



## S2E5: Transcript

# Cracking the Code: Searching for Language in Dolphins

with Dr. Denise Herzing

**TaviaGilbert:**

Welcome to Stories of Impact. I'm producer Tavia Gilbert, and in every episode of this podcast, journalist Richard Sergay and I bring you a conversation about the newest scientific research on human flourishing, and how those discoveries can be translated into practical tools.

In every episode of this season of the Stories of Impact podcast, we're asking the questions: What are diverse intelligences and what do we learn by studying them? And how those lessons support human flourishing?

Today, we meet Dr. Denise Herzing, Research Director and founder of the Wild Dolphin Project and Affiliate Assistant Professor at Florida Atlantic University in biological sciences. For the past 25 years, Dr. Herzing has been on a quest to crack the code — to discover the keys to the language of dolphins. Here's Dr. Herzing:

**Denise Herzing:**

I created the Wild Dolphin Project in 1985 with the vision of trying to find a group of wild dolphins that I could hang out with for 20 years or more and observe their behavior underwater. The express purpose was to study their communication system and see how complex that system was or if it represented some kind of language.

**Tavia Gilbert:**

I'm sure most of us are familiar with the sound of dolphins communicating: these clicks, squeaks, and pops that are so totally unique, so totally dolphin. What has Dr. Herzing learned over her years of study that gives us insight into how dolphins are making sense of those sounds?

**Denise Herzing:** Dolphins make three main types of sounds. They make frequency modulated whistles and a special type of frequency modulated whistle is called a “signature whistle.” So this is a tonal whistle. It’s often within human hearing which is great for recording. Whistles seem to be social sounds, and they’re used in long distance communication, so they travel far. Then dolphins also make clicks which are echolocation or sonar clicks — fairly close proximity sounds, maybe a half-a-mile distant, and they’re really used for navigation and hunting. Then we have the third sound called burst pulse sounds. And these are packets of clicks. And these are social sounds that you would hear during fighting, mating, that sort of thing.

**Tavia Gilbert:** One of the things that has changed over Dr. Herzing’s decades of study is that technology has advanced, so there have been developments like artificial intelligence that allow for deeper study into areas that before were virtually out of reach:

**Denise Herzing:** They’re hard to categorize. And this is why the computer technology now is so critical for us, because that technology can help us start categorizing those sounds and looking at some of their social interactions in a way we haven’t been able to do.

What Big Data does and AI does for us, is it lets us look at other types of sounds that are more difficult for humans to categorize. Is there order? Is there structure? Is there grammar to their sequences of sound types? Are there rules? And then how do we interpret it? That’s actually the biggest challenge. Interpreting is another thing. AI will get us most of the way there and then we still have to use a bit of human ingenuity and metadata and context to try to interpret meaning. Yay AI technology, being able to help us categorize these types of sounds and how they’re different in those high frequencies.

**Tavia Gilbert:** Dr. Herzing dreams of one day having a technology that might allow for humans and dolphins to have a dialogue.

**Denise Herzing:** I mean that’s one reason I really wanted to try to develop some of the two-way technology because like, I just sense that they’re so curious, like they want to be able to say more and do more, as we do, right? You know

I think curiosity seeks curiosity, and intelligence seeks intelligence, and I just think there's so much going on in there that, you know, until we have a tool where they can express that, and that's our challenge, right? I mean they already express whatever to each other. If we want to understand it we have to figure out a way in, you know whether that's to our pets or the wild dolphins or whoever, I just think it'd be fantastic to have that tool to understand these other minds on the planet.

**Tavia Gilbert:** In the meantime, here's what existing technology has helped us learn about the dolphins' whistles and clicks:

**Denise Herzing:** So a whistle is a frequency modulated sound, like you would hear me whistle like, (WHISTLE), right. And it's correlated with social behaviors, specifically moms and calves and individual recognition. So you could actually hear that if you were in the water, for example, with the dolphins, you'd hear a lot of that. The other sounds are broadband and they're short in time, so a whistle could be a second long; a broadband click is short and time and it spans a high frequency so you wouldn't hear all the high frequency stuff, only your high-frequency recording would capture that on the computer. But it's basically packets of clicks, you would hear it, it would, it takes on names like squawks and squeaks. It's just the way humans describe it, but if you measure it, it's a bunch of these tiny little clicks packaged together. And the burst pulses are a mystery, we don't know how information is encoded in a burst pulse sound. Because their sounds are so broadband and there's so many places to put information in that higher area, that they could be potentially encoding information.

Dolphins are really acoustic masters in the water. We still are learning a lot about how they passively listen to sounds, how they encode projecting their own sounds and how they learn these things. This is part of the mystery of their communication system. You know, like the Navy or any group would use underwater transmission information, you can encode things on a carrier wave: secret signals all that stuff. So again, we just don't know what the dolphins are doing with all that sound. So that is really part of the mystery.

**Tavia Gilbert:** Is Dr. Herzing ready yet to call that encoding, that communication, "language?"

**Denise Herzing:** Part of what we're trying to do is look for language-like structures or language-like rules, that might give us an indication how much, if any, language abilities they have. Now, we do know from captive studies that they have the ability to comprehend human-type languages. So we know they have the ability and the behavioral flexibility to do that. The big question is, do they do that in their own system? or is it just because they're exposed to humans in training scenarios, like primates do, that's actually been an issue. Are you enculturating a species in captivity and then testing them for these abilities? Or is it something that could be useful in the wild and they have it anyway? That's really a big question.

**Tavia Gilbert:** It was exactly those limitations of captive study that inspired Dr. Herzing to set up her research area in the dolphins' natural habitat, and to begin to get to know personally this most social of species.

**Denise Herzing:** Jane Goodall planted herself with the chimpanzees, Dian Fossey with the gorillas. Cynthia Moss with elephants. You know, all these researchers found a place where they could observe relatively non-invasively, and just see what the society would show them and tell them about the species. Kind of simultaneously at that time, Jacques Cousteau showed up on the TV, so I was like ok, there is underwater world, I want to be there. Hey, there are dolphins, smart mammals, that to me was the combination. So I really took inspiration from the technique from Jane Goodall and others of just planting yourself out in the wild somewhere and trying to observe.

I chose the Bahamas because you could see underwater. So most dolphin studies in the world really are from the surface, primarily because you just can't see under the water in many places. I really wanted to look at their signals underwater because that's where they behave primarily. The beauty of the Bahamas is clear water, and it's shallow, so it's relatively safe from predators for researchers in the water, that's a big thing. A lot of the landmass is just simply submerged. And so we can be 40 miles away from land and 20 feet of water doing our observations.

The first five years of my work out in the Bahamas, I literally anchored the boat in one area and stayed there. And it was an area where I knew the dolphins went through, we call it the dolphin highway. And it's 40 miles off-shore, there was no reason to be there other than to watch dolphins. I just reasoned that they would be curious and come by and check us out.

So we would be anchored the dolphins would sure enough come by, and we'd slip in the water. And we would just work on being quiet, calm, letting us float with them and letting them check us out. But we were really careful about not pushing them, not chasing them, not harassing them. We worked really hard on learning dolphin etiquette, which for us meant what are the signals they use with each other, which are the wrong signals for us to use? So there were things we had to learn about how we could be with them in the water. And it really was an investment in the relationship because I really wanted them to trust us, ignore us most of the time if that was possible, and interact with us knowing we weren't gonna grab them or chase them or harass them in that sense. And it was well worth it. Finally when they got comfortable enough, we started seeing their natural behavior just around the boat. They would come in and play and fight and mate. It was a patience game, but it was building, you know, for us, we were building our identification catalogue, we were learning who's who. And you know, it was well worth it.

**Tavia Gilbert:** Dr. Herzing has studied bottlenose dolphins, but it's the unique features of the spotted dolphins that has largely drawn her focus over her years of research.

**Denise Herzing:** It turned out they were a really great species to observe underwater, because they get spots with age. So they are pretty convenient to study just for that reason. And they have a lot of identification features because of their spots. So we're really able to track the individuals, so we know their age, their sex, their I.D. We track their relationships, moms and calves, and over time their siblings and offspring.

It's really critical for us to track individuals. Usually they're doing their own thing, they're digging in the sand in the bottom pulling out little fish which are their snacks during the day, or they're playing with each other, like juveniles might drag a piece of seaweed around just for a game with each other. Or there's some courtship going on. They also feed off shore in the deep water at night. So sometimes we'll go out off the deep-water edge and watch them hunt squid and flying fish. So the big picture is: who are they in their society, how do they interact with each other, what are the signals they use? And that's the framework we use for everything we do.

**Tavia Gilbert:** And Dr. Herzing has seen incredible dolphin behaviors that inspire her to continue her quest to crack their language code.

**Denise Herzing:** I can give you one example of something we did observe in the wild that was pretty amazing. So one day we ran across a dolphin named Stubby. The day we observed him, he was hanging out with some mothers and calves as they do sometimes, helping to babysit and tend the group. And a bottlenose dolphin, a fairly aggressive dolphin as they are sometimes, and his bottlenose group came up and they really started harassing Stubby, and there was not much for him to do, it's hard to defend yourself if you're a smaller spotted dolphin.

So the day after that, we ran into this ruckus on the water and there was Stubby with his now very large, not only his normal coalition of males, but a super coalition of other males. And he was chasing the dolphin that had harassed him the day before. So what was really interesting about that is how did he tell or express to his friends, his male friends, that "this is the guy that beat me up the other day we have to go find him"? To me that suggests that they have some kind of planning, and that they might have the ability to communicate in detail what they're doing, where they're going, and who they're going after.

So they have tool use, they have self-awareness, they can understand abstract concepts. So those are pretty big things when you're looking at social mammal intelligence at least.

**Tavia Gilbert:** There is plenty for Dr. Herzing to observe: dolphin fighting, dolphin mating, dolphin hunting, and dolphin parenting, but much of what she studies in the field is dolphin playing.

**Denise Herzing:** So dolphins have a lot of natural toys in the ocean and because they have these long developmental periods as juveniles, part of the process for them is learning how to play, learning how to play by the rules, and being reprimanded if they're not playing by the rules, right? This is part of social learning in any social mammal. So dolphins will play games with sargassum, which is a toy, you know, seaweed in the water. They'll drop it to each other, and they have an etiquette. If a dolphin is dragging a piece of sargassum on its fluke, another dolphin better not pull it off! It needs to be dropped off by the dolphin. Otherwise that's bad etiquette! That's one

thing we've learned too. So when the dolphins invite us into their game, which they do sometimes and we have a sargassum exchange, you know, we try to play by their rules. Of course we're less adept at it and they kind of laugh at us. It's a way of social bonding, really.

You know, we're probably like little ignorant little calves to them, like we don't know how to do the game, we're not that good at it because we can't swim that fast. It's really funny. They'll do things like, they'll drop a piece of sargassum, and then the game is who can get it first, right. So the awkward human will dive down, you know, 10 feet and *just* as you're about to grab it they'll zoom in and grab it in front of you. I guess they like to show off their prowess in the water or something, but, I think they just have fun doing it.

It's about spending time, you know, hanging out with another species and goofing off, really. The idea that they invite you into a game? I mean does any other wild animal do that? You know, I don't know. It's pretty interesting.

**Tavia Gilbert:** And all the time those dolphins — and their human researchers — are “goofing off,” there's serious scientific research about dolphin communication going on in the background.

**Denise Herzing:** We are exploring if there's order or pattern in their sound. We definitely know they have sound types for certain behaviors. What we want to know is when they're eating fish on the bottom and they're making sounds, are those sounds just for hunting the fish, or are they talking about what they had for dinner last night? This is the big thing with language, right? You're not just making a sound that represents hunting a fish or come on over here there's good fish. It's about talking with time displacement like, what did you have for dinner last night? It'd be like someone recording us at the dinner table. Are we talking about the soup we're eating? Or are we talking about what we learned at school? Big difference, right? One is real time context, the other is time displacement of information and that's a key component of language.

I think we need to remember that absence of evidence is not evidence of absence. If we find some order and structure and rules which it looks like we are already finding some, then the question becomes how do you then

really call it a language? I mean animals and humans could still have order to their communication, but it might not be what we call language. So the next level is to add metadata to it, and by metadata, I mean things like the context. All our data might suggest, oh there's rules and there's order and everything's different, and we see they're exchanging signals in certain complicated ways that suggest language just from structure. But the interpretation, the meaning...like an anthropologist might go in and interact with the human culture to really suss out what the real interpretation is, right? That's going to be the real holy grail if we can do that.

**Tavia Gilbert:** One thing that is significant, and suggestive of dolphins' lingual intelligence, is how naturally vocal they are.

**Denise Herzing:** Dolphins are masters at mimicry, especially acoustic, and some postural mimicry. Not many species do vocal mimicry and very few species have the ability to learn vocally.

**Tavia Gilbert:** What else supports Dr. Herzing's belief in the possibility that dolphins do, in fact, have language? She's learned from the study of captive dolphins that:

**Denise Herzing:** The animals could understand syntax and semantics. So changing order of words and meaning, both in their acoustic and visual languages. So they could tell the difference between take the hoop to the swimmer versus take the swimmer to the hoop. So that's really the best example of their comprehension of order and structure of an artificial language.

**Tavia Gilbert:** It's not just the behavior of captive dolphins that suggests there is some organization to their vocalizations. Dr. Herzing's research into wild dolphins suggests something similar.

**Denise Herzing:** We don't know if dolphins have a language. At least our preliminary work suggests that they definitely have some structure and order to their sounds. So whether we interpret that as semantics or syntax, we don't know yet.

**Tavia Gilbert:** That question leads Dr. Herzing to an even bigger inquiry.



**Denise Herzing:** My personal interest also is in, are there any universals in communication across species? Is it possible that some kind of signal or aspect of a signal would cross species so that they can understand each other to a certain point or humans could understand them?

I think it's very interesting scientifically is, what would it take to break through a species barrier? You know, is there enough similarity or some overlap where you could communicate with another species and really interact? It's hard enough with a human culture, right? I mean, anthropologists have had this issue for decades: how do you translate another human culture that's perhaps a little different and you don't know the language and you don't know the rituals? So it's not so far-fetched to think that we'll learn a lot through looking at other species.

**Tavia Gilbert:** So what can we learn from the study of other animal intelligences that might shine new light on dolphin intelligence, or the future of communication between dolphins and humans?

**Denise Herzing:** If we look at what nature does, other species, so what do they do when they interact? And they do two things. One, like different bird species might listen to each other's alarm calls and just learn passively that when that species makes an alarm call, this predator's coming, and so they have the advantage of early warning. So they passively monitor and that's kind of what we're doing with the dolphins, we're monitoring sounds and trying to figure them out. The other thing that happens in nature, at least with some species, is, it might be just too complicated to learn each other's communication systems, so they develop a mutual system of shared calls. For example, orca pods do this in the Pacific Northwest. They would live in really strict pod structure, but when they get together they have a small repertoire of shared calls that they only use when they're together. And we know there's another dolphin species, two dolphin species that do this, too.

**Tavia Gilbert:** And is this research applicable to a wide variety of species?

**Denise Herzing:** We're focusing on acoustic species right now, but there's no reason why you couldn't look at other communication signals like light or touch in some way to see if they could cross the species boundaries, you know, maybe there's some translation there that we could see down the road.

**Tavia Gilbert:** Dr. Herzing hopes that her interest in tools to help study the behavior, communication, and, potentially, language of dolphins will not only be of benefit to her own work, but to other scientists' research.

**Denise Herzing:** We're going to recruit some data sets from other researchers, primarily dolphins and whales, because the program's kind of designed around acoustic signals, and try to exercise their data sets and see if we can pull out structure and rules from their data, so we can really create a tool for other researchers, not just us. I mean, of course we want to know what the dolphins are doing. But the idea is if you could really start looking at all these different species and have a pretty friendly user tool, that's how you really enhance a field, is to create a big tool that is consistent across researchers. So you can start asking questions about, are there any universals between how dolphins communicate and how bats communicate and even how humans communicate?

Another social mammal can probably tell us a lot about ourselves, for example, how do we interact with each other, is that similar or different than how dolphins might interact? Are there ways of interacting with your neighbors that we might learn from, from non-human species that might help us out as humans?

I'd like to think that the tools that we're trying to develop will in fact be utilized by other research and data sets and that it can cross some of those non-human boundaries with other species.

This kind of tool combined with information theory and other tools scientists are developing could really tell us quickly the whole picture of what is that species or that community of species, what's going on there? And can we interact, do we want to interact, and if so, how? Gosh, you know, we'd learn a lot about biology and that process.

**Tavia Gilbert:** As Dr. Herzing considers what we could learn from cross-species study, she's considering another fundamental question:

**Denise Herzing:** What is intelligence, first of all. Still debatable, still measured by human standards for the most part.

**Tavia Gilbert:** And the limiting idea that humans have unparalleled intelligence and capability is one that Dr. Herzing's research into dolphin communication, to her delight, courageously and directly counters.

**Denise Herzing:** One of the big challenges is going to be breaking through the human paradigm of our superiority and our uniqueness in having language. I mean what we have now is fantastic and we're excited, but five years from now, gosh, I mean who knows what we'll have. And I think continuing to apply and to be willing to reassess what you've done and maybe look at it in a whole new way, will be, you know, it's always challenging to a senior scientist, right? Like, we live in our own little paradigms in our work, to be able to say you know what, maybe we were wrong about this approach! Let's take a new approach!

**Tavia Gilbert:** Dr. Herzing will use whatever technology she can, along with her own human intuition, and even human history to advance her studies.

**Denise Herzing:** Can we crack their language if they have it? The other way to go about it is to develop a mutual language, so can you talk about sargassum together in a way, or can you label a toy they like to play with? I mean, it's a beginning. It's actually what humans have done in their own cross-cultural interaction sometimes. In World War II, I think that happened. Soldiers had gotten married or had a relationship with another culture where they didn't speak the same language and so they, you design your own language, right? We've been trying to approach it from these two different aspects. One is pretty high-risk and tricky and really hard with wild animals. You know, it's hard to spend enough time with wild animals and expose them to a new language to really get work done, and we're in the best situation in the world and it's been still challenging!

Or we do the passive recording, decoding that we do just by observing and recording. So there, there are two kind of different approaches. Now the hope would be, if we crack their code as I say sometimes, and figure out what they're doing with each other, what they're saying, we could in some sense put their natural sequences of sounds in our, two-way system where we can actually project those sequences and then test it out in the water. So that might be the next step of playing back any significant sequences of sound to test what they really mean.

We are thinking of having a dialogue with the dolphins. It's really a matter of the level of dialogue. Dialoguing to test out a question? I mean it's going to be challenging. But think about it, if somebody recorded some of your English words and they played a sequence back to you like: "Hello there!" I mean it would mean something to you, right? So we're hoping maybe we can get those regular contextual coded sequences that might mean something like: "Hey, there's a cool fish under the sand here!" And see what the dolphins do. I mean you know you could potentially test some things that way.

**Tavia Gilbert:** What are some of the unexpected lessons that Dr. Herzing has learned, after 25 years in relationship with dolphins in the Bahamas?

**Denise Herzing:** The observation of how intricate and intimate the relationship between the two dolphin species is. What does it take to live in the same area as two species and get along or adjust your behavior accordingly? I think it's been also surprising to see how important the individual is in the society. How it's really clear that the dolphin society incorporates and encourages individuality and unique roles. So for example, you could have a female who maybe she was unlucky had giving birth, but boy, she's the super aunt and she's like taking the kids on and babysitting and so there's like a role for everybody.

The third thing that's been really surprising is how continually curious the dolphins are about us. So sometimes there's times when, like this old wise dolphin is just hanging out with you in the water, looking in your eyes, floating there for 10 minutes. And you just go, what can be so interesting to a wild dolphin about a human that lets them take that time to just hang out and like, what are they thinking?

**Tavia Gilbert:** Dr. Herzing is grateful for those magical moments in her work with the bottlenose and spotted dolphins, and she doesn't take it for granted.

**Denise Herzing:** One of the most powerful feelings is when a mother dolphin brings her new little calf over and I mean that's so vulnerable for the calf, right. But the mothers know, you know, we don't touch and we don't reach out, we don't, you know, we're just going to say hi and videotape them. There's nothing as powerful as having another species really look you in the eye

and interact with you in that way. You know it's a real privilege to be able to be around dolphins who are behaving naturally.

**Tavia Gilbert:** Next week, we'll bring you more diverse intelligences exploration, shifting our conversation from animal intelligence to machine intelligence, and the relationship of machine intelligence to human society. We'll be in conversation with several researchers focusing on the ethics and morality of artificial intelligence, including Walter Sinnott-Armstrong:

**Walter Sinnott-Armstrong:** I think these computer programs can help us figure out that very deep problem in moral psychology, and thus understand our own moral judgments in a much more profound way than we've ever been able to do so before. So I actually think that these programs will not reduce our understanding of morality or our tendency to make moral judgments, instead it will improve and enhance our understanding of morality, and also enhance the judgments that we make.

**Tavia Gilbert:** We look forward to bringing you more from that conversation next week. Before we leave today's episode, we wanted to thank our loyal listeners for sharing great feedback about the stories in this Diverse Intelligences season. We're delighted you're enjoying the series as much as we are. But we also know that some listeners are asking the question: Where's Richard? Why isn't he also a vocal part of these narratives, as he was during our first season of conversations focusing on the Covid-19 pandemic? That is a totally reasonable question, and I'm sorry it never occurred to us before to let you in to what goes on behind the scenes.

A couple of years ago, Richard began to record all the interviews you've been listening to this season — conversations that became his award-winning Stories of Impact video series. While all of the researcher's answers to Richard's wonderful questions were on mic, Richard himself, as the interviewer, was off mic, simply because he and the video crew didn't anticipate at the time that the audio footage might someday be used for podcasts.

It is only because of the difference in sound quality between Richard and the interviewees that we haven't been able to incorporate audio of Richard into the stories we've been telling in this season. But we've been getting ready for our upcoming third season of episodes focusing on Citizenship,

and Richard has been conducting a new series of interviews intended for the podcast alone. You'll hear his voice come back into the mix in the next few weeks. And if and when we dip back into the Stories of Impact archive for conversation originally recorded for video, we'll be sure to let you know, so there will be no question in your mind about where our trusted leader, Richard, has gone. Rest assured that his work, if not always his voice, is at the heart of every story.

In the meantime, thanks for listening to today's Story of Impact. We hope that you're looking forward to hearing more. If you liked this episode, we'd be thankful if you would take a moment to subscribe, rate and review us wherever you get your podcasts, and if you'd share or recommend this podcast. Your support helps us reach new audiences. For more stories and videos, please visit [storiesofimpact.org](https://storiesofimpact.org).

This has been the Stories of Impact podcast, with Richard Sergay and Tavia Gilbert. This episode written and produced by Talkbox and Tavia Gilbert. Assistant producer Katie Flood. Music by Aleksander Filipiak. Mix and master by Kayla Elrod. Executive Producer Michele Cobb.

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