Introduction

On April 22, 1915, the German chemist Fritz Haber and a hand-selected group of technicians coordinated the first large-scale chlorine gas attack of World War I. In the days that followed this assault against Allied troops, the German state celebrated its supposedly successful use of poison gas and Haber was given a military rank with near total control of future chemical weapons development. Historically, Haber's attack signified a massive escalation of chemical warfare, which had previously been either rudimentary or conceptual in nature.[1] Furthermore, the German release of 168 tons of chlorine gas and the involvement of academic scientists in direct warfare efforts proved an unmistakable turning point in World War I's larger historical narrative. According to the Allied nations, Haber and the Germans had broken with the previously accepted rules of warfare and now there would be no turning back. While the other belligerent nations began to bring the full weight of their national chemical industries into the war, the Germans maintained their head start, which was subsequently augmented by Haber's deployment of new chemical weapons such as mustard gas and the German military's adoption of new and improved gas tactics. However, this initial advantage did not quickly or decisively win the war for the Germans and their new weapons tended to bog down ground troops, thereby entering them into a new and uniquely dangerous form of modern warfare. By 1918, these changes fully expressed themselves through the constant gas shell barrages that created a highly toxic world for the average infantryman.

The philosopher Peter Sloterdijk has described Fritz Haber's use of poison gas in World War I as the birth of a new historical epoch, arguing

[1] Poison gas, the term most commonly used during World War I, is one of many chemical weapons. However, not all chemical weapons are gaseous. For instance, mustard gas is a liquid that can become airborne when fired in an explosive shell. Furthermore, more expansive legal definitions of chemical weapons include all of the technologies involved in the dispensing of poisonous chemicals. This study primarily employs the actors' term "poison gas" unless it is intentionally and explicitly referring to the more expansive category of chemical weapons.

that chemical warfare generated a new subjective relationship to the atmospheric environment. By weaponizing the very air that supported human life, poison gas introduced many Europeans to the central precepts of atmospheric terrorism. Sloterdijk writes:

> The attack on humans in gas warfare is about integrating the most fundamental strata of the biological conditions for life into the attack: the breather, by continuing his elementary habitus, i.e. the necessity to breathe, becomes at once a victim and an unwilling accomplice in his own annihilation.[2]

Furthermore, the unique methods of this new weapon forced Europeans to begin considering both the chemical construction of their world and possible methods of protection. For Sloterdijk, such changes represent the birth of the modern mind, since "aesthetic modernity is a procedure of applying force not against people or things, but against unexplained cultural relations (e.g., the previously ignored atmospheric composition)."[3]

For the historian, the birth of a strictly delineated historical "modernity" is difficult to place in 1915. Nevertheless, there is certainly a strong case for dating the beginnings of certain earth-shattering cultural and social changes to the earliest instances of chemical violence in World War I. For this reason, this historical study of German chemical weapons posits the conscious realization of these potential changes among its historical actors as a specifically German "chemical modernity," denoting the distinctive importance of chemical weapons for formulating the contested visions of impending and unseen danger that proliferated in the postwar German world.

In the wake of World War I, these contested visions would help to shape and define Germany's social, cultural, and political worlds. Debates between antigas activists and the scientists and engineers who previously produced chemical weapons brought poison gas production under intense public scrutiny. It was precisely in this moment of heightened anxiety that a loosely affiliated group of scientists and engineers, describing themselves as "gas specialists," took center stage to assure the German public that protection from poison gas was indeed possible.[4] Pulling on their own narration of World War I chemical warfare, these men claimed that

[2] Peter Sloterdijk, *Terror from the Air*, trans. Amy Patton and Steven Corcoran (Los Angeles: Semiotext, 2009), 22–23.
[3] Ibid., 79.
[4] The term "gas specialist" is a translation of a variety of German terms that poison gas experts used to describe themselves in the 1920s, 1930s, and 1940s. This included *Spezialisten*, *Experten*, *Gelehrten*, and *Fachleute*.

Germans could survive in a world permeated by poison gas as long as they maintained the requisite technology, knowledge, and personal discipline.

Through a reliance on distinctly modern technologies, the gas specialists envisioned their own version of a German "chemical modernity" in which the risks of chemical death could be controlled and possibly directed. The inherent dangers of poison gas made it a central concern for interwar scientists and military men who wished to create rational bureaucratic and technological structures that could harness the powers of new military technologies. However, the shifting nature of poison gas and its seeming immateriality ensured that many Germans in the 1920s and 1930s doubted the possibility of such national regulation, let alone protection. Nevertheless, the guidelines and training aimed at producing what interwar experts called "gas discipline" among German citizens fit into high-modernity's broader attempt to mitigate or control the new risks of modern life.[5]

In his well-known sociological studies of risk, Ulrich Beck has asserted that such modern projects of rational protection are only possible through a so-called risk calculus that grants political power to legal and governmental institutions in order to combat unforeseen and complex risks, such as global pollution, newly discovered diseases, urban crime, and industrialized warfare.[6] In this newly insured world, humans are constantly exposed to, or expecting exposure to, such large-scale problems, all of which were created or exacerbated by the process of modernization itself. In fact, according to Beck, modern humans manufacture the very crises that they then build intricate social structures to counteract.[7]

For Beck, this is an ongoing social process that appears to be reaching a critical historical juncture. By the late twentieth century, the risk-mitigating engineering projects of European society had become far too large and dangerous for individuals to sincerely undertake or understand. Thus, large-scale, high-risk projects of science and technology controlled by intricate bureaucratic structures have become increasingly necessary to protect humanity from widespread catastrophe.[8] Simultaneously, the social credibility of these projects is often slowly eroded due to the unanticipated ancillary risks that are invariably part of human-built and

[5] Matthias Beck and Beth Kewell, *Risk: A Study of Its Origins, History and Politics* (Hackensack, NJ: World Scientific Publishing, 2014), 35–37.
[6] Ulrich Beck, *World at Risk*, trans. Ciaran Cronin (Malden, MA: Polity Press, 2009), 26.
[7] Ulrich Beck, *Risk Society: Towards a New Modernity*, trans. Mark Ritter (London: SAGE, 1992), 183.
[8] Charles Perrow, *Normal Accidents: Living with High-Risk Technologies* (New York: Basic Books, 1984), 3.

human-controlled systems.[9] For this reason, the risk-mitigating experts of the early twenty-first century are regularly forced to cede a certain level of institutional and epistemic power as "we increasingly live on a high technological frontier which absolutely no one completely understands and which generates a diversity of possible futures."[10]

With the complexities of contemporary society in mind, this project pushes Beck's insights back to a moment in which certain risk-mitigating technocrats reached the apex of their self-styled institutional power. Since World War I, scientists and engineers under the supervision of Fritz Haber had produced gas protection technologies and guidelines in tandem with new battlefield gases. Combined with a commitment to the martial discipline and training of the trenches, gas protection technologies and plans would serve as the gas specialists' fundamental answer to interwar national poison gas protection. Although national gas protection required massive federal spending as well as constant vigilance and competence from each and every German citizen, the gas specialists' solutions appeared simple and straightforward. Indeed, practically any call for national technological defense provided the German people with a tangible sense of protection while avoiding reliance on what then seemed impotent agreements of international law. At the same time, these prescriptions were not without partisan interest since gas protection technologies and air raid training would provide the gas specialists with significant manufacturing contracts, substantial governmental power, and a new level of professional respect.

The gas specialists' stress on national protection also struck resonant chords with the concurrent desires for rearmament among various militant German nationalists. After their rise to political power in 1933, the Nazis institutionalized the gas specialists' call to action through the creation of the centralized *Reichsluftschutzbund* (RLB), or Reich Air Protection League. Total national protection remained a technical impossibility under the Nazis, but the RLB's effort to universally distribute gas masks after 1937 ostensibly served to provide a material site of individual comfort while simultaneously and collectively militarizing the average German civilian. While some gas specialists expressed concerns over these actions, most were willing to support the measures that made aero-chemical protection a daily concern. As such, the gas specialists easily translated their work to fit under the Nazi regime and briefly thrived in an expanding bureaucratic structure focused on mitigating the risks associated with national aero-chemical defense.

[9] Ibid., 156.
[10] Jane Franklin, ed., *The Politics of Risk Society* (Cambridge: Polity Press, 1998), 25.

However, the ritualized drills of the *Reichsluftschutzbund* were informed not just by the technical knowledge of the gas specialists but also by Nazi conceptions of national belonging and exclusion. Thus, the RLB's activities attempted to realize the dream of a distinctly "Nazi chemical modernity," in which the constant threat of chemical attack was not only overcome through the gas specialists' technological augmentation and steely determination but also mastered and redirected toward those who had failed to protect themselves from the newly poisoned atmosphere.

A wide array of theorists and historians have described the construction of the gas chambers of the Holocaust as the defining moment in the Nazis' search for a technologically assisted method of mass murder.[11] More specifically, the designing of the gas chambers has often provided the ultimate case study for the potential problems of a blind commitment to the practical application of scientific knowledge and the search for technocratic efficiency. For many prominent post-Holocaust thinkers, such an unquestioned search for an efficient means to an immoral end revealed the dark side of "high modernity." For instance, in his 1954 book, *The Technological Society*, the philosopher Jacques Ellul argued that the twentieth century was dominated by what he called "technique," or "the totality of methods rationally arrived at and having absolute efficiency … in every field of human activity."[12] According to Ellul, humanity's reliance on rational thinking and applied science created social conditions that progressively conformed to the smooth and efficient rhythms of the machine. Consequently, Ellul claimed that we had become slaves to the possibility of technological creation, suppressing human freedom and binding ourselves to an increasingly complex and authoritarian technological system.

Regardless of the ultimate truth of Ellul's larger claims, his original insights should encourage us to both historically and morally interrogate the perceived value of technological creation. Frequently, however, proponents of technocratic efficiency have skirted such questions by claiming that technological objects and systems can be neither inherently good nor evil.[13] According to this view, the ethics of technology are decided not in the moment of creation but in the human use of a given object or system. The early twentieth-century German scientists and engineers who created and promoted poison gas and its various ancillary

[11] Konrad Jarausch and Michael Geyer, *Shattered Past: Reconstructing German Histories* (Princeton: Princeton University Press, 2003), 99.
[12] Jacques Ellul, *The Technological Society* (New York: Vintage Books, 1964), xxv.
[13] Jennifer Karns Alexander, *The Mantra of Efficiency: From Waterwheel to Social Control* (Baltimore: Johns Hopkins University Press, 2008), 2.

technologies frequently employed this line of reasoning to defend their research and development choices. For instance, the interwar gas specialist Rudolf Hanslian wrote, "The High Goddess of Science has a double-edged sword. Depending on the impact of [scientists'] achievements *in practice*, they can serve the good of humanity or lead to their ruin."[14]

In light of the continuing cultural power of such utilitarian claims, techno-skeptical theorists such as Langdon Winner have mounted a response. In his well-known 1977 work, *Autonomous Technology*, Winner wrote:

> Is technology a neutral tool to human ends? No longer can an affirmative answer be given without severe qualifications. The most spectacular of our implements often frustrate our ends and intentions for them. Skepticism greets the promise that our transportation crisis will be solved by a bigger plane or a wider road, mental illness with a pill, poverty with a law, slums with a bulldozer, urban conflict with a gas.[15]

For Winner, the concept of "use" is often too narrowly defined. Proponents of unrestrained scientific inquiry and application have traditionally bracketed the moment of technological use in space and time. To their minds, a human picks up a tool and then decides how it should be used. But as Winner argues, technologies are already interwoven into the cultural fabric of humanity before the moment of praxis. Following on the heels of certain Marxist insights, Winner claims that "human beings do make their world, but they are also made by it."[16] Thus, the mere existence of a given technology presents, if not demands, the very possibilities of its use.[17]

Here, Winner may at times overstate the power of both technological creation and use to shape social structures. In his response to Winner's work, the sociologist Bernward Joerges reminds us to avoid retrofitting dramatic histories of technological creation and application for overly pious parables. To Joerges' mind, the authorial intentions behind technological creation and use are often indeterminate and highly contingent. These moments of technological employment do not necessarily induce particular social relations, but they do tell us something important about the social relations of a given moment and place. Thus, technologies

[14] Rudolf Hanslian, *Vom Gaskrieg zum Atomkrieg: Die Entwicklung der wissenschaftlichen Waffen* (Stuttgart: Verlag Chemiker Zeitung, 1951), 8.
[15] Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought* (Cambridge, MA: MIT Press, 1977), 29.
[16] Ibid., 88.
[17] Anthony Giddens, *The Consequences of Modernity* (Oxford: Oxford University Press, 1990), 139.

should be read as a form of media that expresses social relations through both rights to use and actual uses.[18] They reveal to us the ways in which humans ultimately legitimize particular uses of technologies and the ways in which those uses are then employed as a form of social power.

While the technologies behind poison gas inspired various interwar German interpretations that could mix anything from awe and fear to an insistence on practical control, the continued production and use of these technologies required steadfast supporters such as Fritz Haber and the later gas specialists. In their role as technical experts, these men continually claimed that chemical weapons technologies created a more humane and civilized form of warfare that would inevitably lead to greater scientific progress. Thus, their story reveals the importance of a dogmatic commitment to a vision of scientific progress and technocratic efficiency for the subsequent propagation and uses of such deadly technologies. This ought not, however, suggest that Fritz Haber or the gas specialists should be held historically responsible for the gas chambers of the Holocaust. Rather, it holds Haber and the gas specialists responsible for the interwar proliferation of both chemical weapons technologies and normalized visions of a chemically dangerous world.[19] It is this work that inaugurated the many German understandings of "chemical modernity," including the Nazi vision in which the gas chambers of the Holocaust could be conceived and, to a certain extent, legitimated. For this reason, a simple causative connection between Fritz Haber's chemical weapons program and the gas chambers of the Holocaust cannot, and should not, be made.

Admittedly, one could tell this larger narrative about the gas specialists' scientific and technological commitments solely through a detailed developmental history of militarized poison gas. However, gas was a uniquely ephemeral weapon for several reasons. First, it was difficult to detect and describe when deployed. Second, it was never intentionally used on a European battlefield after 1918, thus largely leaving poison gas to the realm of the interwar imagination. The gas mask, on the other hand, provided a material site for civilian interactions with an interrelated web of both offensive and defensive chemical weapons technologies. As such, a study of both poison gas and the gas mask more effectively encourages

[18] Bernward Joerges, "Do Politics Have Artefacts?" *Social Studies of Science* 29, no. 3 (1999): 424.

[19] This also does not mean that Fritz Haber and the gas specialists were the only historical actors responsible for the propagation of chemical weapons technologies or normalized visions of a chemically dangerous world. Indeed, even our current understanding of a chemically precarious world is perpetually reified by seemingly mundane individual and collective relationships to chemical technologies.

us to expand our definition of "the chemical" and to reevaluate technologies intended for protective use that populate daily life. By examining lived experience with the gas mask through German ego documents such as memoirs, diaries, and letters, this project shows that it was often the mask, rather than the gas itself, that introduced interwar Germans to the pervasive presence of technological possibility, mediation, and failure.

As Germans grappled both practically and philosophically with poison gas and the gas mask, they contended with an insistent and newly unstable technological world. Since the gas mask was claimed as the first line of defense against a weapon that could insidiously permeate the atmosphere at any moment, it further mediated a newly unstable relationship between Germans and their environment. With gassing as an imminent threat in the interwar mind, the simple act of breathing air could no longer be taken for granted. For this reason, the German story of chemical weapons technologies exposes the ways in which the conceptual categories of danger, risk, management, and mastery informed subjective relationships to the environment in the early twentieth century.

Of course, the Germans were not the only ones to develop both chemical weapons and corresponding visions of a chemically impregnated world. In the wake of World War I, the English, French, and Americans also developed industrial-scale chemical weapons programs and similarly grappled with the implications of atmospheric warfare. However, none of these other nations were forced to reckon with their chemical poisons quite like Germany. In the early twentieth century, the German nation relied most heavily on ties to its unmatched chemical industry, while Germans themselves experienced a unique level of chemical fear derived from a sense of weakening geopolitical power after the loss of World War I. This produced a more pressing German interrogation of whether chemical weapons could be controlled and, if so, by whom.

At the same time, it is also true that these concerns maintain importance for a longer history with near-global reach. For this reason, this study reappropriates the term "Chemical Modernity" in capitalized letters to refer to the longer epoch in which industrial chemicals and environmental pollutants have increasingly yet quietly come to impact, and even sometimes define, modern life. Since the onset of the Chemical Revolution (around 1770) and the subsequent industrial scaling of laboratory chemistry, work with and among invisible chemicals has changed the ways in which humans understand their environment.[20]

[20] Sara B. Pritchard and Carl A. Zimring, *Technology and the Environment in History* (Baltimore: Johns Hopkins University Press, 2020), 107.

In the wake of either the material or theoretical recognition of potentially life-threatening and diffusive chemical compounds, contemporary humanity can no longer assume that the Earth's atmosphere will always support life. When fully accepting this state of mental uncertainty, potential death can quietly lurk in every breath. The German author Jörg Friedrich makes this clear in his provocative historical treatment of the bombing campaigns of World War II. He writes:

> Now, through heat, radiation, and toxic gases, the very air was being transformed into something unlivable. The incendiary weapon and the subsequent atomic weapon of World War II introduced the notion of extracting a state of destruction from the workings of general laws of nature. Reality was no longer a place in which to dwell or even do battle. Living space became a death zone.[21]

Here, Friedrich dates the dawn of "atmo-terrorism," or the weaponization of the atmospheric conditions necessary for life, to World War II. This is a fairly common claim that is supported by both the sheer death and destruction caused by World War II aerial bombing and the cultural power of postwar atomic fear. Without denying the real human cost of the aerial bombing campaigns of the 1940s, this project both implicitly and explicitly argues that the imagined possibilities for total destruction that would later characterize atomic fear were already present in the 1920s and 1930s. While poison gas could not, in fact, destroy entire cities and nations during this period, contemporaries certainly fantasized about this prospect and began to reevaluate the meaning of individual, national, and atmospheric security. Thus, from "gas psychosis" to "atomic fear" (and now perhaps "environmental angst"), chemical dangers lurking anywhere from the microscopic to the astronomic have come to express a fundamental feature of what it means to be human in the twentieth and twenty-first centuries.

In the newly perilous world described by Friedrich and others, "Mother Earth" is now envisioned as the ground on which the battles of total war will be waged. In coordination with large-scale environmental changes, advances in weapons of mass destruction would seem to suggest that this partially realized form of warfare will soon become a true struggle for mere existence.[22] We can perhaps see this unfolding in everything from the use of chemical weapons in recent Middle Eastern conflicts to the imagined future wars over clean air and water that the

[21] Jörg Friedrich, *The Fire: The Bombing of Germany, 1940–1945*, trans. Allison Brown (New York: Columbia University Press, 2006), 84.
[22] Roy Scranton, *Learning to Die in the Anthropocene: Reflections on the End of a Civilization* (San Francisco: City Lights Books, 2015), 19.

current environmental crisis portends.[23] In these instances, the conceptual categories of danger, risk, management, and mastery that animated early twentieth-century German debates again take center stage in our minds. Thus, atmospheric total war and the questions surrounding human survival will undoubtedly have massive implications for the way in which we now narrate our current moment, our history, and even our future. Since it would seem that we still live under the imaginary power of imminent atmospheric total war, this project refers to the longue durée "Chemical Modernity" in order to make diachronic connections between the climactic German case study and our more contemporary concerns. Specifically, by reflecting on a historical study of German chemical weapons development, it asks us to consider both the historical roots and ultimate implications of large-scale technological fixes for the magnifying problems of modern systemic risk.[24]

To ultimately reflect on such contemporary concerns, the study will follow a largely chronological history of poison gas and gas mask production as well as the developing cultural visions of chemical threat in early twentieth-century Germany. Chapter 1 will begin by historicizing the German development of poison gases during World War I. The chemist Fritz Haber will serve as the central figure in this story. His commitment to both applied science and the imperial German state informed his advocacy for the development and use of militarized poison gas. Employing files from German military archives and personal papers from various scientists and soldiers, this chapter narrates the way in which the German military's decision to employ chlorine gas on the battlefields at Ypres did not shorten World War I but rather generated an arms race in which all belligerent nations attempted to develop the most lethal gases. This military buildup demanded a massive yet efficient apparatus for furthering both scientific research and industrial production. Haber's skill in building the most expansive and efficient national chemical weapons program thus serves as one of the earliest instantiations of what would later be called the military-industrial-academic complex and Haber's government-funded project can be classified as an early prototype for the nationalized techno-scientific projects of the mid-twentieth century.

Chapter 2 provides a developmental history of the modern gas mask, first produced in 1915 at Haber's Kaiser Wilhelm Institute for Physical

[23] Emmanuel Kreike, *Scorched Earth: Environmental Warfare as a Crime against Humanity and Nature* (Princeton: Princeton University Press, 2021), 400.
[24] Katharina Gerstenberger and Tanja Nusser, eds., *Catastrophe and Catharsis: Perspectives on Disaster and Redemption in German Culture and Beyond* (Rochester, NY: Camden House, 2015), 14.