Creating the Future
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Chapter 3: Where did we come from?

3. Where did we come from?

The time's they are a changing

Bob Dylan

Toto, I've a feeling we're not in Kansas anymore

Dorothy

Who are we? Why are we here? Where did we come from? These sorts of questions have likely been on our minds ever since our species gained consciousness. The answer seems to depend on whom you ask. Philosophers and early scientists up to the end of the 18th century could only speculate. For example, they imagined that the universe as a whole followed the life cycles they saw in themselves and their environment. It was born, it grew, and it would eventually die. Thinking positively, it would be followed by another world that was more complex and more perfect. Other people who did not interpret the Bible literally added the possibility that animals that lived in the sea evolved to live on the land.

In the 19th and early 20th centuries scientists such as Alfred Russell Wallace and Charles Darwin took this evolutionary possibility as a starting point. From their observations of the world, Wallace and Darwin guessed that plants and animals evolved through a process called *natural selection*. They saw that plants and animals around the world had somehow adapted themselves to a remarkable range of environments, and suggested that this could have happened by a gradual process in which slight variations were inherited by the next generations. For example, a particular characteristic might help a plant grow better in a certain climate, and as a result this characteristic would be favored and passed along to the next generations. It would be naturally selected over other characteristics that were not as useful.

In the 20th century, scientists developed a far richer understanding of evolutionary processes. They used new techniques and technologies and were able to develop a clearer picture of how our world and our species evolved. For example, they discovered and carefully examined campsite remains, tools, footprints, and DNA evidence to learn how early humans looked and acted. Work by scientists such archeologists and paleontologists continues to give us insights on where we came from.

This chapter is about what these scientists have learned, but before getting to that, it's important to

notice that our question asks about us: Where did WE come from? We're focusing on the evolution of our species rather than evolution in general. If we were to look at evolution in general, we'd need to go back fifteen billion years to the formation of matter, twelve billion years to the formation of the Milky Way galaxy, five billion years to the stabilization of the physical and chemical structure of the earth, and three and a half billion years to the origin of life on earth.

We're picking up the story very late—only 5-7 million years ago when our species split off from the ape family to become human. This is one of three main evolutionary events we'll describe, the others being the emergence of Homo Sapiens Sapiens or "modern human" about 35,000 years ago, and the recent revolution that we will call conscious evolution.

Our early ancestors

Most scientists portray human evolution as a tree, with branches from the trunk representing the development of different species. Branches that end quickly represent variations that did not survive. Branches that grow and split represent species that continued to adapt and survive. This splitting might be caused by a species being isolated from others and thus developing in a different way, or by some sort of unique adaptation, for example, upright walking.

Starting from the tree trunk and moving upward (forward in time), the first major branching occurred about five to seven million years ago. The humanoid species called *Australopithecus Afarensis* split off from the chimpanzees and began to walk on two legs as a habit and to live on the ground rather than in the trees. We do not yet have fossil evidence for the first few millions of years following this split, so we'll have to skip ahead.

Recently, scientists have found fossil evidence that over four million years ago, our ancestors were indeed walking on two legs. The climate had changed making trees more sparse, so Australopithecus Afarensis had moved from the trees of the forest to the open savanna. Scientists believe that humanoids made the adaptation to stand on two legs because this made it easier to look over the grass, to carry food and infants during their first years, and to use tools. More importantly, this adaptation demonstrated versatility, or the ability of our ancestors to adapt to changes in their environment.

The next of our ancestors were *Homo Habilis*, appearing around 2.5 million years ago and

disappearing close to a million years ago, and *Homo Erectus*, appearing around 1.7 million years ago and disappearing around a half million years ago. Notice the overlap, which is typical of evolutionary processes. Habilis and Erectus lived on the earth at the same time for over half a million years!

Homo Habilis may have been the first humanoid to use tools, for example, stone hammers. Their brains were larger than Australopithecus Afarensis, they lived in campsites and in kinship groups, and they cooperated with each other, for example to nurture and protect their children.

Homo Erectus was larger than Habilis. In fact, Homo Erectus was larger and stronger than modern humans. They could travel long distances across the savanna, and they were the first humanoid species to move beyond Africa. Evidence of Erectus has been found as far apart as Great Britain and China. Living in an ice age, Erectus constructed shelters, made clothing, and harnessed fire. They scavenged food over wide ranges from temporary homebases, they created tools that followed standard patterns, and they cooked in pots. Their brains were again larger, and their larynx (voice box) was halfway between where it is in apes and modern humans. This suggests that they may have developed some form of human-like speech. Erectus thus represents a clear transition between an ape-like past and a human-like future.

The species that followed Erectus are, therefore, considered more human. The first of these, called *Archaic Sapiens*, is our direct ancestor. Archaic Sapiens emerged about 200,000 years ago, began to migrate from southern Africa to Europe, Asia, and the Americas about 100,000 years ago, then evolved into the modern human (us) about 35,000 years ago. Archaic Sapiens developed what might be seen as an early form of consciousness, a sense of how they were separate from the rest of the world. They communicated with one another through complex signs, and might have acted on thoughts that went beyond instinct and habit. They established home bases where infants could be nurtured, food could be shared, the sick could rest, and so on. They likely did some hunting but relied primarily on scavenging. They made a variety of tools, and they were the first to prepare raw materials from which other products could be made.

A second descendent of Erectus, not our direct ancestor because of differing DNA, is called *Homo Sapiens Neanderthal* or simply Neanderthal. The Neanderthals are the basis for most of our images of "cavemen." They lived in caves and open-air shelters in Europe and Asia during an ice age. They

developed very strong bones and muscles to survive in these inhospitable areas, and bulbous noses to warm incoming air. They lacked the high rounded foreheads, prominent chins, and other physical features of Archaic Sapiens, and rather than in kinship groups like the Archaic Sapiens, they lived in relative isolation from one another. Surprisingly, they had larger brains than modern humans, but it's unclear to what use these were put. Neanderthal failed to change over thousands of years and, as a result, became extinct about 35,000 years ago. Notice how these two things happened at the same time. The Archaic Sapiens and Neanderthal lived together on the earth for 65,000 years, but then as Archaic Sapiens evolved into modern humans, the Neanderthal disappeared. One species adapted and survived while the other did not.

Modern Humans – The First Generation

The first and most famous of our modern human ancestors is the *Cro-Magnon*, whose intellectual, social, and technological development was truly remarkable. While earlier species adapted biologically over millions of years, the Cro-Magnon triggered the cultural developments that we see in our lives today in just thousands of years. They had brains identical in size to our own and developed sophisticated speech symbols and language. They cooperated with each other in kinship groups, and they traded between tribes. They developed a wide variety of sophisticated tools and other technologies—everything from fish hooks and sewing needles to lamps and ceramics. They established story telling traditions, worshiped multiple gods with rituals and ceremonies, and created beautiful paintings, sculpture, and musical instruments. Most importantly, these developments suggest that the Cro-Magnon had developed the ability to step back and observe themselves. They had developed the level of consciousness we think of today when we say "human." So, 35,000 years ago while the Neanderthal failed to adapt and disappeared, the Archaic Sapiens transformed into Cro-Magnon—into modern human.

The Second Generation

The Cro-Magnon represents the first of four generations of modern humans. The second generation started about 10,000-12,000 years ago with the beginning of the agricultural revolution. Helped by a warming climate, we learned to cultivate the land and produce food in nearby permanent homes, perhaps in agricultural villages, rather than to continually travel to hunt and gather. We created farming tools like plows and scythes, and clay vessels to store food after the harvest. We learned to domesticate

animals to ease our burdens and to have a steady supply of meat. And we developed more sophisticated languages with which to plan our farming for the coming year.

We maintained this basic farming way of life for 6,000-7,000 years, but with improvements in technology, our small villages were able to produce more food than they needed. This meant that they could trade food for other goods produced by people engaged in things other than farming. Thus the rise of occupations such as merchants, traders, and artisans, and the gathering of people in high-density settlements. Think about this for a moment. The simple act of producing more food than needed was a major factor in the rise of cities and major civilizations. (Because the majority of people remained living in small farming villages, and it was these villages that made life in the cities possible, we'll talk about the rise of the cities as part of the same generation.)

Gathering in high-density settlements led to interconnections between, and early civilizations emerged in Mesopotamia, Egypt, India, China, Mexico, and South America. Each of these civilizations developed a set of interconnected cities that served as centers of culture and trade. They developed their own forms of writing, mathematics, and astronomy, and their own communication networks, specialized classes of occupations, and armies. Economics became a powerful force and each civilization created its own type of money to exchange for food and other goods. And the development of writing made it possible to run economies, formalize education, and pass information to those living at a distance (in both space and time). It was in these early civilizations that governments and planning tools like calendars were created, and where metallurgy was developed to make tools and ornaments first from copper, then silver and gold, and then iron. The main effect of all these was the establishment of private ownership of the land and goods and, concurrently, the need to protect and defend one's property. It brought fourth a way of life and a view of the world that was very different from the agricultural village life and the tribal life of the Cro-Magnons.

Combinations of iron-age technology, invasions, and internal decay and corruption brought each of the ancient civilizations to an end. In their place new civilizations arose in Greece, Rome, Persia, India, and China, and these new civilizations brought about significant developments in fields such as science, philosophy, art, and religion. For example, the Greek civilization from about 1,000BC to 700AD stands out for its classic architecture, its development of democracy and self-governance, and the works of

philosophers such as Socrates, Plato, and Aristotle. Major religions were established during this period, including Judaism, Islam, Buddhism, Hinduism, Taoism, and Christianity, and this was the age of the Roman and Byzantine Empires. Again, these civilizations were to disappear as a result of invasions and civil wars.

The Third Generation

The third generation of modern humans might have begun 1,700-1,500 years ago, but the collapse of the Roman Empire led to a thousand-year period often called the *dark ages* in which new discoveries were denied and scientists making the new claims were punished by church authorities. So a new generation was delayed until about five hundred years ago. Once it started, however, the transformation of the third generation was extraordinary.

A scientific revolution profoundly changed our understanding of the world. For example, second generation humans had no concept of the earth being round or circling the sun. They watched seasons go by and the weather change, but had no explanation for this other than “the will of God.” A very few could read and write symbols, but they had no means to readily share what they wrote with others. Until very recently humans had no idea how to use oil or electricity as an energy resource, there were no eyeglasses or engines, and flying was literally for the birds.

In the third generation much happened in a very short time. Scientific discoveries and other innovations led to a technological revolution, for example, to new tools, to energy sources other than human and animal, to machines, assembly lines, railroads, automobiles, and so on. These had the effect of vastly increasing agricultural productivity, so fewer people needed to farm and a majority left for the cities to work in new manufacturing and service industries. A communication revolution began with the invention of printing, and with the availability of books, more and more people learned to read and write. For the first time the Bible was available to people other than church authorities, and their authority was challenged as a result. Public education was born. The arts flourished in what was called the Renaissance (rebirth). Knowledge spread more widely and faster than ever before, and toward the end of this generation, electronics made near-instant worldwide communication possible.

These developments led people to see the world as something that behaved according to reason or

natural laws that could be discovered and used to advantage. For example, rather than being born to a certain life, an individual could use his ingenuity and drive to become something else. (We say “his” because women in this generation were generally not permitted—by men—to share in this.) The results were both good and bad. For example, they included great improvement in the living conditions for many people, longer lives because of advances in medicine, and the development of modern democracies, but at the same time, great emphasis on material gain, weaker connections with community and family, and unprecedented destruction of the natural world.

Evolutionary processes

So, what do these stories of our ancestors tell us? First, they tell us that there are three evolutionary processes:

(1) physical evolution of our environment, for example, changes in the chemical and geological structure of the earth’s surface;

(2) biological evolution of plants and animals, for example, the diversification of species, including humans; and

(3) cultural evolution or change in how we humans live and relate to one another.

As we will describe below, physical evolution came before biological evolution, and biological evolution came before cultural evolution. All three continue to occur, but they do so at dramatic differences in speed. Biological evolution is much faster than physical evolution, and cultural evolution is much faster than biological evolution. As a result, cultural evolution has become the most significant evolutionary force.

This leads to the second thing that the stories of our ancestors tell us—that evolution is now very much affected by our choices. In fact, our choices don’t just cause changes in our culture. Because of scientific and technological advances, they also affect physical and biological processes. But before we get to that, let’s step back and look at physical and biological evolution in more detail.

Physical and biological evolution

By physical evolution we mean the evolution of matter, from a single atom to various elements to living beings. We may think of physical evolution as stable, but this is just the timeframe we apply. It took 15 billion years for our world to get to its present state, so most things change far slower than we notice in a

human lifetime.

Physical evolution created the conditions in which biological evolution could begin. We won't go into detail here, but use these examples to think about how biological evolution has accelerated. Life in a biological sense began about 3.5 billion years ago. For the first billion years or more, lifeforms on earth were extremely simple, mostly just bacteria. Then somewhere around a billion years ago, soft-bodied marine animals like jellyfish developed, followed about 500 million years ago by the first animals with skeletons. Marine animals adapted to live on the land about 300 million years ago, and some grew to sizes far greater than we see today—the dinosaurs. Then in the past 200 million years, an enormous variety of plant and animal species have evolved, human beings only in the past 200,000 years. So, from bacteria developing over more than a billion years, we reach Homo Sapiens just 200,000 years ago, and modern humans only 35,000 years ago.

Over these billions of years there appear to be times when change is sudden. For example, the dinosaurs disappeared very quickly, and many scientists now agree that this happened because an asteroid hit the earth and the resulting cloud of dust changed the climate too rapidly for them to adapt. On a smaller scale, some species appear to have emerged suddenly, perhaps as a result of something going "wrong" in the development of offspring, but the offspring succeeding enough in the environment to live and reproduce.

More typically a very gradual process of biological evolution is thought to occur, and the primary mechanism for this is natural selection. Natural selection works by adaptation to the environment and inheritance. The environment changes, a species relies more heavily on a particular characteristic in the changed environment, and this characteristic is passed along to the next generation. For example, the climate change that forced our ancestors out of the trees and onto the savanna led to our arms and legs being shaped to better support walking on two legs.

This is not to say that every adaptation is successful. It's more like trial and error. A species attempts to adapt to the environment and produces variations. Some variations succeed—they increase fitness—while others do not. When successive variations are unsuccessful and/or when the environment changes too quickly for the species to adapt, it disappears. The species becomes extinct. (Think

Neanderthal.)

One result of natural selection is an increase in variety. Plants and animals in different environments adapt in different ways, therefore we find more and more diversity over time. As we said in Chapter 1, this diversity is desirable because it allows systems, or species in this case, a better chance to adapt to further changes in their environment.

Think about how these principles relate to one another. Adaptation and natural selection happen through small changes in characteristics. Species don't suddenly become something entirely different. Cats don't all of a sudden become dogs. The color of their hair, the shape of their ears, the size of their brains, and so on, all change very slowly in response to changes in the environment. So, natural selection leads to a cat that is better suited to the surrounding environment. You may have heard natural selection referred to as *survival of the fittest*. Here we have the "fittest" cat.

This adaptation of characteristics also leads to increased specialization of function. Certain characteristics serve different functions better, so over time they become more specialized to do so. Some examples include the color-changing ability of chameleons, the night vision of owls, and the incredible sense of smell possessed by sharks. These remarkable abilities developed to serve special functions in these animals' environments. And as these examples suggest, specialization in function leads to greater differentiation in parts. The chameleon's skin, the owl's eyes, and the shark's nostrils are special parts that serve special functions. So adaptation and natural selection lead to greater differentiation of parts—to diversity.

But all these parts can't just do their own things. They have to work together. So, a greater number of parts leads to greater dependence on one another and, therefore, greater integration. (Remember that everything relates to everything.) Greater differentiation plus greater integration means greater *complexity*, and this is the basic path of evolution—toward greater complexity. We'll talk more about complexity later. The important point to remember is that evolution leads toward greater complexity, not toward simplicity.

Cultural evolution

Since the emergence of Archaic Sapiens we have been in a third phase of evolutionary processes, one dominated by cultural evolution. Recall that physical evolution referred to matter and our physical

environment, and biological evolution referred to living things such as plants and animals. Cultural evolution refers to changes in how we humans live and learn, and to how we relate to one another.

The key distinction of cultural evolution is that changes are not brought about by mindless processes but by conscious choice. Rather than wait for adaptation through natural selection and inherited traits we adapt by design. For example, rather than wait for new body parts to extend our arms or keep us warm we design a tool and make clothing. We rely on our own creativity and innovation rather than natural selection.

There are several important consequences of this shift to cultural evolution. First, changes are far faster than ever before. Rather than the many generations and millions of years of biological evolution, changes in culture happen within the space of single generations, recently even within single years. Second, changes are no longer just adaptations to changes in the environment. We change because we choose to change. Third, while natural selection produces diversity by the continual separation of species, and one species cannot reproduce with another, a culture can change dramatically through becoming interconnected with another. And fourth, while natural selection eliminates variations that are not useful in a local environment, cultures can retain and pass along innovations through writing and education.

Co-evolution

Notice how one type of evolutionary process made the next type possible. Physical evolution somehow reached a point where life was possible, and biological evolution reached a point where human consciousness and culture were possible. For example, the biological development of the human brain and the shaping of our vocal chords made it possible for spoken languages to develop, and thus the transmission of information across groups and the development of cultures. It's accurate to describe the processes as mutually influencing or *co-evolutionary*. This is especially clear here at the beginning of the 21st century when we humans have gained the ability to not only shape culture, but to change biology and the physical world. How we use this ability may prove a greater challenge than gaining it.

Evolutionary cycles

The stories of our ancestors tell us three more things. First, they demonstrate how evolution happens in cycles. For example, the generations of Homo Sapiens emerged, developed and matured, then

declined and disappeared. There seemed to be a creative surge that led them to succeed as a species, but then a rigidity and inability to further adapt that led them to fail.

Second, they show that the beginning of these cycles goes entirely against the principles of natural selection. Rather than random variation of parts, the new generations appear to have emerged whole, with the potential to evolve in particular ways. Some sort of threshold seems to have been reached and sudden leaps somehow made. Thus far we have no explanations for these discontinuities.

Third, the stories tell us that where an evolutionary leap ends, and therefore where a new generation begins, is crucial. What a species or generation will become is enfolded or contained within this ending and starting point as creative potential on the one hand, and a set of limits on the other.

The pattern of emergence, development, and decline, and the sudden appearance of new wholes is typical of evolution. And we have much evidence that we are reaching the end of generation three Homo Sapiens. Will our species survive? What sort of leap is required? Will it just happen naturally, or is it something we humans can guide? If we can guide it, what directions should we take?

Core Ideas

3.1. Using a variety of evidence and new techniques and tools we have learned much about where we came from.

3.2. Our early ancestors include Australopithecus Afarensis, Homo Habilis, Homo Erectus, Archaic Sapiens, and Neanderthal.

3.3. Each of our ancestors developed and thrived for a period of time then either adapted to changes in the environment or disappeared. Neanderthal failed to adapt and became extinct, while the Archaic Sapiens evolved to become the modern human being.

3.4. There have been three generations of modern human: the Cro-Magnon, followed by humans of the agricultural and industrial revolutions.

3.5. Geological, biological and cultural evolution involve different processes and occur on different timetables. Cultural evolution has now gained prominence because of its speed and impact.

3.6. Evolution occurs in cycles of birth, development, and decline. The beginning of an evolutionary cycle

is marked by the emergence of a new whole, not just a changed part.

3.7. We are on the brink of a fourth generation of modern human. What that generation will become is unclear.

Activities

A. Five billion years. Three and a half billion years. Five to seven million years. It's hard to think in terms of billions and millions of years and to see how very short our lives are. Maybe this analogy will help. Pretend that you are as old as the human species. That age, five million years, is 1,000 times smaller than how long ago the earth took the form we see today, five billion years. So multiple your age times 1,000. If the human species were as old as you, this would be how long ago the earth settled into the form we see today.

Try it the other way around. Divide your age by 1,000 and figure out how many weeks or days that would equal (after dividing, multiple by 52 or 365). If the earth has been as we see it today for as long as you have been alive, this is how old the human species would be.

Try this with other ages, like the emergence of modern humans (200,000 years ago) or the 2,000 years since Christ's birth.

B. Look at photographs of members of your family, photos from earlier generations if you have them. Examine your relatives facial features and compare them with your own. Do you have your grandfather's nose? Your great-grandmother's ears? If you don't have pictures of your own ancestors, just find some paintings or pictures of people from earlier generations. Look at their clothes and the sorts of things that may be in the background of those pictures. Think about what they did, how they spent their days, how they traveled and communicated with one another, and so on. How have biological and cultural evolution shaped who you are?

C. Think about what each part of your body does. Are there parts that you use very heavily? Parts that you don't use at all? What do you imagine will happen over time and generations to these parts if that pattern of use continues?

D. Explain where our species came from to an 8-10 year old child.

E. If we are about to leave generation three Homo Sapiens behind, what do you wish for generation four? What do you wish humans to become? What do you think being “human” should mean a thousand years from now?