

Toward a Comprehensive Hypothesis About the Development of Language and the Human-Sense-Of-Time

Based in Part on Daniel Everett's *How Language Began*

By Rick Doble



This PDF document is a reprint of my original article
on my seven-year-old blog about the human experience of time:

DeconstructingTime

<http://deconstructingtime.blogspot.com>

PREFACE

To my astonishment, my previous blog-post that I uploaded as a separate document on Academia.edu has been well received. It was recommended by four people and has gotten almost 300 views and over a 100 downloads.

So following up on this article about Daniel Everett's book *How Time Began* and its relation to my ideas of the human experience of time, I have now made a full outline of my concepts that dovetail with his. Please see my earlier blog article for more background information.

<https://deconstructingtime.blogspot.com/2018/10/everett-how-language-began-and-human-time-keeping.html>

Or view the article on Academia.edu

https://www.academia.edu/37624870/How_Language_Began_and_the_Human_Understanding_of_Time_Daniel_Everetts_New_Theories_About_the_Evolution_of_Language?auto=download&campaign=weekly_digest

INTRODUCTION

THE BASIC PREMISE

My basic premise is quite simple. Early humans (genus Homo) emerged from living instinctively in the present to developing language and time concepts that allowed them to manage time in increasingly sophisticated ways. Language gave humans the tools to work with time, to share, to coordinate and to plan. Without these time-tools, the development of farming and civilization would have been impossible.

LANGUAGE FROM THE BEGINNING MUST HAVE INCLUDED TIME EXPRESSIONS

No language could have developed without an initial early understanding of time. Period. All verbs, for example, describe actions which occur over time. As language developed, the ability to describe time and express time became more sophisticated, although different languages handled the problem differently. In Mandarin Chinese today, for example, all verbs are present tense but the context describes the time frame. So in Chinese one might say, "He runs today. He runs yesterday." In other languages, the time indicator is in the verb tense.

THE INVENTION OF HUMAN TIME

Humans invented their own concept of time just as they invented language. While time exists independently and objectively, the way that humans conceive and work with time is uniquely human. We have to speak of time in metaphors such as spatial metaphors, i.e., the past is behind us and the future is ahead of us. Or she has been through a lot. So what follows next is another metaphor that explains how we work with time.

Water, like time, exists objectively and independently. Animals must find watering holes where they can drink, or find new watering holes when one dries up; they find rivers to bathe in and shelter when it is pouring rain. When we humans were in our animal stage, we used water in the same way. Then we learned to control it. So we carried water in jugs, drank from cups and boiled water. Soon farmers learned how to irrigate their fields. Then we learned how to store large quantities of water and to create plumbing that went to a number of locations as was done in Rome 2000 years ago. Eventually, we were able to put water under tremendous pressure as in a fire hose. Today steam turbines run nuclear submarines. So while water is still water, in this example, the way that we use water is uniquely human.

And the way that we use, shape, mold and describe time, I submit, is also uniquely human. We have mathematically divided the day into 24 hours with 60 minutes per hour and 60 seconds per minute which is artificially computed by our man-made

clocks which are now in sync with an atomic clock. While this works very well, our methods for dividing time and then keeping track of time are human inventions.

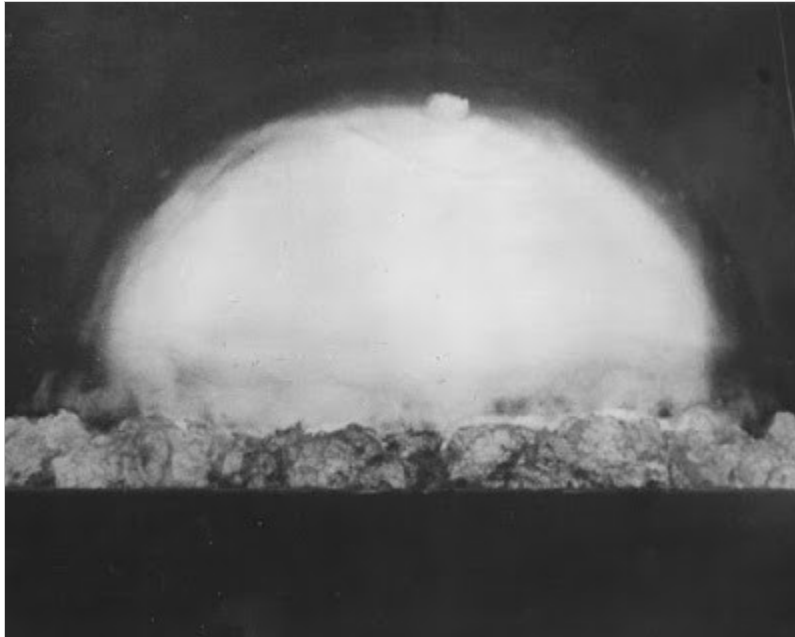


Photo of first atomic bomb 0.053 sec after detonation on 16 July 1945.
This bomb was code-named Trinity and exploded in 10 millionths of a second after it was triggered.

TO UNDERSTAND HOW CIVILIZED TIME BEGAN FOR THE GENUS HOMO, MOMENTARY TIME MUST BE UNDERSTOOD

Using the general timeline for the development of language as proposed by Daniel Everett, I have added my own timetable for the evolution of the human concept of time. Everett believes that language started with Homo erectus more than a million years ago, so I will start at that point as well.

I believe that civilized time as we experience it today (which is continuous time or time as a continuum) evolved hand-in-hand with the development of language. However, to understand this development, the starting point (the point of departure from animal behavior) needs to be understood. Otherwise, the development of language in the genus Homo is hard to comprehend. The starting point is that animals live in the moment.

Animals are tuned into cyclical time such as a dog expecting to be fed by her owner at the same time each day, or birds settling into bushes at sunset or flocks of birds migrating in the fall. Yet cyclical time is quite different from linear time and us humans are the only animal that has been able to comprehend time in this manner.

The following abstract is from a detailed study about the animal perception of time and makes the point that animals are stuck in time, meaning they cannot grasp linear time, they cannot put past, present and future events on a linear timeline with a concept of 'when'. We are the only animal that understands 'when' in any detail.

Are Animals Stuck in Time?
William A. Roberts, University of Western Ontario
Abstract

People can time travel cognitively because they can remember events having occurred at particular times in the past (episodic memory) and because they can anticipate new events occurring at particular times in the future. The ability to assign points in time to events arises from human development of a sense of time and its accompanying time-keeping technology. [ED: In this paper] the hypothesis is advanced that animals are cognitively stuck in time; that is, they have no sense of time and thus have no episodic memory or ability to anticipate long-range future events. Research on animals' abilities to detect time of day, track short time intervals, remember the order of a sequence of events, and anticipate future events are considered, and it is concluded that the stuck-in-time hypothesis is largely supported by the current evidence.

[https://www.msu.edu/course/psy/962/snapshot.afs/Roberts%20\(2002\)%20-%20Are%20animals%20stuck%20in%20time_episodic%20memory.pdf](https://www.msu.edu/course/psy/962/snapshot.afs/Roberts%20(2002)%20-%20Are%20animals%20stuck%20in%20time_episodic%20memory.pdf)

A deep-sea fish has probably no means of apprehending the existence of water;
it is too uniformly immersed in it...

Sir Oliver Lodge, British scientist

Would a fish understand the concept of wet? I doubt it.

Rick Doble

An early member of Homo erectus would probably not be aware of time or the present moment. Like the deep-sea fish, he/she would be so totally immersed in the flow of time, it would be so much a part of life, that the person would not be conscious of it.

So to step from the world of the immediate present into a world where time has a past, present, and future and where time is a continuum and one is aware of the now moment, is like Alice stepping into Wonderland or Alice going Through the Looking Glass.

To understand how Homo erectus was able to conceive of time, to invent a concept of time, and then invent a language to communicate about time took perhaps a million years. It was a long and difficult process.

TO UNDERSTAND OUR OWN SENSE OF CONTINUOUS TIME, WE NEED TO FIRST UNDERSTAND HOW TIME EXISTS ONLY IN THE MOMENT

“Alice: How long is forever? White Rabbit: Sometimes, just one second.”
Lewis Carroll, Alice in Wonderland

There are some simple basic facts about time which might seem obvious but which often are missed. I have found that the obvious is frequently the hardest to explain.

**In a sense, there is only now, right now. As TS Eliot stated so well,
"Except for the point, the still point, [of the now moment]
There would be no dance, and there is only the dance. ...All is always now."**

To say it another way: nothing existed in the past unless it existed in the now moment, nothing exists in the present unless it exists in the now moment, and nothing will exist in the future unless it will exist in the now moment.

Now is the basic building block of time and without it, time does not happen. So the primary state of time is now.

But we, as modern humans, have learned to work with time as a continuous ribbon, to understand that things we do in the past have consequences for the future. From at least the age of six, when we first go to school, we are taught to build on our knowledge and our skills. Things we did yesterday will be the foundation for things we do today and tomorrow. Many people see their lives as a building that is constructed by their dedication to work that adds to their career, for example.

And because of this strong cultural bias for planning and time management, many find it hard to conceptualize a different way of understanding time. But that is exactly what I am asking you to do in the next part of this post.

WHY IS IT HARD TO LIVE FOR THE MOMENT?

Live for the moment... Indeed, all non-human species do it all the time without even being aware of doing it. But it is precisely awareness, which distinguishes human beings from other species, that makes it so hard for us to live in the present.

Human psychology is evolutionary hard-wired to live in the past and the future. Other species have instincts and reflexes to help with their survival, but human survival relies very much on learning and planning. You can't learn without living in the past, and you can't plan without living in the future.

The other reason...is that our intelligent cognition simply denies its existence. Our mind views time as a continuous and linear process. Because it is continuous, any millisecond before the present moment is already past and any millisecond later is already a future.

Eyal Winter Ph.D., *Why Is It Hard To Live For The Moment?*, *Psychology Today*

<https://www.psychologytoday.com/us/blog/feeling-smart/201609/why-is-it-hard-live-the-moment>



A STUDY FOUND THAT CHIMPANZEES LIVE IN THE MOMENT AND SO ARE BETTER AT MOMENTARY TASKS THAN HUMANS

Animals live in the moment, for the most part, and as a result are better at momentary tasks according to one study. As reported in an article from the American Association For The Advancement Of Science, recent studies have shown that animals may actually be quicker and more skilled at momentary tasks than humans.

"It would be extremely rare to find a human with the "extraordinary working memory" of a chimpanzee...but the reasons for this may stem from a tradeoff between memory and language." [ED: memory mentioned here indicates the human preoccupation with time]

"Chimps are living in the world of here and now," Matsuzawa said. "We are living in the world, thinking about the past, thinking about the future, trying to understand the meaning of what we see, and bringing the information back to friends and families and colleagues to share the experience."

Becky Ham, For Better and Worse, Chimpanzee Minds Are Much Like Ours
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (AAAS)

http://www.aaas.org/news/releases/2013/0214_primate_cognition.shtml

WHILE 'NOW' SEEMS OBVIOUS TO US, IT IS ANYTHING BUT

But our discussion of the now moment is far from over. The words 'now' or 'moment' or 'present' or 'immediate' are themselves concepts. These concepts make no sense unless a person can understand what they represent. Before these words, humans lived with an unaware experience of time that simply swept by.

To say 'now' is to be aware and conscious of the passage of time. This basic crucial step was the divide between the animal nature of Homo erectus and the beginnings of civilized human nature. Thinking 'now' puts a person outside of time, it removes a person from the flow of time. That our ancestors were able to make these first steps is remarkable, and even more remarkable that perhaps a million years later, we have developed the concepts of time that we have.

'Now' is an abstract concept, a human concept, and a difficult concept. Why is it difficult? Simple. Now is always changing. It is never the same. It is a moving point of reference and our understanding of time has to keep moving with it. What I just wrote is now past and what you will read later in this essay is in your future (if you keep reading). Yesterday has a different meaning today than it will tomorrow.

'Now' is the critical concept because everything else in time derives from it.



*Time keeps on slippin', slippin', slippin'
Into the future
Steve Miller*

Although we adults live in a time continuum, modern people still have an important need to experience the moment. When we are in the moment, our senses are heightened and our experiences become more intense. The immediacy of the moment floods our being. This feeds a need of our animal nature to return to our roots. To feel fully alive we need to experience the now moment from time to time and I believe we must do so in quite primal ways. At rock concerts many people are swept up in the sound, rhythm and crowd excitement. Music and tribal gatherings are perhaps as old if not older than language. So these concerts are reminiscent of our primitive past. Sports events, especially team sports such as football and basket ball, allow a spectator today to become immersed in the moment of action, often shouting, yelling, and gesturing -- recalling, perhaps, primal memories of the hunt when we lived in the wild. And then, of course, is the most fundamental and primal of all human activities, sex. For many people during sex, time stops or seems to evaporate.

THE BEGINNINGS OF A TIME CONCEPT

Nevertheless when this prehistoric sense of time did begin to develop, it was quite different from modern time, the time that you and I live with everyday. Just as you would be hard pressed to survive in a prehistoric culture if you were suddenly time-traveled back to a group of nomadic hunter-gatherers a million years ago, you would also have a hard time dealing with their concept of time. I believe their concept of time was much more immediate and much more grounded in the present.

I say all of this because most people I have talked to simply think that time is, well, just time. And it does not matter if this time occurred a million years ago or today, time is after all the same. In a chronological sense this is true but in a human sense, it is false. While one day a million years ago lasts as long as one today, we and these prehistoric peoples do not experience it and live within its constraints in the same manner. In fact, the two experiences of time are worlds apart. I say all of this to set the stage for my ideas about the beginnings of the human-sense-of-time.

But wait! There is still more. In order for Homo erectus to carve out the initial beginnings of the human-sense-of-time, something else crucial had to occur. People had to work on their ability to remember things including words and events. Memory must have expanded at the same rate that language developed.

To conceive of time, we must use metaphors. Time is invisible; it is not even as tangible or apparent as air or wind. Since language generally uses spatial metaphors to describe time, I think that the metaphor of carving out an expanse of time from the narrow confines of the now moment is a good metaphor.



There is direct evidence that at least some prehistoric people had an incredible memory. As I pointed out in a blog I wrote six years ago, a 'caveman', in a dark cave hundreds of feet from the entrance, painted a clearly recognizable beautifully drawn bison in color that he only could have done from memory. I am talking about the bison in the Cave of Altamira in Spain. The painting was painted perhaps 20,000 years ago. See my blog on this subject.

<https://deconstructingtime.blogspot.com/2013/01/the-genius-of-cavemen.html>

OUTLINE OF A COMPREHENSIVE HYPOTHESIS ABOUT THE HUMAN-SENSE-OF-TIME

Inspired by Daniel Everett's ideas about the development of language, I have mapped out stages for the development of time concepts in human cultures which I believe would have coincided with the development of language.

A SUMMARY OF EVERETT'S IDEAS ABOUT THE EVOLUTION OF LANGUAGE

Unlike most modern linguists, Everett believes the development of language began much earlier than previously thought. It began perhaps two million years ago with the appearance of Homo erectus (Upright man) who was an early ancestor of us modern humans who only appeared about 200,000 years ago.



Daniel Everett

He came to this conclusion after studying the very difficult language of the hunter-gatherer Piraha who live in the Amazon. The language uses only the present tense and it does not allow phrases to be nested or inserted within a sentence -- known as recursion in linguistics. So basically it is a language of direct independent sentences. Instead of saying, for example, "This is the house that Jack built." The Piraha might say "This is the house" -- referring to a specific house in the village, followed by "Jack builds this house." This directness and sense of immediacy of the Piraha have been called the 'immediacy of experience principle' by Everett who speaks Piraha fluently and is the acknowledged expert of this language. This language reflects the Piraha's point of view that everything must be related to direct experience. So they have no

creation myths, for example, which again is very unusual. Dan eventually realized that he had come across a very old basic language -- possibly a kind of language that had proceeded modern languages -- that might point the way back to the original development of language.



Members of the Piraha tribe.

It dawned on Daniel Everett that he had come upon a people who had preserved a civilization virtually unchanged for thousands, godknew-how-many thousands, of years.

Tom Wolfe, *The Origins Of Speech*, Harper's Magazine, August 2016

With the discovery of a new category of language, that of the Piraha, Daniel Everett has proposed three basic stages for the development of language:

G1: A basic language spoken by Homo erectus, our ancestor, beginning perhaps more than a million years ago

G2: An intermediate language of immediacy like that of the Piraha

G3: A modern language which uses recursion, verb tenses and a variety of ways to express time

OUTLINE OF THE HUMAN-SENSE-OF-TIME STAGES

What follows next are my time stages, T0, T1, T2, T3, T4 that I believe developed along with Everett's language stages.

T0: The bare beginnings of time and early speech:

The larger brain of Homo erectus and the species that led up to Homo sapiens may have had enhanced cognitive abilities that allowed a consideration of time, the beginnings of words and the beginnings of memory. This initial capability could have developed over a million-plus years. It was in this stage that early people began to break away from living in the now moment and began to live with a different sense of time.

T1: The earliest language of Homo erectus:

This language was probably centered around the now moment; the language strung words together like beads on a string with minimal grammar as Everett has suggested.

T2: Early nomadic, hunter-gatherer time of Homo sapiens:

This language was probably like the Piraha language; this language would have basic time concepts as needed to plan, share, coordinate, and relocate but would be primarily grounded in recent experience.

T3: Agricultural, neolithic time:

During this period people achieved an accurate measurement of the year and timekeeping of annual cycles, accurate enough for growing crops and harvesting. It was an understanding of time that was tied to the yearly solar cycle. This was probably a G3 language, but the concept of time was quite different from the next stage that I have proposed, i.e., T4. Neolithic time was cyclical, season to season and year to year. T4 or Industrial Time, is mostly linear where time continues into the future in a straight line.

T4: Man-made time; industrial time, factory time, modern time:

Our modern time is as man-made as cell phones. It is time that is precise down to seconds for ordinary people and down to nanoseconds (a billionth of a second) for computers. Time is coordinated worldwide with mandated time zones and atomic clocks. People are expected to show up on time at work and to understand work schedules and hours that businesses operate. Many things are time-stamped such as receipts, cell phone calls, and digital photographs. T4 is primarily linear time, although annual celebrations such as Halloween and Christmas are honored and are part of cyclical time.

T5: Future Time:

The civilizations of the future will have to adopt a forward-looking sense of time. They will have to plan fifty or a hundred years into the future. They will need to make plans for climate and environmental changes and also for the consequences of their

industrial production.

"Clocks slay time. Time is dead as long as it is being clicked off by little wheels;
only when the clock stops does time come to life."

William Faulkner

EXPLANATION OF A COMPREHENSIVE HYPOTHESIS ABOUT THE HUMAN-SENSE-OF-TIME

I agree with Daniel Everett that language was shaped and developed by the culture, but that culture was also shaped and influenced by its environment and by its technology. So the development of language also reflected the technology, such as Neolithic or new stone age technology.

T0 TIME: HOW THE HUMAN SENSE OF TIME BEGAN

I have suggested that starting perhaps two million years ago early members of the genus Homo may have had an actual sense of time, an enhanced sense of time, just as some animals have an enhanced sense of smell. Their larger brains and the unique prefrontal cortex led to their ability to master sequential operations and to make tools -- which required a sense of time. This sense of time then evolved, developed and expanded up until today. See my most popular article about this topic which has registered more than 6500 views and downloads.

Animal Senses Compared to the Human Sense of Time

<http://deconstructingtime.blogspot.com/2014/08/animal-senses-compared-to-human-sense.html>

Daniel Everett agrees that the unique part of the human brain, the prefrontal cortex, was critical for processes. sequences and planning. Yet he does not go one step further and say that it therefore must have played a part in the human concept of time -- although these processes. sequences and planning could not have occurred without a basic sense of time. Also notice that he says the ability to accomplish sequential actions and toolmaking prepared the brain for language -- which to my way of thinking means that a concept of time preceded the development of language.

From Daniel Everett's *How Language Began*, page 82 & page 96

-- The growth of the prefrontal cortex, itself associated with toolmaking and sequential actions, helped to prepare the brain for language, by providing the cognitive firepower necessary for actions where procedures or improvised sequences are required.

-- The manufacture of tools requires planning, imagination (having an image of what the final tools should look like) and, at least eventually, communication of some sort for instructing others in how to make tools. The sequential operations call upon the prefrontal cortex and produce cultural selection pressure for more cortical horsepower, more smarts.

T1 & T2 TIME: THE EARLIEST DEVELOPMENT OF LANGUAGE & TIME CONCEPTS

To make a convincing case about an early language, I must work backward from what we do know to what we can logically guess. We know very little about the language or the symbolisms of Homo erectus who may have been the first members of the genus Homo to use language as Daniel Everett has suggested.

But if we look at the G2 language of the Piraha, an overriding characteristic jumps out -- one which Daniel Everett has made a key point in his study of the Piraha. The language, and the culture and the way the language is expressed is ruled by what he called the 'immediacy of experience principle'.

Everett says that "the Pirahã's unswerving dedication to empirical reality" means that "the Pirahã accept as real only that which they observe, their speech consists only of direct assertions." For something to be accepted as true or worth considering a person has to have experienced it, he has to know someone who experienced it or she was able to logically deduce something from existing evidence.

John Colapinto, *The Interpreter*, *The New Yorker*

<https://www.newyorker.com/magazine/2007/04/16/the-interpreter-2>

Unlike in English, in Pirahã speakers must state their source of information: they cannot be ambiguous. Pirahã also uses suffixes that communicate evidentiality, a category lacking in English grammar. One such suffix, -xáagahá, means that the speaker actually observed the event in question...Other verbal suffixes indicate that an action is deduced from circumstantial evidence, or based on hearsay.

http://en.wikipedia.org/wiki/Pirah%C3%A3_language

This 'immediacy of experience principle' is central to the language and to the way that the Piraha think. And in connection with my hypothesis about the human-sense-of-time, this 'immediacy of experience principle' indicates that the Piraha language is grounded in the present and that recent time is most important. But this immediacy goes even further. There are no past tense verbs and there are no numbers. So things like hours of the day or two days from now could not be said by the Piraha.

Eventually Everett came up with a surprising explanation for the peculiarities of the Pirahã idiom. "The language is created by the culture," says the linguist. He explains the core of Pirahã culture with a simple formula: "Live here and now." The only thing of importance that is worth communicating to others is what is being experienced at that very moment. "All experience is anchored in the present," says Everett, who believes this carpe-diem culture doesn't allow for abstract thought or complicated connections to the past -- limiting the language accordingly.

Rafaela von Bredow, *Living without Numbers or Time*, *Spiegel Online*

<http://www.spiegel.de/international/spiegel/brazil-s-piraha-tribe-living-without-numbers-or-time-a-414291.html>

Their culture is concerned solely with matters that fall within their direct personal experience, and therefore there is no undefined past or future, only their current personal experience and living memory. They have a concept and expression Xibipíó, meaning "experiential liminality", which describes something "experientiable" or experienced. They do not value past or future, but instead focus on now, i.e. current Xibipíó = current experience. The tribe does not understand unexperienced past; i.e.

if you want to say that "he went fishing last week", Pirahã people will not believe you. First, because such concept of weeks does not exist, instead time is relative and you would have to say that it happened "small time" or "big time" ago.

Viktorija Gorcakovaite, *Happiest Tribe on Earth*

<http://fameiva.com/happiest-tribe-on-earth/>

It is important to note that the Piraha language is not 'primitive' or less useful than modern language. The Piraha language even has some sophisticated features that modern languages do not have such as "suffixes that communicate evidentiality." The language is good enough for its purpose while allowing its members to be firmly rooted in the here and now which is essential for the tribal, hunter-gatherer existence. The Piraha face extreme dangers on a daily basis from poisonous snakes, spiders, scorpions, electric eels, alligators -- you name it. They need their full attention in the moment to avoid these dangers which is why their culture is so present-oriented. The same was probably true, only more so, for a G1 language.

What this means is simple. The earliest G1 language, i.e., a language before the Piraha type G2 language, would have been even more immediate. Over perhaps a million years humans would have gradually emerged from living in the moment to a sense of time that was still quite immediate but that contained a sense of the past and an idea of the future -- a concept that the entire tribe would have needed to share so that it could work as a group with coordinated activities.

In his book, *How Language Began*, Daniel Everett has indicated that there is considerable evidence that *Homo erectus* was capable of planning. And because of that, he is quite sure they had a language. But planning can only occur if there is a shared concept of time as well.

However, initially, this sense of time would have been quite narrow. The earliest language would have been a language that developed from a people who were part animal and in the immediate moment, and part human. The human part of their brain would have contained the earliest awareness of the passage of time.

The concept of time and a conscious realization of the 'now moment' would have taken perhaps a million years to develop so that the tribe could have a common language. While we take these things for granted, these were huge steps which required an extended period to evolve.

A recently published study by the top rated research University of Edinburgh in the UK stated that, "As far back as 40,000 years ago, humans kept track of time using relatively sophisticated knowledge of the stars."

University of Edinburgh, *Prehistoric Cave Art Suggests Ancient Use of Complex Astronomy*, Sciencedaily.Com

<https://www.sciencedaily.com/releases/2018/11/181127111025.htm>

At some point when seasonal time was understood and accurately measured, timekeeping was seen as spiritual, godly, and perhaps even a gift from the gods. While we cannot say exactly when the following occurred, it provides clear evidence of the importance of time to early civilizations.

In the first book of the *Bible* (a sacred text to Christians, Jews and Muslims), in *Genesis 14*, (*Common English Bible*):

God said, "Let there be lights in the dome of the sky to separate the day from the night. They will mark events, sacred seasons, days, and years."

In Greek mythology, Prometheus, the father of mankind, also taught men how to tell time from the stars.

Prometheus said "Listen to the miseries that beset mankind--how they were witless before and I made them have sense and endowed them with reason... [They] managed everything without judgment, until I taught them to discern the risings of the stars and their settings, which are difficult to distinguish." [ED: i.e., how to tell time and the timing of the seasons by the stars]

This quote is from the ancient Greek play *Prometheus Bound* by Aeschylus, 5th Century BCE (trans. Weir Smyth)

<http://www.theoi.com/Titan/TitanPrometheus.html>

T3 TIME: AGRICULTURAL, NEOLITHIC TIME

Because of their understanding and perhaps an obsession with time, it is likely that most Neolithic agricultural languages were early G3 languages with the full ability to place past, present and future events on a timeline. And while we do not have much evidence about Paleolithic culture when it comes to timekeeping, we do have significant clear evidence from the Neolithic era.

From Newgrange in Ireland to the Goseck Circle in Germany (along with another such 140 'circular enclosures'), to the monumental works in Malta, there is clear evidence that these cultures had developed sophisticated solar instruments. These instruments and monuments and passage tombs were able to indicate with precision when the winter solstice occurred.

The passage tomb at Newgrange Ireland, for example, was carefully constructed so that sunlight would enter the tomb and light the passageway down to the end only at the time of the winter solstice.

Why was this so important? These agricultural societies needed to know the exact time of the sun's lowest point so that they could plan their planting and so that they could reconcile their calendars.

The earliest known calendars were generally lunar/solar and so it appears likely that Neolithic people had lunar/solar calendars. The moon's cycles were used for

timekeeping month to month and the sun's cycles were used for determining the seasons and timekeeping year to year. Unfortunately, the lunar and solar cycles do not mesh. This meant that these societies had to develop a way to bring their calendars back into sync each year and they did this, not through calculations -- which the Greeks and Romans would do later -- but with direct observations. And these direct observations were achieved with the aid of their winter solstice instruments -- such as the passageway at Newgrange.

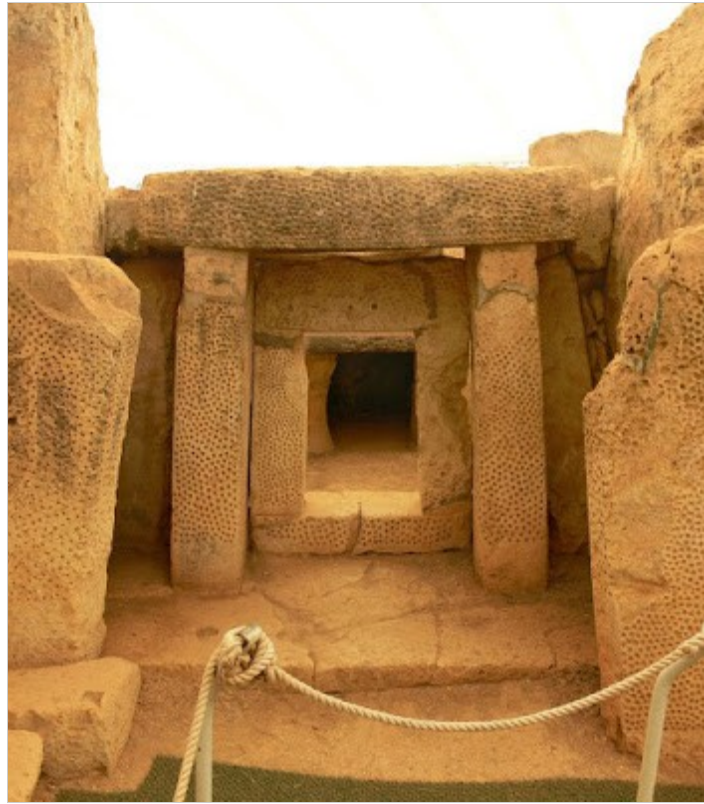
The monuments, some of which are quite big such as Newgrange, also showed a reverence and a sacredness for the passage of time.

Experts now believe that megaliths stood at the very heart of ritual practice for the networks of communities scattered across western Europe later in the New Stone Age, or Neolithic period, that had begun around 10,000 B.C. Their function was both earthly and celestial: a focus for rites concerning the movement of the heavenly bodies across the skies, a memorial to the community's ancestors, and an awe-inspiring site to cement local loyalty and solidarity.

The incorporation of astronomical alignments suggests that neolithic ceremonies were closely bound with the changing seasons. These cycles were critical to agrarian communities, whose leaders would benefit from this essential knowledge.

Michael J. Gantley, *Europe's Mighty Megaliths "Rock" the Winter Solstice*, *National Geographic*

<https://www.nationalgeographic.com/archaeology-and-history/magazine/2017/11-12/history-europe-megaliths-solstice/>



Niche at the Mnajdra South Temple, fourth millennium BCE

The southern [ED: Mnajdra] temple is oriented astronomically aligned with the rising sun during solstices and equinoxes; during the summer solstice the first rays of sunlight light up the edge of a decorated megalith between the first apses, while during the winter solstice the same effect occurs on a megalith in the opposite apse. During the equinox, the rays of the rising sun pass straight through the principal doorway to reach the innermost central niche. Quoted from Wikipedia.org

https://en.wikipedia.org/wiki/Megalithic_Temples_of_Malta

Understanding time as a continuum in a G3 language gave humans tremendous power because now they could plan and organize for the long term. But it had a downside as well. When a G3 level of language evolved, humans became fully aware of the past and fearful of their future. Humans now understood that everything had a past and came from the past. They also understood about the future -- that it was uncertain and that events which had happened in the past, such as floods, earthquakes, diseases, crop failures, and invasions, could happen again. This understanding about the past and future (a kind of linear timeline) led to creation myths which explained where the world came from in the past and a mythology of gods and goddesses who might be influenced by human rituals to assure a satisfactory future.

T4 TIME: INDUSTRIAL, FACTORY TIME

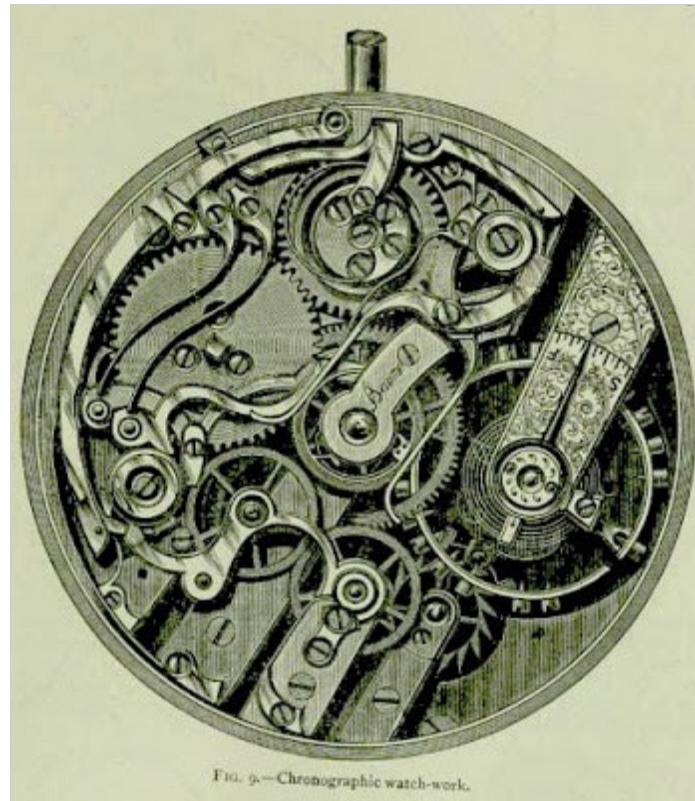
While this might seem like a stretch, I would date the very beginning of modern time with the adoption of the Julian calendar in Rome on January 1, 45 BCE. Although it is known now as the Gregorian calendar, the calendar we use today is essentially the same as Julius Caesar's with a minor tweak by Pope Gregory in 1582.

I pick this calendar as the starting point because it is solar based and no longer takes the moon into account. Before this, in Rome, the calendar was lunar/solar which caused numerous problems, such as leap months, but also maintained an awareness of the moon's cycles as time passed. The Julian calendar ignores the moon and instead requires that people look at a chart to know what day it is. This calendar begins the disconnect between the natural cycles of the moon and stars and the way that we keep time today.

Then about 200 years later the Greek astronomer Ptolemy in Egypt perfected the ancient geocentric (Earth-centered) cosmology and created a model that accurately predicted the astronomical movements of the sun, moon, and planets. He created a system of perfect circles and then circles within circles known as epicycles. His Earth-centered cosmology was quite accurate but was 11 minutes and 14 seconds too long per year, which later had to be corrected by Pope Gregory when he revised the Julian calendar. And while Copernicus-Galileo-Kepler-Newton were eventually able to establish that the Earth went around the Sun rather than the Sun going around the Earth, the geometry of Ptolemy became a model for gearing and making machines. Clocks were constructed using gears based on Ptolemy's circles within circles. It became the blueprint for large clock towers in the 1300s and spawned a belief that the Universe was a huge well-oiled clock. Then the making of clocks led to the making of machines and the Industrial Revolution -- the revolution which still continues in today's modern world.

Clockmaking was, for long, the pinnacle of mechanical arts and the training ground as well as the inspiration for practitioners in other branches of mechanics. So highly esteemed were the craft and its products that seventeenth century pioneers of the Scientific Revolution and of the 'mechanical philosophy' conceived of a planetary system as a gigantic piece of celestial clockwork and God himself as the heavenly clockmaker.

Donald Cardwell, *The Norton History of Technology*



You might think of a clock as a machine that produces the time. Yet it is still a machine. Now to take this idea one step further, we might think of an engine as basically the same as a clock, only instead of producing the time, it produces force or energy. This is because an engine relies on a clock-like series of gears and actions that must be done in sequence.

The new industry of clockmaking was accompanied by the rise of a new and very superior class of craftsmen. These men became skilled in the design and manufacture of gears and in the different ways in which motion could be transformed and applied...Inevitably, or so it seems, the clockmakers transcended their craft and before long they are to be found designing and superintending the construction of water-wheels; later still, in the early days of the English Industrial Revolution, clock- and watchmakers figured as key engineers for the construction and operation of textile machinery. There was, in fact, a direct link between the medieval invention of the mechanical clock and the enormous industrial change that began in eighteenth-century England.

Donald Cardwell, *The Norton History of Technology*

In other words, T4 or Industrial Time is man-made time. In the beginning, with the Julian calendar, people ignored the moon's cycles and referred to a chart. Nevertheless, there was a reverence for time and a feeling that time was sacred. Industrial Time then began because of the Ptolemaic model that described how the universe worked, but later disconnected from the natural world into a more abstract understanding of how gears worked which led to the development of machines and the Industrial Revolution.

Man-made clock time is an essential part of the modern world. However, with man-made time we are increasingly removed from the natural cycles of the Earth and instead governed by the artificial clock. Today we operate on Industrial Time and we also live in an environment that is almost entirely man-made, i.e., manufactured by our industries. This industrial power, based originally on the clock, is now changing the environment of the entire planet. For example, today we move more earth with our machines than are moved by the natural forces of the Earth.

Humans May Surpass Other Natural Forces as Earth Movers
<https://www.sciencedaily.com/releases/2004/07/040709083319.htm>



Traffic in Atlanta, Georgia.

T5 TIME: FUTURE TIME

About forty years ago, around 1980, scientists issued clear warnings that climate change and global warming would have major consequences in the future. The Industrial Revolution and Industrial Time have created a man-made environment that is incompatible with the Earth's natural environment. Unless humans address this situation there may be serious problems ahead. Unfortunately, things that are done today may not affect the environment for decades or hundreds of years in the future making it hard to plan.

Today, for example, Miami Beach is looking as far as 70 years ahead in their development plans because of rising sea levels, instead of the usual 20 year plans most cities use.

<https://www.remiamibeach.com/citywide/high-marks-for-miami-beach-s-resiliency-program/>

Unfortunately, in most cases, these warnings were ignored in favor of the needs of the current economies, in favor of a modern sense of immediacy. Future generations will have to plan way ahead. They will need to plan beyond their own lifespans. This will be difficult but essential if Homo sapiens are to survive.

CONCLUSION

My basic idea is quite simple. We human beings are animals who evolved from animals millions of years ago that lived instinctively in the moment and who had no language. Today we have language and a sophisticated sense of time. These are two very simple but basic facts. So how did this happen?

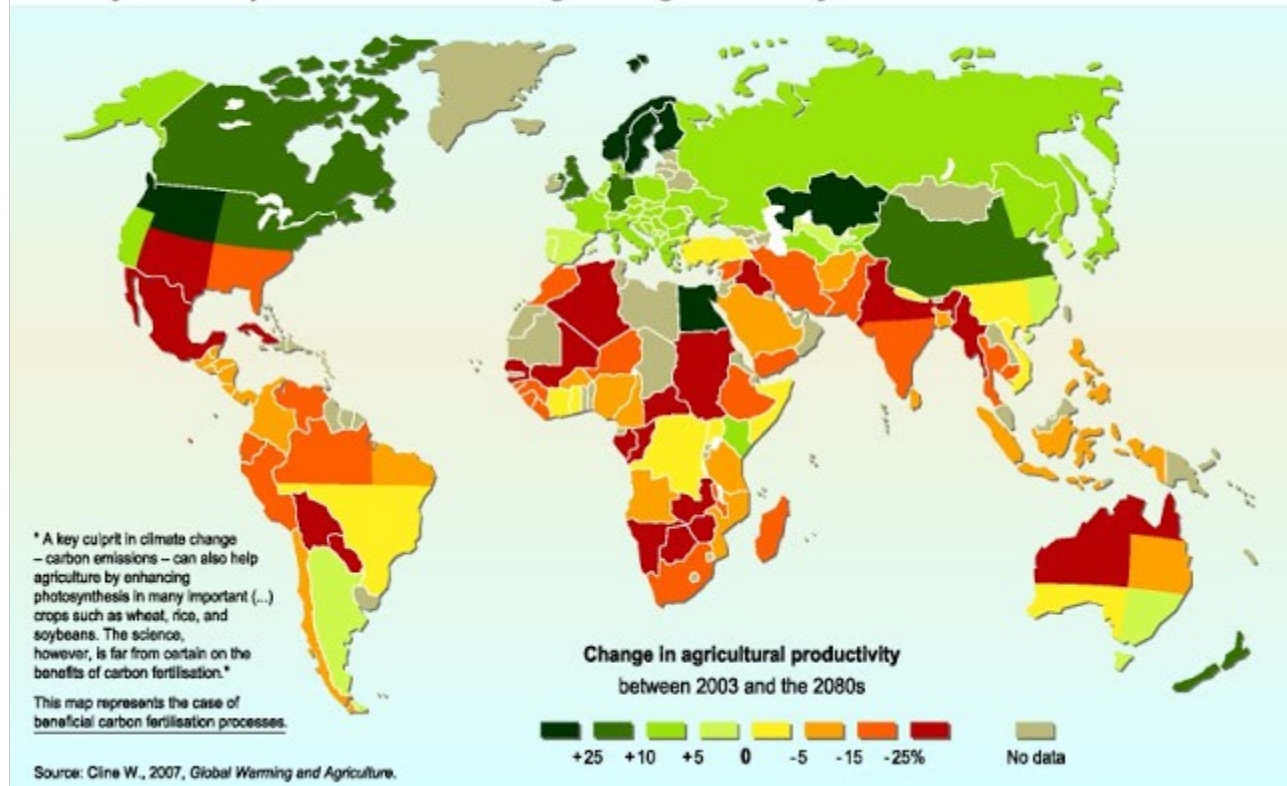
I do not believe it happened quickly but, as Daniel Everett has suggested, may have taken a million years or so to evolve. We had to become conscious and aware of time, then aware of the dimensions of time and processes in time, aware of our memories, and then aware of our projections or our imaginings about the future. It seems likely that this awareness of time evolved hand-in-hand with language which gave us the tools to both conceptualize time and to work with time -- in terms of sharing, planning and coordinating. I believe this probably happened in stages, not unlike those that Daniel Everett has suggested for the evolution of language.

Dan Everett has called language Humanity's Greatest Invention. I do not disagree but feel that we need to add the following: Language in conjunction with a sense of time is Humanity's Greatest Invention.

While language gave us the tools to communicate, our unique sense of time gave us the power to manage time. Civilization or, for that matter, any human society, could not achieve the power it did without an understanding of time: past, present, and future.

I think it is likely that both Daniel Everett's stages and mine will be broken down into smaller increments. So while I have suggested T2 as one stage, researchers might divide T2 into T2-A and T2-B etc.

Projected impact of climate change on agricultural yields



A projection of the impact of climate change on agriculture by the 2080s.