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Title: Nuclear Weapons are the Only Weapons Suitable for Strategic Deterrence by Punishment

Précis: This document is an abridged version of a 3000-word assignment for the “Science & Security of Nuclear, Biological, and Chemical Weapons” module at King’s College London. The prompt was as follows: “Explain why you agree or disagree with the following statement: ‘Nuclear weapons are the only weapons suitable for deterrence.’”

In answering this question, I offer qualified agreement, grounded in the capability and credibility—criteria developed by leading deterrence theorists—of nuclear weapons usage. In the original essay, the “Maximum Damage” portion of the essay featured more detail on specific case studies of testing and use. For the sake of shortening the piece, I further eliminated two paragraphs in the “Dissemination Issues and Potential Enemy Defenses” section, which described potential protections like gas masks, antidotes, and vaccines for biological and chemical weapons and the impact of meteorological conditions on each weapon type. The “Credibility” section was also shortened, as much of it was based on theoretical, rather than empirical, thinking. As noted in the conclusion, I would like to someday consider the impact of diplomatic treaties and verification measures on this essay’s central question.

Nuclear Weapons are the Only Weapons Suitable for Strategic Deterrence by Punishment

Bernard Brodie once described the fission bomb as ‘the absolute weapon’ because of its unprecedented power.¹ Fusion bombs have since then proven the absence of a plateau in weapons innovation and power,² but the question remains as to whether nuclear weapons are ‘the absolute weapon’ for deterrence purposes; are nuclear weapons the only weapons suitable for deterrence? This query is presented in a deceptively simple form, but important confounding questions arise immediately: What is meant by deterrence? What is required to achieve this deterrence? And are nuclear weapons the only weapons that meet the deterrence criteria? The qualified answer to the last question is yes, nuclear weapons are the only non-conventional weapons of mass destruction (WMD) suitable for *strategic* deterrence. Given the capabilities and credibility of chemical, biological, and radiological (CBR) weapons, they can—at best—serve as unreliable, in-kind deterrents.

Before proceeding with the argument, the scope of the essay deserves clarification. Only non-conventional WMDs—chemical, biological, radiological, and nuclear weapons—are analyzed. This correlates with the assumption that advanced conventional weapons in the ‘New Triad’ can ‘substitute for some missions previously relegated solely to nuclear weapons.’³ In regards to the conclusion of this essay, precision-guided munitions within the Prompt Global Strike concept thus behave similarly to nuclear weapons.⁴

I. WHAT IS MEANT BY DETERRENCE

To determine the suitability of different weapons for deterrence, a necessary first step is defining deterrence. At a basic level, deterrence is preserving the status quo through coercion, as opposed to brute force actions.⁵ This paper acknowledges the difference between deterrence by punishment and deterrence by denial. Deterrence by punishment makes the predicted costs of an aggressor’s actions outweigh the benefits, and deterrence by denial diminishes the aggressor’s probability of achieving desired outcomes.⁶ Glenn Snyder offers a model for the aggressor’s calculus of deterrence, and Dr. Susan Martin presented it in this visual format:

(Costs of Attacking) * (Likelihood Those Costs are Imposed) > OR < (Benefits of Attacking) * (Likelihood of Gaining Those Benefits)⁷

In this framework, deterrence by punishment targets the left side of this model (by increasing the ‘likelihood those costs are imposed’) while deterrence by denial focuses on the right side (by decreasing the ‘likelihood of gaining those benefits’).⁸ The former will be used to analyze a defender’s different weapons types, based off how they increase the aggressor’s likely costs incurred. Deterrence by denial does not involve defender’s retaliatory weapons, so it is not applicable to this essay; deterrence by denial instead focuses on defender’s protections and the existential deterrent effect they produce.⁹

Deterrence by punishment can be applied in different forms, and this paper’s focus is on strategic and in-kind deterrence. By targeting vital interests, strategic deterrence increases the likelihood that the aggressor loses vital interests, like population and infrastructure—including buildings, energy,

¹ Brodie (1946), p.3

² Baylis and Garnett (1991), p.1

³ Gerson (2009), p.1

⁴ Rowberry (2014), p.2

⁵ Kenyon and Simpson (2013), p.59

⁶ Snyder (1959), p.7

⁷ Martin, Class Lecture, 06 November 2015

⁸ Ibid

⁹ Snyder (1959), p.7

telecommunications, and water.¹⁰ In potential or existing conflicts, in-kind deterrence threatens an equivalent retaliatory response if one side uses a new weapon type; it increases the probability that both sides face higher cost, based on the potential damage inflicted by the new weapon.¹¹

Before moving forward, one missing piece of information deserves clarification: the identity of the aggressor. This essay will discuss rational state aggressors because deterrence is based on rational choice theory, a calculus of maximizing payoff versus the cost.¹² Thomas Schelling applied game theory to deterrence.¹³ Contrastingly, deterrence, in the conventional sense of benefits and costs, is ineffective against terrorist aggressors who value eternal salvation through martyrdom; the unfortunate irony is that the threatened punishment is the terrorist's most desired outcome.¹⁴

II. WHAT IS REQUIRED TO ACHIEVE DETERRENCE BY PUNISHMENT

Having established a focus on rational deterrence by punishment, the next step is to identify the criteria a weapon must meet to uphold this kind of deterrence. Deterrence theory, as explained by Kaufmann, Schelling, and Zagare, puts forth two such criteria: capability and credibility for retaliation.¹⁵

Capability refers to the potential for one actor to levy massive destructive power on the other.¹⁶ Albert Wohlsletter argued in the 'The Delicate Balance of Terror' (1959) that deterrent forces had to be able to survive an attack and to penetrate the enemy's defenses.¹⁷ While this essay assumes that the defender's weapons survive any first strike, it will assess capability through each weapon's potential damage infliction and ability to surmount defenses.

Albert Wohlsletter further advocated that credibility was as important as capability. Not only could weapons be capable of increasing the likelihood of cost imposition, but a potential aggressor had to believe that a defender would have the political will to use them.¹⁸ French strategist André Beaufré echoed this idea, further emphasizing the role of psychological factors and conventions—as opposed to just material capabilities—in the perceived deterrent threat.¹⁹

III. MEETING THE CRITERIA

To establish deterrence by punishment, a weapon must satisfy the capability and credibility criteria. Starting with capability, this essay compares each weapon's maximum potential damage, but then accounts for dissemination issues and potential enemy countermeasures that can diminish potential. While the capability assessment indicates a weapon's potential for strategic deterrence only, the credibility section also explores the psychology and norms associated with in-kind deterrence by punishment.

¹⁰ Nagy (2004), https://csis.org/images/stories/poni/2004_STRATCOM_Nagy.pdf, 03 December 2015

¹¹ Terrill (2009), <http://www.strategicstudiesinstitute.army.mil/pdffiles/pub941.pdf>, 02 December 2015

¹² Akers (1990), p.654

¹³ Baylis and Garnett (1991), pp.11,14

¹⁴ Wellen (2011), http://www.huffingtonpost.com/russ-wellen/can-nuclear-terrorists-be_b_364960.html, 02 December 2015

¹⁵ Danilovic (2001), p.341

¹⁶ Lawler (1988), p.94

¹⁷ Baylis and Garnett (1991), p.7

¹⁸ Ibid

¹⁹ Ibid, p.16

A. CAPABILITY

1. MAXIMUM DAMAGE

Maximum damage levels provide a good starting point for capability testing because higher levels of power capability tend to reduce the mutual use of force; higher yields increase the likelihood of imposing costs against an aggressor.²⁰ Herein lies the first major distinction between nuclear and CBR weapons, as Bernard Brodie noted that nuclear weapons represent ‘a wholly different order of magnitude in military utility.’²¹ Thermonuclear weapons today utilize fusion to attain yields equivalent to megatons of TNT. The Soviets tested the 50 MT Tsar Bomba in 1961, which could devastate the entire Los Angeles metropolitan area and cause trillions of dollars in economic damage.²²

Lacking a nuclear blast, radiological weapons propagate disruption, injury, and death through contamination.²³ For these weapons, 4 to 5 Sv of equivalent dose can prove lethal, and ‘dirty bomb’ attacks, like the Chechen separatists’ undetonated 70-pound mixture of ¹³⁷Cs and dynamite in Ismailovsky Park in 1995, could kill hundreds of people and contaminate thousands.²⁴ These weapons would cause deterministic injuries like burns or death and stochastic injuries like cancer, and they could induce economic and psychological disruption through mass panic.²⁵

Chemical weapons similarly lack damage capabilities comparable to nuclear weapons. Although chemical effects are felt immediately or within several hours, the threatened cost imposition is confined to human, and not infrastructure, harm: vesicants like sulphur mustard burn lungs, skin, and eyes; choking agents like phosgene and chlorine induce pulmonary edema; blood agents like HCN prevent cells from using oxygen; and nerve agents—including GA, GB, GD, GF, and VX—cause death through paralysis and then asphyxiation.²⁶ One of the deadliest chemical attacks at Halabja in March 1988 used a combination of conventional bombs, mustard gas, and nerve agents like sarin, tabun, and VX to kill over 3200 people.²⁷

Biological weapons continue this trend of not threatening infrastructure significantly, but they may threaten fatalities beyond the magnitude of the thousands. While bacteria, viruses, fungi, and toxins threaten varying levels of mortality (high for anthrax and smallpox, low for ricin toxin, and potential future threats from the nipah and hanta virus),²⁸ a US Office of Technology Assessment of 1993 predicted that if a plane released 10 kilograms of anthrax over Washington DC, it could contaminate 46 square kilometers of area and kill over 130,000 people.²⁹ This scenario does not account for the difficulties of dissemination, though—explained below.

In determining suitability for strategic deterrence by punishment, only nuclear weapons prove capable because they inflict massive damage on infrastructure—not just the population.³⁰ While the order

²⁰ Lawler (1988), p.94

²¹ Zellen (2011), p.64

²² Meade and Molander (2006), p.31

²³ Cordesman (2014), [https://csis.org/files/media/csis/pubs/radiological\[1\].pdf](https://csis.org/files/media/csis/pubs/radiological[1].pdf), 02 December 2015

²⁴ Bale (2004), <http://www.nti.org/analysis/articles/chechen-resistance-radiological-terror/>, 01 December 2015

²⁵ Brown and Rzucidlo (2012), p.627

²⁶ McDonald, Class Lecture, 08 October 2015

²⁷ Barbati (2013), <http://www.ibtimes.com/25-years-after-worst-chemical-weapon-massacre-history-saddam-husseins-attack-halabja-iraq-city>, 02 December 2015

²⁸ McDonald, Class Lecture, 15 October 2015

²⁹ Office of Technology Assessment (1993), p.54

³⁰ Nagy (2004), https://csis.org/images/stories/poni/2004_STRATCOM_Nagy.pdf, 03 December 2015

of magnitude of deaths for a ‘strategic’ loss is debatable, nuclear weapons far exceed the hundreds or thousands of deaths of chemical and radiological attacks.³¹

2. DISSEMINATION ISSUES AND POTENTIAL ENEMY DEFENSES

Dissemination issues and available defenses further lessen the likelihood of threat imposition from CBR weapons.³² For chemical weapons, factors like sunlight, rainfall, humidity, and temperature may dramatically hasten the time these agents stay in the environment, but even more persistent agents waste of 90 percent of the agent during outdoor release. For instance, even though a single drop of sarin can kill an adult rapidly, 1 ton of sarin is required to have only 50 percent casualties over 1 square mile.³³ The production of high-tech, more lethal aerosols demands finding the proper particle size—between 1µm and 5µm—for lung penetration.³⁴ Since this size is not straightforwardly determined, aerosol attacks can be rendered ineffective, as Aum Shinrikyo discovered by killing only 12 people in its 1995 subway attack. As living organisms that can often not be absorbed through skin, biological weapons have difficulties, like chemical weapons, with environmental deterioration and aerosol particle size.

In contrast, the blast radii of over 2 km for the most basic gun-type and implosion nuclear weapons preserves their threatened cost imposition, inflicted in the form of fatalities and total infrastructure destruction.³⁵ Today, the Obama administration only has a minimal Ground-Based Midcourse Defense system—which can intercept warheads attacking from any direction but would be overwhelmed, for example, by a dozen warheads from Russia.³⁶ The relative lack of dissemination issues or defense hurdles reinforce the monopoly of nuclear weapons in strategic deterrence by punishment.

B. CREDIBILITY

1. FOR NUCLEAR WEAPONS

While the previous section notes that only nuclear weapons are capable of strategic deterrence, this characteristic alone is not sufficient; for effective deterrence by punishment, rational actors must also demonstrate the political will to use these weapons. Although empirical evidence establishes this will for CBR weapons, nuclear weapons offer an odd case in credibility, as there has been no weaponized use since Hiroshima and Nagasaki in 1945.³⁷ This gap in usage forces a theoretical, rather than empirical, approach to credibility.³⁸ While the U.S. political will to use nuclear weapons is debatable, the Single Integrated Operational Plan (SIOP) did detail various options for limited nuclear war from 1961 to 2003. As SIOP described targeting options, damage levels, and launch procedures,³⁹ the presence of these considerations in formal government policy satisfies, for the purpose of this essay, the credibility criterion for deterrence by punishment and its various forms.

³¹ Carus (2012), p.6

³² McDonald, Class Lecture, 08 October 2015

³³ Ibid

³⁴ Prelas and Viswanath (2010), p.94

³⁵ ‘General Description of Damage Caused by the Atomic Explosions,’
http://www.atomicarchive.com/Docs/MED/med_chp9.shtml, 02 December 2015

³⁶ Thompson (2015), <http://www.forbes.com/sites/lorenthompson/2015/03/20/the-u-s-has-no-defense-against-a-russian-nuclear-attack-really/2/>, 03 December 2015

³⁷ ‘General Description of Damage Caused by the Atomic Explosions,’
http://www.atomicarchive.com/Docs/MED/med_chp9.shtml, 02 December 2015

³⁸ Baylis and Garnett (1991), p.11

³⁹ Cimbala (1988), <http://www.airpower.maxwell.af.mil/airchronicles/apj/apj88/sum88/cimbala.html>, 01 December 2015

2. IN-KIND DETERRENCE FOR CBR WEAPONS?

While CBR weapons lack the capabilities for strategic deterrence by punishment, their credibility—and ‘capability’—can be discussed in regards to in-kind deterrence by punishment. In-kind deterrence simply aims to prevent escalation in force—regardless of the initial projected cost imposition.⁴⁰ The focus on escalation from the status quo eliminates the need to compare weapons’ capabilities; CBR weapons are all capable of escalating force if not previously used, and rational state actors have empirically proven their political will to use these kinds of weapons.

A case study of chemical weapons, however, proves the practical unreliability of in-kind deterrence. Despite the German monopoly on nerve agents and the Allies’ ability to produce chlorine in WWII, both sides upheld in-kind deterrence during this conflict. The façade of reliable in-kind deterrence, however, collapsed forty years later with the Iran-Iraq War. In 1983, Iraq broke ‘the moral barrier’ by deploying tabun, sarin, and VX nerve agents as well as blistering agents, and Iran responded with its own program.⁴¹ While WWII may have had in-kind deterrence, the Iran-Iraq War showed that this kind of deterrence requires case-by-case consideration.⁴² CBR’s threatened cost imposition is too unreliable to be considered ‘suitable’ for deterrence by punishment in this essay.

IV. CONCLUSION

Within the context of CBRN weapons, only nuclear weapons have the capability and credibility for successful, sustainable deterrence by punishment. Although CBR weapons can integrate psychology to produce phases of in-kind deterrence, these weapons are not suitable for reliable deterrence by punishment, and they lack the capabilities for strategic deterrence. One limitation of this essay is that it did not address the implications of treaties like the Chemical Weapons Convention (CWC) of 1984, Biological Weapons Convention (BWC) of 1972, and the Nuclear Non-Proliferation Treaty of 1968. Without addressing treaties, though, strategic deterrence is of the utmost importance, and only nuclear weapons assure it. In this regard, Churchill was right in calling peace ‘the sturdy child of terror, and survival the twin brother of annihilation’.⁴³

⁴⁰ Terrill (2009), <http://www.strategicstudiesinstitute.army.mil/pdffiles/pub941.pdf>, 02 December 2015

⁴¹ Johnston (2015), <http://www.johnstonsarchive.net/terrorism/chembioattacks.html>, 01 December 2015

⁴² Johnson and Leeds (2012), p. 2

⁴³ Churchill, <http://www.winstonchurchill.org/resources/speeches/1946-1963-elder-statesman/102-never-despair>, 03 December 2015.

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