

## **Anthropology 468: the Mind's Big Bang**

**[Narrator]:** Archaeologist Randy White is far beneath the hills of France, searching for a special moment in evolution. An era cloaked in mystery. When, with hardly a change in appearance, humans began behaving in ways they have never behaved before. He wants to find out how it was that our ancestors became truly human.

**[Randall White – New York University]:** It's down right scary to be in these cave environments. They're cold, dark, damp, frightening, dangerous places and you'll see people going a kilometer underground or two kilometers underground and you find traces of paintings and that sort of thing. There's something much more profound going on than just an interest in exploration. Perhaps this cave that we're exploring here opens onto our site, which could make, if there were any paintings in this cave, could make them the oldest cave painting on the planet.

**[Narrator]:** It's possible, Randy White could one day make a discovery as startling as that made in 1994 when others found under ground caverns adorned with over 300 images. Some painted 34,000 years ago, the oldest rock art known. But finding art is not the only goal. White wants to find something bigger; how the human mind was born. Where once people had looked at bare walls and had seen only walls, now others saw astounding possibilities. And with art came human technology, human communication, human culture. The question is, what happened to make all this possible? How could it be that a species opened its mind and burst into a new realm? How was it that human ancestors evolved a whole new way of seeing themselves and in time, transformed the planet?

### ***Evolution: The Mind's Big Bang***

The Great Rift Valley of East Africa. Here is where the human story began. For millions of years Africa was the landscape of human evolution. Across this terrain, an ancestral people survived, reproduced and passed on their traits from generation to generation. Without Africa humanity as we know it might never have evolved. This is an area that was once inhabited by hominids before they were truly human. Now it's a site scientists visit to understand how people lived and what they thought about over 1 million years ago. Soon after the rains each year, Rick Potts leads a team that scours these highlands, finding stone tools and fossils. Potts believes this place was once a tool-making factory.

**[Rick Potts – Smithsonian Institution]:** It takes really sharp eyes to find that first fragment of fossil or to find that sliver of stone tool that says, hominids were right here at this spot. And so I knew that we were very close to an ancient soil that was nearly 1 million years old that had previously produced lots of fossil bones and stone tools. It turned out to be a hand axe; one of those stone tools that our ancestors made for a long long time; hundreds of thousands of years. These hominids were bringing these rocks down from the highlands and they were chipping the edges or the tool around and they could even hold it in their hand like this and use it for digging or knocking off flakes that

they could use for butchering animals. In a sense this is the Swiss army knife of the Paleolithic.

**[Narrator]:** Here these Paleolithic or ancient stone tool people, made a variety of simple implements repeatedly for nearly a million years.

**[Rick Potts]:** Indeed their minds were oriented towards survival. They had the ability to make these tools which had some sophistication to them. But the fact that they kept making them means that they had kind of a mental template a regularity of thinking that kept producing these same things over and over again. Chances are they didn't speak to one another like we do and apparently they got along just fine with this single tool. So a million and a half years this was around which was an immense period of time an absurd period of time. When you think of today, computer programs don't last for longer than a couple of years before they're improved; before they diversify in some way and our technology in the same way; that's not the way of the technology of these ancient people a million years ago. They didn't have something that we have; the creativity the innovation the diversity of culture which of course characterizes our species.

**[Narrator]:** On the tree of life, human evolution began around 6 million years ago when hominids split off from the common ancestor they shared with chimpanzees. They descended from the trees about 4 million years ago and entered a new world. Two and half million years ago with a modified hand they fashioned stone tools and began to depend more and more on a diet of meat. The size of their brains increased dramatically. And about 2 million years ago some began leaving Africa. These early travelers were successful for awhile, but in the end they all became extinct. It wasn't until about 60,000 years ago that the first truly modern humans, our ancestors, began leaving Africa. They were hunter gatherers, foraging for food, living in small groups, roaming a wide landscape. But they were different from their predecessors; they had begun a revolutionary way of life. This lifestyle had emerged over millions of years through the multiple processes of evolution; mutation, selection, adaptation, competition, failure, punctuated by the occasional success. It was a story of evolution, of change over time; no different from the stories of so many other species, but in the end it produced results new to the planet.

**[Richard Klein – Stanford University]:** Behavior changed very radically at around 50,000 years ago. This is someone who lived in Israel; let's say roughly 100,000 years ago, this skull. Now you might say Israel, is that Africa? At the time in a sense it was. If you look at where Israel is today, Israel is on the very margin of Africa and there have been times in the past when Africa expanded a bit ecologically and Israel was effectively incorporated into Africa. This is someone who looks very much like us. And I think if this person were alive today, if we put the flesh back on and dressed this person properly we would not see any significant difference. Would not be somebody who would cause you to cross the street if you saw this person coming at you from the other direction.

**[Narrator]:** And yet this 100,000 human did not behave like us.

**[Richard Klein]:** And then here we have a fully modern person someone who lived in Africa within the last 40,000 years, basically the same kind of skull, truthfully the same kind of brain or same shape to the part of the skull that contains the brain but this was someone who behaved in a very different way than the prior person. This is someone who made a wider range of recognizable stone artifacts, made a lot of artifacts out of bone and ivory and shell, produced art. People like this would be recognizable, not only in terms of their appearance but in terms of their behavior as fully modern humans.

**[Steven Pinker – MIT]:** In a sense we're all Africans. If you took a bunch of human babies from anywhere around the world from Australia, New Guinea, Africa, Europe and scrambled the babies at birth and brought them up in any society. They'd all be able to learn the same languages, learn how to count, learn how to use computers learn how to make and use tools that suggests that distinctively human parts of our intelligence were in place before our ancestors split off into the different continents.

**[Narrator]:** After leaving Africa some 60,000 years ago, this fully modern species headed east into Asia and even to Australia. Others followed the coast of the Mediterranean north, dispersing into the hills and leaving behind evidence that their minds were unique. Here in Turkey Mary Steiner and Steve Cumin have been excavating a home that these early immigrants occupied. A cave called Ocasla (sp?); one of the earliest modern human living sites.

**[Steve Kuhn – University of Arizona]:** We're standing in the extreme back of a cave here and there's been a variety of activities that took place in this part of the site. At a somewhat higher level than what we're excavating, right here there was a structure a kind of wall of stones that delimited what we think was a bedding area. A little lower down what you see is this triangular shape which is basically a cone of debris which was a garbage dump; there's this white material which is ash and this sort of yellowish-ashy sediment and every one of these white specs is a bone or an artifact, this is just chock full of material it's a garbage dump. Now that may not seem very romantic but as an archaeologist it's a wonderful thing because garbage is full of evidence about how people lived, what they ate, what they did, how they made their tools.

**[Narrator]:** The team hoped they would unearth clues to the routine of life 40,000 years ago. They were in for a surprise.

**[Mary Steiner – University of Arizona]:** Very quickly after we began excavation here we realized that we had something truly extraordinary.

**[Steve Kuhn]:** As soon as we started digging into the sediments we started finding lots of ornaments; mostly shell beads but a variety of other kinds of things. They look like teeth when you first encounter them and my heart rate goes up and I think, "More human fossils!" Yep, it's got the little hole in it, it's definitely perforated.

**[Mary Steiner]:** Oh yeah. This one's in good condition too even some of the original color of the shell.

**[Steve Kuhn]:** It's tremendously exciting and sort of daunting because nobody had reported these before from this part of the world and you're first thought is what did I do wrong, you know.

**[Narrator]:** As they worked layers of sediment they began finding beads dated back 43,000 years. Making them the oldest beads found anywhere in the world.

**[Steve Kuhn]:** Now we have nearly 1,000 ornaments, mostly shell beads of a variety of species but also things like the claw of a large raptor or large predatory bird that's been notched to be suspended in a sort of necklace fashion.

**[Mary Steiner]:** They're always selecting the same species; this is an animal that's relatively rare on beaches but nonetheless does occur in the area. And uniformly people selected these you can see also that they've been artificially perforated by a person so in order that they can be suspended.

**[Steve Kuhn]:** For the first time in the upper Paleolithic people found in necessary in some areas to say things about themselves using durable material items.

**[Narrator]:** Durable items like beads are of no use for hunting, gathering or protections. They suggest that those who lived here had more on their minds than simple survival. So why were these beads so important and what can they tell us about the early days of modern humans? Beads and artifacts have been found along the routes our ancestors took. 43,000 years ago humans had spread north to Eastern Europe then they moved into the Russian plain and central Europe. By the time they settled in Western Europe, 38,000 years ago, they were not just making beads, they were mass producing them. In Southern France, Randy White has been scrutinizing these ancient beads. With powerful magnification he can tell just how they were made and he can reproduce prehistoric bead-making techniques

**[Randall White]:** If I were to give you a piece of soap stone or a piece of mammoth ivory and I were to ask you to put a hole in it, I know exactly how you'd do it, you'd drill a hole in it, you'd turn it to make a hole. But you know what that's part of our culture believe it or not, that's the way we've learned how to do things. Early modern human people had a completely different technique for making holes, they did it as I'm doing, they actually dug a hole into a piece of material at a very early stage of production. And it leaves some pretty ugly traces. But because the process is one by which you grind and you polish afterwards they were able to remove all of those ugly traces and to leave behind the tiniest of little openings. I've got a hole a very very very tiny little hole that I've opened up using a very very large point. It's actually a very emotional experience to be sitting here having finished a bead using exactly the same techniques that people did 35,000 years ago with exactly the same raw materials that people used 35,000 years ago, in exactly the same form in exactly the same place. We have from this rock shelter more than 1,000 beads like this. We know that someone who was mentally, emotionally very much like ourselves, sat somewhere in this vicinity 35,000 years ago and made exactly

what I've just made for you. People have tended to look at beads and suggest that people were just sort of playing around but in fact we know that here at Castanet, they were spending thousands of hours making beads when they could have been doing other things that we might think to be more productive.

**[Narrator]:** Beads are artifacts of the Mind's big bang; they are evidence of our creative and cultural beginnings recalling a time when bands of humans began interacting socially with one another.

**[Randall White]:** Expression in materials is really one of the hallmarks of the revolution if you will. This is something really new on the horizon; this is people creating social identities that don't exist in nature. This is saying I'm a Cro-Magnon woman, I have given birth, I have a particular history I have a particular status within my group and anyone who is a member of that group will be able to see that at a glance by the fact that she's wearing certain kinds of animal teeth, certain kinds of beads, her clothing is decorated in certain ways. It's a mode, a visual expression, but it's expressing social relationships and I think that's something clearly that's very new in human evolution.

**[Narrator]:** Humans using technology in the service of social identity; this was momentous. The birth of the human mind occurred in Africa and left its mark as far away as Australia. But the evidence is most abundant in Europe. It was here that these humans encountered another species of hominid. A species almost identical to them. But not quite. And it was this subtle difference that influenced who survived. We call these ancient Europeans Neanderthals. Compared to us they were massive.

**[Jean Jacques Hublin – University of Bordeaux I]:** Meeting face to face a Neanderthal would be quite an impressive experience. They had a very large body mass; some 200 pounds of muscle and bones for a male. The face is very projected forward in its middle part with almost no cheeks and a receding chin and forehead. And in the middle of this face was probably a huge and projecting nose.

**[Narrator]:** Neanderthals and humans were different in the ways they lived and most remarkably in the ways they died.

**[Jean Jacques Hublin]:** The burial of La Feresee (sp?) shows the body of a male Neanderthal laying on the side in a pit and that's all. And so far we have very few evidence of a Neanderthal burials with any kind of complex construction or organization. Neanderthals do not display many signs of symbolic life. In fact we don't know any kind of art or symbols or pictures used by Neanderthals.

**[Narrator]:** In contrast modern humans seem to have treated their dead with extreme care. In the permafrost of Russia, this man was found buried in clothing embroidered with thousands of delicately wrung beads. Does this suggest that modern humans considered life more precious? Could it be that even though human brains were about the same size as Neanderthals, they had dramatically different abilities? The evidence is controversial. So scientists like John Shay of the State University of New York are

reenacting the activities of both species to understand how their minds might have differed.

**[John Shea – State University of New York]:** The Neanderthal's points big and heavy and the nature of its heavy handle means that it could not have been thrown very far in fact it was probably not thrown at all, it was probably a stabbing weapon used as a modern bayonet. That means that in order to kill an animal the Neanderthals had to get up really close and stab this thing into a big creature putting their lives at risk.

**[Narrator]:** And if a Neanderthal spear ever was thrown, its range was limited.

**[John Shea]:** 23 meters thrown with a Neanderthal-type wooden spear. The modern human weapon on the other hand this piece of antler here; it's very narrow, cone-shaped like a bullet. It's attached to a very narrow handle and this suggests it was probably thrown from a great distance. Making the antler point takes hours and hours and hours; you have to soak the antler until it's just right and then carve it by abrading it against a piece of sandstone, something more or less like this. You know, it takes a tremendous amount of patience to impose will, impose design on this antler. It takes no great amount of time to impose one's will on stone, stone's a very easy material to shape. The Neanderthal point could have been made in a matter of minutes it's very very simple when you know how to chip stone correctly. Quick and dirty is the name of the game for Neanderthal technology. What I'm doing in teaching stone technology here, is I'm trying to recreate the evolutionary environment. (To others he is teaching in the group): This is probably the way modern humans transferred these skills, is an older individual sitting around with younger individuals, you can share information. Neanderthals we don't have any evidence of systematic teachings. It's probably something like they reinvented the wheel a lot, beyond 50,000 years back beyond in early antiquity it's the same thing, over and over and over again. That tells you there's not a lot of information being transferred, it's just imitation. But after 50,000 when the modern humans show up on the scene, every generation there's something new.

**[Narrator]:** Not simply to duplicate old technology but to build on the experience, knowledge and wisdom of elders. This for modern humans was a vital strategic advantage. Now technology would improve from one generation to the next. With this new invention, the spear thrower, a weapon could be launched even greater distances, reducing the hunter's risk.

**[John Shea]:** Neanderthals, 24 meters; 42 meters; advantage, modern humans.

**[Narrator]:** Improved technology suggests a great deal about humans' merging ability to transmit information over great distances across time.

**[Jean Jacques Hublin]:** These pictures are a way to communicate with someone else without this person being here. It can be at the far distance or it can be in the far future. And this is what apparently Neanderthals did not do.

**[Narrator]:** Fossils tell us Neanderthals lived in small, often isolated pockets largely cut off from other Neanderthals.

**[Jean Jacques Hublin]:** For some reason, when they could not survive longer in this spot, they would just move away. The picture we have of the upper Paleolithic modern humans in Europe is quite different.

**[Narrator]:** For modern humans, portable art may have served as a means of communication. Some of it traveling hundreds of miles from where it had been created.

**[Jean Jacques Hublin]:** It's very clear that these people were involved in a net of exchanges at long distances. They belonged to a big cultural entity and it's very likely that Neanderthals did not have this at all.

**[Narrator]:** Perhaps the most compelling evidence of early culture is concealed deep beneath the earth. While we might not know exactly why humans painted in these caves we now can guess how they painted. Archeologist Michel Lorblanchet has studied the techniques of cave art. He thinks some of the images were rendered by a process he calls spit painting.

**[Michel Lorblanchet – Centre Nat. de la Recherche Scientifique]:** Spit painting must have had very important symbolic significance.

**[Narrator]:** Through experimentation he has been able to reproduce the technique of early artists. By mixing pigment with saliva, he believes they achieved a bonding compound that lasted long after the creators were gone.

**[Michel Lorblanchet]:** It's not at all like painting on canvas it's quite different. The cave is full of natural shapes. The cave is extremely exceptional, it's beautiful.

**[Narrator]:** And what might renderings of wild goats and sheep painted in these eerie caverns tell us of the mind's big bang?

**[Michel Lorblanchet]:** It is the first manifestation of human imagination. Modern men tend to make their imprint on the landscape on the territory. So it's wise they penetrated in a deepest spot of the earth, it's like to express themselves to say we are the owner of the earth in some way and we have some a relationship, a personal relationship with the spirit living inside the earth.

**[Narrator]:** In other corners of these caves, Lorblanchet has found artifacts made of bone and a pattern of wear of the rock that lead him to speculate these cave explorers also made music.

**[Michel Lorblanchet]:** I have the feeling of being in a cathedral here, a big cathedral, an important cathedral.

**[Narrator]:** So below and above ground, our ancestors were refining technology and art and communicating in complex ways. It appears that these changes happened rapidly. How could it have happened?

**[Richard Klein]:** My own view is that there was a brain change, that there was a genetic change that promoted the fully modern human brain that allowed the kind of innovation and invention the ability to innovate and invent that is a characteristic in modern humans. If you accept the idea that there as a neurological change 50,000 years ago and that this was rooted in biology, it would just become the latest and most recent in a long series of mutations on which natural selection operated to produce the human species as we understand it today.

**[Steven Pinker]:** It's very likely the changes in the brain didn't happen over night. There wasn't one magical mutation that miraculously allowed us to speak and to walk upright and to cooperate with one another and figure out how the world works; evolution doesn't work that way. It would be staggeringly improbably for one mutation to do all of that. Chances are there were lots and lots of mutations over a span of tens maybe even hundreds of thousands of years that fine tuned and sculpted the brain to give it all the magnificent powers that it has today. The actual organization of behavior goes on at the level of the individual nerves cells and their connections. We have 100 billion nerve cells probably 100 trillion connections. It's just mind-boggling to think of all the different ways in which they're arranged. And a lot of our evolution consisted not just in getting more of this stuff but in wiring it in precise ways to support intelligence.

**[Narrator]:** So it may not have been the size of the human brain but its wiring that endowed us with new skills. According to Richard Wrangham, one of these skills was the knack for living a complex social life. Here in East Africa, chimpanzees show us how we might have interacting with others before the mind's big bang.

**[Richard Wrangham – Harvard University]:** Social climbing is the one thing that really makes a males world but they do it not in just a one to one way; they're very sensitive to the interactions among each other. So if I have a friend that I am trying to impress then maybe what I will do is attack the enemy of my friend. And the enemy of my friend might be doing something like grooming with one of his friends, so I may detect the relationships among other chimps and manipulate them to my own advantage. But what we share with the chimps is an ability to be very subtle in the way in which we can understand the meaning of an interaction that we see in terms of its threat to our own social standing. In humans, a little word to a father of a badly behaved adolescent and all of a sudden you can control their behavior. But no such thing happens with chimps, you have to actually exert physical force or threat of physical force.

**[Narrator]:** But after about 6 million years of separate evolution, humans acquired a significant social advantage.

**[Richard Wrangham]:** How much subtler, how much more satisfying if the counsel of elders can sit around the fire at night and say ‘you know, Joe there, he’s behaving really badly we’ve got to do something about him’, that’s what chimps can’t do.

**[Narrator]:** There’s much more chimpanzees cannot do. The University of St. Andrews in Scotland; here Andrew Whiten considers differences between chimp minds and human minds. With unlikely tools, he and others have identified another critical advantage and possible a key to the human mind’s stunning success; mind reading. Will this three year old be able to look at things through someone else’s point of view? Can she make inferences about others thoughts, can she spot deception. When Sally is away, deceitful Anne will now hide Sally’s marble. Through the age of 3, researchers have found that a child is unable to ascribe actions, motives and beliefs to others. But by the age of 5, the child’s brain has developed a capacity for stepping into someone else’s mind.

**[Andrew Whiten]:** It varies in different children, but generally the 4 year stage is thought of as a kind of watershed when that particular refined theory of mind ability emerges. So a 3 year old would typically have difficulty with it, a 5 year old has generally mastered it. And so far no chimpanzee has passed any test of the attribution of thoughts belief, a 5 year old child passes. I suppose the theory of mind you know, makes us as sublime as we are because we can feel for others so much perhaps you might say on the one hand, at the same time it allows us to be that much more sneaky than any other species on the planet. In societies of humans, being socially competent really counts. Being socially competent allows you ultimately to out compete others to gain better access to resources, the best mates and in those kind of societies it seems that the brain can be more important than brawn . So it’s potentially a powerful evolutionary force because it’s driving a kind of upward spiral. Social complexity begets greater social intelligence; social intelligence presents even greater problems to the individuals to the next generation and they have to be more socially complex.

**[Narrator]:** Complex social relationships, a theory of mind. These are the abilities we associate with modern humans. But how can we express any these abilities without language. With language we can recall the past, quantum future, teach children, tell secrets, manipulate crowds. But imagine a world without language. Nicaragua, Central America. Managua, here as in other places of the world there are those who hardly have any language at all. Maria Noname, Mary Noname, deaf since birth, she has been isolated all her life. Both from the people who could help her and from others with her disability. Her friend, linguist Judy Kegl, understands the depth of her isolation. The two can communicate just a little, using simple and primitive gestures.

**[Judy Kegl – University of Southern Maine]:** The first time I met her she was missing the ability to tell me who she was. She was missing the ability to tell me how old she was. She doesn’t know her name, in order to tell me who she was she had to take me home and show me the papers and pictures of her family. We had to share a context. She can tell me things, I can show you a bit, she can tell me what happened to her father.

*Judy gestures to Maria who makes gestures as though her father had died.*

I asked her about her father dying and she said three. Okay, what three meant was he was shot three times. I know this from working with the other deaf signer; she said he was shot in three places and that's how her father died right? Yeah. Right. And you know, but three is just not enough to give me access to the information I would have needed had I not had prior knowledge about that. What's she's saying is, "I had a daughter that went away and got married and that was it, she never came back. I had a son that went away and I never heard from him again you know that's it I'm alone. That's my life." She was language ready, the problem was she didn't get access to language within that critical period and that critical window for learning language in the way that we learned it is closed.

**[Narrator]:** This window for language remains open until we reach age 7, then is slowly closes as we advance towards puberty. Before the 1980s, many deaf Nicaraguans were like Mary Noname. They never encountered the window for language, because they never encountered others with their disability. But in 1980, after the Nicaraguan revolution, the new government tried to enhance deaf people's lives. It brought deaf village children into Managua to end their isolation. Here educators tried to teach them an existing sign language. The effort failed, the children showed little interest in learning a language forced upon them. Instead they began communicating with each other in their own way. Judy Kegl was summoned to the United States to sort out the problem

**[Judy Kegl]:** I came down thinking wherever there were deaf people, there was sign language and that obviously there would be a full-blown sign language in full swing here in Nicaragua. And this, I said 'well you know I can learn a bit of their sign language if that's what you want, and work with you on learning it'. And they said, 'no they don't have a sign language they have mimickas, they have mime gestures' and they pointed to a group of kids and said, 'we want to know what they're talking about'.

**[Narrator]:** It turned out that they were talking about a lot more than anyone dreamed possible. Kegl had arrived in Nicaragua shortly after the birth of a new language.

**[Judy Kegl]:** Language needs company, language needs a community, language needs some sort of a trigger and that trigger is; it's not so much that it needs a community in the sense that there have to be lots of people. But part of being a community is wanting to share information with each other.

**[Narrator]:** Might this moment resemble what happened around 50,000 years ago; the turning point that lead to the explosion of human creativity? Language does not need a voice, it is our legacy; an inevitability of being human. Today we still don't know exactly when language evolved; when it opened the door to our phenomenal success as a species. But language, every language depends on strict rules, all of them familiar. But many species can communicate, even vocalize. Only human languages are driven by complex rules. Every one of our world's 6,300 languages has them. We call them syntax. In her isolation, Mary Noname never encountered syntax but it is commonplace in the children's languages.

**[Judy Kegl]:** Syntax isn't the set of rules that you learned in your third grade grammar that you had to memorize so you spoke English the way you're supposed to. Syntax is or language, the constraints on language are something that all human beings share; they're the constraints that are imparted to us by the fact that we share a single human brain. They're not just the constraints but the ability to hierarchically organize information that allows us to construct novel sentences that have never been said before that allow us to tell a story that allow us to prophecy that allow us to lie. I can surely communicate for communication's sake when I can syntax then I can truly use a language.

**[Narrator]:** And those most gifted with the tools of language might have been the ones to prosper, according to Richard Dawkins.

**[Richard Dawkins – Oxford University]:** We don't know when language started but as soon as language did start it provided an environment in which those individuals were genetically best equipped to thrive and survive and succeed in an environment dominated by language were the ones who left most offspring and in our forefathers that probably lead to an improvement in the ability to use language.

**[Narrator]:** What exactly as the evolutionary purpose of language? Was it to discuss water holes, weapons, what lay over the hill? Or might it have had another advantage? The answer may be surprising.

**[Robin Dunbar – University of Liverpool]:** The kind of situations we're looking for to study language was just the sort of natural places where you would have a conversation in a very informal relaxed conversation with a friend. So we sort of looked at bars, trains anywhere where you would kind of have a sort of natural everyday conversation.

**[Narrator]:** Robin Dunbar is an eave's dropper. He listens in to other people's conversations to determine what we really talk about.

**[Robin Dunbar]:** I think the conventional view of all those who work on language, linguists and all these kind of people, is that language is about the transmission of technically complex information. This is what I kind of call the Einstein and Shakespeare version of language. And the answer is, oh no it isn't; if you're actually going to listen to what people talk about on a day to day basis back there in their homes or on the street or over the garden fence then it's about social relationships. The most surprising thing was actually how much people did spend in social gossip if you like. We really hadn't expected it to be so great. Social exchange of information should be important in people's lives. We really hadn't expected it to be perhaps more than a third of conversation time and here we were at two thirds.

**[Narrator]:** Two third of all conversation Robin Dunbar believes is dedicated to gossip. Throughout human evolution, could nature have selected not just for the fittest but for those with the most acute social skills.

**[Robin Dunbar]:** What language does, the bottom line if you like, is it just allows us to hold big groups together. It's like kind of opening a window of opportunity. Suddenly there's all sorts of other things you can do with it. Because you can use it to solicit information about third parties; you can now see what happened when you weren't actually present at the time. The problem all monkeys and apes have is if they don't see it they don't know about it; they never will.

**[Steven Pinker]:** Gossip is certainly one of the things language is useful for because it's always handy to know who needs a favor, who could offer a favor, whose available, who's under protection of the jealous spouse. And being the first to get a piece of gossip is like engaging in insider trading you can capitalize on an opportunity before anyone can. But language is useful for other things; for exchanging technical knowhow. How do you get poison out of the gland of a toad, what's the best place to make a spear, where are the berries, what's the best time of year to hunt? It's also good for one on one negotiation; if you give me some of your meat I'll give you some of my fruit. There are all kinds of ways that language can be useful; gossip I think is just one of them.

**[Narrator]:** Language; the force that created modern human culture. And that today tells us who we are, how we belong and where we're bound. Language, according to Richard Dawkins is also central to a new and powerful evolutionary force.

**[Richard Dawkins]:** As far as a human lifetime is concerned, the only kind of evolutionary change we're likely to see very much of is not genetic evolution at all, it's cultural evolution. And if we put a Darwinian spin on that, then we're going to be talking about the differential survival of memes as opposed to genes.

**[Sue Blackmore - University of West England]:** Meme's are ideas, habits, skills, gestures, stories, songs, anything which we pass from person to person by imitation. We copy them. Just as genes are copied inside all the cells of our body and passed on in reproduction, memes are copied by our brains and our behavior and are passed from person to person. And I think what happens is just as the competition between genes shapes all of biological evolution, so it's the competition between memes that shapes our minds and our cultures. So it's absolutely central to understanding human nature that we take account of memes.

**[Narrator]:** Sue Blackmore believes memes have been the forces driving human evolution. Especially since the mind's big bang some 50,000 years ago. She sees ideas, prejudices, trends and breakthroughs behaving much like genes; self-replicating and accumulating from mind to mind, society to society, generation to generation. Memes are the building blocks of a new kind of evolution.

**[Richard Dawkins]:** If units of culture replicate themselves in something like the same way as DNA molecules replicate themselves, then we have the possibility of a completely new kind of Darwinism.

**[Steven Pinker]:** Changes in the human lifestyle for the last 50,000 years had very little to do with the biological change in our brains. The reason we live differently today from the way that the cave men lives, is not because we have better brains but because we have been accumulating all of the thousands of discoveries that our ancestors have made and we have the benefit of huge history of inventions that we communicate non-genetically through language, through documents, through customs.

**[Narrator]:** Memes can be more than passing fads. They can be titanic. They can modify the world, revolutionize life; even suppress the forces of biological evolution. Consider insulin one such meme. Now some 80 years old.

**[Jared]:** Before insulin, diabetics weren't expected to live. It was sort of considered a fatal disease. I would probably not be here without insulin. It's just been a huge - it's allowed me personally, as a diabetic to live.

**[Narrator]:** 14 year old Jared is on a week long hike with others who share his disease, juvenile diabetes. An outing like this may not appear revolutionary but it is. With exercise, a diabetic's blood sugar can plummet dangerously.

**[Jared]:** Hmm 231; normally that's pretty high but on the trail we try to keep our blood sugars up, just in case we go low and we just want to make sure that we've got plenty of sugar in there and since we're doing so much exercise.

**[Narrator]:** Jared has his condition under control, thanks to a device that supplies him with insulin the instant it's required. This may seem mundane today, but before the 1920s individuals like Jared would have died as children. Never to have reached the age of reproduction, never to pass on their genes. Now young diabetics are no longer condemned to death. Insulin; an idea that became a cure is just one more meme that helps modern humans elude the forces of evolution. Like so many other scientific breakthroughs, it provides us with new ways to survive.

**[Steven Pinker]:** A lot of the creations of the brain can make up for physical deficiencies and can actually change the course of evolution. Thousands of years ago, someone who was severely near sighted, probably wouldn't have had many descendants, he would have been eaten or fallen off a cliff a long time ago. But we invented eye glasses and now being near sighted has no disadvantage at all. There are some people who might say, well isn't this interfering with evolution, wouldn't we be better off letting the diabetics and the near sighted die an early death to improve the physical vigor of the species. But that really goes against the way human evolution works. Which is that for tens of thousands of years we've depend for our survival on our own inventions/on our own creation and this is simply extending that process.

**[Narrator]:** Our revolt against biological evolution has taken many forms. Call it culture, call it memes, call it mimetic evolution. Whatever, it makes every one of us this planet's best survival, so far.

**[Sue Blackmore]:** Nowadays I would say that mimetic evolution is going faster and faster and it's almost entirely taken over from biological evolution. Not entirely in the sense that the two are going along hand in hand for example birth control; the memes of the pill and condoms and all these things have effects on the genes in fact they change quite dramatically across the planet; which genes are getting passed on and which aren't. The more educated you are the less children you have. That is memes fighting against genes. What's also going on now at the beginning of the 21st century is that the memes have suddenly made themselves a new home; the internet. We thought we created the internet for our own benefit. In fact if you look in any office and you see people sitting there you know, slaves of the memes, hello, fax coming in...It's going so fast. I would say what's happened here is the inevitable consequences of the mimetic evolutionary process. The memes are getting better and faster and more and more and creating as they go, better copying apparatus for their own copying. I don't know where that leaves us in the future.

**[Narrator]:** For our species, as for all others, biological evolution has been the primary engine of change. But since the birth of culture, some 50,000 years ago, forces far more powerful have overtaken human evolution. The mind's big bang was a birth of a new kind of change. Not of the body but of ideas. For the future of human kind, evolution may be no more than what we make of it.