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Governments across the globe have been quick to adapt developments in artificial intelligence to military technologies. Prominent among the many changes recently introduced, autonomous weapon systems pose important new questions for our understanding of conflict generally, and coercive diplomacy in particular. These weapons dramatically decrease the cost of employing military force, in human terms on the battlefield, in financial and material terms, and in political terms for leaders who choose to pursue conflict. In this article, we analyze the implications of these new weapons for coercive diplomacy, exploring how they will influence the course of international crises. We argue that drones have different implications for relationships between relatively equal states than they do for unbalanced relationships where one state vastly overpowers the other. In asymmetric relationships, these weapons exaggerate existing power disparities. In these cases, the strong state is able to use autonomous weapons to credibly signal, avoiding traditional and more costly signals such as tripwires. At the same time, the introduction of autonomous weapons puts some important forms of signaling out reach. In symmetric conflicts where states maintain the ability to inflict heavy damages on each other, autonomous weapons will have a relatively small effect on crisis dynamics. Credible signaling will still require traditional forms of high-cost signals, including those that by design put military and civilian populations at risk.

Increasingly, governments are using artificial intelligence technologies to revolutionize their military capabilities. In many ways, these technologies present the potential to transform the conduct of war and, in so doing, to alter the nature of state-to-state interactions. Prominent among the many changes recently introduced, autonomous weapon systems (AWS) pose important new questions for our understanding of conflict generally, and coercive diplomacy in particular. Automation, the most novel trait of these systems, allows states to deploy military

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force remotely at startlingly low cost. Automated weapons can enter enemy territory without endangering the lives of soldiers, maintain constant surveillance on important targets without risk of fatigue, and deliver deadly and highly precise strikes in an instant. Already, militaries employ remote-operated technologies to capitalize on similar advantages. As the introduction of automation streamlines and centralizes the planning and conduct of conflict, militaries will come to rely ever more on systems which build upon and extend these features. For example, U.S. military planning emphasizes the need to develop a "global surveillance and strike network" (GSS). This is expected to rely heavily on autonomous weapons. According to a key planning document: "while many elements of the U.S. would have important roles to play in a future GSS network, it would rely disproportionately upon air and maritime forces in general *and unmanned platforms in particular*."[1]

Most importantly, AWS appear to have dramatically decreased the costs of fighting a war. First, the ratio of capital to labor inputs for the conduct of war has drastically shifted. Although they require an investment cost upfront in their design and development, once built, these weapons impose minimal risk to the lives of their operators and require remarkably less labor for their effective performance. For the first time in history, the soldier who pulls the trigger need not be present on the battlefield. Consequently, AWS save on the enormous costs that have been spent in human sacrifice throughout the tragic history of conflict. This is important not only for the direct reason that it reduces danger to military personnel, but also, more broadly, because it offers a more "palatable" way to conduct war. As domestic publics grow increasingly distasteful of violence and casualties, leaders, particularly those held directly accountable to their publics, have found it increasingly difficult to pursue conflict.[2] AWS offer a way to do so with minimal risk to the lives of soldiers, thereby greatly reducing the political and reputation costs suffered by

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states that choose to go to war. For example, while the US lost a full 10% of its aerial personnel in Vietnam, there was not a single pilot causality among a total of 568 drone strikes conducted by the US from 2002 to 2015.[3] By avoiding large-scale causalities, leaders who engage in conflict can also avoid the domestic and international opprobrium that might otherwise impose heavy costs. Additionally, these systems are significantly cheaper to employ. While upfront investment costs are certainly not small, when viewed in comparison with the costs invested in other advanced manned-aircraft, missile technology, or nuclear capabilities, AWS are a relatively cheap technology.[4] Thus, while revolutionary in a number of regards, automated weapons are particularly notable for the ways in which they decrease the costs of conflict financially, politically, and in terms of human sacrifice. Because these costs are extremely important to the existing understanding of coercive diplomacy, we explore how these weapons affect the use and perception of threats in international crises.

In this article, we analyze the implications of AWS for signaling between states. A well-established set of results from the literature on interstate bargaining asserts that credible communication between adversaries sometimes requires signals to be costly. All states, including those unwilling to actually follow through on a threat, stand to benefit from successfully coercing an opponent. As a result, states on the receiving end find it difficult to determine whether or not a given coercive threat demonstrates the sender's genuine intent and willingness to engage in conflict. When these signals are costly to make, however, those who are not truly resolved to follow through will be unwilling to undertake them, thereby allowing the receiver to distinguish between genuine and non-genuine threats. Key to this argument is that the costs of signaling must be sufficiently high such that bluffing states will prefer not to make an empty threat, even when it would be believed. Some rationalist

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theories have therefore argued that only high-cost signals which risk causalities or impose a hefty financial burden are sufficient. Given that the conduct of war with autonomous weapons involves little risk to human life and is drastically cheaper than ever before, are such high-cost signals still necessary? Is it possible to use these weapons to credibly signal intent and successfully coerce opponents when they are so remarkably cheap both financially and politically to deploy?

We focus on how a challenger's acquisition of AWS against a target without these capabilities will affect signaling. We argue that, where AWS lower costs of conflict, states are able to credibly signal intent with certain types of low-cost signals. When powerful states develop these technologies and face much weaker opponents, they will find that communicating credible intent requires less need to pay costs in the form of mobilizations, tripwires and the staking of bargaining reputations. In limited-war contexts where the anticipated costs of war are low, the mobilization of drones and other commensurately low-cost autonomous weapons systems can still send a credible signal of resolve. The new technologies influence not just the level of cost associated with credibility, however, but also the availability of certain other types of costly signals. This might suggest that states will turn toward costless diplomatic signaling in response, but we argue that power asymmetries will hinder the effectiveness of diplomatic signals as well. Rather, in crises over specific issues, states are likely to depend upon staking and defending reputations for resolve more than they did in the past; in some cases, this will imply a greater likelihood of conflict.

We argue further that while the costs of employing force with autonomous weapons may be dramatically low, the costs of war do not necessarily lower significantly. Where an adversary retains the ability to impose substantial damage on a state's society, the costs of war remain high. As a result, conflicts between AWS-endowed

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challengers and non-AWS-armed targets do not necessarily involve a large shift in relative war costs. We argue that threats backed by the mobilization of autonomous weapons systems are unlikely to be able to demonstrate resolve when the costs of war are moderately high. In these cases, the inevitable large societal sacrifice that would result from costly conflict entails the continued need for signals of resolve to be associated with high costs. We therefore expect that, when facing a relatively strong opponent, states with AWS capabilities will rely on certain traditional forms of costly signaling. These include voluntarily placing tripwire forces in harm's way and risking heavy casualties or investing in financially burdensome preparations.[5]

The Bargaining Model of War

To understand how autonomous weapons might change the conduct of international conflict, one must first start with an understanding of how crises have been conducted and understood in their absence. A fundamental dilemma in any given international dispute arises from two essential facts. First, no opponent can ever truly know another state's willingness to go to war. Second, unresolved states always have incentives to bluff, and issue empty threats, when doing so will successfully coerce an opponent. If a challenger knows its opponent will concede to a threat, it has enormous incentive to make this threat as convincingly as possible, even if it is not actually willing to follow through. This behavior, in turn, makes all target states dubious that a coercive threat against them is genuine. The crisis bargaining literature has long sought to address how states can escape this problem and make credible threats that successfully communicate a genuine intention to follow-through.

A core thesis of this literature contends that threats are only credible when they are costly to make. Typically, these game theoretic models involve two players, a target

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who receives some form of threat, commonly referred to as a signal, and a challenger who makes this threat. States make decisions rationally, based on cost-benefit calculations, and both seek to maximize their share of some good in dispute. Challengers who value the good highly or have a high probability of winning compared to the costs of fighting are resolved to fight should the conflict escalate that far. Threats made by resolved challengers are therefore genuine. On the other hand, when costs of war outweigh the benefits of fighting and winning the good, challengers are unresolved. While these states wish to possess the good, they are unwilling to suffer the costs of conflict required to fight for it. Threats made by unresolved challengers are therefore disingenuous bluffs that they will not see through. Generally, a target on the receiving end of a coercive signal has no way of knowing whether or not the threat is genuine because the challenger's value of the good or costs of war are private information, only known to the challenger. When threats are costly to make, however, unresolved challengers will be dissuaded from bluffing because they are unwilling to bear the costs required to send the coercive signal. By weeding out the unresolved bluffing states in this way, costly signaling allows a resolved challenger to credibly communicate its intent and allows the target to distinguish between genuine and non-genuine threats.

Traditional models of costly signaling have focused on two main ways to incur costs and communicate resolve. The first focuses on sunk-cost signals where the challenging state invests in efforts that are, in themselves, costly to undertake (Fearon 1997). Typically, these costs are borne through mobilization and preparation for war. By showing a willingness to undertake actions that, by their nature are costly to perform and difficult to reverse, states can credibly communicate their willingness to fight.[6] This logic helps to explain why states often forfeit the benefits of a surprise attack and instead make overt preparations for war that are insufficient to give the

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state any realistic strategic advantage. For example, the U.S. has sent military assets into a tense region even though the addition of these assets does not greatly affect the balance of power. Further, investing in arms building and certain weapons technology may be more significant in its capacity to demonstrate a willingness to bear costs in preparation for conflict than in the ways these weapons influence military effectiveness and capability on the battlefield.

The second form of costly signaling operates through a so-called tying-hands mechanism. These signals do not impose any cost when they are made initially, but in the event that the issuer backs down they impose a heavy cost. In this way, they tie the hands of those who make them. Fearon argued that one prominent form of tying-hands signal comes through public statements and domestic audiences. According to this argument, domestic observers punish a leader for issuing threats, in so doing, "engaging the national honor," and subsequently backing down.[7] Particularly in democratic states where leaders are held directly accountable to their domestic public through regular elections, leaders are thought to be highly concerned with public opinion and keen to avoid incurring any political and reputation costs for failing to follow through on a threat. As a result, leaders who are not truly resolved to fight will be unwilling to expose themselves to the risk of having to go back on their word and of incurring these so-called audience costs. In this way, verbal threats which in themselves do not carry a cost can still credibly demonstrate resolve when publicly issued.

Many real-world signals have both sunk cost and tying-hands aspects to them. Mobilization for war incurs costs that are paid whether or not the war is fought, making it a sunk cost signal. But if a significant part of the cost of conflict involves moving troops and military hardware into the theater of conflict, mobilization is also a tying-hands signal because it affects the relative value of choosing peace or war in

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the future.[8] Tripwire forces are another example of a signal that contain elements of each type. In these cases, troops are deployed near the border with the target but are much smaller in size and capability than the target's forces. As such, these forces give little military advantage to the challenging state and would be easily wiped out by the target were war to break out. Any conflict in the region would essentially guarantee a substantial loss of the challenger's troops, and this, in turn, would quickly galvanize the challenging state and its domestic public into a full-scale war effort. The main purpose of deploying these troops is therefore not to gain any strategic advantage but rather to demonstrate willingness to enter conflict. Since this is done by influencing the relative political cost of entering the conflict or staying out in the future, this is a tying-hands signal. But since the risk of loss of life incurred and the costs of maintaining and mobilizing the troops must be paid regardless of whether conflict occurs, it is also a sunk cost signal.

Bargaining with Autonomous Weapons Systems

In contexts where revolutionary, low-cost military technology dramatically reduces war costs, how is credible signaling conducted? Given that autonomous weapons systems are exceptionally cheap to deploy, are leaders still able to forward deploy these weapons as a form of sunk-cost signal? Can leaders use AWS to send hand-tying signals when the use of these weapons draws far less public and political attention? We argue that the answer to these questions depends on the type of conflict involved. Autonomous weapons have very different consequences in asymmetric conflicts where relative costs of war are highly skewed than they do in more balanced, symmetric disputes.

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It is important to note that the concept of symmetry of war costs between the target and the challenger is distinct from the resolve of the players. In asymmetric relationships, the challenger, regardless of its resolve to fight, faces very low relative costs of war. In symmetric relationships, however, the costs of war are fairly balanced between the target and the challenger, again regardless of the challenger's resolve. This is most easily understood through the simple equation relating the costs of war to the benefits of winning. Let the probability that the challenger wins the war be p, its value for the good in dispute be v_c, and its costs of war be c_c. We can then state, according to expected utility theory, that if $pv_c \cdot c_c > 0$ the challenger is resolved to fight. Similarly, the cost-benefit calculus for the target is to be resolved to fight if $(1-p)v_t \cdot c_t > 0$. In a symmetric relationship $c_c \cdot c_t$, and in an asymmetric relationship c_c is much less than c_t. In each relationship type, we can further categorize challengers as resolved or not by evaluating whether $pv_c \cdot c_c$ is greater than zero. In other words, two challengers might have exactly the same war costs c_c such that the symmetry of the relationship to the target is the same, but different values of pv_c such that one is willing to fight, and the other is not. In the following sections, we discuss how the introduction of autonomous weapons affects the dynamics of credible signaling within symmetric and asymmetric relationships separately. The challenge of credibly communicating resolve remains in each case since there are resolved and unresolved challengers in both, but the effects of AWS diverge.

Effective Signals in Asymmetric Relationships

When the costs of conflict for the challenger decrease, the costliness of the signal can be smaller as well. This can be seen in models analyzed in Fearon (1997). In both

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sunk-cost and tying-hands signaling models, the equilibrium cost that highly resolved states employ to credibly signal their resolve decreases as the costs of war decrease. With low war costs, states are more willing to contest issues, making their threats inherently more credible. The intuition of this result is straightforward. When it is not very costly for an opponent to follow through on a threat, the receiver is more likely to take it seriously. For example, imagine that a challenging state mobilizes autonomous weapons and readies them at the border with the target. In the asymmetric case, the opponent can keep war limited to only these low cost autonomous forces and would therefore suffer only minimal cost to follow on the threat and engage in conflict. The target, knowing how easy and cheap it would be for the challenger to follow through, is therefore very likely to take the threat seriously. In other words, because war itself is not highly costly, states do not need to demonstrate a willingness to bear large sacrifices in order to demonstrate their resolve to fight. Thus, it is not self-evidently the case that AWS make signaling resolve harder, as some have argued.[9] Specific capabilities of AWS enhance these effects. Two of the most important are the ability to sustain operations at low cost and target objectives precisely, reducing costs that may arise from collateral damage (Zegart 2018).

Autonomous weapons do not merely reduce the costs of conflict, however. They also reduce the costs of deploying force abroad, an action that has traditionally been used as a sunk-cost signal of resolve to fight. Because AWS are costly to build but relatively cheap to mobilize and deploy, the cost and time required to deploy force abroad has been greatly reduced. Further, AWS capabilities are also replacing traditional force projection capabilities in military planning. For example, air defense and missile capabilities make more traditional surface ships and aircraft increasingly vulnerable.[10] According to the so-called “Third Offset Strategy” unveiled by US

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Secretary of Defense Chuck Hagel in 2014, AWS technologies are the appropriate response to these "anti-access / area denial" or "A2AD" capabilities being developed by other powers.[11]

Because militaries have long used mobilization and preparation for war to send high-cost signals of resolve to fight, the replacement of traditional military hardware with AWS carries significant implications for signaling. This is particularly true for sunk-cost signals that are applied to particular foreign policy issues in shorter-term crises. To be clear, many sorts of sunk cost signals will remain, such as the production and forward installment of arms from AWS to missile silos. These actions, however, are typically tied to signals of general resolve to defend broad interests and regions, or sustain power projection capabilities and great power status. Such signals are less relevant to signaling about particular issues in a specific crisis between two opposing states. Deployment and mobilization decisions have often played important roles in signaling intent and resolve in such cases. As the costs of utilizing these traditional, labor-intensive signals grow comparatively larger and larger next to the costs of employing AWS, however, it is unlikely that states will continue to use them. As cheaper autonomous weapons technologies advance, traditional, high-cost signals like tripwires are likely to be seen as far too costly for the scope of the challenge. Game theorists will point out that these high-cost, traditional signals will always exist since, theoretically, even the burning of money may serve as a costly signal. In reality, however, no political leader has ever been willing to do this directly. Political leaders will always look for signals that achieve the desired end at minimal cost. What might these cheaper alternatives be?

One might expect that states would turn to closed-door diplomacy associated with costless signaling mechanisms. If AWS increase power asymmetries, however, many forms of diplomatic signaling will be unavailable as well. Diplomacy typically

convinces by taking on some form of risk. For example, making a demand may risk that an adversary forms an opposing coalition, strikes first, or builds more arms than it otherwise would have. Similarly, insisting on a highly favorable outcome in negotiations may jeopardize the possibility of achieving an intermediate compromise, or may increase the likelihood that negotiations will break down leading to the outbreak of conflict. However, when the power differential between two states is extremely large, as it is in asymmetrical relationships, the adverse consequences risked through the conduct of forceful diplomacy disproportionately rest on the weak state. The powerful state, on the other hand, has little to lose because even if diplomacy fails entirely and war breaks out, its overwhelming power likely ensures that it will easily win the conflict. This can make it very difficult for powerful states to take on the risk necessary to facilitate credible diplomacy. Where AWS exacerbate already extreme power asymmetries, this problem is likely to intensify. The fact that the target of coercion is less willing to resist because of the sheer overwhelming power of the coercing state, or that the target's countering actions are less consequential, can imply that the most powerful states have less ability to use costless diplomacy to avoid conflict.[12] The result is a "Goliath's Curse" – states with extreme power lose the ability to signal in certain ways.[13]

In cases where AWS create asymmetries of power and cost, a clear signaling possibility remains, namely, tying-hands signaling based on reputation.[14] The essential task for the target in any signaling interaction is to form accurate beliefs and expectations about the challenger's true intentions based upon the information it gathers by observing the challenger's behavior. The game-theoretic crisis bargaining models often allow the challenger only one action to affect the target's beliefs. In the real world of international politics, however, these expectations and beliefs are

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not limited to this one-shot interaction in the context of a specific dispute. On the contrary, the target often has a long history of direct interaction with the challenging state and has observed its behavior with others over time and across diverse contexts. In this way, reputation and status produce expectations about a challenger's behavior generally which then shape expectations about its resolve to fight in particular circumstances. As such, developing and maintaining a certain reputation remains an important way to establish the credibility of one's stated intent in any given crisis. A reputation for following through on commitments, for resolve, for military strength and capability, for high cost tolerance, or for perseverance could convince a target that concession is optimal.

Compared to other forms of signaling, reputation signals of resolve have the property that they often increase the likelihood of conflict (Fearon 1997, Sartori 2005). Importantly, reputation is built upon a consistent pattern of behavior. Acting in ways that are inconsistent with or harmful to one's current reputation will alter it. This may impose costs later on as observers form new, different expectations. As a result, the incentive to maintain a reputation often provides an additional incentive for war, and one that can apply to both sides at once. Because all states desire a reputation for resolve, target states which might otherwise concede to the challenger's demand may be pressured to stand firm in order to maintain their reputation. Similarly, challengers who initially miscalculate such that the target refuses to accept a demand when the challenger had counted on a concession may wish to negotiate a different mutually-agreeable settlement. If backpedaling and renegotiating damages the challenger's reputation by making it appear pliable or irresolute in the face of defiance, however, the challenger may also prefer to go to war to preserve its reputation. That said, reputation signaling also reduces the states' need to fight by allowing actors to better communicate what they are willing

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to fight for. Nevertheless, the use of reputation signals instead of others usually increases the likelihood of conflict. Thus, as AWS exaggerate asymmetries of power and other traditional forms of signaling appear enormously costly in comparison, states may turn more and more to reputation as the basis of credibility and this, in turn, may tragically increase the incentives for war for both the target and the challenger.

Finally, autonomous weapons systems may alter the frequency and form of asymmetric conflict. A reduction in war costs corresponds directly to an increase in resolve through a basic cost-benefit analysis. Simply put, a state is more likely to find that the benefits of pursuing both conflict and coercive diplomacy outweigh the costs when these costs are lowered. This is of particular interest for borderline issues where the sudden reduction in war costs changes the state's preferences for pursuing the issue. Prior to the acquisition of autonomous weapons, a state would have seen the cost of pursuing these issues as greater than the benefits, and therefore preferred to let the status quo continue. After the introduction of autonomous weapons, however, a state might suddenly find the benefits outpacing the now drastically reduced costs and would thus choose to pursue the issue. An implication may be that states that gain autonomous weapons will begin to pursue a new set of issues for which they have relatively low resolve, but where the costs of war are even lower as a result of AWS capabilities. This may mean that AWS-endowed states issue more threats over relatively low-level issues compared to their conventionally armed counterparts. Future work should focus on exploring the observable indications of this change in behavior empirically. U.S. involvement in affairs around the globe, outside of a Cold War context, is often thought of as a new imperative resulting from the War on Terror, but it may also represent the decreased costs of involvement through drones in Pakistan, Afghanistan, Yemen and

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elsewhere. Indeed, existing literature suggests that as war costs lower, the probability of conflict increases.[15] AWS capabilities will likely increase this trend.

In sum, states possessing AWS in asymmetric conflicts can credibly signal at low-cost, but this is far from the only implication of this technological revolution. States only need to demonstrate a willingness to engage in behavior that is proportionately costly to their anticipated costs of war. Because AWS dramatically lowers a challenger's war costs in an asymmetric conflict, low-cost signals are credible in these cases. At the same time, however, low costs of mobilizing for particular conflicts, combined with power asymmetries, imply that some traditional signals will lose their efficacy. Traditional signals, particularly those involving the risk of fatalities, will be seen as imposing far greater cost than appropriate or necessary. As AWS further exacerbates power inequalities, strong states may find it more and more difficult to conduct some forms of closed-door diplomacy. As a result, states may become increasingly more dependent on the hand-tying signals of staking and preserving their bargaining reputations, even though this will sometimes lead to unwanted conflicts. Finally, powerful states with AWS capabilities are likely to face new incentives to pursue low-level disputes. Given that this technology makes it easier and cheaper for strong states to deploy force and make credible low-cost threats, we may observe an increase in the number of new issues pursued by strong states toward their weak counterparts.

Effective Signals in Symmetric Relationships

While possession of autonomous weapons drastically lowers a state's costs to deploy force abroad, it may not necessarily decrease the costs of war at home. It is important to remember that a state's costs of war are largely driven by the harm imposed by the opponent. An adversary may still employ tactics or capabilities that

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result in very costly destruction and loss of human life, and these costs are not likely affected by the introduction of autonomous weapons. In particular where intensive attacks occur on one's own soil, devastating destruction is likely not reduced by the development of AWS. We define cases where opposing sides possess a similar potential to impose substantial costs on each other to be symmetric relationships. No matter how advanced autonomous weaponry becomes, the basic fact remains that no defense system on the horizon can ever be impenetrable; for the foreseeable future, the proverbial AWS or missile "can always get through." Thus, even if only one side possess AWS, the basic fact that both retain the ability to impose heavy war costs on each other means that traditional, high-cost signals will remain important.

When symmetric conflicts threaten large-scale warfare and heavy war costs, a proportionately larger cost is necessary to demonstrate a willingness to bear these costs and the resolve to go to war. Take the extreme example of two nuclear powers: in this type of symmetric conflict, the costs of war loom extremely large. Mobilizing low cost autonomous weapons against a foe with the potential to unleash nuclear holocaust would be vastly insufficient to demonstrate a willingness to bear such costly devastation. Rather, in cases of large, symmetric war costs, tripwire forces will remain relevant and useful to challengers. As autonomous weapons drive the likelihood that conflict will require human sacrifice lower and lower, willingness to accept the risk of battlefield causalities will become an increasingly potent signal of resolve. Moreover, as AWS replace traditional labor-intensive force projection methods and make force projection less costly, the sunk-cost signaling aspect of military mobilization and preparation will increasingly fail to meet the high cost threshold necessary to credibly signal resolve. As a result, signals will become increasingly important when they demonstrate a willingness to suffer heavy human

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sacrifice, tying hands by ensuring that states would retaliate and fully engage in conflict.

Further, just as in the Cold War, a key set of questions surrounds when AWS-capable adversaries can keep conflicts limited to particular weapons technologies and levels of violence, or whether the risks of inadvertent wars will remain. These risks may be compounded by the speed of AWS technologies and the potential for first mover advantages in combat. Indeed, a crucial advantage of autonomous weapons is that they can observe and act more quickly than humans. This speed, combined with the potential for AWS technologies to initiate disabling strikes may be destabilizing. That is, AWS have the potential to make first strikes against powerful adversaries more attractive military options. As adversaries develop ways of interrupting communications systems, these weapons may become increasingly autonomous. In fact, credible deterrents may require systems that have the autonomy to act even after governments have been destroyed. These factors could increase the risks of crisis escalation and war. AWS systems interacting in unforeseen ways may even produce dynamics like the one that resulted in the 2010 "flash crash" in the U.S. stock market when high-frequency trading algorithms generated an extreme change in asset prices.[16] On the other hand, autonomous systems, in reducing human error and being free from aspects of human crisis psychology, may also reduce the likelihood of conflict. These are critical areas for future research.

Conclusion

In this article, we have argued that autonomous weapons have important implications for threat-making and coercive diplomacy in certain types of conflicts. In asymmetric relationships where a strong state threatens a much weaker target, AWS capabilities

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can drastically lower the costs for the strong state to follow through on a coercive threat. As a result, high-cost signals traditionally used in interstate bargaining are no longer necessary to communicate resolve. This is simply because a credible signal must only demonstrate a willingness to bear costs to a commensurate degree with war costs. That said, autonomous weapons may reduce the effectiveness of signals which previously communicated resolve through costly mobilizations for war. Strong states may also find it difficult to turn to diplomatic solutions in asymmetric conflicts as AWS capabilities exaggerate power disparities, making it harder for the strong state to leverage its willingness to undertake risk to credibly communicate. This may precipitate a switch to establishing credibility through staking reputation, which will increase the incidence of conflict. Finally, by lowering the costs of war, autonomous weapons may spur states to pursue a new set of issues that were previously just below the cost-benefit threshold.

We see less near term change in the signaling dynamics of symmetric conflicts. While these weapons substantially lower the costs to deploy force abroad, they do not guarantee equivalently low war costs. In conflicts between states of similar power and capability, conflict entails heavy costs not only through the deployment of force, but also, more prominently, through the costs of destruction on society. Where an opposing state can impose heavy damage within one's border, war costs remain high in spite of AWS capabilities. As such, credible signaling in these disputes will still rely on a set of traditional, high-cost signals. In particular, as military technologies grow ever cheaper to deploy, willingness to risk fatalities and sacrifice human life is likely to become an increasingly salient, high-cost signal.

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1. Martinage 2014, 49-50, emphasis added.
2. Pinker (2011) and cf. Braumoeller (2013).
3. Serle and Purkiss (2017).
4. Office of Chief Financial Officer (2017), Office of the Undersecretary of Defense (2017).
5. We will use the term "asymmetric conflict" to refer to the type of conflicts where war costs are highly asymmetric, that is, where one state possesses sophisticated AWS technologies that significantly lower war costs and the other does not have the ability to impose substantial costs on societies in the form of missile attacks and the like.
6. Schelling (1980).
7. Fearon (1994).
8. Slantchev (2010).
9. Zegart (2018) makes the case that AWS generate credibility by lowering the costs of conflict instead of through more traditional costly signaling mechanisms. We agree but expect that costly signals will still be sent and received. They will simply require less cost to credibly signal resolve than those of the earlier era.
10. Cheung and Mahnken (2017, 4-5).
11. The new administration has new names for programs and strategies but in this area, the strategic vision remains largely the same.
12. Trager (2011, 490-91).
13. Sechser (2010), Trager (2017, 219).
14. See Dafoe, Renshon and Huth (2014) for a review of this literature.
15. Fey and Ramsay (2011), Banks (1990).
16. Scharre and Horowitz (2015).