The Dominant Species Debate

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Abstract

21st century technologies will allow the creation of godlike massively intelligent machines, trillions of trillions of trillions of times above human capacities. We argue that humanity will split into two major bitterly opposed ideological camps regarding whether “artilects” (artificial intellects) should be built or not. This conflict will probably result in a major war before the end of the century resulting in the deaths of billions of people - “gigadeath”.

1. Introduction

Physics was reinvented as a frontier of science in the 17th century. In the 18th century chemistry produced similarly spectacular and exciting results. In the latter half of the 20th century, computer science emerged with the same sense of adventure, inspiring some of the brightest minds to explore the potentials this new discipline promised. In the decades following Alan Turing’s assertion that computers could one-day mimic the human cognitive faculty, advances in computational power, and a plethora of design methodologies have yielded successful applications in robotics and computer-based systems.

The advent of digital computing is arguably the most significant phenomenon in the history of science and technology. And the first half of the 21st century seems likely to witness computers and robots that rival or even dramatically surpass human abilities; as well as technologies that allow humans to supplement their biological cognition with silicon implants. But as computer scientists produce systems with greater computational power, and make them ever more autonomous in the real world, many are becoming aware of enormous social implications that could follow breakthroughs yet to come.

This chapter is written to help make readers aware of an issue that could well dominate global politics in the 21st century, coloring and define the age, namely, "species dominance". The question of species dominance has the potential to divide humanity
more bitterly in the 21st century than did the conflicts that defined the 20th century, such as communism versus capitalism, and the entangled issue of nuclear supremacy. Who or what should be the dominant species on earth? Should electrochemical, carbon-based biological life reign supreme, or should electromagnetic, silicon-based machines rise and surpass humanity? And what about the middle ground, will cyborgs meld man and machine into a new race?

Those aware of recent progress in physics, cognitive science, and computer science, as well as trends forecast into the relatively near future, are becoming increasingly aware of the import of results from these converging disciplines. The prospect of building “godlike” creatures fills many with a sense of religious awe that motivates progress, while others experience trepidation about the potential consequences of progress.

The potential of 21st century technologies to generate "massively intelligent" machines is clearly understood by theorists and practitioners in the sciences contributing to this goal. But many less familiar with AI remain relatively unaware of this fact and its implications. "Massive intelligence" means artificial brains which may end up being smarter than human brains by not just a factor of two or even ten times, but by a factor of trillions of trillions of times. The prospect of humanity building these godlike machines raises vast and hugely important questions that cut across all aspects of human life.

One of the great technological trends of our recent history has been Moore's law, which states that the computational capacities (e.g. electronic component densities, electronic signal processing speeds, etc.) of integrated circuits, have been doubling every year or two. Moore's law is a consequence of the shrinking size of electronic circuits so that the distance electrons have to travel between two electronic components, for example two transistors, is reduced. This trend has remained valid since Gordon Moore, one of the founders of the Intel microprocessor manufacturing company, first formulated it in 1965.

According to Einstein, the fastest speed at which anything can move is that of the speed of light (about 300,000 km/sec) and this is a constant of nature that electronic currents have to respect. If one shortens the distance between two electronic components, then an electronic signal between them (i.e. the flow of electrons between them) has less distance to travel, and hence takes less time to traverse that distance. A huge amount of effort over the past few decades has been devoted to making electronic circuits smaller, and hence denser, so that they function faster.

If Moore’s law remains constant until 2020, the size of the electronic components in mass memory chips for example will be such that it will be possible to store a single bit of information (a 0 or 1) on a single atom. Not only will 21st century technology be storing a bit of information on a single atom, it will be using a new kind of computing called "quantum computing", which is radically different from the garden variety or "classical computing" that has been used to date.

The essential feature of quantum computing is as follows. If one uses a string of N bits (called a "register" in computer science, e.g. 001011101111010) in some form of
computing operation (it doesn't matter for the moment what the operation is) it will take a
certain amount of time using classical computing. However, in the same amount of time
using quantum computing techniques, one can often perform $2^N$ such operations. ($2^N$
means 2 multiplied by 2 multiplied by 2 ... (N times)). As N becomes large, $2^N$ becomes
astronomically large. The potential of quantum computing is thus hugely superior to
classical computing.

One bit per atom memory storage capacities together with quantum computing will be a
truly explosive combination. 21st century computers could have potential computing
capacities truly trillions of trillions ... of times above those of current classical
computing capacities.

That said, the assumption that massive memory capacities and astronomical
computational power are sufficient to generate massively intelligent machines may not be
valid. There are those such as Sir Roger Penrose, of black hole theory fame, who assert
that there is more to producing an intelligent conscious machine than just massive
computational abilities. John Searle, Professor of Philosophy at the University of
California at Berkeley, is another ardent critic of computationalism, and is known for his
work on the problem of consciousness. His Chinese Room scenario points out that a
machine could be designed to behave intelligently without actually being conscious.

Even so, objections like these do not substantially undermine the thesis of this chapter,
since it seems to be just a question of time before science understands how nature builds
us. In other words, until science understands the "embryogenic" process used in building
an embryo and then a baby, consisting of trillions of cells, from a single fertilized egg
cell.

We have the existence proof of ourselves (we are both intelligent and conscious) that it is
possible for nature to assemble molecules to form an intelligent and conscious organism.
Nature has found a way to do this, therefore it can be done. If science wants to build an
intelligent conscious machine, then one obvious strategy would be to copy nature's
approach as closely as possible.

In time, an "intelligence theory" will arise, which will explain human cognition on the
basis of neuronal architecture and processes. Once such an intelligence theory exists, it
will allow neuro-engineers to take a more engineering approach to building artificial
brains. We will not have to remain such "slaves to neuroscience". We will be able to take
an alternative route to producing intelligent machines (although admittedly initially based
on neuro-scientific principles).

So with the new neuro-scientific knowledge that nanotech tools will provide, and the
computational miracles that quantum computing and one-bit-per-atom storage, brain
builders will probably have all the ingredients needed to start building truly intelligent
and conscious machines.
Probably sooner than we think, it will be possible to buy artificially brained robots that perform useful tasks around the house. If the price of such robots can be made affordable, then the demand for them will be huge. As technologies and economies of scale improve, the global market for such devices will increase steadily.

Not only will the commercial sector be heavily involved in the production of ever smarter and ever more useful intelligent robots, but so too will the military forces of the world. National governments will be heavily involved in pushing research and development that will spill over in time to the commercial sector, as has been the pattern with technology for over a century.

There will be so much military and commercial momentum behind AI that it is difficult to imagine how the trend toward better and better systems could be stopped, unless a mass political movement forms to block its development. And mass political movements born in the debate over AI is the subject here.

How might a movement to halt the advance of AI get off the ground? It's not too difficult to imagine what might happen. Imagine that in about a decade from now, millions of people have already bought household cleaning robots, sex robots, teaching machines, babysitter robots, companionship robots, intelligent decision support systems, etc., and that these brain based machines talk quite well and understand human speech to a reasonable extent. A few years later what might happen?

Not surprisingly, the models of that earlier year will be seen by their owners as rather old-fashioned and not as attractive as the latest models. The latest models will be more "intelligent" because their speech is of higher quality. They will understand more and give better, more appropriate answers. Their behavioral repertoire will be richer. In short, they will make the earlier models look quite inferior.

Naturally, as newer and better models are introduced, consumers will scrap their old robots and buy new ones, or have their old ones updated with better artificial neural circuitry. And military forces around the world will be following the same pattern as individual consumers of AI. This cycle will repeat itself again and again.

However, many consumers will begin to notice that their household robots are becoming smarter and smarter every machine generation, as the IQ gap between human beings and robots gets smaller and smaller. Once the robots start getting really smart, millions of robot owners will start asking themselves some awkward questions such as, "Could these machines become as smart as human beings?", and, "If so, could the robots be a threat to humanity?" Ultimately, the question will become, "Should humanity allow robots to become as smart or smarter than human beings?"

Once the question is framed in the light of the potential risks posed by mobile autonomous intelligent robots, a plethora of positions will likely emerge in the continuum between the “yes” and “no” ends of the spectrum. Many will ask “exactly” how smart and autonomous machines should be allowed to become, and “exactly” what limitations
if any should be placed on machines’ AIQ (artificial intelligence quotient). What shape will social policy and social institutions take to create and enforce policy in this area?

Naturally, by the time questions like these push to the forefront of the collective awareness, there will be significant momentum behind the many public and private sectors that research, design, and build AI devices and systems. Will it be politically, militarily, and economically possible to stop the robots becoming smarter every year?

There will be those in all walks of life who see the creation of massively intelligent machines as the destiny of the human species. These people will not like any limits being placed on AI. And therein lies the potential for social conflict. Because for emotional, intellectual, economic, and just plain practical reasons people will find themselves occupying different positions on the subject of advancing AI.

As stated earlier, this chapter seeks to shed some light on possible issues and positions within the species dominance debate, with the goal of raising awareness and sparking the imagination of the reader. But maybe more importantly, the ideas discussed herein should serve as a point of departure for scientific social research on attitudes and awareness of AI in populations and sub-populations around the world in the years to come.

Specifically, the chapter will be devoted to developing a language to discuss the topic, and to developing to some extent one of several broad scenarios for the future debate over AI: the scenario of social conflict. The picture painted here is one in which the species dominance debate heats up and approaches or even reaches violence on a large scale. The central theme is that the 21st century will be dominated by the question of whether humanity should or should not build machines to be trillions of trillions of times more intelligent than humans. And that this central question will split humanity into two major political groups which will become increasingly bitterly opposed.

Useful shorthand for the term "godlike massively intelligent machine" from this point forward will be "artilect", coined by combining "artificial" and "intellect". The human group in favor of building artilects, is labeled "Cosmists", based on the word "cosmos" (the universe), which reflects their perspective on the question. To the Cosmists, building artilects will be like a religion; a capstone on the destiny of the human species; something truly magnificent and worthy of dedicating one's life and energy to achieve. To the Cosmists, not building the artilects, not creating the next higher form of evolution and thus freezing the state of evolution at the human level, would be a "cosmic tragedy". The Cosmists will be bitterly opposed to any attempt to stop the rise of artilects.

The second human group, opposed to building artilects, is labeled "Terrans", based on the word "terra" (the earth) which reflects their inward looking, more parochial perspective. The Terrans will argue that allowing Cosmists to build artilects (in a highly advanced form) implies accepting the risk that one day the artilects might decide, for whatever reason, that the human species is a pest. In the Terran view, since the artilects would be so vastly superior to human beings in intelligence and aptitude, it would be easy for them to exterminate the human species if they so desired.
It is not exaggerating to say that there is quite a close analogy between an artilect attempting to communicate meaningfully with a human being, and a human being trying to communicate with a single-celled organism. Human beings might appear to artilects to be so inferior that we would simply not be worth worrying about. Whether humanity survives or not might be a matter of supreme indifference to them.

The critical word in the artilect debate to the Terrans will be "risk". The Terrans will argue that humanity should never take the risk that advanced artilects might decide to wipe out the human species. The only certain way to eliminate that risk will be to prevent artilects being built in the first place.

Cosmists will place a higher priority on the creation of godlike, immortal, go anywhere, do anything creatures (where one artilect is "worth" a trillion trillion human beings) than on preventing the risk of the extermination of humans at the hands of artilects. A Cosmist, by definition, is someone who favors building artilects.

Thus, to the Terrans, Cosmists might seem to be demons incarnate. While to the Cosmists, the survival (or not) of the human species, which clings to the surface of a mossy rock that circles a star amongst 200 billion or so others in our galaxy, in a known universe of a comparable number of galaxies, and with probably as many universes in the "multiverse" (according to several recent cosmological theories) is a matter of miniscule importance. Cosmists will look at the "big picture" - meaning that the annihilation of one primitive, biological, non-artilectual species (i.e. human beings) on one little planet, is unimportant in comparison with the creation of artilects.

Naturally, there will be very powerful arguments made on both sides, which will only make potential conflict between Terranism and Cosmism all the more bitter as the species dominance debate heats up in the coming decades. In the limit, the debate could lead to global war between the groups using 21st century weapons, which almost certainly would mean the death of billions of people, or "gigadeath".

Certainly the artilect debate will be among the most passionate in human history. And an artilect war would likely be the most passionate and bloody in history. The stake has never been so high as the survival of the entire human race.

There are a growing number of researchers and professors who are starting to see the writing on the wall, and who are claiming publicly in media appearances and books that the 21st century will see the rise of massive artificial intelligence. Thus the issue is really starting to hit the world media, and countries such as the US, the UK and France are leading the pack.

The artilect debate will seem like science fiction, and set too far into the future, for many people to worry about now. But as machines continue to get smarter and smarter every year, it will take on an intensity that will become truly frightening.
Humanity should be given the choice to stop the Cosmists before they get too advanced in their work, if that is what most human beings choose. That said, producing near human-level artificial intelligence is a very difficult problem that will take decades to solve. Over the next 30 to 40 years, it is likely that the AIQ of robots will become high enough to be very useful to humanity. Robots will perform many boring, dirty, and dangerous tasks.

It would be premature to stop the research on artificial brains now. However, once these artificial brains really do threaten to become a lot smarter and perhaps very quickly (a scenario called "the singularity") then humanity should be ready to make a decision on whether to proceed or not. Making an informed decision on an issue that concerns the future of the whole species is something so important that the necessary discussion on the artilect issue should begin as soon as possible. There should be enough time for all the issue's intricacies to be thrashed out before the artilect age is imminent.

2. The Cosmists

It may very well be that as the history of post-industrial civilization unfolds, the fate of the human race hangs in the balance of the debate between Cosmists and Terrans. Obviously, arguments on both sides will be persuasive and passionate; made by champions of each cause with very different visions of the future of mankind, and intelligent life on earth.

The Cosmists especially may need overwhelmingly powerful support for their position if they hope to overcome popular fears about the potential threats from artilects. They will surely feel the incredible weight of moral arguments against them. How could anyone think to take such a risk? What possible rewards might justify such a dangerous course? Cosmism will surely be the focal point of the wrath of many Terrans. And as will be discussed later in more detail, it doesn’t take too much imagination to foresee violent conflict.

There is no doubt that the issues involved in the artilect debate will test the foundations of many institutions of civilization. Machines with super-human intelligence could radically effect economic, political, military, family, religious and scientific values and practices. How will history judge those who devise such machines? And what role, if any, will such machines play in the future of life on earth?

Our history books chronicle the rise and fall of political and economic doctrines, medical breakthroughs, as well as new technologies. Innovation often occurs when single individuals or groups capture their beliefs and thoughts in writing. New ideas often manifest in trends that end up starting wars; or in trends that lead to the betterment of many. Consider Rousseau's democratic ideas, Marx's communist ideas, or Einstein’s atomic breakthrough.
The arguments presented in this section might one-day serve as the intellectual basis for trends in many areas of society. And again, unprecedented human betterment may result, or the outcome might be the worst war in human history. Intelligent machines might never be allowed at all, they might be created and then strictly controlled, or they might roam free and earn the status of an independent species.

We begin by presenting a few lines of reasoning that Cosmists might rally around, as well as trends that point to the likelihood that artilects will be created. They evoke very real and human feelings of wonderment at innovation, adventure and exploration, and feelings of religious awe. Maybe above all, the Cosmist perspective marvels at human ability and creativity.

2.1 The Big Picture

The "big picture" argument considers human existence from a perspective that seeks to encompass the evolution of intelligence on earth as a whole; and more broadly, that considers the evolution of intelligence on a cosmic level.

Science teaches us that we humans live on a planet that orbits a very ordinary star, which is one of 200 billion or so in our spiral galaxy. Our galaxy in turn is only one of billions in the visible universe. And some theorists posit that there are likely countless other universes. In other words, in the big picture, the primacy of the human intellect seems utterly negligible in the context of evolution on a grand scale. Further, artilects must be viewed not only as vastly superior to humans as information processors, but also as eternal beings. The life-span of humans is an ephemeral three-quarters of a century or so, paling in comparison to the age of the universe, and to the longevity of artilects. Many Cosmists will feel an enormous responsibility to fulfill the potential for evolution of ever more powerful intelligent entities. In fact, many may come to view humanity as nothing more or less than an agent of natural selection contributing to the broader cosmic phenomena of evolution.

Modern science has deemed the laws of physics and chemistry to hold true throughout the universe, so it seems almost certain that throughout the cosmos, countless different biological organisms and civilizations have evolved, and have reached a stage of technological competence sufficient to produce artilects. It is therefore possible that there are countless more artilectual civilizations in the universe than there are biological ones. As humans, we are as yet unaware of extra-terrestrial intelligence; but in the cosmic scheme of things we have only just crawled from the primordial soup.

From the galactic point of view, would it matter much if the human race were superceded; or even annihilated by machines of our own creation? Similar thresholds must certainly have come and gone throughout the universe as countless biological civilizations reached maturity. Perhaps if humans were to visit distant planets orbiting distant stars, they would find human-like biological organisms fulfilling the role of domesticated animal in mature artilectual civilizations. And perhaps for many Cosmists, rightly so.
The big picture argument is admittedly an intellectual and abstract one. But there is also a tangible aspect to it that considers knowledge and answers to very real scientific questions. If we consider how much scientific progress we have made as human beings in the past century, and then consider what an artilect could do with its massive brain and billions of years of existence, it becomes clear that building artilects could be of some benefit. Artilects would be much more capable of discovering the secrets of the functioning of the universe, and using those discoveries. Artilects could discover and take advantage of phenomena that we as human beings don't even know exist.

2.2 Scientific Religion

The more one reflects on such things, the greater the sense of awe one might feel. Many will feel a kind of religious awe when imagining artilects. And this feeling represents a second line of reasoning that will lead many to advocate building artilects. The "scientific religion" argument holds that a set of beliefs, values, and practices will evolve within the community of those who seek to build artilects; and also out of the knowledge gained from AI systems. In effect, artilects could become revered leaders and be regarded as supernatural.

Religious belief is a cultural anthropological universal, one of the very few. The need for religion is very strong, as evidenced by the fact it is ubiquitous. There are some 5,000 to 10,000 different cultures on earth, and virtually all of them have invented their own gods. Of course, the fact that this huge number of different beliefs are often mutually contradictory and wildly different, merely reinforces the atheist's cynicism, but at least it does show that a hunger for some kind of religion burns strongly in most people.

Although scientific thinking prevents many from being traditionally religious, the craving for some deeper "spiritual" understanding of existence resonates in most people. And for many, Cosmism will fill a void as a kind of religion. Cosmism is compatible with scientific knowledge, and hence acceptable to the critical scientific mind. It's a "scientist's religion", but you don't have to be a scientist to have the same feelings of religious awe when contemplating the potential of what artilects could be.

There is something truly magnificent about the goal of building artilects. The artilects themselves will be godlike in their eternal lifespan and have immense cognitive and physical power. Power to go beyond, way beyond, human limitations. Cosmism as a religion would satisfy a lot of human needs, and importantly, would be compatible with the scientific worldview. The sheer attractiveness of the prospect of building godlike artilects will, for Cosmists, be compulsive, overriding all others, and motivate nearly any means to achieve the glorious goal.

An advanced artilect could be the size of an asteroid. If it were of planet size it could orbit about a star and absorb its energy. If it were in the shape of a huge hollow sphere with the star at its center (a "Dyson sphere"), it could absorb all of the radiated energy of
that star. If such an artilect is built in our solar system, the material necessary for its construction could be taken from the asteroids in the asteroid belt.

So potentially, such a creature could consist of \(10^{40}\) or even \(10^{50}\) atoms, and hence bits. The molecular or atomic switching elements would be switching (flipping from 0s to 1s or vice versa), in femto-seconds (a thousandth of a trillionth of a second), so altogether, the artilect could be switching at about \(10^{55}\) or \(10^{65}\) bits a second. This is an astronomically large number.

Compare this with the equivalent switching rate of the human brain. The information processing of the human brain occurs (arguably) at the synapses (the inter-neural connections) at a rate of about 10 bits a second. Since there are about \(10^{15}\) synapses in the human brain, that means the total brain processing speed is about \(10^{16}\) bit-flips per second.

The artilect's processing capacity is thus \(10^{40}\) or \(10^{50}\) times greater, which is trillions of trillions of trillions times more. Such numbers are so large, that it's difficult for human beings to absorb their significance. Such creatures would be capable of "living the lives" of countless human beings in a mere second of their existence. A human life of about 80 years is about 2.5 billion seconds (\(80 \times 365 \times 24 \times 60 \times 60\) seconds). Computing at \(10^{16}\) bits a second over an average human life, a person processes \(10^{25}\) bit-flips in total. So an asteroid-sized artilect with \(10^{40}\) atoms, could process the equivalent of \(10^{30}\) human lives per second, i.e. a million trillion trillion lives.

What will be truly significant and godlike about an artilect is the ability to use processing capacity in fascinating ways, thinking a zillion thoughts at the same time. The artilect will have the means to continuously amplify its intelligence and knowledge to levels human beings cannot imagine, because its brain will be self-evolved and self-organized to perform zillions of functions simultaneously.

With the full range of chemical elements (from hydrogen to uranium and more) at its disposal, it could design and build its own experiments to investigate its own structures. The knowledge it would obtain could be used to redesign itself in better ways. The artilect would learn zillions of times more about the world and itself than human scientists will ever know. It would be truly godlike in its knowledge and power to manipulate the world.

Human knowledge is said to double every 10 years or so. Let us call the total quantity of human knowledge at the year 2000 a THKU (Total Human Knowledge Unit). What would the artilects’ rate of knowledge growth be in THKUs per second? It takes 10 years for roughly ten billion people to double their knowledge. Even if the artilect had the same intelligence level as humans per unit of matter (which we say above is unlikely) it could still vastly outperform the human population because of its much larger mass and processing speed.
It should be noted that the above calculations are based on traditional classical computing principles. If such an artilect were to use quantum computing, the resulting calculations would make the above numbers hugely too small. But again, the point is that the artilect will be a truly godlike creature, so vastly above human capacities that it will be an object of worship, acting as a great shining beacon beckoning many with hypnotic force.

And not only is the artilect something compatible with science and something worthy of devoting one's personal and professional energies to, but more importantly, it is real, in the sense that it is achievable. It is doable. Creating such creatures will be possible if human beings want to. Human beings, the Cosmists, could become "god builders".

It is very likely that the Cosmist vision will provide humanity a new religion, a very powerful one, suitable for our new century and beyond. Like most powerful religions, it will generate energy and fanaticism as people channel the frustrations of their daily lives into opposing those people who oppose their own beliefs. In this case the opposition will be the Terrans. Major religions have created major wars in the past. Consider the crusades between the Christians and the Moslems in the Middle East, or the Catholics and the Protestants in Europe.

### 2.3 Human Striving

The “human striving” argument arises from the fact humans always seem to want to go beyond what is currently known, currently explored, currently achievable. Humans drive themselves to climb higher peaks, run faster, cure diseases, become stronger and fitter, become more brilliant, etc., etc. Why this constant pushing at the barriers? It must be built into our genes. Evolution has made us this way.

Human beings, and especially children and scientists (big children) have an extremely strong sense of curiosity. Our big brains evolved to discover how our environment works. If we have a better knowledge of the dangers and delights of the world that surrounds us, then we are more likely to survive. But if we lack a curiosity to explore our world, we learn about it more slowly.

Those apes and humans who learned faster by being driven to explore, to push the limits of the known, learned faster and hence were more likely to survive. Well, not always. Some poor chump had to be the first to discover that arsenic was poisonous, but his neighbors learned from his mistake. Since they all had the same curiosity Gene, they learned from his negative experience.

Is it not inevitable that once the prospect of building artilects is with us this century, that our genetically determined striving curiosities will propel us towards building them? Can we help ourselves? Will we have to build them the way Hillary had to climb Mount Everest, simply because it was there, and because the technology and techniques had developed enough to make the mountain conquerable? Last century humanity began to explore space. We have even set foot on the moon and will soon set foot on Mars.
If the Terrans win, and humanity decides not to build artilects and discover the secrets of a higher order of evolved intelligence, it would possibly be the first case of turning back in our collective history. It seems almost impossible, in that light, not to be a Cosmist. It is in our human nature to strive, to be curious, to go where no one has gone before.

The next two arguments are not what one might call "active arguments". And Cosmists would not need to give much of their energy to them per se. They are more passive arguments, in the sense that they will be influential almost by default, independently of overt action.

2.4 Social Momentum

The "social momentum" argument centers around the fact that continuous and powerful economic, political, and cultural momentum toward innovation and technological advancement will favor the Cosmist cause. Institutions are by their very nature difficult and slow to change, and none more so than ways of thinking about society itself. With centuries of tradition and precedent of creating ever better and better machines and technologies, it might prove difficult to prevent artilects; and even more difficult to prevent accumulation of the knowledge, technologies, and techniques required to build them.

Advanced artilects will be the offspring of earlier simpler artilects, which in turn will be the offspring of artificially intelligent and semi-intelligent devices and systems. Relatively limited neural networks and artificial brains will progressively evolve into more successful ones as a natural function of the way science works.

Consider for a moment some of the AI products that we can expect to see developed in the next few decades. We are beginning already to talk with our computers. As the years go by, these machines will become conversational computers. Call them "talkies". Since a lot of people live alone and need companionship, there will be a huge market for such machines, which will get smarter, more emotional, have a richer vocabulary, and better learning, larger memories, etc. over the years. In time, people will start having better "relationships" with their talkies. These conversational computers and robots will be able to adapt to their human owners by building up a knowledge base of their owner's interests, aptitudes, and knowledge, and will behave towards their owners in as familiar a way as a spouse or dear friend might.

In time, vast talkie research, development, and manufacturing infrastructures will be created to satisfy the enormous demand. Social intercourse is a deep need, and as the talkies get better at it, demand from the public will grow. Eventually, high demand and improving realism of such products might be what sets off backlash by Terrans.

A similar scenario will unfold as momentum picks up in the household robot market. These helpful machines will do chores and tidy up around the house. At first, they will perform only very simple tasks, such as vacuuming the carpets, and sweeping the floors, but as artificial brain building develops, the number of tasks these "homebots" can
perform will increase. Like the talkies, they will understand the human voice, so they can obey commands spoken by their human owners.

As the years go by, homebots will become "big ticket" consumption items in modern households, much as the automobile is today. Perhaps they will be talkies as well, so that they can talk back to provide explanations, and also build an intimate relationship with their owner. Again, industrial and social infrastructures will rise to support the profitable growth market.

Another class of AI products that we can expect will be teaching machines, or "teacherbots". These machines will adapt to the intelligence, knowledge, interest and curiosity of individual users; allowing students to learn what they need or want to at their own individual pace. In today's schools, a single human teacher attempts to educate a few dozen students simultaneously, pitching the intellectual level of the presentation at the middle ability range, thus leaving some behind, and leaving some bored and restless.

Teacherbots on the other hand will be able to educate students individually. They will tap into knowledge bases around the world, hunting out information relevant to the needs of their individual students. They will in effect become sources of infinite knowledge and fascination to students at every level.

Teacherbots, talkies, homebots, sexbots, baby sitter bots, and other useful products targeted at industrial and commercial, and military applications will form the core foundation of an AI based world economic sector. Powerful, strong-willed individuals will drive the creation and expansion of these trillion dollar global markets. Over the years, millions of people will be involved not only in using these products, but also in researching, designing, building, selling, and servicing them. It is difficult to imagine an economic sector or profession that will not be profoundly impacted by even the first early successful applications of AI and robotics.

Once millions of people's livelihoods are tied up in AI industry, how will it be possible to stop the development of more and more advanced products if ever the Terrans decide to attempt it? Increasingly, politicians, economists, captains of industry, and the “man on the street” alike will become involved with AI at some level.

It is fascinating to contemplate the potential for polarization amongst and within these groups as growing Terran fear of the rising intellectual powers of the early artilects begins to manifest and push back against the Cosmist agenda. Leaders and followers in all walks of life will confront the same questions and issues. Socioeconomic status might divide people on the issues involved. And national boundaries and culture differences might create rifts between nations in the same civilization, or between civilizations on the whole.

Professionals within the artificial brain based industries will likely prove to be powerful Cosmists, because it will be very much in their self-interest. To minimize the fears of the
Terrans, these captains of industry could make their products as human friendly as possible; make them "warm and fuzzy" so that they will appeal to human nature.

But there will be a limit to the extent to which the growing physical and cognitive abilities of their products can be hidden. The sheer computational miracles that even early artilects will be able to perform will be increasingly obvious, no matter how clever and accommodating their packaging. Sooner or later, millions of people will become conscious of how fast and how smart these earlier artilects become. The "artilect debate" will arise, and will inevitably heat up.

2.5 Military Momentum

The economic, political, and broader social landscapes provide an excellent backdrop against which to consider a specific application of AI that lends itself to the trend toward artilects. The “military momentum” argument could be considered a specific case of social momentum, since military forces around the world are working hard now, and certainly will accelerate efforts in the decades ahead, to create ever more intelligent and autonomous weapon systems. But as is often the case when considering social power and the issues involved in wielding it, the military will be treated separately here.

For millennia, the ultimate "reality test" of a society’s technology and state of military effectiveness took place on the battlefield. Every culture is self congratulatory, but when two cultures go to war, usually, only one wins. Interestingly, the winners and losers in large scale conflicts, especially in modern times, can often be best understood in terms of the technologies of war they employ on the battlefield. Winners usually have superior weapons - iron swords against bronze swords, strong iron against weak iron, the nuclear bomb against TNT, etc.

Since we don’t yet have a global state, individual nations still need to protect themselves from their rivals and enemies. They need to maintain military forces by investing in weapons, training, and research. In this sense, warfare and technology have always been closely linked.

Americans got a terrible shock in 1957 when they saw the Soviets had beaten them in the race to be the first country to launch a satellite - the "Sputnik crisis". It caused a national trauma. One of the results of that shock was the creation of a government research funding agency called DARPA (Defense Advanced Research Projects Agency) to fund blue-sky research that would help the US military create advanced weapon systems. The reasoning at the time was that if Soviet technology could launch a satellite, it could launch nuclear missiles against the US. American technological know-how needed to be given a real shot in the arm.

The reality since then in the US has been that a high percentage of artificial intelligence research has been paid for by the military. Americans will be pouring billions of dollars every year into brain building research within a decade, and using the results of that
research to control soldier robots, intelligent autonomous tanks, unmanned fighters and bombers, etc.

Thus, the Cosmists will feel certain that the rise of artificial brains with growing intelligence is inevitable. The exigencies of military survival of countries in a pre-global world will dictate that Terran pressures must be held in check. When national security is at stake, most governments tend to become very undemocratic, and the stronger the Terran opposition to such military research, the greater the level of secrecy national governments around the world will employ.

It is possible to imagine over time that when young Ph.D.s solicit for jobs as weapons researchers they will be screened for their Cosmist opinions, and that those with stronger Cosmist leanings will be given preference. Maybe the weapons labs will obtain a reputation for being "hotbeds" of Cosmism. Artilect research, like so many other strategic initiatives in the past, might be kept in total secrecy until finally being unveiled long after the possibility of responsible and informed social debate has past.

3. The Terrans

By definition, the Terrans are more "human centric", viewing humanity as the ultimate concern of the human species. The Terran case is powerful, and like Cosmism will be championed by leaders in all the professions and walks of life. The well-founded concerns at the foundation of Terranism are most likely shared at some level by even the most ardent Cosmists. But since the decision to build artilects is binary (either we build them or we don't) each of us will have to choose.

If the primary emotion felt by Cosmists is awe, then the primary emotion felt by Terrans will be fear. Fear of being replaced as the dominant species on earth, fear of the unfamiliar, and ultimately fear of domestication or even extermination. Eventually, the powerful interests seeking to maintain and expand the economic and political power of an artilectual industrial empire, with its strong religious overtones, will confront a primeval fear of the unknown, and an even more powerful fear of destruction.

Terrans may well feel that artilects will be so complex in their structure and dynamics that predicting their behavior and attitudes towards human beings will be impossible. Humanity therefore cannot exclude the possibility that advanced artilects, once built, may feel so superior to and/or so indifferently towards human beings, that they might decide to domesticate or exterminate us. They may do this for reasons we as humans cannot understand, or perhaps for no reason at all (because they can), the way we flush insects down the toilet or swat mosquitoes. Thus, Terrans will argue that the only way to be certain that there will be zero risk of the human species being exterminated is to ensure that artilects are never built in the first place.
Terrans will react against Cosmists and the idea of creating artilects with tremendous fear and suspicion. Ultimately, this reaction could well boil over into aggression and even violence. In the limit, Terrans could resort to violence as individuals, groups, nations, or even civilizations. Seeking to destroy the Cosmists, and literally stop at nothing to prevent artilects from replacing humanity at the top of the evolutionary ladder.

The Cosmist-Terran dichotomy is presented here in very stark, black and white terms, for the sake of discussion. In reality however, there is probably a bit of Cosmist and Terran in most of us. Therefore the level of ideological polarization on the issues involved will probably be smoothly distributed over all possible combinations of mixed sympathies. But be assured that the relative ideological strengths of the two sides will have a dramatic effect on the course of our new century.

The way the world will be a hundred years from now will be determined largely by the relative strengths of Cosmist and Terran sympathies in the world populations. It’s all a matter of degrees and of numbers and of relative power. Sooner or later, humanity will have to decide whether or not to stop the advance of artilectual intelligence. A binary decision will have to be made at some point. People and governments will be forced to take sides. The views of the Cosmists have already been presented. Now some possible Terran rationales are presented.

3.1 Preserve the Human Species

The "preserve the human species" argument has meaning at two levels. First, there is the potential for extinction or domestication of humans at the hands of artilects. Artilects would be capable of completely or partially destroying human populations on a global scale if they chose to do so, and once created and allowed to reproduce and roam freely there would be little that humans could do to stop them. Second, humanity holds the position at the top of the evolutionary ladder as the dominant species on earth and there are those who will simply not want to see anything change that. The anthropic view has come quite naturally for us all, and rightfully so. Humans have occupied the apex of evolution for as long as we can remember. The assumption that the human way is the best way is implicit in nearly everything that we do. But as we contemplate creating an intellectually superior entity, assumptions like this are called into question.

Terrans will make strong use of the first argument in the form of a call for self defense. And rightly so, since acts that are otherwise illegal or not acceptable become completely legal and acceptable when performed by those who fear for their own safety. Injuring or even killing others that are, or are perceived to be, a threat is understandable behavior.

This social reality could manifest itself in many ways as the artilect debate heats up. For example, Terrans may organize collective political action to prevent the creation of artilects. Or individuals or groups in the Terran camp might turn to violence to prevent artilects. Although Ted Kaczynski (the “Unabomber”) did not focus exclusively on preventing AI, his actions are an example of the lengths to which some will go when they feel justified in their cause.
As machines become progressively more intelligent, violence and/or legal sanction could be used against those who design and produce them, those who own them, or those who want to see them continuously improved toward artilect status.

Terrans will argue that what is at stake late this century may be the very survival of the human species; and that human survival at all cost is the top priority. It is non-negotiable. Terrans will not tolerate the idea, as many Cosmists might, that humanity ought to take the risk that a substantial fraction of human beings on the planet may be killed by the artilects. Terrans will not tolerate the Cosmist idea that artilects should be unobstructed to continue their climb up the evolutionary ladder.

Such Cosmist reasoning to the Terrans is madness. It is insane and should be stopped at all costs, even if the Terrans have to exterminate the Cosmists to keep human beings as the dominant species. The prime motive of the Terrans is fear of extinction.

When the artilect debate really begins to heat up, the Terrans will be horrified by the calculations of Cosmists, when the latter begin discussing "acceptable" risks that humanity might be destroyed. The Cosmists will be asking how small, how improbable, would such a risk have to be to be "acceptable". Terrans will remind us all that we are not talking about the risk of a few hundred or even a few million deaths, but of billions of lost human lives, of gigadeath. Terrans will be incredulous that the Cosmists can even contemplate rolling the dice with our species' very survival at stake.

Furthermore, the Terrans will ask themselves how the Cosmists can possibly calculate the risk in the first place? It seems such a futile exercise. The likelihood that the Cosmists will be unable to attach a realistic number to the risk will only reinforce the Terran resolve. If one cannot determine the risk in the first place then one cannot eliminate the possibility that that risk may turn out to be substantial. This line of reasoning will truly frighten many.

### 3.2 Fear of Difference

The “fear of difference” argument, although less rational than the desire to preserve human species dominance, could play a large role in the decision-making of Terrans. Human beings must have evolved a fear of difference and of the unfamiliar. It seems natural, and it is natural, to experience a fear reaction, or a considered cautiousness, or at least to acknowledge the possibility of danger when confronted with a new environment or an unfamiliar situation or object.

In the next few years, as people around the world come to grips with AI, they will probably begin looking ahead a few decades to the time when there could be an artilect box in the corner, or in their mobile homebot, that is almost as intelligent as they are. And for many, human nature will evoke emotions such as suspicion and fear.
Terrans especially will begin to ask, "How can we be sure that the homebots are fully tested and safe? If homebots are given the power to learn, and if their circuits are able to modify themselves on the basis of their day-to-day experiences, then how can we be sure that what they learn will always be compatible with the need to be friendly to humans?"

As the intelligence of the homebots and other AI devices mounts, so will their “difference” from anything we have seen before. And as fear of this difference becomes collective, Terran social movements will form and political pressure against artilects and those who own and produce them will rise. Terrans will argue that it does not matter much if the fear is well founded or not, the fear itself is real. If it does not go away, then the source of the fear should be removed.

The Terran position in opposition of artilects will assume that higher artilectual intelligence implies a greater risk that the artilects could behave in more dangerous ways towards human beings. Is this assumption valid? Is it possible that artilects can be made safe, i.e. human-friendly, no matter what their intelligence?

Isaac Asimov, the American science fiction writer, thought about such questions and came up with his famous "Three Laws of Robotics" (The term "robotics" is his). The essence of these laws is that the robots in his stories were programmed by humans to be always human-friendly. But since artilects will likely be self-adapting, many Terrans will be skeptical of “safe” artilects.

### 3.3 Unpredictable Complexity

As applications of AI progress toward artilect status, early versions will be simple enough in their behaviors to be reasonably predictable, and also for the architectures and processes that give rise to these behaviors to be understood. Scientist who design and build these machines, as well as consumers who use them, will at least have a notion that they know what is going on inside the “black box”.

Such products will be given appealing characteristics that endear them to their human owners. No problem there - but the issue is whether it will be possible to make artilects of human intelligence and beyond, well beyond, that would be “understandable”; and thus predictable. The fantastic and as yet not fully understood complexity of the human organism, some argue, gives rise to unpredictable human behavior.

Since the human brain contains some quadrillion (a thousand trillion) synapses (inter-neural connections), how will it be possible for brain engineers to connect up so many artificial synapses in appropriate ways in their artificial brains? Even if it becomes technologically possible, how will engineers know exactly how to do this so that the connections generate desired behaviors?

This is a huge and fundamental question for the brain builders. And the answer may be that the complexities of the task will be overwhelming, meaning the only effective engineering approach will be "evolutionary engineering". Evolutionary engineering
techniques evolve neural net circuit modules through trial and error to produce desired outputs when fed certain inputs. The point is that although these “brute force” applications of computational power do work, the internal dynamics of successful circuits are seldom studied exhaustively. In short, no one really knows exactly why they work.

It is simply not very practical to look at the details of every successful and unsuccessful attempt at creating desired outputs from given outputs. For a start, there are too many of them, and the internal structural and neural signaling complexities of each module are too great to be analyzed easily. Once the inputs and outputs of these modules are combined to form artificial brains, the complexity level jumps again. Analyzing how all this massive complexity works would be a mammoth task. In practice, circuits update (“train”) themselves (in effect they learn), and when different systems produce similar results, choices between them are made based on overall efficiency and effectiveness.

If one were truly motivated, it might be possible to analyze the step by step behavior of a single neural network module. It would be a very tedious process, but it might be doable. However, the knowledge obtained would probably not be very useful. It would explain how a particular module worked, but that knowledge would not help much. It would not be very useful for example if one's hope was to use that knowledge to promote the understanding of how to design other modules to perform other desired behaviors. One would be left with the conclusion that the only way to make further progress would be to use the evolutionary engineering approach.

In other words, one can analyze results, but one cannot synthesize easily a desired behavior beforehand. Analysis is possible, prediction is difficult. About the only way to build extremely complex neural net circuit modules is the mutate-test-select, mutate-test-select cycle of evolutionary engineering. It's clumsy, but it works. It's nature's way as well.

Evolutionary engineering is a wonderful new tool for engineers. The structural and dynamical complexities of the systems under evolution can be immense, well beyond what human engineers have the intellectual capacities to comprehend, yet successful functional systems can be evolved nevertheless. The great advantage of evolutionary engineering is that the systems that evolve can be arbitrarily complex. They can be more complex than any human could ever hope to design using the traditional top-down, blueprint approach.

This "complexity independence" means that as an evolutionary engineer, you don't care about the inherent complexity of the system that is being evolved. It doesn't matter because the evolutionary algorithm you use to evolve the system only cares about the value of the system's fitness (i.e. the numerical score you get when you measure how well the evolving system performs).

This greater complexity level allows for a greater level of functionality as well. Hence evolutionary engineering is often capable of evolving systems whose performance and functionality levels are superior to those of traditionally engineered designs.
Evolutionary engineering can be great engineering but is not very good science. Science is about understanding the world. Scientists want to understand how things are, how they work. Scientists are basically analysts. Engineers are basically synthesists. Scientists' satisfactions usually come from understanding how some aspect of the natural world functions. Engineers' satisfactions usually come from successfully building something that works well.

For the past 300 years or so, the dominant paradigm in science has been analysis. To understand how a complex system functions, scientists usually take it apart, study the components, and then put the understanding of the parts together to get an understanding of how the complex whole functions. This approach has been spectacularly successful and will remain so. However, now that computers are getting more powerful by the month, a new, more synthetic paradigm in science is making itself felt.

The queen of the sciences has always been physics. It has been the most mathematical and the most rigorous of the sciences. The attitude of the physicists has traditionally been that if a research field wants to call itself a science, then it had better be quantitative, with mathematically testable models, which give numbers that can be checked against the real world.

This mathematical "snobbery" of the physicists has led to paradigm clashes with the evolutionary engineers. The traditional attitude of the physicists is that, "If it's not mathematical, it's not academically respectable". The new and growing counter attitude of the evolutionary engineers is that, "If a system is sufficiently simple to be mathematically analyzable, it's unworthy of an evolutionary engineer's attention". Many physicists disparage the evolutionary engineering approach as "ignorant", because the evolutionary engineers do not understand the systems they evolve. Evolutionary engineers on the other hand label the physicist's approach "impotent", because physicists do not attempt to explain the really complex systems such as the human brain.

As the years pass, the power and prestige of evolutionary engineering will only increase, and Terrans, like physicists, are likely to charge that brain builders cannot understand what their evolved circuits are actually doing or are capable of. Terrans will argue that given the huge numbers of components involved in artilects (e.g. $10^{40}$ bits in an asteroid-sized artilect) there is really no way to build them other than using the mutate-test-select approach of evolutionary engineering. We know that it works, because this Darwinian approach built human beings and all the other biological creatures. It will probably be the only valid technique for building artilects.

Thus, from the Terran point of view, one critical aspect of an artilect will be its behavioral unpredictability. Human beings, in principle, will not be able to predict the behavior, attitudes, thinking processes, and ideas, of the self-evolving artilects. Artilects will be too complex and will be evolving and changing constantly at electronic speeds. Even the artilects themselves will probably not understand their own behavioral mechanisms, for the same reason.
4. The Cyborgs

A cyborg is a "cybernetic organism", i.e. a creature that is part human, and part machine. In a manner of speaking, cyborgs are nothing new, since human beings have been modifying their bodies with engineered products for centuries. For example, a veteran with a prosthetic limb, or a heart patient with a pacemaker. In addition to reactions against artilects, Terrans are likely to react strongly against cyborgs. And of course the Cosmists will want to push ahead with technologies that allow for the commingling of silicon-based and biological intelligence.

As noted earlier, artilects need not be conventional electronic boxes sitting in the corner. Perhaps 30 years from now computers will merge electrochemistry and electromagnetics. As the wedding of biology and electronic technology becomes increasingly possible, it is likely that some people will wish to literally wed their own bodies and brains to electronic components to create cyborgs.

Actually, the traditional definition of a cyborg will become rather old fashioned, as the distinction between what is biological and what is a machine fades away. When one says "machine", most people tend to think of some heavy steel device that moves by electricity or purely mechanical action and does not have billions of components, e.g. a steam engine or a car. But in a sense a biological cell is a machine, a kind of city of molecular scale citizens, all tiny machines doing their own little mechanical job (e.g. split this chemical bond, join these two molecules, transport this molecule to there, etc.).

Nanotechnology will allow us to make molecular-scale machines by the trillions of trillions, and see them self-assemble to make human-scale objects. In many ways, this is what biology does; biology is a kind of natural nanotechnology. The big possible distinction between biology and nanotechnology is that the former is the result of blind Darwinian evolution, while the latter has the potential of being humanly designed, or even self organizing.

As engineering and biology merge, many will be attracted to the idea of becoming cyborgs, finding the opportunity to increase their mental or physical abilities or sensory acuity irresistible. Others will choose otherwise. But the point is that technology will allow it. Once again, humans will likely be split into conflicting groups over the issue, including those who want to become cyborgs, and those who want to prevent anyone from becoming a cyborg. Similar to the abortion issue, where some want to leave decisions to individuals, and some want to mandate decisions for all by law.

There are plenty of science fiction movies which feature humanoid creatures which are sufficiently similar to us to be seen as "like us", but different enough (e.g. with Neanderthal-like heavy ridges over the eyes, or pug noses etc.) to be seen as "not like us". It is the differences that we find disturbing, sometimes very disturbing.
It is very possible that as biological sciences and computing technology permit neural modifications to be made to the human body, this kind of thing comes to be seen as normal, even desirable. In fact, it could well be that those who do not (or cannot) upgrade their cognition or physique will be competing at a disadvantage. A scenario like this has the potential to open a Pandora’s Box of discrimination and segregation issues, as well as equal access issues for those who cannot afford upgrades.

At the end of the day, these cyborg issues will pose significant issues for all humans, and will add fuel to arguments for and against developing such technologies. Cosmists might argue that by providing upgrades for everyone, humanity has an unprecedented opportunity to improve itself; while Terrans might counter that the slippery slope leads toward irreparable damage to the human species, or even total annihilation. Polarization is likely between those who see the technology as a panacea, and others who see it as a Pandora’s box; those who see cyborgs as super-human, and those who see them as an abomination.

Whichever side of the cyborg debate one is on, practical questions will have to be faced, and real problems will have to be solved. Should private and/or socialized medical insurance coverage upgrades? Should those who can afford upgrades be allowed to have them or should laws be passed to prohibit them? How can we assure admittance to universities, and opportunities for employment on an equal basis for cyborgs and pure biologicals?

There are those who point to creating cyborgs as a way to avoid conflict over machine intelligence, and to keep humans in pace with machines. Frankly, this idea seems naive. It would only work if everyone undertook the human to cyborg to artilect transitions at the same rate, which is totally unrealistic. And even this assumes that everyone would agree it is a good idea to allow cyborgs in the first place. It seems much more likely that millions, perhaps billions, of human beings will remain staunchly Terran and will not want to modify their bodies and brains, or to allow others to do so.

To the Terrans, the cyborgian philosophy will be simply a variant of the Cosmist philosophy. The more a cyborg becomes artilectual, the more alien "it" will become. In the limit, the human portion of the new creature will be dwarfed by the artilectual portion in terms of performance and size.

The distinction between an artilect that has no traditional biological component and an artilectual cyborg will not be important when one considers the possibility of implanting mountains of silicon-based data and processing capacity. The brain-injected cyborgs might look human on the surface, but their behavior and abilities would be totally alien. Perhaps the cyborg might spend a trillionth of a trillionth of its mental capacity acting like a human, but why bother thinking in human terms? What would be the point?
5. Conclusions

It will be interesting to see how sides are taken on the artilect issue, and how the issues on both sides will be framed in the world media and institutions. The media, and institutions such as education routinely present new issues to the public and must find ways to define and to help us all understand power balances in social conflicts.

Important to remember this is not intended as an exhaustive examination of perspectives within the Terran and Cosmist camps. Certainly there will be many other rationales on each side.

Ethical debates over the cyborg and artilect issues will be like none conducted by humans before. Humanity will be forced to rethink its values individually and collectively, and to make decisions perhaps none are qualified to make. It is for this reason at least that the point here, as much as any, is that the issues need to be aired in advance. Allowing as much time as possible for bodies of knowledge and policies to be formed before “crunch time”. Before the first headline reads, “brain implant triples memory”, or “new homebot has IQ of 200”.

Summary of the Above Ideas

This section summarizes briefly the main ideas of this chapter.

The authors believe that our new century will be dominated by the issue of “species dominance”, i.e. should humanity build godlike massively intelligent machines (called “artilects” = artificial intellects). 21st century technologies will allow the construction of artificial brains with capacities literally trillions of trillions of trillions of times above the human capacities. As millions of people see with their own eyes in the next decade or two, the rising levels of artificial intelligence in their own household robots etc, then everyone will start asking where all this is leading. Should humanity build artilects? One expects that a great debate will arise posing rival answers to this question. There appear to be at least three major positions to be taken on the artilects issue or the species dominance issue.

The first is that of the “Cosmists” (based on the word “cosmos”, because the Cosmists take a cosmic perspective to this issue). The Cosmists argue that building artilects is the most magnificent thing humanity can do, it is the destiny of the human species to create the next higher rung on the evolutionary ladder. There is a whole universe out there perhaps full of other artilects billions of year old.

The second group is the “Terrans” (based on the word “Terra”, meaning the earth, which is the Terran perspective on this issue). To the Terrans, building artilects is acceptance of the risk (a key word in this whole debate) that the artilects in an advanced form, may, for whatever reason, decide to wipe out the human species. The Terrans will be prepared to sacrifice several million Cosmists (i.e. kill them) for the sake of the preservation of the
survival of billions of human beings. To the Terrans, the Cosmists are fanatical monsters, willing to take the risk of the extermination of the human species. The only logical way this risk can be avoided is that NEVER will the Terrans allow the Cosmists to build artilects in an advanced form. If necessary, the Terrans will go to war to stop the Cosmists.

There is a third group of human opinion on the species dominance issue, called the “Cyborgists” who advocate that a potential conflict between humans and artilects can be avoided simply by allowing human beings themselves become artilects (e.g. by adding components to their brains etc). This third option will certainly be taken up by millions of people, but in the opinion of the authors of this chapter, will not avoid the Cosmist-Terran conflict, in fact it will very probably only make it worse, because not everyone will transform themselves into artilects at the same rate. Millions if not billions of people will remain fully human and feel profoundly threatened and alienated by their cyborg neighbors.

The authors predict (gloomily) a major war before the end of the 21st century over the issue of species dominance. The Cosmists will anticipate the hatred of the Terrans against them and will be prepared for it. The Terrans will hate the Cosmists for risking the annihilation of the human species. With 21st century weaponry, and an issue which will become the most passionate in history (since the stake this time is so high, i.e. the survival of the whole human species rather than of a people or a nation) then extrapolating the number of deaths in major wars from the Napoleonic Wars of the early 19th century to late 21st century puts the figure into the billions, a prospect we call “gigadeath”. We feel no easy way out of this terrible dilemma approaching humanity. We are so pessimistic on this point that we are glad to be alive today. We will at least probably die peacefully in our beds, whereas our grandchildren will probably see the conflict and be destroyed by it.