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[slide 1] I study lots of different animals to understand humans and I can't do it without human animals to help me do it. Here are some of them [2]. I would be remiss not to thank all of the students and collaborators at Duke and other institutions so a lot of the things I will talk about are obviously not just things I have done on my own.

[3] I want to challenge you guys because at the first part of my talk what I want to do is talk about what is cognition at least how I think about it and conceptualize it when I am thinking about animals. Then what I want to do is turn to thinking about how can we get people to celebrate individual animals and their cognitive profiles, number one. And number two, I want to talk about how have we actually been studying apes and develop a new model of research where we are not only helping humans.

Before we do that, I want to test you guys as an introduction of what I think of as cognition. We are going to roll this video in just a second. But first let me set it up. This is Yoyo and she is an 8 year-old chimpanzee living on ___ island. At the bottom of this PVC pipe are three peanuts and those three peanuts would be like winning the presidency or doing a great job, or your bill got passed when you were lobbying. So there is your bill that you want to get passed and you are not sure how to do it and you have never seen this problem before. Yoyo has never seen this problem and she loves peanuts. She has everything in her room that you would have to keep an animal happy. In the experiment we took away all of the tools she could potentially use to solve this problem, things like

sticks and rocks. She almost instantly figures out how to do this and the question is can you figure out how to do this? [video plays]

So some people in the room are like, “oh I know that, that was easy.” Of course you put water and the peanuts float. There is actually a second solution and it is a very male solution, you pee in the tube. There are different strategies to solve the same problem but what I love about this video is that in 60 seconds I can have you understand what cognition is. Some of it seems pretty nebulous otherwise.

Cognition allows you to solve a problem that you have never seen before. That is what is most exciting to someone like me when I am looking for an experiment to try and understand how animals think. Is it is written by inferential reason meaning I can see something in my environment that I have never seen before and I can use a new strategy or I can develop a new strategy to solve a problem I have never seen before.

The next thing is thinking about not just one kind of intelligence [4]. I think we are inundated in our culture that there is more or less intelligence. It is like a cup. It is either empty or full and you are born with whatever you got. We can try to teach you to be better but whatever you got is what you got. We can measure intelligence with a couple of tests and, bingo!, that is your intelligence. [5] I think what animals have taught us, at least those of us who have studied animal cognition, is there are lots of different types of intelligence. So many that we don’t really know how to characterize them. So many that we are not sure how many there are or how to think about how many different kinds there are. So this really demands you to start abandoning this idea that there is just more or less intelligence and that it is just this one thing. But that actually you can have

lots of types of intelligence and the neat thing is an individual or species can have more or less flexibility or skill in deploying each of those abilities.

[6] So you can end up with a situation like this where a species or individual has a lot of empathy but not much in terms of their ability to flexibly navigate. Or you can have a species or individual that is really inhibited but their memory and social learning not so great relative to, let's say, this species here. So you can have difference cognitive profiles of different individuals in a species. But for people who study health and who are in interested in promoting the understanding of animals in their treatment in some sense this goes against one of the strategies typically used to get people excited to help animals which is animals are like us. There is homology between humans and animals and because they are like us because they are similar to us we should treat them better. But what this tells us is that evolution is not just a ____. I absolutely believe in homology and there are many similarities between the cognitive abilities of humans and nonhumans but it's ___ with modification. And so each species of course is unique; that is why we recognize them as a species. And so each species can potentially have a unique cognitive profile and they are designed to solve ___ problems. I get calls all the time from people in the media and they ask me, "Is a dolphin smarter than a chimpanzee? Is a dog smarter than a kid?" And it took me forever to very quickly answer their question. You asking me that question is like asking me is a hammer a better tool than a screwdriver. What is the problem I need to solve and I can tell you who is smarter. Am I underwater? Am I in a tree? The challenge I think for the animal welfare community or animal advocacy community is yes we are similar but we are also wildly different. That, I guess, in some ways can conflict against some of the things that people argue for in thinking about why

should we care about animals. I think that there is a way to take advantage of that as well and I will highlight that for you today.

[7] Before we do that hopefully I will be able to show you another video. I want you to imagine that you go to Las Vegas and you win money. It could happen. You win about a hundred dollars. And you are pretty excited, let's say two hundred. You come back home and you are like you know what this is frivolous and you know it is so great I won but I won it this is just discretionary money; I just want to do something for somebody else. My question for you is who would you prefer to do something for? Would you prefer to do something for someone you know and is maybe a family member or would you prefer to do something for somebody you have never met before, who is a complete stranger and who you may never see again.

It is pretty universal that when I ask that in front of crowds, people want to help their family and people they know, people who are in their group which is why the universities use so much of this in group verbiage and why at Duke sports is so powerful at helping that University. It gives you a feeling of being together with other people they are family even though they are complete strangers.

So what I want to do is roll a video where I ask the exact same question of bonobos. I said to them would you prefer to share food that you could eat yourself and if I did this study with chimpanzees I hate to tell you that the findings would have been that chimpanzees eat food. But we did it with Bonobos and we left them in a room full of food before breakfast, they had not eaten, they were very hungry and this is the small amount of food that they could gobble up when ____. And we just asked them, Would you like to open a door with a one way key into the room next to you and share food?

And if you do do that would you prefer to open the door for someone you know or someone you don't? And this work is supported by Susie ____ who was my coauthor on the first paper and in Japan it is important because Susie is probably the first student ever to study the psychology of these animals. If you want to promote conservation and welfare of animals wouldn't you want people in the country where they live to care like you do about how these animals think and how their minds operate. The same _____ was the first Chinese citizen to ever study great apes in Africa even though China has an increasingly large footprint on the ground in Africa.

So what we did is we put some food down on the ground this is ____. _____ is a five year old female Bonobo and now she has the choice that I gave you I told you about. She could just eat all of this food. This is ____ scratching… am I going to get any? And you can see a lot of aggression. Bonobos live in one of the Francophone countries the Democratic Republic of Congo. But if you are studying chimpanzees and you are only focused on that one species and especially if you are human and you ask humans their preference and you ask humans about who they would share with this is very strange because not only would Bonobos prefer to share the food than to eat it all themselves but they have a very very strong preference to share with strangers over their own group.

[8] What this sets up is the beautiful question of I think as humans we are used to thinking because when I show you the different types of intelligence you could say to me well that is great but humans have bigger circles on every single one of those types of intelligence but of course humans are smarter than other animals. But that is where the Bonobos are such a beautiful example of thinking about where humans are relative to

other animals. Because as proud as this human is here for flying to space and all of the technological _____ the international space stations, Ipads, computers, and cameras and I am being projected on this microphone we have some problems as a species. We have some problems that we cannot conquer. And probably without continued institutional control of these problems we would never have been able to solve them because there is a biological basis for many of these issues. So we have things like stranger phobias, xenophobia. Obviously we are a terrible species when it comes to sexual cohesion. We have sexual taboos, we have infanticide in our own species and obviously we tend to gamble which is why we are all invaders. Chimpanzees have the same set of problems and obviously humans have these problems but we _____ so if you actually look at the darker side of our species and you ask yourself who is more intelligent and you do the entire cognitive profile not just the part that's about Ipads and technology and large scale ____, then humans actually… Well actually, I don't know. Bonobos have never killed another bonobo. Walk out today and go tell everybody to stop killing one another and let's see how smart we are. They are not going to stop. Humans kill and we kill one another. Bonobos somehow have figured out, even though they share almost all of our DNA, a way of not to do that. So if you ask me, I don't know who is more intelligent. Honestly, I would rather be a Bonobo and not have to wake up in the morning and worry about being killed.

In my own research I have two questions that guide what I do. I am interested in human evolution. What is it that makes us different and special? What are our unique cognitive characteristics? And then I am really interested in the evolutionary process. How we came to be the way that we are.

[9] So one of the things that I do is I study dogs and dog psychology. Basically what happened was there was a hypothesis about what makes humans unique and special in terms of how we develop our ability to communicate with others as young children and how that leads to culture essentially. The first thing you see in my one year old son is that he starts following my point gestures, he starts following the direction of my gaze and everything social is built on top of that. That allows him to participate in culture and eventually acquire language. A lot of psychologists follow this as something very unique, completely unique to our own species and essentially what we have found was that that was not the case.

I had a dog at home growing up and someone told me exactly what I just told you and they said this was completely unique and I said, "Well I think my dog knows that." And so that is how it all got started was that scientist was a great scientist. He was ready to be wrong. Science isn't about being right but about being ready to be wrong. And he was ready to be wrong and have his idea challenged.

[10] When I moved to Duke we started a cognition center. In experimental psychology the normal way you do experimental psychology is … I was recruited from different universities. People would take me to a room where the animals are and … I want to study animal psychology so I don't really want… so what is the model? There was never a model by which you would do animal psychology without a ____ so the challenge and the idea was why don't we just do what developmental psychologists do. You don't put kids in cages if you are going to study developmental psychology. Why not just study dogs and we will just study dogs and have people who are dog owners

invite them to bring their dogs to Duke and we will do exactly what developmental psychologists do and we will play games where dogs have to make decisions… and people loved it. [11] We immediately had 1500 people sign up. We didn't even have to advertise. We had almost a 98 percent acceptance rate where we invite people to come into the lab. And unlike the parents--I love them, they are forgiven--these dog owners actually show up. They show up early, which is a problem. And they don't want to leave and so you have a lot of enthusiasm for this approach. We have been doing this for over five years now. And there are other people in the room who also run a cognition center in Europe.

[12] There has been so much work on dog psychology in the last ten years. My wife and I wrote a book, *Genius of Dogs*, summarizing…. I will spare you the details since we wrote a book about it. But the summary of the book … because of the approach that I just describe to you at the canine cognition center. Remember, the problem that ___ told you about. It is expensive typically to do this work. If you are studying animal psychology you are in the worst box in the 2X2 of how expensive it is and how much money you can bring in. You are in the super expensive and can't bring in money box. Good luck with the Dean. So for me the challenge as a young scientist interested in animal psychology is how do I move us from that box to the I can bring in a lot of money and I don't cost anything. [13] And so that is where the Duke canine cognition center sits. [14] We have brought in lots of grants from DOD and NIH NSF and we have brought in money and it costs the University nothing because there are no indirect costs when you have 1,500 dogs in people's houses; you don't need a veterinarian anymore.

So as great as the Duke canine cognition center is there are constraints on what we can do. I can only test a few hundred dogs a year and obviously the number of conclusions we can make are limited because of that. So sitting there and knowing and learning how excited people are at home in learning about their animals, these members of their family we dream up the idea of ___, and of course this is really important for groups interested in helping people understand the lives of their animals at home. But the other thing is I think is the goal of cognition is rooted in how people at home celebrate the individual dog they live with. The key is the individual that they live with. I went to another meeting where they were trying to define what humane is-- and I was shocked to see that all of the definitions that they had--love caring compassion, all of these nice words—not anywhere on that slide was the word individual. Because as soon as humans recognize animals as individuals you completely switch the system of empathy on in a way that you don't when you are a number or just a complete stranger. Remember you yourself most of you voted to help people you know not people you don't know. So cognition is all about the individual dog and getting people to recognize not only that their dog is an individual because if they realize that then hopefully that helps them understand that my dog is an individual, so so is the dolphin. so is the rabbit, so is the chimpanzee, etc.

[15] Okay, so how does it work? You go, you sign up, it does cost money it is privately funded because I don't think it would help if I go to the DOD and say: "I want to do a study to find out if Chihuahuas have a better memory than Great Danes." That would be very difficult to fund. But if I say that to the public people are like, "Let's do it!" So that is what this is. It is a citizen science company. It costs about 20-30 dollars to

sign up. [16] It is very simple: you play science-based games that are all based on the published literature, you record your dog's responses on your Ipad as you go along. You learn from your results, we give you an in depth report comparing your dog to every other dog in our database and telling you where your dog fits relative to all the other dogs, and we generate that cognitive profile that you saw at the beginning. As a result you are also aware that it is not just about you and your dog, that you are participating in a larger endeavor, where you can learn about all dogs. And not only that but we can all learn about all dogs; now that we have thousands of dogs in our database we are able to answer questions we couldn't answer before when we were just testing a few hundred dogs per year.

So there are about ten different tests that you play with your dog that tracks five different types of intelligence and we have just run the factor analysis on our data and it works. There are actually five factors in our data, which is really cool. We have seen this in prior data, but now with a larger sample we can be really sure of that. And then you get your individualized report. I it is amazing to work with the developers in which had to go into the algorithm. I think there are 80,000 different reports that can be generating depending on your data. On each of the different types of intelligence, this is how your dog compares to other dogs. It doesn't just compare your dogs to other dogs; it compares your dog to ravens and to wolves and to chimpanzees and to rats and so we go through the whole animal cognition literature and talk about why we chose the test we did and what your animal did and what your animal's skills are in that area.

So you are sitting there and you are skeptical; some of you might be and that's fine. I actually appreciate that. What I did is I am supposed to be an expert on dogs and

now I have this cognition ____ I tested my own dog of course. What I did is I tried to predict what my dog would do on all these games. And that is the key thing. Can you predict what your dog would do when you play these games. What would he do? These are my predictions. … [17] Boy was I wrong. I learned my dog is extremely bonded in a way that I did not know. And in terms of his memory actually his working memory relative to other dogs is not that great so when I say "sit, stay" and he walks off I am not sitting there going "you are being disobedient." I now know well his working memory is not what he relies on. He probably forgot. And of course in being bonded that is really important because now I know that I have a dog that responds very heavily to how we are feeling relative to other dogs. So you can imagine why this would be very important to know who you are sleeping with every night in a way that you did not know before.

[18-20] So, with citizen science we are getting a lot of data and we are getting it very fast, which means that we can answer a whole host of questions and the cool thing is all of our data is really available online and what you will find is a place where there are filters and you can go under our database, play around and [21-25] you can see is it really true that herding dogs are smarter than non-working dogs. And what you are actually going to learn when you paly this it is really hard based on the data we have collected so far to see big differences in breed groups. Where you see a lot of differences is when you look at the cognitive profiles that we statistically generate and you will see that individually dogs that some dogs regardless of sex age breed etc. are really different than other dogs that are in those other cognitive profiles. But we have found some differences with our data. ___ analyze at look at where you see differences between the pure breed and mix breed. This is really cool and I think it drives home this point of different

cognitive skills and what is smart. So we found differences in ___ memory and ____. And what we see is that pure breeds follow gestures more heavily than mix breeds of course then they must be smarter right? Except for when you look at a memory game the mix breeds are more reliant on memory than the pure bred dogs. So I hope all of you will try; I do have some coupons if you want them I will give them to you.

[26-27] It is not just dogs that are interesting though, even though they are so interesting to us and not just to us but other species as well. I also want to just quickly talk about ____ research consortium in thinking about how do we deal with a problem that there are so many people doing non-invasive work that we can easily categorize under ___ important health research taking a holistic approach solving human health issues, big issues not small ones, I don't know, like pandemics. You know that kind of seems important—people doing non-invasive research that can be important. So what we want to do is build a consortium of people to make sure that we have a community of people that can work together to solve some of these big issues.

I am going to rifle through these slides. [28] You guys all know that apes are endangered and the big thing that is leading to their decline in the wild is the bush meat trade and pet trade, especially in DRC and other places where habitat loss is not the issue in the Democratic Republic of Congo at the moment. [29] As a result of these young infants coming out of the wild there are now sanctuaries, which provide a lifetime of care, and [30-31] truthfully if I was a great ape that is where I would want to live, not in a zoo in America. Obviously, not a lab either. [32-34] The sanctuaries are big and they are microcosms of what you would see in the wild. Everything you would find in the wild in

a primary tropical forest exists in these sanctuaries. A smaller scaled but everything is there.

Ten years of research has shown that these sanctuaries are amazing places to work. [35-36] We have published over 50 papers since 2006 in various journals, lots of studies that you could not have done without using these sanctuaries. [37] Most of these studies were on cognition genetics behavior and not as much on veterinary work but I think that is where the future is and where the ape research consortium could make a huge impact. The idea is not just give researchers but managers the option to communicate… and the problem I have found on the ground is that lots of managers are saying… "My apes are dying of ____ this virus that nobody knows anything about." All great apes get it. Humans are the only ones that don't die of it so far. What is that and what can we do about it? Instead of it being researchers showing up and saying I want to study this, we need a way for managers to go and tell us what they need research on. So that is what this website potentially does.

[38] And you can see, this is just the pilot group that we put together of a very excited group of people to work on issues like we talked about and there are nice descriptions of the sites and their research programs.

Then what we have got is publications of all these different researchers since 2006. It is about 300 pages. So, is this serious research? Is it more than what has been going on in laboratories in the United States? Actually, yes. It is less funded but there is more research.

I have collaborators who are working on the problem of how do you do surveillance to stop a pandemic and in doing that research you have to understand the

transmission of diseases between animals and humans so that is the work we are doing. Veterinary research, right now we have a student there doing ___ study because Bonobos have a terrible case of the flu, we have already lost one Bonobo with about 15 others really, really sick, and it happens every year. So how do we study their respiratory illness from a vet perspective and actually learn something that can help us understand human health as well. So that is the project that we are working on. China is a really important part of it as well. [39-40]