EPISODE TITLE
Can I Join? The Social Behaviour of Animals

PODCAST SUMMARY
Dr. Anne Simon joins Western Science Speaks to talk about the processes within group behaviour in a variety of animals. Later, Dr. Simon talks about her own research with fruit flies and the impact of experiences on genetic predispositions.

INTERVIEW
You’re listening to the Western science speaks podcast. Presented by Henry Standage.

Henry Standage 0:29
Hey, welcome to the show. Today our topic is social spaces. As a fourth year, I take it for granted now, but years ago, I was learning how to conduct myself in large lecture halls for the first time, shared community spaces on campus, whether it be the quiet of the library, or the encouraged rowdiness of a Rick’s Wednesday at the Spoke. Figuring out how to operate in these spaces is a thought process that is neither entirely conscious nor subconscious. Dr. And Simone from the Department of Biology studies fruit flies in order to better understand how different species behave in communal spaces, and furthermore, how we can connect to their truths to the human experience. Here we go.

Henry Standage 1:17
Do you know of any species that are comically far apart in their social spaces?

Anne Simon 1:22
Comically I don't know what we would find comic, I was thinking of an example that’s still not comic but, so animals that are called solitary, like male elephants, for example. They tend to roam on their own, but to be on their own, they need to be able to identify others and decide to not be there. So that’s also a recognition of others. I think the comical part are when you see those penguins, they’re all together, when we see a group of tightly spaced individuals, we find that more funny.

Henry Standage 2:02
Yeah, we just got two cats and my family home. And we already had a dog, the cats are quite solitary, but the dog just wants to like, sniff their butts all the time. Do all animals share this idea of an inherent normal guideline for how to interact in these spaces?

Anne Simon 2:24
Yes. And I think the animals that would steer away from what is appropriate for the species would not necessarily have any advantage in terms of reproduction. So, if there is a certain distance that’s appropriate, and you’re too close or too far, that might be a problem. But that’s a hunch. But I don’t know in human when you have a normal social space, it tends to be related to some difficulty in reading social cues. So, I’m making the assumption that it might be disadvantaged in animals elsewhere, not nonhuman.

Henry Standage 3:06
So, let’s talk about the root of that. So, in the brain, what goes on when we're trying to figure out how to occupy these spaces?

**Anne Simon** 3:14
That social space, that space bubble that individuals have and feel comfortable is determined by receiving the information. There is someone else from my species or close enough, like your cats and dogs, and, different animals are going to use different senses, modalities, which can be vision and smell or touch. And with that information, it’s integrated and then you’re going to have an output for the behavior that’s going to correspond to what’s okay for that species.

**Henry Standage** 3:50
Were on opposite ends of the table here talking to different microphones, but it would be strange if I had pulled up right beside you and gone, let’s just share one microphone. What kind of messages are going on in my brain if I were to have done that?

**Anne Simon** 4:12
So, in humans, we know that there are cultural differences. But we also know that it’s an inability to read cues. If you had come to share the mic with me, I probably would have moved away without even thinking twice. And you would have picked up on that cue and realized, oh, that’s too close, let’s say you would have pushed your chair without paying attention. So, you would have read on my social cues, and we would have determined by interacting together and looking at each other what feels comfortable without really thinking about it. And if someone does not respond to those cues, you’re thinking, what are they doing? So that means someone would not pick up on the fact your kind of scooched on the other side. So, I think that in animals, you would have to properly sense the signals of what’s okay. And if it’s not close enough, then the other animal would come closer. And then you would have that balance of attraction and repulsion. And so, what is the to close? It’s going to depend a lot on why the animals are forming those social groups and that social space.

**Henry Standage** 5:23
Yeah, it’s interesting that you bring up the subconscious element of it, because I think there are scenarios in which you do need to read the room and actually actively analyze is this person uncomfortable? Say, if I’m interviewing someone and ask a question that maybe they’re not comfortable with. What would be the difference in how our brain tries to figure it out? When it’s something subconscious that requires a little more thought?

**Anne Simon** 5:48
Well, I think what’s subconscious is probably going to be shared. That’s my hope. In terms of which we would share with other animals, it would go way faster. So, let’s say for example, a moment where you’re going to use your thoughts. Let’s say there was only one mic here, we would both have to overcome the comfort of the situation. So, it’s uncomfortable, but we can’t speak if we’re not on the same mic, so we would have to overcome that. So, the thought process is going to allow us to overcome some inherent unconscious basic responses.

**Henry Standage** 6:24
I guess I’m trying to also get a feel for the chemical messaging that goes on in the brain between an obvious situation versus a more subtle one.

**Anne Simon** 6:33
So, I don’t think it’s the chemical that’s going to be different because we have a lot of chemicals that are used in different parts of the brain. So, with neurotransmitters, one thing we found in the model in my work is that dopamine is important for determining the normal social space and actually dopamine, is responding to the social experience, so we think it might be downstream of sensing the social environment. In that case, birthing, it’s more the parts of the brain that is going to be important for those differences. All the thought process that we’re speaking about to overcome that
spontaneous behavior are going to be in our cortex in humans and our more emotional response is going to be more central, deeper in the brain, and those deeper functions would be conserved.

**Henry Standage 7:34**
Can you talk a little bit more about dopamine because I find it surprising that that’s a chemical that comes out in social situations because you think of it as a pleasure?

**Anne Simon 7:43**
What gives you pleasure if you eat chocolate is serotonin. What wants you to eat more chocolate because you had pleasure is dopamine, so dopamine is more related to the motivation and going after what’s pleasurable. So, in that case, it would mean that being in close proximity might feel rewarding or pleasurable. So, you would like to have more of that.

**Henry Standage 8:20**
So comfortable social situations are what’s pleasurable in this situation?

**Anne Simon 8:30**
Yes. So basically, the idea is that, so here, it’s more conceptual. The idea is that what would be the evolutionary advantage? What would help your species to keep on passing its genes down would be what would become pleasurable, and you would do more of it so that it can be passed on.

**Henry Standage 8:52**
Why did you decide to run trials with fruit flies to get a better understanding of humans?

**Anne Simon 9:02**
So first you’re working with a simpler model that if you were to work with a mammal. But they have in a fascinating way, a lot of conserved processes. So, a neuron in a fruit fly or neurons in human are very similar. They’re not exactly the same, but they’re very similar. They’re using the same molecules. And in the fruit fly, you can within the same laboratory without too much need for expenses to pay for expensive equipment, you can study the genetics you can study the physiology, so you can dissect and look at the brain and study it. We’re trying to look at dopamine, so you can do pharmacology studies and biochemistry studies. So, on one simple animal, you can really have access to a lot of aspects that can surround one particular field of interest. Whether it’s heart development, brain function, reproduction.

**Henry Standage 10:18**
What kind of traits do we share with them that are observable?

**Anne Simon 10:21**
People first identified the molecules involved in learning and memory and what differentiates, learning from short term memory from long term memory. All those molecules were identified in the fruit fly first and Drosophila melanogaster. We also share the molecules important for circadian rhythm, there was a Noble Prize on 2017 for that, so that was first identified in the flies, we also sleep the same way flies do. So, some flies had daily rhythm that was off. So, we as the flies, as the plants, have daily rhythms or responses to the light. It can be the light, it can be the temperature that sets on our clock, and that clock runs for around 24, 25 hours. And then the sun or the temperature changes at night or the morning are going to set the clock again. And those molecules are involved in setting the clock at the molecular level are the same and they were first identified in fruit flies. What do we share? A male that has been rejected by a female is going to prefer to drink alcohol over water which is not the case if the male was able to successfully mate.

**Henry Standage 11:56**
Fruit flies share that trait?
Anne Simon 12:01
Okay, so they are doing certain things better though, if we were to give them two type of solutions that taste sugary, but one would be a sugar and the other one would be a fake sugar, an amino acid and they would be able to sense if they’re starving, they would be able to eat more of the real sugar. But if they have eaten enough, they don’t really care, they will drink the solution that has the sugary taste because they like it. But if they’re starving, they’ll eat the real calorie one so that they can replace their stocks of energy.

Henry Standage 12:43
I’m definitely going to go home and tell my housemates about that alcohol fact.

Anne Simon 12:47
So, at some point when you speak about the dopaminergic system, you also look at molecules that can be manipulated through different drugs, such as cocaine, methamphetamine, those are the same targets and we can study them.

Henry Standage 13:08
Do they also like to share a cigarette after mating with their partner?

Anne Simon 13:11
Hmm? Do they smoke, they respond to nicotine?

Henry Standage 13:16
A lot more chill than I imagined they were. So, tell us if we were to come by your lab, what kind of various experiments we’d see with the fruit flies.

Anne Simon 13:26
So, we’re looking at a different type of experiment, but we’re focusing on social interaction. So we have an asset in which we put the flies in a little arena that is very flat, there is just little spacers so that they can go in between the spacers within two glass plates, and so they can fly away and they’re in 2D, so we can take a picture of that and we let them roam there and settle to their preferred social space. So, you would see that in our room it’s not so different from this recording room here, apart from the fact that the walls would be white, the tables would be white. We don’t want to disturb the flies. People who are working there have white clothes or white lab coats. And we’re trying to look at their spontaneous activity when they are not starved, they are mated to them don’t have issues like the male’s we spoke about before. They are not disrupted by noise and sounds, and we do that in the middle of the afternoon when they tend to not look for food and not look for mating and tend to be sleeping. They take an afternoon nap that when we’re looking at their preferred social space, and other behavior we look at is how flies are going to avoid other flies scent that flies emit when they’re stressed. So, we’re going to take flies, store them in a little vial, remove the flies, and other flies are going to avoid the viol which there is the marking of the scent of the flies being stressed. And so that is also response to a social cue left by other flies. And with that we’re looking at the volatiles. So, we’re collaborating with Agriculture Canada to identify those volatize that the flies are avoiding, and try to see if we can use some of that in more practical applications beyond the lab, maybe we could try to find ways to deter flies in your kitchen.

Henry Standage 15:31
Can you talk about the differences in the way male and female fruit flies understand an act and social spaces?

Anne Simon 15:38
So that’s very interesting. So there different in size and when we measure their social space for measuring body length, which is a fun time, which we do in ecology, for dogs and other type of aggregation of animals. So, the males and the females fruit flies, that for studying tend to have a
similar social space. Now, it seems like the parts of the brains important to come to that decision are not the same in males and females. Because if you subject them to different experience, the females and the males don't respond the same to social isolation, or not as fast, so the females are more resilient to the social isolation. If you isolate the males and the females for two days, so that the work of our graduate and PhD student in the lab, if you isolate both males and females, and you put them back just in the asset, they have no social experience before, the males tend to be further apart. Less social is our interpretation of that distance. And the female you need to isolate them for seven days to start seeing something, so they are not as affected and interested. Their dopamine level is not as affected either in the female, but the males respond faster to the change in the environment. So, if you don't disturb them, they have a similar social space. But if you push them a little bit by changing their environment, they respond differently. And we have mutants like that, that look like a predisposition to social spacing abnormality. And it's in that work we're doing with Riley. But also, with Wes Robinson and other PhD students in the lab. When we're looking at social space and avoidance of social stance, we're also looking at other assets like climbing, locomotion. And in collaboration with another group in the department, the group of Graham Thompson, we're looking they're looking at social interaction network. So, what are the flies doing? Hello friend, how do they come to that distance? Who are they touching in which order? Anyway, it looks like the females that have one of those mutations are not affected, but the males are. So, there's a mutation in a gene, were only the males are affected. And that's interesting because it's a gene that's been associated to autism in human. So other mutations in the same gene have just one specific mutation that looks like a predisposition.

**Henry Standage 18:30**
So, what you're doing is you're kind of trying to nurture this awkwardness in the flies by isolating them for days at a time. How does it change when you look at nature versus nurture? Somebody that's kind of been predisposed to being abnormal in a group setting versus somebody that through rejection has learned to isolate themselves.

**Anne Simon 18:53**
Yeah, so in both cases, it could come from predisposition and experience. Because there is a part of experience, what you called nurture it's life experience, or what we're trying to look at is how it could be reversed. So basically, one-way experience can affect your behavior is by affecting some of those neurotransmitters that we're speaking about. So, how much of those neurotransmitters are released in a synapse? How much are they used to communicate? How strong is the synapse? How strongly is the synapse going to be able to answer. So, if the experience is able to switch that normal communication between cells, because you already have a predisposition to not be quite at the typical baseline then who helps you go back? So, what we're looking at in the lab is how is it possible to take those isolated flies that have abnormal typical social behavior, maybe it's completely normal when you've been isolated. If you were in the wild and you've been isolated, maybe it tends to be a little bit more distant. And in that case, more aggressive too. So, when we said normally, it might be completely normal for that particular experience, it might be adaptive. But is it possible to bring back to the previous baseline through enriching socially, again, or through changing your environment? How can we bring that back? So that's what we're trying to understand. So that predisposition gets back to becoming a predisposition instead of having individuals displaying the typical social response.

**Henry Standage 20:56**
I have a setting that kind of just came to mind. Prison to me, seems like a really good example of this stuff you look at because you have all these people trying to feel one another out. They're not familiar with one another and some sort of hierarchy evolves. There are people that are more separated from the group and then solitary confinement, famous for breaking a man. And just how people reinsert themselves back into the group if they've been in solitary confinement for a month. It's what your research reminds me of.
Anne Simon  21:28
Well, that's what we're doing. Now that you're saying that we are putting them in solitary confinement and trying to figure out what it takes for them to behave as the group does. And so certain flies are going to be able to go back to what the group does, and certain mutations are such that they can't. So, it's like they are shifted in a way that you can't go back. And we're trying to understand how is that possible? What's happening downstream of the proteins encoded by those genes? How is the circuitry affected? So that it has lost the plasticity to be able to go back with a different social experience.

Henry Standage  22:13
So, it can go both ways. You can lose some of that ability, but you can also get it back.

Anne Simon  22:19
Yeah, and it's going to really depend on your genetic makeup. There's a very interesting image that has been used by one of my favorite researchers in Drosophila field. And so, someone called Mara Sokolowski, her two kids were students at Western actually. And the way she wrote her articles were such inspiration, I really enjoyed her work, and I was so lucky to be able to finally meet her when I came to Canada, because I knew of her a long time ago, and she noticed social interactions between larva stage of the fruit flies. So those little larvae, the maggots that people don't think too much about, or at least not in good terms. She was looking at how they were moving together. And she worked a lot in that field. And whatever she found in the social interactions of the larvae, she was able to expand and apply to other types of research, including in humans how experience is going to shape your behavior and how it's related to the genes you have. And she had a team which I learned through her I don't know if she's the one who coined it, of in humans, the orchid kid and the dandelion kids. And so, it's to signify that you have two types of individuals. The dandelions would be able to thrive regardless of the environment, whether they're well nurtured or not. The orchid kids will be much more sensitive to what the environment is towards them, they can flourish and become beautiful and strong and creative. But if they have too much stressful events, they will just wither, so these two signify the different genetic makeup and in the same environment journals are going to do very differently.

Henry Standage  24:14
Yes, they're much more flexible and the other ones are much more rigid. So, it's an issue of upside for their life, one has more potential but a lower basement.

Anne Simon  24:27
So, they can make the best of a wonderful environment. And the others don't really care about the environment, they're going to achieve their potential regardless of that and that's extreme right. But that was to reflect what she found that you can have the static basis, and some people will not be different at all, even though they have the underlying background because one would have had no stress and the other a little bit too much stress for their potential. The research I'm doing would absolutely not be possible without all the students who are coming in the lab. And I really enjoy having a diverse crowd of students because they are all asking questions like what you're asking, trying to figure out, from their own perspective, what's important in behavior. And the fact that I have people of different ages, of different backgrounds, of different ethnicity. It's making it a lot of fun. So, I enjoyed having that type of discussions that keep me on my toes and make me think about, okay, wait a minute, how do I make sense of all that? How do we make sense of all that? So, I want to have a big shout out.

Henry Standage  25:49
Has anyone ever made the prison analogy before?

Anne Simon  25:52
Not in the way you did.
**Henry Standage  25:56**  
Year three of the podcast, still got my fastball.

**Anne Simon  26:01**  
But people have wondered in another context about how, so you have certain human genetic disorders where the neurons are super social, right hyper social. And they were wondering if hyper aggressive people would have a lack of 21 genes. And if whether you would find an addition of those genes in prisons more often and actually you don’t, you find them in psychopaths. Which might not be in prisons.

**Henry Standage  26:36**  
Well, I think that’s a lovely note for us to finish up on.

**Henry Standage  26:40**  
All right, that wraps up another episode of Western Science Speaks. If you enjoyed the show, you can find us on SoundCloud, Spotify, PodBean, and Radio Western bi-weekly on Mondays at 11:30. Thanks to Anne Simon for coming on. I’m Henry Standage, signing out. Thanks for listening.