00:06 Sarah Crespi: Welcome to the Science Podcast for August 3rd, 2018, I'm Sarah Crespi. On this week's show online news editor, Catherine Matacic talks about a theory that humans may have domesticated themselves and that this chain set the stage for the evolution of language. And Micah Edelson discusses his research on leadership and the role that responsibility aversion or the reluctance to make decisions for others might play in everyday decisions, like picking a home for your family or to the way an autocrat rules a nation. And don't forget, this month's book segment will be on The Book of Why: The new science of cause and effect, by Judea Pearl and Dana Mackenzie. And that'll appear on August 30th. If you've read the book, or plan to, tweet to us @Sciencemagazine. Or email us sciencepodcast@aaas.org with your thoughts and questions. Now we have Catherine Matacic an online news editor for Science. This week she wrote a story along with Michael Erard on human self-domestication and the evolution of language. Hi Catherine.

01:10 Catherine Matacic: Hi Sarah.

01:11 SC: This is a big topic and I think we gotta start with self domestication and work our way over to the evolution of language. I'll get there eventually.

01:17 CM: I think that's a good idea.

01:18 SC: Okay, the term 'self-domestication kinda always brings me up short because I think of domestication as something that's external to the organism. Another animal, saying, "You're gonna be nicer you're gonna be more docile and you're gonna serve my needs, you're gonna have really big muscles." So how can something self-domesticate?

01:37 CM: A lot of it depends on how you define this term domestication, because in many cases, we're looking at it from this process, this process whereby usually humans take other animals and breed them for desired characteristics, whether that's bigger muscles as you said, but usually part of this is we're breeding animals for tameness, for docility because we don't wanna be going up against a cow that's gonna kick us in the face when we try to milk it. But another way to look at domestication, and another way to define it is to look at the outcomes. All we're looking at is the end product and saying, "Is this creature at the other end less aggressive. Is it more docile, is it more tame?"

02:22 SC: So does that fit better with this idea of self-domestication then?

02:26 CM: Self-domestication is something where we don't have some other creature on the outside being the one to decide who gets bred to the next generation instead what's really interesting is with humans over many, many generations right? Like we're talking hundreds of thousands of years here. As we became more reliant on cooperation we basically self-selected for co-operative friendly, kind individuals, we basically kick the aggressive ones or the most aggressive ones out of
the gene pool.

**03:00 SC:** So we self-domesticated?

**03:02 CM:** Right.

**03:02 SC:** So we have some of these same suite of traits that domesticated animals have?

**03:07 CM:** Yeah, that's right, and so when you select for something like tameness there are all of these other traits that come along for the ride and a lot of them are physical. If you look at dogs, versus wolves, they have shorter snouts shorter faces, a lot of times, animals that have been domesticated have smoother brow lines and smaller skulls, and you can see a lot of these changes over time in people as well. One of the most interesting ones that I came across is this trait in which domesticated animals tend to have a lot of white around their eyes.

**03:45 SC:** You mean like inside the eye, like around the iris?

**03:47 CM:** Right, the sclera, that part of the eye. The idea is that if you wanna communicate with other animals you really have to let them know what your intent is. They have to be able to read your mind and one of the best ways to do this, especially with mammals is to follow the direction that their eyes are going in. If there's something that you want other people to pay attention to your eyes are gonna go in that direction, but if you don't have those whites around the eyes, it's very, very hard for people to follow your gaze and as a result it's very hard to use that as a communicative signal.

**04:22 SC:** Okay. So the suite of changes is, obviously you can see it at the level of the animal, but there's also genetic and hormonal changes. A lot of those hormonal changes are happening at development.

**04:33 CM:** Right. And so this is where we talk about how do we get from these physical changes that you can observe in a lot of animals, including humans, to this idea of a language-ready brain or the ability to communicate how are these things tied together. When you have animals that have been domesticated both before they're born, and after they're born, and while they're still in some cases developing, they have lower levels of testosterone and other circulating androgens which are, basically result in those smoother brows and the shorter faces, but at the same time, they've got higher levels of serotonin. And this is a very important pro-social hormone, you could call it. In humans, they help us infer others mental states, they help us learn through something called joint attention, which, if you have a child, is pretty obvious in its early years, an important way of teaching. You look at something, they look at something. The whole point is, is this social ability is a way of learning to take it one step further to language. There's evidence that higher levels of serotonin can help infants link objects and labels, and so the idea is that they're better able to take words and assign the meaning. And so all of these things that we're talking about may not be language per se, but they're the prerequisites, they're the building blocks for language.

**06:09 SC:** We're kinda making a big leap here between domesticated animals and supposedly self-
domesticated people. Foxes for example, the famous fox study where they domesticated them over time and they chose... They basically selected for the suite of characteristics. They're not saying anything.

06:24 CM: No, they're not saying anything, but they're looking at you.

06:26 SC: Yeah.

06:27 CM: So this is what I mean by the building blocks of language. Researchers now are doing something that hasn't really been done in a very comprehensive way before and that is looking at different animals to see what the parallels might be to human language development. And again, we're not talking about full-blown language, we're talking about some of these building blocks. And so in the case of foxes, what's really interesting with the experiment that you mentioned basically after 50 generations, these breeders have taken these crazy, wild foxes that wouldn't be around humans and bred them to the point to where they're very tame, and they have a lot of the physical characteristics, we mentioned earlier, but these domesticated foxes are much better at understanding human pointing and gazing just like the infants we talked about earlier. So this is basically, this ability to mind read which is key to the development of language.

07:30 SC: Let's talk about another common human standing. So this is at the primate called the Bonobo. These are great apes that have some pretty tame habits.

07:40 CM: Right. This is one of the few other species that may have actually self-domesticated themselves. Bonobos are well known for being very gentle, very low levels of aggression. Actually, I think females will not mate with males that are too aggressive, but in addition to that, they also have a couple of characteristics that we look for when we think of a language ready brain. And one of them is that they're able to follow the gaze of others, and they actually in laboratory settings, have been shown to understand human intent. But the thing that we're gonna talk about is their ability to take their calls and re-combine them in novel ways. Now none of us know what these calls mean but recent research has shown what bonobos can do is they can take these calls and they re-combine them in different ways in different situations. And again, there's not enough evidence to suggest that this is really anything approaching language, but it shows this really creative ability to improvise and improvisation is one of the keys to coming up with a flexible language.

08:52 SC: And so when we're linking that to this idea of self-domestication this time in Bonobos?

08:55 CM: Correct. Yeah.

08:56 SC: Let's turn to one more animal example that's being used in this type of research. And this is the Bengalese finch and the Munia. These are two birds, one very friendly/domesticated and the other one, wild. What have we been learning from this pairing?

09:13 CM: So it's really interesting that researchers are turning to birds to study these precursors of language because as you know, they're pretty removed from us, evolutionarily speaking, but these song birds, they are able to do something called 'vocal learning' where they hear the song of other
birds and if they're young enough, reproduce them and in this case, we have an example of a bird that was only recently domesticated, about 250 years ago, breeders took this wild bird, the Munia and started breeding the birds to where they were gentle and more docile and as they did this the birds songs changed.

**09:55 SC:** And you have examples for us?

**09:57 CM:** Yes, we do. And let me tell you, first, how they changed and that way you can listen for it. But the Munia which is the wild bird has this kinda nice, kinda scratchy very noisy song, but the Bengalese Finch has produced a type of song that has these elements that repeat over and over again and switch around in really interesting ways, and there's also a bit less noise. So you can listen and see if you can hear the difference.

**10:24 CM:** Let's go with The Munia first.

[video playback]

[pause]

**10:35 CM:** And then here's the Finch.

[video playback]

[pause]

**10:47 CM:** What do you think?

**10:49 SC:** One of them is much prettier than the other. [chuckle]

**10:50 CM:** Right, yeah. So people are not teaching these birds how to sing. They're learning from other birds. One researcher in particular has speculated and has gathered some evidence to support this, that the birds who are domesticated not only have maybe some changes that are taking place, like the ones we suggested earlier, but because they live in very low stress environments this frees their brains up for experimentation. And learning in a way that's sort of similar, I guess, to the experimentaton of The Bonobos where they're taking these songs and they're re-combining them in different ways. And the other thing that supports this is there have been studies where the Bengalese Finch, who have lower levels of stress hormones in their feces, have brain regions that are related to song development that have more neurons in part because they have fewer of these stress hormones, that are circulating.

**11:54 SC:** Alright, I'm gonna say one more time, these birds aren't talking those foxes aren't talking. What does it say about what happened with people?

**12:04 CM:** Right, because you have all of this evidence suggesting that there are big changes taking place as a result of what we would call domestication or self-domestication. How that
translates into humans is basically at this point, there's a pretty big gap that we need to fill. And so, what a lot of researchers have suggested is that the big push, that kind of pushed us over the edge from this experimentation and from this ability to sort of infer the intentions of others is the idea that as humans we were competing against all of these other species for food, for territory and that therefore, there were pressures on us to become more cooperative. That's the way we essentially won the day and became the species that we are today. They basically had this brain platform that they'd built up that readied them for language and this intense cooperation, that was the thing that set the ball rolling in terms of making our signals more complex.

13:10 SC: So, how does this compare to other theories of how language evolved? For example, gesture came first.

13:16 CM: Yeah, so the gesture thing, which includes everything from pointing and pantomiming to actual sign language. I don't think there's much conflict there. We're talking about all of these things, these building blocks that got the brain ready for complex communication and language whether that's spoken language or whether that's gestured language. The whole point is, is we had all the tools ready to go. This does run up against what has been kinda the dominant theory since the 1950s in terms of how humans developed language. What a lot of linguists have posited is that there was this sudden amazing catastrophic genetic shift that took place at some point in our history where suddenly we had genes that allowed us to produce syntax, to produce grammar and so I think the previous theories talk about this genetically encoded, but very sudden shift and here we're talking about something that is enabled by genes, but it's much more gradual and it precedes in stages rather than all at once.

14:29 SC: What are the next steps for this, how are we going to further refine this?

14:33 CM: What some researchers are doing now is they're actually looking at sets of genes that have been selected for in domesticated animals versus wild animals. So you're talking a domesticated cow versus wild cattle, cats and dogs, horses as well. They've done these big screenings, they've gone through the literature seen which genes vary in the groups of wild and domesticated animals, and then they've compared all of those genes to the genes that other researchers have found very compared to our closest approximation of a wild cousin, which is the Neanderthals and the Denisovans. And so they looked at genes that were similarly selected in domesticated animals and modern humans ran a bunch of tests and basically came up with, I think a couple dozen that are really, that are common among all of them, and that seemed to have implications for things like brain plasticity, and learning. And so there's some hint that there may be more evidence to be found through genetic studies.

15:45 SC: Okay, thank you so much, Catherine.

15:47 CM: Thanks, Sarah.

15:47 SC: Catherine Matacic is an online news editor for Science. You can find a link to her story at sciencemag.org/podcast. Stay tuned for an interview with Micah Edelson on his research into the role of responsibility aversion in leadership decisions. What makes you decide to defer to the group
or decide for others?

[music]

16:10 SC: This week we have Micah Edelson and colleagues. They've published research on a very tricky question, what makes people decide to lead, to decide for a group rather than defer to the group? This isn't the kind of question that can be answered with one study, or probably even has one answer. But Micah and colleagues have come up with an experimental design that aims to pick out the influence of one potential driver, responsibility aversion. Micah is here to talk with us about how it fits in with ideas of leadership, and at an even more basic level, the kinds of cognition we all engage in every day. Hi Micah.

16:47 Micah Edelson: Hello.

16:48 SC: Well, let's start with maybe a simple definition of what responsibility aversion is?

16:53 ME: So responsibility aversion is your willingness to make decisions that influence other people, or in this case, you're unwillingness to do it, your preference not to make choices that influence other people.

17:04 SC: Going into this study, there were several ideas about how this kind of decision-making for others might work. Can you talk about some of those proposed ideas?

17:12 ME: Yeah, so you can imagine some pretty reasonable hypothesis that relate to how someone evaluates the actual underlying choice that they have to make, for example, if they... How do they look at the risks, or the losses or the ambiguity involved in the choice? So you think of making a decision that influences your entire family versus influence only yourself, you might be less willing to take risks when you're making a decision that influences your whole family, the same thing for losses. So that could be the way that you subjectively evaluate the underlying components of the choice.

17:47 SC: What does loss aversion mean then, in this context? You don't like losing and it's worse if there's a group involved?

17:53 ME: In this case, it would mean that you will be more averse to losing when you're influencing the group. So you'll have a shift in the amount of loss aversion.

18:02 SC: And what about those of us that are power mad. [chuckle] The ones who really wanna make decisions for others.

18:07 ME: Exactly. So, that's another potential hypothesis that there's people that like being in control, like making the decisions regardless of who they're effecting and then they won't show any aversion to responsibility, that means that they won't really mind making decisions for other people. Maybe they'll even prefer making decisions for other people if they derive some benefit from that.
18:27 SC: So how did you set up an experiment or a set of experiments, actually to look at the role of responsibility, aversion in these kinds of decisions?

18:35 ME: So in our tasks, the individuals come into the lab and they make decisions as leaders of groups of four participants. Mimic choices about gambles, which have changing probabilities of success or potential gains and losses, and they make this under two conditions. So, they respond to the same gamble twice, once where the individuals selection effects only her, only her monitored outcome and in the group condition where the choice affects all the group members.

19:03 SC: I thought this was very interesting in that if they defer to the group, they have more information about what's gonna happen.

19:08 ME: Exactly. So the group as a whole, always has more information about the probabilities than any single individual, deferring, to the majority is the more informed action and it of course, is the more informed action but it also means that you lose the power to determine your own outcome or your choice, and that means that, on every trial the participants have to kind of weigh both of these aspects. What's the subjective value of determining the outcome versus the value of a better informed decision?

19:33 SC: What were some of the major differences between these two conditions when someone was deciding for themselves, or when they were deciding for the group?

19:40 ME: We find that the way that the individuals are approaching this question is that they hold a set of beliefs about how much certainty they require before making the choice themselves, and they use these beliefs to kind of set a certainty threshold. When they're faced with the choice they think, about the choice options and they see if the value translates to a higher level of certainty than what is their threshold and if it is higher then they'll make the choice themselves, if not, then they'll defer their choice to others. The critical thing is that just looking at the certainty threshold in isolation is not that informative.

20:14 SC: Right.

20:14 ME: What's really informative is how much they change this certainty threshold when they're faced with responsibility for others, and that's the key out of sample predictor of leadership.

20:24 SC: And when you looked at the threshold in your experimental set-up, you saw that there was some correlation between what happened with your experimental subjects and their say military record, or their answer on these questionnaires.

20:35 ME: So we tested if we could predict a standard measure of leadership ability, using previously validated questionnaires or concrete measures such as military ranks, so that was our way to also validate our protocol and our type of decision-making pass that we have. The people that had higher leadership scores where people that didn't shift their certainty threshold, so they maintained it more or less the same, the people that had lower leadership scores were people that tended to shift this certainty threshold to a larger degree. Now, this doesn't mean that they defer
more or less.

21:08 SC: Right.

21:08 ME: They could also defer a lot and still shift the decision threshold very little.

21:14 SC: This is where your egalitarian versus authoritarian example comes in handy. I think.

21:18 ME: Because we're really talking about the important aspect in this framework is about this shift in the certainty threshold. It can account for many different leadership styles including for example, authoritarian leaders that make most of the decisions themselves but also egalitarian leaders that frequently seek group consensus as long as they show a similar change in their certainty threshold. So obviously, in both of these cases, the authoritarian leader, probably makes almost all the decisions themselves whether it influences themselves only, or influences other people in the group. And the egalitarian leader, the exact opposite. But they both can show a very small shift, so they both can be explained using this framework.

21:56 SC: That's like this... That's like leadership with a capital L, dictators, heads of state, but the study is aimed to get at some very basic things that everybody does. Can you talk about how this applies to everyday decisions?

22:09 ME: Yeah, exactly, so leadership is really a complicated or a big fluffy thing. So one option is to study it with qualitative techniques, and another option is to try to break it down to components and look at it mechanistically and we focus on one such component, which we think is important and we call it responsibility aversion, and this really goes beyond what we consider traditionally as leadership just because it relates to, as you were mentioning, decisions that we make every day, you're making a choice as we gave the example of an investment decision, for yourself or your entire family, if you're choosing school for your children, etcetera. So these are decisions that you actually make quite often and we try to develop conceptual and computational framework for what drives this responsibility aversion and how it relates to the choices, if you are willing to assume responsibility or not.

23:02 SC: Well, let's talk caveats for a second, if you don't mind, what other things do you need to look at down the road? Would size of the group for example, affect how likely people were to make decisions for it or what kinds of consequences there are to making a decision? Say, everyone gets mad at you. Is that something that you're gonna look at?

23:22 ME: So, yeah, that's a very good question. First. We don't know what the size of the group, what impact it would have that needs to be tested, but we can imagine that increasing the size will make you even more responsibility averse. And yeah, we're very interested in looking at how people learn to change their responsibility aversion or their choices to lead or follow based on the consequences of their actions and that's something that we're actively pursuing now. In terms of caveats, I would also say that as you mentioned first of all of course, this is only one study and we hope that it can spark some discussion and more incorporation of mathematical models in this type of field of research, but obviously it needs much more empirical evidence to become a mainstream
theory. And that's a good thing, and the other thing is that we don't really measure causality so we
don't know, for example, if people are in leadership positions because they make this choice in the
specific way or they're choosing this way because they have experience in such positions.

24:23 SC: Okay, thank you so much, Micah.

24:24 ME: You're welcome, thank you.

24:25 SC: Micah Edelson is a postdoc in the Department of Economics, at the University of Zurich.
You can find a link to his research and a related insight at sciencemag.org/podcast, and don't forget
to weigh in with your thoughts and questions on this month's book selection. That's, The book of
Why: The New science of cause and effect, for the August 30th episode. You can tweet to us
@Sciencemagazine or email us at sciencepodcast@aaas.org.

[music]

24:53 SC: And that concludes this edition of the Science podcast, if you have any comments or
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