

# Is There a Critical Age or Period for Learning Languages? | Dr. Erich Jarvis & Dr. Andrew Huberman

How similar or different are the brains brain areas controlling uh speech and language and say a songbird and a and a young c human child Yeah So so going back to the 19 fifties or and even a little earlier and Peter Mahler and others who got involved in neuro e the study of neurobiology of behavior in a natural way right Um You know they start to find that behaviorally there are these species of birds like songbirds and parrots and now we also know hummingbirds just three of them out of the 40 something bird groups out there on the planet Orders that they can imitate sounds like we do And so that was a similarity In other words they had this kind of behavior that's more similar to us than chimpanzees have with us or than chickens have with them right They're closer relatives and then they discovered even more similarities these critical periods that if you remove a child and you know this unfortunately happens where a child is feral and that is not raised with human and goes through their puberty phase of growth becomes hard for them to learn a language as an adult So there's this critical period where you learn best And even later on when you're in in regular society it's hard to learn while the birds undergo the same thing And then it was discovered that if they become deaf we humans become deaf our speech starts to deteriorate without any kind of therapy Uh If a nonhuman primate or um you know or let's say a chicken becomes deaf uh their vocalizations don't deteriorate very little at least Uh while this happens in the vocal learning birds So there were all these behavioral parallels that came along with a package And then people looked into the brain Fernando NDABA my former phd advisor and began to discover the area X You talked about uh the robust nucleus of the archipallium And um and these brain pathways were not found in the species who couldn't imitate So there was a parallel here And then uh jumping many years later you know I started to dig down into these uh brain circuits to discover that these brain circuits had parallel functions with the brain circuits for humans even though they're by a different name like brocas and laryngo motor cortex And most recently we discovered not only the actual circuitry and the connectivity are similar but the underlying genes that are expressed in these brain regions in a specialized way different from the rest of the brain are also similar between humans and songbirds and parrots So all the way down to the genes And now we're finding the specific mutations are also

similar not always identical but similar uh which indicates remarkable convergence for a so called complex behavior in species separated by 300 million years from the common ancestor And not only that we are discovering that mutations in these genes that cause speech deficits in humans like in Fox P two if you put those same mutations or similar type of deficits in these vocal learning birds you get similar deficits So convergence of the behavior is associated with similar genetic disorders of the behavior Incredible I have to ask do hummingbirds sing or do they hum Hummingbirds hum with their wings and sing with their Syrinx in a coordinated way in a coordinate way There's some species of hummingbirds um that actually will um Doug ler showed this that will flap their wings and create a slapping sound with their wings that's in unison with their song and oh and you would not know it but it sounds like a particular syllable in their songs Uh even though it's their wings and their voice at the same time hummingbirds are clapping to their song clapping but they're they're snapping their wings together uh in unison with a song to to make it like if I'm going ta ta ta ta ta ta you know and I banged on the table except they make it almost sound like their voice with their wings Incredible I I'm and they got some of the smallest kids would say mind blown Right Incredible Incredible I love hummingbirds and I always feel like it's such a a special thing to get in a moment to see one because they move around so fast and they flit away so fast in these ballistic trajectories that when you get to see one stationary for a moment or even just hovering there it's uh you feel like you're extracting so much from their little little microcosm of life But now I realize they're they're playing music Right Exactly And what's amazing about hummingbirds And I we're gonna say vocal learning species in general is that for whatever reason they seem to evolve multiple complex traits you know this idea that the evolving language spoken language in particular comes along with a set of specializations Incredible when I was coming up in neuroscience I learned that I think it was the work of Peter Marler that um young birds learn songbirds learn their tutor song and learn it quite quite well But that they could learn the song of another tutor In other words they could learn a different And for the listeners I'm doing air quotes here a different language a different bird song different than their own species but never as well as they could learn their own natural genetically linked song genetically linked meaning that they would be like me being raised in a different culture And um that I would learn that the other language but not as well as I would have learned English This this is the idea Is that true That is

true Yes And that's and that's what I learned growing up as well and and and talked to Peter Maher himself about before he passed Um yeah there he used to call it the innate predisposition to learn All right So um which would be kind of the equivalent in the linguistic community of universal grammar There is something genetically influencing our vocal communication on top of what we learn culturally And so there's this balance between the genetic control of speech or a song in these birds and the learned uh cultural control And so so yes if you were to take um you know um I mean in this case we we actually tried this at Rockefeller later on take a zebra finch and raise it with a canary It would sing a song that was sort of like a hybrid in between We call it a can inch right Uh And vice versa for the canary because there's something different about their vocal musculature or the gene or the circuitry in the brain And with a zebra finch even with a closely related species if you would take a zebra finch uh young animal and in one cage next to it place its own species adult male right And in the other cage place a Bengali finch next to it it would preferably learn the song from its own species neighbor But if you remove its neighbor it would learn that Benga finch very well So there's it it has something to do with also the social bonding with your own species Incredible that raises a question that I based on something I also heard But I don't have any uh scientific peer reviewed publication to point to which is this this idea of pigeon not the bird But this idea of when multiple cultures and languages converge in a given geographic area that the Children of all the different native languages will come up with their own language I think this was in island culture maybe in Hawaii called pigeon which is sort of a hybrid of the various languages that their parents speak at home and that they themselves speak And that somehow pigeon again not the bird but a language called pigeon for reasons I don't know harbors certain basic elements of all language Is that true Is that not true II I would say I haven't studied enough myself in in terms of pigeons specifically but in terms of cultural evolution of language and hybridization between different cultures and so forth uh even amongst birds with different dialects and you bring them together Uh you know what is going on here is cultural evolution remarkably tracks genetic evolution So if you bring people from two separate populations together that have been in their separate populations evolutionarily at least for hundreds of generations So someone speaking Chinese someone speaking English uh and that child uh then is learning from both of them Yes that child's gonna be able to pick up and merge uh uh uh phonemes and words together in a way that an adult wouldn't because why

they're experiencing both languages at the same time during their critical period uh years in a way that um adults would not be able to experience And so you get a hybrid and the lowest common denominator is gonna be what they share And so the phonemes that they've re retained in each of their uh languages is what's gonna be I imagine used the most