

Special Article - Criminal Behavior

The Biological and Social Survival of Humankind. A Review

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Abstract

Human beings, driven by their high intelligence and supreme technology, occasionally behave as the rulers of the earth. However, complex human-nature relationships and aggressive social behavior, especially warfare, indicate that humankind could be an endangered species in the future. The incredible evolution of the human brain, which resulted in the appearance of fascinating cognitive abilities, has enabled humans to achieve the most successful biological adaptation on earth. On the other hand, hundreds of various infectious agents and parasites have caused millions of human deaths throughout history and, in spite of modern medical treatment; some of them still have a lethal effect on millions of people each year. Toxic substances from certain fungi, plants and animals sporadically kill people worldwide. Human individual and social aggression have resulted in many millions of casualties from ancient times to the present. Natural disasters also take thousands of lives each year. The degradation of the ecosystems by humans has resulted in health problems and an increased mortality in global population. Although *Homo sapiens* has managed to become the dominant species on earth, he is still only a part of nature, unable to escape from its rules, laws, and power. In conclusion, the world community must achieve a consensus regarding ecological measures, the eradication of certain diseases, global economic progress, and peaceful solutions of social conflicts.

Keywords: Aggression; Evolution; Humankind; Microorganisms; Nature; Pathology; Social behavior

Introduction

The modern human being, *Homo sapiens*, is the highest achievement of our *Mater naturae*, mainly due to the incredible development of his brain, whose 100 billion electrochemically active neurons, interconnected by trillions of synapses, enabled the appearance of fascinating cognitive phenomena: consciousness, thinking, intelligence, judgment, planning, memory, emotions, and specific individual and social behavior, including speech as the most sophisticated and complex type of communication [1-5]. Such cognitive abilities have enabled our species to own a virtually unlimited activity and a fascinating creativity, due to which it became the dominant species on earth.

Based on this, some people believe that humans are “the masters of the Globe” [6] and supreme beings, something like Nietzsche’s *Übermensch* or “overman.” As such, they can rule nature and even overcome it. However, the present review will show that the mentioned opinions are, more or less, far from the truth. The main goal of our study is to point out that, in spite of our dominance over other species and we are only part of the rest of nature and, like other living creatures and we have to struggle for our survival in natural ecosystems and within our own societies. Finally, we shall illustrate some scientific facts by corresponding photographs and drawings, and by mentioning works of artists who always react to important natural or social events [7].

Humans, Inorganic Nature and the Living World

There is a multitude of natural threats in many regions of the earth. A sudden volcanic activity can kill thousands of people, as happened, for example, in the Roman town of Pompeii in the 1st century AD [8]. The earthquake, which struck China in 1556, caused about 830,000 deaths, i.e. the largest number ever [9]. The earthquake in 2004 in the Indian Ocean produced a tsunami, which killed more than 200,000 local people and foreign tourists [10], and the 2011 post-earthquake tsunami in Japan produced almost 20,000 casualties. In addition, floods, landslides, tornadoes, hurricanes, forest fires (Figure 1) and similar events, cause the loss of thousands of lives all over the world each year.

The subject on the living world is mainly related to the harmful influence of living beings on humans, that is, microorganisms, certain parasites, some algae, fungi, plants, and corresponding animals, as well as various biological products [2,11].

Microorganisms and Biological Toxins

As regards microorganisms and fungi, of the total 500,000 sorts of those present in the biosphere, several hundred are important for human life and medicine [1,12]. There are three types of relationships between them and humans. First, certain environmental microbes and fungi, such as yeasts and a few bacteria, enable us to make beer, wine, vinegar, and various dairy products [13], whilst some fungi

produce important antibiotics such as *Penicillium* and *Streptomyces* [11]. Second, symbiotic flora on and in our bodies usually protects us from pathogenic microbes, and may produce some important substances as well [14]. Under certain circumstances, however, the same flora can become pathogenic, especially in patients with a malfunction of the immune system [15].

Third, several hundred types of pathogenic viruses, bacteria, and other agents may affect the human organism. Some of them may cause death in a few hours or days, for example those leading to acute myocarditis or toxic shock [16]. The influence of some others may result in a lethal outcome in almost every infected individual. For instance, *Naegleria fowleri*, occasionally found in some swimming pools and freshwater lakes, is the causative agent of fulminant meningoencephalitis, which is a fatal disease in 95% of all patients [14]. This is also true for prion diseases, against which causal therapy is lacking as well. Some others may have a deadly effect without prevention or therapy, e.g. *Clostridium tetani* bacterium, and the rabies virus.

Other pathogenic bacteria can affect any tissue and organ in humans, where they induce damage or death of the host cells. In addition to the typical bacteria, there are some similar microorganisms, such as *Rickettsias*, *Mycoplasmas*, and *Chlamidiae*, the latter of which are the main cause of female sterility. Viruses can be extremely dangerous as well, e.g. HIV which causes AIDS. Finally, there is another unique infectious agent, i.e. the mentioned pathological prion protein in the brain of some individuals, which often causes Creutzfeldt-Jacob disease in humans, and “mad cow disease” in animals [12].

Some species of microbes have made devastating pandemics in the past. Thus, the plague epidemic known as the Black Death in 14th century Europe, caused by *Yersinia pestis*, killed about one fourth of the European and Asian population at the time [17], and was presented in paintings by the Lorenzetti brothers [7]. Certain microbes, transmitted by the Spanish conquistadors in the 16th century to the local Maya, Aztecs, Inca, and other sensitive populations, were more deadly than invader weapons [18]. At the same time, syphilis was imported from the New to the Old World [19]. This disease later on affected many famous people in Europe, including composers (Schumann, Schubert, Smetana, Donizetti), painters (Gauguin, Lautrec, Manet), writers (Tolstoy), and most likely the famous philosopher Nietzsche. In fact, microorganisms never distinguish ingenious individuals from “ordinary” people.

In the recent past, i.e. in 1918, the influenza virus H1N1 was estimated to have caused over 50 million lethal outcomes worldwide [20]. The influenza infection even in present days takes about 650,000 lives worldwide annually [21]. Tuberculosis affected many people in the 19th and 20th century and, among others, the well-known writers such as Chekhov, Gorky, Balzac, Camus, Maupassant, Bukowski, D. H. Lawrence, and Orwell, and painters and composers, e.g. Delacroix, Modigliani, Chopin, and Boccherini [22]. Even in the new millennium, about 1.2 million people die of tuberculosis worldwide per year, and over 10 million new cases are registered each year [23].

As for modern times, there is a greater chance than ever for microorganisms to spread rapidly and to cause pandemics, due to fast

transportation, crowded settlements, and sexual freedom, as well as to the host organisms' lack of resistance in the case of a new microbe or new strains appearance [1,24]. This was the case, for example, for *Legionella pneumophila* and the Ebola virus (appeared in 1977), *Staphylococcus aureus* (1981), hepatitis E and C viruses (1989), the West Nile virus (2002), and the Zika virus (2007), some of which are very dangerous. For instance, global HIV infection (appeared in 1981) is now present in about 40 million patients, in whom the annual mortality incidence is more than 1.2 million [25]. HIV has caused the death of over 30 million people so far, some of whom were famous artists, musicians, and writers, e.g. the Russian ballet dancer Nureyev, the rock star Mercury, and the novelist Asimov.

Similarly, about 2 billion people have been infected by hepatitis viruses, and there are over 300 million carriers of the hepatitis B and C virus worldwide, from which several millions died between 1990 and 2013 [26]. Some other viruses, such as *Herpes zoster* and especially *Herpes simplex*, have infected three fourths of the global population and live in their sensory neuronal ganglia before causing symptoms occasionally. Moreover, some viruses cause malignant tumors [27]. Finally, *Helicobacter pylori* is housed in the stomach in more than three billion people, causing peptic ulcers or gastric cancer in some of them [28].

Enterocolitis, i.e. diarrheal diseases caused by various microbes and parasites, affects about 300 million people each year and results in 1.5 million deaths [14]. The well-known German writer Thomas Mann mentioned a cholera epidemic in his tale *Death in Venice*. Similarly, nearly 15 million new cases of sexually transmitted diseases appear annually worldwide. Immense health problems are also caused by certain unicellular parasites (*Protozoa*), e.g. *Entamoeba histolytica* which causes dysentery, and *Plasmodium falciparum*, transmitted by mosquitoes, which causes malaria in 500 millions of people all over the world, with about 1 million deaths annually [29]. In addition, certain parasitic organisms such as round (*Nematode*) and flat worms (*Platyhelminthes*), along with *Protozoa*, affect an incredible number of 4 billion people worldwide [12,14].

There are two main ways, i.e. natural and artificial, in which humans fight against microorganisms and other infectious and parasitic agents. As regards the former, the immune system is the most effective natural defense against microbes and other antigens, which kills them by lymphocytes or neutralizes them by antibodies (immunoglobulins) [12,15]. However, the inflammatory products during infection, e.g. cytokines as well as some bacterial toxins, may exert dangerous systemic effects such as sepsis and shock, which cause over 200,000 deaths annually in the United States alone.

Our intelligence and high technology help us fight against various agents to some extent [11,15]. For example, certain antibiotics and similar drugs, including vaccines, have been provided from natural sources or produced by pharmacologists and microbiologists, to be used for infections treatment. However, in order to survive as a species, microorganisms usually engage certain genes which encode the synthesis of specific enzymes for the inactivation of the applied drugs [11,30]. As a consequence, the novel strains of pathogenic bacteria are usually multidrug-resistant, and hence some new antimicrobial drugs must be created constantly. In addition to bacterial resistance development, there are some side effects of



Figure 1: A forest fire. (Photo Marinković S).

antibiotics and certain negative consequences which may appear in therapy. Besides, mass antibiotic application has produced another biological consequence, i.e. a dramatic increase in fungal infections in recent years, especially regarding the *Candida* species [11]. Finally, mutations are very frequent in some microorganisms, e.g. in HIV which may produce about 10 billion viruses per day [1]. This virtually disables a production of an effective anti-HIV vaccine [25].

Finally, the virulence and resistance of some microbes and difficulties in the prevention and therapy of the infections they cause may lead to their abuse in biological war or bioterrorism [31]. Thus, several anthrax attacks already happened in the United States in 2001.

Many types of toxins are produced by living creatures which can in turn harm humans [1,11]. Thus, exotoxins of some land microorganisms, such as *Clostridium botulinum* and *Clostridium tetani*, may have a deadly effect on humans by their neurotoxic action. The marine algae *Dinoflagellatae* produce a large number of toxic substances, which enter certain food chains, especially fish consumed by humans, sporadically causing their intoxication and death occasionally [32].

Certain mushrooms produce several toxins which are occasionally deadly when ingested [11]. It is the same case with ergot alkaloids from particular plant fungal parasites. Moreover, aflatoxin, which is a metabolite of moulds in cereals, is a potent carcinogenic substance which leads to liver carcinoma in humans [14]. Cyanogenic glycosides from many plant species can lead to acute intoxication and a lethal outcome. For instance, hydrogen cyanide may cause death in a few minutes, and hence it was used by Nazi officers, including Hitler's lover Eva Braun, for committing elegant suicides at the end of World War II [33]. Many other toxic or pharmacologically active substances are present in some plant species, e.g. digitalis, oleandrin, atropine, ricin, strychnine, and curare alkaloids [11,34].

Strychnine and cyanide poisonings were described in certain novels by Agatha Christie, whilst some other poisonings are presented in Shakespeare's famous plays *Hamlet*, and *Romeo and Juliet* [35]. According to certain data, Agrippina, the mother of the emperor Nero, had poisoned several high-rank Roman individuals, including her husband, the emperor Claudius [36]. The famous Greek philosopher Socrates poisoned himself probably with the extract from

the plant *Conium maculatum*. There are certain intoxication attempts in modern times as well. Thus, a few years ago, a Texas actress mailed letters contaminated with ricin, one of the most toxic substances known, to US President Barack Obama [37].

Similarly, animal venoms can also be very dangerous. They are present in certain invertebrates, for instance, in jellyfishes (Figure 2), some worms, bees, spiders, and scorpions, as well as in vertebrates that is, in some fishes, amphibians, and especially in reptiles [38]. These venoms can produce certain life-threatening hemolytic, cytotoxic, cardiovascular, and neurotoxic effects. The mentioned toxic substances are introduced following occasional animal attacks on humans. The bites of some venomous snakes have a much higher incidence, i.e. over 5 million worldwide with more than 120,000 fatalities annually [39].

Finally, there are some large wild animals, which can harm and even kill humans by direct attack, although this happens very infrequently [40]. As for sharks, 5,034 attacks were recorded worldwide since 1990, of which 1,205 were fatal [41]. These rare events have inspired Misiorowski and other directors to make corresponding movies. There are also sporadic cases of domestic animals attacks.

Autodestructive Human Disorders

Some disorders within the human organism, with the underlying biological processes, can increase morbidity, but they may have a fatal outcome as well [12,14]. The subject is mainly related to autoimmune, allergic, genetic and psychiatric disorders, as well as to malignant tumors.

As already mentioned, a normal prion protein of the neurons is transformed in some individuals into a pathological protein, which behaves as an infectious particle within the brain and produces a deadly outcome. In addition, there are many autoimmune disorders, e.g. lupus erythematosus, scleroderma, and rheumatoid arthritis [14]. An abnormal immune reaction is also seen in many patients with multiple sclerosis, which affects about 2.5 million people worldwide. Certain types of diabetes mellitus, whose global prevalence is over 420 million people, have an autoimmune basis. Some allergic reactions in predisposed individuals can cause a fatal outcome, especially anaphylactic shock that can lead to death in a few minutes [15].

Some gene mutations and chromosome alterations cause hundreds of disorders which can result in death either during development, in infants, or in adult individuals [14,31]. Similarly, various developmental disorders affect embryos or fetuses during pregnancy and often produce lethal outcome. These and other neonatal disorders cause 2.2 million deaths globally per year [42].

Much more frequently, the causes of autodestruction are certain cancers, which are produced by at least 4-7 gene mutations, or one or several chromosomal abnormalities in somatic cells [14,31]. These neoplasms may lead to a patient's death in several months or years, or over a decade in some patients [14]. In any case, a malignant tumor behaves as the worst enemy against its own organism.

Neoplasms are the second leading cause of global human mortality, just after cardiovascular diseases and stroke [14]. The incidence of new cancer cases is 17 million worldwide annually, and



Figure 2: Jellyfish. (Photo Tomić I).



Figure 3: Our common origin, but diverse evolution. (Photo Marinković S).

the global mortality rate is 9.5 million [43]. Cancer has caused the death of many famous people, e.g. the composers Puccini, Debussy, Bartók, Rachmaninov, Shostakovich, and Bernstein, as well as artists (Fawcett, Hopper, Chapman, Arthur, Piaf, Pinter, etc.), certain scientists (Curie, Sagan, etc.), and some others.

Certain psychiatric disorders, especially major depression, bipolar disorder, and schizophrenia, may cause patient suicide, but also homicide intermittently [44]. The mentioned disorders have a relatively high incidence. In China alone, for example, over 7 million patients with schizophrenia were registered between 1990 and 2010 [45]. Of them, almost 30,000 patients commit suicide each year. As for bipolar disorder, there are globally about 50 million patients [46]. It is an even worse situation with depression, the prevalence of which is up to 5% of the global population, with a great risk of suicide attempts. In any case, many famous artists and writers have suffered from major depression, bipolar or hypomanic disorders, and some of them from schizophrenia, e.g. Messerschmidt, Blake, and Kubik, a certain number of which have committed suicide. In addition, millions of people in the world, especially tobacco and alcohol addicts, belong to the group with a “chronic suicide” tendency [44]. Similarly, psychoactive substance abuse is a great problem in modern society because about 350,000 of overdose deaths are registered worldwide per annum [44].

The Human Destruction of Nature

Intelligence and the other cognitive abilities of *Homo sapiens*, which are very important for our survival and better life, have created many procedures, substances, tools, devices, and apparatuses which can modify nature, either positively or, more often, negatively, in both local and global domains.

Even in ancient times, humans exerted a devastating influence on the natural environment. Thus, there is an example of deforestation in Mesopotamia about 5,000 years ago, which gradually transformed most of that fertile region into a desert [1]. Nowadays, ubiquitous deforestation, artificial lake formation to produce energy, and settlements and road building, can drastically endanger the living world in those ecosystems, and alter local and even global climate conditions.

The industrial revolution in the 19th century, and the scientific and

technological revolution in the 20th century, including the modern 4th revolution, profoundly changed the human-nature relationship [1,8]. Thus, the emission of millions of cubic meters of carbon dioxide (CO₂) into the atmosphere has caused dangerous global warming. Acid precipitations happen occasionally and damage water and land ecosystems, whilst some air and water pollutants have cancerogenic effects [47]. The damage of the ozone (O₃) layer around the earth has caused a decline of this gas followed by diminished protection from solar ultraviolet radiation with a resultant rise in skin cancer incidence.

Air, soil, and ground water pollutions are ubiquitous, and they are a great health threat to the whole human population and other living beings [1,47]. There are several main air pollutants in urban regions, which are particularly generated by certain industrial technologies and the combustion of fossil and coal fuel. Soil and ground waters contain many pollutants, especially in rural environments, e.g. some herbicides, insecticides, fertilizers, and solvents [11].

All the mentioned disastrous effects of human activity have endangered the human population, but have also produced a biodiversity crisis and a mass extinction of about 10% of the species in the biosphere [1]. A great additional danger comes from the radioactive radiation following, for example, the nuclear plant disasters in Chernobyl and Fukushima, which will last for hundreds of years. It is a similar situation with the mentioned Ultraviolet (UV) radiation and global warming. Finally, there is another variety of iniquitous human activity in some ecosystems, that is, the introduction of certain foreign species into corresponding territories [1]. Thus, 12 pairs of non-native pest animals, i.e. rabbits, were imported from Europe to Australia in the 19th century, whereupon the population exploded to hundreds of millions until 1950, damaging the entire ecosystem.

Some other aspects of the progress have additional consequences, for example, technologically based accidents, such as explosions, fire, radioactivity appearance, or the leaking of dangerous chemicals in certain factories or from oil tankers. In addition, transportation accidents instigate scores of injured people and over 1.5 million of deaths worldwide every year [9,42].

Individual Aggression

Aggression is normal behavior in the animal kingdom, regarding



Figure 4: Human aggressive behavior. (Photo Marinković S).

both intraspecies and interspecies conflicts, which is usually a type of adaptation and natural selection [1,6]. Humans sometimes behave similarly to other mammals when their health or lives are in danger [2,4]. However, there are some responses, which are distinct from animal behavior. Namely, people also react aggressively when their freedom is endangered, as well as moral, political and religious beliefs, and other abstract concepts, which are not present in animals.

Unlike these, more or less, normal reactions, pathological aggression may appear manifested as violent behavior of an individual with the intention to hurt other people and, moreover, to feel pleasure occasionally when committing aggression [2,44]. All in all, antisocial, violent, and psychopathic individual aggressive behaviors can be distinguished, all with various consequences: injuries, abuse, psychological stress, and particularly self-aggression (suicide) or homicide, including euthanasia [6,44,48]. The highest suicide incidence has been recorded in Eastern European countries, Japan and some other places, while the lowest one is in the Mediterranean countries. In fact, nearly 1 million suicides is committed globally per year [49]. Mass suicides have occasionally been recorded throughout history, either to avoid surrender, or for certain religious reasons, resulting in thousands of deaths [8].

Some well-known individuals have committed suicide, for example, certain rulers (Cleopatra, Nero, Hitler), philosophers (Socrates, Seneca, Deleuze), poets, novelists and screenwriters (London, Poe, Woolf, Hemingway, Yesenin, Mayakovsky, Tsvetaeva, Zweig, Mishima, Brooks), painters (van Gogh, Kirchner, Gorky, Rothko), actors and actresses (Monroe, Whale, Williams, Gordon, Bhattacharjee, Brandis) and others [7,8]. Mythological, biblical, real or imagined suicides were presented by many artists. Thus, the Roman legend about *Lucretia* was the subject matter of many painters, e.g. Cranach, Botticelli, Titian and Tiepolo [7], and of some composers, for instance, Britten in his opera *The Rape of Lucretia*. The suicidal drowning of Shakespeare's *Ophelia* was depicted by Delacroix, Redon and Millais. Furthermore, *Anna Karenina* in Tolstoy's novel threw herself under the carriage of a train.

Homicide also contributes to lives being lost in every society. Individual murderers, or mass and serial killers, as for example London's Jack the Ripper from the 19th century, the 20th century British Harold Shipman, and the Norwegian Anders Breivik in the

new Millennium and others, resulted in many deaths [50]. In general, there are about 500,000 homicide-caused deaths at the global level per year [51]. Homicides from biblical or mythological stories were often the subject matter of famous artists [7]. We can mention, for instance, Tintoretto's *The Murder of Abel*, Cranach's, Caravaggio's and Titian's *Judith and Holofernes*, and, Moreau's and Klimt's *Salome*. Real murders or murderers were painted by David (*Death of Marat*), Repin (*Ivan the Terrible killing his Son*), Wojtczak (*Murder*), and by Cézanne, Monory and some others. Murder was the subject in certain plays or novels, for example, in *Hamlet* by Shakespeare, *Eugene Onegin* by Pushkin, *Crime and Punishment* by Dostoyevsky, and in *The Trial* by Kafka, as well as in *Carmen*, an opera by Bizet [35,52].

Even some artists were killed, for instance, the musician John Lennon, American actress Sharon Tate, the well-known Italian film director Pasolini, and modern Polish painter Beksiński [7]. It is interesting that some famous artists, such as Caravaggio and Cellini, were accused of committing murder.

Socio-psychology and Societal Organization

Some animals live in groups with a certain social structure [1,6]. The individuals of such groups, especially primates, show the ability to organize dominance/subordinate hierarchies with an alpha male on the top. Such a rank order confers a better survival of the group, and also limits fighting among fellow members [1].

Since humans evolved from socially organized hominids (Figure 3), they have an urge and necessity to live together [3]. According to some authors [1], our social development, including culture, has passed through three main stages: scavenging-gathering-hunting, agriculture, and the industrial and technological revolution. In general, all stages elicit similar effects: enough food and goods production, population growth, certain technology development, labor division and cooperation, economic specialization, competitive groups and class system appearance, a new state organization, warfare, and, consequently, the economic, cultural, political and military dominance of certain societies [53,54].

The interpersonal relationships within a community are based on social cognition, including the social intelligence of each individual, which are actually a result of an interplay of the individual psychosocial traits of the group members who are interconnected by communication and collaboration, similar belief and tendencies, and certain interests [2,4,55]. The social groups within a large society function according to certain norms, the different roles of its members, and status hierarchy. Intrasociety cohesion is maintained by individual and group moral responsibilities, social norms, and a legal system, which all limits individual or group aggression. As regards dominance, two types of it exist, i.e. social and aggressive [56]. It is interesting that individual dominance is developed already in infants as young as 10 months and under [57].

Social Aggression

In the animal kingdom, the members of many species kill those of other species to provide food (predator aggression) or when competing for a territory with certain resources (adoptive aggression) [16]. On the other hand, members of the same species within a group



Figure 5: Allegory of warfare. (Designed by Marinković S).

very rarely kill each other when fighting for social dominance. Only occasionally are there certain inter-group conflicts with some deadly outcomes.

Human social aggression, i.e. collective violence, has been expressed from ancient times to the present days, most often in the form of human sacrifice, slavery and warfare, and less frequently by mass panic and some other types [8,44].

Human sacrifice, including ritual murder, was practiced in ancient times, less frequently in the Middle Ages, and rarely in certain African tribes - until recently. Such rituals were most often performed as an offer to a deity. The Aztecs, for instance, used to sacrifice thousands of war prisoners annually, whose hearts during the ritual were ripped out while they were still alive [58]. Similarly, in some African tribes, living victims were dismembered.

Slavery was one of several ways to abuse and occasionally kill individuals of certain groups or races [8]. It was a common type of social aggression in the ancient era, less so in the middle Ages, but particularly high in colonial times. About 20 million Africans were used as slaves in the colonies and in various Western countries. Unfortunately, slavery is still present, especially in the form of trafficking, which involves over 40 million people worldwide [59].

Social aggression throughout history was also manifested as capital or judicial punishment, not only of criminals but also of political rivals or religious opponents [8]. As regards the latter, many people were tortured or killed in the period of the medieval Inquisition. In modern times, some dictators performed genocide of certain nations, or a mass killing of their own people. Thus, Hitler's Third Reich exterminated about 9 million Jews, Roma and Slavs in concentration camps [33], which was artistically presented by Lebrun on the canvas *Floor of Buchenwald No. 1*, and by Benigni in the deeply touching movie *Life is Beautiful*. Similarly, Stalin was responsible for about 10 million deaths of Russians in Siberia and other places, which was impressively depicted in the novel *The Gulag Archipelago* by Solzhenitsyn.

Mass panic with a deadly outcome is defined as an assessment of each individual in a group that his or her chances for survival in a life-threatening situation is close to zero [2,44]. Such impulsive and uncontrolled mass behavior can lead to countless more casualties than the objective threat itself [9]. Thus, during a football match at a Moscow stadium in 1982, over 300 fans lost their lives. An even worse scenario happened during the Hajj in 2015 when almost 2,400

panicked pilgrims lost their lives in Mecca [60].

Warfare

Social aggression (Figure 4) is obviously common behavior for the human race, especially in the domain of warfare [6,8,48] (Figure 5). Throughout history, most often stronger social groups, nations, or states were killing members of the weaker ones, taking over their territories and properties, as well as women which occasionally increased the gene flow in the aggressor population [1,8]. Similarly, groups with an opposite political or religious ideology were sometimes fighting among themselves, with many consequential victims. Overall, in the recorded history of the last 3,500 years, there were in total only about 200 years of peace on Earth. Dozens of millions people were killed in multitude of wars during the last 6,000 years, whilst many of the survivors experienced posttraumatic stress disorder [44].

For example, numerous people were killed in wars between the Egyptians and Mesopotamians, ancient Greeks and Persians, and during the formation of the Roman Empire, as well as in the 5th century AD attacks by barbarian tribes and Huns, which ended the Western Roman Empire. The Eastern Roman Empire, i.e. Byzantium, faced attacks by other nations, including the Ottomans, who created numerous victims and ended the Empire. Many wars happened in Europe in the following centuries [8]. During the colonization of the Middle, South, and North Americas in the 16th and 17th century, millions of local populations were either killed, became slaves, or died from infections.

Many casualties occurred in the American War of Independence and in the French Revolution in the 18th century. In addition, Napoleon occupied most of Europe and caused millions of deaths, which was impressively presented in *Disasters of War* by Goya, and in Tolstoy's novel *War and Peace* [7]. Many thousands of people were killed in the European social unrests and the independence struggles in the 19th century, as well as in the American Civil War. In addition, millions died during the Russian Revolution in 1917.

In modern times, over 20 million people were killed in World War I, half a million in the Spanish Civil War thereafter, and more than 70 million in World War II [8]. These disasters were presented by many artists and novelists, for example, by Remarque in the novel *All Quiet on the Western Front*, Picasso in his painting *Guernica*, Hemingway in the novel *For Whom the Bell Tolls*, and by Obrossov in his 1941 painting *Wartime Moscow* [7].

Toward the end of the last World War, a single atomic bomb explosion over Hiroshima and Nagasaki instantly killed more than 150,000 citizens [8]. Later on, the wars in Korea, Vietnam, Cambodia, some African countries, and in the Middle East, as well as several civil wars in various regions of the world, produced millions of casualties. Nowadays, many thousands of people lose their lives in some other local wars, and millions of refugees have flooded into European countries where, at the same time, hundreds of innocent people have become victims of terrorist attacks. As for the latter, about 64,000 people were killed in 100,000 cases of terrorism from 2002 to 2011 [61].

The concept of war was "imprinted" in human social psychology from the very beginning. Ordinary people and soldiers throughout history regarded war as an almost normal event, and many of them

as an opportunity for robbery and rape, or belligerence and bravery [8]. Similar goals were important in later history, i.e. gaining new territories and resources, or introducing a new ideology, either political or religious. As for the latter, the Crusades happened, as well as deadly conflicts between the Catholics and Protestants in the 16th century Reformation and in the 17th century Thirty Year War with 8 million casualties. Religious wars or smaller conflicts continue to the present day.

The psychological background of social aggression in general comprises group frustration and anxiety, occasionally due to food shortages, but also selfishness, greed, and striving for group, national, or global dominance [6,2,48,62]. As for modern times, there is again a dominance of powerful countries due to their wealth, economic, and technological and military superiority [8]. Moreover, there is an occasional political and military involvement of the fittest in the affairs of small countries just because the former dislike the political system or the leaders of the latter, or due to some economic, strategic, and geopolitical interests, which is usually associated with violation of international law. Such behavior of the fittest provokes hostility, rage, and a destructive tendency in the weakest, which is one of the causes of local conflicts, but also of terrorism development [63].

Finally, certain within-society conflicts rise, usually due to individual or group tendencies to attain a better position, more influence, financial benefits, or a new ideology, that is, to induce a redistribution of power [2]. Due to that, class, ethnic, political, or religious conflicts may arise, often in the form of a national revolution or a civil war with many deaths [8].

Finally, there is a distinct social violation in the economic sphere. Struggle for profit often involves mighty politicians who sporadically start international economic wars and a consequent global financial crisis, with a grave impact mostly onto the low-income countries. In addition, only a few percentage of the most affluent represent about a half of global wealth, whilst at the same time hundreds of millions of people are starving, many of them to death. However, such a situation cannot last for a long time. Millions of economic migrants have already appeared on virtually all continents.

Concluding Remarks

Homo sapiens, due to his cognitive abilities, has achieved fantastic progress in science, technology, fine art, music and philosophy by designing things, processes and phenomena some of which do not exist in nature [52-66]. Yet, he himself is a creation of nature and thus is influenced by its laws and rules [1]. In fact, nature itself is so complex that over 90% of our scientific work is devoted to revealing the mechanisms of natural phenomena, especially those in quantum physics, astrophysics, and biological domains. Most of the discoveries we have made in this and other fields help us survive on this planet and maintain our status of a supreme species.

Evidently, the history of humankind has several domains. First, the harmful influence of many microorganisms, some algae, fungi and certain parasites, which show a high level of biological adaptation [11,14,31]. Infectious agents still cause a high mortality rate: over 11 million worldwide each year [42]. The morbidity rate is related to an incredible number of several billion people who are occasionally or chronically infected with some microbes or infested with certain

parasites. Therefore, the life span in some of those people is shortened, the quality of life is affected, and their fertility is diminished, in spite of human immune system engagement and modern medical treatment. It means that the infectious agents are biologically very successful, and that our struggle against them will last forever. In addition, if we include some other biological factors, such as autodestructive diseases, and especially cancers, it can be said that an additional 11 million of deaths occur at the global level annually.

As mentioned previously, there are also certain harmful influences of inorganic nature, some of which can be predicted, although none of them can be stopped. On the other hand, there is a human degradation of the biosphere and the rest of nature with possible disastrous consequences, including certain plant and animal extinction, and dangerous effects on humans themselves. All this, along with some technological threats (especially nuclear plants and weapons), also may contribute significantly to the global morbidity and mortality rate.

The situation with humankind can get much worse due to an additional factor, i.e. the population explosion in the last few centuries. Whereas only about 0.5 billion people lived on Earth in 1650, the current population has reached almost 7.5 billion, mainly due to good nutrition, sanitation, and medical care [1]. However, the Earth's carrying capacity is probably up to 15 billion people, due to limited housing and infrastructure space, as well as food, water and energy resources. Such a demographic explosion can be reduced in two ways, either by decreased reproduction (by individual decisions or by government interventions, as was the case in China) or an increased mortality rate (resources limitation, environmental degradation, pandemics, and warfare) [1]. A possible population of some neighboring planets or moons is, for the time being, an idea in the science fiction domain.

Finally, biologists, sociologists, anthropologists, psychologists, psychiatrists, historians, and philosophers have been debating for centuries about the question of human social behavior, especially warfare, which is associated with mass killing and occasionally with pogroms, ethnocide, or genocide [8]. Several theories and hypotheses have been proposed, e.g. Hamilton's rule, parochial altruism, blatant dehumanization, and a social, economic and religious imbalance of power [1,3,6,48,53,64,67-70]. Some others have mentioned that warfare is predominantly a biological event in the form of "social Darwinism" or gene flow necessity [1,6,48], although others believe that it is mainly a cultural and social product [3,53].

Whatever the cause and in spite of some optimistic attitudes [71], history and psychology have shown that individual aggression and social conflicts will probably be occurring until the end of time. This is perhaps a special type of natural selection within the same species. Although we can understand the biological and social basis for such behavior, the ethical norms of our superego cannot accept such a situation, especially the horrible suffering and a massive loss of lives of the most intelligent and most emotional beings on the Earth.

Obviously, there will be no true progress in the world community until some kind of global economic, social and ecological justice is achieved [3]. Otherwise, international conflicts, including wars and terrorism, technological threats, and the degradation of nature, will continue for a long time. In addition, even in the case of achieving

the mentioned global justice, a biological desire for power and social dominance will probably remain forever. In spite of this, a global consensus must still be achieved [3] in order to prevent the suffering and death of millions people in the future.

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