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DNN Features and Performance in the Real World

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Hello and welcome to today's session brought to you by Starkey. We're thrilled to have you join us for this year's Industry Innovation Summit on Audiology Online. Throughout this month, Audiology Online is showcasing groundbreaking advancements in the hearing industry with our 6th annual Industry Innovation Summit. Thank you for being here today and we encourage you to explore our course library for other compelling Summit courses. A special thank you to our title sponsor, CareCredit, and all of the innovative companies participating in the 2026 summit.

And now it is my distinct pleasure to turn today's course over to Dr. Luis Camacho. Thank you Anna and welcome everyone who's online with us today. We are excited and happy to be participating in the Audiology Online Innovation Summit. I know we've done this over the last three or four years and we're really excited to be doing it again. Again, my name is Dr. Luis Camacho, I'm Manager of Education and Training at Starkey and I'll be your host for the next hour or so.

And in this session we are going to be focusing in on Starkey's Deep Neural Network features and performance of these features in the real world. Now, before we get into the content, get into the heart of the matter, I do want to run through a few housekeeping items. First of all, if you have any questions, feel free to type them in the Q and A area and just send those on to me. I will be answering questions at the end of the session, but as you think of them, go ahead and type them in the Q and A area and I'll address them at the end of this session. There is a PDF handout of today's session if you want to download that.

For future reference, you can get that through your pending courses and your AO account. There is also a link in the chat within the classroom. Today's session is available for one CEU credit. To earn that credit you need to attend the full session and then once you've completed the session you can log back into your Audiology Online account and under pending courses you'll be able to access and then pass the multiple choice exam. To earn the CEUs, you do need to be a paid member of the Audiology

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And then lastly, if you are having any technical issues at all, you know participating in today's session, you can contact Audiology Online at the number you see on screen. You can use the Q and A window to inform the online team if you're having any issues or you can email them at the email address you see on your screen there as well. I'm going to quickly just put this slide up here for your perusal. Just some information on the session and the policies around presenting information here at Audiology Online. And then lastly, we do have three learning outcomes for today's session.

At the end of the session, you should be able to identify the different types of DNN and DNN chips used in hearing aids. You'll also be able to identify the sound quality features within Starkey products that utilize DNN signal processing. And lastly, be able to list the healthable features that utilize the inertial measurement units. So again, let's go ahead and jump in. As I mentioned at the top, today we're going to be focusing in on Starkey's deep neural network features as well as some other artificial intelligence driven features, as well as looking at some actual case studies and performance and outcomes of these features in the real world.

So I'm going to give a little bit of a background on kind of the evolution of what Starkey has done utilizing and integrating artificial intelligence into our hearing aids. And you're going to see kind of a build up upon the different technologies that we've integrated since the introduction of our Genesis product line about three years ago, all the way up into the current Omega AI product line. And again, you're gonna see how we really are building upon the foundation of that we created with the introduction of our integrated neural processing unit. And that's where it's a great place to start because at Starkey, we are always looking to create new pathways, looking towards the future. We really like to say that in the next five years we are going to be 10 years ahead of everybody in the industry because of the foundational work that we've been doing over the last seven to 10 years.

Really it takes a long time to develop the chipset, the processing schemes, the sound quality approaches that we're doing. And that really all starts with our integrated neural processing unit. There really are three approaches to deep neural network processing, not just in hearing aids, but also just in general technology. You know, consumer electronics, smartphones, tablets, computers, et cetera. You know, there are a number of different ways in which you can utilize the power of the processor and really kind of, you know, have the architecture around.

This one approach is what's known as an embedded deep neural network chip. And basically this is a utilizing a computer chip that doesn't really have anything specifically dedicated to deep neural network processing. Essentially what you're doing is you're taking different Components or pulling part of the processing power away from other areas and kind of cobbling together a deep neural network. And the downside to that is, you know, basically that there's nothing really dedicated in the design for dnn. And what that means is you've got a pretty low power approach to dnn and it also becomes very power hungry, not very efficient, when in terms of how it utilizes the battery that it's relying upon.

Another approach is having essentially two chips, kind of your main processor and then a dedicated AI chip that's completely separate. The, in this case, of course, you do have dedicated DNN processing. But again, the downside here is you've got essentially two processors running and information has to go back and forth between the two chips. That can lead to delays in signal processing or in information going back and forth. It leads to a larger product and then it is of course also less power efficient, which means you are going to be draining the battery, the power source, much more quick, quickly, when utilizing deep neural network processing using the power of that second chip.

What Starkey has done, and it took a long time to develop this npu, really it took about five to seven years for us to be able to get this into place. But we had this as a vision. And I'm going to play a video for you here in a moment of our Chief Technical Officer, Dr. Achin Bowman, discussing why we did this,

why we took the time for the money, the resources to create an npu, an integrated NPU that has essentially a dedicated chip built within the core processor. And the advantages for this are really pretty evident. Highly, highly powerful, very small and very efficient on the battery.

That's why as we get into all of our DN and signal processing schemes, you're going to see where, regardless of how much, how often, whether these features are on, all the time, or on demand, we're not affecting battery life yet, still achieving some pretty amazing clinical results and the best sound quality that your patients really, really want in the most diverse types of listening situations. So I want to jump to a video and here you're going to see Dr. Dave Fabry doing a quick Q&A; with Dr. Achin Bomek. On, again, why did we go to the trouble of utilizing and creating this chip and a chip that really is commonplace in today's consumer electronics? Apple was the first company to utilize an npu. It's in all of their iPhones, their tablets, et cetera.

It's now commonly used in all of the major mobile phones, Samsung, Google phones, your computers and Currently Starkey is the only manufacturer and taking this approach to chip design and deep neural network integration. So let's take a listen to Dr. Fabry and Dr. Bowmeck. The laws of physics, right, because you've got dramatically improved computational performance, but you're not sacrificing battery life. Because we know with Genesis AI we took range anxiety off the table for patients who wanted to use rechargeable devices and not run out at the end of the day like they often do with competitor devices. So, you know, to, to an engineer, I like to say it's a tug of war.

Typically, no matter what device you are designing, whether it's a phone or a consumer electronic mobile device or hearing aids, just to be a tug of war, do you want more computational performance to do more signal processing? In that case the power consumption is going to be higher. So you had this balance to strike. Well, often to get out of a conundrum and change the playing field, you have to change the architecture. So by going from the traditional computing architecture with DSP to this neural

network architecture allows us to provide a lot more computational capabilities for signal processing and enhance the sound at the same time, not give up on the battery life.

It's a whole different ballgame.

So you can hear there from Dr. Bomick that there really is no compromise with the approach that we're taking. One of the other things I do want to mention, you're going to hear a number of different technology product families mentioned. This video was created when we introduced Genesys, which was our first use of the integrated npu. We're going to be giving examples of Genesys products, examples of Edge AI and examples of the Omega AI products because again, we're building upon the previous generations technology and what we're doing with deep neural network processing. Now with everything that we talk about at Starkey, we know that the main reason people come into your office is to hear better.

That's always job number one for us. And if we take a look at some of the information here from market track from 2022, you can still see the areas of most importance for your patients. Conversation in the workplace, small group, outdoors, et cetera, et cetera. These are the areas that we are focusing in on when it comes to sound quality and hearing performance. And I do want to give a little bit of a kind of a history of the, of artificial intelligence.

Or maybe you think of this a little bit more as a quick tutorial. Some of the terminology that you might hear when talking to someone about artificial intelligence and the different iterations that are used within hearing aids. And artificial intelligence is really just an umbrella term. It's just this terminology that's used around the concept of can we kind of mathematically create a replication of kind of human cognitive function? And that's the general idea around this term artificial intelligence.

When we look at kind of the subsets of artificial intelligence, you're probably familiar with many of these terms when it comes to hearing aid usage. Machine learning has been used really for well over 10 years within Starkey hearing aids in terms of being able to identify specific acoustic scenes, you know, what are the characteristics of sound in an environment. And I think it's great to use a visual analogy to help people understand really what exactly is happening here. So when you think about kind of the classic example of a visual analogy with machine learning, it's this idea of could a computer discern between a cat and a dog? So you essentially, you feed, you know, millions of pictures of cats and dogs into a machine learning algorithm, and then you present that, that computer, that algorithm with a different picture of a cat.

And it does a quick comparison and says, yep, that's a cat. No, that's not a dog. So a quick, quick analysis using tons of data to compare against kind of the next level of that is deep learning or deep neural networks. And we're going to definitely get into this from a sound quality or signal processing perspective, but using that visual analogy. Now what you've got is multiple algorithms running again with cat and dog characteristics, photos, et cetera.

And this deep network can essentially come up with its own rules to decide if that picture put in front of them is a cat and a dog. It's not just a yes or no. It's using multiple algorithms that are interconnected to say, I'm going to come up with my own rules to decide if this is a cat or a dog that's put in front of me. Now, of course, we talk a lot about generative AI, and we're not really going to get into the utilization of generative AI in StarKey products in today's session. But if you're familiar with any of the ChatGPT type of approaches, now with using again, that visual analogy, you can just type into generative AI algorithm and say, what's a cat?

And it can draw you a unique picture of a cat. And so we're building upon all of these algorithms within our signal processing schemes with Starkey products and now with machine learning, again, to focus a

little bit more on kind of what we're really interested in, in audiology and hearing healthcare. Machine learning is used to provide kind of feature classification and acoustic scene analysis. So when sound comes into the microphone of a hearing aid, the algorithm is able to kind of tear that signal apart, break it down into its various features, its patterns, and say, okay, we know this is speech, this is noise, et cetera, create some processing and then put a particular signal processing scheme for your patient to hear as best as they can. And again, machine learning algorithms have been used now for well over 10 years to do this, to identify wind, for instance.

That's a really good utilization of a machine learning algorithm. From there, and we move into a deep neural network where again, we've got multiple algorithms now trying to mimic kind of all of the synapses of the human brain to take the data that's fed into it, to come up with its own unique rules around deciding what type of sound it is and what kind of signal processing we should apply to that incoming signal. A little bit of a, kind of a history or an overview of what we've been doing with DNN signal processing at Starkey. And we're going to go through each one of these, and one I like to kind of call out as our first attempt at DNN signal processing is what we refer to as Voice AI. Now, many of you who've been working with Starkey might not even remember this particular approach.

And I'm not too surprised. I've talked about this with many, many professionals over the last, say, six to eight months and, and kind of surveyed people informally, and there's very few professionals that remember this. And, and really it comes down to the fact that it was a very unique use case scenario. So with Voice AI, this was with our Livio products, and it was very specific to a unique subset of patients. So your patient had to have a more severe to profound hearing loss bilaterally, worse than 50 dB, and they had to have an iPhone.

And the reason for this was that at the time, we didn't have a powerful enough chip to put a DNN processor onboard the hearing aid. So what we were actually doing is offloading that signal processing

to the iPhone. The iPhone was utilizing an NPU at that time, continues to do so. So we use the power of the iPhone's NPU to actually turn the phone into a remote microphone and integrate a unique DNN signal processing scheme. Not utilized a lot because again, the small subset of patients, but, but this was our first kind of dip into the pool of DNN signal processing.

Of course, when we introduced Genesis and the integrated NPU and our speech probability predictor and everything that we're doing with that chip set, we're able to move beyond this particular approach. And our first approach to onboard DNN signal processing is a tool that we call Edge Mode Plus. Again, this was introduced with Genesis, it moved on and carried on into the Edge AI and again continues to exist in Omega AI with kind of enhanced and improved variations of this approach. But the core concept remains the same. It's an on demand real time analysis of the environment.

So essentially your patient can engage this tool if and when they feel the need for additional help in their listening environment. So with Edge Mode plus, this is available in all three technology tiers, but you can see there's a little bit of a breakdown in what's available based on the technology tiers. With the 16 and 20, we've got our on demand tool Edge Mode plus, where essentially once you engage it, it's kind of fixed for that environment. When the patient leaves that environment, they disengage it and go back to their normal signal processing. The 24 technology level product has what we refer to as automatic Edge Mode Plus.

This means that a patient can engage the tool when they get into an environment where they're struggling a little bit more than they wish to. And if they desire, they can leave it on the rest of the day if they want. And essentially as the listening environment changes, Edgemode plus will adapt and morph and change and be appropriate for that particular listening environment. Another thing that's available in the 20 and the 24 technology tiers is what we refer to as kind of the listener intent tool within the My Starkey app. So not only do they get the additional enhance signal processing of Edge Mode plus, they

can actually tell the algorithm, well, I really want to focus on speech, or I really want to focus in on reduction of noise for maximum comfort.

Because as great as this DNN algorithm is, it can't read the mind of your patient. So there's an additional tool for these two technology tiers that allows the patient to kind of fine tune or more kind of razor focus, laser focus, the approach through the listener intent tools in the app. And the results are really pretty astounding. You know, being able to provide that on demand tool, it definitely has reduced the need for multiple hearing aid programs because you can kind of create your own program in the moment. Now I want to get to our first real use case scenario.

And everyone that you're going to see in our examples today are patients that were fit either. During the clinical studies, part of being fitted our center of excellence, many of them worked with Dr. Fabry. And I'm going to start with Justice. Alan Page is the first example, and he's a former Minnesota Viking, I believe is a Hall of Famer. After leaving the NFL, he became a Justice and has a hearing loss.

Here you can see his hearing loss. This is from 2021. Again, this is an example of Justice Page being initially fit with the Genesis product. And this is going to be an example of Edge Mode Plus. And he was fit with bilateral rechargeable canal devices with directional microphones.

And I'm just going to let you listen to a couple of videos between Dr. Fabry and Justice Page in discussing the use and the benefits of Edge Mode Plus. I mean, you know, early on I really would inform you of Edge Mode and your response regarding why you weren't using Edge Mode was what?

I can't remember what I told you before, but I'm guessing it was what I've got now works. Why. Why fix it? Yeah, yeah. If it's not broken, don't fix it.

And even though we know I was happy with what I had. Yeah. And one day.

Okay, Justice Page. So you've had Genesis devices now for. Gosh, I think since last year. Yeah. And.

But then. And we talked about the fact that you gave me the greatest compliment that, that we could ever get is that you just like to put them in your ears and go throughout your day and not have to engage with them to the point that when we talked about the Edge Mode feature as we introduced it in the product, you had to engage with it regularly. And probably you said you were hearing well enough that you really didn't feel the need. But. But now we've updated to the Edge Mode automatic and I think you've had a chance to play with it a little bit.

But. Well, now I've got the. The other side of that issue being it's automatic. So I don't think about it. Right.

Right. You know, other than the initial use of it now, I don't think. I don't think about it. So I, I can't tell whether it's working or not. Yeah, you.

Your initial feedback, you said you thought. You know, I think when we discussed it right after we. You updated the firmware and you did it from the app and you said things sounded more crisp and clear. Clear. And now.

And now you kind of take that for granted. You're hearing well. And. And now we've fallen back in as long as you remember to engage the Edge Mode automatic when you put them in. You're finding that now you like to just leave it there.

Yes. And, and, and, and go about your day. That's, that's where I keep it. That's awesome. Okay.

And, and you do find that you are hearing well notwithstanding, you know, any challenging listening environments. Yeah. Okay, that's good. So in this example, just this page initially wasn't sure if he needed Edge Mode plus, but then once he started using it and then had the automatic component to it, he realized he was just hearing better and it was something essentially he didn't really have to think about. So again, real world example, I'm going to play one other one with Dr. Fabry and this is another patient that was fit in the clinical trials.

And this is a little bit more specific example versus just kind of the general. Yeah, I really like the way the Edge Mode plus sounds happened yesterday. We were seated for lunch in a kind of a noisy area and then a band started and I'm like, holy smokes, which mode should I be in? And I just went, oh well, let's do this Edge Mode because. And it was absolutely weird.

I mean if for those of us who struggle with hearing to all of a sudden have everything just go, hey, I can hear. It's just crazy. And to be able to focus on a conversation, I'm no longer having to be that one sitting there nodding as everybody's talking around, trying to be a nice smiley face.

So another great example of kind of that, that no longer a need to have a dedicated program for an environment. He was, he was struggling in the situation turned on Edge Mode plus provided an enhancement of his listening experience. And we've got a lot of clinical data around Edge Mode Plus. You can improvement of up to 11% in word recognition, a reduction of listening effort as well as an improvement of up to 13dB in signal to noise ratio in those kind of diffuse speech babble type of listening environments from Edge Mode Plus. We built upon that with our Edge AI product, with our always on deep neural network speech and noise.

And again, we've already talked about kind of how DNN is created using multiple algorithms to come up with its own rules around a particular issue or particular problem. With our always on DNN speech and noise. What we've done is we looked at kind of the pathway of conventional DSP noise reduction and

said, well, what if we put the DNN signal processing and speech and noise algorithm running in parallel always on in this process to identify in the speech signal of interest all the time at a higher percentage. And I just want to play an audio clip here. This is again, Dr. Fabry speaking in a noisy cafeteria environment.

First with traditional DSP and then with our always on deep neural network noise noise management approach.

Look, we all suffer from range anxiety.

Look, we all suffer from range anxiety with rechargeable batteries. So that gives you kind of an example or an illustration of it. But again, I want you to take a listen to Linda here who was fit with the EDGE AI devices and the always on speech and noise algorithm and really how it has impacted her ability to listen comfortably and clearly in everyday life.

Hi, Linda. How are you? I am fine. Good. Hey, how long have you been wearing Hearing AIDS?

Probably 10 or 12 years at least. Okay. And we just fit you with the new technology EDGE AI. And how long you been wearing these now? About three, maybe four weeks.

Okay, so tell me what you experienced so far. It's. It's been dramatic. It's almost emotional for me. Why you say that?

I can just give you some great examples. Okay. I was at. We had a family birthday gathering. And for the first time, I didn't have.

I could just be part of the gathering without isolating myself to just one person. My grandkids. I didn't have. They didn't have. I did not have to say what.

What? Say that again. So it made a big difference for you? A huge difference. It's the first time I've had congenital.

Right. Hearing loss. This is the first time I went out with my husband. Been to a baseball game. He sat on my right side the entire night.

That's never happened before. Wow. We had a. We attended a social gathering for lake association. Just a little bar grill.

Again, normally I would just isolate myself to one person, be strategic about where I sit. I participated in the entire event. It. It's been beyond command.

So another kind of real life example of the benefits of the deep neural network signal processing. And one of the things I just kind of want to keep reiterating, we're hearing from patients that are using the different technology levels or the different technology families, I guess is the better way to put it. First, you know, Justice Page, starting with Genesys and the benefits and kind of the daily usage of edge mode plus and then the automatic edge mode plus feature in the, in the 24 technology levels. Now we've got Linda, who's utilizing or was fit with EDGE AI and the always on deep neural network noise management approach. So we've built upon that.

And there's actually she doesn't even mention the fact that she has Edge Mode plus available to her as well. She hasn't really been needing to use that because of the benefits of the always on DNN processing. So as we're talking about Edgemode plus then now DNN always on noise management and we'll get into our latest DNN feature here in a moment. Just know as we're moving from Genesis to

Edge AI to Omega, all of these signal processing schemes are available to your patients. They don't have to be fit with Genesis to get Edge Mode plus or Edge AI to get the always on dnn.

We've built upon that so that all of these technologies are kind of stacked upon each other to provide maximum benefit for your patients. With the always on DNN signal processing that we integrated again some tremendous data that we've been able to come up with or to discover through our clinical validation studies with the DNN noise management, what we found was that patients had a 30% more accurate ability to identify speech in a multi babble speech environment compared to Genesys. Genesys was a tremendous product but did not have the always on dnn. So comparing to an already fantastic product, an amazing improvement in speech identification and noise. Hearing aids became significantly quieter as well with the 6dB reduction in that low level noise.

And one of the things you're going to see kind of over and over again as we're introducing and discussing these different signal processing approaches is there's no impact on battery life as patients have access to these tools. Again this goes back to our chip design and the industries only integrated neural processing unit. So we can do this highly powerful DNN processing, have it on all the time, whether that's Edge Mode plus automatic or the always on DNN noise management, but not see any reduction in battery performance. So that brings us up to our most recent DNN signal processing scheme. And this is available in our Omega AI24 technology products, our receiver in the canal devices.

And this is called DNN360 and this is the industry's first and only DNN driven directional microphone approach. So with DNN360 as sounds coming into the hearing aid, we're really able to break things down based upon kind of three components. You know, what is the acoustic information? You know, is there wind present, is it noisy, what's the frequency response, is it speech, et cetera, et cetera. What are the sensors doing?

So you know, is the patient in motion, are they looking in a certain direction? Take that into consideration as well. As user intent, meaning have they engaged edge mode? Plus all of these things are put into the DNN360 algorithm and then one of four outcome outcomes is decided upon based upon that input. So we can go into an omnidirectional modality.

We could go into what we refer to as spatial awareness, DNN directionality, or our motion based optimization. And I'm going to quickly go through these four different modalities that could occur depending on, you know, the listening environment and what the patient is actually doing. A quiet, I think, is the most easily understood. You know, someone's in a quiet environment, there's, there's really no noise present. We have our speech probability predictor on all the time in any of the modalities because we want to be ready and, and ready and able to identify that speech and, and maximize the clarity of speech and speech understanding for your patients.

But essentially in a quiet environment, the hearing aids go in an omnidirectional mode to pick up sounds all around the patient for the most natural listening experience. In a quiet situation. If the patient is in a situation where there's noise present but there is no really targeted speech signal of interest, we go into our spatial awareness scenario here. For high frequencies, we have a fixed directional modality really to be able to be ready to identify and isolate and improve speech understanding. If speech suddenly occurs in the low frequencies, we go into an omnidirectional mode. This is to allow for identification of sounds around the head that the patient may want to be aware of.

And I'm going to show a video I think that really will illustrate this better here in a moment. Then we move into our DNN directionality. So this is a scenario where there's noise present, but there's also speech present. So now we're using the power of the DNN for independent channels, independent adaptive null steering. So moving beyond just, well, what's the signal to noise ratio in a particular frequency area?

But really looking at the speech probability component and using the power of DNN to be more specific and more accurate in pointing the lobe of sensitivity towards speech in a particular frequency area or point that null to reduce the effects of noise on the patient. And then lastly, our motion based optimization utilizes the onboard inertial measurement unit sensors to identify if your patient is walking or running in this scenario when they're in motion like that. Again, we've got high frequencies in a fixed directional for speech clarity and identification. And then we've got the omnidirectional and the Low frequencies, but we actually bump the gain up a little bit in the lows for better spatial awareness. And I think of this sometimes as a kind of a safety feature.

So if you think about maybe you're out for a jog on a busy street and you want to be able to know, is there a car coming up behind you? Is there someone you know riding their bicycle and calling out that they're on your left? You've got more information around you to know what's happening. So you're aware of your environment even when you're walking, running, etc. In a complex listening situation.

I'm going to play a little video here, kind of letting you see this in motion. So here you'll be able to see kind of a graphic of what the microphones are doing and the different environments that are occurring. As our patient Fawn is moving throughout her day.

Hey, Fawn. Hey. Clay's over there. Okay, great, thank you. And your aprons hanging.

What are we making? I'm just going to see what the clay does. It's a little soft, so. It's really soft. Yeah, it's very soft.

I don't know what I'm making. You don't need to just let it go.

Probably a cup usually what happens.

So in that video you could see Fawn going throughout her day and that this kind of gradual, seamless morphing of the different microphone modalities depending on if there's noise, if her friend's talking to her, you know, if she's moving. And this is really the benefit of the DNN360 tool. Now I'm going to play another video of Fawn and. And this video is a little bit more professionally produced than the other two case examples that you saw around Edge Mode plus and the always on DNN noise management. But Fawn in these videos, she is a patient.

She was part of the clinical studies. And so what we did was kind of a post fitting interview with her to get her impressions of the benefits of her Omega AI products and the benefits of DNN360.

Hearing loss is very isolating. I noticed that I was really feeling left out. It's upsetting. It's really very. It's an emotional thing for me.

I have been wearing hearing aids for quite a while and each time I get a new pair, the technology is even better. The hearing aids that I'm using now make me much more spatially aware. If I'm in the street riding my bike, I can hear traffic behind me or somebody's coming alongside me, which is really important. It used to be that when I'd go to cafes or restaurants, I'd get anxious because I felt like I would be isolated. I wouldn't be able to partake in conversations the way I wanted to.

Now, using my hearing aids in those situations, I don't have that same kind of anxiety. I feel like I am part of the conversation. I think what I'd like people to know is that to erase the stigma, forget about that, and if you're not hearing well, go see a hearing professional, get a hearing test and wear hearing aids. It will improve your life substantially. My name is Fawn and this is my better hearing story.

And I have to say, one of the things that always amazes me every time I see that video of Fawn is she uses the phrase she's more spatially aware. And I was talking to the audiologist that worked with Fawn and she said that they did not prompt her in any way, shape or form and what to say. When they were

asking about her experiences with the Omega AI products and the DNN360, she just came up with this phrase, spatially aware on her own. So the benefits you can see again from Fawn's story are pretty obvious in terms of what we're doing with DN signal processing with the new directional microphone approach. And I know I've said this multiple times, but with Omega AI, not only does Fawn have DNN360, but she has always on DNN speech and noise algorithm and she has access to Edge mode plus if she so desires.

So all of that, those tools are available for your patients with the Omega AI24 products. And again, some incredible clinical data here. A 28% improvement in speech intelligibility over a JI with the DNN360 and up to 8dB of signal to noise ratio improvement for those situations where you want to be more spatially aware for the signal of interest that might be happening around or off to the sides of the patient in those noisy environments. And again, with all of these tools available to your patients with Omega AI, no impact on battery life. Again, the power of our integrated neural processing unit means your patients get all of the benefits of the most powerful DNN in the industry, but they don't have to worry about how is this going to affect their daily usage of their hearing aids.

With battery life, they can have DNN 360 running all the time, DNN speech and noise algorithm running all the time. And even if they want to, they can engage the Edge Mode plus and have it run automatically all day long and not lose any of their battery life on their products. A pretty, pretty amazing power and efficient processing available to your patients. Now I want to move from DNN signal processing and touch a little bit in these last 15 minutes or so on moving beyond better hearing and focusing in on overall health and well being. And in these scenarios, we're not necessarily talking about DNN, but more kind of AI features overall.

But looking at the additional concerns that your patients might have. Yes, hearing loss is the number one reason patients come in to see you. It's the number one focus of what we do with our hearing aids

today. But we also want to look at the patient as a whole. And you can take a look here at top concerns of, you know, older patients.

And yes, hearing loss is up there, you know, as one of the top, but safety and balance, cognitive issues, ototoxicity, diabetes, isolation, et cetera. And we know that many of these concerns are somehow connected to hearing loss. I think we're probably at this point all very aware of the Achieve study and how hearing is connected with areas of concern for many, many of our patients. And that's where I think we can provide additional benefits best hearing possible. But how can we address other concerns that your patients might have around their overall health and well being?

And again, Starkey is incredibly proud that we were the first manufacturer to integrate inertial measurement units into hearing aids, to take the hearing aid from a single purpose device to a multipurpose device for your patients. And the first utilization of this was activity tracking. We still have the most activity tracking classifications in the industry. Very, very accurate and identifying, you know, how many steps a person's taken when they're walking, you know, what's happening when they're running, when they're doing aerobics, are they, you know, biking. So if a patient wants to tap into the accuracy and the information that's available to them from those onboard sensor around their activity levels, excuse me, they can do so easily through the My Starkey app.

The other area that we are still the only manufacturer focusing in on with hearing aids and artificial intelligence technology is a focus in on falls and balance. Again, this is one of the number one concerns for many, many of your patients is the idea that you know, what happens if they fall, Are they a potential risk for a fall? And again, Starkey is the first and still only manufacturer to offer your patients a fall detection and alert system within the hearing aids that they could wear ideally every single day, every moment that they're awake. And this Fall Alert system really provide some peace of mind both to the patient and to the patient's loved ones. And you're going to see it's, it's very, very easy to use.

And when it comes to, you know, kind of how are we, we utilizing artificial intelligence around this tool, it really comes down to the fact that we've been able to train the sensors on board our hearing aids to know what a fall kind of quote, unquote looks like. You know, there's some very specific characteristics that when a person takes a fall. And you can kind of graphically see an example of that here on the screen as you're looking at the presentation today. You know, what's the difference between walking, sitting down, taking a stumble, taking a fall, for instance? And what we've done is essentially feed, you know, thousands and thousands and thousands of examples of different types of falls into the hearing aids.

And here's a couple of videos showing you how we gather this information and then feed this data into the hearing aids and the sensors to very accurately be able to identify, well, that was a fall, that wasn't a fall, and use the power of the artificial intelligence to be very accurate in identifying if a fall happens or not. And again, it's very easy to use. A fall is detected and then an alert is sent to up to three contacts or loved ones. So essentially again, using the onboard sensors, a fall can be automatically detected. The hearing aids communicate with the patient's smartphone and sends an alert out to up to three contacts via a text message.

Once that loved one acknowledges that they got the alert, the patient will actually get notification that that alert was received. And again, I'm just going to play a quick little video kind of running through this process for you. Your hearing health is important and so is maintaining your safety and well being. That's where Fall Alert comes in. The app feature that enables your hearing aids to detect when you fall.

Then send a text message with your location to the people you choose so they can get you help if you need it. False alarm. No problem. You have time to cancel an alert before the text message sends. To set up Fall Alert and invite a contact, just follow four simple steps from your app.

Home screen, tap the health icon. Next, scroll to additional setup and tap set up fall alerts. Learn about Fall Alert on the two welcome screens. You can sample the sound indicators you'll hear through your hearing aids if you fall to familiarize yourself. When ready, tap.

Next, a permission box may appear asking if Fall alert can Access your contact. This would allow the app to enter your contact's details using your phone's contact list. If you choose not to allow this, simply complete the fields yourself. Now send your Fall Alert invite. Your app will then confirm the invite has been texted to your contact.

You can also invite another contact if you'd like to find out if your contact has accepted your Fall Alert Invite, tap more.

Next, tap App Settings and then Fall Alert settings. If your contact is listed as pending, they haven't accepted your invite yet. Here, you can resend the invite if you'd like. If your contact is listed as active, they've accepted your invite and will be notified if you fall.

And I know that was kind of a pretty detailed step through of the setup and you know, once you get into the app, you'll see that it's really not that difficult to do for your patients or alongside your patients, if indeed they do want to set up the Fall Alerts. And I want to wrap up in terms of kind of these case studies around the AI tools that we've got in our healthable technology with a real world scenario. And here you can see we've got an 86 year old woman. She at the time was wearing Aji 24 Ricartes with the fall Detection and Alerts enabled. And this one's near and dear to my heart because this is actually my mom.

So you know, I always use her as a kind of an example as to why do you want to talk about fall potential fall risks with your patients? It's pretty easy in many cases to know if your patient might be at a fall risk and you can obviously simply ask in terms of your case study or your case history with them. But my

mom was wearing JI devices. She took a fall, just kind of set the stage. She had actually taken a few falls in the year prior to a fall happening where I would get the text message and she would almost always quickly call me and say, yeah, I know you got my an alert.

That I felt I'm fine. You know, I was at my friend's house, my neighbor's house and you know, I just kind of stumbled and you know, was able to get back up no problem. But one day this was, and I still remember it was a Friday morning, I got the Fall alert on my phone. I waited for the phone call and none came in. So I gave her a quick phone call and she didn't pick up.

Luckily, she literally lives five minutes away. So I hopped in the car and drove over to her house and I've got a key. I went in and she had fallen at the end of her bed. Luckily, she's probably the ideal hearing aid patient in that she puts her hearing aids in before she even gets out of bed and she has them in her charger right next to her bed. She put them in, she got up, she went to, I don't know, put her bathrobe on or something and she stumbled and fell.

And unfortunately we came to find out she had broken her hip. You know, she was in pain at the end of the bed. I called an ambulance, they came, took her to the hospital, you know, did an X ray and found out that she had broken a hip. And you know, within a matter of hours she was in surgery getting a new hip tip put in. And you know, the reality is, you know, at the current in her, what was her living situation at the time she was living in an independent living house within a retirement community.

You know, no one would have probably checked on her. I know I hadn't planned on actually seeing or talking to her until that coming Sunday. And again this was a Friday morning. So in reality there may have been a chance that she could have been laying at the end of her bed for two days before anyone knowing that something had happened without this fall detection system. So this is a really personal example to me as to why, if you are working with Starkey products and there's a multitude of reasons why you should be recommending Starkey hearing aids to your patients, this is another tool that you

can offer them for peace of mind and real world benefit.

Of course, best hearing possible, but also these healthable technologies. We have since built upon the Fall Alert and Fall Detection and Alert system where we now moving into how can we potentially prevent a fall from happening using those onboard inertial measurement units. So our first foray into this was what we call a balance assessment utilizing the exercises based upon the CDC Steady program where your patients can use their hearing aids and their mobile app to do a series of assessment exercises and actually see are they at risk for a fall and potentially then take steps if the answer is yes, you know, whether it's seeing a physical therapist, starting an exercise program, etc. To improve their physical stature so that they're not going to potentially, you know, succumb to a fall. With Omega AI, we introduced our balance builder tool within the hearing aids and the My Starkey app again using a very well studied program known as the Ortega Exercise program where we use the onboard sensors to allow a patient to actually do a series of exercises that are targeted to the components of their physical activity or their physical performance to help prevent a fall.

So we've got really multiple components around falls and balance with of course the fall detection and alerts being there if a fall happens, but also tools to allow your patient to assess their risk of a fall and then the balance builder to hopefully, you know, strengthen areas of the body to hopefully prevent that. So just to wrap up, you know, you can see here a number of areas around Omega AI and what we're doing when it comes to deep neural network approaches to sound quality, hearing and noise, etc. And then of course, everything that I talked about when it comes to the healthable features, I didn't really dive into the generative AI components because that is another area of artificial intelligence where we've really integrated Gen AI for the first time in the hearing industry into tools that are available for your patient to make their life easier to work with their hearing aids easier. But we do have a number of sessions here at Audiology Online that get into our generative AI tools as well, if you're interested in that. So to wrap it up again, I want to first of all thank all of you for joining us.

Hopefully you found these examples of real world patients getting true hearing benefit from our deep neural network tools moving from Genesis to Edge AI and now to Omega AI, incorporating all of these DNN tools to for the best hearing possible for your patients in the widest range of listening environments. So again, thank you for joining us and thank you to Audiology Online for allowing us to participate in their Innovation Summit. And if you have any questions, I'll keep an eye on the Q and A area and hopefully we see you here at Audiology Online in the future. Thank you and have a great rest of your day. Sam.