ACQUISITION OF LANGUAGE

CHAPTER 1 -- Historical Origins of Human Discourse

The First Orators

Cast your mind back to a place where language, as we understand it, doesn't exist but where there are creatures that otherwise look and act very much like modern humans. Today, they might be mistaken for pigmies or bushmen of South Africa. Now imagine a scorching afternoon, towards the end of summer, perhaps 100,000 years ago. Scrub bushes and struggling trees dot a relatively sparse and dry highland. The people who live in this world can communicate, but probably have not yet "invented" complex syntax. That is to say the grammars in their communication are based on specific situations – mocking tones or a box upside the head might be in fun or vicious; the situation would indicate which.

Although their language is primitive, these people use well constructed stone tools, with hafted spears and axes. They are not master hunters, but they do ok; between hunting and scavenging they have maintained a protein rich diet for thousands of years, even in this harsh environment. For a million years their brains have been evolving at a rate unseen before in history. Now, imagine what a hunt might have been like . . . .

For several hours, a pack of hunters have been running down a wounded antelope. They have pursued the animal at a fast, marathon pace as the sun has ascended from scorching morning to blistering afternoon. The baked earth has been blasting more and more heat at them until, finally, four of them have collapsed into the shade of a spindly tree. But one of them has refused to stop. Because he is more athletic than the others, we will call him "Jock."

Jock keeps raving at his colleagues and motioning up the arroyo. He wants to overtake the antelope before predators do. He runs for a few steps and beckons the others to follow, then runs back and kicks at their feet. But they are simply too hot and too tired to be beckoned. All, that is but one. He has long been Jock's close ally, and despite his fatigue, he drags himself to his

feet. This is all Jock wants. His friend is the smart one of the group and an especially good tracker. Jock doesn't care much what the others do, he has "Tracker."

So Jock and Tracker, continue on at a mile-eating jog up the arroyo, leaving their tribesmen in the shade of the tree. In time, Jock and Tracker come to a division in the arroyo. One smaller branch goes to the left, and one continues in a relatively straight ahead. The floor of the arroyo is scoured down to bedrock and cobbles so the tracks of the antelope are invisible, but after a few moments, Tracker finds signs of the antelope's passage up the left-branching arroyo.

Returning to the entrance of the left arroyo, tracker reaches down to turn a cobble over, creating an artificial footprint, but then he thinks better of the act and, instead, turns a cobble over in the main arroyo.

Imagine the problem. If the pair proceed without indicating which way they go, the other clan members may well gone up the wrong branch. How could the pair, with extremely limited language skills and no literacy, have left a message? The answer, of course, is to create a clearly visible footprint going in the right direction. But on hard sandstone, they would be unable to create a real footprint. So tracker invents a physical metaphor, and the metaphor becomes a note, "we went this way," *and the note is a lie.*

Although they did not have what we would call a language with syntax, these animals were smart and inventive, and they have been able to communicate with each other for the entire history of this and most of the previous species in their evolutionary line. Moreover, primatologists have shown that chimpanzees cheat, steal, and lie to maintain their competitive edges. Since this is a common trait among chimpanzees and humans, we can, perhaps, reasonably speculate that this goes all the way back to our common ancestor; deception was probably as common a communications tool then, as it is today.

In the mean time, the clansmen have become nervous. They know if Jock and Tracker find the antelope before they arrive, Jock and Tracker might carry it back to the clan by a different route. If the clansmen are not there when the antelope is found, they will lose lots of face and power and will be left to beg for meat with the others who didn't come on the hunt. Worse, the

men who consistently arrive with the best meat end up with the best wives. So, tired as they are, after only a few moments rest the clansmen rush on up the arroyo after Jock and Tracker. The group, once again moving at a marathon pace, runs for another hour or so until they come to the overturned cobble – and based on its message, run on up the arroyo. It is perhaps half a mile before they come to a section of soft soil and realized they have been tricked. Doubling back amid angry shouts, they locate the correct arroyo and charge up it. Eventually they round a corner and come face to face with the trackers. Jock looking frustrated, motions for them to keep their heads down. Once they are all together, he points with a nod of his head for them to look up and over the edge of the arroyo. About fifty yards away their antelope, lays dead, surrounded by a score of jackals. While Jock sulks, the newcomers giggle their joy--one of them doing a kind of constrained dance that basically consists of jumping from foot to foot. They ran the antelope down. Twenty jackals had been too many for Jock and Tracker to intimidate, and a good thing, too . . . Otherwise, Jock and Tracker would already have taken the antelope and been on their way back home. Twenty jackals might be too many for Jock and Tracker, but the jackals are no match for six rock throwing men with heavy clubs and stone tipped spears – and, more importantly, everybody gets a share.

On cue, the men charge out of the arroyo, brandishing clubs and spears and large rocks picked up from the ground. They scream, shout, and wave their weapons threateningly, and throw cobbles at the retreating dogs. In moments the antelope is butchered and the humans gone, leaving behind only a bloody spot on the ground and twenty or so disappointed jackals.

A disclaimer of sorts

From the beginning of the hunt, complicated and comprehensive communication took place. Although these animals had no complex language, they were as human as we are and were exceptionally creative about getting around collaboration problems. Perhaps Tracker didn't have a rock to turn over; maybe he broke a twig or scratched a scar in the side of the arroyo with a spear. But in any case, people of the period will have created texts designed to transfer meaning to the others, who had no difficulty following their meanings – even if the meanings were false.

Skeptics might suggest that since this event is fictional, and since I was never there, we have no reason to believe the event ever occurred. In fact, we can know that events such as this occurred because this and similar events occur all the time, even today. At home I might leave an empty cat food can next to the trash rather than throw it away; a metaphor that becomes an object-based narrative saying "I fed the cats." My wife and I commonly use these object-based notes in our daily interactions. She might put a book on the driver's seat of my truck, "Please don't forget this, again."

In a similar vein, last year, a group of painters needed to protect their wet paint by keeping people from using a flight of stairs. They simply put a strip of 2-inch masking tape across the entrance of the stairs. The tape had no sign, but it didn't need one. It became a *metaphorical* barrier – the tape, itself, became a sign saying "do not enter." Humans regularly communicate at this level, and so do chimpanzees and the other great apes.

Ape Speak

The level of communication described above is only slightly more sophisticated than communication among the apes of Africa – especially the communication of the chimpanzee and the bonobo. Usually, communication among other animals is purely situational, a natural extension of nature, herself. In Mammalian Communication, Roger Peters describes the communication of wapiti and deer, "Like the message system of the wapiti, the message system of the mule deer is characterized by large numbers of message forms, but message types, 20, is not much larger than most of the other mammals already discussed."[1] The message systems all include physical characteristics or actions that can be inferred by others. Dog and wolf facial expressions send clear messages to other canines and humans, alike. To varying degrees all animals (at least all mammals) communicate. Apes, however, are much more imaginative and their language is much more sophisticated

An examination of the human protolanguage I discussed above shows that our closest cousins, the chimpanzees (pan Troglodyte) and bonobos (pan Paniscus) use

[1] Peters, R. Mammalian Communication: A Behavioral Analysis of Meaning. Monterey: Brooks/Cole Publishing Company, pg. 159.

similar processes for communicating among themselves. According to Frans de Waal, in Chimpanzee Politics: Power and Sex Among Apes[2] and in Bonobo: the Forgotten Ape[3] these apes have powerful communication and collaboration skills with an identifiable language (albeit a protolanguage) that has been mapped. Unlike our spoken language, filled with complicated syntax, ape language is natural and more situational. In this sense, chimpanzees and bonobos must understand much more about the circumstances surrounding the communication before understanding the communication. This language, although primitive, is still powerful enough to permit cooperation and/or political intrigue among imaginative individuals within a clan.

Frans de Waal has studied chimpanzees and bonobos his entire adult career. For about six years between 1975 and 1981, he studied a colony of chimpanzees at the Burgers Zoo in Arnhem (usually called "Arnhem Zoo"). The resultant book was titled Chimpanzee Politics: Power and Sex among Apes. Following that, he studied bonobos in captivity and in the wild, co-producing an extended profile of bonobos in a combination of exquisite photographs and detailed descriptions of bonobo society (in Bonobo: The Forgotten Ape). Over time, more and more primatologists have supported his work with similar findings. For example, in a major, scholarly text, Primate Cognition,[4] Tomasello and Call integrate many of de Waal's early studies into discussions of behaviorism applied to apes.

Communication and chimpanzee politics

In, Chimpanzee Politics, De Waal, tells of one case, in the Arnhem Zoo, where two chimpanzees broke off a long, dead branch from a tree and, while one secured it against a live tree the other climbed it (avoiding the electric fence designed to protect the tree from the chimps) into the awaiting fruits of their collaboration. Once in the tree, the chimp threw branches of leaves down to his collaborator and others from the colony. Chimpanzees and bonobos commonly enjoy the "aha" experience of invention and, given requirement and opportunity, often invent whatever tools they need. In one case, a

[2] De Waal, Frans. Chimpanzee Politics: power and sex among apes. Baltimore: Johns Hopkins University Press, 1997,
[3] De Waal, Frans. Bonobo: The Forgotten Ape. Berkeley: University of California Press, 2005.
[4] Tomasello, M. and J. Call. Primate Cognition. New York: Oxford University Press, 1997.

bonobo named Kanzi managed to use flaked stones as knives for cutting rope to a specific length. More interesting, however, when given stones of his own and a need for blades, Kanzi managed to manufacture them for himself.

The story of the chimpanzees bypassing the electrical fence describes a recurring event requiring planning, communication, and collaboration, and Kanzi's story demonstrates an ability to invent, but de Waal's Chimpanzee Politics is ultimately about far more complicated communication and cooperation. The book focuses on an ongoing political battle between three (eventually four) adult male chimpanzees. Through a period of years, friendships and alliances changed as the whole clan negotiated its way through the process. Power between the animals changed hands several times over the years until one of the males was finally murdered by two of the others. Just as human coups may simply be moments in continuing violence, the political turbulence among the chimpanzees did not die. A new "candidate" for power almost immediately joined the intrigue. Eventually, the females and subordinate males of the clan chose the chimpanzee they were prepared to support. After several months, one of the murderers (for reasons nobody was ever able to determine) raced into a moat and drowned himself. After that, the new leader of the clan rose to power with the full support of the clan, and a sort of pax troglodyta reigned.

The alternative "chimpanzee"

I have several times mentioned apes called bonobos without actually explaining what they are. A rare primate, the bonobo looks much like a chimpanzee, but also surprisingly human. Like the chimpanzee, they have dark skin (after infancy) and dark hair, but their features are in many respects more humanlike. They have smaller ears, rounder heads, slighter builds, thinner necks, with narrower shoulders, and perhaps a greater tendency toward bipedalism. They are sometimes called "pygmy chimpanzee," but in reality, they are barely smaller than their cousin. They only seem smaller, because their upper torsos are slighter. Interestingly, when they walk bipedally, they look especially human. In Our Inner Ape, Frans de Waal describes them as, "When standing or walking upright, the bonobo seems to straighten its back better than a chimp, giving

the bonobo an eerily humanlike posture." [5] Some researchers suggest that because the Bonobo has never faced pressure to change, it is very much like its (and our) original roots. Some (including Takayoshi Kano, among the best known researchers on bonobos in the wild) consider the bonobo much like the original bipedal human, and in that respect, a closer cousin than the chimpanzee.

"Why you little liar, you!"

Both bonobos and chimpanzees have been observed lying to (and otherwise deceiving) each other and us. In Bonobo: The Forgotten Ape, de Waal quotes Sue Savage-Rumbaugh describing a typical example of bonobo behavior like this:

> They will ask you to look at something else, or to fetch some juice. But the whole purpose is that they have seen that you left a door unlocked, or that you left something behind that they want. They will act as if they haven't noticed, but as soon as you turn your back, they will do the thing that they aren't allowed to do. This something we need to be constantly aware of.[6]

In his Book, Chimpanzee Politics, de Waal describes several examples of Chimpanzees misleading and even cheating each other.

> On another occasion [a chimpanzee named Luit] was making advances to a female while Nikkie, the alpha male, was lying in the grass about 50 meters away. When Nikkie looked up and got to his feet, Luit slowly shifted a few paces away from the female and sat down, once again with his back to Nikkie. Nikkie slowly moved towards Luit, picking up a heavy stone on his way. His hair was standing slightly on end. Now and then Luit looked round to watch Nikkie's progress and then he looked back at his own penis, which was gradually losing it erection. Only when his penis was no longer visible did Luit turn around and walk towards Nikkie. He briefly sniffed at the stone Nikkie was holding, then walked off leaving Nikkie with the female.[7]

[5] De Waal, F. Our Inner Ape. New York: Riverhead Books, 2005. pg. 8.
[6] Interview of Sue Savage-Rumgaugh in deWaal, F. and Lanting, F. Bonobo: the Forgotten Ape, pg. 39.
[7] De Waal, F. Chimpanzee Politics: Power and Sex among Apes, pg 37.

Numerous researchers have discussed observing chimpanzees and bonobos using sophisticated techniques for misleading each other. In addition to sharing the ability to understand and use a protolanguage chimps, bonobos, and humans share the capacity to lie, cheat, and steal to great effect.

"What a monster you are!"

Also, like humans, bonobos and chimpanzees have a powerful sense of outrage over the same kinds of issues we would consider moral truths, and they show a strong sense of empathy. In one case, an adult male in the group threw a tantrum and tossed an infant against a wall. The females immediately and violently attacked him in force. In a different scenario, de Waal describes two interactions that involve loyalty and disloyalty.[8]

> The rules are not always obeyed, and flagrant this of deviance may be punished. This happen once after Puist had supported Luit in chasing Nikkie. When Nickie later displayed at Puist she turned to Luit and held out her hand to him in search of support. Luit, however, did nothing to protect her against Nikkie's attack. Puist turned on Luit, barking furiously, chased him across the enclosure, and even hit him. If her fury was in fact the result of Luit's failure to help her after she had helped him, this would suggest that reciprocity among chimpanzees is governed by the same sense of moral righteousness and justice as it is among humans.

Chimpanzees will also often risk personal harm, coming between an infant and any potential danger. As I mentioned earlier, on one occasion, in the middle of a power struggle, two male chimpanzees collaborated to kill a third. According to de Waal, this was not well received by the females. DeWaal speculates that if female chimpanzees had been there, they would not have let it happen. The females, however, were in a different pen, although the killing occurred in their full view. De Waal describes the subsequent behavior of the females in Our Inner Ape.

> It was the first time in the zoo's history that none of the apes ate their breakfast. After Luit [the attacked chimpanzee] was carried off and the rest of the colony let outside—

[8] Ibid. pg.203.

> onto a two-acre island with grass and trees—the first thing that happened was an unusually fierce attack on Nikkie by a female named Puist.[9]

Nikkie is the chimpanzee believed to have done the bulk of physical damage to Luit. De Waal goes on to describe the relationship between Nikkie and Puist prior to the killing as a strong alliance, but in this case, "it seemed clear she was expressing her opinion about the deadly assault."

Chimpanzees in the wild behave somewhat differently. In, "Of Genes and Apes: Chimpanzee Social Organization and Reproduction,"[10] Anne Pusey describes strikingly different interactions. Rather than describing apes struggling for political power, she describes an environment were chimpanzees form loosely organized groups ranging from a few to well over a hundred individuals. During estrus, females range in an area of approximately 15 to 20 miles seeking out mating opportunities. Otherwise the females spend their time browsing within a smaller area. Males may form in groups of three or five and range in similarly large areas in search of females. According to Pusey:

> by ranging over wider areas than females, males increased the number of potentially receptive females they can contact. Yet, because the distances are so great, single males cannot maintain exclusive access to a number of females. Instead, several males travel together over a large area and cooperate with each other against other males to protect their access to the larger number of receptive females they engage.

In a sense, contemporary chimpanzees in an urban environment, behave very much as we do today. In the wild, they may give us a glimpse of how we might have behaved six million years ago. In the wild or in an urban environment, both the common chimpanzee and the bonobo share an ability for complex, protolinguistic communication and cooperation that is very much like ours.

Proto-lopithecus? The third chimpanzee and first bipedal ape

[9] De Waal, F. Our Inner Ape. New York: Riverhead Books, 2005. pg. 45.
[10] Pusey, A. E. ""Of Genes and Apes: Chimpanzee Social Organization and Reproduction," Tree of Origin, Frans de Waal, ed. Cambridge: Harvard University Press.

According to virtually all paleoanthropologists and geneticists, the first step toward humankind (taken somewhere between 6[11] and 7.5[12] million years ago) was a new bipedal branch of the chimpanzee tree. Much of the behavior of our ancestors that many million years ago still dominates our behavior. Anthropologists use a term, "universal human," to describe characteristics that can be found in all humans. We all generally smile, laugh, grimace, dance for joy, yelp in pain, shout or bark in anger, fight and then makeup, seek revenge for perceived misdeeds, sell sex for favors and to cement relationships, plot political coups, play make-believe, and generally behave similarly throughout all of humanity. But paleoanthropologists could easily use the term "universal chimpanzee" the same way, and all of the above descriptions apply to that universal chimpanzee.

In time, however, significant differences between us and chimpanzees have evolved. For example, we gossip. Usually, the word "gossip" is a pejorative, but in this case it is not. Humans discuss each other and plan far reaching and complex futures around those discussions. At some point in our evolution, after becoming bipedal apes, we evolved a variety of new abilities. Among other things, we learned to use complexities and variations in the syntaxes in our languages; we developed intellectual consciousness (and inner eye or perhaps an inner "I"), logical reasoning based on mathematical constructs, and the ability to sing (generate a virtually infinite combination of sound patterns). The first bipedal apes had no grasp for even simple, artificial, syntactical combinations. Nor could they sing. They were unable to apply linguistic structures because they were missing the parts of the brain that permits us to apply them. According to numerous paleoanthropologists they were also unable to make complex sounds because their larynx was positioned too high in their throats. For example, Richard Leakey describes early hominoid speech capabilities: "In humans, the structure is very different and is unique in the animal world. . . . The lower position of the larynx creates a much larger pharyngeal space above the vocal cords, allowing for a far greater

[11] Diamond, Jared. The Third Chimpanzee: The Evolution and Future of the Human Animal. "About The Book." New York: Harper Perennial, 1993, p. 6.
[12] Leakey, Richard and Roger Lewin. Origins Reconsidered: In Search of What Makes Us Human. New York: Anchor Books, 1993, P. 94.

range of sound modification."[13] In short, the bipedal apes were physically unable to form the words we use, and they lacked the components in their brains to form syntax. In terms of appearance, they may have looked very much like a contemporary bonobo, prehensile toes and all. Despite being bipedal, the first hominoids in our line were much more chimp-like than human-like.

The first step was no doubt one that occurs among chimpanzees even today. Oliver the Chimpanzee is a bipedal chimpanzee who currently lives in a nature park in San Antonio, Texas. He is so human-like that for decades, many were concerned that Oliver was an "abomination" – a chimp-human hybrid. In 1997, he was tested genetically, and determined to be a full-blooded chimpanzee. According to the Houston Chronicle, "testing, completed amid little hoopla last fall, found no evidence of human chromosomes in the chimp's blood. But [the] research leaves unexplained Oliver's unchimplike peculiarities and mannerisms -- such as walking on two feet --which continue to generate heated debate among a small group of Oliver aficionados."[14] If we accept that there may be a range in chimpanzees and bonobos between almost continuous knuckle-walking and almost continuous upright-walking, then it follows that chimpanzees and bonobos must produce bipedal chimps from time to time. That makes it easy to imagine a clan of proto-human/chimpanzees with a bipedal gene that occasionally manifested itself as a largely bipedal chimp. Historically (and genetically), this predilection could be very useful if the conditions became just so – and they became just so.

Power of climate change in Africa

Geologists who have studied the upheavals Africa has suffered over the past millions of years can point to an event that would have made bipedalism valuable. Perhaps eleven or twelve million years ago the Great Rift of eastern Africa began to grow. As Africa and India, traveling at the insane speed of perhaps 11 millimeters per year, slammed into the not-so-soft underbelly of Asia, the earth crumpled and twisted. Mountains grew and rifts formed. The Great Rift was a part of that. Volcanoes erupted

[13] Ibid 261
[14] Herrick, T. "Chimp Seems Unique, but Not a Missing Link." Houston Chronical (San Antonio Bureau), January 10, 1997.

and mountains rose, changing a wet climate to dry, while the rift sank and expanded, filling with huge lakes, even larger wetlands, and a river.

On the east side of the rift, in an area that is now Ethiopia, dense forests eventually died out, replaced by alternating woods and savannahs. Pressure from the change became so great that all of the apes and monkeys east of the rift went extinct – all of them, that is, except for a small bipedal ape. This little ape may have still largely lived in the trees but could cross grasslands efficiently while watching for predators. There is genetic evidence supporting a thesis that early on, the clans may have included a mix of knuckle-walkers and bipedal apes. But the genetic propensity for upright-walking is more useful in a grassland, so knuckle-walking eventually died out in this or subsequent species.

Richard Leakey suggests that the process did not happen immediately. "The evolutionary shift from quadrupedalism to bipedalism would have required extensive remodeling of the ape's bone and muscle architecture and of the overall proportion in the lower half of the body."[15] Leakey argues, "That this transformation occurred at all indicates to me two things: first, the pressure for change through natural selection was keen, and second, the transformation itself was, on evolutionary time scale, rapid."[16] On the other hand, Oliver, the bipedal chimpanzee, occurred in a single generation. Moreover, de Waal says, "Bonobos are excellent bipeds. True to some theories on the origins of the human upright posture, they often walk on two legs carrying food."[17] So it is reasonable to assume, that the genes that privilege bipedalism have existed in chimpanzees and bonobos all along. Combine this evidence to Leakey's argument that the evolution occurred very quickly on a evolutionary time scale and one has a sense of the possible range of evolutionary time required for this first step towards human-hood. At the time Leakey suggested these changes, he suggested that the apes were forced out of dense forests onto a savannah-like environment with scattered woods. Traveling from wood to wood for food and shelter would make bipedalism a natural evolutionary advantage.

[15] Leakey, R. Origins Reconsidered, 83.
[16] Ibid, 84
[17] De Waal, F and Frans Letting. Bonobos: The Forgotten Ape. P. 53.

Humans walk away -- Ardipithecus ramidus and Australopithecus anamensis

Discovered in the Middle Awash region of Ethiopia in 1994 by Tim White and his two colleagues, Gen Suwa and Berhane Asfaw, Ardipithecus ramidus represents the oldest known hominid fossils found. Initially, the finds included only a few teeth and bone fragments. Because the teeth were so humanlike, the fossils were named "Australopithecus ramidus," but more complete skeletons found later indicated that the animal had limited bipedalism and significant ape-like features, and so Tim White (who found a number of additional fossils from this species) and Gen Suwa renamed the species "Ardipithecus ramidus." Despite its ape-like features, it is considered by many to be the first hominoid step away from the chimpanzees. This may or may not be the "missing link," but it or something like it stepped out of the chimpanzee tree some six or seven million years ago. This is what it might have been like at that time.

Imagine a clan of two dozen dark and hairy animals that look for all the world like chimpanzees crossing a mile or two of grassland between two woods. The males are about 15% larger than the females. They all have the same hair, same brow ridge, lack of chin, long arms, prehensile feet. . . . Some of the chimps are upright-walking, though perhaps they drop to their knuckles from time to time. Most of the other chimps are still largely fulltime knuckle-walkers. Because he is taller and walking upright (head above the grass), one of the bipedal males sees the grass ripple in the distance and recognizes a big cat moving in the general direction of the clan. Based on the warning of the biped, the chimps escape to the nearest trees.

Suppose, however, the warning came late. Suppose the cat is already stalking the chimps. Bipedal running can be slower than quadruped running but is more efficient over a distance, and the bipedal apes may have been able to run longer before exhaustion – particularly the younger ones. When the cat overtakes a pack of running chimpanzees it won't kill them all, it will just kill the one in the back of the pack.

Primatologists Kevin Hunt describes efficiency of cross country travel as follows:

> Knuckle walking not a long distance travel adaptation, and I think they grow fatigued much quicker than humans or baboons.[18]

[18] Private communication with Kevin Hunt..

The younger knuckle-walkers might have more consistently been in the back half of the running group when the predators overtook them. Despite the fact the bipedal apes may have been slower on the ground and less efficient in the trees, over time the genetic propensity for knuckle-walking could have been purged if the group were forced to spend much time out-of-reach of trees. To make matters worse for the knuckle walkers, the wetland/grassland/woodland evolved into a mix of scrublands, dry grasslands and high plateaus. In the end, it may have been an environment where only a bipedal apes could survive, and even then only if they could get very smart very quickly.

Disclaimer

There are a few holes in the above narrative that proto-humans and chimpanzees live together over time. We tend to be a xenophobic lot. It is possible that when clans saw that they had (deformed) bipeds, they expelled them, along, perhaps with their mothers. Upright-walking and knuckle-walking clans might not have been mixed. Another thing to consider is the differences in locomotion. Chimps move in a diagonal, crab like manner; humans move directly forward. Chimps face the ground; bipeds look straight ahead. It is possible that chimpanzees were less able to consider destinations than humans, once humans had seen their destination. I can't help but wonder how compatible bipeds and knuckle-walkers are on cross country trips. Humans may have developed a mental attitude about cross-country travel that was different from their more chimpanzee-like clansmen. So, while the clans might have been a mix of upright-walking and knuckle-walking, it is also possible to speculate that they were not. On the other hand, recent genetic studies indicate that hominoid and chimpanzee mixed genes for tens-of-thousands of years before finally parting. [need citation]

Lovejoy's theory

There is a different argument about the forces driving the evolution of bipedal apes presented by Owen Lovejoy. Lovejoy suggests that bipedal apes had an advantage because they move efficiently while carrying more once their hands were free. Following Lovejoy's model, we can imagine a clan of chimpanzees who might have to range over

large areas of limited food. The females of the group can't be constantly carrying their infants on extended excursions, so the males perhaps often go on food gathering excursions and leave the females to forage. Apart from being able to see farther and travel in greater safety, the bipedal males can also carry more back to their mates and offspring. Leakey submits a problem for the hypothesis, however. From the point of view of genetics, this assumes that the males could be certain that the offspring they were feeding were their own – meaning an unlikely, ongoing, relatively monogamous relationship. This is not chimp-like because among chimpanzees only the chief and his lieutenants get to mate with the females. It is not bonobo-like because bonobos are sexually promiscuous (everybody mates with almost everybody else), and it would be impossible to ever know if the offspring is from a specific male. It would seem there is nothing to be gained, genetically, by feeding a female and her offspring when she only mates with the big cheese or by feeding a female that mates with everybody. Still, there is another way to support Lovejoy's argument. Suppose the animal that got back soonest with the most food got the best sex. This is very much in keeping with the bonobo psychology. According to de Waal, bonobos connect sex with food.

> For my study, which began in 1983, I chose the San Diego Zoo. At the time, it housed the world's largest captive bonobo colony – 10 members divided into three groups. I spent entire days in front of the enclosure with a video camera, which was switched on at feeding time. As soon as a caretaker approached the enclosure with food, the males would develop erections. Even before the food was thrown into the area, the bonobos would be inviting each other for sex: males would invite females, and females would invite males and other females.[19] (85)

According to de Waal, female chimpanzees are promiscuous and are happy to have sex with various males when they could sneak away from the clan leader. Furthermore, they do exchange sex for favors and food.[20]

[19] De Waal, "Bonobo Sex and Society."
[20] De Waal, Frans. Chimpanzee Politics: power and sex among apes. Baltimore: Johns Hopkins University Press, 1997,

Suppose the proto-humans who came back with the most food got the most sexual favors. The upright walking chimp with the free hands could carry much more food over far longer distances and much faster – he would get more sexual opportunities and have more successes for his genes. Eventually, the male who consistently brought back the most food would have the most offspring, and maybe even become the "favorite" in a normally matriarchal bonobo environment. Then he could mate with any of the females he wished.

In either case (bonobo or chimpanzee scenario), the chimp who consistently came back with the most food might eventually key on a specific female and feed her and her offspring more often than not – creating the evolutionary propensity for monogamy (or polygamy), male female roles, a strong moral sense of sexual behavior, etc.

Back to Anne Pusey's scenario

Earlier I mentioned this scenario offered by Anne Pusey. In her scenario, male chimpanzees roam the forest in search of females in estrus. In this alternative narrative, it's possible that a bipedal ape or a group of bipedal apes could cover more ground and mate more often and more successfully than knuckle walking apes – even mating in regions generally controlled by competing groups.

Alternatively, bipedal apes may not only cover more ground, having access to more females, but the bipedal ape can carry more gifts in terms of fruit or meat. This, perhaps, makes some combination of Anne Pusey's and Lovejoy's scenarios viable. If the bipedal ape had more range and more gifts he would also have more opportunities to spread his genes. Conversely, the female bipedal ape in estrus could also cover much more ground in search of mating opportunities.

Another narrative

So, let us consider a different group and attempt to make sense of it when examining both the conditions of the time and universal chimpanzee behavior in the forests in light of the combined hypotheses of Pusey and Lovejoy and recent genetic studies.

In the foreground, a dozen, or so, chimpanzees surround a tree that should be filled with ripe fruit, but isn't. What little fruit there is has been picked over until only the greenest and most inedible remain, and a cloud of hunger hangs over the group. Food has been dwindling so that in no region is there enough to support the entire clan in the long term. Fruit and nuts ripen in increasingly remote places, and the tribe must resort to foods their ancestors would have overlooked. For thousands of years, the forests have retreated toward the rivers and wetlands. Along the edges of the forests that are left, grass has replaced much of the undergrowth that would have supplemented their diet a thousand years ago.

The chimps move along the edge of the forest, seeking out whatever opportunities are available. Most of the chimps shuffle along, crabwise, placing much of their weight on their knuckles as they walk. But a few of them seldom move onto their knuckles. Although they don't look particularly different from their brothers and sisters, they seldom walk like them. Among the knuckle walkers these bipeds pass unnoticed.

One of the bipeds sees vultures in the distance and recognizes the sign of a lion's kill. She hoots at the others and points with her arm at the distant opportunity. The chimps have mixed emotions about the distant kill. The food would be good, but it seems so far and it is out on the plain, away from the safety of the trees, and where there is a kill, there are predators. Some of the chimps fade back into the safety of the trees, while a mix of males and younger females begin the odyssey across the grass.

Although they began together, the knuckle walkers among the chimps have tended to meander as they moved toward the kill, while the bipeds have tended to focus on their destination and move more directly toward it. Now, we have two approximately equal but separate groups crossing a grassland. Within a few hundred yards of its destination, the first group has identified all of the players in this field.

A young wildebeest lays bloodied and dismembered under fighting and feeding vultures. In the distance a well-fed cat (ancestor of the puma and cheetah and looking a bit like each) dozes in the branches of a tree enjoying the shade and occasionally growling its discontent with the ruckus of the vultures. After only a few moments of sizing up the situation, the chimps charge the kill. They fend off the vultures as they grab the parts they can carry and run back toward the forest. The cat jumps to its feet growling in its outrage, but it is young and without a mate. Even one-on-one with a chimp, a fight might be a tossup, but against a pack of them, the cat wouldn't stand a chance. It knows better than attack a pack of chimpanzees in full bluff. Because the

prey is small and largely dismembered, the bipedal chimps have no difficulty carrying the animal as they run. On the way back, they run into their knuckle walking cousins. There is a great deal of outraged bluffing. The largest of the chimps beats on the ground and one of the bipeds with crashing blows. He jumps up and down on his poor victim, but in the end when the others stand their ground screaming their rage, he relents rather than face all of them. When the meat is shared with the pack (as it is always shared), it is once again the bipeds who share it. Sharing isn't as simple as passing out the bits of meat. In this case (in bonobo fashion), females and males alike, offer themselves sexually and as allies to the ones with the food.

Adding another possible environment to the narrative

Recently, fossils have been found that imply a somewhat different scenario. Science writer Ann Gibbons, points out that numbers of contemporary paleoanthropologists suggest that the model of dense forests becoming savannas or scrub (and so primitive man is forced out of the trees onto the grass) might be wrong. A new theory, suggests that the early fossils imply a bipedal ape living in or near wetlands much like the Okavango Delta. The suggestion is that thriving in a huge wetland would require significant upright walking, but the payback would be enormous. In an article about nutrition and human evolution, Stephen Cunnane suggests that a shore-based diet is especially rich in nutrients[21]. In Human Evolution,[22] Marc Verhagen and Pierre-Francois Puech suggest that it is unreasonable to believe that humans evolved in a savanna-like environment, in part because none of our physical characteristics match any of the other animals that evolved there. They suggest that early humans may have had a diet that included large numbers of mollusks. According to them, regularly breaking mollusk shells with local cobbles may have given them a predisposition toward tool making and use. Making a habit of carrying the cobbles and sticks with them might have provided them their first weapons.

[21] Cunnane, Stephen. (1999) "A Shore-Based Diet Rich in Energy and 'Brain-Specific' Nutrients Made Human Brain Evolution Possible." Proceedings of the Ghent Conference on Water and Human Evolution. Ghent University.

[22] Verhagen, Marc and Pierre-Francois Puech. (2000) "Hominoid Lifestyle and Diet Reconsidered: Paleo-Environmental and Comparative Data. Human Evolution. 15 pg. 151-162.

The apes of the wetland, would be most able to effectively hunt and browse if they largely walked upright. In such an environment the knuckle walker would be at an extreme disadvantage. Based on the fossil records that surround the finds, the oldest of all hominids found so far appears to have lived in such an environment. In fact, Verhagena and Puech point to descriptions of at least twenty-five of the most important hominoid fossil finds that imply living in an aquatic environment. A few decades ago the author Desmond Morris, suggested the earliest humans may have spent a great deal of time in water, in his book the naked ape. Morris's theory has never been well received by the paleoanthropology community. It might be one of the great ironies, his theory proved more true than researchers first imagined possible.

And so, in a final scenario, we can visualize a chimpanzee like creature spending much of its time up to its neck in water. The creature is adapting to a wetland that Ann Gibbons describes as follows:

> [F]rom the air, the 6000 square mile Okavango floodplains looked like a mat of grass and papyrus reeds interwoven with fresh water channels, lagoons, and wooded tropical islands sprouting palm, date, and fig trees. On the ground, the Delta was teeming with wildlife, including crocodiles, snakes, elephants, hippopotamuses, lions, cheetahs, leopards, and other modern counterparts of the animals Brunet and his colleagues had found in the ancient flood plains of the mega-lake Chad (237).

From the air the old lake Chad of six million years ago, would have looked the same, only much larger. In an environment where a increasingly dry climate is destroying the dense forests and converting the world to one impossible for ape habitation, a the forests in marsh sounds like a pretty good retreat for continued existence. This gives us one final scenario that might apply to the first bipedal ape.

In the foreground, a large tribe of chimpanzees wade in the murky waters of a river flowing through a mangrove swamp. The waters are filled with dangers, but the chimps have long known how to keep thickets of roots between themselves and the open waters (home to crocodiles) in the one direction and the grasslands (home to the big cats) in the other direction. The chimps walk upright wading among the roots, feeling for mussels, crayfish, and other tasty delights with their feet. From time to time, one pulls a mussel out of the water, transfers it to one hand and bashes it with a heavy stick or cobble

carried in the other. In the remote past, these chimps ancestors would have used a rock in much the same manner for breaking the hard shells of nuts. But these have learned the value of a big stick for other purposes.

Imagine a tribe of mixed chimpanzees living along the fringes of a marshy river. In one direction is the river and nearby marsh covering more than a thousand square miles. In the opposite direction is a sea of grass surrounding dispersed islands of woods. The chimpanzees enjoy opportunities in both environments. On the grasslands are opportunities for pillaging the kills of predators when the chimpanzees can get to them before the vultures and other scavengers. Getting to the kills takes speed and endurance. The kills are not typically convenient, requiring navigating distances in tall grass – farsightedness and focus on the destination is an advantage. It is also a dangerous game, so height is also an advantage for seeing lurking dangers.

Over a distance of 100 meters no human can outrun a knuckle walker. In sprints, it has a definite advantage, but over long distances, the bipedal ape shines. They would not have run marathons back then, but they may have had significantly more endurance than their knuckle walking cousins. And once they reached the kill site, they might easily scoop up the entire kill and quickly be running back for the safety of their forest – a significant advantage compared to knuckle walkers trying to drag a carcass off. For an animal that used endurance running as a tool, cooling is a premium. Less hair and more sweat glands would also be an advantage.

In the mean time, males and females also spend a great deal of time in the river and its backwaters searching for the tenderest roots and tubers in addition to crustaceans, mollusks, and slow moving fish. Again, upright walking is privileged, as is hairlessness. While they search for food, they carry rocks and (perhaps) heavy sticks with them. The rocks and clubs can be used as tools for acquiring food, and they can be used in self defense.

Chimpanzees cannot swim, so these chimpanzees probably stayed in the shallows, but if they tended to stay in marsh grasses and among the reeds, they may have been somewhat safer from predation from big cats and crocodiles alike. On the other hand, it may be that chimpanzees cannot swim because there is normally no good reason to learn. One might be forgiven for suspecting that bipedal apes might have a swimming advantage.

In none of the above scenarios is the knuckle walker equipped to survive over the long term. The knuckle walker would have been able to sprint to a tree and scramble up it much faster than a biped. On the other hand, if the chimpanzees are in the middle of a grassy marshland and a leopard elects to charge across the water, the one at the back of the group is most likely to be caught; the ability to climb a tree is not of value when running a long distance through water a foot deep – it seems that in such an environment, the more bipedal the better.

To what extent did these hominoids communicate?

"How," you might ask, "could we possibly know how these earliest hominoids communicated?" In fact, the task of determining the communication levels of these animals is not so difficult as it might seem. Chimpanzees, bonobos, and humans have all evolved a great deal and have significant differences. Even the chimpanzee and bonobo show marked differences on close inspection. Still, I have a couple of times mentioned a universal chimpanzee. If we look at all species of modern chimpanzees (including us), the characteristics we hold in common might be considered universal. While it is true that many traits can evolve independently, it is reasonable to argue that many of the things we share today may have existed in our ancestors. Conversely, it is unreasonable to assume we <u>all</u> evolved the same most common of these characteristics independently. For example, contemporary, urbain chimpanzees are ruled by a single male. To the extent they are ruled, bonobos are ruled by the females in the group. Humans are . . . well . . . who knows how we choose our rulers. Politically, the groups are very different. On the other hand, politics in all three groups (even in the wild) are fluid and constantly shifting, and the fluidity is often driven by evolution and devolution of alliances and conspiracies and not by the strongest body in the pack. Although neither chimpanzees nor bonobos have language with complex syntax, they (we all) nevertheless engage in ongoing (virtually nonstop) political intrigue. We all lie, cheat, and steal; we are all capable of sympathy; we all recognize ourselves in mirrors; we all enjoy the <u>aha</u> moment of invention or discovery, we form and reform alliances; we collaborate to conspire; we tickle each other; and we communicate many of the same thoughts using similar facial and body expressions (e.g., we extend our arms when begging, pout similarly, etc.). The

list of commonalities is extensive, too extensive to believe we evolved all of them independently. So, we can reasonably assume the first bipedal chimpanzees that stepped in our direction had pretty sophisticated communication skills, including many or all of those I listed above.

Similarly, these bipedal apes would probably have created tools. Among other things, the tools might have included sticks for extracting termites and ants, hammers and anvils made of cobbles for cracking nuts, tough shelled fruits, and shellfish, impromptu clubs for defense against attacking prey, plus rocks and other heavy objects for throwing or hammering. We can be confident our ancestors used these tools at the least, because humans, chimpanzees and bonobos use them every day. Moreover, they teach their children how to use the tools as well -- another commonality we share with the universal chimpanzee.

THE NEXT GENERATIONS

Australopithecus afarensis -- Lucy and her new daughter

In the mid-1970s, paleoanthropologists Donald Johansen and Tim White found what they believe to be the fossils of the earliest hominoid yet, and in 1978 they named the species "Astralopithecus afarensis" (Southern ape man from afar). When they made it, their claim that this was an early hominoid, ancestor of man, was met with a great deal of skepticism. But over time, the academic critics have largely succumbed to the evidence of numerous fossil finds that this is the first identifiable ancestor of humans that is not actually an ape. A number of the more spectacular finds include Lucy (Donald Johansen and Tom Grey, 1974) that proved these early hominids had legs and pelvises designed for bipedal walking, discovery of amazing footprints from these hominids (that proved they did walk bipedally), and more recently the discovery of "Lucy's child" (Zeresenay Alemseged, 2006) demonstrates that although hominids were bipedal, their brains were no larger than the chimpanzees' and their hyoid bone prevented the complicated sounds necessary for speech communication.

Maeve Leakey discovered somewhat younger fossils in 1995. Calling these fossils Australopithecus anamensis, they suggested they were the ancestors of Australopithecus afarensis.

According to paleoanthropologists the bipedal ape was probably the direct ancestor of both Australopithecus africanus and Australopithecus robustus. Although both africanus and robustus are only a step more human-like, and almost certainly had different lifestyles, they are both human, representing a visible branching of our tree of life. The famous "Lucy," oldest of all fossils found so far is Australopithecus africanus. According to paleoanthropologists, Australopithecus robustus had huge teeth that might have been designed for grinding vegetation. They also had barrel chests that may have topped a huge gut for digesting that vegetation. Australopithecus africanus appears to have had smaller teeth designed for chewing meat. In time (a couple million years, give or take) robustus died out. In the first pages, I describe conditions where an ape with a purely vegetative diet would be hard pressed to survive. These may have been the conditions robustus faced when he succumbed.

Descriptions of the evolution of man a relatively straightforward after this. Although there are a number of differences of opinion among paleoanthropologists, in general terms, evolution of humankind after Australopithecus Africanus, the path of human evolution seems straightforward.