

## The enemy votes: Weapons improvisation and bargaining failure

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### Abstract

Belligerents could in principle avoid the *ex post* costs of conflict by revealing all private information about their violent capabilities and then calculating odds of success *ex ante*. Incentives to misrepresent private information for strategic gain, however, can cause miscalculations that lead to war. I argue some private information can lead to miscalculation not because it is purposefully misrepresented for strategic gain but because it is too decentralized to be easily revealed. The decentralized private information that produces improvised weapons requires a process of discovering suitable local resources and battlefield testing driven by local military entrepreneurs which frustrates information revelation. Decentralized private information used to improvise new weapons and capabilities like those which emerged in Afghanistan and Iraq show that it can take many years, decades, or even an indeterminate amount of time for fighting to reveal relevant information about violent capabilities.

“What the layman gets to know of the course of military events is usually non-descript. One action resembles another, and from a mere recital of events it would be impossible to guess what obstacles were faced and overcome. Only now and then, in the memoirs of generals or of their confidants, or as a result of close historical study, are some of the countless threads of the tapestry revealed.”

—Clausewitz (1976 [1832], p. 112).

“... it strains credulity to imagine that the parties to a war that has been going on for many years, and that looks very much the same from year to year, can hold any significant private information about their capabilities or resolve. Rather, after a few years of war, fighters on both sides of an insurgency typically develop accurate understandings of the other side’s capabilities, tactics, and resolve.”

—Fearon (2004, p. 290).

In 2010, almost nine years after Coalition Forces invaded Afghanistan, a team of U.S. bomb technicians were reverse engineering an improvised explosive device (IED) found there. Compared to other home-made explosives, the device was simple—and intentionally so. Having been constructed from wood, foam, and odorless explosives the device was extremely difficult to detect. Worse, the team was struggling to determine what chemicals were being used to trigger the main explosive charge. They had been stumped by Afghan IED-makers who had earlier been stumped by Coalition metal detectors and bomb dogs. Neither party could have foreseen

the capabilities to which each side would respond, as such information could not emerge without actual warfare prompting it to be discovered. If war prompts this continuous back-and-forth process of discovering new military capabilities, and if violence is restrained to the relatively low levels typical of an insurgency, how can the question of which belligerent is stronger be settled?<sup>1</sup>

The bargaining failure literature attempts to answer questions about why wars break out, persist, and end. For all sides, wars are extremely costly and these costs diminish the amount of resources left to be split once hostilities cease. These losses are potential gains to be captured if, *ex ante*, both sides can reach a bargain based on who the likely victor of a war would have been. Both sides could in principle bring knowledge of their resolve and military capabilities to the table and compare their relative positions, walking away with a bargain that redistributes wealth without having to first destroy any through fighting in order to discover who has the upper hand. The literature offers three main explanations for why this preferable state of affairs mostly goes unrealized and instead descends into war. First, the issues or resources being fought over are indivisible. Second, there are issues of credibly committing to the bargain. Third, there is private information about the relative resolve and military capabilities of one or more sides to the conflict. This uncertainty can cause miscalculations about relative strength that make war appear more attractive than it would be under perfect information.<sup>2</sup>

This third explanation comes with an additional caveat where agents are purely rational: Agents intentionally cause uncertainty as they are looking to gain strategic advantage from it, such as by lying about the number and location of their

nuclear submarines. This excludes explanations of uncertainty stemming from the irrational biases of imperfect agents, but it does not address persistent uncertainty about military capabilities stemming from issues of decentralized knowledge and military entrepreneurship. It also does not explain the long periods of continual adaption in military capabilities seen in wars such as those in Iraq and Afghanistan.

Using the example of improvised weaponry, this article addresses a deficiency in the private information explanation of bargaining failure. Improvised weapons, like the one that stumped U.S. bomb technicians, depend on highly decentralized information in their construction, and they produce highly decentralized information in their use. Decentralized information is difficult to incorporate into a centralized bargaining process and tends to create persistent uncertainty regarding relative capabilities instead. Warfare does reveal information but it also incentivizes the discovery of new capabilities when old ones fail to provide defense, at least partially offsetting the gains in information it otherwise provides.<sup>3</sup>

I take as given the restraint counterinsurgents show in escalating the level of violence to heights sometimes reached in conventional wars where improvised weapons, and the information they depend on and generate, may no longer matter. The nature of the weapons improvised in places like Afghanistan and Iraq would likely be inconsequential if Coalition Forces had resorted to total war or nuclear weapons. Instead, restrictive rules of engagement and a focus on nation-building give insurgents breathing room to discover weapons capable of influencing a (relatively) low-intensity, low-violence war. The bargaining failure literature extends to insurgencies, but argues that the difficulty of reaching a bargain in these types of wars comes from insurgent's superior knowledge of the local population and terrain, and from the weakness of local governments. While that may be correct, the insurgents' superior knowledge of local resources and enemy disposition should not remain unexamined.<sup>4</sup>

I also distinguish between adaptation as it occurs in conventional war and adaptation through weapons improvisation in insurgencies. Adaptation in conventional military capital tends to be standardized to facilitate mass production, and this makes calculating the changes in relative strength those adaptations represent easier. In contrast, improvised weapons are constructed from whatever resources are locally available which makes for a much higher number of unique weapons with unique contributions to insurgents' strength, making evaluations of relative strength far more difficult. The decentralized construction of many different improvised weapons is reinforced by the high costs insurgents

**Using the example of improvised weaponry, this article addresses a deficiency in the private information explanation of bargaining failure. Improvised weapons often depend on highly decentralized information in their construction and, correspondingly, they often produce highly decentralized information in their use. Such decentralized information is difficult to incorporate into a centralized bargaining process, and thus it tends to create persistent uncertainty regarding relative fighting capabilities. Warfare does reveal information, but it also incentivizes the discovery of new capabilities when old ones fail to provide defense, at least partially offsetting the gains in information it otherwise provides.**

would face in scaling up and standardizing improvised weapon construction. The larger their production operations the more obvious and easy to target they become for their conventionally stronger opponents.

The article proceeds as follows. The next section explores the private information problem as currently viewed in the bargaining failure literature. The section thereafter demonstrates the impact of decentralized information on the bargaining process, with examples drawn from the Joint I.E.D. Defeat Organization's (JIEDDO) counter-IED (CIED) efforts in Afghanistan and Iraq. The final section concludes with the implications for the bargaining failure theory of war and the decision to go to war.

### **Private information in the bargaining failure literature**

The problem of private information for the bargaining process has been widely explored in the bargaining failure literature. Fearon answers the most basic question: Aware that they could split a larger *ex ante* pool of resources by sharing information instead of fighting, why would rational combatants choose to keep private information about their capabilities hidden? The answer is that, as compared to peaceful negotiation, the parties retain an element of potential surprise each believes may lead to a favorable outcome in war. As Meierowitz and Satori show, the strategic advantages that come from private information can be so great that not only do agents withhold it, they also choose to invest in military capabilities that generate it.<sup>5</sup>

Just which private information is considered relevant for the bargaining process necessarily changes with the kind of war being fought. Information about where the best guerilla hideouts are in a mountainous region being held private matters far more in a low-intensity insurgency than it does in a nuclear war. Indeed, weapons improvisation tends to occur more often in insurgencies than in conventional wars because of the relatively lower level of violence. The bargaining failure literature does explore the question of private information in these kinds of wars: Insurgents tend to have superior

knowledge, that they can keep hidden, of not just the local terrain but also of the local population and local government.<sup>6</sup>

Whatever the nature of the private information, however, the bargaining failure literature treats the private information problem as a temporary one. After all, there is no intrinsic value in holding a secret. The secret is valuable only when combined with action and that action then reveals the secret, allowing beliefs about the probability of victory to converge and making bargaining more likely. War is taken to be a quick and effective revealer of private information concerning military capabilities both, because those capabilities are not thought to change very much and because the stakes are so high that there is intense pressure to capitalize on any advantage as quickly as possible. The incentive to exploit advantages is therefore enough to prompt the quick and reliable revelation of private information that may have hindered the bargaining process.<sup>7</sup>

Entrepreneurship does not feature prominently in the bargaining failure literature. The intentional generation of private information could be considered an entrepreneurial act, and sustainable entrepreneurial search for new and better solutions to the problems posed during war is not present in the theory. Existing models allow for secretive investment in an aggregate measure of strength that is then revealed during a subsequent phase of fighting or for the capture of homogenous objectives—usually forts—during a phase of fighting that then has an impact on a subsequent bargaining phase. The literature contends that the more phases of bargaining and fighting there are in a war, the more certain both sides become regarding their relative capabilities. Technological change, however, is recognized as an impediment to this march toward certainty. Technological change is driven by military and commercial entrepreneurs and can generate new information that must be discovered through fighting, but the literature treats this kind of change as relevant for assessments *between* wars rather than assessments *within* a given war. Relevant technological change comes too slowly for it to enable private information to be a persistent problem.<sup>8</sup>

To summarize, the main theoretical stream of bargaining failure due to private information rests on some critical assumptions. First, actors involved in bargaining and fighting are either unitary or else experience little difficulty in relaying newly discovered information (internally or externally) from discoverer to bargainer. Issues of credibility are explored in the literature but are separately considered. Second, private information is only a rational explanation for war if it is being consciously misrepresented for strategic gain. Nonrational explanations may include mistaken interpretations and biases but these are separately considered. Third, war quickly and

reliably reveals private information about military capabilities regardless of the type of war. This is due to the strong incentive to quickly exploit informational advantages and due to technological change occurring too slowly to outpace the discovery process of warfighting in a sustained way. These three assumptions are challenged in the next section.

### Improvised weapons and decentralized information in Afghanistan and Iraq

Using unitary actors in the bargaining failure model has certain advantages in terms of simplicity, but a proper analysis of the private information problem requires that we introduce more complexity. Hayek noted that one of the chief problems a central planner faces is that of acquiring the vast sums of information needed to direct economic activity. Localized knowledge of where resources are, where they are wanted, and what can be done with them creates what Hayek called a “division of knowledge” no less complex than the familiar division of labor. Where a bargainer is dealing primarily with standardized military forces, the problem—though still daunting—is more manageable. A far more difficult problem is faced when trying to communicate the local knowledge of all weapons improvisers concerning what inputs are available for their craft, and what they expect to be able to achieve with them, to a bargainer in a manner that is timely and which will not overload the bargainer with information.<sup>9</sup>

The principal-agent problem at play here is not one of misaligned incentives. Even assuming perfectly aligned interests between bargainers and weapons improvisers, the capacity of bargainers to receive all necessary information, and the capacity of weapons improvisers to transmit all necessary information, is as much in doubt as the ability of all economic actors to transmit the necessary information they have to a central planner. The private information needed to produce improvised weapons, and the private information those weapons themselves produce, is so decentralized in nature that bargaining failure occurs simply due to the complexity of the knowledge problem. While prices serve as efficient means of communicating decentralized information in markets, there is no corresponding mechanism in warfare. An exploration of how numerous and heterogenous are the inputs into improvised weapons will show the overwhelming nature of the knowledge problem which thus far has been obscured by reliance on aggregate measures of “strength” or “deadliness” that fit better into formalized models.<sup>10</sup>

In the making of IEDs set off by the movement or actions of their victims, Afghan improvisers worked with a wide variety of inputs just in the construction of the triggering device. They used saw blades, strips of aluminum foil from cigarette packets,

bed springs, bike springs, planks of wood, strips of foam, water bottles, shampoo bottles, ballpoint pens, and still other civilian goods and resources. Casings for IEDs could be found in ordinary items like slow cookers or propane tanks or pipes, or in military items like artillery shells or ammunition cases. Fragmentation effects could be achieved with nails, screws, scrap metal, rocks, and other perfectly common resources. More advanced explosive effects could be achieved with copper when superheated by the detonation of an IED, and that copper could be found in home electrical wiring, home appliances, TV sets, computers, and other sources. The explosives themselves came from multiple sources, with the two most common being potassium chlorate (the substance that makes matches burn) and fertilizers like ammonium nitrate.<sup>11</sup>

It is tempting to think that the problem faced by the weapons improviser is that of discovering the single-most cost-efficient IED that can be produced from this myriad of possible inputs, but it would be foolish to draw this conclusion. Instead, the improviser is engaged in constantly discovering the most cost-efficient designs which are compatible with shifting resource availability, changing prices for inputs, and a dynamic war against an adaptive opponent. If, say, metallic inputs produced the most cost-efficient IED and the weapons improviser came to rely on those metallic inputs, then the opponent could drastically improve the odds of victory by investing heavily in metal detectors. To remain effective, the improviser has to substitute into other inputs made of plastic or wood, for instance. Constant change of design, and thus constant change of inputs, characteristics, and effects, is a necessity for the weapons improviser.

The list of possible inputs into IEDs given above was a small selection. Other examples are discussed further on in this article. The total list of possible inputs is unknowable for the simple reason that war causes a tremendous shift in priorities and results in resources intended for home or commercial uses to be diverted to the pursuit of victory. In dire enough situations weapons improvisers emerge to “throw the kitchen sink” at the problems imposed by their enemies, meaning their search of suitable inputs spans both military goods and all civilian goods. Organizing such a list of possible inputs and their possible effects is clearly an impossible task, and such a list would give bargainers what military professionals call “analysis paralysis”. The only way for this decentralized information to be uncovered is through the efforts of dispersed improvisers to conduct local searches. The local nature of the information they depend on (for instance, this region has plentiful sources of copper wiring and is heavily trafficked by armored vehicles) and constantly changing environment

ensure that relevant information about military capabilities remains privately held at levels below the bargainer.

A few challenges may be raised to the argument that this kind of decentralized information is relevant. It may be said that production of successful improvised weapons will be scaled up the way production of a successful commercial product is. This would make knowledge of a weapon’s characteristics and effects widespread and make concern over the process of discovery a temporary matter at best. This does not happen for two reasons. First, scaled up production requires more machinery and larger buildings. These are more easily identified and targeted by counterinsurgent forces than a less productive but also less conspicuous private home. Second, scaled up production requires reliable access to the same inputs, and unless one is to assume that no effort is made to deny access to those inputs one must conclude that changes in weapon design will be frequent. In fact, attempts to control or ban access to explosive materials resulted in shortages and high prices for inputs like fertilizer. Improvised weapons have a plethora of substitutes, though, and when improvisers were forced to switch from fertilizer explosives to cheaper or legal substitutes the result was a change in the characteristics of their weapons, namely larger explosive yields.<sup>12</sup>

Another challenge that may be raised is that the individual characteristics of the improvised weapons do not matter for the bargaining process, only some notion of their aggregate “effectiveness” or “deadliness”. Ignoring the obvious problem of how such an aggregate would be measured or defined, the deeper problem is that different improvised weapons are created for different purposes and will also produce different effects depending on the countermeasures they face. Some IEDs are created to target personnel on foot, some are designed to function in urban environments rather than in open fields, some are designed to punch through vehicle armor, and so on. Attempting to find an aggregate measure of their “effectiveness” makes no more sense than searching through the Army’s bridging vehicles, earth movers, armored personnel carriers, and tanks for a measure of their “vehicleness”. Moreover, two improvised weapons with the same explosive yield may be thought to be effectively the same, but if jamming efforts can block the signal receiver of one and not of the other then any measure of their actual effectiveness would differ where those jammers were present. The complexity of the input problem and the unique weapons that improvisation produces cannot be usefully abstracted away.

Since the nature of the private information used in the construction and fielding of improvised weapons is decentralized, it should not surprise that neither the counterinsurgent nor the insurgents themselves begin their war

with anything like full knowledge of the effect those weapons may have. The trouble improvisers would have trying to share their local knowledge combined with the lack of incentive to discover that knowledge before war breaks out (that is, the incentive to use civilian goods for civilian purposes absent a war) makes for a situation where relevant private information exists and remains private despite no one intentionally misrepresenting it.

The incentive to discover improvised weapons comes with the failure of the conventional weapons that were supposed to defend the area the improviser is in. Coalition Forces invaded Afghanistan on 7 October 2001. The initial phases of the war showed the destructive power of Coalition air forces and special operations teams. The Taliban put up what conventional resistance it could until losing their last major stronghold of Kandahar in November 2001, less than two months after the first strikes. The rapid destruction of easy to identify and target conventional forces like Afghanistan's MIG fighter jets and heavy artillery then incentivized a quick transition into relatively safer guerilla tactics and, later, improvised weapons. One of the earliest reports of an IED attack comes from March 2002. While this report shows the beginnings of improviser response to Coalition-imposed incentives to avoid direct confrontation, IEDs did not surpass direct fire ambushes (a comparatively higher-risk method of producing defense, given Coalition conventional superiority) as the Afghan insurgents' preferred method of attack until April 2008. Instead, starting low at the beginning of the war, the number of effective (resulting in death or injury) IED incidents grew from just 36 in 2004, to 127 in 2006, and to 820 in 2009.<sup>13</sup>

The growth of IED use is even better illuminated in percentage terms. Relative to the prior year, effective incidents of IED use increased by 108 percent in 2006, 62 percent in 2007, 88 percent in 2008, and 112 percent in 2009. The Center for Strategic and International Studies' IED Metrics for Afghanistan stops recording incidents in May 2010, but comparing January through May of 2009 and 2010 shows a further 241 percent increase in effective IED incidents, with a total of 135 effective incidents in the month of May 2010 alone. In 2008 IEDs began accounting for over 50 percent of American forces killed in Afghanistan in a year, and nearly 66 percent of all American forces killed in Afghanistan in 2011. The Taliban, and other Afghan insurgents, were slow to realize the impact the IED could have on Coalition forces. Had they held private information about how effective the weapons could be, there would have been no reason for them to attempt the conventional forms of resistance that ended so quickly and catastrophically. The six year transition away from direct fire

ambushes to IED attacks and the sustained large changes in the number of effective incidents year after year reveal a very long process of insurgents discovering their own private information.<sup>14</sup>

The problem of private information in the form of highly decentralized knowledge, which is constantly changing as opponents adapt to one another, is all the more serious for the bargaining process if it is too complex for the information revealing properties of warfighting to cope with. War is widely treated as a quick and reliable method of revealing private information in the bargaining failure literature. The more warfighting struggles to reveal relevant private information, the longer that war must become before a bargain can be reached. Smith and Stam have argued that technological change could cause beliefs about the probability of victory to diverge but there is currently a hole in the bargaining failure literature regarding whether or not technological change can occur rapidly enough within a given war to explain why, for instance, insurgencies last so much longer than other wars.<sup>15</sup>

The vast number and heterogeneity of inputs into improvised weapons offers great adaptability to the improviser. This adaptability is, in reality, technological change tailored to meet the demands of the situation the improviser faces. Where new models of traditional military capital, like jets, can get stuck in development for decades, the makers of IEDs in Afghanistan and Iraq were often able to alter their designs within months, making previously useless bombs useful once again. The constant changes and improvements made just to the subset of IEDs known as remotely triggered IEDs serves as an excellent demonstration of how the information-revealing properties of warfighting can be outpaced by the rate of technological change.

Remotely triggering IEDs is generally the preferred method of detonating IEDs because of the safety it offers the triggerman and the flexibility it allows in timing attacks. These properties provide ample incentive to improvise new remote triggering devices when old ones are countered, even when opposition forces are sinking nearly a billion dollars into anti-remote triggering measures year after year. Afghan insurgents began remotely detonating IEDs with a very crude weapon called the Spider as early as 2002, before JIEDDO had been formed. The Spider used radio receivers and digital signal decoders like those found in commercially available walkie-talkies, lamp bases from fluorescent lights converted into firing circuits, and whatever explosives were available. Pre-JIEDDO efforts such as the Warlock family of jammers were intended to jam the frequencies these devices operated on or to pre-detonate them, and they were successful at first. This spurred improvisers to search for alternate remote triggering methods. Improviser

search of local civilian goods revealed garage door openers and key fobs which operated at a lower power level than what the Warlock could pick up and modify in time to work. A back and forth between new remote triggers and jamming on new frequencies and power levels ensued until somewhere between 2006 and 2007 when JIEDDO combined a variety of jammers so as to win the fight over the use of the electromagnetic spectrum. By the end of 2007 JIEDDO had increased the number of jammers being used by the Army and Marine Corps up to 37,000 and was claiming to have reduced the use of remote triggering across Iraq and Afghanistan from 80 percent of IEDs with identified triggering mechanisms to 20 percent. However, the same also report notes that the number of IED incidents in Afghanistan grew during that same year, and while remote triggering fell out of favor in Iraq it continued to be the preferred method of detonation in Afghanistan. The different contexts in which the wars were taking place produced different results for JIEDDO's countermeasures, and even what success they had would be short-lived.<sup>16</sup>

In December of 2007, Lieutenant General Thomas Metz became head of JIEDDO, when jamming efforts were enjoying overall increased success. Two years later, in October 2009, in a Congressional hearing on defeating IEDs he was asked to comment on the performance of the jamming technologies that JIEDDO continued to invest in. His response was:

“Well, sir, it was interesting when I took over from General Meigs, he said, ‘The good part about your tenure is you are going to be out of the jamming business.’ The problem is the enemy votes, and the enemy has stayed adaptive in his use of the electromagnetic spectrum. So although we thought we had done enough in the jamming business that it would then transition to the services, we needed to stay in the jamming business because the enemy decided to move to different frequencies and make things more complex.”<sup>17</sup>

The fight for the electromagnetic spectrum had been going on for over five years by the time General Meigs made his claim about being out of the jamming business. He believed that the march toward certainty about relative capabilities had been completed, but in 2008 JIEDDO was still funding jammer research and updates while increasing the number of deployed jammers up to 47,000. In 2009 Lieutenant General Metz was admitting that the jamming approach to defeating IEDs cost “... in a couple of those years close to \$1 billion” and that remotely detonated IEDs remained a significant concern. The JIEDDO annual report for 2010 gives little detail on the actual jamming technologies pursued but does still have

them listed as an ongoing investment, and therefore an ongoing threat.<sup>18</sup>

The eight years between the Spider and JIEDDO's 2010 annual report were characterized by constant change and uncertainty in the fight over remotely detonated IEDs, contrary to what the bargaining failure theory would predict after such a long period of fighting. JIEDDO annual reports from 2006, 2007, and 2008 all cite the three trillion dollars in annual investment worldwide by the information technologies industry as providing ample resources for insurgents to use as substitutes for older remote triggering methods. JIEDDO's 2009 annual report specifically gives credit to frequent advancements in commercial cell phone and radio technologies as the factor enabling insurgents to innovate on remote triggering methods faster than JIEDDO could innovate on jamming technologies between 2002 and 2008. Mobile phone subscriptions in Afghanistan increased from 470,000 in 2004 to 12.5 million in 2010, meaning cell phones became commonly available for improvisation during the occupation. Cell phones were favored inputs for more than just their ability to send signals. Modern cell phones can overcome connection problems such as reflected signals and transmission errors, and these features unintentionally helped insurgents defeat even the combined efforts of the Warlock jammers in operation prior to 2006. The ubiquity of these phones, their robustness against signal jamming, and the multiple frequency bands they could operate on made them the preferred remote triggering method in Afghanistan up through 2007.<sup>19</sup>

The incremental progress of JIEDDO's jamming systems eventually drove up the relative cost of remote detonation for Afghan insurgents enough so as to cause them to favor other triggering methods such as victim-operated or command-wire detonated, although they never forced them off remote detonation altogether. By 2010 Afghan insurgents had had roughly three years of high operating costs in remote detonation thanks to JIEDDO's jammers. Three years of search spurred by these costs led improvisers to discover a substitute that used the unique high-powered radio waves produced by Coalition jammers as a triggering mechanism. Such an IED makes the use of jammers dangerous and opens the door again for developments in remote detonation if jammers are turned off to avoid it, sparking a new round of discovery regarding relative capabilities.<sup>20</sup>

In this one subtype of IED alone there were eight years of search and uncertainty. The continuous pressure of occupation led to sustained innovation, made possible by unaccounted for masses of adaptable civilian goods and resources and which lasted far longer than existing theories allow for. The technological change made possible by improviser adaptation

was aided by civilian technological development. New cellular technologies and hardware are constantly being put out to the market and, combined with the improviser's ability to iterate on designs quickly, the result is a rate of technological change that can frustrate war's information-revealing properties within a given war rather than in the longer periods between wars.

### Conclusion

Weapons improvisation helps weaker belligerents frustrate better armed and funded militaries by creating uncertainty around important military capabilities. Improvisation is a form of substitution, and substitution spurred by a cost increase increases with time. The counterinsurgency strategies that prevail today depend on long time lines to subdue the insurgency and address its social, political, and economic roots. Counterinsurgency strategies that depend on long time lines to perform "clear, hold, and build" operations play directly into the strength of weapons improvisers who use that time to find substitutes. Moreover, counterinsurgency best practices usually involve foot patrols that put counterinsurgents in closer contact with the local populations they wish to influence. Without this close contact the counterinsurgent has difficulty gaining the trust of the population and gaining access to local intelligence. Improvised weapons like IEDs tend to push counterinsurgents into the greater protection of vehicle-mounted patrols, which prevents them from easily interacting with the local population that is supposed to be their prize. Given these difficulties, a second look is necessary whenever planning a war against what appears to be a weak opponent. Their apparent weakness could quickly turn into adaptability sufficient to resist overly optimistic foreigners. If a nation is dead set on fighting a weaker opponent, this analysis of weapons improvisation suggests a quick and limited war with goals and time lines drastically cut back—where feasible in political, budgetary, military, moral, and other ways.

### Notes

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1. Main explosive charge: Higginbotham (2010).
2. Bargaining failure literature: Blainey (1988); Fearon (2004); Powell (2004). Three main explanations: Fearon (1995). On bargaining and bargaining theory generally, see Anderton and Carter (2009); Anderton (2017).
3. Gain strategic advantage: Powell (1993).
4. Weakness of local governments: Fearon and Laitin (2003); Fearon (2004); Walter (2009).

5. Peaceful negotiation: Fearon (1995). Invest in military capabilities: Meirowitz and Satori (2008).
6. Superior knowledge: Fearon and Laitin (2003); Fearon (2004); Walter (2009).
7. Not thought to change much: Fearon (2004). Intense pressure to capitalize: Blainey (1988); Fearon (1995); Wagner (2000); Powell (2004).
8. Entrepreneurship does not feature: Reiter (2003). Subsequent bargaining phase: Meirowitz and Satori (2008). Assessments between wars: Smith and Stam (2004).
9. Hayek: Hayek (1948).
10. Central planner: Hayek (1948).
11. Explosives from multiple sources: JIEDDO (2011); Burton (2007); Dawar and Abbot (2012).
12. High prices: Abbot and Dawar (2012). Explosive yields: Mulrine (2008).
13. March 2002: Shachtman (2011). April 2008: JIEDDO (2008). 2009: Allison, Cordsman, and Lemieux (2010).
14. Effective incidents increased: Allison, Cordesman, and Lemieux (2010). 2011: Dao and Lehren (2010); Porter (2012).
15. War is widely treated: Blainey (1988); Fearon (1995); Wagner (2000); Powell (2004). Insurgencies last longer: Smith and Stam (2004).
16. Anti-remote triggering measures: Snyder (2009). As early as 2002: Shachtman (2011). Search of local goods: Shachtman (2011). By end of 2007: JIEDDO (2007).
17. Quote: Snyder (2009).
18. Up to 47,000: JIEDDO (2008). Annual report 2010: JIEDDO (2010).
19. Annual reports: JIEDDO (2006, 2007, 2008). 2009 annual report: JIEDDO (2009). Mobile phone subscriptions: Harpur (2017). Unintentionally helped insurgents: Shachtman (2011).
20. Three years of search: Higginbotham (2010).

### References

- Abbot, S. and R. Dawar. 2012. "Farmers Angry at Counter Terror Tactic in Pakistan." Available at <http://www.sandiegouniontribune.com/sdut-farmers-angry-at-counterterror-tactic-in-pakistan-2012sep13-story.html>.
- Allison, M., A. Cordsman, and J. Lemieux. 2010. "I.E.D. Metrics for Afghanistan January 2004 – September 2010." Available at [https://csis-prod.s3.amazonaws.com/s3fs-public/legacy\\_files/files/publication/101110\\_ied\\_metrics\\_combined.pdf](https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/101110_ied_metrics_combined.pdf).
- Blainey, G. 1988. *Causes of War*. 3rd ed. New York: The Free Press.  
<https://doi.org/10.1007/978-1-349-19395-0>
- Anderton, C.A. 2017. "The Bargaining Theory of War and Peace." *The Economics of Peace and Security Journal*. Vol. 12, No. 2, pp. 10–15.  
<https://doi.org/10.15355/epsj.12.2.10>

- Anderton, C.A. and J.R. Carter. 2009. *Principles of Conflict Economics*. New York: Cambridge University Press.  
<https://doi.org/10.1017/CBO9780511813474>
- Burton, F. 2007. "The Imminent Spread of EFPs." Available at [https://www.stratfor.com/imminent\\_spread\\_efps](https://www.stratfor.com/imminent_spread_efps).
- Clausewitz, C. 1976 [1832]. *On War*. Edited by M. Howard and P. Paret. Princeton, NJ: Princeton University Press.
- Dao, J. and A. Lehren. 2010. "Grim Milestone: 1000 Americans Dead." Available at <http://www.nytimes.com/2010/05/19/us/19dead.html>.
- Fearon, J.D. 1995. "Rationalist Explanations for War." *International Organization*. Vol. 49, No. 3, pp. 379–414.  
<https://doi.org/10.1017/S0020818300033324>
- Fearon, J.D. 2004. "Why Do Some Civil Wars Last So Much Longer Than Others?" *Journal of Peace Research*. Vol. 41, No. 3, pp. 275–301.  
<https://doi.org/10.1177/0022343304043770>
- Fearon, J.D. and D.D. Laitin. 2003. "Ethnicity, Insurgency, and Civil War." *American Political Science Review*. Vol. 97, pp. 75–90.  
<https://doi.org/10.1017/S0003055403000534>
- Harpur, P. 2017. "Afghanistan—Telecoms, Mobile and Broadband—Statistics and Analyses." Available at <https://www.budde.com.au/Research/Afghanistan-Telecoms-Mobile-and-Broadband-Statistics-and-Analyses>.
- Hayek, F.A. 1948. *Individualism and Economic Order*. Chicago, IL: The University of Chicago Press.
- Higginbotham, A. 2010. "U.S. Military Learns to Fight Deadliest Weapons." Available at [https://www.wired.com/2010/07/ff\\_roadside\\_bombs/](https://www.wired.com/2010/07/ff_roadside_bombs/).
- JIEDDO. 2006. *Annual Report 2006*. Available at [https://www.jieddo.mil/content/docs/2006\\_JIEDDO\\_Annual\\_Report\\_\(U\).pdf](https://www.jieddo.mil/content/docs/2006_JIEDDO_Annual_Report_(U).pdf).
- JIEDDO. 2007. *Annual Report 2007*. Available at [https://www.jieddo.mil/content/docs/2007\\_JIEDDO\\_Annual\\_Report\\_\(U\).pdf](https://www.jieddo.mil/content/docs/2007_JIEDDO_Annual_Report_(U).pdf).
- JIEDDO. 2008. *Annual Report 2008*. Available at [https://www.jieddo.mil/content/docs/20090625\\_FULL\\_2008\\_Annual\\_Report\\_Unclassified\\_v4.pdf](https://www.jieddo.mil/content/docs/20090625_FULL_2008_Annual_Report_Unclassified_v4.pdf).
- JIEDDO. 2009. *Annual Report 2009*. Available at [https://www.jieddo.mil/content/docs/20090909\\_FULL\\_2009%20Annual%20Report\\_Unclassified\\_v1\\_lr.pdf](https://www.jieddo.mil/content/docs/20090909_FULL_2009%20Annual%20Report_Unclassified_v1_lr.pdf).
- JIEDDO. 2010. *Annual Report 2010*. Available at [https://www.jieddo.mil/content/docs/JIEDDO\\_2010\\_Annual\\_Report\\_U.pdf](https://www.jieddo.mil/content/docs/JIEDDO_2010_Annual_Report_U.pdf).
- JIEDDO. 2011. "Victim Operated Improvised Explosive Device (VOIED) Recognition Guide—Afghanistan." Available at [https://www.jieddo.mil/content/docs/VOED%20Guide\\_Final\\_v1.1.pdf](https://www.jieddo.mil/content/docs/VOED%20Guide_Final_v1.1.pdf).
- Meirowitz, A.H. and A.E. Satori. 2008. "Strategic Uncertainty as a Cause of War." *Quarterly Journal of Political Science*. Vol. 3, No. 4, pp. 327–352.  
<https://doi.org/10.1561/100.00008018>
- Mulrine, A. 2008. "Taliban's New Super-Bomb Threatens US Troops, Even in Pricey MRAPs." Available at <http://www.usnews.com/news/iraq/articles/2008/10/31/talibans-new-super-bombs-threaten-us-troops-even-in-pricey-mraps>.
- Porter, G. 2012. "How the U.S. Quietly Lost the I.E.D. War in Afghanistan." Available at <http://www.ipsnews.net/2012/10/how-the-u-s-quietly-lost-the-ied-war-in-afghanistan/>.
- Powell, R. 1993. "Guns, Butter and Anarchy." *American Political Science Review*. Vol. 87, No. 1, pp. 115–132.  
<https://doi.org/10.2307/2938960>
- Powell, R. 2004. "Bargaining and Learning While Fighting." *American Journal of Political Science*. Vol. 48, No. 2, pp. 344–361.  
<https://doi.org/10.1111/j.0092-5853.2004.00074.x>
- Reiter, D. 2003. "Exploring the Bargaining Model of War." *Perspective on Politics*. Vol. 1, No. 1, pp. 27–43.  
<https://doi.org/10.1017/S1537592703000033>
- Shachtman, N. 2011. "The Secret History of Iraq's Invisible War." Available at <https://www.wired.com/2011/06/iraqs-invisible-war/>.
- Smith, A. and A. Stam. 2004. "Bargaining and the Nature of War." *Journal of Conflict Resolution*. Vol. 48, No. 6, pp. 783–813.  
<https://doi.org/10.1177/0022002704268026>
- Snyder, V. 2009. "Defeating the Improvised Explosive Device (IED) and Other Asymmetric Threats: Reviewing the Performance and Oversight of the Joint IED Defeat Organization (JIEDDO)." U.S. House of Representatives. Committee on Armed Services. Subcommittee on Oversight and Investigations. Washington, D.C.: U.S. Government Printing Office. Available at <https://www.gpo.gov/fdsys/pkg/CHRG-111hrg54776/pdf/CHRG-111hrg54776.pdf>.
- Wagner, R.H. 2000. "Bargaining and War." *American Journal of Political Science*. Vol. 44, No. 3, pp. 469–484.  
<https://doi.org/10.2307/2669259>
- Walter, B. 2009. "Bargaining Failure and Civil War." *Annual Review of Political Science*. Vol. 12, pp. 243–261.  
<https://doi.org/10.1146/annurev.polisci.10.101405.135301>