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Looking to Listen – Demystifying Central Auditory Processing with Visual Examples

Presenter: Elizabeth Haley, AuD, CCC-A

It's my pleasure to welcome back Dr. Beth Haley with us today, Dr. Haley will be presenting Demystifying Central Auditory Processing with some visual examples. If you'd like to learn more about Dr. Haley and her background, you can read the bio on the course registration page, but at this time I'll hand the mic over to you.

Dr. Haley, thank you so much.

These are my disclosures and learning outcomes for the course.

Welcome. Thank you so much for being here. And I'm going to be speaking with you today about central auditory processing, some important concepts in central auditory processing and central auditory processing disorders and give you hopefully some relevant strategies to explain these very thick, very dense concepts for your patients and hopefully to help you better wrap your minds around these concepts as well. Firstly, I just like to state the importance of healthcare literacy in general in our work as audiologists. Being that we're communication professionals, it's very important that we're continually thinking about how we present information to our patients.

And healthcare literacy is a great field of research to explore if you have interest in this. More generally, healthcare literacy is defined as the ability of individuals to obtain, process and understand basic health information and services necessary for making informed health decisions. And healthcare literacy is a very critical component of our healthcare delivery, of our effective healthcare delivery model. It influences patient outcomes and it has impacts on overall public health. So this is definitely an area that we should be thinking about as communication professionals in exploring some of the research in healthcare literacy.

There is quite a wide breadth of research and a number of great articles have shown that this is again, a very important concept for us to think about, maybe specifically, specifically with our patients that

have hearing or listening difficulties. And A meta analysis, for example, from 2016 indicated a strong positive correlation between high healthcare literacy, effective healthcare literacy, and adherence to medical treatments. So essentially our patients are far more likely to engage with us and be following along with our treatment plans that we so carefully construct for them and if they have access and high level of healthcare literacy. Unfortunately, for patients that have hearing and processing issues, we know that verbal information that we give them during appointments, they may be forgetting about 40 to even 80% of that verbal information that's given during a medical appointment. So certainly that tells us that we need to consider some other strategies of giving this information because we don't want people missing sometimes upwards of half of the information that we're giving them during during a medical appointment, which can already be very overwhelming for the patient with a communication issue.

A systematic review has also estimated in 2014 that limited healthcare Literacy, aside from having sort of the empathetic cost and impact, also has very real economic healthcare costs and impacts. So it can account actually for an additional 3 to 5% of total healthcare costs annually if we are not properly addressing healthcare literacy across the board. And, of course, I do feel that we are professionals who can handle this and begin to address these concerns in very relevant ways in our practice, because we're used to thinking about what helps people communicate effectively. And we know that individuals with hearing loss may, may in particular face challenges in understanding their healthcare options simply because they're unable to hear or maybe even process complex information that is being thrown at them.

Basic auditory processing skills can also significantly impact reading development. So if the argument is, well, if we're forgetting, you know, potentially 40 to 50, 40, 40, excuse me, to 80% of what's being said verbally during a medical appointment, perhaps we can provide some literature to the patients before sending them home. And I do absolutely agree with this strategy in general, and research would support that. It is very important to give patients some sort of written handout or written form of that

information. That's very important.

But we know that specifically, our patients with processing issues may struggle with some aspects of reading or of organizing complicated, you know, longer paragraphs and complicated linguistic information via even the written format. We know, for example, that there are relationships between CAPD and other developmental disorders that impact literacy, such as dyslexia. And so this is not just healthcare literacy. Think this can impact our general ability to read, write, and process written information, but it certainly impacts how we want to approach healthcare literacy for our CAPD patients.

So I realized quite, quite quickly. I've been working with auditory processing patients for about nine years now, and I realized rather early in my practice that we definitely needed to explore some other ways of presenting important concepts in CAPD to these patients and to their caregivers as well.

This got me thinking a little bit about how I learn as an individual and how I like to teach information when I'm teaching in a classroom setting. And I personally do feel that it's very important to provide not only a lecture or speak over information, but to also provide corresponding visual imagery. So I wanted to explore the literature a little further and see if this thought of mine sort of supported in the research and literature, the research in healthcare literacy. And it turns out that visual imagery can actually support our ability to process healthcare information in a number of very important ways that are listed on this slide. It can enhance our comprehension of information, making very dense, complex information a little bit more manageable and more concrete.

It can also facilitate how we retain information. So not only are we able to comprehend information a little bit more easily, making the information a little bit more palatable, but the hope is that we can also help our patients to retain that information over a longer period of time, which, of course, is very important to their adherence to treatment plans. This can also be very helpful for addressing language barriers. If a patient does come with a developmental language disorder or issue, this can also be very

beneficial for our patients, for whom English is not their primary language. So this provides a really nice way to tackle multiple types of language barriers.

Also can be very helpful when working in pediatrics. Not something I've specifically explored in the literature here, but working primarily in pediatrics, in my clinical experience, I certainly feel that kids respond very well to strong, concrete visual images. And there's also just some improvement in patient engagement when you're sort of interacting with that patient and showing them a visual example, like some of the exam examples I'll show you in this talk. It hopefully just gets their brain kind of connected and engaged in a few different modalities, a few different ways. This can really promote our health care and health literacy in education in general.

So it can also be very beneficial if you're presenting this information to other professionals in an interdisciplinary context. And just in general, visual images can sort of help ground us and can be very beneficial in navigating health information just in general. So while the focus of this talk is not necessarily to give you a broad overview of what CAPD is, that's a little bit outside of the scope of this talk. I just want to make sure that we're on the same page in terms of kind of what we're defining this as. This, this disorder as.

So CAPD, according to the Breton Consensus Conference in 2000, is a deficit in the processing of information specific to the auditory modality and associated with difficulties in listening to speech, language, and learning. So, as you see, first and foremost, this is a condition that is specific and that we can target treatment in the auditory modality. This gets complicated when we think about some of the cognitive aspects that impact processing, and I will speak on some examples of that. But keep in mind that just a cognitive issue, like having an attention disorder, for example, is not sufficient to diagnose a central auditory processing disorder. We are looking for very specific results on our diagnostic testing that support that we're.

This is really a problem of the auditory modality. This also impacts speech, language, and learning. So that's sort of the key information derived from the Breton Consensus Conference in terms of Ash's understanding of capd, they start to categorize CAPD a little bit. So they refer to sound localization, lateralization, temporal aspects of sound recognition, auditory pattern detection and auditory discrimination. So they start to sort of categorize what is apd.

And I like this, and I'll show you in one of the visual examples a way to categorize this information that I found beneficial with my patients. When patients though come into the office, you know, already looking at the previous slide, that is a lot of information to impart on a patient. It's a lot of information to impart on you folks. And you're familiar with this, this conceptually. So these patients really are coming in describing symptoms or describing characteristics or behaviors often.

And our goal here is to sort of link some of these characteristics and behaviors with these visual examples. So these patients really leave feeling like we've addressed the issue that they're coming for because they're not thinking, oh, I have a problem, you know, specifically with sound detection of short syllables. We may be thinking at that level, but auditory behaviors and characteristics are the level they're thinking at the about these, these problems. So some of the more common ones that I, I see or run into would be difficulty kind of calling to mind and verbalizing short term or long term information, saying how or what frequently. Some of these very much mimic what we see in peripheral hearing loss as well.

Probably the most common thing I see, maybe especially in, in the pediatric population, would be difficulty following verbal multi step instructions. That's a very common complaint. Confusing different words or having sound sensitivities can also be reported. And then as I've touched on, we sometimes have patients that report issues with phonics, spelling, writing. This can definitely impact language and literacy development as well.

Difficulty in the presence of background noise is probably one of the other top common ones that I hear as well. So difficulty following verbal multistep instructions and difficulty in the presence of background noise, these would be the two things that I would encourage you to sort of practice thinking about how you'd explain to patients, because those are things you will, I'm sure, hear multiple times. Working with patients that have central auditory processing issues, again, beyond the scope of this talk, there, there are lots of really interesting and really helpful models that have been proposed over the years to sort of better define what central auditory processing skills impact a central auditory processing disorder. And so I have categorized them for you here again to sort of model for you that categorization and laying out information in a nice clear visual manner like this can be very helpful. But certainly this is a bit of an oversimplification here and what we more often see, rather than seeing each area, each domain perhaps being impacted, you know, only one of these domains impacting one individual.

What we tend to see are what I call constellations of symptoms or constellations of issues, where there may be issues with multiple categories listed here on this slide. So I don't want you to think of these as just isolated categories. They do often co occur and kind of co mingle. But we do tend to see these certain constellations, they tend to co occur or cluster in certain individuals in a specific way. So.

So for example, you may see an auditory figure ground or speech and noise issue for very short words, co occurring with an issue with temporal processing or recognizing gaps. Those tend to co occur sometimes. So an oversimplification. But it's important to me that I give you a little bit of a framework for how I'm going to talk about some of these visual examples. So I will not address each of these categories, but the category that I am going to give you a, a really hopefully helpful visual example of falls under the temporal processing category.

So this is timing related information in apd and I'm going to speak specifically on auditory closure. And what is auditory closure with respect to temporal processing? To speak very briefly on the others

auditory figure ground is that difficulty hearing speech over background babble noise. Dichotic listening involves listening and processing two competing messages that are presented simultaneously to the left and the right ear. And that can sound like a lot of information all at once.

But very simply, you are playing one message to the left ear at the exact same time another message is being played to the right ear. And if you're asking the patient to combine those messages in some way and repeat back what they heard in the right and left side both. That's binaural integration. Binaural separation is when you ask the individual to only repeat information that they hear in perhaps their right ear, suppressing information from that.

That left ear. I'll speak about temporal processing in the visual example when we get to kind of the, the real fun part here, phonemic processing being our processing of the little discrete components of speech, or excuse me, of, of yeah, of speech that make up a word, phonemes, and then auditory vigilance being auditory attention. So these are some of the bigger categories. And when I present these to patients, I would really encourage you to think about presenting them in some kind of a table format. And I've given you this as an example.

Again, the purpose of this talk, not necessarily to be to reiterate all of the information in this table. It's certainly helpful information and I encourage you to take a look at this, especially if you work with, with APD patients. But this is more to demonstrate the importance of just laying out this information in a really clear and concise manner. So presenting kind of the domain that we're looking at. What difficulties can, can arise if there's an issue in that domain and what that information would present, like what behaviors that that patient is coming to you with, what behaviors are they concerned about that could be explained by a difficulty that we're finding in our diagnostic testing.

So again, giving you this table to kind of give you that framework and orient you, I will not reiterate all the information on this, this slide, nor on this slide. This is just capturing all of the domains that we might

potentially look at with apd. So I encourage you certainly to take these examples and modify them for your purpose. This is a little bit of me just sort of sharing a helpful format for presenting this information. So let's get into some of the funner visual examples.

The first that I'm going to share with you demonstrates a way that we can explain a diagnostic concept in apd. And the diagnostic concept that I'm going to look at and explore with you falls under that temporal or timing related category of auditory processing. And this is referred to as auditory closure. So this is a concept, a actually a cognitive based concept or a cognitive process that does occur in other systems besides the auditory system, which is one reason why we're able to use it as a great, as a great visual example. So closure is again a cognitive process by which a system like the auditory system fills in gaps in sound information.

There's actually some research that suggests that when we parcel up spoken information, like if you were to take a sentence from this presentation, analyze it and break it down into much more discrete components like words or even phonemes, those phonemes would be completely unintelligible at that level once they're processed down to the root. And that's not because we're not capable of enunciating a phoneme. It's not, that's not because we're not capable of, of pronouncing these sounds accurately. That's because of the phenomenon co articulation, because as we pronounce sounds together in the context of a sentence that those sounds start to get very jumbled and the reality is your brain is not actually processing every feature of what I'm saying. That would take way too much energy for your brain.

And our brains are actually relatively lazy. They want to take the path of least resistance when processing information. So as we get better and better at hearing certain sounds, as we grow up, we begin to be able to fill in the blanks even when part of the message is distorted or when it's completely missing or occluded. And this is really important. Think about this just for one moment, because when

we are looking at an auditory processing issue or even a peripheral hearing loss in some cases, information absolutely is getting missed, because we're not.

We know that information is not making its way all the way up to the brain either because there's an acuity issue, the sound is literally not loud enough to make it to the brain in the case of a peripheral hearing loss, or there's a processing issue, the processing load is too great, or there's a deficit in one of the categories listed in prior slides. And that information, you know, we're not getting a complete picture. Our brain is not getting a complete picture if there's a true CAPD happening. Missing information is one thing we can fill in, but we can also fill in occluded information. And, and for the purposes of the, of the auditory discussion, you can almost think of this term occluded like the term masking.

We know that when we have processing and when we have peripheral hearing loss issues, both there's issues with masking and co articulation and some of our speech sounds cover up or occlude other speech sounds. So this phenomenon I see as being very, very essential to understanding capd because realistically, our brain is doing a lot less actual hearing of the discrete elements of sound and a lot more of this closing. I'm making that word up a little bit, but it's doing a lot more filling in the blanks than we realize. And this phenomenon in general is, is very well studied. It's related to Gestalt psychology, which Gestalt psychology basically posits that the human perceptual system, or basically our perception, is our reality and it tends to perceive incomplete forms as a whole.

We really don't like missing information because we really want to facilitate our understanding of complex environments. And so, unsurprisingly, auditory closure plays a really significant role in how individuals process specifically speech information, particularly in noisy environments or when auditory information is not complete. Visual closure you can think of as essentially analogous to this Auditory closure. We know that also the human visual system tends to organize visual elements into coherent

holes. I like to think of pointillist artwork to explain this concept.

One of my favorite examples being the artwork in Ferris Bueller's Day off, where Cameron, if any of you have seen that movie, it's. It's a very famous scene set in Chicago's art museum, where Cameron is staring at that big image where it's set in a park and there's individuals just playing in this really beautiful park. But the image is actually constructed with little dots. And this is called pointillism. And pointillism is a very interesting thing to think about.

Um, but it's. It's a great sort of example of how things like visual closure might work, because our. Our brain inherently wants to take these little data points, pixels on a TV being another great example, and it wants to really summarize that information as one whole concept. And it's doing this in the visual system. It's doing this in the auditory system.

And just like there are some processing issues in the auditory system, there can be processing issues with visual closure in the visual system. People with schizophrenia and people with dyslexia being two groups where this is likely to play a role in some of their. Their deficits. So this is the part I'm very excited to show you, and this is mimicking or sort of mocking how I might present the concept of visual closure in an example to a patient. So what I'm going to ask you to do is just keep your eyes in that square in that box and focus on that box.

And as we progress through the next slide, you'll see I'm going to start to give you little elements here of an image. So there's kind of a couple little features you can start to pick up off as I increase either the number of elements, the depth or sort of salience of the elements. You see this image getting darker as I add things like an outline to give you some cohesiveness to this message. As I give you color, which is another great visual element your brain can make predictions about. You see that this image unfolds, excuse me, into an image of a duck.

Very simple image, but we start with having no idea what this image is. And as we add in these perceptual elements, you see the image begin to emerge. Now, in the visual system, this is very easy to do in real time, because you can compare all these elements right in front of you in real time, kind of like the image of the pointillist artwork. In the auditory system, timing becomes a really important aspect of this because kind of, as shown in this example, you need to watch these perceptual elements unfold over a little bit of time, over giving yourself a little bit of kind of something to ground onto and some features to really hang on to and to process. So you can use this to kind of explain to your patients then what kinds of features are going to help them best in their auditory message.

Fill in this picture to, to think about a sentence. Very generally, words like a, the, you know, articles, they're not very meaningful words, but we know that certain moments in a sentence indicate more meaning. And so if you can show a patient just how concretely this image of visual auditory closure works in recalling this full image, it can really help you to start to present this as a general concept to them in the auditory system. I feel it makes it way more concrete. And there's also some sort of theoretical basis for doing this because we know that visual cues such as lip movements actually can influence how we perceive ambiguous auditory information.

So if someone is questioning, did we, did I say this word or this word? And they're very similar sounding words. You can also remind your APD patients, look at the power of, of processing these visual features and look at how well that helped you draw a conclusion about this message before you even had the whole image. You can do this same thing with listening. You can, you can teach yourself, we can together teach you to know which elements of a sentence and which moments are a sentence are going to be key for you.

So being able to sort of introduce these visual concepts also helps us to tackle this idea of sort of cross modal integration. So speech reading, we know, benefits people with CAPD and people with hearing

loss. That's a way that you can have your patients hopefully buy into this as a concept.

Next, I'm going to speak about a second diagnostic example called bistable perception. And bistable perception is going to be most closely analogous to dichotic listening. It's not a perfect analogy, but for, for the purposes of explaining this to patients, that's going to be most closely analogous to having competing messages in, in opposite ears. And I personally like to refer to sensory illusions and I'm going to give you a visual illusion in a moment that I like to use to explain, explain this concept. Now, sensory illusions can occur in all sensory systems as far as I've researched, including tactile.

The tactile example I like to give is if anyone remembers back from at least when I was a child, There was a very temporary period of time where I believe it was Heinz ketchup released. Purple ketchup. Purple ketchup. I. I don't care what anyone says.

I know that it is exactly comprised of the exact same material as, as our regular old red, red ketchup. But you will not convince me that purple ketchup tastes the same. I think it tastes gross. I think it's the worst out of all of them. And green ketchup is almost as bad.

So these sensory illusions can occur also crossmodally. And to think about a common saying of, you know, we eat first with our eyes. The example of the ketchup is kind of another good example that, that is hopefully helping you buy into this idea that we can really think about these visit visual images to help us logic through this information and make it concrete in a different way. So by stable perception to just catch us all up on the same page. Definitionally, it's the individual's perception of an unchanging stimulus.

So the catch up's not different, but our perception of that catch up is, is different. And with respect to visual or auditory domains, this involves spontaneously alternating between two different interpretations of a message. So sensory systems being that we rely on comparison between what's coming in and

kind of what we think is going to be coming in. What we. What do we think someone's going to end a sentence with versus what do they actually end that sentence with?

We're constantly making these comparisons. And so it's not. It makes complete logical sense to me that like, we compare information across our two ears. When we're thinking about dichotic information, we compare information across our two eyes and we use binocular rivalry as a way to systematically kind of test this in experimental studies. So binocular rivalry, I would say, is a close, analogous.

Analogous analogy to dichotic listening in that it involves also presenting the eyes with two images that are overlapping not temporally like they are in the ears, but in terms of spatially. So you may have one set of plaid, plaid lines in kind of moving in one direction and overlay it with a second. And that may completely change your perception of the movement of these lines across the screen. There are a lot of really cool examples of this. And I really encourage you to get creative with this and maybe after this talk, explore some of these visual illusions and think about how you can use them with your patients.

I'm going to show you one here which is a very famous example of the vase profile illusion. This is from, from actually Art, it's really was meant to just be introduced as artwork and has since been adapted and has been used in many research studies to explore this idea of bistable perception, of having conflicting messages presented to you and having to sort of process each message separately and also wrap your head around the fact that there's kind of two. Two things going on here. So in this image, hopefully everyone can. Can see the illusion.

Hopefully it's quite evident. But you see in kind of the middle white portion of the image that there's a depiction of a vase. But if you look to the sides of the image, you see faces. And so the way this image is constructed reminds us in a really concrete way that our brains can actually really only interpret technically one kind of stream or one message at once. It has to alternate back and forth between these two messages.

And that's one of the reasons why dichotic listening can be such a difficult skill and can be so hugely impactful when it's not functioning properly.

One important aspect of these visual images of the illusion that I just showed you is this idea that it's also not just about processing the message that's really there. So people with CAPD don't just have to process the sentence that they're actually hearing, but one of the reasons why you see in the behaviors and characteristics, they'll sometimes respond the exact opposite to a direction is because we're not only required to process the message in front of us, but we're actually also required to inhibit conflicting messages. Messages that are not the interpretation that we. We want to go with or that is helpful to go with. Excuse me.

And the Stroop effect, which I'm demonstrating on this slide, is a great way to explain this to patients. So the most common iteration of the Stroop effect is in this color word example.

And in this example, you'll see some. Some words, some colors written below. And you'll notice that there's. There's some incongruencies going on here. So the word, for example, the word black is written in green.

And this creates some processing tension in our brain because we naturally automatically like to read words on a screen in front of us. It's kind of the reason why closed captioning can be. Can be so effective because our brains just automatically like to read the word as it's presented. Because again, we're processing that gestalt processing. We're trying to take that whole image and make sense of it.

We're trying to take that whole sound and make sense of it. So While processing what's really there, we also have to inhibit what, what is not a good interpretation. And in the Stroop, we ask individuals to respond not with the, the word that's written, so not to say black, but to actually say and respond with

the color of the word. So in this example, the individual would have to say green, black, orange, red, blue, purple. And that is a little nerve wracking to make sure that we get correct.

Even myself, having practiced with this talk, has to sort of think for a moment to make sure that we're not inadvertently going back to our first interpretation. So this can be very difficult to tackle for someone with a processing issue because not only are we needing to free up their brain to have the energy to process the actual message that's coming at them, but because of the disorder in their system, they're probably. Their brain is sort of pinging and highlighting probably a lot of incorrect or inconsistent messages, things that we don't want the interpretation to go towards. This just presents another example of how you might be able to visually sort of depict this droop effect for your patients. So this is a more kind of spatial example of this droop effect.

Again, just to wrap up this, this part of the talk, there are similarities between processing of ambiguity in the visual system and in the auditory system. These have been observed in many studies and have definitely suggested that the two systems share common principles of perceptual biastability. So this convinces me that I'm, I'm allowed to take this liberty to some extent and use these visual examples to inform our understanding of auditory ones. So let's speak about a treatment example next. And again, it is outside of the scope of this talk for me to go exhaustively into all the different ways that we approach treatment with capd.

More generally, we, we tend to want to use several different strategies to treat capd just because of the complexity of what's likely going on for that individual. And outlined here are some of the, the approaches or, or strategies that we might kind of bigger picture focus on. For these individuals. We may use direct skills, remediation, bottom up kind of training, perceptual training. We may use compensatory strategies helping the individual to fill in the blanks.

For example, in the example of auditory closure, we may use different trainings to give them additional practice. We may give them a device that increases either their signal to noise ratio, or we may give them a device that increases just the level of sound in general. Depends on what, what specific type of CAPD we are dealing with. But one of the most simple ways, frankly, of addressing these patients and giving them something first appointment out the door to start working on is to give them some environmental montages and even just listening and communication strategies. I'm going to share with you these next two treatment slides again to give you a framework of some just examples of interventions and treatments for capd.

Because even when I've given other talks about this subject, I've often had people follow up with me about, well, you know, how do you even approach treatment for these different areas and different, different categories. So while again, not the focus of this talk, I love just, you know, sharing this, this information and I really believe that it's important we don't reinvent the wheel. Let's share our resources here. So this is just to give you an additional resource and some, some potential options to think about treatment in these various categories. To talk through the actual example though, I'm going to try to highlight for you the, the power of using communication strategies which can be hard to get patients to buy into sometimes.

So let's talk about cognitive priming. Priming is one of my, I think one of the most fascinating and one of my favorite psychological phenomena. And what it means is simply that exposure to a previous stimulus then influences a person's subsequent responses to any related stimuli that follows. Follows, you know, that, that prime. So an initial stimulus, an initial prime activates a certain category of our memories.

I like to think of our brain almost like a Dewey Decimal filing system. And so we're activating just one category of that filing system. I actually also love if you've seen movies inside out and inside out too.

The way that they present memory and sort of show long term memory in those movies is kind of how I think about my memory. It's almost like many, many bookshelves and we need to get, get the person to the right bookshelf so they're not off in the nonfiction section when they want to read about, you know, science fiction, let's say.

So this can serve as a really important mechanism for shaping our experience. And there are a lot of types of priming. I won't go exhaustively into these, but there are a lot of different types of priming. So I really encourage you at the end of the talk to think kind of creatively about ways that you can prime your patients, that you can give them some kind of indication categorization of what's to come in our appointments. And there are a lot we, we can do this in, in so many ways.

I could probably give a talk just on this topic, but to give. To talk through just a couple examples of types of priming. Perceptual priming is a really common one that we think about with sound because perceptual priming involves either visual or auditory kind of characteristics, looking at things like amplitude, frequency, duration, et cetera. So there are, again, a lot of different types of priming we can prime conceptually based on categories we can prime based on prior meanings, like referring to a doctor. And then more easily and more quickly being able to call to mind the term nurse.

Definitely encourage you to explore some of these concepts of priming when you refer back to these slides and to just wrap up, you know, kind of all of the different types of priming that I've observed in the literature that I think relate, relate to this issue. So feel free to explore these later at your leisure. The example that I'm going to give you is an example based on what I'm sort of presuming, I'm going to assume that a lot of our backgrounds here are medical or scientific in some way. So the example that I'm going to give you, I'm cheating a little because I'm not just saying the word, I am visually presenting it. But the example is the word cell.

And as you know, there's multiple interpretations of the word cell. Cell. The interpretation on this slide is cell, like a biological cell. And given that we have some scientific, I'm sure, very bright people in this. This room right now, that is what I'm going to presume, based on your prior experience, you're going to think about when I say the word cell.

But of course, we also know that this is also a representation of a cell. Correct? And if we change the word slightly and we say cells, our visual imagery also changes. So rather than showing a singular cell, like the cell with the cell wall, kind of how we all imagine it in biology, now we're going to a more multifaceted image and seeing multiple cells. And this can change our imagery of the jail cell as well.

You're probably no longer seeing this image. You're probably seeing something more like this image in your internal mind. Because the way that we think about language and the way that we visualize language very much correlates to the way that we are hearing certain words and hearing certain language. So what if I change the word again? What if, since I'm saying it verbally, what if I didn't really mean sell the way that we thought I meant sell.

I meant this kind of Cell. Now we're drawing a different image to mind, right? And for an individual with APD who is needing to not only process what features of sound, amplitude, volume frequencies, what information is coming out to them at that level, they're also needing to figure out, am I even on the right interpretation? Kind of generally in an overarching way. So this is a lot of processing work for individuals with apd.

And a simple, simple thing that we can do to make it easier for someone with APD listening during a conversation is to simply tell them what we're talking about, give them a prime, give them a word, give them a vocabulary unit to sort of hold on to. Excuse me, that will help them get to the right bookcase far more quickly than if we just leave it up to an. A more ambiguous determination like the word sell. So I really encourage you to think about what, you know, other examples like this and other examples of

words that have multiple meanings. And how can you sort of visually present this to patients in clinic.

You can even have them draw their mental image of a specific word and show that comparison that way. So this is just, I feel, a very good way of getting patients, and hopefully clinicians as well, to buy into some of those simplest aspects of treatment, which are literally give the person the subject of what we're talking about and help them get to that right kind of mental bookcase. There are some other great examples of visual priming using the color red to evoke urgency in a sale. Marketing uses visual priming, oh my gosh, all the time in brand logos, but we can even impact our emotions. For example, seeing a picture of a happy face before reading a positive review can actually make the review seem increasingly positive, even more positive than you would have rated that review had you not been primed or sort of prompted with that smiley face.

Very fascinating when we think about how differently we might perceive the world if. If this concept did not exist. And I encourage you to explore these other examples. One that might be really helpful for your quiz is to refer back to the Yani and Laurel audio clip, which, I apologize, I don't have time to play right now to play today. But if you remember, the Yani and Laurel clip is a nice example of ambiguous auditory processing in which individuals either hear Yani or Laurel, depending on how their brain decides to complete that message.

So just some other examples you can explore for your own personal uses later as you're. You're counseling your patients. I genuinely hope that this information helps you not only understand this information in a more concrete way, yourselves, but that you feel comfortable imparting this information and kind of a simple format to your patients. So overall, we always want to make sure, you know, I personally feel this is a good idea to use these visual examples. I hope you, you as well feel that this is a good idea and a good way of approaching this issue.

But it's always important to just confirm this in the research. And the reality is that health care literacy and counseling are extremely interrelated and that we do have a role and a very important responsibility in counseling our patients. And we need to be sure that we are enhancing their understanding of hearing loss, enhancing their understanding of the effects of any processing issues that they may have, hearing or listening issues. We want to help them disclose these issues and feel comfortable talking about it, which I think this visual format, again, sort of draws them into the app appointment and really engages them to be also a part of that discussion and an important member of that discussion. We want to decrease their stress, not use jargon, keep the information as simple and straightforward as possible.

And we overall want to increase satisfaction with the therapeutic progress that they're having. We want them to understand that these gains may feel small because we're trying to really remap the way that their brain is approaching sounds. So I think explaining these in a more concrete way really helps them to hopefully appreciate what it is that we do and the beauty of the work that they're doing in, in therapy and in addressing their processing issues. And ultimately, as I presented even in earlier slides on health care literacy, we know that continuation of these visual examples can really support the long term adherence to treatment. So we often, although we do other forms of counseling, we as audiologists are often primarily responsible for informational counseling.

And I think using these visual examples is specifically so beneficial in informational counseling. And I would say the research does support that. So really the role that we're held to is that we are to inform patients and, or their family and communication partners about processing issues and its consequences. These visual examples do meet that goal. We want to present information informally and use easy to understand information.

We want to open that dialogue and not sort of keep people at a distance by using too much jargon. I do feel these visual examples do a good job of that and, and the research in healthcare literacy would support that as well. We want to present essential information first. And I think giving that visual kind of cue to map onto helps patients to understand the most important concepts first. And we also want to use explicit categorization, which is another reason why I presented you with the examples of, of the tables.

Because categorizing things, even very simply in the format of a table or chart, or presenting it visually that way can also just be very important to appropriate and effective informational counseling for patients with apd. So I'm of the belief that visual aids can be used during counseling to help patients understand abstract concepts in central auditory processing disorders. I hope that I have swayed your opinion about this topic to that extent. To some extent. And I'm happy to take some moments here to answer any questions.

And thank you so much for your attention to this topic. It is one that is very near and dear to my heart.

Okay, so I'm going to pull up questions in case people do have questions for me. Oh, I'm so sorry. So, actually, I'm going to go ahead and first jump back to our priming slide because I do realize that is a bit of a thick concept, and I would really like to just make sure that people are feeling comfortable with this. I kind of expected that there may be some questions about. About this.

This topic. So let's just go through a few more examples of types of priming. And I'm going to start with this slide because I feel that this type of. These types of priming are going to be the ones that are most relevant for our field, so most relevant to communication and hearing and listening issues in general. And I really encourage you to even Google some visual examples of these types of priming.

So I spoke a little bit about perceptual priming already. This is when a person is primed based on some kind of physical characteristic of a stimulus, like size, shape, or color in the visual domain and in the auditory domain. Remember, this is going to be something like the frequency is changing slightly in a sentence, or the stress or emphasis is. Is changing slightly in a sentence to help draw the listener's attention to the fact that this is an important and very meaningful unit that they will need to pay attention to. So adding emphasis in a sentence is just an example of a way that we naturally and intuitively perceptually prime information.

I think semantic priming, if I were to select one of these many options, I think that semantic priming is probably the one that is the easiest to display visually. So if, if you are not going to spend any time thinking about any of these other categories, semantic priming would be the one that I would encourage you to think of a great example to use with your patients. So in semantic priming, we know the term semantics. This involves related word concepts. So for example, I think of the example of the word steal personally, because I used this example once in a class that I was teaching, and I'm.

I'm based here in Pittsburgh, and I was teaching a class in Pittsburgh, and I said the word steal in the class to show an example of priming, because of course, there's multiple interpretations of the word steal. And I was expecting one outcome. I'm not sure what outcome you guys are expecting, but think for a moment about what you would associate with the word Steve Steel. And for those of you who know something about Pittsburgh, we have the Steelers here, the football team, and we are considered Steel City. So the stealing and mining industry here is a very big industry.

Many, many people are involved in this industry. And every single person in the class. When I said the word steel, primed, cognitively, semantically primed on the example of. Of steel, like the hard metal objects, steel. And this surprised me greatly.

I'm not sure what this says about, about me, but I was thinking of steel, like to steal money to steal an object. So you. You can see in that example, especially if an individual is really expecting kind of that one meaning, and, and they're hit with a total opposite of what they're expecting, that can actually create a little bit of like a cognitive pause, right? And a little bit of a moment where it. It kind of is a break in their.

Their processing ability. And, and to be honest, information coming at you when you've had sort of this. This break and what. What you're expecting when something has not met your exp. Expectations, that can really be jarring from a processing perspective.

So repetition priming is another really fascinating example. And the way that I might encourage you to approach this with patients would be to potentially explore some examples in music or in music therapy. Repetition priming is something that is capitalized on in music and in helping us to. To really appreciate and kind of have that. That emotionally positive feeling towards music.

Music, or emotionally negative, if that is the goal of the musician. So using repetition and keeping with patterns tends to get us feeling very cognitively relaxed because our brain knows that we're doing a good job of predicting what's coming. You know, we don't need to really be inhibiting much information because, okay, patterns sort of make sense to our brains, but when we purposefully break a pattern, that can be very jarring from a processing sense. And actually, movies like horror movies, for example, will use these all the time. So a horror movie might specifically use a very discordant sound, one that you are not really expecting to give you that kind of like eerie, uncomfortable, physically uncomfortable feeling.

So there, there really are some strong representations of these concepts of priming, even in our, our own body. And then, of course, conceptual priming. When I talk about the getting to that bookcase, getting to that right category, conceptual priming can be a really key and effective way if you can think

of a great example of conceptual priming to get the person to that category. Again, the most, the easiest one, the most simple one that I sometimes will include at the end of my recommendations for specifically kids that have processing issues is when you're in class, when you're in biology class and it's a class that you're learning a lot of words that might sound very strange and that you might not have a good prediction that you can make about, you know, what, what that word is is going to sound like in its entirety. Simply writing on the board like we are talking about bugs.

And then when you, you know, use the, the more scientifically complex term for bugs, the brain will make that association much faster because you've essentially placed that person's ears right in front of the correct bookcase, is the way that I think about this. So again, I, I really appreciate the time that you've taken to explore some of these concepts, hopefully thinking about them in a slightly different way, and I am absolutely happy to answer any questions that you all might have.

Thank you so much. Dr. Haley, will you advance to that final slide just to remind participants to complete the exam if they wish to earn CE credit for today's presentation? It doesn't look like we have any questions in our queue, so we just like to thank you for your time and your expertise and thank you again for joining us on Audiology online. We'll go ahead and close today's presentation.

Thank you so much, everyone. Thank you so much for having me.