THE THEORY OF VIOLENCE

On the neurobiological violence inhibition mechanism and solving the problem of violent behavior by regaining lost inhibitory control

Version dated 27.11.2022

The most actual version of the study, contact details and social pages of the author, as well as other information can be found on the website antiviolence.io/en

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Introduction

When it comes to violence, although it seems to be a socially unacceptable phenomenon, the claim that it is natural to humans is most often not questioned. Observing constant violence in the animal world and human society, it may seem to us that this is indeed a normal and natural phenomenon. Of course, in the case of interspecies relationships, for the most part, this should not be doubted because we can all easily see how animals eat each other and how fierce competition for territory and resources between different species happens. However, the situation with violence will not be so unambiguous if we look at intraspecific relationships.

Did you know that in the nervous system of many animals, and even humans, there is a mechanism that, when activated, inhibits offensive aggression towards members of their species while not affecting either defensive aggression or other forms of behavior and social communication? In particular, such a result was demonstrated by experiments with mice and rats. Activation of this mechanism led to a sharp decrease in their aggressiveness while leaving them the ability to self-defense. Also, a lot of evidence, including the findings of military experts, suggests that the average and healthy individual has a strong inner resistance to killing other people.

The theory that many species have inhibitors of intraspecific aggression, which developed in the course of biological evolution, has existed for quite a long time and originates from the very emergence of **ethology** – the science of animal behavior. Based on this theory, a model of the violence inhibition mechanism in humans was also proposed, explaining the development of empathy and the emergence of psychopathy. And even the results of some studies in the field of neurophysiology and genetics confirm its validity.

In turn, the prevalence of violence we observe can be easily explained by the fact that it draws too much attention to itself. One person, who committed murder, will obviously be more noticeable than a thousand other, peaceful people. Violence is not so common and it should be considered as a deviation and pathology rather than a natural phenomenon of social communication. We will get acquainted with all the details and evidence behind such a conclusion. Also, based on them, we will develop potential solutions to the problem of still existing violence in society and human relationships.

I. Definitions of the concepts of aggression, violence, and self-defense

To make it possible to study the topic of violence as a form of behavior and social communication, we need to give this concept a concrete definition. In this case, as well as in the definition of another important concept – self-defense, we will start from the broader concept of aggression. An **ethological** approach will help us to solve this problem. Of course, the definitions thus obtained may differ from many other, more generally accepted definitions. However, exactly these definitions will make it possible for the most objective and accurate distinction between different forms of behavior from a biological point of view, which is extremely important for our study.

As a feeling, aggressiveness consists in anger, expressed as irritation, dissatisfaction, or hostility. However, **aggression** in intraspecific relationships can be defined as a form of social communication characterized by **constrained** actions, reactions, and social signals between participants in the conflict.

It is important to pay attention to this "constraint". It consists in rules and rituals of certain magnitude, expression, and sequence, which make aggression functional, dynamic yet structured behavior within inhibitory limits. Regardless of species-specific rules, these components are necessary for functionally driven aggression [1][2]. Also, this inhibition of aggression is the main function of the violence inhibition mechanism, which we will discuss later.

The difference between violence and functional (or adaptive) aggression lies in the behavioral sequence or interaction dynamics between two or more conspecifics in combat. Violence is characterized by the absence of inhibitory control and the loss of adaptive functions in social communication.

As a quantitative behavior, **violence is an escalated, pathological, and abnormal form of aggression** characterized primarily by short attack latencies, and prolonged and frequent harm-oriented conflict behaviors. As a qualitative behavior, violence is characterized by attacks that are aimed at vulnerable parts of the opponent's body and context-independent attacks regardless of the environment or the sex and type of the opponent.

It is believed that functional aggression, unlike violence, is not anticipated to target vulnerable body parts even in the midst of an agonistic interaction unless challenged, as seen in defensive aggression [1][2][3].

According to the **threat superiority effect**, humans (like many species) have the ability to quickly and effectively detect threats in the environment, which allows

them to activate defense mechanisms in time and adequately respond to the threat [4]. Such a reaction can be expressed by flight or defensive aggression (it is also called a fight-or-flight response). Threat stimuli can be innate due to the fact that humans have encountered them in the course of biological evolution (for example, snakes), or acquired through experience due to the adaptation of defense mechanisms (for example, a knife or a gun) [5][6]. In addition, humans are more likely to recognize angry facial expressions from other humans than neutral and happy expressions, as well as expressions of sadness and fear [7][8].

Self-defense can be defined as a form of aggression performed in the presence of a threat in the environment and social signals. Also, in the case of intraspecific relationships, **self-defense (or defensive aggression) is defined as a form of aggressive behavior performed in response to an attack by another individual**. It is worth noting that extreme forms of defensive aggression can have violent characteristics. However, it is distinctly different from offense in terms of its behavioral expression and inhibitory control [9].

II. Myths about violence

In this chapter, we will look at a variety of myths about violence that prevent a full understanding of the nature of this phenomenon. As ethological, archaeological, military, and other evidence demonstrates, violence, especially lethal one, is largely absent from intraspecific animal and human relationships. The average and healthy individual has a strong inner resistance to killing, but the minority of murderers is still enough for violence to have a huge impact on society and lead to numerous victims.

If you have no doubts about this fact, and you are interested in studying the theory of the violence inhibition mechanism directly, then you can immediately skip to the third chapter. But I would still recommend getting acquainted with these myths and their refutation.

1. Are intraspecific killings common in mammals?

A study of 1024 mammalian species showed that only about **40% of them** were observed to have lethal violence – cases of death of individuals from aggressive actions by members of their species (including infanticide, cannibalism, and intergroup aggression). Of course, this figure may be underestimated due to the lack of data, but even after adjusting for this probability, non-violent intraspecific relationships are still common and prevail over violent ones. Overall statistics show that lethal violence is the cause of death in mammals in only **0.3% of cases** [10]. Many researchers have come to the conclusion that most intraspecific aggression is non-lethal, and individuals which avoid agonistic situations involving serious possibilities of defeat or injury are evolutionarily successful. Also, among social and well-armed species, restraints against injuring or killing conspecifics are common [11].

As for the relationship of territoriality and social behavior with lethal violence, in both cases, there was an elevated level of it, which is easily explained by the increase in the number of conflicts due to more frequent social contacts and territorial fights. However, even for social territorial species, the overall level of lethal violence does not exceed 0.8%. Of course, against the background of other mammals, primates stand out with an increased level of violence. However, in their case, the overall level of lethal violence does not exceed 2.5%. And the closest human relative, the pygmy chimpanzee (or bonobo), is widely known for its non-violent nature.

As data from the study of 1024 mammalian species show, the most lethal violence is observed in lemurs and marmosets, in which case its level can reach almost 20%. However, such cases are an extreme exception. Species with a level of lethal violence above 2.5% do not account for even 13% of all considered by this study. If we take species with its level above 5% (such a level is observed in the most violent hominids), then we get only 6% of those at all. We can safely assume that killing a conspecific is not the rule but rather the exception to it.

2. Lethal violence in human history or "The Myth of the Violent Savage"

It is a common notion that the level of lethal violence (the death of humans at the hands of other humans) in prehistoric times was extremely high and normally could even reach 50%. This means that half of the "savages" were murdered.

However, arguments of this kind are highly exaggerated and are based on limited examples, not on overall statistics. A study examining 600 human populations shows that in the entire history of Homo sapiens, the lethal violence rate was **only 2%**, and this includes cases of wars and genocides [10]. Some studies also argue that the theory of the universality of war in human history lacks empirical support, and evidence for high levels of prehistoric violence (such as that demonstrated in "War Before Civilization: The Myth of the Peaceful Savage") may be unreasonably inflated [12][13].

During the Paleolithic period, the Old World had a lethal violence rate of 3.97%. Particular attention is drawn to the large excavations of sites of the Natufian culture from the Epipaleolithic period in the territory of modern Israel. Of the 400 human remains dating back to the period of 11-15 thousand years ago, only 5 indicated the violent nature of death. This example comes from a study of prehistoric warfare in Europe and the Middle East, where the claim that wars accounted for 15% of prehistoric deaths is called absurd. It also states that humans do not have any evolutionary predisposition to attack people from other social groups, and excavations dating back to the European Paleolithic do not show evidence of wars, only extremely rare cases of cannibalism [14]. The Neolithic, Mesolithic, and Bronze Ages also were not characterized by high levels of lethal violence (3.59%, 3.39%, and 2.33% respectively).

Large excavations in Britain, Spain, Italy, the Middle East, and North Africa of sites of the Iron Age also show extremely low levels of lethal violence. For example, a study of 25 Mesopotamian archaeological sites shows that only 28 out of 1278 (i.e., 2.2%) of the remains examined have traces of healed cranial injuries related to violence. Based on the evidence of bloody military conflicts and some

level of violence in everyday life in this area, the researchers expected to find a much larger number of injuries of this nature [15].

In general, excavations of sites of the Iron Age more often show violent deaths, but there is a simple explanation for this. The excavations with the most violent deaths are dating back to Britain during the reign of the Roman Empire. One of the archaeological excavations in London showed many men who had died from violence. However, this can be explained by the "headhunting" by the Roman army and/or defeats in gladiator fights [16]. And the excavations of the Middle Age, showing the most violent deaths, relate to the battles of Visby and Aljubarrota. These cases hint to us that the bulk of the victims of lethal violence falls on organized attacks by certain violent groups of people, including those of a military nature. In what follows, we will only verify the correctness of this conclusion.

Even more interesting evidence is the records of the death and its causes of the inhabitants of London in the period from 1629 to 1659, as well as in 1665. In the first case, out of 263,440 entries, only 470 (i.e., 0.18% of all deaths) related to violent death, and in the second, out of 97,306 entries, only 30 (i.e., 0.03%) related to it [17][18].

The level of lethal violence in the New World in different periods was also not high. As an example, it is worth citing large excavations of sites of the Classic period from Central California. Among 2182 remains, only 11 (i.e., 0.5%) had traces of violent death. Similar excavations from Central California but of sites of the Post-Classic period also showed a low level of lethal violence (less than 0.3%). Of the extremely violent examples, it is worth highlighting the Crow Creek Massacre, in which an entire Indian settlement was destroyed at the hands of authentically unknown attackers. This can again tell us that the main cause of lethal violence is the attacks of certain violent groups of people.

Another fact in favor of this argument is the overall percentage of people who died due to mass murders in the 20th century. In total, out of 11.5 billion people who lived in the 20th century, 5.5 billion people have died (6 billion have lived into the 21st century). About **203 million (or 3.7%)** deaths are the result of mass murders. At the same time, only **8 million (or 0.15%)** deaths can be attributed to conventional murders [19].

Claims about extremely high violence in prehistoric men are often based on the analogy with the high violence of some modern hunter-gatherer tribes, especially the Hiwi and Ache of South America with 55% and 30% lethal violence rate, respectively. However, this argument hides the fact that, if you compare these tribes with other similar tribes, then the latter turn out to be far from being so violent [20].

There are also cases of completely non-violent tribes, famous examples of which are the Paliyar from South India and the Semai from Malaysia. It also turned out to be false that in tribal societies men who commit murder should be more reproductively successful, and since in the past all people lived in tribes, this allegedly made a human a natural born killer. But the studies that make such a claim have methodological problems, and their results do not agree with the conclusions of many other studies [21].

In general, it is incorrect to describe human violence based only on individual cases of extremely violent isolated tribes. In addition, based on it, one should not lightly draw conclusions about the level of lethal violence in the tribes of the past – a mistake that some researchers make [12].

3. What genocides can tell us about human violence

Remembering the genocide of the Tutsi ethnic group in Rwanda, it may seem to us that almost the entire Hutu people, incited by supporters of the idea of extermination of the Tutsis, simply turned into murderers. We can also remember how terrible the Pol Pot regime was when up to a quarter of the population of Cambodia died. However, in assessing such phenomena as war or genocide, one should definitely not rely on subjective feelings, where it would be better to carry out detailed calculations.

It is known that the Khmer Rouge in 1975-1979 under the Pol Pot regime exterminated from 1.5 to 2 million Cambodians. The forces of the Khmer Rouge by 1975 can be estimated from 55 to 70 thousand people [22][23]. Regular Khmer Rouge forces (excluding regional units) for 1976 are estimated at 72,248 people [24]. The population of Cambodia at the beginning of the genocide was about 7.8 million people. Based on these numbers, it is obvious that less than **1% of the population** was responsible for the death of 20-25% of the population of Cambodia at that time.

Based on the most widely accepted studies, between 500,000 and 662,000 Tutsis died as a result of the genocide in Rwanda, some estimates reach up to 800,000 dead [25][26]. So how many Hutus took part in the genocide? One study puts the number of murderers at 50,000. It also states that the genocide was not a spontaneous eruption of tribal hatreds, it was a controlled attack by a small core [27]. Another study estimates the number of participants in the genocide (those who committed murder attempts, murder, rape, torture, and other forms of serious violence) from 175 thousand to 210 thousand people [28]. At the time of the

genocide, the population of Rwanda was over 7 million people (of which more than 90% were Hutus).

What does this mean? The vast majority of the Hutu people, and even the majority of their adult male population, did not take any part in the genocide. And direct murderers made up less than **1% of the population**.

It should not be surprising that such a small percentage of people could arrange genocide. Because it is unlikely that people who are called to murder, who do not feel much aversion and resistance to such exhortation, and whose potential victims do not have a serious opportunity to defend themselves will stop after only one or two killings. Rather, it is reasonable to expect that they will kill everyone who gets in their way while it is possible. Small groups of such killers, especially being armed, could slaughter thousands of civilians at once.

The study estimating the number of murderers in the Rwandan genocide at 50,000 people states that it is not impossible that even 25,000 people could kill hundreds of thousands, if not a million people in 100 days. Think about it – in order for such a scenario to become a reality, one murderer needs to commit only one murder every two and a half days [27]. There is also evidence that in one of the Rwandan military camps there were 2,000 well-trained soldiers, and of these, just 40 people could kill up to 1,000 Tutsis in 20 minutes [29].

In support of our conclusions, it is also worth noting cases when one person personally killed thousands of people at once. For example, the Croatian war criminal Petar Brzica killed up to 1360 Serbs in one night. And the NKVD officer Vasily Mikhailovich Blokhin shot up to 20 thousand people in his entire service. Such cases only confirm the fact that the killers, in the presence of an unlimited opportunity to kill, will personally commit dozens, hundreds, and possibly thousands of murders. Accordingly, it is always should be expected that the number of murderers relative to the number of those killed will be rather small.

4. How wars proved the non-violent nature of humans

According to the American publicist and former Lieutenant Colonel Dave Grossman, most humans have an intense resistance to killing other people. The resistance is so strong that, in many circumstances, soldiers on the battlefield will die before they can overcome it. A strong kill inhibitor is inherent in **98% of soldiers** [30][31]. Psychologists Roy Swank and William Marchand found that after 60 days of ongoing battles, 98% of surviving soldiers are psychologically traumatized, and only **2% of them who are predisposed to be "aggressive psychopaths"** are not concerned with this kind of problem since they do not

experience any resistance to killing [32]. Also, among the many mental disorders observed in soldiers, it is worth highlighting the psychosomatic paralysis, common during the First and Second World Wars, most often of the hand and fingers which they shot with (respectively, left-handers experienced paralysis of their left hand) [33].

According to the American military commander, brigadier general, and historian Samuel Marshall, in the Second World War among American soldiers, only 15-20% fired at the enemy positions. In many cases, those who did not fire were willing to risk great danger to rescue comrades, get ammunition, or run messages. As studies by army psychiatrists show, the biggest cause of combat defeats in the European theater of World War II was the fear of killing other people and not, as many might think, the fear of being killed (or wounded), which came in second place [30][34].

It is worth noting that Marshall's research is sometimes criticized. However, as Grossman writes, this criticism is unfounded, it was not presented in real academic studies, and Marshall's conclusions still turned out to be correct. Perhaps Marshall's methodology may not meet rigorous modern standards, but this does not mean that he lied [35].

Back in the middle of the 19th century, French army officer and military theorist Charles Ardant du Picq conducted his own research – a survey among other officers, who told him that many soldiers simply shoot in the air without aiming [36]. At the beginning of the 18th century, at the Battle of Belgrade, there was a case when two imperial battalions fired at Turkish enemies until they approached them at a distance of only 30 paces. However, as a result, they were able to kill only 32 Turkish soldiers. At the same time, an experiment conducted a little earlier in the Prussian army showed that soldiers hit non-living targets from a distance of 225 yards (205 meters) in 25% of cases, and from a distance of 75 yards (68 meters) – in 60% of cases [37]. Such cases in the armies of that time, when an entire line of soldiers killed only a few enemies, were extremely common.

The Battle of Gettysburg, the bloodiest battle of the American Civil War, is quite a demonstrative example. Of the approximately 170,000 soldiers involved, approximately 7,000 died, and after the battle, more than 27,000 abandoned rifles were found, 90% of which were loaded. Rifles of that type took a long time to load compared to the time it took to fire a shot. This could mean that most of the soldiers on both sides were loading their rifles, perhaps even pretending to shoot if someone nearby actually fired, but couldn't fire themselves. And many of those who did shoot most likely did not aim at the enemy [38].

There is also another interesting fact from the statistics of the US Air Force. Less than 1% of pilots accounted for about 40% of downed enemy aircraft. Most of the pilots did not shoot down anyone and did not even try to shoot down. In addition, when the US Air Force tried to identify commonalities among aces after World War II, it was found that in childhood they often fought with their peers. And they were not just bullies, as a rule, avoiding real fights, they were "fighters" [33][38].

It is also worth mentioning the statement, that roughly 80% of males choose to avoid violent conflict. If forced into violent conflict, they just do not fight, although present. The 20% left does not reject violence as a behavioral option. Nevertheless, the main part is probably defensive only, that is, they use violence only if compelled to. Finally, about 1 percent adopts an offensive elementary strategy. Historical and statistical facts confirm the existence of a ratio noncombatants : defensive combatants : offensive combatants. Roughly, this ratio looks like 80:19:1 [31].

Looking back at how many victims some wars, and especially World War II, had, it is difficult to agree that only **2% of soldiers** actually committed murders. However, this can be explained by distancing, which allows soldiers not to perceive their potential victims as real and concrete people. As Canadian historian, journalist, and retired naval officer Gwyn Dyer describes, such a strong resistance to killing was not observed among gunners, bomber crew members, and naval personnel [38]. Also, a decrease in resistance to killing could be observed in machine gunners who, without seeing their target, were able to convince themselves that they did not kill anyone at all [30].

In modern contract armies, for example, the US Armed Forces, a thorough selection is carried out, and the design of soldier training takes into account lessons of the past and is aimed at turning the killing from a conscious action into a conditioned reflex. Yet, many soldiers who end up committing murder are later unable to come to terms with this fact and begin to suffer serious psychological trauma [30].

As current data shows, this problem even affects the operators of combat drones, sometimes located in another part of the planet from the battle. In one study of 600 operators, 42% reported moderate to high stress, and 20% reported emotional exhaustion or burnout. A later study found that drone operators suffered from the same levels of depression, anxiety, PTSD, alcohol abuse, and suicidal ideation as traditional combat aircrews. It can be concluded that one person's awareness of the fact of a killing can lead to psychological trauma, even if it was a distant killing [39].

5. The source of all violent crimes is the vast minority of people

According to one Swedish study, **the 1% of the population is responsible for 63% of all violent crimes**. The sample of this study was 2,393,765 individuals over a time period of 32 years. Murder, assault, robbery, a gross violation of personal integrity, kidnapping, arson, intimidation, as well as unlawful coercion, threats, and imprisonment were categorized as violent crimes (including attempts to commit them when possible).

Only 93,462 (i.e., 3.9%) out of all individuals considered, committed at least one such crime, while 21,530 individuals (i.e., 0.9%) committed from 3 to 10 crimes, and 2,812 (i.e., 0.1%) more than 10 violent crimes. It is also worth noting that in total they committed 234,383 violent crimes, or 2.5 crimes per one criminal [40].

In 2020, 2,044,221 crimes were registered in Russia. Of all crimes, 1.53% were related to murder (7,695), intentional infliction of severe physical harm (20,019), kidnapping (411), and rape (3,535). Another 2.14% of crimes were assigned as robberies and burglaries (43,700). We can also add here 2.7% of threats to kill or cause severe physical harm (55,223). Lastly, 1.66% of crimes are intentional infliction of harm to health of moderate severity (28,185) and beatings (5,716). Concluding, about 8% out of all crimes are violent [41].

On average, per 100,000 people, 1,393 crimes were registered. Of these, 111 crimes are violent. However, not every violent crime is included in official statistics. Based on the study of crime and victimization, it can be assumed that only approximately 25% of violent crimes end up in official statistics (55% of attack victims go to the authorities, and 44% of their complaints lead to prosecutions) [42]. Therefore, we may roughly increase the number of violent crimes by 4 times, namely, to 444 per 100,000 people a year. We should also not forget about recidivism, as about 57.7% of criminals have already committed at least one crime before, meaning, there are at least 2.36 crimes per 1 criminal (in fact, this number should be even higher if we account for criminals with multiple relapses, detailed information about which is not available). Overall, the number we get is, in 2020, approximately 188 violent criminals per 100 thousand of the population in Russia (i.e., 1 violent offender per 532 people, or about 0.19% of violent offenders from the entire population).

There were 29,406 homicides in Mexico in 2019 (individual victims were 34,588). The murder rate was about 22 per 100 thousand of the population or 26 individual victims per 100 thousand of the population (or 0.026%). The number of cases of intentionally inflicted injuries was 164,143, deriving 123 victims per 100,000 population (or 0.123%). Official statistics also speak of 1,329 cases of abductions in 2018, however, studies show that the vast majority of abductions are not

reported or investigated by law enforcement agencies. The real number of abduction victims was 81,966 people, that is, 62 victims per 100,000 population (or 0.062%). Sexual crimes accounted for 51,662 cases in 2019, i.e., 39 victims per 100,000 people (or 0.039%) [43]. In general, it can be tentatively said that about 250 people per 100 thousand of the population (or 0.25%) per year in Mexico become victims of serious violent crimes, including murders, but excluding robberies, for which accurate data have not been found.

Having examined the statistics of violent crime, we can conclude that despite the large difference in its level between different countries, in none of them the vast majority of people are violent.

6. What famous experiments say about violence

6.1. "Universe 25"

"Universe 25" was a famous experiment in which ethologist John Calhoun created a pen for mice with an abundance of resources. Initially, the population of mice grew rapidly up to 2200 individuals, but after that, mice began to refuse to reproduce, their number began to decline, and in less than 5 years, the population completely died out.

Many reasons were given for this result. The conditions of Calhoun's pen for mice were, in fact, far from heavenly. There is also an opinion that the problem lies in the very abundance of resources, and humanity, with its current high well-being, will face the same fate. But few people are aware of the fact that the main mistake was the structure of the pen, which allowed 65 of the largest males to forcefully block everyone else's access to females and food. This caused a chain of events that led to the extinction of a population, artificially limited in space and extremely violent in its order. In more well-organized pens, where it is impossible to establish such a violent dominance hierarchy, a population of mice can live for decades [44]. This experiment demonstrates well why, under certain conditions, violence is a threat to the survival of the population and is not an evolutionarily optimal strategy.

6.2. Milgram experiment

In 1963, psychologist Stanley Milgram decided to conduct a series of experiments to clarify the question: how much suffering are ordinary people willing to inflict on other, completely innocent people, if such infliction of pain is part of their work duties? The subjects, being in the role of "teacher", had to punish the "student"

with an electric shock in case of incorrect performance of tasks. Starting at 15 volts, with each new error, they had to increase the shock by 15 volts up to a maximum of 450 volts, after which they had to continue to use the maximum shock. Of course, the student, being an actor, did not receive a shock and only pretended to be in pain. In different versions of the experiment, the student and the teacher were separated either by a soundproof wall (i.e., the teacher could only hear the student knocking on the wall) or by an ordinary one (i.e., the teacher could hear screams, requests to stop, or complaints about alleged problems with heart).

According to published data, one of the series of experiments showed that 26 subjects out of 40 (65%) increased the voltage to 450 volts and did not stop giving an electric shock until the researcher gave the order to end the experiment. And only 5 subjects (12.5%) stopped at a voltage of 300 volts when their victims showed the first signs of discontent [45]. Reproduction of the experiment in different conditions and with different people, as stated, showed approximately the same results.

However, we will see a very different result if we take into account the data from the Milgram experiment that has not been published. After analyzing 656 post-experimental questionnaires, the researchers found that 56% of the participants actually stopped the experiment at one point or another because they believed the person behind the wall was actually in pain. Another study, looking at 91 interviews conducted immediately after the experiments, found that among 46 participants who continued the experiment after the victim was displeased, 33 participants (72%) did so because they simply did not believe that the victim was really hurt (which was actually the case – the actor only imitated it) [46]. Based on this, we can roughly say that more than 85% of the participants in the Milgram experiment were unable to intentionally hurt another person.

6.3. Stanford Prison Experiment

Another well-known experiment about violence is the Stanford Prison Experiment. The participants of this experiment were divided into two groups – the guards and the prisoners, who lived in a simulated prison. Soon after the start of the experiment, the guards began to brutally abuse the prisoners, a third of them showing sadistic tendencies. Two prisoners were even removed from the experiment due to the psychological trauma they received, and the experiment itself was stopped ahead of time for ethical reasons.

For almost 50 years, many believed in the truthfulness of these results. However, the experiment turned out to be completely untenable. The experiment basis denied

external interference, yet the guards were aware of the results that were expected from them and received clear instructions. Potential participants knew in advance what awaited them in the experiment and what roles they would play. And after a while, some of them said that they just had "played" their role. One of the expelled participants later admitted that he was only faking psychosis because he did not like the experiment and wanted to leave as soon as possible. Finally, the data researchers published were far from complete – out of the 150 hours of the experiment, only 10% have been recorded (6 hours of video and 15 hours of audio). Also, very little personal data of the participants were collected, which could affect the course of the experiment [47][48].

Conclusions about the experiments on violence

Such experiments very often create myths around themselves that do not correspond to reality. In the case of "Universe 25", the method of conducting the experiment and the interpretation of the results were incorrect. Much of the data from the Milgram experiment was simply hidden in the archive. And the Stanford prison experiment turned out to be a staging with a predetermined result. Therefore, it is always worth questioning each such experiment. It is likely that the most popular interpretation will be fundamentally wrong.

It is worth remembering another experiment – the performance of the artist Marina Abramovic called "Rhythm 0", in which she completely surrendered to the will of the audience, allowing them to freely use 72 objects and her body. As a result, for 6 hours of the performance, she was brutally tortured and even almost shot. It was concluded that all people are cruel, and under suitable conditions, this cruelty will surely break out.

So far, there are no refutations of this experiment. But it can be assumed that it was either staged, like the Stanford prison experiment, with which, by the way, it is sometimes compared, or the point is the unrepresentative sample of viewers, or cruel people were specially selected for the role of viewers (in many of her performances Abramovich deliberately put herself in danger and almost died several times). Note that such assumptions can be put forward for any experiment that allegedly proves the violent nature and cruelty of a human.

7. Violence draws too much attention to itself

Sometimes it is stated that not a single day in the history of mankind has passed without violence and military conflicts. So, it should be a natural phenomenon for

humans and human society. However, this opinion is based more on the subjective evaluation of events taking place in the world than on real data, as well as on the excessive visibility of violence against the background of all other events.

There is one illustrative example of how violence can attract significant attention: 69% of Americans believe that domestic violence is a common problem among American football players. This belief is based on media scandals unfolding around players who actually do this. But if we rely on statistics and not on subjective feelings, it turns out that in the families of American football players, domestic violence occurs almost two times less often than on average in American families [49].

Observation of violence makes people believe that it is common. But to give a real assessment one should only rely on real data and not arbitrary statements.

III. The Theory of the Violence Inhibition Mechanism

1. Evolutionary preconditions for inhibition of intraspecific aggression

The analysis of intraspecific aggression should begin with a consideration of its positive aspects, which later will allow us to avoid some misunderstandings. Aggression, including violent one (i.e., physical harm and murder), allows the stronger and healthier individuals in the population to prevent the weaker and unhealthy individuals from procreating. Also, it is beneficial for a particular individual, which is able to use it for the sake of its own survival and to pass on its genes further. It also serves as a tool in creating and maintaining a dominance hierarchy that coordinates the actions of otherwise scattered individuals. Finally, since aggressive behavior does not allow different individuals or groups of individuals to stay close for an excessively long time, this leads to their even distribution over the entire territory available for habitation and hence to the even distribution of limited resources.

Nevertheless, do not make the **mistake** of looking at violence in isolation from circumstances and factors of the environment. In this case, the two most important are: the presence of strong innate armament in some species and their inability to escape from violence (due to limited area of habitat, social behavior, or other reasons), which will lead to frequent conflict situations. The stronger these two factors are, the higher the risks of violence. At a certain point, the risks become too high for the benefits derived from violence to offset them. Violence ceases to be an evolutionarily optimal strategy of behavior. And its risks can grow up to the point that individuals simply exterminate each other in violent fights and destroy their population.

If members of a population have strong innate armament, then the individuals which are most prone to violence will encounter the armament of their conspecifics if they initiate attacks, and this can often lead to their death. Also, disastrous for the aggressor may be the resistance of the armed victim, which has nowhere else to escape. Even several victories in such a situation cannot guarantee the evolutionary success of the aggressor since one of such attacks is still likely to end in its death. At the same time, less violent individuals will die less often since they do not initiate attacks but only defend themselves. They will be less likely to face the risk of dying from violence than their aggressive conspecifics, which means they will more often have offspring.

As a result, natural selection has to move towards the development of strong inhibitors that prevent harming and killing among conspecifics since individuals

lacking such inhibitors will likely be removed from the population, not being able to pass on their genes further.

Observations of animal behavior support this conclusion. The concept of aggression inhibitors was first formulated by the ethologist Konrad Lorenz. According to his theory, this mechanism is most developed in those species that are able to easily kill an individual of approximately their own size. Describing his own observations of wolves, Lorenz showed how aggression inhibitors are activated when one wolf demonstrates to another a gesture of submission or vulnerable parts of its body, such as the neck or belly. As a result, a petrified aggressor cannot continue the attack. Also, observations of ravens showed that they do not peck out each other's eyes, even during fights [50][51].

The ethologist Irenaus Eibl-Eibesfeldt listed many such observations from various researchers. Fiddler crabs, due to their anatomical features, do not open their claws in fights wide enough to injure an opponent. Many species of fish, lizards, and mammals are characterized by the ritualization of fights. A noteworthy example is oryx antelopes, which carefully handle their sharp horns in fights with other oryx, but at the same time use them to the full extent in defense against lions. It is also worth mentioning venomous snakes, many of which squirm, bloat, and push each other during fights but do not bite or even display their weapons [52][53]. Even very primitive creatures have a similar mechanism. So, jellyfish, including the extremely deadly box jellyfish, have a chemical blocker that prevents their tentacles from releasing poison when they collide with a conspecific. At the same time, all other creatures are stung automatically [54].

Aggression is less inhibited in weakly armed species. Compared to ravens, turtledoves with a less sharp beak can even kill a conspecific if it is deprived of the opportunity to escape (for example, when placed in a cage). Under natural conditions, conflicts do not threaten the survival of turtledoves in any way, they are unable to kill a conspecific quickly, and it can easily escape [50].

Animals with a solitary lifestyle are also quite aggressive. If we consider their case in more detail, then its evolutionary influence can be equated to a form of escape. In that way, violence cannot threaten the survival of polar bears or jaguars, which out of the breeding season rarely cross each other's paths for the resulting fights to have any effect on the population as a whole [51]. It is also important to mention the example of lions. Their aggressiveness can be explained by social factors. For example, each pride has only a few males, and young ones leave it when they reach a certain age. Also, some ethologists say that the reasons for the high aggressiveness of lions are not yet fully understood, however, within one pride aggression is still inhibited [52].

2. Self-defense as an evolutionarily stable strategy of behavior

As we found out earlier, violence is not an evolutionarily stable strategy of behavior for species that have strong innate armaments and are unable to escape from it. The most aggressive individuals that initiate attacks will die more often due to the armament and resistance of their victims. As a result, there will be evolutionary pressure for members of a population to develop inhibitors of intraspecific aggression, or so-called violence inhibitor, since individuals lacking such a mechanism will be less likely to pass on their genes further.

It is worth understanding one important point – this will not work if the victim of the attack cannot use its weapons in order to protect itself. This leads us to the assumption that at the time of the presence of an immediate threat to life, the function of the violence inhibitor should be suppressed for a short period of time, sufficient to repulse the aggressor. It is a necessary condition for the development of the violence inhibitor in the course of biological evolution; otherwise, more aggressive individuals would gain an evolutionary advantage.

This assumption is consistent with the concept of the **threat superiority effect**, which we considered at the beginning of our study. According to it, the presence of a threat in the environment and social signals leads to the activation of defense mechanisms and the suppression of other ongoing cognitive processes [4][5][6].

Also, computer simulations of evolutionary processes have shown that neither the belligerent strategy (hawk), which consists in making attacks, nor the timid strategy (dove), which consists in retreating when attacked, are not as evolutionarily stable strategies as the retaliator strategy, which means to behave non-aggressively but in the event of an attack to fight back. Timid individuals cannot compete with aggressive individuals, but aggressive individuals risk getting hurt in fights. Therefore, the mixed retaliator strategy is the most optimal [21].

3. The violence inhibition mechanism in humans

How inhibition of intraspecific aggression functions in the case of humans can be explained by resorting to the **Violence Inhibition Mechanism** (VIM) model. Based on the conclusions of Konrad Lorenz and Irenaus Eibl-Eibesfeldt that many animal species have inhibitors of intraspecific aggression developed in the course of biological evolution, the neuroscientist James Blair suggested the presence of such inhibitors in humans, proposing the VIM model. In developing this model, he also pursued the goal of explaining the emergence of psychopathy as a result of a malfunction of this mechanism [55][56].

VIM is a cognitive mechanism that is directly activated in humans by non-verbal distress cues from other humans, such as a sad facial expression or crying. This causes an aversive reaction, and the stronger the distress signal, the stronger the corresponding reaction: a slight sadness on the face will cause only partial aversion, but screams and sobbing can completely stop the aggressor.

As studies show, the observation of distress cues does induce a physiological response in the form of such a reaction. This reaction can be observed from a very early age. Infants aged 2-3 days cry to the sound of crying, and this reactive crying is not simply a response to noxious auditory stimuli; infants do not cry to equally loud and intense non-human sounds [55].

Evidence of this kind can be used to explain empathy – the ability to understand the feelings and state of other people regarding oneself, so it is necessary to find out how it is related to VIM. Moreover, VIM is not just a mechanism that causes an unconditioned reflex (aversive reaction) to an unconditioned stimulus (distress cues). Blair argues that through the process of conditioning (the formation of conditioned reflexes) it becomes a cognitive prerequisite for the development of three aspects of morality: the moral emotions (i.e., sympathy, guilt, remorse, and empathy), the inhibition of violence, and the ability to distinguish between moral and conventional transgressions.

During development, individuals are faced with the fact that distress cues from other people cause VIM activation. This is an unconditioned reflex to an unconditioned stimulus. At the same time, they can often try on the role of the victims in order to understand their state. In this way, an association of the distress signal that activates the VIM with the state of the victim is formed. This association becomes the conditioned stimulus for the conditioned reflex. As a result, the individual becomes able to show an empathic response only by thinking about someone else's distress. In line with this, film sequences where the victims of violence talked about their experience, while not showing any distress cues, evoked a corresponding physiological reaction in the audience [56].

The inhibition of violence works similarly. As early as childhood (even at the age of 4-7 years), normally developing individuals will experience an activation of the VIM and aversive reaction due to distress cues emitted by the victims as soon as they might attempt to commit an act of violence. Over time, even the very thought of committing violence will begin to lead to this reaction, and the probability that an individual will behave violently will gradually decrease.

The activation of VIM also acts as a mediator in distinguishing between moral and conventional transgressions. Although, in order to do so, it is necessary to first gain experience demonstrating moral transgressions – actions consisting in causing

harm to people. The association of moral transgressions with subsequent distress cues from victims will eventually lead to the development of a conditioned reflex that activates VIM. In turn, social transgressions that do not lead to harm but only consist in violating established social norms will not be associated with distress cues, which means that the corresponding experience will not lead to the development of a conditioned reflex. This is how the individual becomes capable of identifying moral transgressions in actions.

Of course, individuals without VIM can evaluate a moral transgression as a bad act if someone tells them that it is bad. However, in their assessment, they will refer to the words of other people without experiencing an aversive reaction from causing harm in reality. Perhaps with a favorable upbringing, a good social environment, and the absence of provoking factors, they will not commit violence. But no inner inhibitors, in comparison with normally developing individuals, will prevent them from doing this.

To support the validity of his model, Blair cites the results of many studies. Children with a predisposition to psychopathy and adult psychopaths do show a poor ability to distinguish between moral and social transgressions. The same applies to children with conduct disorder. In addition, and in line with the VIM position, adult psychopaths show reduced comprehension of situations likely to induce guilt, although they show appropriate comprehension of happiness, sadness, and even complex social emotions such as embarrassment. Moreover, and a direct prediction of the VIM model, children and adults with psychopathy show pronounced impairment in processing sad and fearful facial and vocal expressions [57]. What is important to note is that the ability to distinguish between moral and social transgressions is not associated with a bad upbringing and abuse in childhood [56].

Many other studies also support this model. For example, aggressiveness from Callous and Unemotional traits (abbr. CU-traits) is associated with poor ability to recognize fearful facial expressions and fearful body postures [58]. Children with high scores of CU-traits also experience problems with recognizing expressions of sadness, and children with high scores of conduct disorder with recognizing expressions of fear [59]. Schizophrenics with a history of violent crime differ from non-violent schizophrenics in their lower ability to recognize facial expressions, especially expressions of fear [60]. Finally, people with high affective psychopathy scores were found to be less able to distinguish genuine distress cues from staged ones. At the same time, this effect did not extend to other emotions, such as happiness, anger, or disgust; it was specific to distress cues [61]. Many other studies show similar results and therefore confirm the validity of the VIM model.

Finally, it is worth noting that psychopathy as a result of the malfunction of the VIM is a mental disorder by Wakefield's criteria. According to these criteria, a condition is a disorder if it is negatively valued (as "harmful") by sociocultural standards, and it is in fact due to a failure of some internal mechanism to perform a function for which it was biologically designed (i.e., naturally selected) [62][63].

Of course, the VIM model does not provide a complete explanation of the nature of aggression regulation, which is why Blair later expanded it and developed the Integrated Emotion System (IES) model, which considers the neurophysiological aspects of this process [57]. However, it still confirms the presence of restraints on intraspecific aggression in humans and gives a general idea of how they work.

4. How the violence inhibitor could have developed in humans in course of their biological evolution

To fully understand why the vast majority of people have a strong enough variant of the violence inhibitor that does not allow them to cause serious harm to other people or kill them, we need to understand what the evolutionary prerequisites were behind this.

On the one hand, the natural armament of a human is rather weak. Without additional tools, an ordinary person is not able to kill another person with a single punch or bite, and the victim can also escape with a pretty high probability. This means that violence is not dangerous for the human population, and the victims of attacks cannot give a strong enough rebuff to the aggressors, so they do not risk dying by committing attacks and most often pass on their genes further. Accordingly, weeding out the most aggressive individuals from the population and evolutionary pressure to strengthen the violence inhibitor should not appear.

On the other hand, humans have been using artificial weapons for a long time, including for the purpose of self-defense. Moreover, ancient people were used to living in small, isolated tribes, where violence was not the optimal strategy of behavior because if it would get out of control, it could easily lead to the death of the entire tribe. Later, as people faced a growing population density, that lead to an increase in social contacts, not excluding the violent ones, which also created certain risks. Finally, over time, violence became less and less acceptable at the level of culture and social order. As a result, even punishments for crimes were made more humane. A few centuries ago, it was the norm in many societies to carry out the death penalty for a minor insult or display of disagreement with a socially acceptable position. Now, some countries have completely abandoned even strict imprisonment. In Norway, for example, prisoners are only deprived of

their liberty but not of many other goods and activities needed to live a fulfilling life.

Based on the concept of gene-culture coevolution, cultural changes affect the selection in the human population in favor of certain traits [64]. A classic example is the development of lactose tolerance in humans because of the development of dairy farming. Overall, all the factors we have listed to some extent influenced the selection within the human population for thousands, and even tens and hundreds of thousands of years. The factor of the weak natural armament of a human does not play such a big role, but it cannot be ruled out either. Generally, it can be assumed that most people are characterized by having strong inhibitors of intraspecific aggression, but some of them are still able to initiate an act of violence without experiencing any resistance to this.

Perhaps, in view of the rapid social, as well as scientific and technological progress, humans did not have time to fully adapt to the new environmental conditions, in which it is extremely necessary to inhibit aggression. A similar idea was already expressed by Konrad Lorenz, who feared the consequences of humans becoming the most armed species on the planet [50]. However, the average and healthy individual still has a strong inner resistance to killing, and it gives us cause to believe that there may just be hope for mankind after all [30].

IV. Neurophysiology and genetics of aggression inhibition

1. The role of serotonin in the modulation of aggression and how the violence inhibitor can be activated pharmacologically

It is worth starting from the evidence that can confirm the existence of the violence inhibitor as a specific neurophysiological mechanism. Also, it can confirm the validity of the conclusion regarding defensive aggression as a functional and evolutionarily optimal form of behavior, which is not contradicted by the function of the violence inhibitor.

A study on how serotonin shapes moral judgments and behavior suggests that a mechanism similar to Blair's VIM operates for imagined harms in the case of moral judgments. The neurotransmitter serotonin (5-HT) is responsible for the functioning of this mechanism, and the model developed in the study explains its parallel role in the inhibition of actual harm (in the case of aggression) and imagined harm (in the case of moral judgments) [65]. Many other studies also confirm the key role of serotonin in the modulation of aggression in animals and humans [2][66][67][68][69].

Various experiments conducted on rats and mice showed that some agonists of the 5-HT_{1A} and 5-HT_{1B} receptors (these chemical compounds cause a biological response in receptors or, put simply, activate them) are able to suppress offensive aggression while not affecting defensive aggression as well as other forms of behavior.

For example, in various experiments with mice and rats like the resident-intruder paradigm, when administered into the lateral ventricles of the brain, agonists such as TFMPP and eltoprazine had a significant effect in reducing aggressiveness while not affecting defensive behavior. This effect was associated with the activation of postsynaptic 5-HT_{1B} receptors. It should be noted that the administration of eltoprazine into another part of the brain, the dorsal raphe nucleus, had a nonselective effect, suppressing both types of aggression and other forms of social communication, making the animals behave passively [70]. Administration of a selective 5-HT_{1A} agonist called F15599 into the ventro-orbital prefrontal cortex of male mice reduced the manifestation of intense elements of aggression, biting during attacks, as well as lateral threat postures (demonstrating aggressive intentions), without affecting non-intense manifestations of aggression and other forms of behavior [71].

Administration of the 5-HT_{1B} agonist CP-94253 into the ventro-orbital prefrontal cortex of mice also reduced the frequency of attack bites and the manifestation of

lateral threat postures [72]. The importance of 5-HT_{1B} receptors in the inhibition of aggression was also demonstrated in an experiment where administration of the agonist anpirtoline reduced the manifestation of various forms of aggression in mice, including aggression from social interaction with an opponent and aggression from frustration [73]. An extremely selective effect compared to other agonists showed administration of the 5-HT_{1A} agonist alnespirone to rats. Again, this did not affect the defensive behavior in the case when the individual encountered an aggressive conspecific, as well as other forms of behavior [74].

The serotonergic (5-HT) system, and more specifically the 5-HT_{1A} and 5-HT_{1B} receptors, plays a key role in the modulation of aggression in various species, including humans. It should be noted that in the case of 5-HT_{1A} receptors, the activation of postsynaptic receptors in the amygdala, frontal cortex, and hypothalamus leads to the inhibition of aggression, while the activation of presynaptic receptors inhibits the functioning of the 5-HT system itself, which, on the contrary, can lead to aggressive behavior [66].

2. Association of impairments in some brain regions with a lack of aggression regulation, the manifestation of conduct disorder, and psychopathy

Before further analysis of the neurophysiology of aggression inhibition, we should divide it into proactive (instrumental) and reactive (affective) forms. Reactive aggression arises as a reaction of the subject to a certain stimulus (including a threat stimulus that can lead to self-defense) or as a result of frustration. In turn, proactive aggression consists in achieving a certain positive result by resorting to aggressive actions; it is a planned and motivated act of harming the victim.

The amygdala plays the main role in the regulation of aggression, being involved in the formation of emotions and conditioned reflex reactions, as well as the ventromedial prefrontal cortex (or orbitofrontal cortex), which is involved in the decision-making process [57][67][68][75]. Together, they regulate the neural circuit that mediates reactive aggression (this network includes the medial hypothalamus and periaqueductal gray) and regulates the subcortical systems that respond to threats (among them, the basal ganglia, including the striatum). Both impairments of the amygdala and the orbitofrontal cortex can lead to an increase in the level of reactive aggression. At the same time, the orbitofrontal cortex does not inhibit reactive aggression but only increases or decreases the chance of triggering this process, depending on the surrounding social signals. The neural circuit that mediates proactive aggression is regulated by the amygdala (it includes the temporal lobe, which processes information, as well as the striatum and premotor cortex, which are necessary for the implementation of actual behavior) [57][75].

Psychopaths are characterized by an increased level of proactive aggression. They also show impairments in empathic response and regulation of fear-related behavior, which are the result of amygdala dysfunction. But psychopaths are not like other patients with amygdala dysfunction. Other functions of the amygdala, such as the formation of incentive and reward associations and certain aspects of social cognition, are only mildly or not impaired at all in individuals with psychopathy. The reason for this may be the presence of a genetic anomaly, which, instead of leading to extensive dysfunction of the amygdala, acts pointwise, disrupting the work of individual neurotransmitters [57].

Let us now turn to a framework for understanding conduct disorder, which confirms that it is the dysfunction of the amygdala and ventromedial prefrontal cortex that leads to disorders associated with aggressive behavior. Traits of psychopathy and CU-traits are associated with reduced emotional empathy. This is a result of reduced sensitivity of these brain regions to distress cues (as we know, the observation of signals such as expressions of sadness, fear, and pain from other people leads to direct activation of the violence inhibitor in humans) [76].

Based on this framework, we get the following: genetic factors lead to decreased amygdala responsiveness, which in turn reduces the empathic response, and this is the cause of aggression from CU-traits, antisocial behavior, and instrumental aggression. Another cause of antisocial behavior and instrumental aggression, as well as under-regulated responses to social provocations and reactive aggression based on frustration, is an impairment in the ability to make decisions, which in turn comes from decreased responsiveness of the striatum and ventromedial prefrontal cortex. Genetic influence also plays a significant role here. In addition, the occurrence of dysfunction in one of the brain regions is associated with dysfunctions in others. Thus, with decreased responsiveness of the amygdala, one would expect decreased responsiveness of the striatum and ventromedial prefrontal cortex. Environmental factors such as trauma, exposure to abuse, and neglect in upbringing only play a role in increased amygdala responsiveness, resulting in greater sensitivity to threats. However, even here genetic influence is involved, as it is present in all the components considered by this framework.

From the neurophysiological evidence, it is also worth noting that measurement of the binding potential of 5-HT_{1B} receptors using positron emission tomography demonstrated its lower level in the anterior cingulate cortex, orbitofrontal cortex, and striatum in people with a high level of aggressive traits. At the same time, in the case of the striatum, the connection with psychopathic traits was also found [77].

Finally, we should also note that one of the studies showed that the stability in reactive aggression from childhood to adolescence could be explained by genetic (48%), shared (11%), and nonshared (41%) environmental influences, whereas the continuity in proactive aggression was primarily genetically (85%) mediated [78].

3. Genetics of aggression regulation

Various studies show dozens of genes that affect certain aspects of offensive aggression. However, it is obvious that for effective regulation of aggression, the number of genes and neurotransmitters involved in this process must be limited (i.e., only some of them should play a key role). A range of evidence, ranging from evolutionary ancientry to pharmacological and clinical data, points to 5-HT_{1A} and 5-HT_{1B} receptors [66].

Since 5-HT_{1A} and 5-HT_{1B} receptors play a key role in the modulation of aggression, the genes corresponding to them are part of the genetic nature of the violence inhibitor (in humans, it is HTR1A gene, localized on chromosome 5, and HTR1B gene, localized on chromosome 6). Knockout of the 5-HT_{1B} gene in mice resulted in increased aggressiveness in their behavior. Knockout of the 5-HT_{1A} gene did not give such a result, however, this can be explained by the functional difference between the corresponding presynaptic and postsynaptic receptors, which we discussed earlier, as the gene knockout affects both types of receptors at once.

The fact that antisocial alcoholism (leading to impulsive and aggressive behavior) is associated with some alleles of the 5-HT_{1B} gene is an example of clear evidence of the role of serotonin receptors in the modulation of aggression in humans. Compared with a control group of healthy individuals and non-aggressive alcoholics, antisocial alcoholism in Finns was significantly associated with the HTR1B H861C polymorphism and to some extent with the HTR1B D6S284 polymorphism. Both polymorphisms were also significantly associated with antisocial alcoholism in the studied American Indian tribe [79]. In addition, the HTR1B rs11568817 genotypes were found to be very different between groups of children with high and low scores of CU-traits [80].

In addition to the 5-HT_{1A} and 5-HT_{1B} genes, it is also important to consider three more genes: TPH2, MAO-A (also known as the "warrior gene"), and SERT [66]. Their respective enzymes are involved in 5-HT synthesis in the brain. In the case of the TPH2 gene, the C1473G allele may play an important role. 129X1/SvJ mice, homozygous for the 1473C (C/C) allele, were more aggressive than mice of the BALB/cJ strain, homozygous for the 1473G (G/G) allele. However, the difference

in alleles did not affect penetrance – the percentage of mice that exhibited aggressive behavior when the corresponding allele was present. It was also found that the intensity of aggression is not related to its penetrance. However, in the case of rats and silver foxes, in which low aggressiveness was achieved by selection, increased activity of the TPH enzyme (as well as higher concentrations of serotonin and its metabolite, 5-HIAA) was observed. It should also be noted that the knockout of the TPH2 gene in rats led to aggressive behavior from a decrease in the sensitivity of 5-HT_{1A} receptors [81].

Mice with MAO-A gene knockout showed increased aggressiveness and decreased 5-HIAA levels, which also indicates a decrease in the function of the 5-HT system. The same can be seen in humans as well. Males from one Dutch family with a point mutation in exon 8 of the MAO-A gene showed an increased level of impulsive aggression. Moreover, polymorphism in the promoter region of the MAO-A gene was associated with antisocial alcoholism in German subjects. Many other studies also demonstrate that mutations in the MAO-A gene are associated with abnormal male aggression.

Also, one study found that carriers of a low-active variant of the MAO-A gene, due to childhood abuse, were up to 4 times more likely to commit violent crimes in adulthood. At the same time, carriers of the high-active variant turned out to be "immune" to abuse and did not become more violent than the average individual [82].

Mice with a knockout of the serotonin transporter gene SERT (SLC6A4) showed reduced aggression in their behavior due to stopping serotonin reuptake and a corresponding increase in its level. However, it should be understood that the serotonin transporter is also involved in the modulation of other processes, so such elimination of its function can only have a non-selective effect (which we will see a little further). Still, it should be of note that the short variant (S) of the promoter region of the gene (5-HTTLPR) leads to a decrease in the expression of the 5-HTT protein. For the homozygous allele (S/S), it showed a significant relationship with aggressive behavior and a tendency for violence in people in various samples: children, adults, adopted children, cocaine addicts, and patients with conduct disorder [83]. In addition, this allele is associated with decreased responsiveness of the amygdala.

4. Limitations of the neurophysiological and genetic nature of the violence inhibitor

Earlier we mentioned that for effective regulation of aggression, the number of genes and neurotransmitters involved in this process should be limited. Of course, dozens of genes, as well as many systems and receptors, have a certain influence on aggression. However, this is not so important within the framework of the topic we are considering since we are specifically interested in the violence inhibitor as a mechanism that inhibits offensive aggression. To confirm its limited to 5-HT_{1A} and 5-HT_{1B} receptors neurophysiological and genetic nature, one might consider what the attempt to suppress aggressive behavior by pharmacological interaction with other systems influencing aggression leads to.

Dopamine receptor antagonists such as chlorpromazine and haloperidol are widely used in the treatment of aggressive patients. However, these are antipsychotic drugs that suppress nervous activity, which leads to the suppression of defensive aggression and other side effects. Barbiturates and benzodiazepines, which affect the function of GABA receptors, face the same problems, which also severely limits their potential as anti-aggressive agents. Beta-blockers such as propranolol and nadolol are only effective in some patients, such as those with organic brain syndromes and chronic psychosis, and also lead to side effects. Serotonin reuptake inhibitors, which block the function of the serotonin transporter, showed to be effective in reducing aggressiveness in patients with borderline personality disorder. Yet they cannot selectively reduce aggressiveness due to the influence on other forms of behavior and having serious side effects. Finally, agonists and antagonists of 5-HT_2 receptors are also able to reduce aggressiveness, however, the former lead to side effects, while the influence of the latter is still very poorly understood [84]. It should be noted that 5-HT_{2A} agonists include many psychedelics known for their anti-aggressive and empathic effects [85]. However, their influence can hardly be called selective.

Based on this, it is 5-HT_{1A} and 5-HT_{1B} agonists that seem to be the most promising drugs in the treatment of aggressiveness since they have an extremely selective effect without affecting defensive aggression and other forms of behavior. This opinion is also shared by some researchers who support the resumption of research on the development of such anti-aggressive agents (or so-called "serenics") [86]. Some of them claim that "modern research suggests that aggressive behavior should be studied as a separate functional disorder" and "it is hoped that new insights into the neurobiology of aggression will reveal novel avenues for treatment of this destructive and costly behavior" (by aggressive behavior they mean the disinhibited one) [87][88].

It is also very important to note that activation of these receptors has exactly the effect that is expected from the violence inhibitor, while the pharmacological interaction with other systems influencing aggressiveness has a different, non-selective effect. This may confirm the limited neurophysiological and genetic nature of the violence inhibition mechanism, where only a few genes and receptors play a key role.

5. Association between the violence inhibitor, oxytocin, and prosocial behavior

Oxytocin is a hormone that plays an important role in prosocial behavior. It contributes to the formation of the maternal and pair bonds, predisposes a person to trust individuals with similar characteristics, who are classified as "in-group" members, helps to establish relationships between people, etc. Also, an important role in prosocial behavior, including the formation of a paternal bond, plays the hormone vasopressin.

These hormones are often called aggression regulators. It is believed that in intragroup relationships, oxytocin contributes to the establishment of altruism and non-violence, uniting and coordinating the actions of individual members of the group. On the contrary, in the case of intergroup relationships, this only increases aggressiveness since a cohesive group is able to fight more fiercely with other, "alien" groups, whose members are not trusted. This often explains the emergence of wars between different groups of people [89].

At first glance, this explanation does not fit well, if not completely contradicts the theory of the violence inhibition mechanism. But in fact, there is no contradiction at all if you understand how both mechanisms interact. This topic could be part of the violence myths chapter, but for its understanding, it is very important to know the neurophysiological aspects of the violence inhibitor.

Interestingly, the 5-HT system, including 5-HT_{1A} and 5-HT_{1B} receptors, is involved in the regulation of oxytocin and vasopressin secretion [90]. In one of the experiments, administration of the 5-HT_{1A} agonist to mice led not only to the suppression of offensive aggression but also to the emergence of prosocial behavior (close social contact and grooming) due to the secretion of oxytocin. At the same time, pretreatment with an oxytocin receptor antagonist did not reduce the anti-aggressive effect of the 5-HT_{1A} agonist but only suppressed prosocial behavior. Pretreatment with a vasopressin receptor antagonist had no effect at all [91].

It can be concluded that the regulation of aggression and stimulation of prosocial behavior are functions of different neurophysiological systems. Moreover, the 5-

HT system is able to influence the function of the oxytocin and vasopressin receptors, but not vice versa. This means that it is the theory of the violence inhibition mechanism that explains the regulation of aggression, while oxytocin is related only to prosocial behavior. And the absence of such behavior, for example, when confronted with an "alien" (but a member of one's own species) or due to a malfunction of the oxytocin receptor, does not mean at all that the individual will be predisposed to committing a violent attack.

6. Association between the violence inhibitor and the pro-aggressive effect of testosterone

As we know, the male sex hormone testosterone is one of the causes of aggressive behavior. However, to avoid misunderstanding, it is worth looking at how this hormone is related to the violence inhibitor. One study on this issue tested the hypothesis that the pro-aggressive effect of testosterone arises from the suppression of the 5-HT system function and disproved it. Testosterone activation of aggression and serotonin inhibition of aggression work independently of each other. And the influence of serotonin on testosterone-induced aggression appears to be mediated by a parallel inhibitory pathway. And it is assumed that this influence occurs in such areas of the brain as the medial amygdala, hypothalamus, prefrontal cortex, and lateral septum (septal area), where both sex hormone receptors and serotonergic nerve terminals are located [92].

This effect of serotonin is necessary to restrain aggression so that it does not cease to be an adaptive and functional behavior, and this conclusion is consistent with the violence inhibitor theory. And since testosterone does not disrupt its function, it cannot be the cause of uninhibited aggression. Of course, it increases aggressiveness but only within the natural inhibitory control.

V. The solution to the problem of violence and potential areas of its application

We now know that many animals, and even humans, have an innate mechanism that can suppress offensive aggression without affecting defensive aggression, as well as other forms of behavior and social communication. Understanding the neurophysiological and genetic aspects of this mechanism can contribute to the development of several solutions aimed at both temporary and permanent elimination of violence from the behavior of individuals by correcting and strengthening the function of their violence inhibitor.

The most obvious solution is to create a **pharmacological drug** based on such an agonist of 5-HT_{1A} and/or 5-HT_{1B} receptors, which will have the most selective effect, activating the violence inhibitor without affecting other neurophysiological functions.

This drug can be used in the treatment of patients suffering from increased aggressiveness. Research on 5-HT agonists for this purpose has already been undertaken in the past, and some researchers are currently supporting its resumption. It could also be applied to violent criminals as an alternative to imprisonment or other forms of punishment and correction.

Perhaps a less selective but stronger and fast-acting version of such a drug in some situations could be used as a safe alternative to tranquilizers. Such a situation may be the need to quickly calm down an overly aggressive patient or remotely stop a person with obvious violent intentions using, for example, a dart gun. The latter concept can even be used to create appropriate self-defense weapons.

Another option is to create a **gene therapy drug**. This is a new approach to the treatment of congenital and genetically determined pathologies. The best-known example of gene therapy is the treatment of spinal muscular atrophy in children with the drug Zolgensma, which corrects the corresponding defective gene.

To fix a dysfunctional violence inhibitor, we need to perform brain gene therapy, which is also a realistic task. For example, scientists have recently been able to develop gene therapy to treat a serious genetic disorder that leads to a lack of key neurotransmitters (dopamine and serotonin) and causes mental retardation, inability to fully control body movements, decreased muscle tone, seizures, and a host of other symptoms. During experimental treatment, seven patients aged four to nine years got rid of seizures, began to try to speak and smile, and two of them were even able to walk with assistance, which was previously considered fundamentally impossible for such a diagnosis [93]. Also, the possibility of gene

therapy treatment of neurological and neuropsychiatric disorders with a genetic origin is being actively studied [94].

At the moment, the most promising solution in brain gene therapy is the use of adeno-associated viral vectors as a deliverer of the correct gene variant to the necessary cells of the nervous system. One of the recent studies demonstrated the possibility of the effective application of such gene therapy in large mammals [95]. Another study showed how its use in the nucleus accumbens to restore the expression of the p11 protein gene that binds 5-HT_{1B} and 5-HT_4 receptors can help treat depression [96]. And the task of gene therapy, which corrects the function of a violence inhibitor, is actually also the restoration of the correct expression of genes responsible for certain enzymes and receptors in certain regions of the brain.

Gene therapy drugs of such kind would **solve the problem of violence once and for all**, especially if mass testing of people is carried out, looking for impairments in the function of the violence inhibitor. It could even become a widespread practice, as is now the case for medical examinations and vaccinations upon admission to educational institutions or employment.

Such tests are already possible. An electrophysiological study of the violence inhibition mechanism in relation to aggressive traits showed their inverse association with the Stop-P300 amplitude in response to facial distress cues. And in relation to the CU-traits it showed their inverse association with the amplitude of N170 according to the reaction of the subjects to all facial expressions. These amplitudes may provide useful electrophysiological markers for detecting dysfunction in the violence inhibitor [8][97]. In addition, it should be possible to develop simpler types of testing than electroencephalography. Studies even show the possibility of creating portable genetic tests [98].

Testing of the function of the violence inhibitor could be carried out even in children from a very early age. That small percentage of them with dysfunction after just one injection will be able to get rid of the risk of turning into violent individuals for life. The problem of violence will eventually be solved long before it occurs. Society will come closer to achieving **free and non-violent order**, where there is no place for either private manifestations of violence or violence as a method of implementing and supporting certain social norms.

Of course, gene therapy technology is still at the beginning of development and too expensive, but in the future, it may become extremely affordable, as it was with many other technologies in the past. Now, the main part of the cost of any gene therapy drug is the cost of its development. However, the cost of creating each subsequent dose in mass production should decrease. It is unlikely that in this case, the cost of the drug will be higher than the cost of modern vector vaccines.

Another potential solution concerns the **defense sector**. It is technically possible to create a drug based on a self-replicating viral vector that can be transmitted from person to person. At the moment, a similar concept is already being used in attempts to create so-called "contagious" vaccines. Once such vaccines were successfully applied to the rabbit population in the fight against two viral diseases [99].

Perhaps, based on the current knowledge of the violence inhibition mechanism, it is quite realistic to develop a biological solution that will be the most humane version of a strategic defensive weapon. It can be applied to a hostile army in the event of an attack to restore the function of the violence inhibitor in the violent part of its soldiers. In view of the rapid reduction in the cost of biotechnology, this solution may become available even to small countries that previously could not afford any serious deterrent.

Of course, the actual application of such a biological solution poses some risks and **should be avoided**, limited only to use to deter potential aggressors from attack. Though, in general, this is still a much more humane type of weapon than the already existing chemical, biological, or nuclear weapons.

The social consequences of eradicating violence in society

The process of eradicating violence through therapeutic correction and strengthening the function of the violence inhibitor in a minority of people with its deficiency will undoubtedly lead to a number of changes in society. It is very important to list these changes so that no one doubts the need for such an undertaking. It is also important to consider some of the contentious issues associated with this process so that this idea does not acquire any misconceptions.

Obviously, a positive and indisputable consequence of this is **the solution of the problem of violent crime**, which will radically reduce the level of stress in society, help to avoid human victims of violence, as well as the financial and material costs associated with it.

A controversial point is the potential abuse of such therapy by governments. At first glance, by reducing the level of violence in society, they can selectively increase their violent potential by not applying such therapy to some of their agents. However, in reality, the result will be the opposite. Governments recruit enforcers from society, and the lower the overall level of violence, the lower their ability to do so. And despite this fact, they will most likely still be inclined to approve the practice of therapeutic eradication of violence since this is potentially the fastest, easiest, and cheapest way to solve the serious problem of violence in society and get rid of all the costs associated with it.

Ultimately, the following results can be expected:

– Governments will stop using violence to maintain social order and stop being "stationary bandits" using their positions for their own benefit. They will have to replace violence with other methods, such as reputational and financial sanctions applied to citizens who violate social norms. Thus, **a free non-violent society** will be achieved, and the institution of statehood, if it remains, will undergo radical changes, especially in terms of methods of conducting its activities;

– For the same reason, **the unleashing of military conflicts will become simply impossible**, a non-violent society will not tolerate this, and no one in it will be ready to participate in military attacks.

Another point of contention concerns the ability of non-violent individuals and societies to defend themselves against violent threats. But there is nothing to worry about:

– It must be remembered that **defensive aggression** in the presence of an immediate threat to life is a natural form of behavior, the violence inhibitor

suppresses only offensive aggression and the desire to initiate harm to other people;

– A free non-violent society is able to protect itself from external threats with the help of modern weapons of deterrence, simply making itself **an unprofitable victim**. One of the proposed and available options for such a weapon could even be a drug to restore the function of the violence inhibitor, working on the principle of a "contagious vaccine". Of course, the actual application of such a biological solution to attacking troops is extremely risky and should be avoided by using it solely as a deterrent. However, this is still a much more humane type of weapon than the already existing chemical, biological, or nuclear weapons.

Finally, it is worth noting that in modern high-tech society, there is a risk of using the achievements of scientific and technological progress in violent aspirations, including the use of weapons of mass destruction. An obvious example of this is nuclear weapons, however, the matter is not limited to it. The threat of bioterrorism is already quite real, and it is not known what other threats await us in the future. The eradication of violence, in turn, will drastically reduce this risk. Perhaps this will even help to **avoid the potential self-destruction of humanity**.

How to popularize the violence inhibitor concept

After reading this study and becoming familiar with the theory of the violence inhibition mechanism in detail, you may want to share your knowledge with others. Moreover, I would strongly recommend you to do this, as the more people are aware of the true nature of violence, the faster a solution will be found that will contribute to its complete eradication from social relationships in human society.

Before that, however, I would like to give you useful instructions on how to convince other people of the validity of the arguments and conclusions presented here. These instructions recap the essence of the entire study in a concise and understandable form. It is important to get acquainted with these instructions not only to convince other people but also in order to consolidate the knowledge you have gained.

Numerous myths about violence, which we have already considered in detail in the second chapter, are deeply rooted in the mind of a significant part of society. Therefore, any conversation on the topic of violence should begin with their dispelling, using clear and specific facts, as otherwise your arguments, due to the other's confidence in the veracity of all these myths, might look quite untenable, if not completely absurd.

The first part of your argument should look like this:

In most animals, intraspecific killings simply do not occur. In mammalian species, for example, they occur only in 40% of them. And only in 6% of species killings they reach such an abnormally high level as 5% or more out of all causes of death. It is worth noting that the killing rate of even the most aggressive hominids does not exceed this level.

Throughout human history, only 2% of people died from killing. It was not something ordinary even for prehistoric savages – that is a myth mostly based on separate archaeological excavations and the example of just two modern isolated hunter-gatherer tribes. Also, most of the killings have always been committed by separate violent groups of people, often organized in armies.

For example, up to 25% of the population of Cambodia died from the actions of the Khmer Rouge, which made up less than 1% of it. And according to one of the studies on the issue of the Rwandan genocide, even as little as 25 thousand people are capable of killing hundreds of thousands, or even a million people in 100 days. Think about it yourself – in order to do so, the murderers, on average, will have to

make only 1 murder every 2.5 days. In the history of wars, genocides, and repressions, there were even cases when 1 man personally killed thousands of people.

Some military studies, relying mainly on data from the Second World War, claim that 98% of soldiers experience strong resistance to killing other people. Most soldiers, especially in draft armies, are simply cannon fodder, and only a small fraction of them constitute actual fighting power. And only 2% of the soldiers who survived after long continuous battles do not suffer from psychological trauma – these are the soldiers who barely experience resistance to killing.

Next, it is necessary to explain the reason for this state of affairs, that is, to talk about the theory of the violence inhibition mechanism:

Ever since the emergence of ethology – the science of animal behavior, there has been a theory that many species have innate inhibitors of intraspecific aggression. There are a number of factors that make harming and killing conspecific bad, threatening one's own survival, and therefore an evolutionarily suboptimal strategy. Two of them are especially worth highlighting: the presence of strong innate armament and the impossibility of fleeing violence, for example, due to the limited habitat of the population or strong dependence on social behavior.

For example, it is common for wolves to stop an aggressive skirmish when one of their conspecifics shows a submissive posture or exposes vulnerable body parts. Ravens never peck out each other's eyes. Many snakes do not use their venomous teeth in territorial fights. The males of almost all species of bovids, and antelopes of the oryx species, for example, while fighting for females, always handle their sharp horns carefully, while they use them freely to cause harm in case of defense from predators. Even such primitive creatures as jellyfish have a chemical blocker that does not allow them to sting their conspecifics that fall under their tentacles, while all other creatures would be stung automatically.

Humans are no exception to this rule. Even during early childhood, any normally developing individual would experience an aversive reaction to other people's distress cues – signs of sadness, fear, and pain that they express when someone commits an act of violence towards them. Over time, such aversion would be tightly associated with violence, making the individual unable to commit it even without observing any distress cues. Thus, the violence inhibitor plays an important role in the development of empathy and its dysfunction, as expected, is a direct cause of psychopathy.

The results of experiments with serotonin receptor agonists is an extremely important and convincing argument:

Animal experiments have shown that some serotonin 1A and 1B receptor agonists (the drugs that activate them) are able to selectively suppress offensive aggression without affecting defensive aggression (for example, when confronted with an aggressive conspecific), as well as other forms of behavior and social communication. This effect does not arise from the suppression of the activity of the nervous system, as is the case with antipsychotics. The effect is also not like the use of psychedelics which anti-aggressive and empathy-stimulating effects are usually highly non-selective. In this case, the activation of the serotonergic system suppresses only offensive aggression.

Also, worth noting that in the case of humans, some variants of the serotonin 1B receptor gene are strongly associated with aggressive traits, psychopathy, and aggressiveness from alcoholism. Moreover, increased aggressiveness is observed in people with certain variants of several other genes that directly affect the functioning of these receptors, such as MAO-A, also known as the "warrior gene".

After that, your interlocutor should be convinced of the existence of the violence inhibitor, which finally allows you to move on to the last topic – proposing solutions to the problem of violence:

Violence is far from a purely social factor. First of all, it is the result of a pathological condition, due to which one does not feel any aversion to violence, and also lacks empathy. A good upbringing or a supportive social environment can make such people less likely to commit violence. Unfortunately, this will never give a guaranteed result and is unlikely to correct their pathology in any way.

Such a problem requires the creation of a treatment that restores proper inhibitory control of aggression and all other feelings that are inherent in most people from birth. A sufficiently selective agonist of serotonin 1A and 1B receptors could be applied to violent criminals as an alternative to other forms of punishment and correction. A less selective but stronger and fast-acting version of such a drug could even become a safe alternative to tranquilizers, applied to people with obvious violent intentions, and perhaps even used in the form of a dart gun as a means of self-defense.

By far the best solution would be to create a gene therapy drug, a single injection of which will permanently fix the function of a defective violence inhibitor. Similar drugs already exist, such as the well-known Zolgensma used to treat spinal muscular atrophy.

Experimentally, gene therapy has proven to be extremely effective in treating even one serious genetic brain disorder that makes a person unable to speak and control their body, leads to seizures and a number of other similar symptoms. Administration of a gene therapy drug to children with this disorder in two cases even returned the ability to walk, which was considered fundamentally impossible for such a diagnosis. The possibility of using gene therapy in the treatment of neurological and neuropsychiatric defects of a genetic origin is also being actively studied.

It is possible to develop tests that would detect violence inhibitor dysfunction, passing of which would be required in the same way that medical examinations and vaccinations are often required today. The possibility of such testing has already been shown in one study of the violence inhibitor electrophysiology. However, it should also be possible to create simpler tests that do not require an electroencephalogram.

If all children were tested in this way and a gene therapy drug was applied to the small percentage of them who had such a disorder, then the problem of violence could be solved long before it occurred. With a wide application, such a practice could lead to the achievement of a free non-violent society, where there is no place for either private manifestations of violence or violence as a method of implementing and supporting certain social norms.

A conversation like this, taking **less than 10 minutes**, should convince almost any person of the validity of the theory we have considered. Of course, you can often expect additional questions, but if you have fully read the text of the study presented here, then answering them should not be a big problem for you. I also advise you **to share the link to this page (https://antiviolence.io/en) with other people** so that they can read all the details themselves.

Also, if possible, it does not hurt to recall the problems that violence leads to in society and talk about positive social changes due to the eradication of violence. Perhaps a convincing argument is that in the modern and technologically advanced world, any violent conflict can lead to catastrophic consequences, such as the use of weapons of mass destruction.

A small percentage of people, even after that, will stubbornly stand on absolutely opposite positions, exposing violence as something natural and necessary. It is pointless to continue to convince them, as you can spend several hours on this to no avail. It is better to spend this time trying to convince a dozen other people who have less categorically pro-violence positions.

Additional materials

Why violence should be completely eradicated

We can say with certainty that violence has no place in society and human relationships and should be eradicated, as it leads to way too many negative consequences, including the risk of potential global catastrophe. But in order to be motivated to turn such an initiative into reality, we need to understand what exactly these consequences are. Based on the theory of the violence inhibition mechanism, we can clearly define violence as a pathological form of behavior, which allows us to develop therapeutic methods for its eradication. But it will also be very useful for us to examine violence in terms of its impact on society, as well as taking into account specificities of our highly scientifically developed civilization and the era of the technological progress in which we live.

To begin with, it is worth noting that we are not considering only the problem of private violence, as this phenomenon needs to be looked at more broadly. Obviously, violent crimes lead to human casualties, a decrease in human well-being, and an increase in the level of stress in society, which worsens the quality of life for everyone, even for those who are not direct victims. But structural violence has the same impact on society. In many ways, our society is built on it, and in general, the emergence of the states themselves is well described by the theory of a stationary bandit, according to which this initially happened not by the voluntary consent of people to create power but because of their submission to power under the threat of violence [1*]. Of course, the institution of statehood is considered to be very important for solving problems and achieving certain objectives in society, but our own goal now is not going to be to dispute the function of states, as our conversation will be purely about the methods they resort to in their activities.

The most important thing that we need to understand is that there is no huge difference between people who commit acts of violence as part of their official duties (i.e., on the orders of their "superiors") and those who commit them willingly on their own (i.e., out of their own free will). What unites them all is a reduced, suppressed, or even completely absent ability to experience an aversion and resistance to violence. Contrary to common misconceptions, it is extremely difficult for the average and healthy individual to commit violence, even if circumstances force them to do so. Archival data from the Milgram experiment shows that most of the subjects actually failed to intentionally hurt another person, and according to military data, 98% of soldiers have a strong inner resistance to killing other people [2*][3*].

Accordingly, violence cannot be divided into acceptable and unacceptable, as all violence has the same root, and all of it leads to the same negative consequences. Violent actions require capable people who will not be limited by any natural inhibitors and therefore may well use them as an acceptable tool in the fulfillment of any of their aspirations or duties, if possible.

But until people treat all violence as a definitely negative social phenomenon and justify some of its forms (even if they, for the most part, would not commit it themselves), it will not be possible to solve the problem of violence. Understanding the theory of the violence inhibition mechanism makes it absolutely absurd to justify this phenomenon since this means justifying behavior that has disproportionately negative effects on society while being the result of a pathological disorder. Therefore, it is necessary to strive for the complete eradication of violence, not looking for its acceptable forms, and, of course, stop justifying it since this will only delay the solution of the problem.

Now we can go directly to the consequences of violence. As mentioned earlier, violence increases the level of stress in society, which interferes with the full life and productive activities of people and generally leads to human casualties, even lethal ones. One example is how violent individuals with violence inhibitor dysfunction make their partners experience psychological trauma. As one Canadian study of victims of abuse in heterosexual relationships shows, up to 30% of abusers meet the criteria for psychopathy, and it is these people who are the strongest predictor of long-term violence in a relationship. Also, due to a dysfunctional violence inhibitor, they easily ignore distress cues (expressions of sadness and fear) from their partners unless they can use it for their own manipulative purposes. For example, by manipulating fear, they can intimidate their partner, force them to have sexual contact, or take substances. And what is the main conclusion of the study – it is psychopathic abusers that have the worst effect on the mental health of their partners, leaving them with post-traumatic stress disorder [4*].

This also applies to structural violence because throughout history, "stationary bandits" and especially their power structures often abused their position, restricting people's freedom. While under some regimes (the most obvious example being the Nazi Germany), mass violence against certain categories of citizens was generally legitimized. Yet one should not expect that under democratic regimes violence will suddenly become a limited and beneficial tool for society because even in an ideal direct democracy, the executors of forceful measures will still be the absolute minority of people, having their own interests and the ability to impose them on society by force. Even if all decisions are made directly by citizens, they would still not directly participate in their

implementation. Therefore, the problem of states is not in the very structure of their political system but in the use of coercion in their activities.

From an economic point of view, an act of violence is a forced decrease of the victims' well-being, often along with an increase in that of the aggressor. If robberies become regular, time preferences increase – this means that people, due to the inability to accumulate significant funds for the future, will begin to spend more of them now on goods for short-term consumption. Labor productivity will also decrease as the markets begin to focus on the primitive production of short-term goods, and long-term investment simply will not bring profit because robbed people do not have the opportunity to purchase high-tech and expensive goods. The economic, scientific, technical, and industrial development of society will slow down. The cost of violence is also expressed in the fact that because of it a significant part of the time and funds have to be invested in ensuring security rather than directly in productive activities [5*].

It is the "stationary bandits" that commit such robberies. The violent potential that they possess in comparison with ordinary citizens gives them the opportunity to engage in economic abuses. People's funds are forcibly withdrawn through taxation, and they can be spent without any account. Governments make decisions that enrich only themselves and the monopoly companies associated with them to the detriment of ordinary citizens and private companies. And people often can't do anything about it. Even if they are somehow lucky to change the political system, because of maintaining the power structures and violent potential, the new system will only become another "stationary bandit". In such conditions, one should not be surprised by the constant economic crises.

Before addressing the last topic – the catastrophic consequences of violence, I would like to say a few words about what alternatives can be offered to violent methods of suppressing offenders. Since we start from the need to eradicate violence as a pathological form of behavior, resorting to therapeutic methods aimed at restoring inhibitory control over aggression in violent offenders (and generally in people who are capable of committing violence), we only need to understand what to do with non-violent offenders. It is quite clear that in the case of the eradication of violence, only non-violent methods of suppression of non-violent crimes are possible. They can be reduced to reputational or financial sanctions, perhaps even to a complete refusal to cooperate in certain types of social and economic relations (i.e., ostracism). We can come up with a large number of measures to influence violators of the norms and orders established in society that do not require any forcible coercion.

We have already briefly considered the negative social and economic consequences of violence. However, you can often live with them somehow. But violent aspirations may not end only with a decrease in the well-being of people and individual casualties. In the modern high-tech world, they can even lead to catastrophic consequences. Of course, one can immediately imagine the scenario of a full-scale war between states with the massive use of nuclear weapons. But this scenario is extremely unlikely, given that nuclear weapons are in the hands of a limited circle of people and are extremely difficult to produce.

However, scientific and technological progress does not stand still, and new variants of weapons of mass destruction may appear. Currently, the potentially most affordable option is to use rapidly developing biotechnologies. Even 20 years ago, sequencing one human genome cost $100 million, 10 years ago it cost $1 million, and now it costs $1,000. Cheap DNA/RNA synthesizers are becoming more affordable, as some models can be bought for several tens of thousands of dollars, and it can be expected that with the passage of time, they will only become cheaper.

A scientific work published in 2018 by a group of Canadian researchers on the recreation of the horsepox virus, closely related to the smallpox virus – one of the deadliest diseases in human history, is an illustrative example of how affordable the creation of biological weapons might be [6*]. The cost of this project was estimated at approximately $100,000. The researchers sought to create a new, even safer vaccine against smallpox. However, a significant part of the scientific community was critical of this study and accused the scientific journal PLOS One of allowing the publication of a work that could help terrorists create bioweapons. Back in 2011, virologist Yoshihiro Kawaoka conducted experiments to create a flu vaccine. He tried to recreate the strain of the virus that preceded the 2009-2010 epidemic to see how the virus had changed over the course of 4 years. As a result, he modified it so that it became resistant to human immunity [7*]. Of course, his work began to be criticized since humanity would be powerless if the virus leaked from the laboratory.

It is not known what other dangerous means will become more affordable in the future. But what is known for sure is that people and groups of people with violent aspirations may well try to use the dangerous achievements of progress, which may end up with a global catastrophe and self-destruction of mankind, or at least the destruction of the civilized world and throwing back the development of mankind into the distant past. And, of course, one cannot abandon scientific and technological progress, especially considering that this is the only hope of mankind for survival in the long term. Therefore, it is necessary to get rid of the root of such a threat – the problem of violence in society and human relationships. Perhaps it is

violence that is the very factor of the "Great Filter" that can lead civilization to extinction before it can go beyond the borders of its native planet and begin space colonization?

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Do people tend to harm others indirectly

As we know, the average individual is absolutely not inclined and is not able to cause other people direct physical harm by committing violence against them, especially in such cruel forms as causing serious injury or murder. Why this happens is well explained by the theory of the violence inhibition mechanism. But the problem of causing harm is not limited to its direct forms, many means can be used to make this action indirect, thereby weakening the natural resistance to it. In view of this, one might even say that the solution of the problem of violence by therapeutic methods, i.e., regaining inhibitory control over aggression in individuals with its weak expression, will not radically change the whole situation with this problem. People will continue to harm each other simply by resorting to other, non-violent methods.

To deal with this issue, we need to have a good understanding of how human harm inhibition works in general. One can look at military research that has shown that technical means that distance a soldier from potential victims can weaken his resistance to killing. However, recent evidence suggests that even this does not necessarily work. Combat drone operators are still suffering from serious

psychological trauma just like ordinary soldiers. This shows that killing is still an extremely difficult task, at least in the case when people realize that behind their seemingly "virtual" actions there are still real killings of real people. We can be sure that many would not even initially agree to such a job despite a good salary and a minimum of some physical risks.

An even better decision would be to look at the Violence Inhibition Mechanism Model (VIM). This mechanism inhibits harm in general. Because the violence inhibitor is directly activated by other people's distress cues (expressions of sadness, fear, pain), this process can be observed even when no physical harm is being caused. A study proposing the VIM model gives the example of a child trying to take a toy away from their peers. If they put on a sad expression when resisting this, the first child will be inclined to give up. And research on victims of relationship abuse shows that it is the ability to ignore such distress cues that allows psychopathic individuals to easily manipulate their partners, of course to their detriment.

From such examples, it can be understood that it is in principle unusual for a mentally healthy individual to harm other people, and this is the result of the function of the same mechanism that inhibits the infliction of direct physical harm. The very understanding that, due to some actions, someone will necessarily suffer will predispose a person not to do so.

Of course, causing another person some kind of psychological or economic harm, or even physical harm through distancing is a much easier action than killing while directly observing the victim - the resistance to this is not so strong. If less than 2% of individuals are capable of killing, then a much larger percentage is likely capable of simply intentionally causing harm in any of its forms. However, the more obviously certain people are non-violent, the more likely it can be expected from them that they will not harm anyone at all. So the best strategy to avoid hurting yourself is not to have any dealings or relationships with those whose violence inhibitor is clearly weakened. After all, if a person, even slightly, but still capable of committing violence, then you should not be surprised that this person will be able to easily cheat on you in a relationship or business, ignoring your "distress". You should always be careful with such people.

Association between the violence inhibitor, empathy, and guilt, and whether a person who is capable of easily committing violence can experience these emotions

According to the Violence Inhibition Mechanism Model (VIM), it is this mechanism that is a prerequisite for the development of such emotions as sympathy, guilt, remorse, and empathy. However, its immediate function is precisely the inhibition of violence, which occurs as an aversive reaction to distress cues (expressions of sadness, fear, pain, etc.) from other people. What happens outside of this process but is still the result of the violence inhibitor function, in turn, arises due to conditioning – the formation of conditioned reflex reactions. Simply put, the acquisition of experience by individuals and their socialization create conditioned stimuli to activate this mechanism. Thus, in the course of their development, individuals become capable of experiencing an aversive reaction even simply by imagining causing harm to another person, and not only by directly trying to do it and directly observing distress cues.

The role of the violence inhibitor in the development of empathy is explained as follows: individuals, when observing distress signals, can often imagine and understand the state of victims, and try on their role. As a result, the association of distress signal that activated the violence inhibitor with these representations will occur, and individuals will become able to show an empathic response only by thinking about someone else's distress. With the development of other previously listed emotions, everything happens in a similar way.

It can be seen that the violence inhibitor links the empathic response (perceptions of another person's distress) to the aversive response through a conditioning process rather than generating it on its own. And a person can show empathy not only because of this mechanism but also, for example, because of the oxytocin system, which plays an important role in prosocial behavior, classifying people as "in-group" members, as well as pair bonding. Thus, a significant connection was found between empathy and the oxytocin receptor (OXTR) gene, as well as the CD38 gene, which affects the release of this hormone [1*].

It is worth noting that violence inhibition, as a function of the serotonergic system, can also affect the release of oxytocin. However, animal experiments have shown that the suppression of the oxytocin receptor does not interfere with the anti-aggressive effect of the activation of the serotonin 1A receptor but only leads to a decrease in prosocial behavior. This means that the regulation of aggression and the stimulation of prosocial behavior are different neurophysiological functions and the functioning of the system responsible for the first can affect the functioning of the system responsible for the second, but not vice versa.

The manifestation of empathy is influenced by both these systems at once, which can speak of it as also a separate neurophysiological function. The situation can be similar to other emotions, such as guilt. The study proposing the VIM model notes that the ability to experience guilt arises as a result of conditioning. But shouldn't there be a separate neurophysiological mechanism responsible for this emotion?

This material is an attempt to expand our understanding of how aggressive behavior is regulated, as well as to explain a person's ability to experience empathy or guilt despite a weak or completely dysfunctional violence inhibitor. Of course, in this case, these emotions will be developed much worse, but this does not necessarily mean their complete absence. Even brutal killers may well be able to love and feel sorry for others or feel guilty about their actions. However, it is always worth remembering that the vast majority of people are unable to commit violent attacks and murders due to strong inner resistance to such acts. And this is exactly the norm for the average healthy individual.

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Proactive epigenesis: upbringing and education as a method of epigenetic fixation of nonviolence

As we know, the human brain has certain intrinsic and innate predispositions, including a predisposition to inhibit violence, as well as moral emotions such as empathy and sympathy. However, although humans are neurobiologically predisposed to certain values, it is very important to take into account the influence of culture and society. In this case, we should remember epigenetic mechanisms that play an important role in how the structure of the brain develops in response to ethical and social norms. This can greatly help us in the problem of how to eradicate violence from human relationships

To begin with, it is worth briefly considering what epigenetics is. This branch of genetics studies changes in gene activity during cell growth and division, that is, changes in protein synthesis caused by mechanisms that do not change the DNA structure itself. Such changes can persist during cell division and even be inherited, but this heredity is temporary and is not passed for more than several generations. From an evolutionary point of view, this is a mechanism for creating temporary adaptations to temporary changes in environmental conditions. A good example of this is a study that found that the grandchildren (but not granddaughters) of men who went through a famine in Sweden in the 19th century were less prone to cardiovascular disease but more prone to diabetes [1*]. It is also known that factors

such as stress, hunger, and environmental temperature that affect the mother during pregnancy determine the epigenetics of the child. However, it is worth noting that unlike mutations, epigenetic changes are reversible.

Understanding the epigenetic influence on human development has led some researchers to the idea of such a concept of upbringing and education of children as proactive epigenesis. This idea suggests that the moral education of children from kindergarten should rely on an understanding of how human neurophysiology works and how it interacts with cultural and social influences. It is also, of course, necessary to understand that inspiring models and gentle encouragement have a strong positive effect, while violence, for example, corporal punishment, can seriously harm a child. And for a better understanding of this idea, we should consider in more detail some of its points [2*].

Based on it, if new cultural patterns, such as a better ability to control violence, become epigenetically stored in our brains, then more peaceful societies might hopefully develop. However, it is doubtful that they can be accepted in a society which inhabitants' nature is in conflict with them. It is unlikely that societies that encourage violence will be able to stabilize non-violent traits. The solution to this is the use of special education programs for many generations, which in any case will have a positive impact.

We should add that there is definitely no conflict at least with the biological nature of humans in an education aimed against violence since they are naturally predisposed precisely to the inhibition of violence. Although the real problem may be authoritarian authorities in many countries, normalizing violence as an acceptable, if not necessary, tool in the control of public order.

Also, the idea of proactive epigenesis in itself does not say which particular neurophysiological mechanisms in humans should be paid attention to in the formation of educational programs. But it is obvious that, first of all, it is important for us to be familiar with the theory of the mechanism of violence inhibition, based on which we can connect the innate predisposition to inhibition of violence with the serotonergic system, as well as the genes and enzymes that affect its function. For example, we can think of the MAO-A gene. As one study shows, it mediates the impact of abuse in childhood on violent behavior in adulthood. The carriers of its high-active variant are "immune" to such influence and do not become more violent than the average individual. But carriers of the low-active variant are at risk, maltreatment makes them 4 times more likely to commit violent crimes [3*].

The idea of proactive epigenesis involves the search for some universal ethical norm, which must be fixed epigenetically. But, again, it is not clearly stated what kind of norm this should be, although in general, the idea is about creating a non-

violent society. Ethics can be a subject of heated debate, so it is important for us to define some sort of minimum standard that everyone can actually agree on, and nonviolence is just that. Moreover, the presence in a human of an innate violence inhibitor points to this norm as a natural part of human behavior, while many other norms can already be more a product of culture and environment, and not our biological predispositions. So, the question of a universal ethical norm can already be considered solved.

The problem that the idea of human biological improvement has negative connotations associated with its use by some dictatorships to create a society predominantly populated by "good citizens" or "racially pure citizens" can also be considered solved. We understand that such formulations can be determined by a long list of points and comes from the subjective opinion of authorities. The norm of non-violence is the minimum possible norm, it is already inherent in the vast majority of people from birth, and the ability to easily commit violence due to the violence inhibitor dysfunction can be clearly defined as pathology and mental deviation. The caution called for by the researchers who put forward the idea of proactive epigenesis is already provided in the norm of nonviolence, the main thing is not to go beyond it and not add any other norms, which is what dictators have always done in practice. The norm of non-violence is a sufficient norm to achieve a better society.

Finally, they are also wary of the idea of a drug and gene therapy solution to the problem of violence due to a lack of understanding of the consequences of this on the functioning of the human brain. Of course, based on the available research and the concept of the violence inhibitor, we can see great promise for this approach, especially given that dysfunction of the violence inhibitor is pathological from a medical point of view and therefore needs to be treated. But nothing prevents the development of both ideas in parallel. While there are no reliable and effective therapeutic solutions to the problem of violence, it can be smoothed out by proactive epigenesis, which is inherently a more cautious solution. Also, keep in mind that epigenetic influences can be temporary and reversible, so we cannot drop the search for a more effective therapeutic approach.

Proactive epigenesis is a great idea for those who would like to change society for a better, more non-violent side through social methods and especially through upbringing and educating children. Anyone who does or plans to do this should better study human neurophysiology and become familiar with the specifics of the violence inhibition mechanism. If you understand well what a person needs in order to experience aversion and resistance to violence, to be able to show empathy, and also how exactly the violence inhibitor directs the development of an individual towards non-violence, then your efforts will definitely not be in vain.

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