

"PRIME TIME PRIMATES"  
SHOW 504

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EPISODE OPEN

ALAN ALDA We've come to a Caribbean island whose only inhabitants are monkeys, to ask the question, what can they teach us about ourselves?

ALAN ALDA (NARRATION) Can we find the roots of human morality in how chimpanzees share? Do chimps use tools...

ALAN ALDA You want a stick?

ALAN ALDA (NARRATION) ...the same way we do? What's the link between this odd primate and a special human skill?

ALAN ALDA It makes her smile.

ALAN ALDA (NARRATION) And we'll find out how to behave in polite society.

ALAN ALDA I'm Alan Alda. Join me and my new friends for Prime Time Primates.

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## KEEPING THE PEACE

ALAN ALDA This island off the coast of Puerto Rico is an exclusive preserve for macaque monkeys, whose original home was in India. Monkeys here live pretty much as they would if we weren't around.

ALAN ALDA (NARRATION) It's a great place for monkey watching.

ALAN ALDA Monkey watching is fascinating for two reasons. How like us they are. And how not like us they are. The big difference, of course, is in our heads. People are capable of language, mathematics, culture, complex social structures - wonders that seem to us to be so far above the abilities of monkeys that they must be uniquely human. But are they? That's the question we'll be asking for the next hour. How much of us is in them? And how much of them is in us?

ALAN ALDA (NARRATION) Our first story is about what these days is a very hot topic. Aggression. Macaques - rhesus monkeys - spend much of their time hanging out in large groups. Mostly they get along just fine, and arguments only rarely turn violent enough for someone to get hurt. And when things do get a little too stressful, the monkeys have plenty of room on the island to get away from it all.

ALAN ALDA But what if they lived in more crowded conditions? These monkeys aren't on an island. They're in a large enclosure at the Yerkes Primate Center in Atlanta. And how they cope with crowding here may help us understand how their fellow primates, people, cope with the stress of living in the crowded artificial conditions of cities.

ALAN ALDA (NARRATION) It may look as though the monkeys here have plenty of room, but they're 500 times more crowded than they are on the island. They are part of a long-term experiment on crowding in monkeys inspired by the ideas of Yerkes primatologist Frans de Waal.

ALAN ALDA How long have people been studying crowding in animals?

FRANS DE WAAL Well, probably very long, but the most influential study came out in the 60s, where someone did a study on rats. Rats lived in a small room and it got more and more crowded the more they multiplied, and they became very aggressive. They even started killing and eating each other.

ALAN ALDA (NARRATION) It's unusual here at Yerkes for the monkeys to get packed together the way the rats were, but every now and then they have to be

rounded up for routine medical care. They're used to the operation, and they head for their indoor cage as soon as their keepers appear. Once inside, they're anything but aggressive. In fact, their behavior reminded me of the way we humans cope with being tightly packed together.

ALAN ALDA When you crowd people together in an elevator you don't tend to get more aggression, you tend to get very ritualized polite behavior. People don't even look at one another.

FRANS DE WAAL Yes, they avoid looking at each other, they avoid interaction and so they avoid anything that may cause some problems there because it's a very crowded space. And if you do with rhesus monkeys an acute crowding experiment - which is sort of the elevator effect - you get similar behavior. They may stay next to each other but they don't move and they don't interact very much.

ALAN ALDA (NARRATION) So when we're really packed together, people and monkeys seem to cope the same way - by being very careful. But what about everyday life? Monkey society is based on a strict hierarchy, in which everyone knows his or her place. In this moderately crowded enclosure, one important way to avoid conflict is by grinning a lot - more scientifically called the bared teeth response.

FRANS DE WAAL That's a behavior that goes up dramatically under more crowded conditions, as if the subordinates are constantly telling the dominants, "I'm subordinate, don't worry about me, I'm still at the same place in the hierarchy so you don't need to attack me."

ALAN ALDA Are there some monkeys where baring the teeth is a sign of aggression? I mean showing your teeth...

FRANS DE WAAL Well you can show your teeth in two ways. If a rhesus monkey opens the mouth and stares at someone, that's a threat. But the baring of the teeth in a sort of smile type of way is a submissive gesture. In the apes such as chimpanzees and in humans, it has got an affiliative and friendly component, but still nervousness is often involved, and if someone smiles too much we say that's a nervous person.

ALAN ALDA I'm a little nervous about getting scratched and bitten later!

ALAN ALDA (NARRATION) Peter Judge is in charge of the crowding studies. Here's a typical incident in the long hours he spends monkey watching. This baby is just a few weeks old, and a popular playmate for the other monkeys. The

mother, named Allie, is constantly fending off unwanted invitations. Suddenly a young monkey called DJ gets too rough.

PETER JUDGE Allie threat DJ.

ALAN ALDA (NARRATION) But moments later, DJ approaches Allie, and the two monkeys make up.

PETER JUDGE DJ sits in proximity Allie. DJ groom Allie

ALAN ALDA (NARRATION) Grooming each other is the monkey's main way of relaxing and having a good time together. What Peter Judge found is that in the potentially explosive conditions of crowding, monkeys do a lot more to keep the peace between each other than they do when they have room to spare.

PETER JUDGE If you look at aggressive behavior, some of the aggression goes up and some of it doesn't. If you look at friendly behavior, almost every category of friendly behavior increases. We think that in a condition like that where you're always close to your potential aggressor, it's worth your while to restore the relationship and resolve the conflict.

ALAN ALDA (NARRATION) Rhesus monkeys have been off on their own evolutionary pathway, separate from the one that led to humans, for something like 30 million years. More closely related to us - separated by only 6 million years of evolution - are chimpanzees. It was watching chimps that first convinced Frans De Waal 20 years ago that the higher primates all share a deeply-rooted instinct for making peace. This group of 19 chimpanzees, living below Frans' office at Yerkes, includes Jimoh the alpha male or group leader; and Peony, the dominant female, here with her daughter. The adolescent males in the group often act like adolescents. But the fights rarely get serious, and as with the rhesus monkeys they usually end in friendly reconciliations - this one involving tickling and laughter.

FRANS DE WAAL Now we will throw them in...

ALAN ALDA (NARRATION) Frans recently began some experiments with his chimps that are convincing him that not only peacemaking, but even such supposedly human traits as morality, have biological roots which that we share with chimpanzees. These bundles of leaves are a treat for the chimps, an addition to their regular diet.

FRANS DE WAAL Thats a juvenile who took it and the alpha male takes it over from him..

ALAN ALDA (NARRATION) Most of the chimps gather around one of the bundles, and peacefully share the leaves. But the bundle right below us was taken by a young female called Georgia, who is much less willing to share.

ALAN ALDA You think Georgia is stingy because she hasn't learned to share yet or is she just naturally stingy?

FRANS DE WAAL Well, in human terms you would almost say that she doesn't have the confidence yet and the position yet to be generous with others. She still very much in a sort of competitive mode like, "How much can I get myself?"

ALAN ALDA (NARRATION) Georgia sat with her back to us, her new baby's hand just visible at her elbow, firmly monopolizing her bundle.

FRANS DE WAAL In a year we collect thousands of food transfers between individuals. We see that among adults, it's reciprocal- if I share a lot with you, you will share a lot with me. Juveniles are totally out of this. Juveniles work on a stealing operation.

ALAN ALDA (NARRATION) Georgia's tactic of stealing backfires as another juvenile steals the whole bundle from her.

FRANS DE WAAL That's a typical juvenile way of doing it.

ALAN ALDA (NARRATION) Georgia's selfishness has other consequences, too.

FRANS DE WAAL Individuals such as Georgia, who are not very generous. When they are in need of food, they're the first one to be rejected by other individuals. And so it is as if the other individuals are saying "Well, you're never sharing with me, why should I share with you?". And this is also how young females such as Georgia are gradually learning. It's much better to cooperate with a system like that. We actually get more out of it by cooperating and contributing to it.

ALAN ALDA (NARRATION) Frans and his research assistant Mike Seres have kept track in the thousands of trials they have run of just who shares with whom. What's remarkable is that the chimps keep track too. So if one chimp shares food with another in the morning... the generosity is returned by a spell of grooming in the afternoon. The very young are allowed to get away with behavior that the females in this group don't tolerate from an adolescent male. He picks up a stick and tries intimidation, but the group isn't impressed. Here's Georgia, again causing trouble. Jimoh ambles over, nudges her gently, and she holds out her hand in apology. Again, Jimoh breaks up a squabble. So while as in human society there's conflict and aggression, chimps have many strategies for keeping

the peace. Frans sees in these behaviors the root of what in humans we call morality.

FRANS DE WAAL They have many of the emotions and elements of human morality such as empathy and sympathy probably. Generosity. Certain forms of altruism. Rules and regulations. Conflict resolution, which is one of my main interests, is how to resolve conflict among themselves. And basically you can look at human morality as a system that resolves conflicts among parties that live in one society.

ALAN ALDA Does that lead you to think in a different way about the origins of human morality than you did before?

FRANS DE WAAL Human morality must have some deep evolutionary roots. It must come from somewhere. And probably in other animals we can find not the whole system, but we can find certain elements of human morality. And that is what I am seeing when I look at chimpanzees.

ALAN ALDA (NARRATION) Chimpanzees are our closest non-human relatives. But they're not the only primates with a code of ethics. Even though they branched off from us 40 million years ago, there's a species of monkey that also trades tit-for-tat - Capuchins. Capuchins are being studied by one of Frans de Waal's research students, Lisa Parr.

LISA PARR Capuchins are well known for being very manipulative in their food. So you can that their ..oops

ALAN ALDA Wasn't too good about that manipulation.

LISA PARR I think he wants the whole bunch. He doesn't want just a piece. They also have extremely large brains for their body size. It's the largest among the new world monkeys.

ALAN ALDA And they all have crewcuts- too.

ALAN ALDA (NARRATION) Today 's experiment will involve Bias, a female capuchin. And Vincent, a male colleague.

ALAN ALDA (NARRATION) Vincent is given a bucket of apples. Then it's time for us to discreetly withdraw.

LISA PARR These two individuals are very tolerant of one another. They are sitting very close together. And they are doing what we've term passive food sharing

ALAN ALDA What does that mean passive food sharing?

LISA PARR It means the food possessor is sitting close enough so that discarded pieces and broken bits of pieces are within reach of the passive food partner.

ALAN ALDA So because he is not preventing her from taking the food, that's considered sharing .

LISA PARR Exactly.

ALAN ALDA Now is there any indication that he is leaving these pieces deliberately in some way or are they just falling out his mouth. I mean is he just a sloppy eater who doesn't care who grabs his food.

LISA PARR Well, we have control studies that we do where there is only one animal in the cage and under those circumstances, the animal usually doesn't sit close to the mesh so the pieces aren't left within reach.

ALAN ALDA (NARRATION) So Capuchins too share and share alike. It seem that no matter what primate species he looks at, Frans de Waal finds evidence of cooperation and peacemaking.

ALAN ALDA It seems kind a reassuring idea that this drive for holding down violence comes naturally to our cousins and probably to us.

FRANS DE WAAL I'm glad you use the word naturally. Because usually people use animals only for the bad side of human nature like what people do in Rwanda or Bosnia. They say they are acting like animals. So as soon as we do something bad its sort of beastly behavior. If we do something good, its our noble human nature that causes it. And I think we have both sides in us and we can see both sides in the primates. We have aggressive tendencies, violent tendencies, there is no denying that. At the same time we have mechanisms to deal with these issues

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## CHIMP MANNERS

ALAN ALDA (NARRATION) Like human babies, chimp babies are completely dependent on their mothers when they're born and for a long time afterwards, as they learn to become good chimps.

ALAN ALDA But when chimps are born in captivity a lot of mothers don't seem able to teach their babies the proper rules of chimp society. So at Yerkes , a lot of babies are brought here to the chimp nursery. Where its up to humans to teach them how to become good chimps.

ALAN ALDA (NARRATION) Abandoned at birth, 3-week old Julie is now being raised by Kim Bard - who tries to be as chimp-like as she can.

KIM BARD We nurture them as babies chimpanzee style. We don't want them to be humans, we want them to be good chimpanzees. So, human babies you would feed lying down. Chimp babies eat like this. What are you smiling at?

ALAN ALDA Is that a smile?

KIM BARD Yes, that's a smile.

ALAN ALDA She smiles with her bottom teeth, a little like Bob Hope.

KIM BARD They smile with the bottom gums, in her case showing. If you see the top teeth, its by definition not a smile in a chimpanzee.

ALAN ALDA (NARRATION) Like human babies, chimp babies are magnets to adults.

ALAN ALDA Funny, I must be a least as programmed as she is, because I got a lot more interested as soon as she grabbed my fingers. Do you find that happening in a mother chimp if the baby grabs on to her.

KIM BARD She has the baby grabbing on to her all the time. And what she does is do these kinds of things.. what does it do if I move her leg? What does it do when I move the other leg?

ALAN ALDA (NARRATION) And soon I was playing mother chimp.

ALAN ALDA So what happens if I do this? It makes her smile. If I do this? If I do this. And a one and a two and three and four and a five... Look at this the beginning of aerobics. You want to do pull ups? Oh good.. and two and three. One more. You can do it! You can do it! And four- she is smiling, she loves it!



ALAN ALDA (NARRATION) In their own social groups, young chimps interact with relatives of all ages - brothers, sisters, cousins, aunts and uncles. They learn essential chimp manners - the dos and don'ts of chimp society. Most important, young females - soon to be mothers themselves - learn how to handle babies. So in the nursery, young female chimps are encouraged to play with younger animals. Today Evelyne, age 3, is there to help look after Andie, who's 18 months. Until the nursery program began, many female chimps raised in captivity were unprepared for motherhood.

KATHY There are mothers who have just been around infants and they go "I don't know what to do with them?". When they cry, should I pick them up or should I toss them somewhere? I don't know what this thing is. With this experience, this is something that occurs in the wild- a lot of juveniles get experience with younger siblings, they know, they learn how to react.

ALAN ALDA (NARRATION) Evelyne got a little worried by our camera.

KATHY Andy was displaying at you all. And Evelyne wants her to keep her distance a little bit, so she kind of grabbed her back. Evelyne is being very protective towards Andy.

ALAN ALDA (NARRATION) While Evelyne was the perfect older sister with Andie, 7-month old Lindsay was a bit more puzzling. Curiosity took over from caring - until finally a toe was just too tempting... Then it was my turn. I'd been cautioned to expect anything.

ALAN ALDA Hello. What do say? How are You? So far, so good- and now it was time for me to learn a few chimp manners.

KIM BARD It's okay.

ALAN ALDA Now that scared me. Does he mind if I get scared?

KIM BARD Yes. He is telling you that he scared.

ALAN ALDA He is coming up to my face like that. Is he trying to scare me?

KIM BARD No, he is scared himself.

ALAN ALDA This one is poking me in the ear

KIM BARD He is grooming. He is trying to tell you he's is a little nervous. And the way to calm chimpanzees when they are nervous both to make you a little calmer

and to make him calmer is to groom. We try to - don't look at their face, but you look at the part you are grooming. And immediately you are going to find that they relax. And not move and get into this very still posture. We make chimpanzee grooming sounds. Either a ..... or the kind Kathy makes is ----- . But its a very focussed attention-getter.

ALAN ALDA That's got his attention a lot!

KIM BARD And what Lucas likes- he just calms immediately. Is he grooming you?

ALAN ALDA I think he is trying to eat my chin

KIM BARD If you have a freckle or something- that might be particularly intriguing.

ALAN ALDA A freckle? What do they like them for dessert?

KIM BARD This is a way to ask for play.

ALAN ALDA When they put their hand on the head like that?

KIM BARD They are like- tickle me right there.

ALAN ALDA Oh I see. If I was to ask for a little tickling. He is not really watching.

KIM BARD What you need to do is to get really loose. So you get loose..

ALAN ALDA I'm going to get really loose now..

KIM BARD And when ever they touch you, even if they don't mean it as tickling, you laugh.

ALAN ALDA (NARRATION) Unfortunately, my chimp laugh didn't seem too convincing - especially to Merlin.

ALAN ALDA Ouch.

KIM BARD That's not nice- but now he is saying I'm sorry .

ALAN ALDA (NARRATION) Merlin and I made up, as all good chimps should.

ALAN ALDA That's okay. That's okay.

ALAN ALDA (NARRATION) And here in the Yerkes nursery, that's the goal - rearing chimps to be the best chimps they can be.

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MONKEY SEE, MONKEY DO?

MIKE TOMASELLO We'll put some honey in here...

ALAN ALDA (NARRATION) Every once in a while, Mike Tomasello gives the chimps at Yerkes some honey.

MIKE TOMASELLO They poke sticks into holes and beehives..

ALAN ALDA (NARRATION) In the wild, chimps often use simple tools to get at food. They crack open nuts with rocks, and poke sticks into beehives for honey.

ALAN ALDA You want a stick? This use of tools seems very human-like - yet another example of a behavior apes share with humans. It's even led to speculation that apes learn skills and pass them on to others just as we do. But is that really what's happening ?

ALAN ALDA How do did they learn to do this? Do they learn the same way we do?

MIKE TOMASELLO Well there are a couple of different theories about how they might go about learning this. On the one hand I would say they do go about learning it in very much the same way a child would. They are exposed to the tool, they have a problem in front of them and they either some combination of trial and error or insightful problem solving. And in many cases, I believe they do employ insightful problem solving in the sense that they don't have to try out every possible solution. They can look at the problem and see which one might work better.

ALAN ALDA (NARRATION) That chimps can figure out for themselves how to use a stick to get honey is impressive enough. But can they pick up the skill by watching others, as we can? To help answer that question, Mike Tomasello has recruited another primate species, a close relative of both chimpanzees and gorillas - the orang-utan. Orangs are more placid and so easier to work with than chimps - though they have their little foibles.

ALAN ALDA Is it okay to look them in the eye?

MIKE TOMASELLO Oh yeah they are fine. He might spit at you, but other than that they are fine.

ALAN ALDA (NARRATION) This is Iney. My job was to try teaching her how to use a rake to get a piece of fruit.

ALAN ALDA Look at this. Look at this

ALAN ALDA (NARRATION) I made a show of turning the rake over, making it easier to pull in the apple.

ALAN ALDA Umm. Good. Iney ignored my advice. Tiram looked uncooperative from the start. This time my rake was already turned over, so I simply pulled it in. Tiram also ignored my action and experimented on his own.

MIKE TOMASELLO Good job. Good job, Tiram. What I did with the rake didn't seem to matter.

ALAN ALDA I didn't turn it over. But Tiram did turn the rake over. Why?

MIKE TOMASELLO Because Tiram is going to do what ever he is going to do regardless of what you are doing. He is figuring out how to do it on his own.

ALAN ALDA I think the reason that they don't do exactly what I do is that I don't grab it with my feet. I'm just using my hands

ALAN ALDA (NARRATION) Tomasello believes that what apes learn from others is the general idea that a tool can be useful - not the exact details of how to use it.

ALAN ALDA So, they benefit from seeing it used. And they come over to the place where its being used. And they will pick it up and use it. But they won't exactly imitate the use. Its not like a carpenter teaching his daughter how to use a plane.

ALAN ALDA (NARRATION) This difference between how apes learn and how children learn is Mike Tomasello's main interest.

MIKE TOMASELLO This is Matthew. This is Alan.

ALAN ALDA Hi Matthew. This is fun. And I finally got to work with a primate species I'm a bit more used to.

ALAN ALDA Can you say what this is?

MATTHEW Its an airplane.

ALAN ALDA (NARRATION) Tomasello has set up an experiment with children that's similar to the one with oranges.

ALAN ALDA Watch me, Matthew

ALAN ALDA (NARRATION) With the rake already on its back, I pull in the toy. The key point is that I didn't turn the rake over; it was already the way I wanted it. And Matthew also doesn't turn over the rake - even though it would obviously work better if he did.

MIKE TOMASELLO It's Alan's turn. Next time, I make a show of flipping the rake. And that's all Matthew needs. MOTHER Good job, Matthew.

ALAN ALDA Okay, Mike's going to drop it here.

MIKE TOMASELLO Rachel, watch, I'm going to drop it in. With Rachel, I again make a big deal of flipping the rake.

ALAN ALDA And I take it out. Mike's going to drop it in now , it's your turn. You try it. Rachel gets it at once - but like the oranges, she puts her own spin on the solution.

ALAN ALDA That's very good. You're pretty good with that bear. But after again watching what I do with the rake, Rachel imitates my actions precisely.

MIKE TOMASELLO Rachel's turn. And it's this ability to exactly imitate that Mike Tomasello believes is the key difference in how humans learn when compared to apes. It gives kids like Anna a short cut to learning that apes don't have. And it maybe what enables us to pass on from generation to generation everything that's been learned before. The way chimps use sticks to get honey is a reminder of both how like us they are - and how not like us they are. And it gives us another insight into what makes humans so different.

ALAN ALDA You think there is any thing we can learn about the way we learn by studying this more basic way the chimps learn.

MIKE TOMASELLO Many times with humans the problem is that we are so immersed in something we can't get out of it to see it. So, we all have had the experience of going to another culture and seeing them do something differently. And we didn't realize what we did until we saw that it could be done differently.

And I think that is a lot of the value of studying non-human primates is to see how something is done differently.

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## CHIMPS COUNT

ALAN ALDA Even though the way apes learn is different from the way humans learn, when apes are reared and taught by humans they can learn some surprisingly human skills. The best known of these is when chimps and some gorillas have been taught a simple language. But what's not so well known is that some chimps have been taught elementary math skills.

ALAN ALDA (NARRATION) This is the playground of a unique elementary school housed at Ohio State University, where Sally Boysen is teaching chimpanzees to count.

SALLY BOYSEN One. Two. See that. One, two. Where's the two? That's it.

ALAN ALDA (NARRATION) Bob, 4 years old, is one of her youngest pupils.

SALLY BOYSEN One. Two. Good work, that was good. We're not done yet. Try a cookie.

ALAN ALDA (NARRATION) Like most 4-year olds, Bob's attention sometimes wanders.

SALLY BOYSEN He's learning just those first two numbers and once - I knew he was going to do that. His attention span is a lot shorter than a child's, and we end up investing a lot more time in playing and social interaction than in actual training. That's kind of the opposite of what we see in children. Where they spend a couple hours at school and 15 minutes in recess, we spend 15 minutes in school and two hours of recess.

ALAN ALDA (NARRATION) While Bob is still in kindergarten, 10-year Sheba is already a first-grader.

SALLY BOYSEN Seven. That was the right answer. OK, you can...

ALAN ALDA (NARRATION) She is learning her numbers from 1 through 7

SALLY BOYSEN How many is that? How many is it? Five is the right answer. Ok, you get 'em all. Ok, good work.

ALAN ALDA (NARRATION) Sheba also understands zero.

SALLY BOYSEN Okay. Look, Sheba. How many things do we have here? None. There are no candies.

ALAN ALDA (NARRATION) And sometimes runs the class herself.

SALLY BOYSEN Oh, you think you should get reinforced anyway. How many is that? You can do your own trials. It was one. That was good. Well, gee, I don't even have to be here. That's right.

ALAN ALDA (NARRATION) Now that Sheba knows her numbers, Sally plans a new challenge. She puts 3 peaches in one box. And 3 peaches in another. This is the first time a chimp has ever been given an addition problem.

SALLY BOYSEN Okay. How many peaches? How many? Show me. Yes! Six is the right answer. Good girl, there's six peaches out there.

ALAN ALDA (NARRATION) The task involves Sheba's counting the first set of peaches, holding that number in her head, then continuing the count with the second set.

SALLY BOYSEN Get the right answer. Five. Good.

ALAN ALDA (NARRATION) Without ever being trained to add, Sheba gets it right the first time. Then Sally makes the task even harder, by replacing the peaches with plastic numbers.

SALLY BOYSEN There we go. Okay. How many was that. Can you pick? Show me. Four. Perfect.

ALAN ALDA (NARRATION) Astonishing though Sheba's performance would seem to most people, Sally isn't surprised.

SALLY BOYSEN To find capabilities in the range that we have with numerical concepts is not surprising to me. It means we have to rethink our ideas about what humanness is all about, and also what chimpanzeeness is all about.

ALAN ALDA (NARRATION) There's one numbers game Sally has devised that really demonstrates Sheba's chimpanzeeness. One of the players is Sarah. Her job is to eat candies. Sheba's job is to choose how many candies Sarah gets.

SALLY BOYSEN One, two, three, four down here. Are you watching? Miss Priss.

ALAN ALDA (NARRATION) Here's how the game works:

SALLY BOYSEN We're going to put two in here. Which shall we... Give those to Sarah, OK.

ALAN ALDA (NARRATION) Whichever set of candies Sheba points to first goes to Sarah.

SALLY BOYSEN And Sheba only gets two...

ALAN ALDA (NARRATION) Sheba gets what's left.

SALLY BOYSEN Too bad.

ALAN ALDA (NARRATION) So if Sheba understands the game, she should pick the smaller amount first.

SALLY BOYSEN Five in that one and we'll put one in there. Now which one do you want Sarah to have? Oh, you want Sarah to have these. It's okay.

ALAN ALDA (NARRATION) But no matter how many times they try it, Sheba always points to the larger amount first. It's a game she just can't seem to figure out how to win. Sally has a hunch that making the task more abstract might help.

SALLY BOYSEN Let me ask you a question. Which one do you want to give - you want to give two to Sarah.

ALAN ALDA (NARRATION) And remarkably, Sheba now picks the smaller number first.

SALLY BOYSEN Oh, you lucky girl. One, two, three, four, five, six.

ALAN ALDA (NARRATION) Sarah is not that impressed by Sheba's new skill.

SALLY BOYSEN We have four - now wait, wait until I show you what else we've got. Now what shall we give to Sarah? Two, we'll give Sarah two.

ALAN ALDA (NARRATION) Sally Boysen suspects that because of Sheba's natural greediness, she can't resist the candies themselves. But while the numbers engage her reason, allowing her to play the game intelligently. Unlike Sheba, the males in Sally's group are too big and too aggressive to be let out of their cages.

SALLY BOYSEN I've got your toe...



ALAN ALDA (NARRATION) Still Sally has found a way to play with them...and to work with them.

SALLY BOYSEN How much of a peach is this? Half of a peach. Right.

ALAN ALDA (NARRATION) Darrell is working on fractions.

SALLY BOYSEN It's a half of a peach. That's right. What's that in your mouth, a peach pit? Thank you. Yummy, yummy. How many of these do I have? Two bananas. Right. There's two bananas here. Now watch what I'm going to do. This. And one more time, and now I have this little weensy piece. It's a fourth of a banana.

ALAN ALDA (NARRATION) When Sally cuts the fruit in front of him, Darrell chooses correct fraction.

SALLY BOYSEN ( To Darrell) I've got some left, too. I have another fourth. That's right. There it is.

SALLY BOYSEN Darrell has to understand that there are whole things and there are parts of things; and that we can assign a name for different parts of an apple, for example. So that there's a special name for a half of an apple, a special name for a fourth of an apple.

ALAN ALDA (NARRATION) The chimps aren't happy when Sally turns her attention to the camera. But they figure out a way to get revenge. Soon, they're calm enough to start work again. Darrell's next challenge is to figure out what fraction of a pear this represents, without actually seeing the fruit cut up.

SALLY BOYSEN (to Darrell) Not half. Oh, you're guessing all of them, guessing all of them. I want to show you something. Look what if I took a whole pear like this. Oops. This is one pear, isn't it? And I'm going to cut it up for you.

SALLY BOYSEN Darrell's still not able to reliably pick the correct fraction. It really helps him still at this phase of the understanding of the concept to see a whole piece of fruit divided into portions. But we're working towards that.

SALLY BOYSEN (to Darrell) Darrell, look how many pieces I cut this into - one, two, three, four. That's right, this is only a fourth. That's good, a fourth. Good, do you want it? You don't want it? Okay. Would you rather have a piece of candy? Alright. There you go. You can stay here. We're still working.

ALAN ALDA (NARRATION) Sally believes that chimps, like humans, have an intuitive understanding of numbers. It isn't that Sally is teaching them to count or add or do fractions. Instead, she is simply giving her chimpanzees an opportunity to show us what they can do.

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## FINGER FOOD

ALAN ALDA (NARRATION) These are primates too - lemurs - the most distant of our primate cousins. Lemurs branched off from the family tree 70 million years ago. Common then, they live wild today only on the island of Madagascar. But about 500 lemurs also live here in North Carolina, in a forest owned by Duke University. Some lemurs are nocturnal: They wake up only when it gets dark. This lemur is an aye-aye. His name is Nosferatu. In Madagascar, the aye-aye is considered an evil omen, and often shot on sight. Aye-ayes are one of the most highly endangered primates in the world. And one of the weirdest. To eat breakfast, Nosferatu scoops out an egg using his extraordinary 6-inch long middle finger. Breakfast over, Nosferatu goes foraging much as he would in the forest, looking for worms and insect larvae living inside tree branches. How he does it fascinates Duke University psychologist Carl Erickson.

CARL ERICKSON How do you find food in a rainforest at night when it's rather rare and it's hidden below the surface of the tree. It seems like a formidable problem and I would really like to know what is in his head when he does that.

ALAN ALDA (NARRATION) To find out what's in Nosferatu's head, Carl is making an artificial tree branch, complete with hiding places for worms. He's going to test three different hypotheses about how the aye-aye is finding its prey. The first hypothesis is that Nosferatu's sharp ears can hear the worms even when they're deep in the wood.

CARL ERICKSON It's possible that when he taps, the prey gets excited and that he hears that excitement and so he goes for the act of prey. One way to make sure he can't hear them is to have them dead.

ALAN ALDA (NARRATION) Chopped-up - and therefore silent - worms test the second possibility: that Nosferatu smells his prey rather than hearing it. The third option is that it's not the worms but the holes the aye-aye finds, so one is left empty. The cavities are two inches beneath the surface. Nosferatu can't wait to begin the hunt.

CARL ERICKSON He is very eager. And as you can see often times I can't get the wood blocks in fast enough for him.

ALAN ALDA (NARRATION) Nosferatu has no trouble finding the first cavity, with the live worms. After fishing them out he moves on - and at once finds the hole with the dead worms. But worms, live or dead, don't seem to be what he's locating - because soon he finds the empty cavity as well. It's the cavities, not the worms, he's searching for.

CARL ERICKSON What we need to do then is find out what it is about cavities that is so interesting to the aye-aye .

ALAN ALDA (NARRATION) One thing about cavities the aye-aye find interesting is their shape. Carl makes a pair of X-shaped cavities, and gives them to Nosferatu to check out . The aye-aye taps around, apparently making a mental map of the shape - then selects where to gnaw very precisely.

CARL ERICKSON The aye-aye seems to have selected the area near the intersection. And this suggests to us that it is not simply detecting the configuration, but is going beyond that to find a strategic location and reach all the arms of the X through a single entry point.

ALAN ALDA (NARRATION) Carl has made a cut-away branch with tunnels and a central hole, to see what's going on inside the tree. Nosferatu, as usual, is an enthusiastic collaborator. The extraordinary flexibility of Nosferatu's middle finger means the worms have almost nowhere to hide. The aye-aye may be only a very distant relative. But in its ability to create mental maps, and in particular in its extraordinary dexterity, there's a kinship with humans that shines through even 70 million years of evolution.

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## THE MATING GAME

ALAN ALDA For our last story we are heading back to the place where we began, the island of Cayo Santiago, about half mile off the shore of Puerto Rico. We are going there because while there are a lot of things you can learn about monkeys in captivity, there are some things - like matters of sexual politics - that can only be studied when you are looking at monkeys in the wild. And monkeys on Cayo Santiago are about as wild as monkeys can be.

ALAN ALDA (NARRATION) Nine hundred rhesus monkeys live on this island today - the descendants of monkeys released here 60 years ago. Mothers are at the center of rhesus society - as John Berard of the University of Puerto Rico has learned from 13 years of monkey watching.

JOHN BERARD The mother-infant bond in primates as in humans is very strong  
The whole society revolves around mom.

ALAN ALDA (NARRATION) The Cayo Santiago monkeys have been watched by generations of researchers. But probably no-one has got to know them as well as John Berard. Wandering the island with him is like being introduced to his extended family..

JOHN BERARD This is her son who is an adult

ALAN ALDA (NARRATION) ...And some of its squabbles.

ALAN ALDA What do you think happened?

JOHN BERARD Yeah, what happened here was... that a male went after the infant. And then the mother of the infant came by and scooped up her infant and then turned and screamed at the male.

ALAN ALDA (NARRATION) Who bosses whom is built into monkey society. Females inherit their rank from mom and keep it all their lives. This imperious blond monkey is group's dominant female. And this is the dominant male, scattering all before him. While the monkeys live freely here, they get some help from those who watch them. This feeding corral provides much of their food, and is a good place to see the dominance heirachy in action.

ALAN ALDA What's most of their fighting about?

JOHN BERARD Most of their fighting actually is just little family spats.

ALAN ALDA Like what? It's your turn to do the dishes..

JOHN BERARD Often its hard to tell..

ALAN ALDA What would it be? Food?

JOHN BERARD No, its simply...your in my spot.

ALAN ALDA Your in my spot? That's what they fight about? They have this whole island?

ALAN ALDA (NARRATION) Unlike females, most males leave home at puberty. When they join a new group, they enter at the bottom of the social ladder. It's humiliating and stressful, and John Berard's research has been aimed at finding out why they do it. This young female is the key to the answer. Followed by her

baby, she leaves the feeding corral - and is in turn followed by a high-ranking male. Most previous research on monkeys would suggest he is the most likely to mate with her. But tagging along is a low-ranking newcomer to the group. And now an elaborate game begins. The female is in control here, sitting between the high ranking male on the left and the newcomer on the right. The dominant male stays close, but the newcomer strolls away - and the female follows. The young male has found a secluded spot in the bushes. As the female heads toward him, the older male spots her and chases her away. But it was clearly a risk she was more than willing to take.

ALAN ALDA Now what is this attraction to the new guy in the group. I mean it sounds like all those Hollywood movies, where the young guy comes in on a motorcycle and he is new to town and all the women say wow ....what is that?

JOHN BERARD I think its the motorcycle thing. They use to have motorcycles back here in the 40's. But then they got rid of them.

ALAN ALDA Little monkey motorcycles... What do you think is the attraction?

JOHN BERARD Its just novelty. I think .. it just pretty obvious that they like new males. And we have been watching females in this one group now for six years. And every year its the same thing, its the new guys. Its forget about the guys that they mated with last year. Forget about the guys who are long term residents. It's just the novelty aspect..

ALAN ALDA (NARRATION) Back in the bushes, the novelty of the outsider proves irresistible. Until again, the dominant male interrupts - and again vents his anger against the female. John's research suggests a male's high rank doesn't cut much ice with the group's females. In fact, it may act against him.

ALAN ALDA Do monkeys develop a long term sexual relationship here on this island?

JOHN BERARD No typically what happens is that, males join groups and they are new to the group. And females go out of the way to mate with the new guys in the group. So they mate the first year in the group. Then they become friends after that. Once they become friends rhesus females don't mate with their friends.

ALAN ALDA The mating stops after the friendship starts?

JOHN BERARD So it is like sex first, then friendship, then that's it.

ALAN ALDA And they never rekindle the old flame?

JOHN BERARD Once it's out, it's out , yes.

ALAN ALDA (NARRATION) What John wants to know now is, who is fathering most of the offspring? The outsiders or the insiders? There's only one way to find out - an island wide program of paternity testing. The researchers are capturing the monkeys one by one for blood testing. It's a tense time for people and monkeys alike. John frees most of the monkeys - and the mother and baby he's after obligingly run into a cage. Mother and baby are lightly anesthetized so that blood samples can be easily taken. Both will wake up in an hour or so and be released. The results of the DNA fingerprints confirm what John suspected. The newcomers to the group, despite their lowly social status, are siring as many offspring as the dominant males. So the island's babies have many different fathers - and therefore many different genes - thanks to the females' taste for novelty.

ALAN ALDA What do you suppose is the evolutionary advantage to having novelty being exciting? I mean I presume that's... somewhere in there is why novelty is a factor in this. How does it work?

JOHN BERARD The kids are being sired by different males every year. And that must be adaptive in some way to rhesus macaques. Rhesus live in a variety of habitats. They live from Pakistan to China. From sea level to high in the mountains. So in order to adapt to that many different kinds of environments, perhaps its very important to have a genetically diverse stock.

ALAN ALDA (NARRATION) There's one more surprise from John's research - another reason high social rank, for males, can be a curse rather than a blessing. The sons of high ranking females inherit their mom's rank, and are treated like princes by everyone in the group. They don't even have to fight their own battles. No sooner has this high-born son picked a quarrel, than a female from the group rushes in to finish it. When these privileged males finally do leave home, they have a much harder time of it than more lowly monkeys. They are the victims of much more aggression... And many never do successfully enter a new group, living out their lives as solitary hermits on the fringes of monkey society.

ALAN ALDA It kind of sounds like familiar behavior. The privileged kid who can't necessarily take care of himself while he is on his own.

JOHN BERARD They don't know how to buy corn flakes or anything. They always had it provided for them. So they go to supermarket and they can't choose what to buy.

ALAN ALDA (NARRATION) We began our exploration of the primate world by asking how much of our non-human cousins is in us , and how much of us is in

them. What we've found can lead to a new appreciation of both them and us: Of the things we share through our common evolutionary origins; and of the things that make each primate species unique since we've gone our separate ways.

ALAN ALDA It's very easy to talk about these animals as if they are human. A lot of their behavior seems like what we do. So you think that their thinking process must like ours, but maybe it is? How much is it?

JOHN BERARD Again, you always have to be careful. The questions you're asking me is what's going on their minds. The real answer is we really don't know. All I know is what they are doing. And its obviously they are doing these things and its obvious these rules exist in the laws because all the males and all the females do the same sort of thing. They do it in their own style but its how they do it...

ALAN ALDA (NARRATION) And after an hour of monkey watching, I began to wonder just who was watching whom.

ALAN ALDA This guy is jumping around through the trees, he has his eye on me.

JOHN BERARD That's because you are the new guy here. She knows that.

ALAN ALDA And she is doing this lip smacking thing at me. What does that mean?

JOHN BERARD That's simply a sign of assurance. It's neither aggressive nor submissive. It's simply that she wants to get friendly.

ALAN ALDA She's not blowing me kisses?

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