Just as phytoplankton is the ultimate giver, humans are the ultimate takers. Phytoplankton are the very base of the food web, consumed by small organisms like zooplankton. Zooplankton are consumed by small animals, which are consumed by slightly larger ones, all the way up until the energy reaches human mouths. Humans are omnivores and we can eat everything, but nothing eats humans as its primary food source. The only case in which an animal would attack and kill a human is in an act of defense, not for our nutritional value. We are not a food source for other animals, unless we are already dead and decomposing. The fact that humans have risen to the top of the food chain is fascinating, and we can only attribute that power to a very complex and ingenious process that has taken place over millions of years.

Humans are not necessarily superior to the animals we consume, but we are undeniably different. Humans value intelligence and communication, and because of our exceeding capability to do these things, we sometimes get caught up in the belief that we are better than other species. All species have different qualities and value different things, and humans are no exception. We have an ultimate desire and craving for socialization, which is embedded in every part of our being, and has been for as long as humans have existed. This need comes from our will to survive. Humans cannot survive alone; the only way we can survive is to live in a community that helps to support and nurture one another, each individual contributing in different ways.

Somehow, we have risen to dominate the world, whether or not we are the most powerful beings. We are not the fastest species, we are not the strongest species, we are not the biggest species, we do not have the most acute senses, and we are not even the oldest species. There are still many questions that concern where we come from, and there is no way we will ever truly understand our deep roots. Relatively speaking, homo sapiens are very young and have not existed for long at all, but we have been able to evolve at an incredibly fast pace compared to other species, developing a society unlike all others.

Humans have a unique capacity for introspection: the ability to reflect on our species and ourselves. This examination of our species has led to a large interest in how our society has advanced throughout the course of history, which narrows down to one process: evolution. Evolution is the process that living organisms take to develop into a more complex form. It is something that happens over millions of years, each generation changing slightly so that the organism can prosper more in its environment. Extensive research has been done on the human process of evolution, and a vast amount of information regarding the topic of evolution has been uncovered. Darwin's theories of natural selection have provided a basis for scientific research and have sparked an interest in figuring out evolutionary mysteries, leading to many questions about our roots. What characteristics allowed us to evolve so differently from other species? Valuable human qualities can be found in many other species, so what made humans rise above them?

To answer questions like these, we must carefully observe every aspect of the human body and mind, and all that we know so far about the evolutionary process. Studies in these areas have revealed many pieces of information that have helped us understand ourselves better.

The key to many human evolution successes lies within our brains. The human brain is what separates us the most from other animals, particularly our large and powerful neocortex. The neocortex is the top 2-4mm layer of the brain, and it is made up of 6 layers.[1] It is involved in

[1] "Neocortex (Brain)". *Science Reference*. Science Daily. 18 April 2013. <http://www.sciencedaily.com/articles/n/neocortex.htm>

higher functions such as sensory perception, generation of motor commands, spatial reasoning, conscious thought, and language. Genetic origins of the distinct evolutionary advancements of the neocortex are not well understood, but the human neocortex can be considered to be the crowning achievement of evolution. If any organ in our body were to be substantially different from other animals, it would be the neocortex.[2] Despite the importance of the neocortex, surprisingly little research has been done on how this distinct human difference has emerged. We do know that the first step in the evolutionary development of the human neocortex was its enlargement, which occurred mainly by expansion of surface area. The neocortex is smooth in rats and other small mammals, but the folds and wrinkles in the neocortex of primates expand its surface area, which makes our cognitive skills, like auditory and visual processing, more acute.[3]

Another extremely valuable piece of information about our brains has been discovered surprisingly recently, and has led to many great answers about human abilities. The information was discovered in a test by Dr. Giacomo Rizzolatti at the University of Parma in Italy, who was scanning primate brains with MRI to map the neurons that fire when a monkey opens a nut.[4] By accident, the monkey witnessed one of the scientists opening a nut, and scientists were shocked to see that the MRI scan showed the same results as when the monkey itself opened the nut. Scientists were so surprised that they then did a couple more similar tests to make sure that the MRI machines weren't broken, and found that the scans were not lying - the same neurons in the brain fire when performing an action as when witnessing that action.[5] They then went on to see what species these neurons exist in, and have discovered that they exist in most mammals, and are especially prevalent in primates. These neurons, called mirror neurons, explain quite a lot about the behavior of species that have them, particularly humans. Any species that carries mirror neurons has the capacity to imitate, which greatly improves the intelligence of their species by giving them the ability to learn from others of their kind. Watching and learning from relatives means millions of years of evolution can happen instantly. For instance, bears have evolved over millions of years to have thick coats for warmth. But a young child can watch his father skin a bear and learn how to be warm instantly; millions of years of evolution have happened in a matter of minutes.[6]

Mirror neurons may seem very basic and only useful for the emulation of motor skills, but in reality they are one of the fundamental platforms for human evolutionary success, acting as the most basic human social system. Mirror neurons are what make humans so good at reading body language and facial expressions, which gives us the ability to not only mirror other peoples actions, but other peoples feelings. Because of the direct relationship between emotion, reading body language and facial expression, and mirror neurons, defective mirror systems are

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[2] Rakic, Pasko. "Evolution of the Neocortex: Perspective from Developmental Biology". *NIH Public Access Author Manuscript*. 2 August 2010. US National Library of Medicine. 18 April 2013. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2913577/>

[3] Rakic, Pasko. "Evolution of the Neocortex: Perspective from Developmental Biology". *NIH Public Access Author Manuscript*. 2 August 2010. US National Library of Medicine. 18 April 2013. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2913577/>

[4] "Mirror Neurons". *Nova Science*. 25 January 2005. PBS. 17 April 2013. <http://www.pbs.org/wgbh/nova/body/mirror-neurons.html>

[5] Rifkin, Jeremy. "The Empathic Civilization". *Ted Talk*. August 2010. TED. 19 April 2013. <http://www.ted.com/talks/jeremy_rifkin_on_the_empathic_civilization.html>

[6] Ramachandran, VS. "Mirror Neurons and Imitation Learning as the Driving Force Behind 'The Great Leap Forward' in Human Evolution". *The Third Culture*. Edge. 19 April 2013. <http://www.edge.org/3rd_culture/ramachandran/ramachandran_p1.html>

likely to be associated with autism. Studying mirror neurons has proven to be very useful for scientists and doctors with autistic patients. Having properly functioning mirror neurons means that watching someone experience sadness, anger, or happiness will trigger your own emotional neurons, allowing you to feel the observed emotion. This is essentially what gives us the ability to be empathetic. If you can look at a person and connect with them, you can learn from them, share with them, love them, and empathize with them.[7] If an actor is talented enough that they can feel what their character is feeling, they can show it on their face and in their bodies, which will make the audience experience it too.

Humans are an empathic species, and that separates us from other animals. Theories about what drives us include utilitarian and materialistic drives, and an exclusive self interest. But really, what drives us is the need to belong and be loved. Jeremy Rifkin, a political advisor and writer, is adamant that humans should live in an empathic civilization and believes that we have a responsibility for being empathetic towards all beings for the wellbeing of the earth. He explains that around the age of eight, we start to learn about the concept of death and the fragility of life. With the help of brains being wired to feel other people's emotions, this realization produces an intense empathy towards other beings because we understand that life is difficult and that everyone is struggling to be alive. "We are homo empathicus," Rifkin says.[8] Humans can only exist as social beings, and we need to be loved and nurtured by the people around us for that to happen. To create this sense of unity, tribes since prehistoric times have come up with their own creation myths to provide an explanation to members of their tribe about where they came from. Although all the myths were different, every recorded tribe or group had one without fail. These religious explanations created a bond between members that held the tribe together, offering a cooperative group mindset, which has a much better chance of survival than a single individual.[9] A lot of our human success has come from the ability to be empathetic, which ultimately comes from the mirror systems in our phenomenal brains.

As humans evolved, our mirror neurons got more and more developed, and we were able to learn more from each other. Humans learn by looking and copying. If you see someone else doing something, you can do it too. By looking, copying, and learning, we were able to do things other creatures couldn't. Mirror systems have been discovered in various mammals, seem to exist in all primates, and have recently been found in birds. But human mirror systems remain different and more advanced than any other species. We not only have the ability to recognize an action, but we have a second mirror system that shows us how the observed movement is performed, and why.[10] This gives us even greater ability for imitation and learning, leading to exclusively human skills like communication through speech. Language is one of the most powerful traits that humans possess. Other animals can communicate, but they can't talk; they can't communicate on the same sophisticated level as we do. Through language, you can implant the complex meanings of your thoughts into someone else's mind.[11] Before language, humans

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[7] Rifkin, Jeremy. "The Empathic Civilization". *Ted Talk*. August 2010. TED. 19 April 2013. <http://www.ted.com/talks/jeremy_rifkin_on_the_empathic_civilization.html>

[8] Rifkin, Jeremy.

[9] Wilson, Edward O. *The Social Conquest of Earth*. New York: W.W. Norton and Company, Inc., 2012. Print.

[10] Rizzolatti, Giacomo. "The Discovery of Mirror Neurons". *GoCognitive*. 26 March 2011. Gocognitive.net. 19 April 2013. <http://gocognitive.net/interviews/discovery-mirror-neurons-1>

[11] Rifkin, Jeremy. "The Empathic Civilization". *Ted Talk*. August 2010. TED. 19 April 2013. <http://www.ted.com/talks/jeremy_rifkin_on_the_empathic_civilization.html>

would only learn by looking and copying. But with the introduction of language, we can teach and learn from each other through it, helping our species learn faster and better.[12]

Language is a practical way of defining social roles. With it, we can divide up tasks amongst our community to help it thrive. Our society utilizes language as a technology for benefiting as a cooperative group, meaning more people to help move the community forward. If humans had turned towards living only as small family groups, the benefits of our knowledge would only reach close relatives. The human evolutionary path would have gone into the forest and been short lived, much like that of the Neanderthals.[13] But, we chose to exist as a large group, and through language there has been a vast expansion of cumulative knowledge. The technological world today is expanding upon this by introducing more forms of communication. With the invention of phones, computers, and the Internet, we are able to share our knowledge with people on the other side of the world in a matter of seconds. This speeds up the flow of ideas, technology, and even genes.[14]

However, language also exists as a barrier. It not only has the ability to connect us, but the ability to separate us. Languages can divide us by closing off our society to societies with different languages. It serves as a way to establish identity as well as protecting knowledge, wisdom, and skills from other people. Different languages and dialects evolved for this reason - protection from other groups.[15] This phenomenon exists in nature, too. Animal calls differ from species to species, so that an animal's mate can be directed in the right direction. This raises a good question about animal communication. If animals can make sounds, why don't they talk like us? Studies of the mirror neuron system show that animal sounds are involved with very different parts of the brain than those of a human. Dr. Rizzolatti, the same man who discovered mirror neurons, conducted many more experiments regarding the mirror neuron activity in human and animal brains. He was also interested in the use of the mirror system in language, and performed several experiments trying to distinguish the difference between the vocal activity of humans and apes. What he found was that human and animal vocalization have anatomical differences in the brain. The call of animals comes from a very deep part of the brain associated with emotion, and so animal vocalization is purely based on the communication of emotion.[16] While humans also have emotional brain activity connected to communication, an additional layer of brain activity exists during human speech. The part of the brain that controls most of human vocalization is located on the lateral area of the brain, much closer to the surface than that of ape vocalization. Our additional mirror system and different anatomy of the brain is what allows us to communicate with each other through language. But our advanced brains and mirror systems are not enough. Some physical qualities of humans also come into play with our ability to create sound. Because of the position and shape of the human larynx as well as the mouth and

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[12] Pagel, Mark. "How Language Transformed Humanity". *Ted Talk*. August 2011. TED. 18 April 2013. <http://www.ted.com/talks/mark_pagel_how_language_transformed_humanity.html>

[13] Pagel, Mark.

[14] Pagel, Mark. "How Language Transformed Humanity". *Ted Talk*. August 2011. TED. 18 April 2013. <http://www.ted.com/talks/mark_pagel_how_language_transformed_humanity.html>

[15] Pagel, Mark.

[16] Rizzolatti, Giacomo. "The Discovery of Mirror Neurons". *GoCognitive*. 26 March 2011. Gocognitive.net. 19 April 2013. <http://gocognitive.net/interviews/discovery-mirror-neurons-1>

tongue, humans are able to produce sounds that our close ape relatives cannot. Apes are not physically capable of producing "k" or "t" sounds.[17] Our complex tongue and mouth movements make it possible for us to have developed such an intricate language.

There is still debate about the development of language in children and whether the ability for such refined language skills comes from nature or nurture. It is a question that scientists have tried to pursue for a long time, but the idea of raising a child in silence would be too cruel to test. A language deprivation experiment would offer many answers to questions about the development of language in humans, but because of its cruelty, it has become known as "The Forbidden Experiment". [18]Another option would be to examine children that were raised without contact with humans, or feral children. However, there is not certain evidence of any of these children's existence. For a while, a Ukrainian girl named Oxana Malaya was thought to be a feral child, and scientists were excited to examine her. But, there is no certain evidence that she was raised without any human contact, so we cannot gain any solid information from her case about the development of speech. But scientists thought of another, rather obvious, way to test the age-old question of nature versus nature and language. Zebra Finches are birds that also have mirror systems that the male birds utilize to imitate their father's calls. Scientists took a male Zebra Finch, and raised it from birth in a soundproof environment, giving it no interaction with other birds and therefore no way for it to develop a song from "nurture." Sure enough, the finch started producing rough warbles and chirps. When introduced to a group of females, they eventually mated and reproduced. The family continued to live in a soundproof space, separate from any other birds. The baby birds imitated their father, and their sounds were slightly stronger. When they had babies, the babies improved upon the sound even more, and it only took four generations for the males to sound like Zebra Finches found in nature.[19] This tells us that we both have the built-in ability for language, as well as language has been improved upon generation through generation.

Mirror neurons have provided an incredible basis for humans to evolve upon. Aside from language, mirror neurons have led to many other developments. Humans are highly inventive, and if we can imitate each other, we can improve upon other people's ideas to make better things. Primitive stone tools can evolve to rough hand tools, to modern day tools. Inventions like tools may have happened accidentally in one place, but then spread very quickly given the human brain's built in capacity for imitation learning.[20] V.S. Ramachandran, a neurologist and psychologist says, "Perhaps any major 'innovation' happens because of coincidence but we have been able to take those accidents to amazing levels."[21]

But the brain is not the only factor that comes into play with our ability to use our hands. Humans also have a very unique quality that is rather uncommon - opposable thumbs. A stroke of luck like this meant that humans could develop tools. Without opposable thumbs, we would undeniably not have become as successful as a species. Humans also had enough luck to evolve to walk on two feet, which saved energy, and this bipedal movement allowed us to use our hands and thumbs for other purposes. Our forelimbs got redesigned for flexibility in the manipulation

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[17] "Lucy". *Radiolab.* 19 February 2010. 23 April 2013. Radio.

[18] *Why Do We Talk?* BBC, 2009-2010. Film.

[19] *Why Do We Talk?*

[20] Ramachandran, VS. "Mirror Neurons and Imitation Learning as the Driving Force Behind 'The Great Leap Forward' in Human Evolution". *The Third Culture.* Edge. 19 April 2013. <http://www.edge.org/3rd_culture/ramachandran/ramachandran_p1.html>

[21] Ramachandran, VS.

of objects. The arm, particularly in males, became efficient at throwing objects with good aim.[22] The development of spears meant we could kill food from a distance, and soon our food-gathering techniques exploded with improvement. We had methods to kill other animals, and we were no longer such a vulnerable species, and had the benefit of being able to acquire energy from both plants and animals. We evolved a high aerobic capacity to run long distances, chase prey, shed our fur, and evolve sweat glands for cooling. The environment was perfect for humans to thrive in at this time in the Savanna woodlands of Africa. Low vegetation was perfect for humans to watch for prey and predators, and Acacia trees were easy for bipeds to climb.[23] All of a sudden humans became predatory.

Humans were able to thrive by living in small, nomadic groups and carrying out a hunter-gatherer society. They lived in one place for as long as they could keep feeding themselves, and then moved on to find more food.[24] But humans were too successful for this way of living; hunting became too time consuming and not productive enough to feed a quickly growing group. Gathering became more productive than hunting, but it was physically harder. These early humans were forced to change their way of life, or they could not have continued to grow as a species.

It was when hunting was no longer productive that humans started doing something that would become the basis for today's society. Bab edh-Dhra is a site in the Jordan valley where archeologists have been working on uncovering evidence of early human societies.[25] Here, they found evidence of the first granary. In a time of scarcity like the one experienced by the people who lived here, saving and protecting their food was revolutionary. Instead of spending so much time and energy foraging for food and hunting scarce animals, these Middle Eastern people would collect grains and store them, protecting them from insects and moisture year round. Soon enough, humans started collecting seeds from these grains and scattering them around. Seeds that were especially tasty, big, or easy to harvest were favored and planted again. It was this way that farming and agriculture in the human society first developed. This was the turning point of humanity, where we went from being hunter-gatherers to farmers. Humans would find land near a water source and grow food there, which meant they had everything that they needed to be able to survive for a long time.[26]

However, not all farming societies were successful, because successful farming had a lot to do with the inbred advantages of the physical environment. Places like the Middle East, China, and Africa that easily grew cereal crops like wheat, rice, and barley were the places that were most successful. These crops are nutritious enough to sustain a village, and they are also easily harvested and stored for a year-round food supply.

Geographic luck really does play an incredible part in the success of humanity, as certain locations provide resources that humans can take advantage of and others don't. Another thing that was gifted upon the Middle Easterners was access to good animals. Animals that are useful for farming are relatively large plant eating mammals, which reproduce productively. Animals can be used as meat and milk to sustain the community, and their hides can be used for both clothes and shelter. Domestic animals need to be social - it is for this reason that horses were

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[22] Wilson, Edward O. *The Social Conquest of Earth*. New York: W.W. Norton and Company, Inc., 2012. Print.
[23] Wilson, Edward O. *The Social Conquest of Earth*. New York: W.W. Norton and Company, Inc., 2012. Print.
[24] *Guns Germs and Steel.* Dir. Jared Diamond. National Geographic, 2005. Film.
[25] *Guns Germs and Steel.*
[26] *Guns Germs and Steel.*

domesticated and zebras were not.[27] The animals need to get along with humans to a certain degree for them to be useful to people. Animals also contribute to farming, and help crops be more productive. Cereal crop leftovers can be used to feed animals, and animal waste can be used as fertilizers to help the food grow and be more nutritious. Animals can also pull plows, and be used to carry heavy things, alleviating the physical burden for humans.

Each of these advancements in food production not only helped sustain the wealth of a community, but also allowed it to be productive and efficient. As populations grew, there were more people to work on feeding the village, which relieved some people of that duty. These people could now break off and specialize in other skills, and our advanced brains and communication skills allowed us to split up tasks amongst the community so that every individual could contribute to the productivity of the village. With agriculture came an explosion of arts and crafts activity, and people quickly became more adept with new materials. Plaster was invented and people started investing more time and energy into their homes, and villages grew bigger, stronger, and more permanent. This was a transformation in the human living style because before them humans led a completely nomadic lifestyle. People started experimenting with and getting accustomed to fire, ultimately leading to the invention of steel, which contributed to our society's evolution immensely.[28]

At this point in human evolution, we now held power over most other animals. We were controlling and domesticating our natural surroundings, and were able to feed ourselves and become a strong group. All of this was possible not because of one thing, but because of many things working to human advantage at once. Our minds and bodies collaborated perfectly together, and we were able to cooperate with the environment. If you were to eliminate any of these elements, humans would not have evolved in the same way. Without opposable thumbs, we would not be the same. Without being in an environment that was advantageous to human bodies, our powers would be insignificant. Without the need for agriculture, our society would not have developed it, and we would never have come to be as advanced as we are.

But is our current state our best state? Is the farming industry we have today better for us than the hunter-gatherer lives our distant ancestors led? Humans are a highly inventive species, but are also one of the most destructive.[29] Modern human activity is affecting and altering the environment negatively, and we can't live without the environment. If we continue like this, we will march towards our own destruction. Our hunter-gatherer relatives saw their prey not as inferiors, but as equals and sometimes superiors, and sometimes animals were even worshipped as gods.[30] The human mindset that our species is the most significant entity in the universe is a fairly recent idea, developing alongside global warming and the extinction of thousands of other species. The more humans prosper, the more damage we do to the world we are living in.[31] Sometimes we forget that someday, nature could swallow us whole. Our influence on climate change and the raising of water levels only leads to our own doom - if we continue to do what we are doing, we will end up literally drowning in our own prosperity.

We learned how to control food supplies not by destroying plants, but by nurturing them. Will we be able to take this success and implement it on a bigger scale to preserve our earth and our lives? Doing so seems to be the only option if humans hope to continue to thrive. In our state

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27 *Guns Germs and Steel.* Dir. Jared Diamond. National Geographic, 2005. Film.
28 *Guns Germs and Steel.*
29 Gray, John. *Straw Dogs.* London: Granta Publications, 2002. Print.
30 Gray, John.
31 Gray, John.

of evolutionary human control, what is our responsibility on this earth? Is it our responsibility to mend all the damage we have done? In the words of Joseph Beuys, "Human ability is not to produce honey, but to produce ideas." It is now our responsibility to use our ideas to turn our culture around, and start supporting the world that gives us life.

Our pre-human ancestors were not chosen, nor were they great. They were just lucky.[32] But evolution is not over for humans. Evolution is not predictable, and we have no idea what will happen in the future. Perhaps in a couple thousand years we might exist as a different species, an even more empathetic species. Rifkin's theories of empathic civilization provide a hope for our kind: if we can extend our empathy to the entire human race and even further to all living beings, we will be able to care for our world.[33]

Evolution takes place for the betterment of a species, and ultimately should lead a species to sustainability. But, humans as we exist today are not sustainable, and because of this, we will continue to evolve. By looking at other animals' short-lived population spikes, we can only hope that the human population will also somehow even out to a sustainable level - a level that the earth will be able to handle.[34]

It is certain that evolution will continue because evolution is a never-ending process. As time passes, all species are forced to adapt to the world as it changes. Because of this, humans will continue to evolve towards being a more balanced and sustainable species. One day, I hope humans will be able to contribute to the earth to create a balanced planet, with all the living beings on it connected through this mystery called life.[35]

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[32] Wilson, Edward O. *The Social Conquest of Earth*. New York: W.W. Norton and Company, Inc., 2012. Print.

[33] Rifkin, Jeremy. "The Empathic Civilization". *Ted Talk*. August 2010. TED. 19 April 2013. <http://www.ted.com/talks/jeremy_rifkin_on_the_empathic_civilization.html>

[34] Rifkin, Jeremy.

[35] Rifkin, Jeremy.