PREVIEW EDITION, MAY 14, 2017

Library of Congress Cataloging in Publication Data not yet registered.

Humanity

An Unauthorized Biography

by

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May 14, 2017

Chapter 1

The Fault in Ourselves

> "The fault, dear Brutus, is not in our stars, But in ourselves, that we are underlings." – Cassius in Shakespeare's Julius Caesar, Act I, Scene 2[1]

We *Homo sapiens sapiens* are really quite amazing. Species have come and gone by their tens of millions since life began on our planet some three and a half billion years ago. The vast majority of the losers somehow failed to adjust to a rapidly changing environment. They were either eaten by better predators, starved when they could not find food, ravaged by disease, or faced the destruction of their habitat. We have been so successful that we have no predators other than ourselves. We produce more food than we need, and we have made tremendous progress combating diseases.

We have overcome these challenges because our infantile species is the inheritor of a new bag of tricks. We can adapt faster than the pace of evolution alone allows. We can tell each other stories, and use those stories to pass down the life lessons from generation to generation. Our amazing flexibility has allowed us to spread from our African birthplace to every continent, and every reasonably sized island (and a number of unreasonably sized ones). Tens of thousands of us are flying through the air at any given moment, and more cross the oceans. Some fortunate few even fly into space. You and I are remarkable creatures indeed.

And yet we are not assured of survival. An average species, if there is such a thing,

makes it to something like a million years. Some manage to surpass ten million. Ours is so young that we cannot yet know. We may be the bright, brief victims of our own success, or we might spread our genes into the universe. It is simply too early to say.

The last substantial threat to our existence on Earth is the destruction of our habitat. It is a threat with two heads, one provided by the limits of our tiny planet, and the other by our own internal competition. The first is slow, the second fast. We will need to escape the clutches of both.

Some threats straddle the boundary between the two. Climate change is one such. We have run squarely into the limits of our planet even as we are actively reducing those limits. We must instead learn to work with a planet that is both our only home, and the place in the universe we find most accommodating.

The geologist E. Kirsten Peters has studied the long term impacts of climate change, beyond the turn of the century that most of her colleagues use as a convenient time horizon. “If we view climate changes as our enemy we will always be defeated,” she observed, “for climate will always change. Natural climate change is frequent, often extreme, and sometimes rapid.” Peters rightly points out that our planet has experienced ice ages far more often than it has the warm periods that spawned our species and its immediate predecessors. She does not deny the impact of humans on climate, but focuses on the long term. In the long term we must adapt not just to the next hundred years but to the next million or more in order to survive as a species. In that time, our planet will become dryer as it falls closer to the sun. “Our goal cannot be to hold climate static, but to understand its menacing and manic moods – and adapt as nimbly as we can to changes in whatever directions and at whatever rates they arrive.” Our culture, thinks Peters, must more optimally adapt to change.

Our immediate future holds challenges enough. We will need to act rapidly to fulfill our growing needs. We need food, energy, and shelter in unprecedented quantities. We will need to paddle ever faster to keep up with our own demands. Our track record to date – world wars, political brinksmanship, shifting alliances, the constant competition

between ourselves – strongly suggests that we are hardly adapting optimally to our large scale challenges. It is the purpose of this book to ask why, and to wonder what we might do about that. The answers that I propose are not always comfortable.

My mother was in her late eighties when she wondered why rain was noticeably more common near her Northeastern Ohio home than it had been in her youth. She had also noticed the increase in black squirrels in their small town south of Cleveland. The squirrels nested in their roof and garage, and tended to chew on their antiquated electrical wiring. She was right on both counts. Rainfall had increased by roughly 20% in her area during her lifetime, and squirrel populations were shifting. I started to explain about climate change, and how the increased evaporation of surface water from the Great Lakes was lowering lake levels, changing snowfall patterns across North America, and increasing rainfall, especially in autumn. "Oh, I don't believe in climate change", she told me.

"What do you mean, you don't believe in it?" I asked. Climate change has been thoroughly studied, and scientific consensus has been well established on the basics[2]. Yet my mother thought that she could simply choose to "believe" in it or not.

I thought of Michael Mann, the climate scientist partially responsible for the "hockey stick" graph that is the single most recognizable icon of climate change predictions. Mann had written his first self-learning computer program while still in high school, graduated with a degree in physics and applied mathematics from the University of California at Berkeley, completed three masters degrees and a Ph.D. from Yale in geology & geophysics, has published over 160 peer reviewed research papers, and is considered one of the leading climate change researchers currently active.[3] Mann has dedicated his life to uncovering the subtle records of past climate, and has invented statistical methods for their analysis. He has studied climate and its variability for most of his adult life. Mann thinks that human activity is changing the climate, along with variations from natural sources. My mother did not. She had graduated from a secretarial training program following high school, and had performed local volunteer work for

the past half century. When finding herself in a conversation that included multisyllabic words, she tended to remind people that, “There is nothing wrong with being boring.”

Although I loved my mother, and respected her dedication to her community, there was no reason to believe that she was capable of judging the truth or falsehood of climate change. I said so. Her capabilities and experience did not justify her even having an opinion. She really should accept the word of the experts unless some evidence came to light suggesting that they were lying, or mistaken. “Oh, you think you know so much. I just don’t believe it.” She would discuss it no farther.

On the February day when I was writing about my mother for this book, U.S. Senator James Inhofe of Oklahoma, a Republican, brought a snowball onto the senate floor. He stood at the podium, lifted the snowball from a bag, and said, “In case we had forgotten, because we keep hearing that 2014 has been the warmest year on record, I ask the chair: You know what this is? It’s a snowball and that just from outside here so it’s very, very cold out. Very unseasonal.”[4] Inhofe tossed the snowball underhanded toward the chairperson’s podium, where it was caught by an assistant. Inhofe’s position on climate change is not substantially different from my mother’s, with the minor exception that Inhofe is the chairperson of the United States Senate Committee on Environment and Public Works.

Why would my mother or Jim Inhofe come to think that their opinions are as valid as Mann’s or Peters’? That is a question I would like to try to address, because the answer is critical to our future as a species.

1.1 Leaders, Lookouts, and Danger

The shift of climate change from science to public policy debate, and the attendant questioning of the science itself, says more about us as a species than we might like to admit. These are not simple disagreements between reasonable people. They are indicative of a war over the definition of objective truth; who gets to define it and how

the knowledge will be used to build and maintain our societies.

The cause of our disagreements is built into the fabric of our being. It has been with us since our beginning. We need to return to our roots to see how it works. First, though, it is critical to say a few words about how we view each other.

We are so often called *Homo sapiens* that many readers might think that the the second *sapiens* in the opening sentence of this chapter was a mistake. The name separates our subspecies from our close cousins *Homo sapiens idaltu*, who died out some 160,000 years ago. Paleoanthropologists are still arguing whether Neanderthals (*Homo neanderthalensis*) should also be reclassified as one of the *Homo sapiens* subspecies. Our subspecies is currently (and rather too loosely) defined as being comprised of "anatomically modern" humanity. All of us currently on the planet, from the San people of the Kalahari to Philippine Negritos and the Tamils of Sri Lanka, from the Celts of Western Europe to the Tehuelche of Patagonia, are all members of *Homo sapiens sapiens*.

Unfortunately for those of us who would like to view the human race as the distinct object of our study, many insist on finer-grained classifications. Those classifications rely on silly and meaningless physical differences that have so little to do with our humanity, such as skin color, head shape, fat distribution, or the shape of the cross section of our hair. All of us are descendants of Africa, the first anatomically modern human beings, and we carry the vast majority of their characteristics with us today.

Groups of humans have fought with each other for all of history and probably all of prehistory. Each group defines itself as correct, right, normal, worthy, and competing groups as somehow not. We dehumanize our enemies so instinctively and immediately that it is nearly impossible to see other people for what they are – other people. The racial theories that came out of the European expansion of the fifteenth, sixteenth and seventeenth centuries of the Common Era must be mentally discarded if the remainder of this book is to make much sense. We should come to understand the concept of race for what it is; a way to separate others for our own ugly advantage.

To deny race is not the same as denying racism. Racism is the fear and often loathing

of people in other groups, and understanding it is central to my purpose. Racism is not only alive and well, but I contend that we cannot simply legislate it away. We will need to stare racism directly in the face in order to understand ourselves.

With those caveats firmly in mind, pretend for a moment that you are living on the East African Plains a long time ago.[5] You are living in a group of around forty individuals, including adults and children. Your group is led by a middle-aged male since no one in the group is very old. The leader sharpens a long stick to make into a spear, gathers most of the other adult males and goes off for a hunt. They are after some small monkeys, which they will attempt to corner and then spear. A young and overeager male, injured in an earlier hunt, stays in his bed to heal.

The females have been collecting nuts. They see smoke on the horizon, and stop for a moment to stare at it. One female howls a warning. Another picks up the cry, but the rest ignore them. They shrug and carry on. The nuts are brought to their camp and distributed, first to the high-status females, and eventually to the rest and the children. They save some for the hunters, and bring some to the injured teen.

One of the children throws a rock at a young male, a teenager. The teenager grabs the child hard by the wrist, pulls him down by a stream and hits him. The females come running at the child's screams. The mother recognizes her own child and races to his aide. Other females help. The offended male screams at them, pushes the child to the ground and strikes the mother.

The hunting party returns to the disrupted camp carrying the kill of the day. Most of the females divvy the meat while the leader disciplines the offender. The leader puffs himself up and shrieks. He hits, kicks, and bites the young male until he withdraws to the edge of the camp. More antisocial behavior will result in his being expelled from the group, and even killed if he tries to return. Banishment is almost certainly a death sentence. He wouldn't be able to survive on his own, and no other group will take him in. He submits to the leader's will with a show of submission, bowing his bruised head and holding out his hands.

The leader picks up the child, and brings him to his mother. He comforts them both. The other females look on with approval. They will back a younger male when the time comes, but that time is not yet. His leadership position is safe as long as he can settle disputes with such authority. They will trust him to handle other groups as well as he handles problems within the group.

Rain begins to fall. The group withdraws into shelter, where the meat is distributed according to rank. The leader gets the best share, but gives some of his portion to the hunter who made the kill. The hunter puffs with pride, and his social status goes up a notch in the group's estimation. A senior male grabs a big stick, clears it of smaller branches and leaves, and stands it upright. The adults, some carrying children, dance around the pole, singing in their not-very-impressive way, thankful for the feast and for a stable group in which to live. Little threatens them as long as the hunt is good and the group is held together. The group fears only the nighttime predators, the leopard, the hyena, and the lion. They think little of the diseases that kill more of their number than the predators.

It is hard to say what the group will do when the forest fire comes their way. They will smell the smoke if they are downwind, and flee before it. The flames could catch them if the wind picks up. Maybe they will get lucky, and maybe they won't. Maybe disease will decimate the group, and maybe it won't. Maybe the hunt will be good, or not. The group doesn't worry about disease, or even a far-off fire, because it cannot anticipate or change them. It worries about predators because it can anticipate and plan a response.

This was us, forty thousand years ago. The seeds of our war with each other were set into our DNA much longer ago than that.

Imagine now that you are a chimpanzee. The story above could just as easily apply to you now. There would be some minor differences only if the story included a fire, or speech more complicated than simple noun-verb relationships. Researchers over the past fifty years have watched our closest cousins dancing around a central pole, fresh

from a hunt conducted with spears sharpened with their teeth.[6] Mothers respond to the cries of their children. Group members care for the sick, and watch out for each other. Chimps choose their leader for his political skills in keeping the group together, and in resolving disputes. The followers exercise a veto power over any leader who doesn't make the grade. The degree to which chimpanzees are like us dwarfs the ways in which they are different, even though our differences are clearly important.

Some wild chimpanzees have even been observed to drink alcohol fermented from the sap of palm trees.[7] Does that sound familiar?

A human who encouraged dancing after a hunt would have given thanks to a god. He would claim special access to the spirit world, and oversee healing, dream interpretation, and the passing down of the oral tradition. We would call him a shaman. We have no idea how chimpanzees think about their compatriot with the pole.[8]

Our species surpassed the chimps and other great apes by evolving to communicate better, and so to work together more effectively. Humans also have an interesting tendency to overly imitate other people. The combination has allowed us to pass down learned knowledge more effectively. As explained by the psychologist Thomas Suddendorf,

> Great apes have some capacity for cooperation and social learning through which they maintain behaviorial traditions. However, without sufficiently sturdy pillars of imitation and teaching, neither the knowledgeable nor the ignorant are sufficiently equipped for a ratchet effect to build up an ever-increasing, cumulative cultural heritage.[9]

We communicate with each other better than any other animal. Our prominence was laid down by the time the first hominids controlled fire, some hundreds of thousands of years ago. Our split with the rest of the chimps occurred at least five million years before that.

It seems easy for people to see the differences between us and chimpanzees. We have clothing and computers and schools, and they do not. But we are more similar than we

are different. We too are bipedal mammals with grasping hands and large brains who cooperate in social groups for mutual survival. Our lineages sit next to each other on the tree of life, nearly identical in DNA, and we are much more alike in body plan, social order, diet, and probably experience of the world than we are with, say, dolphins or oak trees or fungi.

Our deep similarities with great apes are culturally difficult for some of us to accept. The ancient Greeks and Romans seem to have had no such problem. Aristotle noted it, as did the early Greek physician Galen. They were most likely influenced by the presence of monkeys and apes in areas of the world known to them, including Africa and, for Galen, the India discovered for the Greeks by Aristotle's student Alexander the Great. "Many peoples in Africa, Central and South America, and the Indian subcontinent thought of apes and monkeys as beings with some deep connection to humans," noted the dynamic science communicators Carl Sagan and Ann Druyan in the 1990s, "aspirant humans, perhaps, or failed humans, demoted for some grave transgression against divine law, or voluntary exiles from the self-discipline demanded by civilization."[10] How human it was for all of those people to understand our relationship with apes exactly backward.

It took the monotheisms of the Middle East, a place where monkeys and apes were not to be found, to rip the idea of a relationship from the minds of Westerners. The Judaic story of Exodus relates how Moses threw down the animalistic golden calf in favor of his invisible god. Christianity and Islam are the inheritors of that tradition. The barbarous Europeans required some centuries of looking around the world during their own ascendent age for Darwin and his fellow naturalists to return the connection to collective consciousness. We are still arguing over our ancestry today, as when a third of American adults in 2013 agreed with the statement that "humans and other living things have existed in their present form since the beginning of time."[11] This misunderstanding is a direct result of the desert climate around Jerusalem and the power of myths to promulgate through time and across place.

One of our most impressive leaps of cognition over the chimps is our ability to plan for the long term. We are able to store seeds so we can plant next year's crops. We can combine our ability to plan with our ability to get along so that we can construct projects that might require years of execution. Yet we have retained blind spots that threaten our existence. We plan poorly, or not at all, for situations where we cannot build consensus. We rarely listen to those on the periphery who sense something that others cannot understand. Our insistence on consensus works for us when the outlier is insane, or a conspiracy theorist, or a cult leader. Our ability to ignore dangerous outliers ensures that most of us, most of the time, won't be led too far astray. It works against us when an outlier is a genius, or a marginalized group who just happens to be right.

Our ability to plan is nearly synonymous with our definition of intelligence. The neurophysiologist William H. Calvin has noted, "When you can't think about the future in much detail, you are trapped in a here-and-now existence with no 'What if' and 'Why me?'."[12] This is how most people think about the animal mind. Animals are unable to plan well or thoroughly, unable to be fully aware of their situation and to consider the ramifications of their actions. Humans are widely thought to be exempt from these limitations. We can think about the future, and plan for it, but like our hunter-gatherer ancestors, we only think about parts of the future – those parts we think we can control. We worry about predators that aren't present, while ignoring diseases that are and fires on the far horizon until they strike us. We react to those things for which we cannot plan. We have only partially broken out of a here-and-now existence.

The failure to worry about the approaching forest fire applies, if not quite equally, both to chimps and to us. Both of our species will react when we need to, whether or not some members see far-off danger early and warn of it. *Something* is causing us to ignore our long term interests while we pursue our daily lives. Like our cousins with their own social hierarchies, we worry about our appearance, the comings and goings of temporary celebrities, or who will win the Super Bowl. We have another piece of cake instead of opting for the salad. We spend big on a vacation when we know that

our retirement savings are not where they should be. We whistle past the graveyard, pretending that death will never come to us.

Many of our long term interests suffer. Our population continues to rise, entire ecosystems are collapsing, oceanic dead zones are spreading in areas that formerly provided lucrative fishing, and the burning of fossil fuels is producing climate change. We are actively ignoring the smoke on the horizon hoping, perhaps, for a favorable wind. We seem unable even to address relatively simple problems such as the banning of land mines, or the systematic reduction of nuclear weapons. Our lack of ability to plan for all aspects of our future is endemic to the human condition, regardless of time, place, or culture.

The thing that causes us to ignore certain long term interests is our all-too-human nature, evolved over millions of years to eat, survive, and reproduce for another day, another month, or another year. We share almost all of the basics with the chimps, adding only some faculty with language, planning, and invention. Like them, we are amazingly well adapted to think in the short term, to live in small groups, and to survive in the face of predation, and minimal resources. Unlike them, we can plan for some aspects of our future. But we are utterly terrible at running a global, highly interconnected society full of people who do not look like we do, and do not think like we do. We fear when we should not fear. We compete when we must cooperate.

The desires that some of us have to explore and create have been turned from the needs of immediate survival to both the infantile and the sublime. We may choose in our leisure to be placated with entertainment, or to explore the depths of space and the breadth of time. Although most choose the former, a few have begun to find the outline of answers to humanity's most fundamental questions: Who are we? Why are we here? What is our role in the huge universe in which we find ourselves?

The answers are not always comfortable. We find ourselves caught between the ego-inflating knowledge that we possess the greatest level of intelligence we can find and the equally ego-deflating knowledge of our insignificance in the grand sweep of the observ-

able universe. “Human beings are at one and the same time”, said the Scottish novelist James Robertson, “utterly splendid and utterly insignificant.”[13] These two simple facts, uncovered with such effort and expense over centuries, collide in a disturbing way in the human psyche.

We forget how recently this upheaval has come upon us. It was only ninety years ago – only two years before the birth of my father – that Edwin Hubble realized that the universe was larger than our galaxy, and less than five hundred years since prevailing dogma assured people that the Sun orbited in the Earth. The entire social experiment that is civilization is only a couple of hundred generations old. Our way of life is changing so rapidly that it seems foreign to people a generation older or younger than ours. Our ancestors’ way of life often lasted unchanged for hundreds of thousands of years.

It is no wonder that many of us turn away from the disturbing messages of science and prefer to return to the comforts of religion. Nor should it be a surprise that the fastest growing religions are highly communal in nature. Adherents are in a very real sense returning to the beliefs of their ancestors, and more importantly to their actions, to feel more settled in the face of knowledge they find threatening, scary, and frankly dangerous.

Others, a small minority to be sure, embrace the changing worldview. It was bound to be so. Think, for a moment, about the dynamics of our traditional hunter-gatherer group. They could be anywhere. Hunter-gatherers spread out of Africa to every continent save Antarctica. Few are particularly old. Infant mortality makes the average life expectancy in the mid or late twenties, and assures that teenage pregnancy is the norm. Our modern avoidance of “children raising children” would have no place in such a society. It would be insane even to consider.

The group leader’s primary duty is to keep the group safe, and that generally means keeping them working together. Togetherness is more important than being “right”. Decisions are made to maximize group cohesion. Keeping any group of people together is never easy. The ancient Greek philosopher Plato keenly observed the problem nearly

2,400 years ago. "There is in every one of us, even those who seem to be most moderate, a type of desire that is terrible, wild, and lawless."[14] Leaders sit on this powder keg, attempting to keep the group from dissipating under the drives of their own desires.

Initiations into adulthood are brutal, and are used both to engender feelings of belonging, and to identify futures leaders. The anthropologist Kilton Stewart observed such an initiation on the Bataan Peninsula in the Philippines in the early 1950s in which the front incisors of young boys were chipped into a point:

> A block of wood was held behind the tooth of the initiate, and the point of a jungle knife was held diagonally against a corner of the tooth. It was then struck a sharp blow with a rock. It was a painful process, but the initiate was not allowed to cry out. If he did, he had to wait another year to receive this badge of adulthood. They said no one could be a good leader if he cringed at pain, and one could not be trusted unless he was willing to suffer to become one of the group.[15]

Other tribes have other initiation rites. They are all painful. The savagery of the initiations reminds us more of William Golding's novel *Lord of the Flies* than the colonial myth of the noble savage. Kilton was writing about his experiences with the Negrito people at the same time that Golding was writing his "dystopian" work. All hunter-gatherer groups, perhaps all human groups, survive by a constant process of creating and then living into their myths. Their myths constitute a practical, empirical science of psychology that keeps the group members generally happy, and bound together.

Focusing only the relationship between leaders, followers, and future leaders leaves out much of human experience. We do more than fret about keeping groups together, and more than worrying about eating, status-seeking, and breeding. Importantly, some people, like Michael Mann, do try to uncover non-obvious facts about the world around us. That sort of information gathering has been critical to our success. How then to model this missing, but important, element of human behavior?

There are many models of human psychology, but there is one that has been used to describe the intersection of politics and behavior for millennia. That model addresses how evolutionarily-driven aspects of group behavior affects our politics and our social fabric. Plato noticed that people may be categorised by their own desires, for wealth perhaps, or for notoriety. Maybe they just want to be the most attractive to the opposite sex. Individuals have within themselves the panoply of human desires, but some come to dominate.

Plato modelled three aspects of personality. There was reason even in the fourth century BCE to adopt a three-part model. Traditional human societies, what we would now call hunter-gatherer groups, typically have three defined roles: a leader, a shaman, and everyone else. In a traditional society, all three roles exist in balance. The leader leads. The shaman investigates, and serves as a bridge to those aspects of experience that bedevil humanity, from dreams to illness. The leader thinks about group cohesion, the shaman thinks abstractly of knowledge. Followers are then freed to pursue every other facet of human concern, including passing on the best genes to the next generation.

Those three roles, argued Plato, were core to the human condition. He might very well have been right. Those roles, as far as we can currently determine, were stable in anthropology for more than 90% of modern humanity?s history. There is some evidence for their basis in our biology. Civilisation changed the balance between them, but not their existence.

Stories, most of them cautionary, are passed down from an elder shaman to a young apprentice and recited at routine gatherings. These stories represent the collected wisdom of the group. The shaman controls the stories and may highlight or suppress warnings to the group. His claims of supernatural control give him power and often cause his social isolation. The shaman and his apprentice may live with the group, or be ritually cast out and thereafter not allowed to mingle with the rest. There are many variations. In each case, though, the shaman is the “one who knows”, and his powers may be used for good or ill. It is the shaman that protects, and the shaman who is simultaneously

feared. Illness is considered to be the work of evil spirits or of shamans in rival groups.

It is the shaman that oversees healing, and intercedes with the spirit world. The explorer and anthropologist Sir Everard im Thurn, a magistrate in British Guiana in 1883, explained "The [shaman] has power depending on his knowledge of the medicinal value of herbs... the importance of the shaman [is] that he deals both with body and with spirit, that he is both doctor and priest."[16] The shaman taps into the dream world, a place understood to be as real and tangible as waking existence. Sick people look for answers within their grasp and to their shaman for help.

The geographer Jared Diamond, who has explored much of the Papua New Guinea Highlands, says of shamanistic healing,

> The shaman's bedside manner relieves the patient's fear and may provide a placebo-based cure; assigning a cause to an illness, even if it's not the right cause, makes the patient feel better by letting him adopt some action rather than waiting helplessly; and if the victim does die, it may mean that he sinned by violating a taboo, or that a powerful sorcerer was responsible who must be identified and killed.[17]

Shamans do have many legitimate medicines at their disposal, empirically discovered and passed down by word of mouth. They possess an intimate knowledge of nearby plant life and whether the effect of each is positive or negative to health. Some reduce swelling, others calm digestion, or induce sleep. Some kill. The placebo is far from their only trick.

Hunting and killing rival shamans is a major cause of inter-group violence. The ensuing battles help to mix the gene pools when women are captured and brought home by the victors. Trade, warfare, raids, begging, each society chooses a technique to ensure that marriage occurs outside of one's tiny little kin group.

The headman, the one who leads, is often in conflict with the shaman, the one who knows. The leader relies upon the shaman when something, anything, happens that he

doesn't understand. This includes disease, bad dreams, the safety of food, the irritants of insects, and, critically, some of the interactions with other groups. But the leader can never forget that his main task is to keep the group together. He will do that in preference to the shaman's concerns at every opportunity.

Stress is relieved by the time-honored techniques of song, dance, and trance.[18] Special holidays are defined by the oral tradition. The group may prepare for weeks or months, and then culminate in a feast, dancing, and more stories. Both adulthood rituals and allowance of first mating are tightly controlled by the elders. Lack of food or an unexpected pregnancy result in unapologetic infanticide, or geronticide, the abandonment or poisoning of the elderly. The practice is illegal in all modern countries, and historical examples are rare. There is evidence for the occasional practice called *thalaikoothal* in Tamil Nadu, a state in India.[19] Other cultures that retain legends of historical senicide include Japan (*ubasute* "abandoning an old woman" and *oyasute* "abandoning a parent"), Sweden (*ättestupa*), and Serbia (*lapot*). Those doubting that these legends reflect fact might note that the original Greek version of the Hippocratic Oath made doctors promise "Nor shall any man's entreaty prevail upon me to administer poison to anyone", which rather infers that some people did ask doctors to do just that.[20]

The shaman makes good use of the analgesic effects of song, dance, and trance is his own practice. He will use misdirection, the appearance of magic, and outright lies to convince his patients of his powers.[21] His goal is to encourage a placebo effect. He is well aware of the concept, even though he has no scientific understanding of it. He might throw his voice, adopt different voices, use hallucinogens on himself and his patients, or use any number of tricks to cover the gaps in his knowledge. He may tie leather throngs to his toes, and obscure them with rugs or skins, to shake a tent's sides when a "spirit" is supposed to be present. He may hide a rattle, or a drum, under his clothes. His secrets are closely guarded, even from his apprentice. He will prefer, however, to first use any real knowledge he has. Which plants work for which symptoms? Which foods are most nutritious? Where will the game be, and when? He will be an expert in everything that

moves and changes within the tribe's range. There is much he knows, and much that is beyond him.

And yet, members of a hunter-gatherer tribe may be better adjusted people than we are. They are often well satisfied, have a sense of belonging, fear less, or at least grieve effectively. They look after each other and are much less alone than we are. That is not to say that they are more healthy, or more safe. Our modern societies are the exact reverse of our natural state; we are more healthy, and more safe, but less satisfied, and more fearful. Through much effort, we have traded one type of security for another.

How did we get here? It was once thought that humans evolved their larger, and more complex, brains in order to walk. That theory was disproven by the existence of the famed Lucy, a 3.5 million year old *Australopithecus afarensis*. Lucy was well adapted for walking in spite of her otherwise chimp-like brain. Stone tools and control of fire were later thought to be the triggers, but the possibly 2.8 million year old *Homo habilis*, and their immediate descendants *Homo erectus*, both of which had fire and stone tools, had cultures that remained nearly unchanged for two million years. *Habilis* and *erectus* were no more seemingly inventive than a bower bird, or a paper wasp, and maybe even less inventive than a crow. Yet the brains of our ancestors grew steadily larger during this period. Why? Because our ancestors were evolving to get along with each other.

Our brains reached their current size around one hundred thousand years ago, even though "culture" – an explosion of tools, decorative art, evidence of individual identity, probably sophisticated language – didn't occur until forty thousand years ago. The time in between was embedding the patterns of human group dynamics into our very selves, iterating experimentally from the foundation handed down from our last common ancestor with the chimpanzee.

This is our heritage, the environment for which we are adapted. The problems we face today, our struggles to get along with outsiders, our need to form small groups, our desire to keep the scary shaman away until we need his help, are buried deeply

within ourselves. We are the products of our traditional environment, evolved primarily to get along with our small little groups. We will greet a stranger, but constantly look for threats, and for guidance from our leaders. An initially friendly encounter can turn rapidly ugly if our leaders decide that it should.

We banded together to overcome those feared predators of the night. They, after all, do not work together nearly as well. We may not have the fiercest teeth, nor the biggest claws, but twenty spears arrayed in a simple phalanx makes that matter not at all.

Disease once kept us in check when predators no longer could. The adoption of settled agriculture since the end of the last ice age damaged the health of its adherents by reducing the diversity of their diet and closely associating them with both domestic animals and their own waste. We have overcome those issues to a large degree. We know to separate our waste, and our animals. We grow much more food than we need, and adjust reasonably well to local floods and droughts. We have cured many diseases, and can treat many more. We have dominated our environment in the ways we always wished to. Predators cannot visit us in our homes. We have all the food we want, including those tasty sugars and fats.

We subconsciously demand those things that were rare in our natural environment. Sugars, fats, salt, shelter, safety and personal good health are all on that list. It is our constant striving for those rare items that made an enemy of nature as soon as we had the powers to take it on. Nature was dangerous to us, so we have become dangerous to it. Our evolution adapted us to strive, not to succeed. Having succeeded, we can suddenly get all the rare things we want. Unfortunately, we still want so much sugar and salt that they make us sick. We want glittery diamonds from deep mines that require a horrible human cost to extract. We want lights to take away the dark nights, and rapid means of travel, whose energy requirements cause us to ruin our own ecosystem. These are all, in the words of historian Ronald Wright, “progress traps”.[22] Our success is as bad for us as it is good for us. Our progress can cause us to create new problems that we cannot always solve.

Our cooperation won us a planet. Our insistence on cooperation blinds us to some very particular dangers. We now fight the most important war of all; the war to survive when we face dangers most of us cannot see, and cannot verify. How many of us can keep up with the flood of new scientific discovery, much less integrate those findings into our lives? How many of our politicians can make policy informed by good science? How many want to? We are caught between a desire to maximize the cohesion of our tribes, and a need to break free of such Stone Age concerns.

A proximate result of our victory has been an explosion in our population. Our numbers have doubled, and doubled, and doubled again in the last few generations, at the same time that our lifespans have increased. Our demands for fresh water, food, medicine, shelter, clothing, have never been greater. Those demands are not a little bit greater. They are utterly unprecedented. We have had to tie our food production to technological mechanisms in order to grow enough food, using petrochemicals both to fix nitrogen into the depleted soils and to transport harvests from distant farms. A conservative estimate suggests that between 30 to 50 percent of all crop production globally is now dependent upon nitrogen fertilizers.[23]

Of even more concern is that humans are drawing water from approximately one third of our planet's global groundwater reservoirs faster than they are being refilled.[24] We are literally consuming the planet in ways that it cannot accommodate.

Perhaps we could continue to stay ahead of our challenges if our minds could adjust to the new scale of our societies. But that is a chasm we cannot easily cross. Millennia of natural experiments have shown us that culture alone won't do it. Our governments worldwide, regardless of philosophy or structure, are run by small groups of small groups, each with a leader, followers, and some shamans – some healing and some malevolent. It is the human group dynamics of the hunter-gatherer tribe that threaten our survival now. It is those dynamics that we must understand, and possibly change, in order to ensure our survival as a species.

1.2 Defining Truth

The hidden pattern of human group leadership, the inward-looking leaders and the outward-looking shamans, worked so well that it may have become embedded in our physiology. We are born with the ability to fit into small groups, and to be a follower, perhaps a leader, perhaps a shaman. We all have the ability bend over backward to keep the group together even when it is demonstrably wrong about something specific. We tend to fear the shaman, and try to keep him at bay. We will react as slowly as time seems to permit to his warnings. We would immediately react to a sighting of a tiger, but merely cower at the warnings of a displeased deity. We fear when we are ill, never anticipating that day will come, and only then put our lives in the hands of the one who knows.

Is there then a "gene for" shamanism, or for leadership? The situation is almost assuredly not that simple. It it possible that minor variations in the levels of certain neurotransmitters and hormones account for the expression of these ancient roles. Personal choice also sometimes applies, as does familial expectation. Some, to paraphrase an old saw, are born, some are made, and some have leadership or shamanism thrust upon them.

We know, for example, that leaders typically have lower than average levels of the stress hormone cortisol, and higher levels of testosterone. This is true for both men and women. These levels vary naturally depending on many factors, including genetics, environment, age, and levels of physical activity. They can also be intentionally changed through our actions. It seems that adopting so-called "power" postures reduces stress and increase feelings of confidence.[25] Some studies have suggested that a mere two minutes of standing with your feet widespread, your arms raised above your shoulders, and your chin lifted can decrease levels of cortisol, and raise levels of testosterone.

The opposite is also true. Sitting with an inward, closed posture, such as crossing your arms and legs, can raise cortisol levels and decrease testosterone as blood flow is reduced in the carotid arteries. These are postures of concentration, and are commonly

associated with both depression and with deep insights. Those studying difficult topics, such as mathematics, writing poetry or solving computer programming problems will typically unconsciously adopt such postures. They are postures of shamanism.

Although the details of hormone balances, and their manipulation, are still being worked out, it is clear that hormones such as cortisol and testosterone play important roles in how we act.

There is more. Leaders are most often gregarious extraverts, whereby shaman have a much lower threshold of emotional arousal, as mediated by the neurotransmitter dopamine.[26] Extroverts get a bigger rush from the brain's reward system than do introverts, especially when a gamble pays off. This extraverted behavior correlates well to the presence of a particular allele on the dopamine D2 receptor gene, according to a 2005 study. The authors of that study noted, "These results demonstrate a link between stable differences in personality, genetics, and brain functioning."

So leadership and shamanistic traits may be functions of the physical body. There are multiple genes that impact leadership and shamanistic behaviors as well as environmental, and behavioral factors. It takes more than a gene or two to make a leader, or a shaman, but the potential is probably encoded within us.

Leaders and shamans are locked in a timeless struggle to define truth for their societies. Which is more important in a given situation, an external threat or group dissolution? Most often, preference is given to the latter, which keeps us shielded from the objective truth of the outside world. Leaders fear internal dissent more than anything else. This makes sense as a way to maximize our survival under almost all conditions. Our individual desires could lead us in many directions. It is only by working together that we can survive and thrive.

Leaders and shamans compete fiercely, as with the current arguments between the Intergovernmental Panel on Climate Change (IPCC) and the Republican Party in the United States over climate change policy.

The headman has grown into the politician, continuing to keep control over group

cohesion. The politician is just a headman in a suit. Objective truth is not nearly as important to a headman as stability, and consensus. Each one will rally their followers to create a bond, a sense of identity, and a wall against the darkness. The leader is still the leader, whether in a hunter-gatherer tribe or a billion-person country. Religion, and its intimate associate nationalism, are still the leaders' tools of choice for keeping social order. Religion is, as it ever was, "regarded by the common people as true, by the wise as false, and by rulers as useful."[27]

The shaman, however, has fared less well since settled agriculture changed our ancestral dynamic. The shaman has split into the academic, the scientist, the engineer, the journalist, and the sometimes the priest. The shaman is, then as now, a specialist. He is the very archetype for the specialist. As the "one who knows", the shaman has been both the one to apply knowledge for the good of society, and the professional outsider who looks outward for danger. The IPCC is a gathering of shamans, as is the International Astronomical Union.

Shamans often adopt pseudonyms that proclaim their knowledge, such as Internet "gurus" or coding "wizards". Neil deGrasse Tyson, director of the Hayden Planetarium in New York City and a popular science communicator, wrote a magazine column for many years using the pseudonym "Merlin". Our term for a learned person, "doctor", applies to both medical and research professionals. Leaders, by contrast, are the "head" of an organization, a "great general" or "captain of industry", or most tellingly, "father". Our languages echo with the self-aggrandizement of shamans and leaders as they stake out roles for themselves.

The ancient partnership between the leader and shaman is no longer a close one. Leaders can ply their trade just as well when populations grow, but shamans can no longer easily override consensus in times of danger. The larger the group, the less power shamans have over the minds of the people. Most people most of the time will regard the inward-looking leaders before the outward-looking shaman.

We can now see more clearly the relationship between Michael Mann the shaman,

my mother the follower, and Senator Inhofe the leader. People often question what Inhofe actually believes. We can see that it doesn't matter what he believes. He might be an atheist, or a homosexual, or accept evolution and climate change. We will probably never know. We can judge, however, that he has based his actions on fostering strong group cohesion in order to allow him to lead. He has guaranteed himself electoral victories for thirty four of the last thirty seven years by echoing what the people want to hear, and encouraging them in their beliefs. Leaders are the same in that regard from a chimpanzee troop to the pinnacles of modern politics.

My mother's role also becomes more clear. We can see that she does not wish to contemplate the entirety of the universe. She does not wish to be made to feel small, nor to worry about threats that are far off, or over which she has no personal control.

Michael Mann is fighting an uphill battle, as shamans always do. He has come to see a distant forest fire and must now raise the alarm. Like with our ancestors, rising his message above the noise of daily life is the challenge. Mann published key climate modeling formulae and directions to use them in *Scientific American* magazine in March 2014. He provided all the directions one needs to perform the calculations, including links to raw data and software tools from the Pennsylvania State University Department of Meteorology.[28] He also published his results to the same analysis so that people can directly compare them to their own results. I'm certain that my mother never took him up on the offer and am willing to bet that Senator Inhofe has not either. Education is not in itself sufficient to change the dynamic between leaders, followers, and shamans.

Our desire to put group cohesion in front of objective truth limits our ability to react quickly to threats. This effect is particularly pronounced when a threat is too obvious to our shamans, yet cannot be seen by our people. But our mechanisms of group cohesion most often dominate over our fear of the shamans' warnings. Perhaps our group memory includes some knowledge that the traditional shaman includes the placebo, and the parlor trick, in his medicine bag. Suspicion of shamans may be as inbuilt in us as dependance is.

There are also tremendous practical temptations for our leaders to deny the largest challenges of our time. They need to worry about employment, safety, and, most importantly, the actions of other leaders that might diminish their own actions. At the highest levels and at the lowest, group cohesion is the key to their troubles. It is simply not their job to worry about the true nature of the universe.

The attempt by shamans to educate the public can and does cause a backlash by leaders. Two examples should serve to illustrate what happens.

In December 2014 and January 2015, the office of Governor Scott Walker of Wisconsin proposed changes to the University of Wisconsin's mission statement as part of the administration's annual budget request.[29] The proposal attempted to remove the search for truth from the university's mission, and to replace it with the goal of meeting the state's workforce needs.

The original mission statement reads:

> The mission of the system is to develop human resources to discover and disseminate knowledge, **to extend knowledge and its application beyond the boundaries of its campuses** and to **serve and stimulate society by developing** in students heightened intellectual, cultural, and humane sensitivities, scientific, professional and technological expertise, and a sense of purpose. **Inherent in this broad mission are methods of instruction, research, extended training and public service designed to educate people and improve the human condition. Basic to every purpose of the system is the search for truth.**

The governor's proposal would have changed the mission statement to read[1]:

> The mission of the system is to develop human resources **to meet the state's workforce needs**, to discover and disseminate knowledge, and to

[1] Emphasis was added to both versions of the mission statement to more clearly identify the changed areas.

> develop in students heightened intellectual, cultural, and humane sensitivities, scientific, professional and technological expertise, and a sense of purpose.

This is a clear example of the tension between leaders and shaman. Academics and journalists predictably responded with appeals to objective truth – exactly the item under attack.

Governor Walker backed down in this case by declaring that the changed language was a "drafting error". Independent investigation by the Milwaukee Journal Sentinel uncovered documentary evidence that the changes were intentional.

A similar, and more successful, attempt to control the promulgation of objective truth was perpetrated by the administration of Governor Rick Scott in Florida. Governor Scott took office in 2011. His administration immediately, and apparently verbally, instructed the state's Department of Environmental Protection to ban the terms "climate change", "global warming", and "sustainability" from its written documents.[30] The ban was uncovered by the Florida Center for Investigative Reporting and its media partners by interviewing current and past officials.

The threat of climate change to Florida's beaches and wetlands has already become noticeable enough to require practical responses. In February 2015, Governor Scott began to use the term "sea-level rise" without rescinding the earlier ban.

U.S. Republicans are hardly the only leaders who deny objective truth as uncovered by science. Members of the Democratic Party also deny the findings of science when they help to foster group cohesion. The primary current examples are the efficacy and safety of vaccines, and the safety of genetically modified organisms (GMOs) used in the food chain. Leaders elsewhere feel free to deny other aspects of science, including mainstream Christian, Muslim, and Jewish religious leaders (and a few Hindu and Buddhist sects) who claimed that the 2004 Indian Ocean tsunami was literally an act of a vengeful god against people who were inadequately observant of their religious duties.

We can only shake our collective heads at others, such as Saudi Sheikh Bandar al-

Khaibari, whose YouTube video went viral when he claimed in early 2015 that the Earth is "stationary and does not move".[31] Sheikh alKhaibari used Quranic quotations, and his own version of logic to explain to university students that one could not fly from Saudi Arabia to China if the Earth was rotating because the airplane would get there rapidly in one direction, but could never reach the destination in the other. Of course, the Earth's atmosphere is rotating along with the planet, from West to East. There is a difference in flight times, but they are due mostly to prevailing winds caused by the planet's rotation, as published airline schedules clearly show. It is unknown whether the cleric had reviewed French physicist Léon Foucault's visible proof of Earth's rotation using a pendulum, or whether he understands that a three-person crew on the International Space Station was orbiting the spinning Earth when he published his video on the Internet. It is a major problem for shamans that leaders find so much of objective truth to be nonintuitive, and therefore often unbelievable.

We can dismiss leaders who reject science as crazy only when they do not hold power. We must realize that many of them do, in fact, have power to influence and control.

We have discovered that the universe is a logical place, and follows understandable rules. It is time that we noticed that it is we ourselves who do not see its workings as logical. We are ruled by our own internal dynamics. They keep us working together for our survival in small groups, as if we were still alone in the vastness of a wilderness. It is not the universe that needs to change, it is us.

The pace of change wrought by our science has reached a breaking point with our Stone Age brains. Leaders like Senator Inhofe, Governor Walker, and Governor Scott are following an imperative written into our species in that ancient time. Their insistence on fostering group cohesion at the expense of objective truth is increasingly at odds with the challenges of our times.

Will we go into our new millennium carrying our Stone Age baggage, or will we begin to make ourselves into better people? Perhaps it is time for us to rebalance our

desire for group cohesion with our desperate need to accept objective truth.

Until we do, we will remain scared little monkeys huddled together in the storm.

Notes

[1]Gaius Cassius Longinus was a real life Roman senator, and leader of the plot to kill Caesar. The quote may be found in Act I, Scene ii, lines 140-141.

[2]For differences between scientific consensus and the American public's understanding of consensus, see the survey by Pew Research Center, [125].

[3]Michael Mann's official biography is available from Pennsylvania State University at http://www.meteo.psu.edu/holocene/public_html/Mann/about/index.php retrieved 26 October 2015. Additional biographical details came from his published curriculum vitae at http://www.meteo.psu.edu/holocene/public_html/Mann/about/cv.php retrieved 26 October 2015 and [111].

[4]Senator James Inhofe's throwing of a snowball on the floor of the U.S. Senate was reported by ABC News on February 26, 2015 (see http://abcnews.go.com/Politics/sen-jim-inhofe-throws-snowball-senate-floor-attempt/story?id=29255635 retrieved 18 April 2015).

[5]The hunter-gatherer scenario was developed by reading a large number of anthropological works, especially [71], [72], [22], [40], [42], [43], [129], [135], and [161].

[6]Wolfgang Köhler's primatology studies from the 1970s reported the dancing of a group of chimpanzees around a central pole. This probably relates more to group dynamics than religion per se, but it provides a fascinating continuity of behavior from our closest extant ancestors and the earliest human religions, regardless of the human justifications for the action. The observation is in Köhler's The Mentality of Apes[93]. A useful discussion on Köhler's study and its wider context is to be found in the first volume of Joseph Campbell's The Masks of God series, in the first volume, Primitive Mythology[22] (pp. 358-359): "It seems to me extraordinary," Köhler concludes, "that there should arise quite spontaneously, among chimpanzees, anything that so strongly suggests the dancing of some primitive tribes." On the same page Campbell says:

> We note, furthermore, the surprising detail of the central pole, which in the higher mythologies becomes interpreted as the world-uniting and supporting Cosmic Tree, World Mountain, axis mundi, or sacred sanctuary, to which both the social order and the meditations of the individual are to be directed. And finally, we have that wonderful sense of play, without which no mythological or ritual game of "make believe" whatsoever could ever have come into being.

Evidence for wild chimpanzees (*Pan troglodytes verus*) making and hunting with spears is provided in [133]. Interestingly, female chimps make and use spears more often than males: "Males accounted for 70% of all captures but hunted with tools less than expected based on their representation on hunting

days. Females accounted for most tool assisted hunting." The only known chimpanzees that hunt with spears live in Sénégal.

[7]Wild chimps (also *Pan troglodytes verus*) at Bossou in Guinea, West Africa were reported to consume alcohol in the form of ethanol from raffia palms in [76]. The animals soaked up the liquid using porous leaves formed into a sort of sponge.

[8]There is surprisingly little agreement about just how aware (or "conscious") chimpanzees and other great apes are of their actions as compared to humans. Thomas Suddendorf nicely summarizes the difficulties in interpreting the available science in [164], starting in chapter 3.

[9]Suddendorf, chapter 9.

[10]The quotation regarding our cultural relationship to apes and monkeys is from Sagan and Druyan, Shadows of Forgotten Ancestors[146]. The Scopes "monkey trial" and Thomas Huxley's retort to Bishop Wilberforce commented upon in the same work (pp. 72) also relate.

[11]Poll results regarding Americans' views on evolution came from Pew Research Center's 2013 poll on religion and public life, [124].

[12]Calvin further suggested in [20] that the "development of long sentences–what modern children do in their third year–was the most likely trigger" of creativity about 50,000 years ago. Mental creativity is in turn responsible for the ability to have a detailed conversation, internal or external, and leads to story telling – to pass down knowledge, to entertain and eventually to control. Like any features driven by evolution, creativity and long term planning are built on an older foundation, and from existing components. They give us certain abilities, but should not be seen as providing a completely general view into the future. That is something we assuredly do not possess.

[13]Quoted from his novel The Testament of Gideon Mack[144].

[14]Plato's quote is from The Republic, Book IX, [128]. An alternative translation is available from http://classics.mit.edu/Plato/republic.10.ix.html retrieved 6 May 2015.

[15]Published in Pygmies and Dream Giants, [161], pp. 104.

[16]Quoted in [129], pp. 200.

[17]The World Until Yesterday, [43], pp. 339.

[18]The nice phrase "song, dance, and trance" was borrowed (with permission) from J. Anderson Thomson, and is used in both his public lectures and his book [169].

[19]A description of modern senicide in Tamil Nadu may be found in [91].

[20]An English translation of the original Hippocratic Oath is to be found in [29].

[21]For a description of a shaman's use of tricks, see Harris, Our Kind, [72], pp. 411.

[22]Ronald Wright describes progress traps in A Short History of Progress, [180].

[23]An estimate of the percentage of crops which are dependent upon nitrogen fertilizers is provided in

[162].

[24]Stress on global groundwater reservoirs was estimated by researchers primarily at the University of California, Irvine, using NASA's Gravity Recovery and Climate Experiment (GRACE) satellites. The studies may be found in [141] and [142]. A related NASA press release from 16 June 2015 is available at http://climate.nasa.gov/news/2297/ retrieved 26 June 2015.

[25]The use of so-called "power poses" to lower the stress hormone cortisol and raise testosterone have been studied by social psychologist Amy Cuddy and her colleagues at the Harvard Business School. Cuddy's TED talk on the subject [31] has been viewed more than 37 million times by 11 December 2016, and ranks as one of the most popular talks published by that organization. An earlier version of her ideas were presented in a video published on the Harvard Business School blog at [30]. However, some recent studies have called this research into question. [136] failed to replicate the original study's findings, and [153] suggested there was no effect based on statistical evidence. Cuddy and her colleagues stand by their evidence as of [32]. Further work will be necessary to settle the issue conclusively.

[26]The study that demonstrated genetic differences between how introverts and extraverts process stimuli is [27]. The authors specifically say, "Here, we show that individual differences in extraversion and the presence of the A1 allele on the dopamine D2 receptor gene predict activation magnitudes in the brain's reward system during a gambling task." Similarly, the study at [39] reported on varying responses to drug rewards by extraverts and introverts. The authors note that, "The findings suggest that extraversion is associated with variation in the acquisition of contexts that predict reward." That is how an introverted shaman defines leadership traits!

[27]The provenance of the quote about religion ("regarded by the common people as true, by the wise as false, and by rulers as useful."), widely attributed to the Roman philosopher Lucius Annaeus Seneca, called Seneca the Younger, (c. 4 BCE – CE 65) is disputed. It definitely appears in Edward Gibbon's The History of The Decline and Fall of the Roman Empire, in Volume I of the original 1776 edition, and in [66], pp. 35., as "The various modes of worship, which prevailed in the Roman world, were all considered by the people, as equally true; by the philosopher, as equally false; and by the magistrate, as equally useful."

[28]Michael Mann published climate data and tools to validate his calculations in [112].

[29]Wisconsin Governor Scott Walker's attempt to change the mission of the University of Wisconsin to remove the search for truth was documented by Politifact on February 6, 2015 (see http://www.politifact.com/wisconsin/statements/2015/feb/06/scott-walker/despite-deliberate-actions-scott-walker-calls-chan/ retrieved 10 March 2015.

[30]Florida Governor Rick Scott's banning of the terms "climate change", "global warming", and "sustainability" from written documents of the Florida Department of Environmental Protection under the

administration was documented by the Florida Center for Investigative Reporting on March 8, 2015 (see http://fcir.org/2015/03/08/in-florida-officials-ban-term-climate-change/ retrieved 10 March 2015).

[31] Saudi Sheikh Bandar al-Khaibari's views on the shape of the Earth were reported by Al Arabiya News on February 16, 2015 (see http://english.alarabiya.net/en/variety/2015/ 02/16/Saudi-cleric-Sun-revolves-around-stationary-Earth.html retrieved 10 March 2015.