Human Modification of Earth:

Earth's survival is Our survival...

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Introduction

Our species is responsible for a dramatic increase in Carbon Dioxide levels in the atmosphere. Many scientists believe that our activity is resulting in the gradual warming of the planet, and this warming may one day have a disastrous effect on the ecosystem and life itself. This includes human life.

The purpose of this paper is twofold. First, I intend to ask the question: *Is the human species worth preserving?* Or, in other words, does it matter if something threatens our existence? After answering this question in the affirmative, I will move on to the next section of the paper in which I assess the damage that we are doing to the environment. I will show that our Carbon Dioxide emissions are contributing to Global Warming and, furthermore, that the effects are already being observed. By referring to scientific predictions, I will show that our planet faces some dramatic environmental changes. After exploring the implications of this data, I will conclude that Global Warming is a possible threat to all life on Earth.

Having accepted that human life is worth preserving, and given the possibility that global warming threatens human life, I will suggest that we should put a stop to global warming. My conclusion will be that when faced with a disaster of global proportions, the rational decision is to act on the side of caution and cease all activities that contribute to the risk of such a disaster occurring.

1. Is the Continued Existence of the Human Species a Good Thing?

Before analyzing global warming, I want to spend a little time on a preliminary question: "Is the continued existence of humanity a *good* thing?" The reason this question is important is because many scientists believe that global warming poses a serious threat to human existence on Earth. In the next section I will look at the scientific evidence and show that the data gathered gives us reason to believe that this is true. But first, I think it is important to decide if a threat to human existence is

indeed a problem. Considering the impact that we have had on the planet, it could be considered a good thing for Earth to be rid of the human species. Many plant and animal species would certainly survive a lot better in the absence of people, so it could be the case that the continued existence of humanity is a bad thing. Perhaps global warming should be considered to be a means by which the planet can cleanse itself and start afresh.

In this section I will look at such possibilities and will show that -- despite the damage we've done -- the continued existence of humanity is a good thing. Once I have established that our species' survival is a good thing it will follow that anything threatening our survival is a *bad* thing and should be prevented at all cost. This will lead on to the next section in which I establish that global warming is a possible threat and must be halted.

1.1 The Good and the Bad of the Human Species

We humans are an interesting species. We seem to be caught in some sort of trap, or middle ground, between being violent animals governed by primitive survival and territorial instincts, and being sophisticated calm creatures that have the ability to admire beauty, produce music, and understand the nature of the universe. Scientists and philosophers have given us insights into the mysteries of existence. Musicians have somehow managed to produce combinations of sounds that can make us happy, while at the same time reducing us to tears. Artists have an ability to capture aspects of the world that seem strangely hidden from the rest of us; and though we don't see these features in the world the artist can present them to us in a way that we can admire. These features of humanity seem to be worth preserving.

However, at the other end of the scale we have examples of people pursuing wealth and profit at the expense of other people. Greed is rampant throughout the world, and it does not seem to matter who suffers in the process, as long as the accumulation of material possessions and money can continue. People form tight, close-nit groups and place other people into categories, which implies a lack of equality and a sort of "us VS them" way of thinking. This way of thinking has resulted in some of the darkest moments in our history, during which the planned deaths of millions of people were implemented -- people who were really no different than their murderers except for the fact that culture had placed them into the "them" category. During the 20th century our planet saw an incredible explosion of population in the undeveloped nations. Millions of people in these countries are starving and do not have access to essentials such as clothing, water, and medication. Their basic needs are not being met, and yet the developed nations are producing surpluses of food that will never be used. Somehow the human social structure has developed to a point where people can be starving on one side of the

planet while on the other side people who have more than they need will attempt to accumulate *even more*, and will not pass on any their wealth to the needy. Such features of human nature may incline us to think that the human species is not worthy of its place on Earth. Perhaps the extinction of humanity would be a good thing. It would certainly do away with much suffering.

The good and the bad of the human species seem to exist side by side. Humanity is a paradox in this way. We are the creators and the destroyers of beauty. I am not sure if our aggressive tendencies will ever be overcome. They may be biologically determined, which means they will exist in our genetic makeup for millions of years. However, humanity *does* have the ability to *suppress* some biological urges. Cultural programming can provide humans with a whole range of new behaviors that are capable of dominating over innate behavior. *Memetics* is a field of enquiry that studies the way in which cultural traits are passed from one individual to the next (for background and an overview on memetics, see Blackmore 1999, Dawkins 1976, Dennett 1995, Silby 2000a, 2000b, 2000c).

According to memetic theories, new ideas and behavior -- which are known as *memes* -- can spread throughout cultures far faster than new behavior encoded in genes. This rapid spread of new behavior has resulted in our species having a behavioral repertoire that is far richer than that of our early ancestors. Furthermore, memetic (or cultural) behavior can override some innate behavior. For example, in many people the biological urge to reproduce has been suppressed by social programming that compels them to wait until they have succeeded in their careers. Now, as far as biology is concerned, careers are irrelevant. The only reason we exist is to replicate our genes. But social programming has given humans other reasons to exist, and this has resulted in the suppression of the innate reproductive desire. Many people still carry out sexual behavior (just go to a bar on Saturday night and you will see some very primal mating rituals -- dancing, singing, drinking...) so in this way the urge is satisfied. But the consequences are avoided through the use of contraceptive devices, whose usage is brought about through social conditioning. Other examples of memetic behavior that override biological behavior include suicide, homosexuality, some forms of altruism, and sexual fidelity.

Now, if basic behaviors such as self-preservation and reproduction can be suppressed by cultural programming, then it is plausible to suppose that other biologically determined behavior can be suppressed by cultural programming. It is possible that our culture will evolve behavioral patterns that will suppress some of the undesirable behaviors listed above. If this turns out to be true, then the only features of humanity that will be left will be the desirable ones, and these are well worth preserving.

1.2 Why are the desirable behavioral patterns worth preserving?

The next question is obvious. *Why* are the desirable human behaviors worth preserving? The first reason requires the acceptance of a basic premise, that *happiness* is better than *no happiness*. You may need to take a leap of faith to accept this premise, because I cannot provide solid reasons for believing that it is true. However, I believe that 'common-sense' will incline most people to think that this premise is reasonable. If given the choice between a happy world and a world of no happiness -- or worse, misery -- most of us would go with the happy option.

We humans are capable of feeling great happiness. This feeling usually comes about from the things we do. Music, for example, can lift a person's mood and give them great pleasure. If we consider pleasure to be a form of happiness, then music is an example of a human creation that produces happiness and reduces suffering. Obviously, if there were no humans on the planet, then there would be no such human activity. There would be no creations that could make someone happy. And even more importantly, there would be no humans on the planet who could experience happiness. Happiness would not exist. "What about the other animals?" I hear you ask. Well, it is not certain that non-human animals have the cognitive complexity to enjoy happiness; but even if they do, the removal of the human species would significantly reduce the *total* happiness on Earth. Furthermore, the impact of global warming could reduce many species to starvation and near extinction, thus reducing their happiness as well. So if we are to accept that happiness is a worthwhile end, then we should attempt to preserve life on Earth.

Happiness aside, many people believe that we should protect life on Earth for its own sake. Environmentalists work very hard to protect endangered species from extinction because they believe all species have the right to continued survival. If this is true, then the same applies to the human species and we should do everything in our power to ensure *its* survival. Unfortunately, not everyone will find this idea compelling. A great many people spend their entire lives focused on very local issues -- issues that really only affect a small number of people. The possibility of humanity's extinction does not really concern them, as long as they will not be affected during their lifetime. I believe this to be a shallow way of living, and I find it disturbing to see this type of thinking is so wide spread. Does it make sense for people to ignore the future and the rest of our species, and only focus on themselves? One way to answer this is to ask ourselves whether we owe anything to passed generations. Billions of people were involved in the development of our societies. They made discoveries and invented artifacts that we benefit from today. They fought wars and learned from their mistakes, and they developed, slowly, a moral system that we attempt to live by. Would it be right for us to put our species at risk after everything our ancestors accomplished? Don't we owe a debt to our ancestors? Shouldn't we work together for the continued development and perfection of humanity? If we allow the extinction of our species, it

will be as if none of our ancestors ever existed. All their efforts will have been wasted. But if we change our way of thinking, and take pride in the accomplishments of our species, then we might be able to shift our focus to the bigger picture and protect our ancestors' legacy. In doing this, we will be compelled to focus on improving life for all species, and continue the development of humanity. This is a worthwhile goal and its fulfillment would bring about happiness and well being for all. This would be a good thing.

If I am right in thinking that the continued existence of the human species is a good thing, then it follows that anything threatening human existence is a *bad* thing and should be avoided. In the next section, I will establish that global warming is a potential threat to the human species.

2. Global warming is a global threat

Does global warming threaten our species? By the end of this section, you will either answer this question in the affirmative, or you will remain uncertain. I do not think, however, that you will answer the question in the negative. Our ecosystem is very fragile and, as I will show, altering it poses a *possible* threat to our species -- so the answer to the question has to be either "yes" or "maybe". It cannot be "no".

Quite a bit of work has to be done in this section. First I will explain the causes of global warming. Then I will offer evidence to show that global warming is in fact occurring right now. This will lead on to a description of what may happen to Earth's climate and ecosystems if global warming is allowed to continue. It is at this point that we will start to recognize a potential threat to our continued survival.

2.1 What causes global warming?

This is a relatively easy question to answer. Think about your home on a warm summer's day. If you keep all your windows and doors closed, but allow the sun's warmth to radiate into the house through the glass, the temperature in your home will start to rise. This is because the thermal radiation from the sun is being trapped in the house with no-where to go. The same process is at work on planet Earth. Thermal infrared radiation from the sun (light in the infrared part of the spectrum cannot be seen with the human eye) enters the atmosphere and gets absorbed by certain gases -- most notably Carbon Dioxide and Carbon Monoxide (CO_2 and CO). Most of the other wavelengths of solar radiation get reflected off the surface of the planet and radiate back out into space, but the thermal radiation forms a blanket over the planet which has the effect of warming the surface temperature. This effect is what led scientists to coin the term "greenhouse effect". Heat trapping gases turn the planet into a sort of

greenhouse. Heat can get in, but it can't get out.

It is actually a good thing that this happens. If Earth had no infrared absorbing gases, virtually all of the sun's radiation would be reflected back into space and the planet's average surface temperature would be about 20 degrees Celsius below zero.

During its history, planet Earth has enjoyed a good balance between the production of heat absorbing gases and the natural processes that remove those gases (mainly through the photosynthesis activity of plants and sea plankton). This has kept the environment in check and has allowed life to flourish. There have, of course, been periods of climatic change. Sometimes the planet naturally warms up, and then after a while it cools down. But this type of process does not happen over night. It can take tens of thousands of years for the planet to go through is warming and cooling cycle.

Here's an important question: What happens if we upset the balance? Or, more to the point: What happens if we significantly *increase* the amount of heat absorbing gases in the atmosphere? Well, common sense suggests that the more heat absorbing gas there is in the atmosphere, the more heat will get trapped in the atmosphere. If more heat gets trapped in the atmosphere, the Earth's temperature will rise. This makes sense, but the story is not quite so simple. While it is true that more CO2 and CO in the atmosphere will lead to the absorption of more heat, we have to consider the possibility that there will be less heat to be absorbed. This is because an increase in temperature also results in an increase in cloud cover, because of the evaporation of water; and an increase in cloud cover leads to an increase in the 'reflectiveness' of Earth. The more reflective Earth is, the less radiation can make it through to the surface. The question is, would the increased reflectiveness of Earth counter the increase in CO and CO2 and leave Earth's temperature balanced? To answer this question, we can look at a test case -- the planet Venus. Venus has a cloud cover that is extremely dense -- so dense that very little heat actually gets through to the surface. Given the amount of radiation that makes it through, the average temperature on Venus should actually be lower than the average temperature on Earth (Sagan 1997: pg 106). Despite this, however, the temperature on the surface of Venus is about 470 degrees Celsius (900 degrees Fahrenheit). The reason the temperature is so high is because of the huge quantity of CO2 and other greenhouse gases in its atmosphere. The little heat that does make it through the cloud cover is absorbed and does not radiate back into space. Venus is hot, and it can only get hotter.

2.2 It's getting hot here!

Since the industrial revolution, the human species has been upsetting the balance between heat absorbing gases in the atmosphere and the natural

processes that extract them. During the late 1990's, we were responsible for pumping over 7 billion tons of CO2 into the atmosphere each year. This has largely resulted from our burning of petrol, wood, and coal (CO2 is a byproduct of these processes). At the same time, we have leveled large forests -- forests which are full of nature's CO2 extractors -- and those forests have been replaced with farm animals who consume grass and produce incredible amounts of methane (another heat trapping gas). The ratio of CO2 in the atmosphere is currently over 370 parts per million -- this is a 15% increase of the ratio found in the 1950's. Furthermore, the rate of increase is expected to rise as we move through the 21st century.

The increase in CO2 in the atmosphere bears a relation to the increased temperature of Earth. In 1999, research showed that since 1975, there had been an increase of 0.5 degrees Celsius in the 5 year average surface temperature. NASA reported that this rate was faster than any other time period of similar length, since records began. In addition to this, temperature records show that the hottest 7 years since measurements began all occurred in the 1990's. In fact, scientists have been able to show that the rate of warming in the 20th Century does not fit with the pattern of the previous 600 years. They have done this by comparing today's rate of temperature increase to past rates *reconstructed* from tree rings, fossilized pollen, corals, and ice cores. It's as if all of a sudden, the planet started to heat up very rapidly. Climate scientists now believe that if nothing is done to reduce the rate of greenhouse gas emissions, Earth will experience an air temperature increase of about 2.5 degrees Celsius. This will not only result in large increases in the number of extremely hot days, it will also bring about increases in weather extremes -- storms, snow storms, floods, and hurricanes. Some countries will experience their coldest winters ever as a result of the change in the global climate. Global warming does not entail hotter days for everyone.

A common way to object to these findings is to question the techniques used to gather the data. Skeptics claim that the data are skewed because of urbanization and changes in the type of instrumentation used. This is a good point. Cities are naturally hotter than the country because of the way they are built. Huge concrete and steel structures are bound to trap heat. And changes in instrumentation are bound to give rise to inconsistencies. Today's measuring equipment is a lot more accurate and reliable than the measuring equipment of 20 or 30 years ago. Nevertheless, researchers have taken these factors into account. Temperature measurements are not made in cities, and readings from instrumentation are corrected to reflect changes in technology. Great efforts have been made to ensure that the data accurately reflect changes in the environment.

As a result of the increased temperature on Earth, we can expect a rise in the sea level. This is because of the gradual melting of the Ice Caps and glaciers. We can already detect a rise in sea level. Measurements taken

from key locations around the world reveal that the ocean level is about 18 cm higher than it was in 1900. According to geological records, this rise in sea level has occurred at a rate unparalleled in the last few thousand years. If current predictions are accurate, we can expect a rise in sea level of about 50 cm during the next 100 years. This is an alarming figure. The cost of responding to such an increase in sea level in a 100 year time frame is estimated to be as high as $200 Billion -- and that is in the United States alone. Of course, large countries like the U.S may be able to adapt to a rise in sea level, but for small island communities such a rise would be catastrophic. According to projections, entire islands in Polynesia and the Indian Ocean will be completely submerged. Populated areas in large continents are also under serious threat. Predictions for Venice, Egypt, New York City, and other coastal areas point to devastating changes as river levels rise and flat regions are flooded. Millions of people will be forced to move out of these areas and settle elsewhere. Society will be put under strain and will have a difficult time coping with these changes. It seems that global warming will effect us all.

But does global warming threaten the entire human species? This is an important question. While it is true that millions of lives will be affected by global warming, it is not clear that the entire human species is at risk. Perhaps we will be able to adapt to a change in climate and continue to survive. Many lives will be lost through starvation, but humans are ingenious and may develop new societies and new farming techniques to counter the inevitable changes in the environment. Optimists (of which I am one -- believe it or not) have great faith in human resourcefulness and think we can survive anything. However, despite our resourcefulness, we have to ask the question: is it worth the gamble? We really don't know that humanity can survive the changes in the environment, so it may be more prudent to exercise caution and ensure that the changes don't take place.

Consider the possibility that our current predictions only scratch the surface of the environmental impact of global warming. Our planet *could* be in danger of becoming a hellish Venus type world. This is not beyond the realm of possibility. If we continue to increase levels of heat trapping gas in the atmosphere, it is possible that Earth may reach a critical point of no return, after which continued global warming is self perpetuating. Rises in temperature mean drier forests, and more lightening storms. Lightening storms start forest fires, which result in dramatic increases of greenhouse gases -- as well as a loss in greenhouse gas extractors. These increases in temperature cause more evaporation, which results in dense cloud cover. More clouds means less sunlight, which means less photosynthesis. Less photosynthesis means fewer plants, which means even less greenhouse gas extraction from the atmosphere. Planet Earth could find its temperature climbing out of control towards a point at which no life can survive. This is an extreme scenario, but it is not impossible.

The point I am trying to make is that since we *don't know* what will

happen we should not take any risks.

Consider the following analogy of our situation:

Imagine that you are standing in an enclosed room. There is no way out and the room is knee deep in petrol. Now, in the center of the room is a candle, which is sitting quite securely on top of a 4 foot high stand. The candle is gently burning.

Suppose that for some reason, you spend all day every day pouring cups of petrol into the room (perhaps these cups are being supplied through some hatch in the wall). As a result of this activity, the level of petrol in the room is rising -- slowly, but constantly.

During your day, you read articles in which scientists hypothesize about the interaction between petrol and a naked flame. They suggest that if a flame comes into contact with petrol, there could be a devastating reaction that has the potential to destroy the environment -- destroy your room. In this one room world, scientists have never actually witnessed the result of a flame coming into contact with petrol, and you have never seen it happen. However, they have amassed a huge amount of data relating to combustion and are pretty sure that when the level of petrol in the room reaches the flame, a disaster will occur. Of course, the only way to be sure would be to let it happen -- but then it would be too late.

The question: in the light of the scientific predictions, do you continue to pour petrol into the room? Or do you incline towards the side of caution and stop?

In this analogy, it is obvious that you should stop pouring petrol into the room. A simple cost/benefit analysis shows this to be the best option. If you continue to poor petrol into the room you have two possible outcomes:

1) Life as normal (benefit)

2) Death (cost)

On the other hand, if you stop pouring petrol into the room, you have one outcome:

Life not quite as normal.

Weighing the risks shows that the rational option is to stop pouring petrol into the room. This is because the potential cost of continuing with the activity far outweighs the benefits of continuing with the activity.

Now, exactly the same applies to our situation with global warming. The risks are too high, so we should cease all activities that warm the planet.

3. What can we do?

I believe the only sensible action we can take is to put a stop to our production of greenhouse gases. Although we do not know for certain that our species' existence is at risk, it seems unwise to wait and see. We must work together as a concerned people and convince our governments that we want our planet to survive -- we want our species to survive. Together we must ensure that international agreements on the reduction of CO2 emissions are adhered to -- by ALL governments. Action groups should continue to oppose the destruction of natural forests. As individuals, we should do whatever we can to spread the word and avoid burning petrol. Don't drive when it is unnecessary. Walk, or ride a bicycle.

Many people are unaware of the damage they are doing to the environment. They may have some awareness of the issues, but they will still complain about petrol prices and insist upon driving cars for recreation. As concerned people, it is our duty to educate others. If we are unsuccessful in our attempts to convince world leaders, then we must bring about action ourselves. This means the systematic boycott of petrol driven vehicles, and the boycott of companies that profit through the destruction of natural forests. Together we can put a halt to global warming, but only if we act soon. It would be a tragedy of human reason if we let our planet's environment warm up to the point of no return.

Will we survive?

This paper has been an attempt to publicize global warming and its ramifications for the human species. Before assessing the impact global warming, I attempted to show that our survival is a good thing. This seemed like an obvious place to start. After all, if it turned out to be the case that our survival was a bad thing, then no warning about global warming would have been necessary.

Our species has good and bad points, but we have the capacity to develop beyond our aggressive tendencies. When this happens, only our good points will remain, and these are well worth preserving. People can enjoy music, art, philosophy, and life; and this makes planet Earth a happy place. Working on the assumption that happiness on Earth is better than no happiness, I have concluded that humanity must survive.

Having decided that humanity must survive, the next step was to show that global warming poses a threat to our survival. This was done with the help of scientific data collected from a number of sources -- as well as a little speculation about the hellish, worse case scenario. The data I used in this essay are readily available from a number of sources, and although they only touch the surface of the information available, I think the point was made. Global warming *is* occurring, and it *does* pose a threat to our species.

We know that humanity is worth preserving, and we know that global warming is a possible threat to humanity. A simple cost/benefit analysis shows us that the rational course of action is to remove the threat, and that means we must alter our activities on Earth. This is because the potential cost of allowing the continuance of global warming far outweighs the benefits of continuing with our current lifestyle. It is far better to change things now than to have regrets in the future.

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