

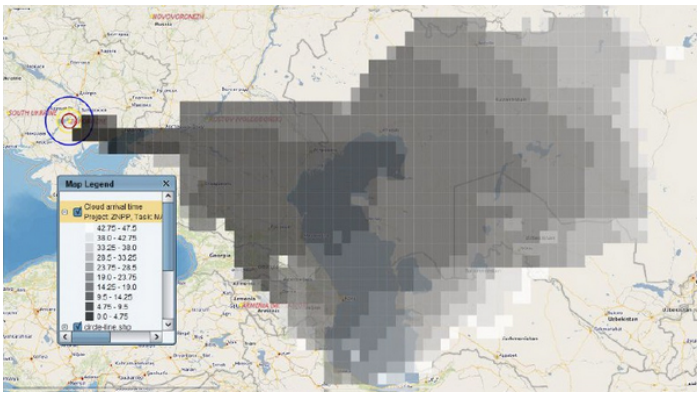
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# Nuclear Cyberwar: From Energy Colonialism to Energy Terrorism

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Nuclear Cyberwar: From Energy Colonialism to Energy Terrorism

Along with targeted airstrikes on the infrastructure of Ukrainian cities, one of the first events of Russia's full-scale invasion of Ukraine was the February 24 occupation of the Chernobyl Nuclear Power Plant. One week later, on the evening of March 3, a Russian rocket hit the industrial zone of Enerhodar ("energy's gift"), a satellite town within five kilometers of the largest nuclear power plant in Europe. The Zaporizhzhia Nuclear Power Plant (NPP), in operation since 1972, sits on the Dnieper river in southern Ukraine and has six active pressurized light-water nuclear reactors. After striking Enerhodar, Russian troops began moving through the night towards the nuclear power plant. They soon took over the plant by breaking through lines of local Ukrainian Territorial Defense units. Members of these units threw Molotov cocktails at the Russian tanks in response to their persistent firing at civilian infrastructure, including the destruction of a school and a residential building. After two-and-a-half hours of Russian advances, Ukrainian troops guarding the nuclear station facilities withdrew, refusing to engage in combat on the the NPP grounds.<sup>1</sup> The Russian army broke through the station's gate. Station personnel continued, in vain, to try to stop the troops. They shouted warnings via megaphone: "This is nuclear industrial infrastructure! There is danger of a nuclear accident! Stop shooting and leave the premises! This is an act of nuclear terrorism!"<sup>2</sup> Around midnight, a fire broke out in a training building on the plant's grounds due to the Russian troops' continuous shelling. Its flames burned for at least four hours throughout the early morning of March 4. The fire was eventually extinguished, but it became one of the most utterly terrifying broadcast events of our time.<sup>3</sup> The occupation of both Chernobyl and Zaporizhzhia NPPs created a sense of catastrophic proximity and, in some ways, echoed and reiterated the nuclear threat articulated by Vladimir Putin on March 27, when he ordered the Russian minister of defense and the chief of the general staff to transfer deterrent forces of the Russian army to a "special regime of combat duty." These instances of "nuclear terrorism" lie at the nexus of "cyber" and "nuclear" warfare, where the two major forces of cyberwar converge for a full realization of its grimmest scenario. We should hope that we can still evade its consequence.



Calculation of cloud arrival time performed by the Norwegian Radiation and Nuclear Safety Authority using the atmospheric dispersion model MATCH (JRODOS), hrs. Photo published on Telegram channel, Energoatom.

## Nuclear Tensions in the Cyberdomain

Cyberwar is a radically invasive and violent event of high complexity. It is entangled in the operation of several information systems and cuts across various materialities and flows – from the digital to those of flesh and blood. Media scholar Nick Dyer-Witheford and I have recently theorized cyberwar by offering a broad politico-economic definition: it is a manifestation of the recurrent technological revolutions (industrial, electronic, cybernetic) by which capital renews itself. Originating in Second World War and Cold War cybernetics, cyberwar is oriented toward the future. It slopes toward the new levels of *automation* likely to characterize all social relations, including war-making, in the twenty-first century. Unlike military and security specialists, we do not distinguish between cyberwar (in the form of cyberattacks, disinformation, psyops) and war on the ground. In *Cyberwar and Revolution*, we emphasize that cyberwar, in both its defensive and offensive aspects, may be distinct from, preliminary to, or simultaneous with other forms of hostility, including the “kinetic” use of weapons.<sup>4</sup>

Our work traces the history of *cyberwar* – both as an idea and a way of fighting – through a multiplicity of distant and related realms and contexts. Like all other writers on cyberwar, we also had to address the fact that its genealogy is paradoxically rooted in William Gibson’s science fiction. *Neuromancer* gave us a vision of cyberspace, “a consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts ... a graphic representation of data abstracted from banks of every computer in the human system,” where a hacker is exploited by a corporate tycoon.<sup>5</sup> American pop culture movies of the 1980s, such as *WarGames*, also contributed to envisioning

the possibility of an accidental nuclear war. In the 1983 movie, which allegedly so worried the fortieth American president Ronald Reagan that he perceived it as a warning, two teenage hackers log into a system of networked computers to change their high school grades. They go on to find themselves in the online gaming realm of chess, checkers, backgammon, and poker, only to discover more tempting offerings like *Theaterwide Biotoxic and Chemical Warfare* and *Global Thermonuclear War*. The name of the second game alludes to Herman Kahn’s 1960 book on the same topic, which develops the strategic doctrines of nuclear war and evaluates its effect on the global balance of power. The teenagers choose to play this one as the Soviet Union, targeting American cities and reverting military cybernetic vision towards their adopted state. But within a computer network where new linkages constantly emerge to bring any previously disconnected realms into an unusual proximity, this playful simulation of an imagined enemy is misrecognized as real. As a result, the North American Air Defense Command’s ensuing response almost leads to a Third World War carried out through cyberspace.

By the 1990s, cyberwar was no longer a fiction, although its scope and impact were still being debated by military and security specialists – either openly in the press or behind the closed doors of exclusive think tanks. Simultaneously, the United States, China, and other countries often initiated so-called “operations” – which were either purely digital or a hybrid model, where the digital aspects of operations unfolded as action on the ground. Operation Moonlight Maze, conducted around 1999, related to a series of probes into the networks of the Pentagon, NASA, the US Department of Energy, as well as private universities and research labs. Those early exercises were followed by Operation Makers Mark, Operation Storm Cloud, and other cyberattacks coded by somewhat strange names. One of the better-known examples is Operation Titan Rain in 2003, allegedly carried out by hackers from the People’s Republic of China – possibly members of the People’s Liberation Army – who attempted to penetrate the networks of US defense institutions, military contractors, and high-technology businesses. In the relatively recent case of Operation Grizzly Steppe, the hacker groups Cozy Bear and Fancy Bear allegedly leaked Democratic National Committee communications during the 2016 US elections. The “worst breach of US military computers in history,” attributed to Russian agents, preceded it in 2008. Operation Buckshot Yankee was a catastrophic event in which a malicious code placed on a flash drive uploaded

itself to US Central Command networks.<sup>6</sup> It was a turning point in cyber security for the US government and led to the creation, in 2010, of the United States Cyber Command.<sup>7</sup> USCYBERCOM has since been responsible for coordinating the cyber activities of different military services and conducting operations in the “cyberdomain,” a realm which it institutionally categorized, in 2011, as equally important as land, sea, air, and space. In other words, the cyberdomain is officially a key terrain of irregular warfare with state and nonstate actors.<sup>8</sup>

In several of these operations, the cyberdomain of war intersected with that of nuclear conflict. Given both cybernetic and nuclear history, this connection is not new or surprising, but it has been certainly *renewed* within the last decade. The control and command of nuclear weapons depends on increasingly digital communication systems whose collapse may lead to catastrophe. And, as political scientists Erik Gartzke and Jon Lindsay remind us, cyberwar has always been “thermonuclear” in its strategy: while nuclear weapons and cyber operations are nearly complete opposites in their destructive capabilities, they are nevertheless “particularly

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complementary.”<sup>9</sup> The ways to achieve such complementarity vary significantly. The most representative example of these complementary forces is Operation Olympic Games, a joint project of US and Israeli agencies known for deploying state-of-the-art Stuxnet nuclear centrifuge-destroying malware. Between 2010 and 2012, the operation disabled over a thousand centrifuges at Iran’s uranium enrichment plant outside the city of Natanz in order “to sabotage Iran’s uranium enrichment program and prevent President Mahmoud Ahmadinejad from building a nuclear bomb.”<sup>10</sup> To this day, as cybersecurity journalist Kim Zetter writes, the Stuxnet worm is “known as one of the most sophisticated viruses ever discovered – a piece of software so unique it would make history as the world’s first digital weapon and the first shot across the bow announcing the age of digital warfare.”<sup>11</sup> Cryptologist Bruce Schneier estimated that the software could have taken eight to ten people six months to write, and required laboratory testing as well as gathering extensive intelligence for effective targeting.<sup>12</sup>

### The Imperial Roots of Nuclear Occupation

Although Ukrainian troops withdrew from the Chernobyl Exclusion Zone without engaging in



Rafael Mariano Grossi, IAEA Director General, shows the international press and media during his press briefing as he points on a map on the situation at the Zaporizhzhia Nuclear Power Plant in Ukraine, IAEA Vienna, Austria, 4 March 2022. Photo: Dean Calma / IAEA.

combat, the State Nuclear Regulatory Inspectorate of Ukraine reported that Russian troops' heavy military vehicles disturbed enough contaminated soil to significantly overload control levels of gamma radiation dose rates in the Zone.<sup>13</sup> Nuclear policy expert James Acton noted that the seizure of the infamous plant added "a disquieting nuclear dimension to the unfolding humanitarian catastrophe of Russia's illegal and unprovoked invasion of Ukraine," which is also a "brutal assault [that] violates the security guarantees that Moscow provided in 1994, when Kyiv allowed it to remove nuclear weapons left in Ukrainian territory after the collapse of the Soviet Union."<sup>14</sup> The occupation of Chernobyl weaponized the plant's entire remaining nuclear energy production infrastructure by turning it into a nuclear weapon. This transformation constitutes an act of *nuclear terrorism*.

A premediated and unlawful act of terrorism committed either by rebels or governments can be isolated, but it can also take place in the context of war. In this case, it should be distinguished as such. "Clearly war and terror are intimately related," historian Charles Townshend writes. "It is hard to imagine a war that did not generate extreme fear amongst many people,

and sometimes this is more than a by-product of violence – it is a primary objective. The essence of terrorism, by contrast," he explains, "is surely the negation of combat. Its targets are attacked in a way that inhibits (or better prohibits) self-defence."<sup>15</sup> Russian forces, it seems by now, were better prepared for a parade than combat. They intended to achieve victory in their failed blitzkrieg by a series of distributed terrorist acts. Their attacks on "not just selected but also random targets" were meant to seize attention and paralyze the country by shock, horror, fear, or revulsion.<sup>16</sup> The occupation of a nuclear power plant – one such terrorist act – equally targets local and remote publics, opening multiple channels of negotiation or pressure to compensate for the Russian military's disorganized invasion.

To better understand the recurring nexus of "cyber" and "nuclear" in cyberwar, let us look closely at the structure of two cases: Stuxnet and the occupation of the Chernobyl and Zaporizhzhia nuclear power plants. The occupations may seem extremely different from the sophisticated Stuxnet computer worm implanted to simulate and slow down the work of Iranian centrifuges. After a relatively easy takeover of the Chernobyl NPP, the occupation of



View of a six-story L-shaped building, with the inscription "Let the atom be a worker, not a soldier," in Pripjat, Ukraine (now the Chernobyl Exclusion Zone). Still from found footage, Pripjat Film Archive. Courtesy: Oleksandr Syrota. License: CC-BY-NC-ND.

Zaporizhzhia met significant local resistance. It was also significantly more risky and bizarre. The occupation was executed by shelling the nuclear plants' facilities with projectiles, many of which did not immediately detonate and were literally dropped on the premises like stones catapulted by a ferocious medieval army. Some of these projectiles struck the cooling system of a transformer serving nuclear reactors of the Zaporizhzhia NPP. Prior to being discovered, they were lodged in the buildings' walls and infrastructural elements without exploding. Then Russian troops proceeded to search, collect, and detonate this ammunition right on the grounds of the plant. In these events at the Zaporizhzhia NPP, we have finally encountered that barbaric dimension of cyberwar where the reality of its dystopian and even apocalyptic future temporarily or permanently invades the present.



Detail of the central part of the awards which were circulated to the "liquidators" of the Chernobyl disaster. This pattern represents a drop of blood through the radiation signs of alpha, beta and gamma. License: CC BY-SA 2.5.

If Stuxnet, a code, penetrated a system to intervene in its mechanical workings to *slow down* the supposed production of a nuclear bomb, Russian invaders' rocket-propelled grenades penetrated the nuclear plants' systems to destabilize their complex assemblages of networks that expand far beyond Ukraine and ensure international information exchange around nuclear safety control and regulation of energy production. These cases are structurally similar; the latter is simply a reversed version of the former. They both demonstrate that an act of cyberwarfare always assembles at the

intersection of different domains; it involves different materialities; and it is necessarily linked to war. Unlike Stuxnet, the act of terrorism at Zaporizhzhia NPP aimed to *accelerate* the transformation of the industrial object into a potential nuclear bomb. However, as Energoatom CEO Petro Kotin explains, neither in the case of a potential accident at the Chernobyl NPP nor at the Zaporizhzhia NPP will we see a mushroom cloud. If the reactor with fuel in it is damaged, or if the container with processed fuel is damaged, or even if a strong explosion happens somewhere close to a reactor, it may start a chain of reactions or another system response to the "unusual activity." This in turn might eventually lead to what happened in 1986: an explosion of a "dirty bomb" that releases and throws around a huge amount of radioactive elements.<sup>17</sup> If one container at the Zaporizhzhia NPP is broken, the damage would be equal to 10 percent of the Chernobyl catastrophe, Kotin says. But the Zaporizhzhia station hosts 173 containers on its premises.<sup>18</sup>

As with any act of terrorism, Russian forces' terrorist takeover of these nuclear power plants is highly media oriented, but only strives for exposure it can control. On March 7, fourteen journalists serving Russian state media visited the occupied Zaporizhzhia NPP to produce reports in which NPP workers were supposed to greet and thank the invaders for protecting them by means of the "special operation."<sup>19</sup> Other witnesses, including representatives of the IAEA, either did not have access to or were reluctant to visit the sites and could not evaluate their condition or the level of damage sustained. The reasons for the occupation of the Chernobyl NPP and the Zaporizhzhia NPP might be different, but they are similarly difficult to comprehend. Kotin speculates that a banal explanation might be that the premises of a nuclear station is seen as a good military bases because the vehicles are safe there from hits by Ukrainian air forces. Russia's intention might also be to add the Zaporizhzhia NPP to the Crimean energy system; or it might be related to discussions in the early 2000s, as Kotin recalls, when Putin propagated the idea that Ukrainian and Russian nuclear stations should be a united industrial complex under the supervision and command of the headquarters in Russia.<sup>20</sup> The traces of this imperial fantasy are obvious in this unfolding case of nuclear terrorism.

In mid-March, the Ukrainian national nuclear company, Energoatom, reported the presence of eleven employees of the Russian state atomic energy corporation Rosatom on the premises of Zaporizhzhia NPP.<sup>21</sup> Here, the Russian military and a high-level state corporation participate in a joint act of nuclear

terrorism. The imperialist genealogy of this act is rooted in Soviet times, when the construction of all Ukrainian nuclear plants – the South Ukraine NPP, the Rivne NPP, the Khmelnytsky NPP, the Zaporizhzhia NPP, as well as the decommissioned Chernobyl NPP – began almost simultaneously in the 1970s, when the USSR announced a move towards “a larger stake in the world market for nuclear energy” by “exporting enrichment services to Western European countries,” envisioning “an expansion of their previously limited role” in international nuclear trade.<sup>22</sup> The original myth of the “peaceful atom” was embraced amidst Soviet enthusiasm for the atomic industry’s promise of rebooting the stagnating economy towards what historian Paul Josephson describes as an “atomic-powered communism.”<sup>23</sup> With their Soviet/Russian-built VVER-1000, VVER 440, and VVER-320 reactors, these plants simultaneously materialize the Ukrainian atomic present and constitute the remainders of the Soviet atomic past. Unsurprisingly, this infrastructural legacy attracts the Russian imperial army.

In Ukraine, the imposed narrative of the “peaceful atom” was the subject of ongoing subversion. Back in the seventies, a popular slogan expressing Soviet nuclear enthusiasm, “Let the atom be a worker, not a soldier” (*Хай буде атом робітником, а не солдатом*), was installed on the roof of #6 Sergeant Lazarev Street, one of the tallest apartment buildings in the city center of Pripjat, Ukraine. The sign promoted and prompted the “correct” way to think and speak about the “peaceful atom,” although the clandestine production of weapons-grade plutonium was an open secret in Pripjat before the proximate 1986 disaster left it a radioactive ghost town.<sup>24</sup> Apart from cybernetics, the nuclear power industry was another agent of technological modernity: it contributed to the irreversible convergence of war and peace. The entangled scientific careers of its key figures also exemplify this space between a bomb and peaceful atom. “Igor Kurchatov, head of the atomic bomb project,” Josephson notes, “late in life sought atoms for peace because of his horror over multimegaton hydrogen bombs. Anatolii Aleksandrov, his successor at the Institute of Atomic Energy ... gained fame for submarine nuclear propulsion and infamy for the Chernobyl reactor design.”<sup>25</sup> The letters of the “peaceful atom” slogan remain on the roof of that apartment building in Pripjat. Before the Russia-Ukraine war, a visitor to the Zone of Exclusion might occasionally spot a playful subversion of the ideological slogan: *Хуй буде атом робітником, а не солдатом*, which can be translated as “There is no way the atom is a worker, but a soldier.”

## Nuclear Colonialism

The invasion of Ukraine has mobilized the urgent necessity of engaging with critical perspectives on colonialism and empire to detect the anchoring points of imperialist fantasies and obsessions. The colonial history of Ukraine vis-à-vis the Russian Empire, as historians would note, is not straightforward. “One has to be rather cautious when applying the term *colony* to the Ukrainian territories under the Russian empire or Soviet Union,” historian Yaroslav Hrytsak notes.<sup>26</sup> Indeed, the Ukrainian case is messy. Always as borderlands, always a meeting place of nomads. This is why, Hrytsak explains, it “represents a wide variety of colonial experiences that are hard to group together under the umbrella of postcolonial theory,” so that “one of the most productive approaches is to apply the concept of internal colonization, or rather ‘modernization with internal colonization.’”<sup>27</sup> Here he refers to historian Timothy Snyder’s argument that “Iosif Stalin explained the logic of his first Five-Year Plan as one of internal colonization, in which Soviet power had to treat Soviet territories as the maritime empires treated their distant possessions.”<sup>28</sup> Among these several readings of “internal colonization,” philosopher Paul Virilio’s term “endocolonisation” stands out for its emphasis on the role of a “war model” in the emergence and operation of the modern state (with the Soviet state as one example): “Unlike the exocolonialism associated with State territorial expansion and empire building over the last six or seven millennia, endocolonialism is a colonialism turned inward.”<sup>29</sup> For Virilio, as social theorist Udo Krautwurst notes, this notion from *Pure War*<sup>30</sup> indicates “the intensification and extensification of war within and throughout actually existing state forms, an inwardly directed expansion of the principle of the State, manifested in an increasing militarization of the social.”<sup>31</sup> Russia’s acts of nuclear terrorism during the Russia-Ukraine total war – an example of complex “asymmetric warfare and the ‘hostage-holding’ function of military control in contemporary mediatized societies”<sup>32</sup> – evolves from colonialist control of the territories within the Soviet state’s imperialist politico-economic domination of Ukraine. The occupation of the Zaporizhzhia NPP is not accidental. It is an imperialist zero-day exploit of cyberwar, when a barbaric army from a different age enters your land as if it still belongs to the politico-economic Union that collapsed over thirty years ago.

Russia’s efforts at internal colonization also correlate with a different kind of colonialism: nuclear or waste colonialism. Although most of the Chernobyl Zone’s contamination was a direct result of radioactive fallout from the 1986

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accident, initial pollution of the site began a decade earlier through multiple accidents and leaks. The KGB archives on Ukraine reveal numerous reports of technical imperfections in equipment during the first stages of construction of the plant in the 1970s, followed by reports of significant radioactive leaks in the first half of the 1980s. Between 1983 and 1985, there were five significant accidents and sixty-three primary equipment failures at the Chernobyl NPP. These events were not reported to the public. Meanwhile, internal KGB communications show that following these leaks, the permissible level of radioactivity in nearby villages was exceeded hundreds of times.

For centuries, the total square kilometers controlled by the Russian Empire was “the largest in space and the most durable in time of all historical empires, covering 65 million square kilometers for Muscovy/Russia/Soviet Union versus 45 million for the British Empire and 30 million for the Roman Empire.”<sup>33</sup> To manage its vast territories with ---ethnically and nationally defined peripheries, the Soviet Union adopted two opposite approaches to governing the population: forced resettlement and the obstruction of social migration. The latter strategy operated by, for example, refusing passports to entire villages, which prohibited their inhabitants from travelling.<sup>34</sup> The subsumption of the Polissia region during the construction of Soviet Cold War infrastructure – including the ballistic rocket detection radar Duga-1 and the Chernobyl NPP – is an overlooked case of nuclear colonialism.

Like other types of colonialism, “a system of domination that grants settler access to Land for settler goals,”<sup>35</sup> nuclear production in Polissia resulted in land dispossession – this time, by radioactive contamination. <sup>36</sup> The construction of the Chernobyl NPP and its array station in the 1970s introduced military rule to the Polissia region, a large forested and marshy area that spans portions of Belarus, Ukraine, Poland, and Russia. The military regime set up multiple security checkpoints to surveil the local population and erected internal borderlines to protect the critical new infrastructure from random eyes. The proximity of secret plutonium production had devastating consequences for traditional Polissian cultural practices. For centuries, the region’s terrain protected its inhabitants from invasion and isolated them from foreign influences. In the absence of these influences, Polissian people retained their traditional wooden architecture, their traditional dress, and a rich store of customs, rites, and folklore. <sup>37</sup> Because of this isolation, people in Polissia never formed a strong sense of Soviet or national identity, and instead identified

themselves as *tuteshni*, or “those who live here,” emphasizing a strong association with their land.<sup>38</sup> With the construction of the Chernobyl NPP, the *tuteshni* became dual hostages of Soviet nuclear colonialism: first by the force of its security regime and then by exposure to radioactive leaks, which they endured a decade prior to the Chernobyl catastrophe. “Pollution,” researcher Max Liboiron writes in *Pollution Is Colonialism*, “is best understood as the violence of colonial land relations rather than environmental damage, which is a symptom of violence.”<sup>39</sup> It is not accidental that the contaminated territory coincides with the areas of securitization and surveillance imposed by the Soviet empire.<sup>40</sup>

On March 31, after the fifth week of occupation, Russian troops suddenly announced their intention to withdraw from the grounds of the Chernobyl NPP by taking captive Ukrainian servicemen with them to Belarus. Presumably, some of the troops suffered the impact of ionizing radiation, to which they were exposed at levels beyond all norms. Unlike the occupation of the Zaporizhzhia NPP, which could have several potential explanations, the occupation of the Chernobyl NPP cannot be explained in any practical way. Unless, of course, it was purely symbolic, which is also typical for terrorist acts. Speaking of the symbolic meaning of the Chernobyl station, let us recall Virilio’s theory of accidents. It implies that without accidents, we remain unaware of how technology functions or, more generally, what technological modernity is about. Without a shipwreck, the invention of the ship is incomplete: “The shipwreck is consequently the ‘futurist’ invention of the ship, and the air crash the invention of the supersonic airliner, just as the Chernobyl meltdown is the invention of the nuclear power station.”<sup>41</sup> Virilio grants the Chernobyl disaster the status of “original accident,” as a key representation of the aforementioned convergence of war and peace typical for technological modernity. I mention this passage here not only because it is tempting to speculate, with Virilio, about the afterwardness of technological accidents, but also because I must now disagree with him. I propose that the full realization of the nuclear power station, as a representative technology of “shipwreck modernity,” did not occur in 1986, but in 2022. The full realization of the nuclear power station as a key technology of modernity was not in its accidental meltdown, but in the non-accidental act of nuclear terrorism with an imperialist genealogy carried out during the Russia-Ukraine war.

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