The Invention of Human Language

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"Dark Matter of the Mind" you do know and even though you're linguists you know what dark matter is. Yes. "Of the Mind in the Culturally Articulated Unconscious. Another one I like is "Don't Sleep, There are Snakes: Life and Language in the Amazonian Jungle" or Amazonian jungle. The one we're talking about today "How Language Began: the Story of Humanity's Greatest Invention and the one that's coming I'm also really excited about "American Aristotle: the Life and Mind of Charles Sanders Peirce." There are other books so don't, you're not gonna run out. I mean if you start now and you're under fifty you could get there. There is a, just to say, there's a if you don't have this the length of attention for books there's a fantastic New Yorker profile on Dr. Everett. So I'm very excited because I hear that it's going to be exciting. Lots of really questions which are probing and, right? Questions good and probing questions so I'm very very very excited to welcome Daniel Everett. Okay. So I'll walk around a bit. I come to Harvard now about once a week twice a week because I'm writing this biography of Charles Sanders Peirce who graduated from Harvard in 1859 when he was going here as a student his home sat where Sever Hall currently sits. Those of you who are familiar with Harvard Yard. And the person who designed that hall, HR Richardson, was a fellow student of Peirce's in the 1859 class. There were eight of them and Peirce wrote little summaries of each of them. Said Richardson wasn't very smart and he also talked about Strong Vincent a great American civil war hero who died on in Gettysburg saying that he was a bit flashy and also dull. Peirce thought everybody was dull but he was the first summa cum laude in chemistry from Harvard and he was a geophysicist for 31 years for the US government. He was an astronomer at Harvard and is mainly known as a mathematician, logician, and philosopher. So that's very different from this work although you'll see that Peirce is implicated in the evolution of human language so I want to thank several people and you can see their names.

So now we'll go to something else. Not that grateful. Language is a biocultural behavior so language is is a bio cultural complex and and thus research into its origins is necessarily

interdisciplinary and so if you're an archaeologist you're not going to find out by yourself how language came about and you're not going to do that if you're a linguist so it requires a lot of people working together and and I started on this project by myself but have been working quite a bit with archaeologists in particular Larry Barham from the University of Liverpool whose specialty is Homo erectus there are also a lot of different ideas about what language is I'll tell you the right one in a bit but language requires to understand the evolution of language we need some archaeology linguistics and field research on contemporary languages semiotics that's where Purse comes in comparative biology philosophy cognitive science paleo neuroscience neuroscience evolutionary theory and genetics so it's it is quite a daunting task for anyone to even try to summarize the research that's going on there so we could ask the first question we might ask us what is language what is it that we think evolved and one view is that language is a grammar as is a set of sentences to arrive by a recursive grammar that's a very popular definition of it among linguists and or the other idea and the one I'm going to urge upon you this evening is that language is the transfer of information by symbols so there is no firm cutoff between humans and other species humans are better at communication by language than other species are but it's not something that is found exclusively in humans but I'll try to make that clear who has language well everything communicates if you follow purses work the entire universe is a sign everything is communication minerals communicate the trees right now we'll start communicating with the environment the shorter days and start to grow their leaves back so everything communicates but not everything has language only only humans really appear to have language and and we talk about other species and we have to be very careful about what we say about them relative to humans to get this right so communication again is the transfer of information by signs which I'll make clearer as we go along and language is the transfer of information by symbols symbols that are open-ended and created by people well they could be created by anybody but they just happen to be created by people and so there are three types of signs that are very important to the story and two of those are found throughout nature icons and indexes an icon is something that resembles something else there's some sort of correspondence you know a reflection in the water or of a certain kind of a feeling that you get that corresponds to a particular musical event an index is a sign that's connected physically to what it represents so smoke is connected physically to fire it's an index of fire a footprint is an index of the creature that made it symbols are signs that refer to objects by convention habit or rule and I'm to simplify things I'm simply going to say that symbols are conventional signs they are things that don't have to mean what they mean there's no necessary connection to what they mean so dog refers to a canine in English petrol in Spanish and cashew who and Portuguese kneel pie in pita ha these are just conventional things they're just physical forms that take a canoe that are conventional to refer to meanings that are significant in that culture so the threshold the productive symbols was likely fairly sudden but the evolution of the platforms for language and symbols took evolutionary time and are not limited to Homo sapiens they don't just get a creature that one day stands up and starts talking we expect to see a lot of correspondence and a lot of continuing continuity between our species and other species when we look at look at communication so we find that that birds have particular song dialects depending on the geographical area they're found even in the same species that

dolphins communicate that chimpanzees and gorillas have have fairly interesting communication systems they're not human language but they're also not totally unlike human language one view is that language the view that language is primarily a former grammar came about in our species and Homo sapiens about 100,000 and 200,000 years ago the alternative view which I will talk about tonight is that language has existed for about sixty thousand generations or more than a million years in this so another thing to clarify is that speech is secondary the the sounds that are coming out of my mouth are just one way to express language it can be expressed by color coded shapes it can be expressed by hand signals it can be expressed by mouth signals by sounds and you don't need a lot of speech to have language after all think of the computer how many speech sounds does a computer have individual things that it can recognize well it has two one and zero and everything that can be said can be said with ones and zeroes computers have better memories in some respects than we do so they can remember long and distinguished longer sequences so we tend to have more than just two symbols actually you could have just one symbol and have a language you know right because you could have AA means tree and aa means by the tree and ah means over there by the tree or something like that but that's hard to remember so those systems don't tend to do too well in fact I don't know of any languages like that the smallest system that I'm aware of is pita ha which has 8 consonants if you're a man seven consonants if you're a woman and three vowels and it also has two tones which is something when we talk about the evolution of speech we sometimes forget that there are tone languages and that people can distinguish words by tones rather than just by consonants and vowels there's some evidence some people that come to Fitch for example as a biologist at the University of Vienna thinks that early species of humans had full speech capabilities in fact he argues that non-human species have full speech capabilities the answer is it doesn't really matter that much the because language is not about speech it is about it is about symbols and transfer of information by symbols however also if you talk about the the components of all languages so every language in the world has the three vowels e uu and I tell you that pita ha only has three vowels if you're a linguist you can guess that those vowels are e hoo because every language has those vowels those are called the quantal vowels they're just the easiest to hear there in fact they're so important that according to Phil Lieberman whose son Daniel I believe teaches here is has argued that that the entire evolution of the tongue in the human mouth is to be able to produce those vowels they're that important and they help distinguish the speech of all languages did they come later well according to Fitch and others they didn't come later but according to work by by Geoffrey lakelyn and Phil Lieberman but especially Geoffrey Layton's work there is a rapid evolution in this in the vocal apparatus starting about the time of Homo erectus which would be explained if that's when language started they would need speak better speech to to communicate with language although you don't have to make clear sounds to have language you can have garbled speech and it's still language it's like getting a Model T Ford is that a car yes it is it's not a Ferrari but it's a Model T so we didn't start off necessarily with the full capabilities that we have today but but we had enough speech to get by there are a lot of external conditions on on human speech evolution so work by Damien Blasi and Sean Rogers and and Caleb Everett who not not coincidentally shares my name all argue for XO centric factors affecting the evolution of speech anyway our hero is Homo erectus I'm sure

that he or she looked just like this I was very I was very I'm always intrigued to write to discover new findings in the literature about the accomplishments of Homo erectus because we tend to really downgrade Homo erectus you know if you remember if you're old enough to remember the American comedian Ronde rodney dangerfield you know his line is I don't get no respect that's how I feel about Homo erectus at times everybody's impressed with the latest artwork from Neanderthals or or sapiens but erectus is really where it all started and in fact in recent study published there was there's been some news about it in the last couple of days it was discovered that homo sapiens modern Homo sapiens in Africa have DNA evidence that shows that they interbred with a homo species that existed prior to the split of Neanderthals and sapiens well that's Homo erectus they didn't mate with chimpanzees and gorillas as far as we know they had to see a certain amount of similarity between themselves and erectus almost certainly and and there would have done that Homo sapiens and erectus coexisted for many years together in fact homo erectus is the most successful species in the history of our genus Homo so they existed from 1.

8 million years ago to about a hundred and forty thousand years ago some would say even more recently they're far more successful than we are they existed well over a million years longer than homo sapiens has existed their height was between 5/8 and 511 so they weren't little australopithecines they were big guys they had you know big bones they could have pretty much taken on any Homo sapiens walking around they were wide ranging polymorphic species they had a lot of variation in skull size and in in physical strength and they arguably did possess some modern vocal apparatus from what we can tell from the it's very difficult to find the small little bones that define a modern vocal apparatus but in recent work there has been discoveries of what appear to be hyoid bones that belonged to Homo erectus which would have meant that they had fairly modern speech capabilities they were ocean travelers magnificent tool makers they invented fire they started communities much of what we take for granted as human accomplishments are human accomplishments they're just from a non sapien species of human so they're our gradualist versus saltation its views of language origins so did language come about gradually or just pop in the beam I think it came about gradually just to set the groundwork is language uniquely human or non unique human set of abilities shared with other animals Descartes who was very good mathematician but an extremely poor philosopher charles sanders purse in fact has all sorts of sections about why Descartes was a bumbling idiot but of course that Charles thought that about many people but he severely attacks all of Cartesian philosophy but one of the one of the interesting distinctions of course is that Kurt Descartes felt that only humans had cognition and that other animals were basically meat machines they were just you know you didn't hate me to be kind of animals to worry about them because they had no consciousness they had no brains they had brains but no minds because dualism comes from Descartes in modern times so there's a very different view from Descartes this is the view that we are just continuous in nature humans are just animals like others shouldn't be a shock for people these days although it is a shock for many linguists to think in those terms so the evolution of the brain how big was Homo erectus his brain and what does it matter their average brain size was about nine hundred and fifty CCS whereas a Neanderthals brain was about fourteen hundred CCS and a modern humans brain is about

twelve hundred and fifty to thirteen hundred CCS although many modern European females have brains in the in sighs range of homo-erectus about 950 CCS and as as people who study the brain have come to realize size doesn't matter so much but you can find you can see the ranges here the circle is where we find most of the Homo erectus brain sizes but you also find some sapiens in there and Neanderthals and as you go out towards the upper edges of the chart you do start to get into fairly sapiens exclusive territory but just remembering that we don't fully understand the brain that's putting it mildly and so then the main thing that matters is the organization of the brain and that's extremely difficult to tell with fossils how their brains were organized so human ancestry is is represented in this chart with erectus at the bottom a maybe floresiensis who was from the islands of Flores this sometimes called The Hobbit little creature who was over there according to some linguists there are still stories about them told by the by the indigenous peoples I don't think that's probably right but they do have stories about little creatures running around through the the jungles but from erectus came all the other creatures that are related to us all the other 20 or so species of Homo but erectus was the first now where does Charles Sanders purse come in he was by the way banned from Harvard so it's really interesting that his papers are here at Harvard then one has to come here to study purse because Charles Eliot who was president at the time didn't want him on campus because he was he was seen coming out of a hotel with a woman who wasn't his wife so he would lost his job at at Johns Hopkins University and that was the only job he ever had in academics and he was banned from the Harvard campus even though his brother was the Dean of mathematics and his father had been professor of mathematics for 50 years here anyway so he was the one who invented for the very first time first of first and second order logic that's creditors often good to given to godlet Frigga but in fact purse had it worked out in some ways before Fraga and independently about the same time he invented semiotics the theory of signs before so sewer he invented pragmatism from William James there's actually an interesting correspondence between purse and James purse was a member of the National Academy of Sciences and he was explaining to James when he could not nominate him for membership in the National Academy of Sciences because most scientists took James he said we consider you a literary man not a real scientist so but James got famous for the idea of pragmatism although the idea comes from purse at that time that he was alive he was considered America's greatest mathematician the German mathematician Ernest Schroeder wrote him and said that your genius and your reputation shall shine like the Sun for eons into the future which clearly was wrong but but he was a brilliant mathematician he made fundamental discoveries in mathematics he was the first person to link the the absolute length of a meter to a wavelength of light from measurements he took over 20 different places in the globe he his only book he ever wrote was on the physical properties of light photometric researches and and he's the first person to notice that the milky way rotated all sorts of things he did in his spare time and as I will argue in in the biography about Percy was the inventor of cognitive science as we know it sort of as we know it today anyway this is Perce as a young man here he was interesting guy I'm gonna skip this and go on to culture because culture really is the important thing here you can't have a language unless you have a culture and you can't have a language a culture unless you have a language their symbiotic symbiotically related each determines or constraints and leads to the conditions to develop

the other so in my definition culture is an abstract network shaping and connecting social roles hierarchically structured knowledge domains and ranked values so rank values are very important to culture so it's not enough to know that people have the same values so for example if you're French you might think that good food is very important and that being in good shape is also very important and if you're from say Houston Texas you may believe the same things but if you think that good food is more important than being in shape you'll look one way and if you think that being in shape is more important than good food you'll look another way so the value rankings are as important or more important than the actual values themselves culture is always shifting so universal grammar is a very popular term it was made popular in modern times by Noam Chomsky although the term goes back to the 12th century grammarians known as the motifs tie and in the US the first person to ever talk about universal grammar was Charles Sanders purse his view of grammar was both he and Chomsky interestingly enough felt that recursion I can talk about recursion separately but anyway they thought that recursion was the basis of grammar of grammar but for Purse it was meaning recursive meanings not forms not the sentences but the way that so for example if I say Bachelor I have to interpret that in terms of say unmarried man and I interpret unmarried in terms of other symbols and I interpret man in terms of other symbols so that every symbol starts us to a recursive chain that has no end we everything is connected and to understand one thing we have to understand a great deal of culture so the the difference is for Purse universal grammar followed from logical principles there was nothing necessarily genetic about it it simply followed from logical principles if you had symbols they were subject to certain logical constraints and those would affect the form of the language whereas the second version of universal grammar Chomsky's is that not only is is human biology responsible for under human linguistic capacity but the genes are severe are specific genes linked to language so those are very different views of universal grammar so now let's move on to tools tools turn out to be a very important part of reasoning about the origins of human language the tools are individual devices or processes that meet perceived needs of individuals and communities or a set of devices processes and expertise used to harness the properties of a particular material full culturally constructed repertoire of knowledge conventions devices and processes values are vital at each stage so tools are really complicated this is clearly a complicated tool but so is a shovel a shovel has a specific kind of function and it's got you know if you make a shovel out of out of rubber it won't work very well there's a whole lot of things that have to go into a into as tool as simple as a shovel or a knife to make it be what it is and it starts to take on meaning features that go beyond its function human technology in meshes the material with the ideational we have ideas and we and they're manifested materially tools involves social constructivism tools become symbols as they emerge from the values knowledge structures and social roles of a particular culture symbolism and erectus tools is therefore crucial evidence so that's what one thing we really need to look for in addition to the other accomplishments of erectus now it's true that other species have tools but other species tools tend to be opportunistic and one of the interesting things for example about erectus is that they took very good care of their tools they colored their tools they carried their tools with them over long distances they planned ahead no other species is known to do that although it's a good Darwinian I wouldn't want to say that no other

species could you know I wouldn't want to predict what no other species could do because every time somebody tries to do that we find that they can learning of technical skills takes place using a combination of language gesture imitation and guided intervention this applies to all erectus and Neanderthals instance and sapiens tools and we'll be getting to that this is partially based on lab experiments with stone tool users and my experience in the Amazon I see this too so so it's at the mini archaeology departments they have napping labs k in AP P naught n AP and and they they learn to make stone tools graduate students learn to make stone tools and they brew they bruise their hands they cut their hands it's it's really hard so the simplest form of stone tool is like the Oldowan tools which will see a picture of those takes several huppah love hundred hours very often for students PhD students to learn to make accurately when we get into the more complex tools it takes even you know a lot longer and what people have found in these labs is that even the simplest tools it's very hard to simply show by example how to do it language tends to be implicated in in this in the skill acquisition now this could simply be because their sapiens right and sapiens talk so why not avail yourself of the speech that that you have in the amazon i have watched many men teach their sons how to make tools like blow guns and bows and arrows and a lot of the time is in silence but then you will often hear a question and an answer about something that was very difficult to see or a movement that was very quick so tools take explanation and in many cases so once again on a sign a sign refers to an object so if I have a sign if I say water that's the object and the representation is wate R and the interpretation that you're going to make is something to drink so icons their physical resemblance correspondence they don't tend to have much intentionality about them a reflection in the water is there whether you intended it to be there or not but they can last after someone's not there so the smell of or a footprint can last for quite a while all animals are able to interpret indexes in fact when we talk about animals interpretation abilities almost all the time in the experiments when they're talking about amble animals learning symbols in the personal sense they're not learning symbols they're learning indexes and icons which are very different levels of cognitive accomplishment from symbols and so symbols are the final ones and these are the properties that are important for us no symbols no language they involve displacement the thing that we're talking about doesn't actually have to be there I can say water and hold this up or I can say water without it there and you still know what I'm talking about that the object doesn't actually have to be there indexes lasts a long time these footprints are about 3.

7 million years old found by Mary Leakey in there called the late holey footprints and if you follow them out you can see that it's a large Australopithecus probably authority' thickest walking with a small one and they walk and they turn and look at something and then they walk on and it rained after they had walked by and this is volcanic ash that hardened like concrete and left their footprints there this is Australopithecus africanus and as far as we can tell they're the first creature to ever preserve an icon so they're starting to look at things and contemplate I don't think that's too strong a word contemplate the similarities so this stone which is about three million years old is called the maka pons got pebble it's was found in a cave in South Africa and it's unlike the material that the other stones in the cave was we're from and if you look at it it has a interesting characteristic it looks like a smiley

face and and this thing is about three inches by two inches so it's too big to have gotten caught between their toes and carried up there coincidentally this seems to be something that Australopithecus and Australopithecus found interesting and carried up to the with no particular functional role other than it looked like a looked like a face australopithecines also made tools their tools about 3.

3 million years old found in different places or the Oldowan tools discovered largely by initially by the Leakey family icons are all over the place in addition to seeing icons in nature we have them in churches and here are tools that have been actually made into icons and symbols both and from symbols to grammar so there how complex does a grammar have to be everybody will agree every every linguist will agree that you can't have a language until you have a grammar but how complex does the grammar have to be well there are there are a couple of different possibilities and one of the points that I make in the book is that we find all of these in the world today so one we could call a g1 grammar which is just words put in a linear order and that seems to be the case for example in Peter ha and Rio which is a language of New Guinea which is John saw Mary so there's no other structure let's say in a language like this there's just those three words John saw Mary a G 2 grammar would be like a G 1 grammar but have additional hierarchy or structure into the phrases so the man you saw yesterday is here where you saw yesterday as a sentence hierarchically located inside a larger sentence or you could simply say the very big ball roll down the hill there you start to get more structure it's not simply linear order of words a G 3 grammar has both recursion and hierarchy so what is recursion it's the ability to put one thing inside another of the same type and just keep doing it so the the man who is here said that bill said that Mary said that Peter said John bought a house when you start to get structures like that so that you can say there's no longer sentence and a language then recursion is the best way to handle that a recursion is communicatively very useful you can pack a lot more information in a sentence with recursion but I've argued that although recursion can be found in any language it's not a necessary component of all languages and in fact there are good reasons why some languages would avoid it so erectus had icons we know that they carry things around they didn't carry around small smiley faces that we know of but they did carry around phallic symbols like this cuttlefish bone that was found in Morocco about 450,000 years ago and erectus also started making quite complex tools so there there are three grades of tools in the Paleolithic especially in the lower Paleolithic there are old of on tools about 3 million years ago there are Chilean tools made as recently as two hundred thousand years ago and then finally there are level wattles which are the most complex tools found in the Paleolithic so these are refined which means they've been thin these take it quite a bit of effort and skill to function and they have various parts to them you don't just start off banging two rocks together to get one of those you have to have a plan there are certain things that have to be cut out of the tool it has to have a certain shape to be functional so when erectus started working on tools they might start with a large piece of rock and out of that they had to break out the pieces that they needed to get the kind of functional tool and they make them all pretty much the same to work for them erectus was the first to come up with a controlled use of fire the pre shaping of stone tools working them before they actually started chiseling out the tools they used wood and bone tools as well and we think

they might have also used half the tools and half the tools are quite important because that's when you tie a handle on that shows a lot of functional improvement over others and it shows a lot of foresight and planning so these tools had had a great deal of complexity over hundreds of thousands of years and in recent research in modern-day Ghana Larry Barham has discovered about 900 thousand year old tools that seemed to have been dyed with ochre that's a significant finding because dyeing tools shows that they had that's um not simply a functional aspect of tool making that is a that is an aspect of tool making that shows thought that goes above the mere function of the tool hafting tools combinatory thinking imagining the future and likely invented by erectus it's one of the most significant technological breakthroughs in human tool making and ochre is also very important and we see things like hand axes they had they had a tool kit not not nearly as extensive as the Neanderthal tool kit or as a homo sapiens tool kit but it's an extensive tool kit they had hand axes and cleavers they had pics and so we see different stages we should recall the simple stage of Oldowan tools that we saw that australopith estrella Pittacus had we see our Chilean tools these are already starting to get refined and showing a lot more work and then we get to the the Cadillac of the the tools of erectus levallois tools not everyone agrees that erectus made levallois tools they're dated some are dated as as early as six hundred and twenty-five thousand BC but not everyone agrees with those dates the dates that do have the widest agreement are about three hundred thousand years ago that would apply that would mean that they could have been used by Neanderthals or sapiens or erectus so it's difficult to limit them exclusively to erectus however a million years ago we see larger tools that are made with the same way that levallois tools are made levallois tools require a lot of hammer work before the final stage which is lifting the core out of the larger tool and that takes a lot of planning a lot of discussion or a lot of skill and and many of the people who study the tools a fairly wide consensus is that levallois tools can't be learned by imitation alone there has to be linguistic instruction when we get to this level of tool complexity and these tools were in fact found as early as a million years ago tools that were made by the same process not everyone would call them by the same name but they were made by the same process so every tool that was made had to have various functional features so if we can if we find tools that have nothing but functional features it's difficult to see anything symbolic in that we can say of any tool that it's an index of the tasks to be performed it's an icon of other tools you have one tool as a model to make another tool so it does represent a growth in in in significant but to get to the level of symbols we need to see things that aren't simply part of the function and we start to see some of this at the end of the Chilean age we see tools that are made a little bit more elaborately than they need to be made they're painted they're died and and in fact when Larry and I were working on some tools that he had just brought back from Africa this this past summer another expert on erectus tools walked into his lab that at Liverpool and said oh those are from East Africa because apparently East African and West African erectus designed their tools in different ways so that the design of the tools was representative of the group that they came from they indicated robustness you know one of the earliest ideas when they started to find these non-functional aspects of erectus tools was that it was men showing off for women making the tools to show that they were better tool makers but of course we have no idea whether it was men who made the tools or women who made the tools so we don't know there was

somebody was probably showing off but we don't know who it was showing off but then we find really interesting things about erectus that are difficult to explain and we find that you know so this shell is 750,000 years old and the markings on this shell were done in Java by a Homo erectus using a shark tooth on on this large show and the marks were made without ever picking up the shark tooth their constant continuous representation and we start to see a lot of this kind of thing with erectus this kind of attempt to represent things such as this rock we find these geometric shapes that erectus is starting to carve into shells and into tools so that we realize that erectus is starting to see things beyond their their mere functionality and then about 250,000 years ago we find this venus of Barakat ROM which is in the Israel Museum in Jerusalem which is got red ochre on it partially formed by humans partially formed by nature but it's the first real artwork that we know about there others about the same time and it does seem to have been made by erectus so erectus tools they they have symbolic and social components they go beyond the functionally necessary they go into style that represent one tradition over another they're beyond icons and indexes they're simultaneously indexes of tasks icons of other tools and symbols of the values and labor of the community symbols in linear order simply turn out to be language as soon as you can start symbolizing things you have the ingredients that are necessary for language so if they had language what other things did they do that might have shown that they had language so the tools show us that they had the ability to symbolize and and and this would have been a cognitive breakthrough for language but is there any other evidence well it turns out that there are but let's talk about how you get to Modern Languages from just a few symbols most things are enhancements so we add things so you have language systems that decide what they're going to represent what is it that you want to talk about so among the peat aha for example there are no numbers there are no color words they don't have the number one does this mean that they're cognitively deficient well they also don't have golf clubs there are a lot of things they don't have and a lot of things we don't have how many men in here know how to make a good bow and arrow there they they produce what their culture needs their culture doesn't need numbers they don't have numbers and this has been verified with a lot of experiments over the years so they also don't represent tents but they do represent so they don't have past tense or present tense or future tense but they have a lot of ways of distinguishing different perspectives on how an action takes place whether it took place at a certain height whether it took place near the river so they build into their verbs how many verb forms does a does English have right it's pretty poor five seeing saying some singing sings that's it you've exhausted the entire word grammar of English with those but if you go on to Spanish or Portuguese you'll get 30 to 50 types of verbs but in Pete aha since there are 16 suffixes possible you have 2 to the 16 possible verb forms which is about 65,000 verb forms so their grammar is not like ours it has very complex verbs but simple in other ways compared to us it's what a culture decides to represent that starts to work its way into the language conceptual systems how do we interpret these things do we interpret these things strictly based on the symbols we see to interpret them based on other cultural nuances and these all start to form part of the language and enter the language in different ways linguistic systems will have different rules different structures different constraints so this show that language has at least three these major components the objects the ways they're interpreted and the forms that we choose to represent them in

and languages differ a lot so if I say yesterday what did John give to Mary in the library there's intonation my pitch is modulated to depending on whether it's a question or a statement and and these are add-ons to make things clearer it's not necessary to have this intuition intuition to distinguish questions from statements but it is very very useful in Pete aha that like many of the world's languages are probably close to half of the world's languages such as Chinese and Korean and others the language is tonal so the word for ear in Pete aha is away and the word for foreigner is away and the word for skin is away and the word for Brazil nut shell is away and the word for hand is alwey so if I whistled it and those are all very important in Peter house so you've got to be able to hear those tonal distinctions but obviously tones not necessary because we don't have it in English and although English may not be as attractive sounding as Peter Han it still seems to work so we there are all sorts of things we can add once we get symbols there are all ways that we can embellish them with with sound structures and the kinds of syllables we use the way we organize things and then we we start to think about how language is represented in the brain and in the work of Evelina federico at MIT x' brain and cognitive sciences department she's found that language is not at all found in just one part of the brain as people thought for many years but that it's distributed throughout the brain and what she calls a language Network and that this network is fairly similar for and across all languages and across all people but it's a lot more complicated than simply saying it's in Broca's area we've heard of that area or Verna Keyes area actually the interesting thing about Brokaw's patient is the part of his brain that was damaged was not Broca's area but simplistic views of where language is found in the brain are being challenged every day by more research so there are various ways that we enhance grammar in you know morphemes are little parts of words like the 65,000 Peter ha word forms there are phrases sentences paragraphs discourses conversations all of these are important and they're found and they occur naturally over time the interesting thing about languages though its although it's very complicated once we start to look at a Finnish system we can see that its components are relatively simple and build up over time and that the core component to every aspect of the language that's been built up is the symbol so what else did erectus do well by just under 2 million years ago they were spread out across the world that we find them in Beijing we find them in Iran we find them in in various parts of the world we find the erectus there were still many in Africa and so they were traveling and we find seven hundred and ninety thousand year old settlement in Israel yes urban oh yeah Cove and in there we find the controlled use of fire specialized spaces various components that that show for example separate areas of the settlement are used for processing meat processing fish processing plant what seemed to be communal areas so erectus did seem to have a fairly the ability to have an organized society there's evidence that their society was organized and this is found and from this in this ongoing work in Israel and other places this is found at where the black dot is is an erectus settlement in Israel there are a lot of interesting archaic human sites in the Middle East and Israel and other places because if you're coming out of Africa at the time they were coming out because the Sahara Desert was actually a lush green forest you come out turn right and you know it's all you can do you can't go straight because that's the ocean turn right and you're in the middle-east and that's why we find those to be some of the earliest settlement so here's the excavation that and Israel finding these different aspects of it there's also good

evidence that erectus traveled across distances they could not see across in the ocean and there are several interesting things to draw from this first of all most marine archaeologists argued that you can't have a viable human community without 20 to 40 people arriving roughly at the same time in an area so when we find evidence of viable human culture in places like Flores and Indonesia so if you if you look at the island of Flores and Indonesia the point where erectus would have had to cross is about 28 miles so it's about the size of the English Channel you could think well you know people swim the English Channel and and we know that other animals could swim across but Flores is is split off from the rest of you know what would have been at that time the mainland by the strongest ocean current in the world it's called the Pacific through flow and it was the same current back then 750,000 years ago as far as we can tell so it was too difficult for a human to swim across that current in fact if you just put a raft in the water or just put a log in the water and and start off you're gonna get washed out to sea you're not going to make it to Flores the current is too strong so for humans who have gotten there it's highly likely that they had boatbuilding capability in fact an archaeologist in in Australia Robert Bednarik has built boats using erectus tools a Chilean tools and levallois tools and and shown that he can build boats that can get to get there in that period of time the question is could they have done that without language and there's an article by a Max Planck evolutionary anthropologist David Gill called how much grammar do you need to build a boat and a and he argues that you actually don't need much grammar but you do need language to be able to build a boat and so the idea that they could sail and this is a controversial idea most things said about the past or controversial because you can say they got there and they had to get there in a certain number but you can't show that they got several places the ideal thing would be to show them in places where we so some people have argued they got across by tsunamis right but that sort of defies the physics of tsunamis which tend to come towards the land now there are cases of people who've been found out to sea there was a Japanese guy found floating on a roof I think after the tsunami that hit Japan a couple of years ago so it does occasionally happen but it doesn't seem to be a very productive way of travel you know sort of fortuitous and they did this a lot even in places where we don't know of tsunamis having hit so contra the Russian archaeological team found evidence of in socotra 1.

4 million years ago which is a hundred and fifty miles from the closest land we start to see evidence of potential burial this stone on the right is called Excalibur it's a colored hand axe of the period Julian hand axe and it was found in a grave does that mean it was buried on purpose with him we start to see evidence of that it's difficult to say convincingly that it was but it is interesting that it was a colored hand axe found around the time that Neanderthal was starting to appear the the erectus Neanderthal transition period and we find wooden Spears that were preserved for almost four hundred thousand years according to some dating which would have put them back in the time of of erectus so erectus about 1.5 million years ago they start making extremely complicated tools they start travelling around the world they start an evolutionary process physical where they start to get more articulate speech that capacity for more articulate speech they seem to be mastering boat travel the ocean was never barrier to erectus anytime there's an ocean barrier you can expect to find erectus on the other side they had organized settlements so all of these tasks imply the

likelihood of language if we look at other species and we see species that are far removed from humans that seem to approximate some sort of linguistic ability it's it's hardly surprising that we would see an even greater ability in these creatures that were so much like us and had almost modern sized brains so if it's correct there is evidence for language nobody could say this case has been proven but it is highly likely once we take off the burden of languages looking like modern languages and we realize that a language is the transfer of information by the discovery and use of symbols and elaboration of those symbols over time then we see a gradual evolution of language and we see evidence of erectus and no reason to withhold the judgment that they had language to account for all the different things that that they were able to accomplish in their long history they were preceded by these guys these are just a variety the the various species of australopithecines Nature experimented a lot before it got to us you know that could mean that we're the best or it could mean that you know it doesn't necessarily mean that were the best and when we ask where erectus went just look around we are erectus we erectus was the was the antecessor ancestor of Neanderthal of sapiens of every other human creature that has existed they were the smartest creatures the world had ever seen they were the most widely traveled they sailed they built fire they had settlements they had the strong evidence for symbolism in their tools it's very difficult to see why we would withhold the judgment that they likely had language and what they had to have had was more than simply grunts and squeals they had to have something that was able to communicate actual content about the world around them the kind of thing that would have been essential and been discovered in symbols so thank you very much we have time for a few questions if anyone wants to raise their hand I can run this hello thank you for a nice talk to my knowledge what is peculiar to homosapians is the use of actual what we would today call artwork such as was seen of course in the stone caves in France and perhaps in Africa earlier your talk is the first I've heard where you can say that Homo erectus was actually doing dude I would I don't know if you call it art or not of course today we still don't know if everything what is heart and what it's not but that's another matter but that is one thing that seems to have been killed but even that occurred relatively late in the lifetime of Homo sapiens also I'd be interested to know if you think homo erectus now don't we have learned how to use fire but I'd actually learned how to make it so thank you yeah on fire the archeological evidence seems to be that yes they could make it they had controlled use of fire we find it regularly in their settlements as far as artwork this is a a red herring that a lot of archaeologists have have thought to be somewhat important because we think of art as symbolic actually some artists symbolic but a lot of art especially representational art is simply iconic it's a lower level of cognitive development than symbolism so art is is a wonderful accomplishment but it's not crucial to the linguistic line it's it's a sort of red herring to think that if we find painting it's almost certain that if we find painting they could talk but it's there's no argument from that to that if we don't find painting they couldn't talk painting is just a development cultures develop over time and I know of many cultures that I've done research on in the Amazon that have no art but they certainly can talk you know I mean we I mean you could there's there's they don't do anything that is is more elaborate in some ways than homo erectus did Homo erectus was a hunter-gatherer band and and so we find many cultures today that live fairly similarly I'm you know they're a lot smarter they have

bigger brains they can they can think of other things but and if you take them out of the hunter-gatherer band and raise them in a city they'll be unrecognizable for anybody else who was raised in the city which I doubt would be the case for Homo erectus but at the same time art doesn't we want to say that art represents language because it's complicated cultural accomplishment and it is it can be symbolic but it's often simply iconic so art seems to be a separate cultural development that is off the line of language evolution and and I don't find it convincing to say that art is either here nor there when it comes to the to it language evolution testing okay what how would you describe the limitations of their language of erectus yes so I work with languages that have similar properties I mean so in other words if you think about what the simplest grammar could be just words in a linear order I've worked with languages like that and the fact is they can say anything we can say the complicated grammars that we have have very useful communicative functions but they are not necessary to express modern thought or complicated thought so the fact that somebody is we can say they have a a simple grammar doesn't mean they have simple thought it's that's another thing that that has happened in the history of anthropology and linguistics to somehow think that language is the mirror of thought and it doesn't have to be there are a lot of things you know for example I work with hundred rupees that have very few words for time does this mean they don't know there was yesterday so the pita ha for example have no word for yesterday and no word for tomorrow and we often find that this or that culture doesn't have a word for X and so we drive we drive all kinds of conclusions from it but I don't see any conclusions to draw from that they can think about those things everybody knows they got up yesterday and they're getting up today and they'll probably get up tomorrow but the fact that they choose not to talk about them as a separate kind of cultural value so I don't find the simplicity of grammar connected very tightly to the complexity of thought yeah they could have said yeah there we if they had symbols we it's it's they probably didn't have many limitations I mean you could say maybe they had the intelligence of an eight-year-old or a ten-year-old sapience child no way to really know that but let's say they did eight-year-olds can talk a lot I'm curious if we know how or how easy or difficult it is to know whether a tool that they used was made was made by them and not created by nature or how we discern well it's always very hard when you're going back in time to have dating methods that can can link them to a species so if you find a tool that six hundred thousand years old they were the only ones around so nobody else was around so they made it but if you find a tool that was a hundred and fifty thousand years old well there were a lot of species of humans around at that time so narrowing it down to Homo erectus becomes more difficult but you can tell based you can guess based on the settlement patterns but it's difficult to tell with precision once you start getting into the area where other homo species were existing side by side oh that it was made some of the older on tools could have just you know to one rock fell on another and suddenly you get this but these at Julian tools these more complex tools there's no way they came about by accident they had to have been designed planned and and constructed with a great deal of craftsmanship takes hundreds of hours at least 500 hours for from what I've heard for a graduate student in archaeology's to be able to make a naturally in hand x2 not to make its how long it takes to learn it they can make them faster after that I'm curious to know like what led to the I guess eventual demise of this species like given your talk like how

successful they have been at traveling and establishing communities all around the world so I'm just curious like what led to like a global and too successful run yeah it's a very good question we're the only ones left standing so did they die out did they become us you know one answer is they they didn't die that we are them the other answer is that Homo sapiens has you know they're smarter and they're they one thing we've shown as a species throughout our history is the ability to to slaughter other people that look like us so the fact that the Homo sapiens might have killed them all doesn't seem to have that doesn't seem to be totally outside the realm of possibility either so I don't know why they disappeared and I was asked I was asked a similar question when I was giving a talk in Hungary and I probably should have been more careful but I said you know the Hungarian Jews didn't disappear because they didn't have language so there are all kinds of reasons that people disappear I am you briefly said at the beginning that the homo erectus you found there was one that they found a hyoid bone in it so yeah you're you're speculating that you know then they have vocal cords and they could they could then you know produce sounds I mean so are you thinking the the later species all had the hyoid bones and could vocalize we don't really know some people to come so Fitch would believe that we almost certainly had Homo erectus had this modern speech capability my point is that it really doesn't matter evolving modern speech is a tremendous advantage but it's not a necessary condition nor is it a sufficient condition for having language we can look at other species that seem to have we listen to a parrot they can produce human speech sounds fairly well that's so it shows that it's not a sufficient condition for language and the fact that erectus might not have had it would show that it's not a necessary condition for language because we have deaf people today who talk with American sign language and say anything we can say so language is looking for a physical medium to be transmitted and that usually and most efficiently is human speech and with quantal vowels and modern speech we can communicate much more clearly but it's neither necessary nor sufficient to have language they could have produced sounds they might not have been very clear but the reason that chimpanzees don't talk is not because they can't produce sounds they produce enough sounds as my point what about computers is that any creature that can produce two sounds could talk in principle my dog makes a lot of sounds and I understand a lot of them I'm trying to figure out if any of them are symbols but they're certainly she's very articulate and letting me know when it's time to do certain things so I have mastered a repertoire of her sounds and and she uses them but that doesn't mean that she you know I don't expect her to give me advice about you know how to find my grandmother and in ancestry.

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