SCIENTIFIC AMERICAN FRONTIERS PROGRAM #1504 "Chimp Minds"

AIRDATE: February 9, 2005

CHIMP MINDS

ALAN ALDA Hello and welcome to Scientific American Frontiers. I'm Alan Alda. Tonight we're going to be visiting relatives, spending time with an engaging if unruly bunch of cousins that we formally broke up with about 6 or 7 million years ago. I'm talking about chimpanzees of course, with whom we share almost all of our genes but not a lot of our lifestyle. Which raises a fascinating question. If we're so much alike under the skin, what makes us so different? Or put it another way: how much of what we fondly imagine to be uniquely human, isn't? To find out, we're checking in with a bunch of youngsters who are learning to fish… for ketchup. We ask if chimpanzees raised by humans think more like humans… And we wonder if a chimp finds it odd to use a bird as a screwdriver. That's all coming up in tonight's episode, Chimp Minds.

TERMITE FISHING

ALAN ALDA (NARRATION) It's 9:30 in the morning and time for Hank to lead the way into his handsome new domain at the Lincoln Park Zoo in Chicago. All seven chimpanzees — including three youngsters — have only recently come here from their previous home in Florida. There's plenty for them to do in their new environment, which has both indoor and outdoor space. But after a leisurely stroll to pick up the apples and carrots just tossed here by the keepers, several of the chimps head over to one corner, where there's a realistic-looking termite mound. In the wild, chimpanzees often fish in mounds like this with sticks, hoping to snare a tasty termite snack; and fishing in the holes in the artificial mound has quickly become a popular sport with the Lincoln Park chimps — unless they're distracted by early morning visitors.

ELIZABETH LONSDORF So you can see that from this side the holes are not obvious where they are. It looks very much like a natural termite mound. So initially when they were learning this, they had to figure out which of these depressions were actually holes.

ALAN ALDA (NARRATION) Elizabeth Lonsdorf has spent many hours watching chimpanzees fishing for termites, mostly in the place the phenomenon was first recorded — by Jane Goodall some 40 years ago. Goodall's now legendary

observations of chimpanzee behavior at Gombe National Park in Tanzania had not gotten off to a good beginning. The chimps were proving elusive.

JANE GOODALL I couldn't get near them until one never-to-be-forgotten day I was walking through long wet grass after a very frustrating morning, and through the vegetation I saw this dark shape squatting on this golden-colored termite mound, peering and peering. And I saw… he had his back to me, he was picking pieces of grass and clearly poking them at the termite mound, I just couldn't quite see and I didn't dare move, and he's obviously picking something off. And I saw him reach out and pick a twig and strip the leaves, and that's so exciting because we used to think we were the only creatures on the planet who used and made tools.

ALAN ALDA (NARRATION) Since Jane Goodall first noticed chimps fishing for termites, they've been seen using tools for other things — cracking open nuts, for example. What's more, different communities of chimps use different tools for different purposes — so while one group hammers at nuts to crack them, another doesn't. Some groups fish in termite mounds, while chimps in other communities ignore them. So chimps not only use tools like humans, they also — like humans — have behavioral traditions, passed down from generation to generation. By 1998, when Elizabeth Lonsdorf first went to Africa to study chimpanzees, this notion that they have behavioral traditions akin to human cultures had become widely accepted.

ELIZABETH LONSDORF So that in itself fascinated me and I said, OK, I want to do something about that. And where that led me was really to try to understand how these cultures are maintained in a community, how they are passed on.

ALAN ALDA (NARRATION) Elizabeth began what was to become a three-year study of a group of chimpanzees in Gombe, including a pair of infant twins as they learned termite fishing from their mother.

ELIZABETH LONSDORF This is their mother Gremlin. And you can see a little white tail tuft there? That's a chimp behind. So there's two babies on her belly that are just nursing, this is their first real interaction with tool and the mound. And they kind of just reach out if the tool's in front of them.

ALAN ALDA I see her hand grabbing on.

ELIZABETH LONSDORF Yeah, reaching to mom's mouth, those type of things, actually at this stage they could actually be bit by a termite, and if mom drops one on their head, they'll get bit by a termite. This is the twins the following year, and you can see they're off their mother's belly, they're much more alert, and this is when they really begin to bug her and they're really intent on learning this. And

notice, it's important that she is not teaching them, she's not helping out in any way, she's actually annoyed that there's a little critter on her head. And the youngster's stealing termites off of her arm kind of getting in the way, watching very closely. So I think most things about this are learned in some way.

ALAN ALDA (NARRATION) Learned — but not taught. Through all her hours of watching youngsters picking up the art of termite fishing, Elizabeth never once saw the mom's do any actual teaching — an important difference from most human cultures, which invest a lot of effort in passing on learned skills from one generation to the next.

ELIZABETH LONSDORF This is the twins with their older sister and you can see they're really starting to but her now and really intent on learning this skill

ALAN ALDA They're really watching carefully now.

ELIZABETH LONSDORF This is typical piece of social interaction you see on the termite mound in the wild and also here at our termite mound. There's lots of wrestling over tools and…

ALAN ALDA But she already knows that the stick is associated with eating the termites.

ELIZABETH LONSDORF She may. She may also just think, my sister has something cool she's playing with. But here it looks like she knows that that stick is important for some reason to get inside of the mound.

ALAN ALDA (NARRATION) The most striking of Elizabeth's observations was that males learned very differently from females.

ELIZABETH LONSDORF Here's a nice example of a male. He kind of fusses with the mound, he's interested, but then he kind of much rather go off and play. He's going to bug other individuals, he's stomping wanting to get into a play bout with somebody. He steals his mother's tool here, that's being pretty disruptive. And just to placate him, she'll tickle him a little bit, that's a tickle. She plays with him just enough to kind of get him to go away. But he's running around the mound wreaking havoc essentially.

ALAN ALDA (NARRATION) It was a whole year later before this young male, called Fudge, finally decided to settle down and focus.

ELIZABETH LONSDORF Now, he's almost three and a half, is when he's being as attentive as the twins were at one and a half. So that's the sex difference. Girls are really paying attention really early on, boys not until two years later.

ALAN ALDA (NARRATION) This is another three and a half year old male, Samson.

ELIZABETH LONSDORF He's trying to make a tool, this is the first time I saw him trying to make a tool. And he's kind of doing it OK, he makes something very short. But then he swipes the surface of the mound. So he's gotten that he needs the mound, he needs a tool, he hasn't gotten the hole part yet.

ALAN ALDA He doesn't know about the hole. Just brushes it across.

ELIZABETH LONSDORF Yeah, just brushes it across and magically expects termites to appear, and they don't, and he gives up.

ALAN ALDA (NARRATION) And this is Titan, another male, who finally gets it at age five and a half.

ELIZABETH LONSDORF And you can see he's fishing quite successfully. Important to note — he's five and a half. Females can do this at three and a half. So that's kind of one of the main conclusions we have from our study: females learn in up to two years earlier; once they learn it they're actually better at it. We measured the number of termites that they got out per dip. So females were getting more termites out per dip. And then also the females tended to mimic their mother's technique. Males completely did their own thing and they all preferred short tools. Short tools are easier to get in because, you know, you have to progressively thread it down there; they're also though, less successful at it. You get less termites out and you have a higher failure rate if you have a shorter tool.

ALAN ALDA What, males are just inherently dumber, I just don't get that.

ELIZABETH LONSDORF I think it's just a path of least resistance.

ALAN ALDA (NARRATION) Exploring this male-female difference was one reason Elizabeth now watches the Lincoln Park Zoo chimps from both outside and inside their termite mound — which doesn't actually contain termites at all, but tubes of mustard or ketchup — low calories treats that are easier for the keepers to handle than termites. The mound is baited every other day and at random times, so the chimps aren't ever quite sure if it's worth a visit or not — unless they hear the keepers underneath.

ELIZABETH LONSDORF So they just baited it. And you can see Chuckie, our young female here is the one going to the top. She's one of the better termite fishers. She's got a nice, pretty nice tool there. There she goes. She's testing — I

don't think that one's full yet, the keepers are underneath right now. There she goes. See?

ALAN ALDA Yeah, she got some.

ELIZABETH LONSDORF So, in between, when she walked away a little bit there, the keeper got that tube on.

ALAN ALDA (NARRATION) The mound was first baited about two months ago.

ELIZABETH LONSDORF When we first baited the termite mound the very first day, one of the young males was the first to kind of realize that there was food in there. He walked by the mound and kind of attended to it and sniffed and he could smell something different. The he walked right up to the mound, put his nose in a hole, sniffed, you know, big sniff, OK there's something in there. Then he stuck his tongue down the hole. Then he tried actually to bite the mound itself like the mound might all of a sudden be made out of cotton candy or something. And then he did get a small tool made out of hay here, or a small twig, and dropped it, and tried to put it in but he dropped it, he lost it.

ALAN ALDA (NARRATION) Today, that same young male, Optimus, still seems not to have quite figured out the appropriate size for a tool — and soon reacts in characteristically male fashion. Meanwhile Chuckie, the young female, puts on a virtuoso display.

ELIZABETH LONSDORF Now this is an individual who often gets forced off the mound when she's being really successful and also the chimps will often take her tools. She tends to make really good tools, the other chimps will take them. And she kind of throws up her hands and goes and gets something else. She's a little girl — there's nothing she can do about it. It's the difference in their kind of skill level that's interesting. As you can see, our alpha male is nowhere near the mound, he's over there.

ALAN ALDA Now what is that, he doesn't like to associate with the girls or what is it?

ELIZABETH LONSDORF No, I just think he's not interested in doing a task that's really hard to get a treat. He would rather just hang out.

ALAN ALDA (NARRATION) Now, it's time to do a little repairing of the male ego. Male chimpanzees may have very good reasons in the wild for their poor study habits and clumsy fishing skills — and that's because while the female chimpanzees are quietly fishing for termites, male chimps are often off noisily hunting for monkeys. Monkey meat is an important protein source for males,

which they don't share with the females. So for a young male, rough and tumble play is more important than practicing his fine motor skills… while for a female, extra protein comes from a deft touch while termite fishing. Back at our ketchup mound, almost everyone except the alpha male is settled in, even including Optimus, who finally has a tool that works… only to have it promptly stolen.

ELIZABETH LONSDORF The individual that just took his tool is Cashew, who's an adult female and her son is next to her, swiping her ketchup from her. So he is not yet really into fishing on his own, he would rather mom do the work and he would rather steal. But notice, she is not offering it to him, she doesn't, you know, really seem to want him to have it, but he's just in a good place to get it from her. Behind them on the mound is Nana, she doesn't have any children on this mound, she's a young female, she doesn't have kids yet, she's quite a good termite fisher, she does it very often and she was the one that first after we baited was the first to get food out.

ALAN ALDA (NARRATION) So it was Nana who was the founding genius of the Lincoln Park cultural tradition of mustard-and-ketchup fishing She also has a liking for Chuckie's tools… Since Nana's breakthrough discovery all the females have become accomplished fishers. And Chuckie, as she always does, patiently sets about making a new tool.

ELIZABETH LONSDORF What she might do is break off that nice thin piece which is a perfect tool. Instead of those big, strong branches, she pulled off a really thin piece, that's a perfect tool for this behavior.

ALAN ALDA (NARRATION) But while Kipper goes on swiping ketchup from his mother, the ever-resourceful Chuckie has already decided she needs a new supply of tools — perhaps to insure against future thefts.

ELIZABETH LONSDORF Oh, she's got a bunch of them. She has a couple of options now. So you can see a lot of opportunity or learning all around the mound. They can watch or steal from another individual, like Kipper is there with his mom, can do a lot of testing out of different tools. And you can see how teaching maybe isn't necessary. I mean maybe you pick up enough from watching it's really not worth the effort of doing any active demonstration.

ALAN ALDA (NARRATION) While watching her chimps in the wild, Elizabeth always wished she could see inside the termite mounds. Now she can — and she plans one day to make the tubes inside bend and twist like real termite holes to see how the chimps figure them out.

ELIZABETH LONSDORF One of the things we might do instead of making the tubes more difficult first is to make the substance they're getting out more difficult.

So imagine mealworms instead of ketchup. Imagine putting them in there. That's not going to be as easy as ketchup because they're going to get knocked off the tool, they're not going to stick as easily maybe. So that's what's so nice about this being so manipulable. We can actually manipulate the difficulty of the foodstuff as well as the tube.

ALAN ALDA Mealworms… I'm just so glad we split off from their ancestors.

ELIZABETH LONSDORF We just can't do termites…

ALAN ALDA (NARRATION) Elizabeth Lonsdorf has found intriguing parallels between how chimps and humans learn — with the boy-girl differences especially striking a chord in anyone who has raised the human kind. But the fact that chimps don't teach also highlights a crucial difference between us and them, and may be one of the reasons why human cultures are so dynamic, while among chimpanzees what you see is literally what you get.

ELIZABETH LONSDORF This aspect of studying chimpanzees interests me because I think it really brings apes and animal behavior alive for people, they realize that there's these fascinating differences, and they become more concerned. Well, what if these chimps that termite fish go away? Then we've lost that culture and it's gone. So it's a really nice way to draw conservation into studying animal behavior too, because as you lose communities, you lose some of these things that might be quite unique to that community.

ALAN ALDA (NARRATION) In the new primate center at the Lincoln Park Zoo, the termite mound is almost as strong a draw for the public as it is for the chimpanzees. ELIZABETH LONSDORF So, you want to try it?

ALAN ALDA Oh, I can't wait. I'm not going in there with them, am I? ELIZABETH LONSDORF No, no, no.

ALAN ALDA (NARRATION) Chuckie was the expert, so I'm copying her.

ELIZABETH LONSDORF It goes deeper.

ALAN ALDA It does?

ELIZABETH LONSDORF Yeah, that's one of the hard ones.

ALAN ALDA You mean, I might not actually be smarter than a chimp?

ELIZABETH LONSDORF They've had more practice.

ALAN ALDA Thanks for trying to make me feel better. Wait, maybe I have the wrong end.

ELIZABETH LONSDORF Maybe come at it from the front. There you go.

ALAN ALDA Oh wow.

ELIZABETH LONSDORF It's a hard one, kind of a down and up one.

ALAN ALDA Yeah, but I needed my mom to tell me how to do it.

CHIMP SEE, CHIMP DO

ALAN ALDA (NARRATION) The chimps we've seen so far were raised with little contact with humans. But the chimps at this chimpanzee sanctuary in Florida are different.

TINA OK Grub, Grubby…

ALAN ALDA (NARRATION) The six animals here made cute pets or performers as infants. Then they became big, strong, and unwanted. Around the nation there are now several sanctuaries like this, where discarded chimps can live the social and active lives their minds deserve. But their presence here provides an opportunity for a psychologist from Florida Atlantic University, David Bjorklund.

DAVID Bjorklund These chimpanzees in particular have a different rearing history than wild chimpanzees. One fascinating thing about them is from early on, the ones I'm working with anyway, have had significant human interaction. In many cases treated much like human children.

TINA OK, Grub, here you go. Here's the tool you're going to use, Grub.

ALAN ALDA (NARRATION) And like human children, they get plenty of toys to play with — though 9-year-old Grub seems a bit baffled by a stick and plastic washboard.

ASSISTANT Watch what I do. Doesn't that sound pretty? Okay…

ALAN ALDA (NARRATION) But then he's shown what they can do.

ASSISTANT Do it again. Watch…

ALAN ALDA (NARRATION) Grub is clearly fascinated — and after a wait of ten minutes to allow the demonstration to evaporate from his short-term memory, he's given the washboard again. And this time… Now comes the real test. Grub is given four new objects. First, the experimenters check to see if Grub may have come across things like this before. Well, he's interested — but doesn't seem to have any ideas about what they may be used for.

ASSISTANT Watch this…

ALAN ALDA (NARRATION) Grub is very attentive, as usual.

ASSISTANT Watching? Here we go…

ALAN ALDA (NARRATION) Ten minutes later, he's given back only the trowels. Right away he gets it.

DAVID Bjorklund He saw the cymbals and Now he's generalized it to the trowels. Very different shape, different handle. He's really very happy about it, too. We think that that shows he has not just learned a specific behavior, but he's generalized, he's learned a concept, he's generalized the concept.

ALAN ALDA (NARRATION) David Bjorklund believes that — at least in chimps raised in human society — this ability to generalize a concept suggests a more sophisticated way of learning than simply direct imitation. Bjorklund's team has also tested whether chimpanzees have a concept in their minds of how the world works — including the basic notion that inanimate things are fundamentally different from living — or once living — things. Here's a stuffed hawk being used as sandpaper — an animate object being used as an inanimate one. Will 4-year-old Noelle find this more intriguing — odder — than the plastic hammer? She's given a choice as to which to investigate further — and it's the hawk as sandpaper. Next up, a rock treated as a pet, versus a rock as a rock. Again, Noelle can choose which one she finds the more interesting. And sure enough, it's the rock as pet. So far, Noelle's choices could be explained if she just likes anything animate — either the object itself, or its treatment. But now for the first time she's facing some "animate-ness" on both sides -- blackbird-pet, versus blackbird-screwdriver.

DAVID Bjorklund Time.

ALAN ALDA (NARRATION) But she still gets it -- blackbird-screwdriver was the weird one. So far it's a solid worldview. Now comes the toughest challenge. Inanimate log, treated like animate pet… up against a powerful combination — animate duck, treated like an animate object. That's a kind of double dose of animate-ness.

ASSISTANT What were you doing in that bucket, you silly mallard?

ALAN ALDA (NARRATION) And it's too attractive for the young chimp. The pet log should have violated her expectations, as psychologists say, but she missed it.

DAVID Bjorklund But you did see earlier when there were the blackbirds - one being treated like a screwdriver, and one being treated like a pet, she went with the one being treated like a screwdriver. So there's a little bit of going-for-the-violation-of-the-expectation, Noelle. But when push comes to shove, is she has a choice between an animate object, no matter how it's treated she tends to go towards that.

ALAN ALDA (NARRATION) Human 3-year-olds also fail this test. But now let's see how 9-year-old Grub does, with the identical series of tests. First hawk-sandpaper… ...against hammer. No problem — but as with Noelle, this was the only animate element in the trial. Next, pet-rock against rock-rock.

DAVID Bjorklund Time.

ALAN ALDA (NARRATION) Again, no problem. But again this was the only choice with any animate element to it, in the way it was treated. Now, animate blackbird treated animately, against screwdriver-blackbird. It's a tougher choice, but like 3-year-old Noelle he still picks out the one that's peculiar.

ASSISTANT Go look.

ALAN ALDA (NARRATION) Finally the big test. The doubly-attractive mallard treated animately, against the log treated animately. This is the one Noelle failed.

ASSISTANT Look at you. How pretty you are.

ASSISTANT What a beautiful log you are.

ALAN ALDA (NARRATION) And unlike the younger Noelle, Grub gets it — as would a 9-year-old human. All the chimps we've seen in this show give us a fascinating glimpse into what human and chimp minds share — and into how, in the last 6 or 7 million years, they've grown apart.