf infants with deaf mothers.

And you can see that in these pictures here. This is five days old. This is Kim's son at five days old. And eyes are open, alert, following. And my son Holden, my husband is holding him and he's looking at me. He's three days old in this picture.

And you can see his eyes are open, he's alert. One of the few where his eyes were open.

And even the nurse ‑‑ I remember this part ‑‑ the nurse was there during my labor and delivery. She said, Holden's eyes are so big. None of us actually have big eyes in my family. It's not a trait of ours. It's just that he was very alert. And that was unusual for the nurse, and she commented on that.

So what we learn is deaf infants look at their mother, responding to the movement, either an object held by the mother, or the mother's face, hands and body. And if the mother's gaze redirects, the infant will follow. It's not something that has to be taught. It is something that is innate.

So the takeaway points from today's session...

Is that speech does not seem to be critical to the human language acquisition process. You should, of course, talk to your fetuses in‑utero, play music. I played music. I put the headphones on my belly and played music. I thought, you know, this baby might be deaf, but anyway, it can't hurt. You know, talk... sure, of course. But it was fine. He was born fine and he's, you know, developed fine. But I think people are concerned about that, and there is no need to be concerned. The brain is ready to acquire language and will develop accordingly.

And spoken and sign language, as you know, have their own maturational time course, and like we said, there aren't going to be tremendous delays. Obviously every child is a little bit unique, but those languages develop at the same time.

And babies are born with that natural tendency to rhythmic patterning. So whether it's an auditory, visual or tactile doorway, that pattern is set. The brain is ready to acquire language.

So deaf‑blind babies as well. Which is another project, another research project for somebody to do. It seems equally ready to learn language.

We are not done with this research. We would like to formalize it into a further research, send out a survey via Facebook and connect to larger deaf community. We do have dreams of sort of going big with this. And then we'll be able to do follow‑up interviews to get at some specific qualitative kind of information.

And that is my presentation. If you're interested, share your contact information with me. I have, I think, the final slide... yep, the final slide is our contact information. So take a screenshot of this and get in touch with us.

And now I'm happy to answer any questions you may have. I think I saw a hand in the back. Yes?

Are there any questions?

Really? None? Or perhaps I just explained it all very well.

>> AUDIENCE MEMBER: This is a question for parents who are hearing and have deaf babies. How many of you notice that your ‑‑ that as you are talking to your child and your child is not hearing, do you notice the lips moving?

Is that something... I've seen it maybe once or twice, but I haven't seen it with all my babies, so...

>> HEIDI MacGLAUGHLIN: Any parents that have noticed mouth movements?

Are you responding?

Okay.

>> AUDIENCE MEMBER: Yes, my daughter, she's six ‑‑ she'll be six next month, but I did notice that before she acquired speech, that her lips would move constantly and I also noticed when she was born how big her eyes were. But I thought it was just because she had big eyes. Now they don't look that big anymore.

>> HEIDI MacGLAUGHLIN: There's a question over here.

Yeah, part of my bonding with my four children, who are all deaf, is that replication. So if they would make a face, I would copy their face. So I think we were imitating each other, those kinds of movements. That was something that we engaged in.

I'll just repeat for maybe people who didn't see in the back. I have four children. Several parents I have talked to, one had a hard of hearing child and then a deaf child second. And I asked, because the first one was hard of hearing. So, you know, I wondered what happened in that experience. And they said, you know, the first child did seem to look a little bit but not always attention, you know, by the visual input, and was sometimes distracted by auditory input. And that second baby, she knew the second baby was deaf because the eye contact was there immediately in a very different kind of way.

I asked another parent who had three deaf children ‑‑ again, they knew that their baby was deaf because both the first and the second and the third had this kind of very intense eye contact. And so that's why I wanted to do this research. It seems like a very rich area.

Question in the back?

>> AUDIENCE MEMBER: [ off microphone ]

>> HEIDI MacGLAUGHLIN: I'm sorry. Maybe come up and ask me the question afterwards. I think I just got the ‑‑ I think I got the time sign. I did.

We are out of time, but come on up. Or I'll meet you in the hallway.

Thank you so much for coming.