Chapter 7
The Intangible Consequences of Nuclear Weapons Use

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Analyses of the effects of nuclear weapons have traditionally focused on the physical destruction they produce, especially their human toll, devastation of cities, and damage to the environment. To the extent that nonphysical effects are taken into account, strategists have emphasized the influence of nuclear weapons on national decision-making, particularly whether a limited strike would escalate to an all-out nuclear exchange. Yet, the range of nonphysical weapon effects is much broader, encompassing social, psychological, political, and economic impacts that would reverberate long after a nuclear attack. In a limited-use scenario, these ramifications—designated as "intangible" effects in this analysis—may greatly surpass the physical damage incurred, just as the cost and scope of the response to September 11 dwarfed the direct effects of the attacks. Moreover, unlike physical phenomena, many of these intangible effects are the result of human decisions and are thus theoretically controllable. Given that the limited use of nuclear weapons is probably more likely than a massive nuclear war, there is a pressing need to understand these intangible effects and identify practical steps to minimize them.

From the first use of the bomb in 1945, the imagery associated with nuclear weapons and the grim descriptions of their effects have left an indelible mark on the human consciousness. The ubiquity of these media—photographs of mushroom clouds, postapocalyptic films, and the vast literature on nuclear war—has produced a nearly universal conception of what a nuclear exchange would entail. Yet, precisely because images of widespread death and devastation are so easily recalled, the *physical* effects of nuclear weapons have always overshadowed in our imagination the many other consequences of their use. This emphasis on physical phenomena was

understandable during the Cold War, when the destruction from a nuclear war was understood to be nothing short of apocalyptic. To the extent that nonphysical effects were considered at all during this period, they were generally deemed superfluous to the physical damage from a nuclear exchange. As Arthur Katz and Sima Osdoby noted then, the images of mass destruction that these weapons evoke are "so overwhelming that they normally represent the end, not the beginning, of a dialogue."[1]

Today, however, a global nuclear war is probably less likely than limited-use scenarios involving a handful of nuclear weapons. Notwithstanding the persistent hostility between the United States and Russia, no great ideological struggle exists between the major powers; US and Russian nuclear stockpiles have sharply receded; and the few states reckless enough to start a nuclear war can do so only on a modest scale. Likewise, terrorists would be exceedingly lucky to achieve even a single nuclear detonation. Any deliberate use of nuclear weapons may therefore be limited in scope, and the destruction would not be so great that humankind would be indifferent to the state of the world after the attack. For this reason, greater attention should be paid to the broad category of nuclear weapon effects besides purely physical ones. These include the social, psychological, political, and economic repercussions of an attack, which result largely from reactions—conscious and unconscious, rational and irrational—of people and institutions that are physically unaffected. This shift in focus is necessary because the relative salience of an attack's nonphysical effects rises as the magnitude of its physical consequences declines. Just as the cost and scope of the response to September 11 dwarfed the direct effects of the attacks, the social and political ramifications of a limited nuclear attack may greatly surpass its physical damage. Recognition of this likelihood has two chief implications: in the calculus over whether to initiate a nuclear strike on another state and in the response to a nuclear attack on one's own country, either by a foreign government or by terrorists.

In the first circumstance, a nuclear attack should never be undertaken without a firm understanding of its probable effects, broadly defined. As scholar George Perkovich cautions, "Part of the calculation of whether a state would be willing to use nuclear weapons is that the consequences of doing so should be less harmful to that state than the alternative of not using these weapons."[2] Making this calculation requires an appreciation of the full range of consequences, including the many intangible effects that

may be more significant and durable than physical ones. These intangible phenomena are so named because their dependence on individual and collective reactions makes them inherently more nebulous and unpredictable than physical effects. Yet, their amorphous nature should not be seen as subtracting from their gravity, as numerous historical events attest.

In the second scenario, when one's country is the victim of a nuclear attack, national leaders and the public at large should recognize that, in contrast to physical destruction, many intangible effects are theoretically controllable. This feature allows certain adverse consequences to be limited by the quality of individual and government decisions. To enable wise decision-making, there is value in developing as complete a picture as possible of the intangible effects of a nuclear attack, an exercise that might shed light on the most consequential of these, as well as those that are most amenable to intervention.

Before cataloging these intangible consequences, however, a brief taxonomy of nuclear weapons effects is useful. The first category—direct physical effects—is the most obvious: human casualties, destruction of infrastructure, environmental degradation, and other tangible results of blast, radiation, fire, electromagnetic pulse, and fallout. Within this class are both prompt effects, such as the immediate fatalities from a nuclear blast, and delayed effects, such as long-term cancer-related deaths from radiation. Although direct physical effects are geographically limited and finite in duration, their diversity is nonetheless considerable. They include, for example, injuries from falling glass far from the blast site, fires spreading through collapsed buildings, and traffic accidents caused when drivers are blinded by the flash of a detonation.[3]

The next category consists of *indirect* physical effects, such as the phenomenon known as nuclear winter. This term refers to the hypothesis that soot from a nuclear exchange would enter Earth's stratosphere and blot out the sun, in an extreme case preventing photosynthesis and removing the necessary conditions for life on the planet.[4] Other indirect effects involve cascading disruptions from the loss of key assets, such as the destruction of factories that manufacture products (e.g., ball bearings) that many other industries need to function. (This phenomenon can also apply to human assets. For example, the deaths of almost three hundred physicians in the Hiroshima bombing and another sixty in Nagasaki greatly hindered the

provision of medical aid to survivors.[5]) While the disruption of systems that support life—food production, water distribution, electrical power, communications, and so on—would have profound human impacts, this damage is, strictly speaking, physical and thus is not addressed extensively in this chapter.[6] As time goes by, however, the failure to restore these services may have less to do with physical damage sustained than with the competence of political or commercial entities, complicating the designation of their nonoperation as an "effect" of the attack.[7]

The role of human agency in amplifying the consequences of a nuclear attack, or producing altogether new ones, calls for a qualitatively distinct category of effects. These intangible consequences are understood to occur alongside physical phenomena but are inherently more difficult to predict and quantify. Moreover, because the former often manifest at the individual level, they may be as diverse and numerous as the population they affect. A brief but illustrative list of these potential effects would include irrational behavior resulting from the public's fear of radiation; the social effects of large-scale migration from an affected region; the disruption to domestic and overseas equity markets; the shift in global attitudes toward nuclear weapons and perhaps even commercial nuclear energy; the military response of the targeted nation; and a host of other effects too numerous to count.

Although the focus on physical effects dominated nuclear scholarship throughout the Cold War, a smattering of research on intangible consequences occurred during this period. Government-funded studies covered such arcane topics as the mental effects on soldiers after the battlefield use of nuclear weapons and the social discord that would attend life in fallout shelters.[8] One such effort was a Department of Defense study in the early 1960s on the social and psychological effects of a nuclear war. This research addressed a wide range of intangible effects, including the family unit in a postattack world, cooperative versus competitive behavior, the debilitating effects of fear, and difficulties in motivating survivors. The authors acknowledged that "it is unquestionably more difficult to predict survivors' behavior than the state of physical resources after any specific hypothetical attack." However, they argued that understanding both was important to prepare for life after a nuclear exchange.[9]

While much of this scholarship concerned massive nuclear attacks, many of its insights are applicable to limited-use scenarios as well. For

example, a major research focus was the effect of psychological trauma on society, particularly its potential to produce counterproductive behaviors. This phenomenon is no less germane to limited nuclear attacks than to widespread ones. Accordingly, the following section reviews noteworthy themes from research on intangible consequences from the beginning of the nuclear age through the Cold War.

Scholarship on Intangible Effects

While the world was preoccupied with the physical destruction of Hiroshima and Nagasaki, a small number of strategists recognized a decidedly nonphysical effect of the new atomic bomb. In his 1946 book *The Absolute Weapon*, Bernard Brodie predicted that the chief value of nuclear arms would be their effect on human decision-making rather than their destructive power. He posited that leaders would be dissuaded from destroying an enemy's cities with these weapons because their own would be destroyed in turn and no advantage would accrue from striking first.[10] Thus, the central purpose of military power, which had historically been to win wars, would henceforth be to avert them. This insight would form the foundation of nuclear deterrence, the reigning military paradigm of the Cold War. Although "counterforce" targeting of enemy strategic weapons would soon undermine Brodie's logic, it remained the case thereafter that the principal utility of nuclear weapons would be their influence on human behavior.

Nonetheless, strategists could not ignore the terrible ramifications if nuclear weapons were actually used, and analyses of these consequences soon began to proliferate. Unsurprisingly, these studies focused heavily on physical phenomena. Yet, a minority of scholars chose to focus on the potential social and political effects of nuclear weapons, many of which they extrapolated from the nearest empirical analogue to nuclear war that was then available: the strategic bombing of cities during World War II. Because early nuclear doctrine assumed that these weapons would be used against civilian population centers, the "terror bombing" of British, German, and Japanese cities during the war provided useful points of comparison.

Fred Iklé, who would later serve as under secretary of defense for policy, was among the first to examine what he termed the "social versus the physical effects from nuclear bombing." In a 1954 analysis, he painted a disturbing

picture of these social effects, describing the life of survivors of a nuclear war who would "dwell in congested housing, commute in crowded vehicles, queue for food, eat in emergency cafeterias and perhaps live without water except for a communal emergency supply." For those relocated to other parts of the country, he predicted tension with populations in "reception towns" due to ethnic, religious, and class differences. "Evacuees will have to trek on in search of shelter and food, gradually spreading over the countryside and colliding with the flow of refugees from other devastated cities," he wrote. "Friction and competition for the diminishing sources of existence are bound to occur." Iklé speculated that in the case of a massive attack, the number of evacuees would be so overwhelming that residents of unaffected communities would be forced to "share their homes, their kitchens, and their household goods." Consequently, they would be "engulfed in the deprivations and distress of the evacuees" and "fare little better than the survivors from devastated cities."[11]

Scholar Johan Galtung identified several additional factors that might erode social cohesion after a nuclear war. For example, citizens may feel anger toward government leaders for having enjoyed better physical shelters during and after the attack, manifesting itself in disobedience of their orders. Survivors may feel the need to "come to cognitive and emotional grips with the disaster," possibly leading them to conclude that their own government was culpable and thus an illegitimate source of authority. An "everybody for himself" mentality may prevail in which the population fragments into small, self-interested groups and large-scale cooperation becomes impossible. Galtung also speculated that the synergies between short-term physical effects and longer-term consequences would induce "a feeling that the worst may be still to come, a factor that may make a nuclear war very different from other disasters in human history that usually have a well-defined worst, initial period." Most ominously, he suggested that the distress from such a war might "remain unprocessed as a collective psychological time bomb that can be released, e.g., through skillful use by particular types of politicians."[12]

In 1979, the Office of Technology Assessment released *The Effects of Nuclear War*, a widely cited study that described a Soviet nuclear attack on Detroit and a corresponding US strike on Leningrad.[13] While the study focused overwhelmingly on physical phenomena, it also addressed effects stemming from psychological injury, noting the possibility of "major

changes in human behavior as a result of the unprecedented trauma." These changes included the prospect that survivors might "place the blame on 'science' or on 'scientists,' and through a combination of lynchings and book-burning eliminate scientific knowledge altogether."[14] Given the unprecedented nature of nuclear war, such outlandish predictions were inevitable. Scholars were free to conjure virtually any postwar reality they wished as long as their vision assumed significant and long-lasting aftershocks on society.

While many of these Cold War era analyses have retained their relevance, the emphasis on massive nuclear exchanges is too narrow for contemporary studies of intangible effects. Because the range of nuclear-use scenarios is arguably more diverse today, a reexamination of nonphysical consequences is in order. The following sections examine the potential effects of two conceivable uses of nuclear weapons in the present day—a limited state-launched attack and an act of nuclear terrorism. Although the ratio of physical effects to intangible ones is uncertain in these scenarios, the social, political, and economic effects of either event would be extraordinary, especially in comparison to their relative proportion in a massive nuclear exchange.

Limited State-Based Nuclear Attack

Unlike the physical effects of a nuclear detonation, which, with the exception of variables such as height of burst, are basically fixed, intangible consequences would depend on the target struck and the context in which the attack occurred. A single warhead that decapitated a country's leadership, for example, would obviously produce greater political repercussions than an identical weapon used against a remote oil refinery. Likewise, an attack on a state's overseas military outpost, where the casualties would largely be uniformed personnel, would presumably be more permissible under international law than a comparable attack on civilians. The range of responses to such an attack would therefore be governed by a sense of proportionality that would likely be absent in the latter case.

The geopolitical circumstances of a nuclear attack would also influence its intangible effects. For instance, a completely unprovoked strike by a foreign government would elicit outraged calls for revenge, which would

likely be heeded. Yet, if the attack were itself in retaliation for an earlier military action against that state, some of the blame might be apportioned to the leaders who initiated the original aggression. Or consider an attack that is perceived as having saved more lives than it extinguished, such as the destruction of a nuclear facility of a state with potentially malevolent designs. While many of the consequences of breaking the nuclear taboo would still obtain in this scenario, the intangible effects of such an attack would bear no resemblance to those that followed an indiscriminate attack on civilians. (Scholar George Quester goes so far as to suggest that the relatively modest damage from a tactical weapon might produce a highly counterintuitive outcome: a "nuclear war that is surprising for how *little* damage it inflicts."[15] If this perception reduces the long-standing terror of these weapons to some extent, it might increase the probability of their further use at some later date.)

In light of the diversity of conceivable attack scenarios, a closely bounded test case is necessary for a manageable analysis. The following discussion therefore considers a single-warhead attack on a civilian population center in the context of an international crisis. Although this choice is somewhat arbitrary, it satisfies two crucial criteria. First, the scenario is fundamentally plausible; second, it features many of the familiar physical effects to which intangible consequences can be compared: high casualties and physical damage to a major urban area. A 2013 case study by the antinuclear organization Article 36 assesses such an attack, describing the effects of a one-hundred-kiloton detonation above the British city of Manchester, population 2.7 million.[16] The size of this yield provides a useful contrast to a terrorist nuclear attack, which the conventional wisdom suggests would be at most in the ten-kiloton range.[17]

Despite the study's nominal focus on the "humanitarian" consequences of a nuclear attack, it heavily emphasizes physical effects: 81,000 dead, 212,000 injured, devastation to residential and commercial buildings, destruction of vital infrastructure, and so on. While the loss of the services and facilities that the article highlights (e.g., hospital beds, first responders, and communications networks) would indeed make life difficult for survivors, the deeper effects of the attack are largely unexamined. Indeed, the study's brief mention of intangible consequences consists of passing reference to an "unprecedented social and cultural loss" and a massive "long-term impact on the psychological, social and economic fabric of UK

society." The following analysis therefore adds texture to these themes, identifying specific intangible effects and exploring their impact on human behavior. These consequences are divided into domestic and international phenomena, with the former focusing on impacts to the targeted country and the latter speculating on the global ramifications of the first use of nuclear weapons in seventy years. However, before enumerating these effects, it is worth revisiting the atomic bombings of Japan, whose aftermath may foreshadow many of the potential effects of interest to this chapter.

The Past as Prologue: The Intangible Effects of the Atomic Bombings of Japan

Of the historical events that can be used to infer the intangible effects of a nuclear attack in the present day, the most obvious are the atomic bombings of Hiroshima and Nagasaki. Beyond the well-documented physical destruction of these cities, scholars have recorded a wide range of social, psychological, and political effects of the bombings, many of which persist to this day.[18] Firsthand accounts attest to the profound effects on the mental state of survivors, which in turn drove a range of noteworthy behaviors. Father John Siemes, a Jesuit priest who witnessed the Hiroshima attack, authored a harrowing account of its carnage, conveying the breakdown in social order that occurred. "Among the passersby, there are many who are uninjured," he wrote. "In a purposeless, insensate manner, distraught by the magnitude of the disaster, most of them rush by and none conceives the thought of organizing help on his own initiative. They are concerned only with the welfare of their own families."[19]

Robert J. Lifton, a psychiatrist who studied the psychological effects of the bombings, described Hiroshima survivors as experiencing "a sudden and absolute shift from normal existence to an overwhelming encounter with death."[20] In the years that followed, many of them recounted an obsessive attention to their health, living with the fear that delayed symptoms would one day materialize.[21] They also reported concern that their future children would be afflicted with radiation-related illness, a prospect that was the basis for their stigmatization by others. As Mikihachiro Tatara recounts, "knowledge that an individual comes from a Hibakusha [atomic bombing survivor] family raises the specter that there may be 'bad blood.' . . . As a result, the Hibakusha Nisei [second generation] may be socially rejected out of fear that their genes will taint marriages and families."[22]

As poignant and far-reaching as these social and psychological effects were, the political impacts of the bombings proved to be their most significant consequences. The first of these was of course Japan's decision to surrender, which is widely (although not universally) attributed to the bombings.[23] Other intangible effects would take more time to materialize, although the significance of the new weapon in human affairs was immediately apparent. In particular, one effect of unveiling the atomic bomb in such a dramatic fashion was the instant recognition by the other world powers that the United States possessed a military weapon without peer. This revelation especially influenced the dynamic between the United States and the Soviet Union, then just beginning to embark on the Cold War. Indeed, any subsequent effect of the bomb on Soviet decision-making must be counted among the attacks' intangible consequences.[24]

Over the long term, one of the more enduring effects of the atomic bombings was their influence on international perceptions of Japan. So great was the shock to human sensibility that this event has improbably allowed Japan—the perpetrator of wholesale atrocities during the war—to don the garb of a *victim*. To the chagrin of the many countries Japan has subjugated, the Japanese have largely escaped the generational guilt that has attached to the German people since the war's end. To Japan's credit, however, the effect of the bombings on its national psyche appears to be sincere; the Japanese allergy to nuclear weapons is so profound that the faintest hint of developing an indigenous nuclear deterrent elicits national hand-wringing to this day.

Although the atomic bombings of Japan provide a wealth of scholarship on intangible effects, they represent a very limited data set. Further, the attacks did not occur in a vacuum; Hiroshima and Nagasaki were merely the final two Japanese cities destroyed in a bombing campaign that had already devastated dozens of others, and the Japanese were by then thoroughly inured to violence against civilians. A nuclear attack on a country at peace, even one embroiled in an international crisis, would be vastly more jarring to that state's psyche. Because the intangible consequences would be correspondingly greater in this circumstance, a reassessment of this category of effects must be made, albeit with the benefit of various nuclear disasters that have occurred in recent decades.

Domestic Effects of a Nuclear Attack

For understandable reasons, the first metric used to gauge the severity of any disaster is typically its human toll. While the deaths and injuries from a nuclear attack represent a strictly physical effect, many manifestations of these casualties fit squarely in the intangible category. For example, the knowledge that mass death had occurred in one's country would be psychologically devastating to millions of people who are physically unaffected by the event. To put the notional Manchester attack in perspective, the eighty-one thousand dead would be four times the number of British fatalities on the first day on the Somme in World War I, a national tragedy that continues to haunt the United Kingdom a century later.

Although the psychological trauma from a nuclear attack would be felt nationwide, it would be most acute for survivors in close proximity to the detonation. Fred Iklé notes that nuclear weapons would aggravate the "emotional disturbances" that normally attend warfare because they produce "injuries that distort the appearance of victims and have a powerful effect upon those who see them."[25] Disposal of the dead, as well as caring for the sick and injured, would inevitably scar those who undertook these tasks. Even among those not directly affected by the detonation, the fear of its migrating effects, particularly radiation, would be profound. Indeed, as psychologically jarring as the Hiroshima and Nagasaki attacks were, public awareness of radiation was extremely low at the time. Today the fear of this form of energy is universal, and events involving radiation have an extraordinary potential to produce mass terror.[26]

A predictable result of this fear would be the flight of survivors from the surrounding region, many of them permanently. During the Three Mile Island crisis, which involved a partial meltdown of a nuclear reactor in Pennsylvania, approximately 40 percent of the local population self-evacuated, including 140,000 pregnant women and preschool-age children.[27] Likewise, after the 1986 Chernobyl disaster, more than 336,000 people were forcibly evacuated from contaminated areas, with many more leaving voluntarily.[28] A crucial difference between these events and a nuclear attack is that the latter may not be a one-off event. Residents of other major cities, fearing that theirs may be targeted next, may also choose to self-evacuate, creating a nationwide exodus from urban areas.

Although these evacuations evoke images of terrified mobs fleeing for their lives, there is reason to believe they may be more orderly than is commonly assumed. Studies have found that genuine panic tends to occur only when survivors find themselves in an enclosed space from which escape routes are closed or believed to be closing.[29] Whether this condition would be present after a nuclear attack is difficult to predict. Emergency response guidance from the National Security Council strikes an optimistic chord, suggesting that the "dominant behavioral response" after a nuclear attack would "likely be for people to engage in the kinds of pro-social, altruistic behaviors that occur in most disaster situations, unless fear of radiation and contamination or lack of needed information complicates response and recovery efforts."[30] However, the absence of panic does not mean that mass evacuations would be free of antisocial behavior. Depending on the size of the affected population and the length of the displacement, considerable discord might occur. During World War II, for example, relationships between British evacuees from the cities and their hosts in the countryside often deteriorated because of the stress of the upheaval on both groups, as well as class differences, the urban–rural divide, and the inadequacy of government services.[31]

Once outside of the immediate danger zone, the number of evacuees seeking medical treatment would likely far exceed the actual group exposed to radiation, straining an already taxed medical infrastructure. This phenomenon, known as the "worried well," occurred in the 1987 radiological incident in Goiânia, Brazil, when junkyard workers broke apart an abandoned cancer therapy device containing cesium-137 and distributed its glowing blue pieces to unsuspecting friends and family.[32] Although only 249 people were directly exposed, more than 112,000—roughly 10 percent of the city's population—sought medical exams once the recipients began to suffer radiation sickness and die.[33] After a nuclear attack, servicing the worried well would compete with the medical needs of the legitimately stricken, which would likely be a sizable group.

Over the long term, the psychological trauma sustained by survivors would lead to significant health effects. This phenomenon was borne out in the aftermath of the Chernobyl accident, arguably the closest historical analogue to the actual use of a nuclear weapon since World War II. Chernobyl produced a range of mental health problems for those living near the reactor, including depression, anxiety disorders, substance abuse,

and posttraumatic stress disorder. Indeed, a 2005 report by the Chernobyl Forum observed that psychological consequences continue to be "the largest public health problem unleashed by the accident to date." Those living in the surrounding communities developed "an exaggerated sense of the dangers to health of exposure to radiation" in which they "exhibit a widespread belief that [they] are in some way condemned to a shorter life expectancy."[34] Sadly, inner torment is not the only long-term effect with which survivors would have to contend. If history is any guide, some degree of social stigma would also attach to individuals from areas associated with radiation, as it did in the wake of Hiroshima and Nagasaki, Chernobyl, Goiânia, and the 1999 nuclear criticality accident in Tokaimura, Japan.[35] The stigmatization that followed the Goiânia incident was particularly severe: visitation to the area plummeted, local products went unsold, and residents were often treated like lepers when they traveled to other parts of Brazil.[36]

While those nearest to a nuclear detonation would feel these short- and long-term effects most acutely, the consequences of the attack would not be confined to a fixed area. The realization of an event dreaded for generations would leave the broader public reeling in shock and disbelief. In addition to grieving for the dead, a desperate uncertainty would hang over the country about what the future held. In particular, a widespread fear might take hold that humankind had just entered an ominous new age in which behavioral norms between states would no longer be observed. It is difficult to predict what effects these emotions would have on individual and group decisions, but some reasonable guesses can be made.

One assured consequence would be a grave injury to the national economy, the first manifestation of which would be a precipitous drop in the stock market. Although computer limits would quickly halt trading on the day of the attack, the collective loss of investor confidence would result in steep losses when the market eventually reopened. Indeed, between the close of trading on September 10, 2001, and the end of the first week of trading after the September 11 attacks, the NASDAQ lost 16 percent of its value and the New York Stock Exchange lost more than 11 percent, a total market capitalization loss of more than $1.7 trillion.[37] Given that a nuclear detonation would vastly exceed the destruction of those attacks, the effect on the market would be far greater.

Other economic effects would depend on the dispensability of the targeted city to the national economy, with damage to struggling cities like Cleveland or Detroit being less harmful than comparable damage to Chicago or New York. Additionally, targets that perform specialized functions (e.g., port cities) or account for a substantial fraction of a crucial industry (e.g., Silicon Valley) would produce a disproportionate level of economic damage. For example, Charles Meade and Roger C. Molander studied the effects of a nuclear attack on the port of Long Beach, the second-busiest container port in the United States, and calculated the direct costs would be in excess of $1 trillion. While staggering in and of itself, this figure does not account for cascading economic effects such as disruptions to transoceanic commerce and the unavailability of goods after the attack.[38]

Meade and Molander also identified a range of longer-term economic effects, including widespread defaults on loans and mortgages in the affected area, the bankruptcy of national insurance companies, and the failure of investors in large financial markets to meet contractual obligations for futures and derivatives.[39] Additional costs would include outlays for survivors' medical care, workers' compensation, and, if the precedent of the September 11th Victim Compensation Fund is any guide, billions in federal payouts to victims' families.[40] Other economic consequences would not be tied to the site of the attack, such as the nationwide rate of work absenteeism in jittery urban areas. Although the large-scale shift to telework during the COVID-19 pandemic might mitigate the impact of this phenomenon in some sectors, the separation of workers from their workplaces in key industries would lead to lost productivity. And whether working remotely or on-site, the lingering trauma might distract workers across the economy from peak productivity for some time. Consequently, extraordinary intervention by the government might be necessary to buttress the economy, reassure investors, and ensure liquidity after the attack.

The government's ability to function effectively in this circumstance would be one of the great uncertainties, and various disasters have featured starkly different public attitudes toward institutions of power. After the September 11 attacks, the American people rallied around President George W. Bush, giving him approval ratings above 90 percent less than a year after a bitterly contested presidential recount.[41] During the Three Mile

Island incident, by contrast, distrust of the government rose dramatically in the affected communities. Residents believed that neither the nuclear industry nor the state and federal governments were in control or being fully candid about the danger, and one of the most pronounced legacies of the crisis was a general loss of trust in these institutions.[42] As a testament to how deeply the event shook the public, the Nuclear Regulatory Commission did not issue a license to build a new nuclear reactor in the United States for more than thirty years.[43]

If a loss of confidence in the government were to occur after a nuclear attack, it would come just as a major expansion of government power was necessary to cope with the scale of the disaster. This response would entail a mobilization of government resources—and perhaps coercive authority—unseen since World War II. Early in this process, the notion that state and local governments would bear primary responsibility for response operations would likely be dispensed with quickly. In all likelihood, the federal government would assume responsibility for many dimensions of the response with or without the consent of governors and mayors.[44] Emergency equipment, vehicles, and perhaps personnel from nearby states could be pressed into service, effectively nationalizing these assets for an indefinite period. Beyond this upheaval to federalism, recourse to even more extreme measures, such as price freezes on consumer goods and the imposition of martial law, is entirely conceivable.

Over the long term, the government would face the wrenching decision of what to do with the devastated city. If it were sufficiently large and commercially vital, such as New York, permanently abandoning the city would probably not be palatable. For a more moderately sized city, however, the cost of rehabilitation would have to be weighed against the loss of its commercial and symbolic value. If the former outweighed the latter, the decision would be extremely difficult. After Hurricane Katrina, for example, policy-makers seriously debated whether it was advisable to rebuild New Orleans or simply relocate its displaced residents and accept a permanently diminished city in its place.[45] Given the presence of radiation after a nuclear attack, which is costly to decontaminate and invokes a unique dread, the decision to abandon a city might be easier than in the case of a comparable natural disaster. Yet, this decision would produce an intangible consequence of its own: the long-term effect on the nation's

morale of seeing a permanent reminder of the tragedy in the rusted, crumbling husk of a once-great city.

In truth, the degree to which a nuclear attack would transform society is difficult to overstate. No catalog of intangible consequences can make any remote claim of comprehensiveness, nor perhaps is there even value in speculating on these effects beyond the broad level discussed here. A more useful exercise might be to look past the attack's domestic effects and consider its ramifications for the rest of humanity. Although these global consequences are no less difficult to enumerate, even the most superficial treatment of them underscores the extraordinary impact that a nuclear attack would have on the international system.

Global Effects of a Nuclear Attack

Although certain effects of a nuclear event would be largely confined to the country that had been struck, others such as political turmoil and economic disruption would not stop at its borders. Still others would be unique to foreign states, such as the decline in exports to the targeted country due to increased security restrictions and diminished consumer demand. However, this analysis does not attempt to distinguish between the domestic and global intangible effects of a one-off nuclear attack. Nor does it attempt to enumerate the many possible military responses to the event, which would produce wide variance in its global consequences. The most significant of these possibilities is that the response would take the form of a nuclear counterstrike, in which case the social and political repercussions in the first country attacked would be replicated wherever additional nuclear detonations occur. Instead, the following discussion addresses the long-term impacts to international security that could result from a nuclear attack and especially the ways in which it might affect attitudes toward nuclear weapons over time.

Among the most significant international reactions would be the attempt to grapple with the violation of the nuclear taboo, an unwritten inhibition against the use of nuclear weapons that has been a tremendous source of global stability.[46] It is unclear whether a single nuclear attack would undermine the taboo irrevocably or whether it could eventually be restored. Worldwide revulsion over the strike might be enough to reinforce the tradition of nonuse, but a more radical expression of disapproval may also be necessary. One school of thought holds that the only statement

strong enough to underscore the unacceptability of a nuclear attack is, paradoxically, the further use of nuclear weapons. While many other factors would supersede the integrity of the nuclear taboo in deciding whether to retaliate with nuclear weapons, the notion that such retaliation might be necessary to restore this tradition would be a significant intangible effect of the attack.

Whether or not the nuclear taboo could be reinstituted, crossing the nuclear threshold may also have implications for other international norms, such as the inhibition against chemical weapons use. Such was the abhorrence of these weapons after the First World War that this taboo has held, with relatively few exceptions—the most notable being their use by Saddam Hussein and Bashar al-Assad—for more than ninety years.[47] Yet, because any chemical attack would pale in comparison to a nuclear one, the occurrence of the latter might persuade the remaining holders of chemical weapons that their use would somehow be more permissible going forward.

Closely linked to the future of the nuclear taboo is how the attack would influence the attractiveness of nuclear weapons to other states. If this event were perceived as ushering in a new era in which these weapons would be used more promiscuously, several latent nuclear powers (e.g., Japan and South Korea) might feel compelled to develop nuclear weapons for their own security. This decision would hinge to a great extent on perceptions of the future credibility of nuclear deterrence. After all, if the targeted state had been a nuclear power and possession of these weapons did not prevent the strike, the very premise of nuclear deterrence—that threats of retaliation inoculate a state from nuclear attack—might be called into question. If so, two starkly different conclusions might be reached.

On one hand, nuclear-armed states might revise their operational doctrine to emphasize preemption rather than deterrence. If one or more nations were perceived as impervious to threats of retaliation, the nuclear powers might adopt declaratory policies reserving the right to forcibly disarm them at the slightest hint of an attack. Or they might simply strike these countries without provocation just to be safe. New capabilities might also accompany these doctrinal shifts, including improved missile accuracy and greater earth penetration for counterforce strikes. Coupled with a lowered political threshold for using nuclear weapons, these improved capabilities might usher in a period in which nuclear attacks become more common. That is, nuclear systems with appropriate yields and accuracy

could become newly perceived as effective warfighting weapons rather than instruments of Armageddon. In this case, a new deterrent model based on credible use might supplant the traditional construct based on nonuse with apocalyptic overtones.[48]

On the other hand, the failure of deterrence might have the opposite effect, leading to a fundamental rejection of the political and military utility of nuclear weapons worldwide. In light of the ominous direction that world affairs could take after a nuclear attack, it is easy to overlook the possibility that there might be positive repercussions of the event. To wit, the destruction of Hiroshima and Nagasaki arguably made such an impression on world leaders that they behaved conservatively in subsequent nuclear crises, a crucial intangible effect of the bombings. Or consider the Chernobyl disaster, perhaps the most lasting consequence of which was its effect on Mikhail Gorbachev's attitude toward nuclear weapons. The Soviet leader was by all accounts deeply influenced by the catastrophe, and scholars have speculated that his subsequent openness to arms control, and his eagerness to improve relations with the West more generally, was a direct consequence of Chernobyl.[49]

Similarly, the horrific effects of a nuclear attack might induce an even stronger aversion to these weapons, perhaps reinvigorating the global campaign to abolish them. Indeed, the attack might galvanize world opinion to such a degree that even more sweeping changes to the international order are made possible. Just as the United States received an outpouring of solidarity after the September 11 attacks, the victim of a nuclear strike could enjoy an unprecedented opportunity to use the tragedy for constructive purposes. If this event set in motion a process to demilitarize international politics more broadly, the balance between the tragic and hopeful effects of the attack might ultimately tip toward the latter.

For good or for ill, the first nuclear attack in more than seventy-five years would be an event so monumental that few dimensions of world affairs would be untouched by it. Perhaps no other development holds the potential to effect such radical global change save one: an act of nuclear terrorism. Yet, despite their obvious similarities, there would be important differences between these events. In the interest of identifying the full spectrum of intangible effects, special consideration must be given to the unique consequences of terrorist violence.

Nuclear Terrorism

After the September 11 attacks, policy-makers and the public alike were tormented by the idea that an even greater catastrophe might occur at the hands of terrorists. This fear was stoked by speculation about the probability of a terrorist nuclear attack and ever more lurid descriptions of what such an event would entail. A widely cited Harvard study calculated that a ten-kiloton nuclear device detonated in New York City would kill upward of 500,000 people.[50] (Even if this estimate is off by an order of magnitude, the deaths from such an event could approach the number of US combat deaths in the entire Vietnam War.) Another study by the RAND Corporation concluded that a similar weapon detonated in the port of Long Beach would kill some 60,000 people, exposing 150,000 more to hazardous radiation and displacing several million residents.[51] Despite the emphasis on physical effects in these studies, the statements of many public leaders seem to recognize the potentially deeper impact of intangible consequences.

President Barack Obama, among others, has argued that a terrorist nuclear attack would devastate "our very way of life" and represent nothing less than "a catastrophe for the world"—an admonition that suggests far more grievous effects than mere physical destruction.[52] After all, it is not uncommon for human beings to die by the hundreds of thousands in natural disasters, disease outbreaks, and violent conflicts without significant international repercussions, much less genuine global upheavals. The 2004 Indian Ocean tsunami, for instance, killed more than 230,000 people with little long-term impact, while upward of 5.4 million people died in the Second Congo War, a conflict that few Westerners were even aware of.[53] And although the aftershocks of the COVID-19 pandemic have not yet taken shape, the deaths of more than four million people worldwide do not appear to have produced any tectonic shifts in the international order. Thus, the death toll alone from an act of nuclear terrorism would not constitute the global calamity that Obama imagined. Rather, his implication seemed to be that the true catastrophe would come in the form of cascading effects, which would convulse the international system long after the attack itself. Among these effects would be the inevitable policy responses of the wounded nation, which history has shown can compound an injury manyfold.[54]

Indeed, the range of unfortunate reactions to the September 11 attacks is a case study of the phenomenon, providing a rough baseline of intangible effects that may be reprised after an act of nuclear terrorism. Notwithstanding the differences between these events, a brief review of the United States' response to September 11 is valuable, if only to underscore that the intangible effects of a disaster can greatly exceed its physical devastation.

The Past as Prologue: The Intangible Effects of September 11

Without diminishing the appalling human toll of September 11, the range of nonphysical effects of the attacks is even more imposing. It includes the extraordinary expense of response and recovery operations, lost economic output, the disruption from border closings and restrictions on air travel, the costs of short- and long-term domestic security measures, and the hemorrhaging of blood and treasure in overseas military operations, to say nothing of the opportunity costs of each of these. Also noteworthy were the psychological and social effects of the attacks, both positive and negative. On the positive side were the upsurge in public displays of patriotism, the sincere (if short-lived) comity between the nation's political parties, and the public's willingness to finally confront the threat of Islamist terrorism. The adverse consequences were far more numerous and in many ways more difficult to capture, but it suffices to note that the first major attack on US soil in sixty years profoundly altered Americans' mental well-being.

For those in close proximity to the attacks, the gruesome scenes—disintegrating buildings, office workers leaping to their deaths—were profoundly traumatizing. An epidemiological survey conducted after September 11 found that the prevalence of posttraumatic stress disorder in the New York City area stood at more than 11 percent.[55] Moreover, these psychological effects were not restricted to the cities directly affected. A study published in the *Journal of the American Medical Association* found that 17 percent of the US population outside New York reported symptoms of posttraumatic stress two months after the tragedy, and almost 6 percent did so six months later.[56] This psychological trauma, coupled with the fear that other attacks would soon follow, gave rise to policies whose severity would have been inconceivable before this event. Some of these were reminiscent of a particularly shameful episode in American history, the

wartime internment of Japanese Americans. Not long after September 11, a controversial policy was instituted requiring noncitizen male residents from a number of predominantly Muslim countries to register with the government, and more than 177,000 did so before the program was terminated.[57] More ominously, hundreds of aliens were held for months in connection with the investigation without being informed of the charges against them and with severe restrictions on communications with family and counsel. Many of these detainees were subjected to harsh treatment, such as the use of hostile dogs to intimidate them.[58]

In the years after the attacks, senior US officials sanctioned the use of even more inhumane methods at Guantánamo, Abu Ghraib, and secret CIA facilities.[59] As one nonpartisan review concluded, September 11 produced unprecedented discussions "directly involving a president and his top advisers on the wisdom, propriety and legality of inflicting pain and torment on some detainees in our custody."[60] In addition to the reputational costs these tactics imposed on the United States, they also proved harmful to US security, not least in bolstering resistance to American war aims in Iraq. According to the head of the unit tasked with locating al-Qaeda leader Abu Musab al-Zarqawi, "the No. 1 reason foreign fighters flocked [to Iraq] to fight were the abuses carried out at Abu Ghraib and Guantánamo. Our policy of torture was directly and swiftly recruiting fighters for al-Qaeda in Iraq."[61]

The invasion of Iraq itself was of course the most significant intangible effect of the September 11 attacks, a decision that led to the deaths of 4,500 Americans and the wounding of another 32,000, in addition to as many as 200,000 Iraqi civilian deaths.[62] Moreover, the economic cost of the war was estimated to exceed $2.4 trillion by 2017, a figure almost thirty times greater than the roughly $80 billion toll of the terrorist attacks.[63] Although the Iraq War was not solely due to the September 11 attacks, it is highly doubtful that public support for the invasion could have been mustered in the absence of this national trauma nineteen months earlier. Indeed, the Bush administration explicitly linked the Iraq action to the "war on terrorism" and succeeded to such an extent that at the time of the invasion, nearly seven in ten Americans believed that Saddam Hussein was personally involved in September 11.[64] Even less ambiguous is the link between the terrorist attacks and the war in Afghanistan, from which the United States took no less than twenty years to extract itself. Coupled

with the Iraq War, the colossal toll of these discretionary reactions to September 11 becomes apparent.

Understanding the intangible consequences of terrorism—psychological trauma, military and police overreaction, and so on—is crucial because their achievement is often as desirable to terrorists as physical destruction, and perhaps even more so. Indeed, in a model of terrorist objectives and values created by the Center for Risk and Economic Analysis of Terrorism Events, the "benefits" of attacks from their perpetrators' perspective included "horror effect," economic impact, symbolic value, and impact on the American way of life.[65] All these consequences fall squarely in the intangible category. Because many of them are within the control of the targeted nation, recognizing terrorists' desire to achieve these outcomes is critical to forming judicious responses to an attack. Of course, the shock from an act of nuclear terrorism would be so great as to test the resolve of even the most resilient society, perhaps defying the best-laid plans to respond dispassionately. Nevertheless, the response to the September 11 attacks should serve as a cautionary tale in navigating the landscape after an even greater catastrophe.

Domestic Effects of Nuclear Terrorism

Many intangible effects of a terrorist nuclear attack would resemble those resulting from other large-scale disasters. Others would be unique to the event, especially effects stemming from the public's fear of radiation. Likewise, while an act of nuclear terrorism would feature many of the same characteristics as a state-orchestrated nuclear strike, certain factors that are peculiar to terrorism may compound the adverse reactions to the event.

In a study on how to enhance the public's resilience to mass-casualty terrorism, Joshua Pollack and Jason Wood identify a number of potential "indirect effects" of such an attack, which are merely intangible consequences by another name. These include posttraumatic stress disorder, depression, self-evacuation from urban areas, civil violence, and erosion of support for the sitting administration.[66] At the root of each of these phenomena is the psychological injury that would attend this event, which would be exacerbated by the unique nature of terrorist violence. Unlike the case of a state-launched strike, there may be no physical assets to retaliate against after a terrorist attack, denying the catharsis of avenging the insult. Similarly, whereas conflicts with states have a finite duration,

and relations with enemies can theoretically be repaired, the threat from nuclear-capable terrorists can only end with their total annihilation. The difficulty of achieving this outcome may lead to despair over the potential for indefinite conflict, which would carry not only the possibility of further attacks but also the enormous cost of security countermeasures and military operations to prevent them. Additionally, the inevitable military mobilization may be understood as inaugurating a conflict not only with the terrorists themselves but also with their coreligionists worldwide. Each of these sources of distress would be present from the first moment of the attack, although more urgent concerns would likely preoccupy survivors in the attack's immediate aftermath.[67]

For those outside the blast zone, many of whom would be severely injured, two objectives would be paramount: seeking safer ground and gathering information. Both of these would be hindered by the disruption of internet and cell phone communications, heightening survivors' sense of helplessness. Elsewhere in the city, family members would try to reconnect with one another—in particular, parents would try to reach their children—even in inhospitable areas and in defiance of evacuation orders. (School policies enacted after September 11 that prevent children from being released to their parents may set the stage for hostile confrontations.[68]) Routes of egress from the devastated city would quickly become clogged, and large movements of people on foot would occur. The challenge of securing essential services—food, water, shelter, sanitation—for evacuees would tax their already strained capacity to cope with the catastrophe. Although a spirit of cooperation may take hold in this environment, the unprecedented nature of a nuclear attack may lead to antisocial behaviors on a significant scale. For example, competition for limited medical resources, and especially radiation decontamination, could produce breakdowns in civility.

People in other regions would also be preoccupied with their physical safety, which they may judge to be threatened even if they lived far from the site of the attack. These concerns would arise because the terrorists would almost certainly try to gain extra mileage from the attack by raising anxieties that another may be imminent. For instance, the perpetrators might make a dramatic public announcement that another city would be attacked unless certain political demands were met. This announcement would present the residents of other cities with a difficult

choice: either remain in place and risk death or join the throngs of citizens evacuating the nation's urban centers.[69] Some of these refugees may choose to permanently relocate to more rural areas, a migration that could eventually include businesses and government agencies.[70] The social and political consequences of this phenomenon would be difficult to predict, but even a modest reversal of the worldwide trend toward urbanization, in which more than half of the world's population lives in cities, would be of enormous lasting import.[71]

Enticing survivors to return to the devastated city would require a mammoth decontamination effort that would likely exceed actual needs. After the Goiânia incident, for example, scores of contaminated buildings were demolished over an area of forty city blocks.[72] The economic toll of this incident included $20 million in remediation costs and hundreds of millions in losses from a downturn in tourism and damage to the commercial infrastructure—all from a small source of cesium. Little imagination is required to envision the economic impact of a genuine nuclear detonation. Nonetheless, analysts have made these very calculations, and the cost is as staggering as one would expect.

In 2005, researchers at Pacific Northwest National Laboratory studied the economic consequences of a terrorist nuclear attack, beginning with the cost of decontamination, decommissioning, and disposal of contaminated debris. They also included variables such as the expense of evacuating and relocating residents; the cost to repair or replace damaged property; compensation to owners for lost property use; the cost of lowered real estate values; and the financial toll of lost business to the local, regional, and national economies. Finally, the team included a macabre estimate of the lost future productivity of the dead. Their conclusion was that a thirteen-kiloton device detonated in New York City would produce economic costs comparable to the total US gross domestic product for all of 2005.[73]

In addition to these costs, security policies enacted after the attack would likely hamper commercial activity: borders and ports would be closed, rail shipments from ports suspended, and air traffic grounded for an indeterminate period. Further, restrictions on domestic travel and other personal freedoms might be imposed to assist the apprehension of terrorists still at large in the country. The speed with which these measures are relaxed would depend on whether the threat had been neutralized, but as long as they were in effect, shortages of fuel and basic goods would begin

to occur, further demoralizing the population.[74] These effects would require a massive government intervention to ameliorate. The cost of this effort, coupled with the chilling effect of security measures on commerce and a general loss of investor confidence, could trigger a prolonged depression.

Over the mid to long term, other social and political ramifications would take shape whose character is difficult to surmise. Whether these would have a net negative or positive effect on society is uncertain, although some combination of constructive and harmful responses can be expected. A renewed sense of national unity like that seen after September 11 is certainly possible, although its duration and tangible impact may be just as ephemeral. Depending on the identity of the attackers, a climate of intolerance toward certain ethnic or religious groups could arise, possibly leading to organized violence. This development could undermine the assimilation of these groups into mainstream society, increasing the threat of religious and political militancy over the long term.[75] Within the broader population, anger over the attack could give rise to enthusiasm for radical responses to the terrorist threat, including the suspension of certain civil liberties. Finally, the thirst for retribution would almost certainly lead to military operations abroad. This response would play a significant role in determining the global effects of the attack, although many such developments would occur independently of the wounded nation's reaction.

Global Effects of Nuclear Terrorism

Various factors ranging from the flow of information on the internet to the globalization of markets would ensure that an act of nuclear terrorism anywhere would be a truly international event. Many global consequences would merely be external extensions of phenomena experienced in the targeted country (e.g., disrupted commerce), whereas others, such as the casualties from its military response, would have no domestic analogues. Cumulatively, the magnitude of these global effects might surpass that of the consequences in the country where the attack occurred.

Among the immediate overseas effects would be the psychological repercussions of the attack, which would be felt in every corner of the planet. Recent research suggests that September 11 had a pronounced psychological "spillover" effect, resulting in lower levels of "subjective well-being" among British residents interviewed after the event.[76] At the very least, a vivid confirmation that nuclear terrorism is possible would force

the residents of every large city in the world to contemplate a similar attack where they live. Additionally, if the perpetrators of the attack were Islamist terrorists, innocent Muslims in countries that have traditionally been the setting of foreign military operations might be apprehensive that they will become collateral victims of the targeted nation's retaliation.[77]

The psychological effects of the disaster would manifest themselves in a variety of ways, but one probable response would be heightened opposition to all things nuclear. Indeed, Three Mile Island, Chernobyl, and Fukushima each contributed to a widespread anxiety about nuclear energy that shaped global nuclear policy for years. After the Fukushima disaster, for example, Germany quickly moved to shutter eight of its nuclear reactors permanently and undertook to close the remainder of its fleet by 2022.[78] Similarly, in an Italian referendum three months after Fukushima, 94 percent of voters rejected a plan to restart the country's nuclear program, which had been abandoned in the 1980s—after a similar referendum following the Chernobyl disaster.[79] The collective backlash after a malicious use of nuclear energy might be even more intense, demanding the disposition of nuclear fuels not only in military stockpiles but also in the civil energy sector.

A successful antinuclear movement would have grave implications for the economies of many nuclear-reliant states. However, the most staggering economic effects of a terrorist nuclear attack would result from more immediate phenomena. To begin with, equity markets around the world would inevitably plunge, as they did the day after the September 11 attacks.[80] Later, if the attack led to a recession in the targeted country, as it almost certainly would, the cancer could metastasize into a sharp global downturn. These economic effects would impose considerable suffering throughout the world. As former United Nations general secretary Kofi Annan has noted, an act of nuclear terrorism "would not only cause widespread death and destruction, but would stagger the world economy and thrust tens of millions of people into dire poverty." Given the relationship between poverty and infant mortality, he warns that "any nuclear terrorist attack would have a second death toll throughout the developing world."[81]

As in the case of a state-launched nuclear strike, the wounded nation's retaliation would likely be the most consequential reaction to a terrorist attack. After a manufactured disaster of this scale, national leaders would face enormous pressure to slake the public's desire for revenge. Advances

in radiochemical forensic analysis would probably allow the source of the nuclear material used in the device to be identified, which could implicate a foreign government in assisting the plot. The penalty for having done so would be severe, possibly including efforts to hold individual political and military leaders personally responsible. Even if there is a tenuous or nonexistent connection between the state from which the material originated and the terrorist attack, the desire to hold *someone* accountable might override standard legal and moral thresholds governing the use of force.[82]

Military action against the terrorists themselves would of course be unrelenting. Recall that almost a decade passed between the September 11 attacks and Osama bin Laden's death, illustrating the durability of a state's grievance against the authors of mass murder. Virtually all the organizers of those attacks have been killed or captured, and the top tier of al-Qaeda has been systematically eliminated. Likewise, the group responsible for an act of nuclear terrorism would be ruthlessly dismembered. The extent to which this campaign affects innocent people, whose injury would be a significant intangible effect of the attack, would depend on the nature of the armed response. A war paradigm, complete with air strikes or outright invasion, would naturally cause more collateral deaths than a covert approach, such as Israel's assassination of Black September's leaders after the 1972 Munich massacre. Furthermore, the externalities of the former approach would be much greater. For example, those who lose family members and property in the action would be deeply hostile toward the responsible state, possibly resulting in further acts of terrorism over the long term.

In addition to these direct outcomes, military retaliation could force a restructuring of the international order, with formerly unaligned states pressed to cooperate with the wounded nation against the terrorists and any state sponsors. Resistance to such pressure, or disapproval of the military and political response writ large, could strain relations with erstwhile allies, as the Iraq War did with many of the United States' allies. Additionally, the long-term behavior of the victim state would surely be colored by the tragedy, possibly in ways that alienate friends and neutral states alike. If the attack led to persistent bellicosity on the world stage, the hostility that it generated would count as a lasting intangible consequence.

As in the case of a state-launched attack, the domestic and global ramifications of an act of nuclear terrorism are simply too diverse to enumerate in any comprehensive way. However, several key themes emerge from even a limited examination of these phenomena, and these themes can be used to identify policy implications concerning intangible effects. Chief among them is the fact that many such effects are discretionary. With proper foresight and discipline, the individual and collective responses to a nuclear attack can minimize self-inflicted damage to a considerable degree. Consequently, efforts to mitigate the adverse effects of an attack would be most efficiently directed at intangible consequences, the category that is most within our control. The remainder of this chapter is devoted to exploring the means by which this essential truth can be practically applied.

Policy Implications

Fostering awareness of the nonphysical consequences of nuclear weapons is an exercise in tension with the long history of fetishizing physical effects, which only increased after September 11. When the prospect of a terrorist nuclear attack suddenly became all too imaginable, websites soon sprang up allowing one to enter a ZIP code and observe the physical destruction of a nuclear device at various distances from ground zero.[83] Yet, the folly of this myopia was plain over sixty years ago when Fred Iklé observed that the public "knows more about the physical effects [of nuclear weapons] than it can cope with. It makes little difference whether a certain destruction radius is ten or fifteen miles if we cannot grasp the social implications of large-scale destruction at all."[84]

Despite the overwhelming focus on physical damage, there are sporadic acknowledgments in US government literature of the broader range of effects from a nuclear detonation. For example, an Air Force guidance document entitled *Nuclear Operations* notes that beyond the physical consequences of nuclear weapons use there are "significant psychological and political effects, which may lead to unintended consequences." A US nuclear attack may have "short- and long-term negative effects on relations with other countries," including allies who find the use of these weapons unacceptable. Thus, the president and US military planners are advised to consider military options "in the full context of their effects rather than in

isolation."[85] However, the mechanisms through which this understanding is to be imparted are not specified, and the impression forms that they do not exist in any formal sense.

Similarly, some US officials have demonstrated awareness of intangible effects in the context of nuclear terrorism. Then CIA director John Brennan, for instance, remarked in 2012 that an attack with weapons of mass destruction would, in addition to killing large numbers of people, have "a mass effect on economic, social, political, and cultural systems far beyond the carnage generated at the point of attack."[86] However, such rhetoric seems to be employed for shock value, underscoring how horrific an attack would be rather than illuminating plans to manage these consequences. Although government literature occasionally acknowledges intangible effects, formal planning documents generally neglect these phenomena. To wit, a 2011 Lawrence Livermore National Laboratory report on "response planning factors" for the aftermath of nuclear terrorism addressed prompt physical effects, fallout, and so on but scarcely touched on human reactions to the event.[87] National Security Council guidance issued the previous year was slightly more attentive, at least noting that "social, psychological, and behavioral impacts of a nuclear detonation would be widespread and profound, affecting how the incident unfolds and the severity of its consequences." Yet, even in this document, physical effects reign supreme—the discussion of behavioral responses is not significantly longer than the recommendations for radiation decontamination of household pets.[88]

Several factors account for the nuclear policy community's allergy to intangible effects. First, technical personnel dominate this field, and their quantitative inclinations pull them toward metrics that can be readily measured, such as physical destruction.[89] Because intangible consequences are less amenable to quantification, technical experts tend to zero them out in their thinking. Second, analysis of these consequences is extremely difficult, and there has been little rigorous research on the subject beyond the speculative writings surveyed earlier. As a result, even if policymakers could be persuaded to address intangible effects, ignorance of these phenomena would make it challenging to identify the most effective approaches for doing so. Given the diversity of intangible consequences, the obvious candidates for government intervention would be policies that address the root causes of multiple phenomena. Yet, even this approach is problematic because many of these root causes are highly resistant to

intervention. For example, what practical means are available to assuage the psychological injury that results from the death of tens of thousands of one's countrymen?

Nonetheless, attempting to minimize intangible effects should not be seen as a hopeless task. These phenomena are largely the products of human behavior, and history suggests that individual and collective conduct can be conditioned, for good or for ill. In light of the salience of intangible effects in many historical events, serious efforts should be made to identify areas that are most ripe for policy prescriptions. Further study of these consequences should inform not only preparedness efforts for coping with a nuclear attack but also domestic and international policy responses in its aftermath. The final sections of this chapter explore potential policies that might help mitigate the harm of intangible effects at both the individual and government levels. Although state-launched nuclear attacks and acts of nuclear terrorism present different implications, there is sufficient overlap in the consequences of these events that certain government interventions may apply to both.

Influencing Individual Responses to a Nuclear Attack

Perhaps the most widely recognized but elusive means of mitigating counterproductive behavior after a disaster is to strengthen the public's "resilience."[90] While no universal definition of this quality exists, it generally refers to the capacity to cope with a difficult event, whether man-made or naturally occurring, and quickly return to a state of normality. Attempts to strengthen resilience date to the earliest years of the Cold War, when the government took efforts to educate citizens on steps they could take to protect themselves from a nuclear attack.[91] Most famously, American children were taught to "duck and cover" when they saw the flash of a nuclear detonation. According to scholar Michael T. Kindt, many of these policies were designed not so much to provide real protection against nuclear weapons but to "place preparedness in the hands of the population rather than establishing the federal government as the primary protector of Americans against attack."[92]

In the present day, allusions to resilience are littered throughout the disaster preparedness literature, and references to the concept have been enshrined in government doctrine.[93] The 2011 *National Strategy for Counterterrorism*, for example, states that the nation contributes to its

"collective resilience" by demonstrating that the United States possesses "the individual, community, and economic strength to absorb, rebuild, and recover from any catastrophic event."[94] Yet, these documents are marked by a poverty of specific proposals for nurturing resilience, and there is little evidence that terrorism preparedness has taken hold in the public consciousness in the way that civil defense did during the Cold War.

President Bush launched Citizen Corps after the September 11 attacks to bring together government and communities for "all-hazards" emergency preparedness.[95] However, high rates of inactivity have been found among Citizen Corps councils, the community organizations established to foster preparedness.[96] Similarly, an early attempt to increase individual responsibility was decidedly unsuccessful. In 2003, the Department of Homeland Security recommended that various items be stored in family preparedness kits, including duct tape and plastic sheeting to seal rooms in the event of a chemical attack.[97] This advice was roundly ridiculed in the media and arguably made the public *less* inclined to take disaster planning seriously.[98] Nonetheless, through its Ready campaign, the Department of Homeland Security continued to conduct public messaging on preparedness, advocating the storage of a seventy-two-hour supply of food and water, a first-aid kit, and the development of emergency plans for families to rendezvous after a disaster. However, these steps are only as effective as they are followed, and there is little reason to believe that a critical mass of Americans has responded to the call for preparedness.[99]

A possible explanation for this failure is that campaigns to strengthen resilience simply cast the net too wide, addressing disparate disaster scenarios under a single rubric. Indeed, the Citizen Corps' stated mission is to make communities "better prepared to respond to the threats of terrorism, crime, public health issues, and disasters of all kinds."[100] By lumping terrorist attacks together with forest fires, the government may dilute its ability to influence behaviors that are specific to man-made catastrophes. Rather than attempting to increase resilience generally, focused interventions may yield better results. And given the uniquely destructive nature of a nuclear attack, it seems appropriate that this scenario should receive the lion's share of attention in preparing the public to cope with a catastrophic event.

One behavior whose modification would be hugely consequential after a nuclear attack is the flight of survivors from an area that has just been

struck, an impulse driven largely by the fear of radiation. Planners have long advocated conditioning the public to shelter in place after a nuclear detonation rather than self-evacuate, which would minimize exposure to fallout when radiation dose rates are highest.[101] The Lawrence Livermore report cited earlier found that if survivors understood basic principles of radiation and behaved accordingly, 96 percent of potential casualties from fallout—potentially hundreds of thousands of people—could be avoided after an attack.[102] However, achieving this outcome would be difficult for several reasons.

Advising residents to remain in place after a nuclear detonation very much contradicts the human instinct to flee danger. Further, seeking shelter is superior to self-evacuation for *most* but not all survivors. As Ashton Carter, Michael May, and William Perry note, "For most people in the city struck, their best bet to avoid serious radiation exposure would be to find shelter below ground for approximately three days until radiation levels had subsided and only then to evacuate the area." But for a "comparatively few people just downwind of the detonation . . . sheltering would not in fact offer enough protection, and their only chance would be to leave as soon as possible."[103] Learning in real time which group one belonged to requires a means of communication that presently does not exist. Furthermore, even if such a system were created, responding to this information accordingly requires the public to be conditioned to trust government instructions in an emergency, which may be the most difficult requirement of all.

With regard to the first of these necessities, there are no plans for a system that can withstand the unique physical effects of a nuclear detonation and rapidly disseminate critical data (e.g., fallout plume direction) to the population of a major city. Although the government maintains an Emergency Alert System to issue warnings via television and radio, this tool lacks the ability to influence individual behavior among those most at risk of exposure.[104] This is so because the system broadcasts only audio messages (to those who happen to have the television or radio turned on) and does not distinguish between radiation risk groups. For several years the government has been implementing the Commercial Mobile Alert System, which would broadcast emergency messages to mobile devices. However, even when fully operational, this system would only issue blanket warnings to the public, and plans call for its use in a variety of scenarios, including weather warnings and AMBER alerts for missing children.[105] A

more sophisticated tool could conceivably leverage the GPS feature of many cell phones and tablets, which might allow specific groups to be targeted with tailored instructions (e.g., shelter in place versus self-evacuate). Further, narrowing the use of this medium to catastrophic attacks might increase the seriousness with which the public takes emergency alerts.[106]

While the challenge of issuing life-saving information is potentially solvable with technology, conditioning people to follow government instructions is arguably more challenging. This effort would involve either educating an apathetic public before a nuclear attack or a terrified population after one. In the first instance, most people prefer not to mentally engage the prospect of a nuclear attack in their daily lives. Once a detonation has already occurred, it would be difficult to impart complex and often counterintuitive information to panicked survivors in real time. A substantial body of literature has explored the challenge of communicating risk to the public after a radiological or nuclear attack, but there is little evidence that this scholarship has produced many actionable conclusions, much less that these findings have made their way into US planning efforts.[107]

Despite these obstacles, there are reasons to believe that communicating technical information to the lay public can succeed. Notably, the United Kingdom's Health Protection Agency won plaudits for its communication strategy after the 2006 polonium poisoning of Alexander Litvinenko in London. The agency was diligent in assuring the public that the radiation risk was confined to a specific geographic area, which reassured those outside the affected zone. Although some approaches used in the Litvinenko case, such as offering free urine tests for those concerned about radiation exposure, may not be scalable for an act of nuclear terrorism, the response to this incident demonstrates that technical information can be successfully imparted to an unlearned population and that psychological consequences can be alleviated.[108] If similarly effective methods can be devised to transmit information after a nuclear detonation, not only would survivors' mental health be spared but so would many of their lives.

Minimizing casualties from fallout is not a panacea, but doing so may mitigate other consequences far from the site of the attack. For example, if the size of the death toll and images of mass evacuations are sources of mental anguish in other parts of the country, both would be reduced by optimal behavior on the part of survivors near the blast site. Likewise,

managing a much smaller pool of casualties and a more orderly evacuation from a devastated city would relieve pressure on first responders, allowing them to target their resources more effectively. Above all, managing the scale of the disaster might help temper the impulse of national leaders to respond excessively to the attack.

While the government has an obvious interest in influencing individual behavior following a nuclear attack, one class of reactions is exclusive to government leaders—domestic response and recovery operations, law enforcement and homeland security measures, military operations, and diplomatic initiatives overseas. Given that such policy responses are often the most consequential effects of terrorism, it is crucial that leaders' decisions not compound the damage should an attack occur. The following discussion focuses on heightening awareness of intangible consequences among government leaders and identifying the various ways their decision-making may improve as a result. Although this knowledge would be most applicable in the aftermath of a nuclear attack, it is also germane to the decision to initiate the first use of nuclear weapons. In both cases, the full range of nuclear effects, and not just physical ones, should inform leaders' decisions.

Influencing Nuclear Doctrine and Government Responses to a Nuclear Attack

Of the two most momentous decisions that leaders can make with respect to nuclear weapons—whether to launch a nuclear strike and how best to respond to such an attack on their own country—it is difficult to predict which would be most influenced by an appreciation of intangible effects. In the first instance, every leader would have some intuitive grasp of these consequences even without a conscious campaign to highlight them. Any president contemplating a nuclear attack would surely feel the weight of history on their shoulders, and sensitivity to its judgment would probably lead to conservative decision-making. However, there are conceivable scenarios in which a vague notion of intangible consequences might not be enough to override the perceived military advantages of using a nuclear weapon. One such scenario is the detonation of a weapon in an uninhabited area as an expression of resolve, which might be seen as less provocative than the destructive use of a weapon and thus more likely to de-escalate a crisis.[109] However, the short-term effect of this act must be balanced against

its broader global repercussions. If the full range of intangible effects were properly understood, their magnitude might outweigh the perceived advantages of conducting a nuclear demonstration.

Although the consequences of a state-launched nuclear attack have already been surveyed at some length, certain of these effects would redound to the particular detriment of the perpetrator. One would be a significant reputational cost regardless of the circumstances of the attack. Indeed, the United States still bears a stigma in some quarters for dropping the bomb on Japan despite that country's serial war crimes and unprovoked attack on Pearl Harbor. Any violator of the nuclear taboo would suffer a considerable political penalty for this decision, especially if subsequent attacks occur and are then attributed to the weakening of this international norm. While such opprobrium would be less troubling to states accustomed to international scorn (e.g., Russia and Israel), certain expressions of disapproval would be felt by even the most recalcitrant regimes. It is entirely conceivable, for instance, that long-standing allies would join in economic sanctions against the offending state, inflicting pain on its general population and diminishing the government's popular support. Finally, the agent of the attack might be seen as inviting similar aggression on itself over the long term. Just as a nation that tortures detainees has no reasonable expectation that its own captives will be treated humanely, the author of a nuclear strike would arguably forfeit its right not to be attacked similarly in the future.

Assuming the policy community accepts the salience of intangible effects, two principal steps must be taken before these consequences can be integrated into nuclear policy. First, further research is needed to identify the full range of intangible phenomena as well as means to mitigate especially harmful effects. Second, mechanisms must be developed to incorporate these findings into crisis decision-making, nuclear doctrine, arms control policy, and national security strategy writ large. The latter requirement is perhaps the more difficult of the two because it involves institutionalizing complex and often subjective concepts, to say nothing of overcoming the bias toward physical effects in the nuclear policy establishment.

One approach is to socialize intangible consequences as widely as possible, with particular emphasis on the externalities of poor decision-making. Even without prescribing specific means to avoid these consequences, simply being exposed to them would make decision-makers more mindful of their pernicious nature. A variety of media can be used

toward this end, such as government strategy documents and academic literature, both of which should feature a greater symmetry between physical and nonphysical effects. Likewise, intangible consequences should be included in the curricula of security studies courses and professional military education programs. Members of the armed forces and civilians with responsibility for nuclear operations should be exposed to these concepts at every stage of their careers, which could be accomplished by incorporating the concepts into their frequent war games and tabletop exercises. Finally, nongovernmental organizations should encourage a public discourse on the cascading effects of nuclear weapons use. Rather than focusing chiefly on the physical destruction from a major nuclear exchange—typified by the Doomsday Clock of the *Bulletin of the Atomic Scientists*—these organizations might emphasize the spiraling consequences of more limited nuclear strikes.[110]

Each of these approaches would be equally germane to preparing leaders for the response to a nuclear attack—a scenario in which intangibles are more likely to influence their judgment. Unlike the decision to launch a first strike, where the question is whether or not to initiate a truly world-historical event, responding to a nuclear attack in some form is unavoidable, and decisions are simply a matter of choosing the most advantageous course of action from many competing alternatives. Because every reaction, large or small, would be an intangible effect of the attack, leaders' appreciation of intangible effects would color a much wider range of choices than the largely binary decision of a first strike.

Although the need to positively influence reactions to a nuclear attack is clear, the same conundrum that complicates this objective at the individual level also applies to governments: the enormous range of potential responses makes it difficult to craft targeted guidance. One possible way to address this dilemma is to reinforce select themes that touch on a wide variety of policies, much as managing the public's fear of radiation has broad applicability at the individual level. With respect to government decisions, if there is an analogue to strengthening public resilience, it is the need to underscore the potential for counterproductive responses to a nuclear attack. Because the pitfalls of poor decision-making after a state-sponsored strike have been explored for decades, the following discussion focuses on responses to an act of nuclear terrorism, although many of its observations would apply equally to both scenarios.

The tenor of the reaction to a terrorist nuclear attack, and especially its military dimension, offers perhaps the best opportunity to minimize harmful intangible effects. After such an incomprehensible national trauma, government leaders would seek to punish the guilty party as quickly and severely as possible, if only to assuage public anguish. Yet, acting on erroneous information or lashing out indiscriminately could have profoundly damaging effects. This is particularly true given the knowledge that precipitating an overreaction is often the explicit aim of violent extremists. Indeed, shortly after September 11, Princeton scholar Michael Scott Doran warned that a rash military response to the attacks would follow the script of Osama bin Laden's "piece of high political theater" whose audience was not the American people but the *umma*, or global Islamic community:

> The script was obvious: America, cast as the villain, was supposed to use its military might like a cartoon character trying to kill a fly with a shotgun. The media would see to it that any use of force against the civilian population of Afghanistan was broadcast around the world, and the *umma* would find it shocking how Americans nonchalantly caused Muslims to suffer and die.[111]

To their credit, US leaders initially resisted the impulse to lash out after September 11. Almost two months passed between the attacks and the first US military operations in Afghanistan, and that campaign was marked by scrupulous efforts to minimize civilian casualties. Only with the US misadventure in Iraq did the United States begin to follow bin Laden's playbook, killing huge numbers of Iraqi civilians, poisoning attitudes toward the United States in the Muslim world, and sinking hundreds of thousands of American troops in a multiyear quagmire. With luck, this historical lesson would counsel against a similar reaction to a terrorist nuclear attack. Yet, the demand for a commensurate response may prove to be irresistible. Of particular concern is the danger that leaders would retaliate with nuclear weapons, if only to answer the attack with an act of comparable significance. As Scott Sagan notes, such a response might play directly into the hands of Islamist terrorists. "U.S. threats to retaliate in kind might be welcomed," he warns, "since the U.S. use of nuclear weapons could hasten the downfall of allied regimes in the Muslim world through protests in the mosques and riots in the streets."[112]

Retaliating against a terrorist nuclear attack might also include states that had aided the plot, wittingly or unwittingly. Aside from straightforward sponsorship, a state may inadvertently facilitate an attack through lax security practices that allow terrorists to acquire fissile material. Various American officials have suggested that the United States might take military action against such states, as then senator Joseph Biden did in 2007 when he declared that "we will hold accountable any country that contributes to a terrorist nuclear attack, whether by directly aiding would-be nuclear terrorists or willfully neglecting its responsibility to secure the nuclear weapons or weapons-usable nuclear material."[113] Whether such rhetoric will actually deter states is open to question, but there are several reasons why the threat might be counterproductive. As Michael Levi cautions, threatening retaliation in this circumstance "undercuts efforts to work cooperatively with those states to improve their nuclear security; dissuades those states from informing others if they discover that their nuclear weapons or materials are ever stolen . . . and makes it difficult to work with those states in the aftermath of an attack to prevent further detonations."[114]

As a general rule, it is advisable to avoid pronouncements before an event that prescribe certain inflexible responses once it occurs. Although there may be some deterrent value in threatening a severe response to a nuclear attack, if deterrence then fails, the state may find itself in a "commitment trap."[115] At this point, it must either make good on the pledge, even if it is not in the country's interest to do so, or risk harm to its national reputation, especially the credibility of future threats. In short, by making such pronouncements, leaders squander the crucial quality that makes intangible effects more manageable than physical ones—their ability to be controlled through wise decision-making.

Appreciation of this quality applies no less to domestic policy responses than to overseas military operations. The former might take a variety of forms, ranging from wasteful or counterproductive security measures to more fundamental trespasses against the norms of governance. The first variety can be difficult to resist because the demand for "security theater" after a disaster is both a bottom-up and a top-down phenomenon. That is, the general public yearns, sometimes subconsciously, for reassurance that it is being protected, and policy-makers grasp for symbols that they are doing *something* to protect the public even if the measures are largely cosmetic. The result is often as ludicrous as it is wasteful, such as the lavish

terrorism preparedness grants to rural communities with virtually no risk of being attacked. Other domestic responses may be far more corrosive, affecting the very way of life of the society struck by terrorists. These might include the imposition of curfews and price controls on consumer goods, increased monitoring of communications, extrajudicial detentions, and restrictions on the movement of people and commodities. Although such policies might have little bearing on the recovery from an attack or the prevention of new ones, they might reflect an ineffable sense that the event "changed everything," requiring almost axiomatically that radical changes to society occur.

In this climate, a key challenge for policy-makers would be to ensure that every policy enacted has a demonstrable link to security and justifies any fundamental change to society that results. However, this responsibility does not fall to the government alone. Individuals have an obligation to resist responses that exchange timeless elements of the national character for short-term increases in security, real or perceived. At the very least, they should avoid in their personal conduct behaviors that signal acquiescence to such policies. If an element of human agency is the defining feature of intangible consequences, every individual has an obligation to behave in ways that do not exacerbate the damage from an attack.

Conclusion

For various structural reasons, the difficulty of factoring intangible effects into preparations for a nuclear event is unlikely to diminish. During the Cold War, when a massive nuclear exchange was considered plausible, intangible consequences simply could not compete with the awesome physical damage of such a war in the human imagination. Following that era, when the likelihood of a nuclear exchange was thought to have plummeted, contemplation of *all* nuclear weapons effects, physical and nonphysical, virtually evaporated. Thus, a convenient reason to overlook intangible effects has always been close at hand. Any attempt to focus attention on these consequences today would run counter to the steady retreat of nuclear weapons from the public consciousness over the last three decades.

Even if the mounting disinterest in these weapons could somehow be reversed and the dominance of physical effects could be overcome, there

are further reasons to doubt that a greater appreciation for intangible effects will have the impact on global nuclear policy that it should. After all, no stampede to eliminate nuclear weapons followed the discovery of nuclear winter, and more than a quarter century later thousands of these weapons still exist. Yet, it is also possible that this is too cynical an interpretation of the influence of studies and writings on nuclear decision-making over the decades. Perhaps the seventy-five years in which these weapons have not been used is due in part to efforts to underscore just how horrific a nuclear war would be. In this respect, efforts to increase awareness of intangible consequences are clearly called for, regardless of their probability of success. To ignore this call would be to render ourselves defenseless against the large proportion of nuclear weapons effects that are entirely within our control.

Notes

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12. Johan Galtung, *On the Social and Cultural Implications of Nuclear War* (Princeton, NJ: Princeton University, April 1986).
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61. Matthew Alexander, "I'm Still Tortured by What I Saw in Iraq," *Washington Post*, November 30, 2008, https://www.washingtonpost.com/wp-dyn/content/article/2008/11/28/AR2008112802242.html.
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63. The estimated cost of the Iraq War includes not just direct outlays to prosecute the war but also long-term economic costs. The Department of Defense's direct spending on the war totaled at least $757.8 billion. See Amy Belasco, *The Cost of Iraq, Afghanistan, and Other Global War on Terror Operations since 9/11*, CRS Report RL33110 (Washington, DC: Congressional Research Service, March 29, 2011), 17, https://www.hsdl.org/?view&did=4795. For broader economic costs, see "U.S. CBO Estimates Long-Term War Costs," *Reuters*, October 24, 2007, https://www.reuters.com/article/us-iraq-usa-funding/u-s-cbo-estimates-2-4-trillion-long-term-war-costs-idUSN2450753720071024. The $82.7 billion figure for the cost of the September 11 attacks was derived from two studies on the direct property losses and the macroeconomic effects of the attacks, respectively. Patricia Grossi estimates that the loss to property in and around the World Trade Center complex totaled $22.7 billion. See Patricia Grossi, "Property Damage and Insured Losses from the 2001 World Trade Center Attacks," *Peace Economics, Peace Science and Public Policy* 15, no. 2 (2009): 1–18, https://doi.org/10.2202/1554-8597.1163. For the broader economic consequences of the attack, Brock Blomberg and Gregory Hess calculate a 0.50-percentage-point decrease in gross domestic product growth as a result of the attacks, for a net effect of $60 billion. See S. Brock Blomberg and Gregory Hess, "Estimating the Macroeconomic Consequence of 9/11," *Peace Economics, Peace Science and Public Policy* 15, no. 2 (2009): 1–26 https://doi.org/10.2202/1554-8597.1167.
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attacks: "Whereas members of al Qaida, an organization bearing responsibility for attacks on the United States, its citizens, and interests, including the attacks that occurred on September 11, 2001, are known to be in Iraq." See the Authorization for Use of Military Force against Iraq Resolution of 2002, Pub. L. 107-243, https://www.congress.gov/107/plaws/publ243/PLAW-107publ243.pdf. For polling on the public's belief in a link between Iraq and the attacks, see "Washington Post Poll: Saddam Hussein and the Sept. 11 Attacks," *Washington Post*, September 6, 2003, https://www.washingtonpost.com/wp-srv/politics/polls/vault/stories/data082303.htm.

65. See Richard John and Heather Rosoff, "Estimating Likelihood of Terrorist Attacks by Modeling Terrorist Objectives and Values," presented at DHS University Network Summit on Research and Education, Washington, DC, March 15–16, 2007.

66. Joshua H. Pollack and Jason D. Wood, *Enhancing Public Resilience to Mass-Casualty WMD Terrorism in the United States: Definitions, Challenges, and Recommendations*, Report No. ASCO 2010 042 (Ft. Belvoir, VA: Defense Threat Reduction Agency's Advanced Systems and Concepts Office, June 2010), ii, https://irp.fas.org/agency/dod/dtra/resilience.pdf.

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72. Charles D. Ferguson and William C. Potter, *The Four Faces of Nuclear Terrorism* (Monterey, CA: Center for Nonproliferation Studies, Monterey Institute of International Studies, January 1, 2004).
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80. The following single-day percentage drops were recorded: 4.6 percent in Spain, 8.5 percent in Germany, 5.7 percent in the United Kingdom, 9.2 percent in Brazil, 5.2 percent in Argentina, and 5.6 percent in Mexico. See Floyd Norris and Jonathan Fuerbringer, "Stocks Tumble Abroad; Exchanges in New York Never Opened for the Day," *New York Times*, September 12, 2001, https://www.nytimes.com/2001/09/12/business/day-terror-markets-stocks-tumble-abroad-exchanges-new-york-never-opened-for-day.html.
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85. United States Air Force, *Nuclear Operations*, Air Force Doctrine Document 2-12 (Washington, DC: US Air Force, May 7, 2009), 8–9, https://irp.fas.org/doddir/usaf/afdd2-12.pdf.
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87. B. R. Buddemeier, J. E. Valentine, K. K. Millage, and L. D. Brandt, *National Capital Region Key Response Planning Factors for the Aftermath of Nuclear Terrorism*, Report No. LLNL-TR-512111 (Livermore, CA: Lawrence Livermore National Laboratory, November 2011).
88. National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, *Planning Guidance for Response to a Nuclear Detonation*, 112.
89. In 1964, for example, Robert McNamara famously quantified the level of damage that he judged would be sufficient to deter the Soviet Union—the loss of one-quarter of its population and two-thirds of its industry. See Memorandum from Robert McNamara to President Lyndon Johnson, "Recommended FY 1966–1970 Programs for Strategic Offensive Forces, Continental Air and Missile Defense Forces, and Civil Defense," December 3, 1964, https://nsarchive2.gwu.edu/nukevault/ebb275/20.pdf.
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93. See, for example, F. H. Norris, S. P. Stevens, B. Pfefferbaum, K. F. Wyche, and R. L. Pfefferbaum, "Community Resilience as a Metaphor, Theory, Set

of Capacities, and Strategy for Disaster Readiness," *American Journal of Community Psychology* 41, no. 1–2 (2008): 127–150, https://doi.org/10.1007/s10464-007-9156-6.

94. *National Strategy for Counterterrorism* (Washington, DC: The White House, June 2011), 8, https://obamawhitehouse.archives.gov/sites/default/files/counterterrorism_strategy.pdf. *Presidential Policy Directive-8: National Preparedness* (https://www.dhs.gov/presidential-policy-directive-8-national-preparedness) defines *resilience* as "the ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies."
95. See the Citizens Corps page on the Ready.gov website, www.ready.gov/about-citizen-corps, last updated May 26, 2021.
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