

Foreign Attacks on Space-Based Assets and Public Support for Retaliation

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Abstract

How well do theories of the domestic politics of international conflict generalize to space-based conflict? We study this question using an experiment embedded in a survey of the American public. In the experiment, we present respondents with a hypothetical scenario in which China attacks U.S. government communication systems. We vary the following elements: whether the attack occurred against space-based or ground-based assets, whether it was a cyber or kinetic attack, repair or replacement time of the equipment, and the number of fatalities. After manipulation, we ask respondents about their level of support for retaliation measures ranging from breaking diplomatic ties to military strikes against China. The results suggest the public does not view space-based conflict differently than a conflict on the ground. However, individuals are more likely to support harsher retaliatory measures in response to kinetic attacks and attacks that produce fatalities.

Keywords: International Conflict, Domestic Politics of IR, Survey Experiments, Outer-Space, Cyber Conflict

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Several rich literatures in international relations suggest the public in democracies can both constrain and compel leaders as they consider responses to foreign aggression. The public may *compel* leaders by demanding action in the face of damage to infrastructure and the loss of life—a kind of “trip wire effect” (Schelling 1960).³ At the same time, leaders in democracies are *constrained* by voters who have little patience for military operations that lack clear objectives and endpoints, incentivizing leaders to respond selectively and, when they do, to fight hard and effectively (Fearon 1994, Reiter and Stam 1998, Kertzer and Brutger 2016, Carter 2017, Crisman-Cox and Gibilisco 2018). While we have learned much from past work on the domestic politics of international conflict and foreign aggression, the emergence of both outerspace and cyberspace as domains of conflict has caused some scholars to question whether the arguments presented in these older literatures still apply (Petras 2002, Gartzke 2013, Kreps 2014, 2023, Horowitz 2020, Falco 2020).

In particular, scholars have studied whether aggression in cyberspace “hits different” because it is often not accompanied by the dramatic physical effects and imagery that attend kinetic attacks, and attribution is often more difficult (McLaughlin 2011, Gartzke 2013, Horowitz 2020, Brantly 2021). For similar reasons, others have questioned whether attacks on national assets in space are likely to mobilize the public to the same degree as attacks on national assets on the ground (Steer 2017, Zhao and Jiang 2019). Much of the existing work on conflict in outer space focuses on theoretical situations, which highlight the “dual-use” nature of satellites and consider the potential for different types of orbital attacks (Petras 2002, McClure 2012, Bardin 2013, Blake 2014, Lubojemski 2019, Falco 2020). And while there has been much-informed speculation on these areas, the observational record is quite thin—as there have been no recorded incidences of

³ Though see Musgrave and Ward 2022.

militarized interstate disputes in outer space. Moreover, if/when space-based and/or cyber conflicts do occur, our analyses of public responses are hampered, in the main, by strategic selection bias on the part of both foreign aggressors and leaders choosing how to respond (Schultz 2001).

In this paper, we sidestep these issues and make progress on questions concerning the domestic politics of space-based conflict using a survey experiment fielded on the U.S. public.⁴ In the experiment, we study whether the public conditions its desired policy responses to foreign aggression on the method of attack (cyber vs. kinetic) and/or the domain of the attack (outer space vs. on the ground). We investigate how public support for a range of retaliatory options changes in response to attacks on ground- and space-based U.S. communication assets. We randomly assigned individuals to a hypothetical but plausible scenario in which China attacks U.S. military communication systems. While we fix the aggressor and type of target, we vary the location of the communications system (space or ground), type of attack used (cyber or kinetic), and time needed to repair the system (days or years). To benchmark the effect of these manipulations, we also included treatment conditions in the ground/kinetic scenarios in which U.S. military personnel are killed. Following treatment, we asked respondents to indicate their level of support for each of the following retaliatory measures: breaking of diplomatic ties, sanctions, cyber attacks, and kinetic attacks.

We find the difference between retaliatory support for ground- and space-based attacks to be both substantively and statistically insignificant. Foreign aggression in space appears to carry the same perception as a ground-based conflict in the minds of the American public. However, the public is about 12 percentage points more supportive of kinetic retaliation in response to kinetic attacks (relative to cyber attacks), whether those attacks occur against space-based or ground-based

⁴ This research was reviewed and approved by our University Institutional Review Board.

assets. We show that this effect is similar in magnitude to fifteen U.S. personnel being killed. These results contribute to the literature on the domestic politics of international conflict by showing that the public generally does not differentiate between foreign aggression against ground-based and space-based assets. At the same time, our results show the public conditions its willingness to retaliate (and how to do so) on the method and material consequences of an attack (Shandler et al. 2021, Leal and Musgrave 2022, Walsh 2015, Walsh and Schulzke 2015, McDonald and Walsh 2021).

Research Design

In the fall of 2022, we fielded our study on a sample of U.S. respondents recruited by Lucid.⁵ Lucid used demographic quotas on age, gender, ethnicity, and region to ensure we had access to a broad and representative cross-section of the public. Of the 3,725 individuals who responded, 2,495 (approx. 66 percent) passed our pre-treatment attention checks.⁶ All respondents read a common introduction:

In the following set of questions, we will ask you about three closely-related, hypothetical scenarios that the United States could face in the future. While they are hypothetical, we have tried to describe them in ways that might closely resemble a real future event. Please read each scenario closely and then indicate your support for the measures described in the questions that follow.

⁵ Coppock and McClellan 2019 show that survey experiments fielded on the Lucid platform return similar results to benchmark national samples. Because of rising inattention among respondents on the platform (Arnold et al 2022), we used two pretreatment attention checks in the survey to screen out inattentive respondents (Berinsky et al. 2021). The first asked respondents to select their favorite color, but the question included additional instructions for the respondent to select the “red” response option to show that they are paying attention. The second asked respondents to agree or disagree that “two is greater than one.” We code those who did not agree with that expression as inattentive. We present results for those that passed both pre-treatment attention checks. Our results are similar if we include inattentive respondents. See the appendix.

⁶ Demographic breakdown is in the appendix.

We then generated three scenarios in which China attacks communications infrastructure in the United States. We varied the scenario in three main ways. First, respondents learned that the location of the attack occurred either against a U.S. communications satellite in space or against a ground communications relay station. Second, respondents were informed that it was either a cyber attack or a kinetic attack with physical explosives. And third, we varied how long the impact of the attack would be felt by variously telling respondents that the interruptions from the attack lasted a few days, a few weeks, or a few years. In addition to these three main treatment arms, some respondents assigned to the kinetic/ground attack scenarios also learned that a number of U.S. military personnel manning the communication relays died in the attacks. We use the effect of these deaths on support to retaliation as a benchmark against which to gauge the magnitude of the effects that we observe in the other arms of the experiment.

Taking motivation from Tomz and Weeks (2021), we selected four retaliatory options that represent a wide spectrum from least to most consequential for an opponent. After reading about the attack, we asked respondents to report their level of support for the following responses: breaking off diplomatic ties with China, sanctions against China's economy, cyber attacks against China's communications infrastructure, and kinetic attacks against China's communication infrastructure. Responses were on a five-point Likert-style scale from "strongly oppose" to "strongly support" with neither option in the middle. For ease of exposition, we dichotomize this scale. We code those reporting any level of support as 100 and all other responses as zero. Results are qualitatively similar if we use the raw scale.

Table 1. Survey Treatment Conditions

Fixed: Aggressor and Victim	Varied: Mode of attack	Varied: Domain of conflict	Varied: Repair time
China attacks on U.S. communications infrastructure.	Kinetic	Ground relay stations (within ground, deaths: 0, 5, 15)	Quick (several days or weeks)
	Cyber	Satellites in orbit	Long (several months or years)

Research Design Motivation

China has emerged as a major challenger to the United States, according to policymakers. With U.S. communications infrastructure heavily reliant on satellite and ground relays, these objects represent likely targets for an adversary seeking to disrupt U.S. government operations. In our scenario, China acts as the aggressor, targeting U.S. relays or satellites in the opening move of a conflict. In such a conflict, China could choose to strike a ground-based relay in the Pacific or a telecommunications satellite in orbit and could do so using either cyber or kinetic weapons. Varying the type of weapons used is essential as it has been shown to have different effects on public opinion (Walsh 2015, Walsh and Schulzke 2015, Macdonald and Walsh 2021). We vary the costs of the attack in two ways. First, we vary how long the infrastructure is out of commission. A relay could likely be repaired relatively quickly, but in space, access is much more difficult, prolonging the time period needed to restore the asset's capabilities. However, if a simple repair is needed on either space or ground assets, a timeline of weeks to months is reasonable. Evidence from previous literature shows that the prolonged effects of attacks on the U.S. can directly affect support for retaliation (Leal and Musgrave 2022, Shandler and Gomez 2022, Shandler et al. 2023).

Second, we vary the cost of the attack by introducing casualties among U.S. military personnel operating the relays to scenarios that included kinetic attacks on ground infrastructure. In space, all satellites are operated remotely, removing the possibility of human deaths. On the

ground, while cyber attacks *can* cause personnel deaths, it is historically unlikely. A kinetic attack on a ground relay station manned by U.S. military personnel and causing casualties is more likely. For each ground-kinetic scenario, there were three fatality possibilities including zero, five, or fifteen military personnel deaths. Shandler et al. (2021) show that the lethality of an attack can increase appetites for stronger responses.

Results

We estimate treatment effects and marginal means using OLS. We regress support for each form of retaliation on indicators of treatment and a battery of pre-treatment control variables (gender, age, education, and expressed support for a U.S. military response to an invasion of Taiwan by China).⁷ To facilitate unbiased comparisons between our space and ground conditions, we restrict our attention to this first set of analyses to scenarios in which no U.S. personnel died.⁸ We use this model to estimate marginal means for each of the treatment conditions and present the results in Figure 1. The form of retaliation represented in each row is indicated with the label on the right. The severity of the retaliation is roughly ordered from least severe (new sanctions) to most severe (kinetic retaliation). The contrast in question (domain, method, or duration) is indicated by the column labels at the top. We report the average treatment effect across the contrast in question and the associated p-value in the text labels at the bottom of each subplot.

We begin by considering our main question of interest: whether respondents conditioned their support for retaliation on whether the attack took place in space or not. The leftmost column

⁷ We include these controls to maximize efficiency (Clifford et al 2021, Gerber and Green 2012), but our results are similar without them.

⁸ Recall that in our space scenarios, no U.S. personnel are lost. In our kinetic-ground scenarios, we randomly assign casualties to be zero, five, or fifteen. Our initial analyses only include responses from the ground scenario for those assigned to the zero casualties condition.

of Figure 1 plots estimates of support in the space and ground conditions averaging over the other treatment conditions for each of the dependent variables. For everything from new sanctions to kinetic retaliation, the public was indifferent to the domain of the attack. Whether the attack was in space or on the ground, there is broad support for both new sanctions and breaking diplomatic ties. Similarly, while absolute levels of support for more significant forms of retaliation (cyber and kinetic) are lower, they do not depend on whether the respondent learned that the attack was against assets in space or not. We take this as evidence that the public does not view attacks against space-based targets as qualitatively different from attacks against ground-based targets. We see a similar pattern of results when we examine the effect of the duration of the outage (middle column of Figure 1).

The story changes somewhat when we examine kinetic vs. cyber attacks (right column of Figure 1). The public appears to view kinetic attacks as qualitatively different from cyber attacks. While support for sanctions and breaking diplomatic ties is similar across scenarios in which kinetic and cyber attacks are employed, support for other forms of retaliation is higher in the case of kinetic attacks. The public is marginally more supportive of launching cyber attacks (ATE: 4.5 percentage points, $p < .000$) and significantly more supportive of kinetic retaliation in the case of a kinetic attack (ATE: 9 percentage points, $p < .000$).

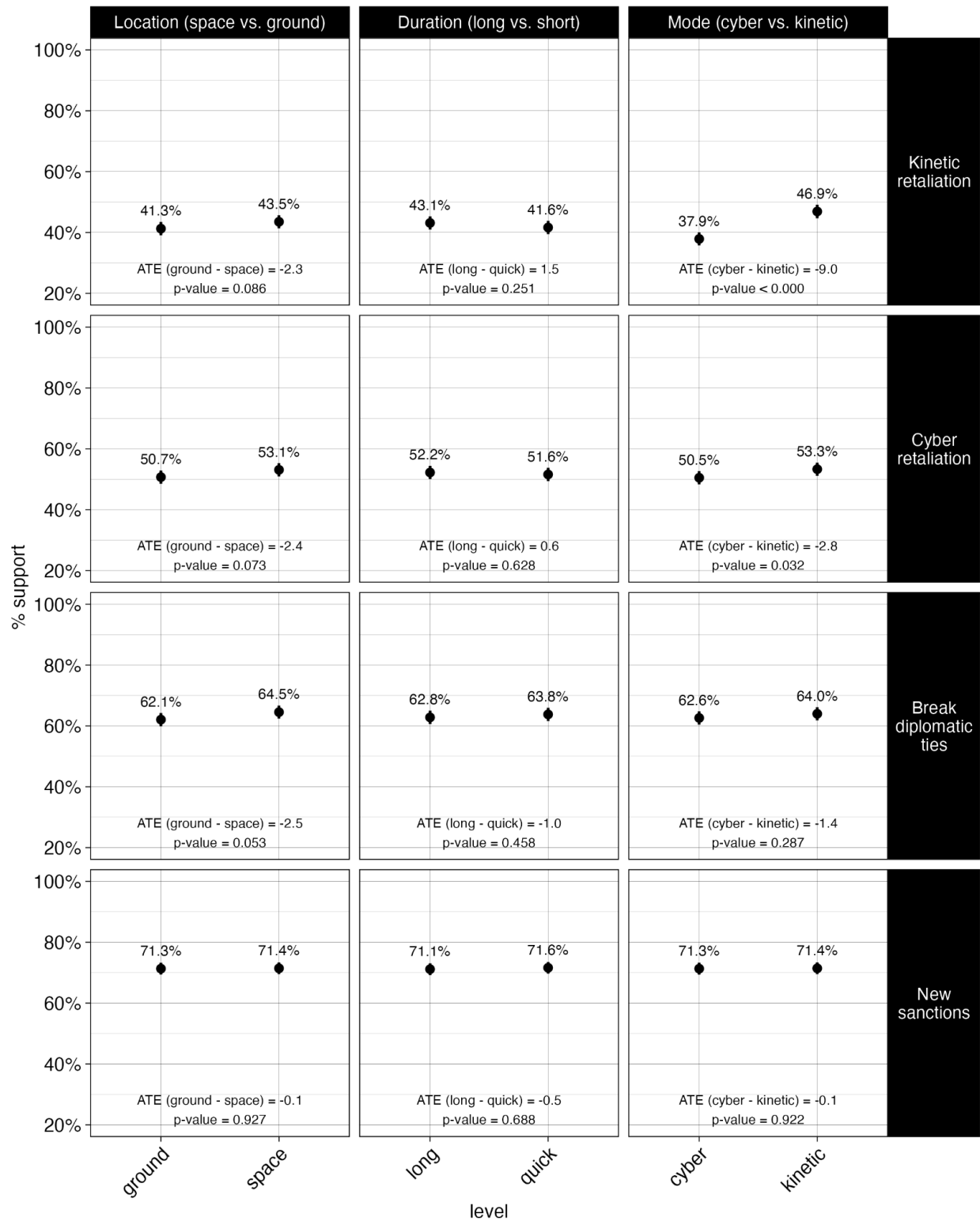


Figure 1. Marginal mean support for retaliation against attacks by domain, duration, and mode.

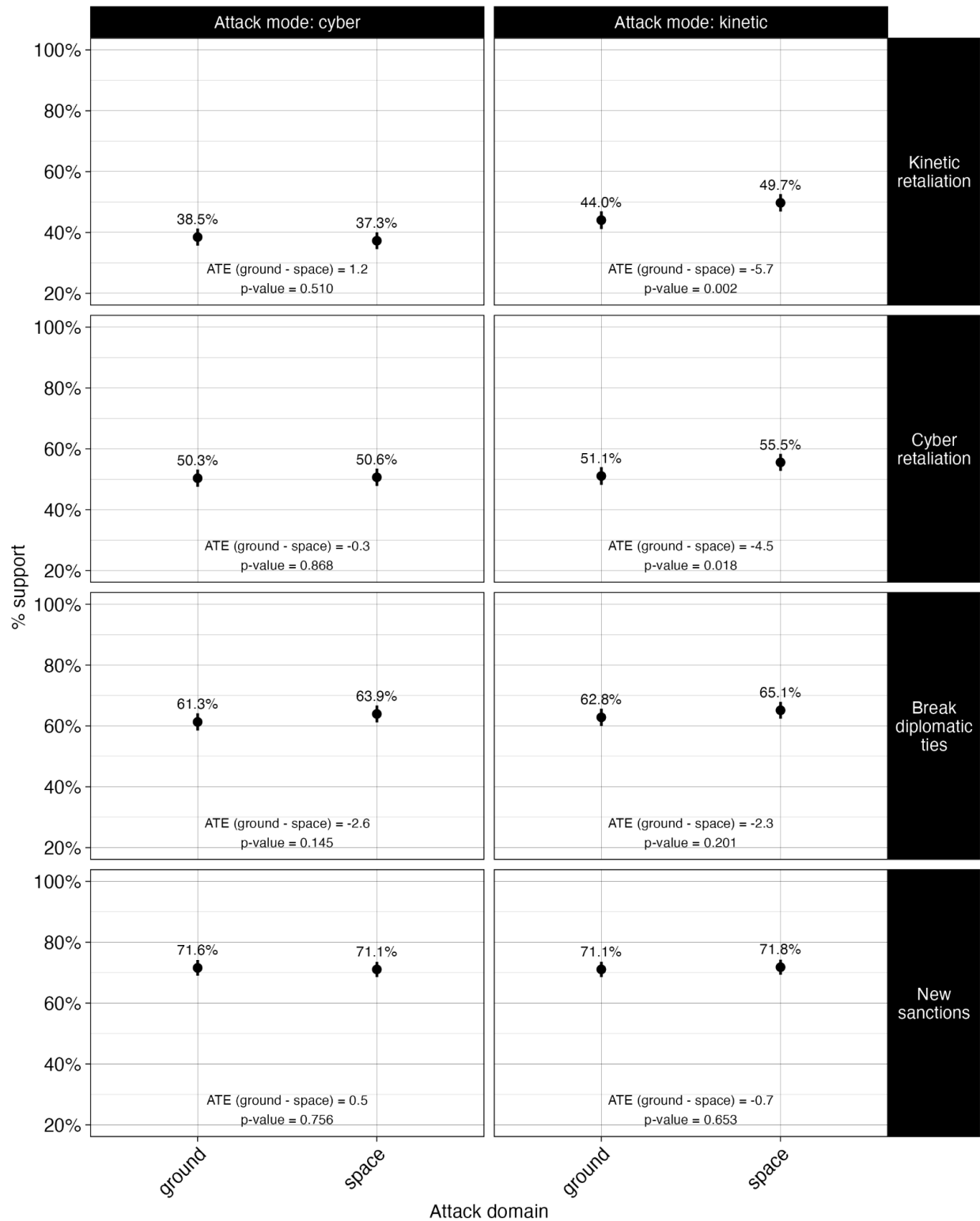


Figure 2. Marginal mean support for retaliation by domain (space vs. ground) and mode of attack (cyber vs. kinetic).

While the public is not sensitive to the domain of the attack, they do appear more likely to view kinetic attacks as warranting significant retaliation. By averaging over the other treatments, we may be obscuring differential effects across, for example, the domain of conflict. To investigate this, we produce estimates of marginal mean support for each form of retaliation for each combination of attack mode (cyber and kinetic) and conflict domain (space and ground). We plot these estimates in Figure 2. These results, again, show little evidence that the public distinguishes between space and ground attacks even when we account for differences in the mode of attack. The one exception is that respondents appear more willing to endorse kinetic responses to kinetic attacks on space-based assets than to identical attacks on ground-based assets (ATE: 5.7 percentage points, $p = .018$).

Thus far, we have seen that the public does not generally distinguish between attacks on space-based and ground-based assets. We do, however, find evidence that the mode of attack is important to the public. While we took pains to construct scenarios that are in the realm of plausibility, none of the scenarios that we used have actually occurred in the real world, so it is hard to know just what the real-world significance of these effects might be. To gain some leverage on this question, we included treatment conditions in our ground/kinetic attack versions of the scenario that allow us to benchmark our findings against the well-studied effect of the death of U.S. military personnel. We plot the effect of these deaths in Figure 3. These results show that support for retaliation monotonically increases in the number of U.S. personnel deaths for all forms of retaliation. The most dramatic effect, however, is seen across personnel deaths in support for kinetic retaliation. Support is about 12 percentage points higher ($p < .000$) in the 15 deaths condition than in the zero deaths condition. This suggests that, in terms of its effect on public support for kinetic retaliation, moving from a scenario in which China has attacked U.S.

communications infrastructure using kinetically to a scenario in which they launch a cyber attack on the same assets has approximately the same effect as moving from a scenario in which 15 U.S. personnel are killed to one in which no personnel are killed, all else equal. These results are important because it suggests that our respondents were reacting to our scenarios in a manner consistent with the findings of past research and long-standing theories of the domestic politics of international conflict.

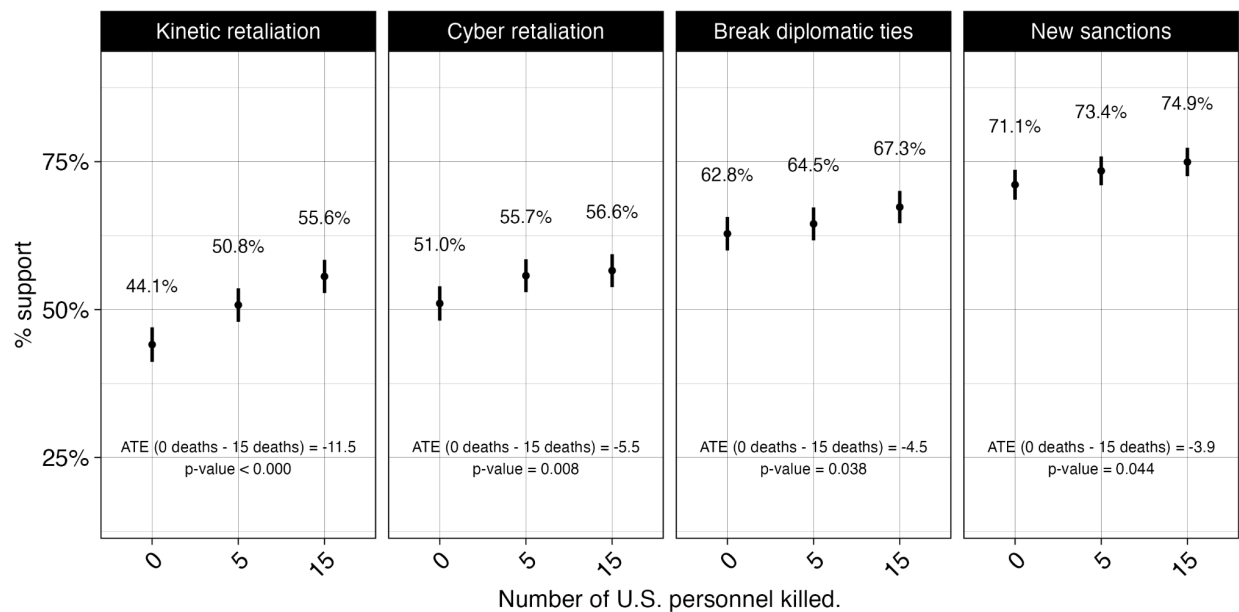


Figure 3. Marginal mean support for retaliation across the number of U.S. personnel killed in the kinetic/ground scenarios.

Conclusion

Using a survey experiment fielded in the United States, we show that the public does not condition their support for a wide array of retaliatory responses to foreign aggression on the domain of the attack. While the absolute level of support for measures up to kinetic responses varied in absolute terms, it did not generally depend on whether the attack was against space-based or ground-based assets. In contrast, we showed the public does distinguish between cyber attacks

and kinetic attacks, being less likely to support retaliation of various kinds in the case of the former. Likewise, we showed that the public is more willing to support retaliation of all kinds when kinetic attacks against ground-based assets result in the deaths of U.S. military personnel. These contrasting results are consistent with past research in this area and bolster our confidence in the null effect we found against space-based assets.

When analysts contrast space and ground-based conflicts, they are often comparing events that are likely to differ on a host of dimensions. We designed our experiment to carefully isolate the effects of location (space vs. ground) from other dimensions of foreign aggression (the mode of attack and its consequences). Doing so allowed us to isolate a “pure” space effect when all other factors are equal. Our findings suggest that, at least when it comes to attacks against space-based communications infrastructure, the theories we rely on to understand public reactions to foreign aggression and the responses of leaders are likely to serve analysts well. To the extent that scholars need to develop different tools to understand the domestic politics of conflict in emerging domains, cyber remains prominent. In our studies, demands for retaliation were more muted in that setting. In our view, the implications of this cyber vs. kinetic divide for theories of domestic politics and escalation remain unclear. Leaders may feel less *compelled* to respond to such attacks, dampening escalation dynamics. At the same time, anticipating fewer demands among foreign publics for retaliation might make cyber conflict more appealing to aggressors. This increased appeal might make the use of cyber warfare tools more frequent since leaders may feel less constrained, making escalation more likely. To make progress on these questions, scholars might employ experiments like ours on leaders and policy elites in an effort to decompose these cross-cutting effects.

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Supporting Information for “Foreign Attacks on Space-Based Assets and Public Support for Retaliation”

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1 Example vignette

In the following set of questions, we will ask you about three closely-related, hypothetical scenarios that the United States could face in the future.

While they are hypothetical, we have tried to describe them in ways that might closely resemble a real future event.

Please read each scenario closely and then indicate your support for the measures described in the questions that follow.

Figure 1: Experiment introduction (seen by all respondents),

China has decided to attack U.S. military and government communications systems. In recent hours, China has initiated kinetic attacks (involving physical explosives) on major U.S. telecommunications ground relays in the Pacific. This action has completely, but temporarily, halted communication on some secure networks between the U.S. government and foreign allies, prevented U.S. access to some foreign internet servers, and disrupted U.S. military communications. U.S. officials suggest the relays will be replaced within several weeks. Five U.S. personnel were killed in the attack.

Please select how strongly you agree with the following statements.

	Strongly Oppose	Oppose	Neither support nor oppose	Support	Strongly Support
The U.S. should temporarily break off diplomatic ties with China	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The U.S. should introduce sanctions against China's economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The U.S. should initiate cyberattacks against Chinese communication assets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The U.S. should initiate kinetic attacks (involving physical explosives) against Chinese communication assets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 2: Example scenario and dependent variable questions.

2 Demographics

	Lucid sample (N=2,495)	National benchmark (CCES 2022)
Gender		
Male	1,253 (50.22%)	48.12%
Female	1,242 (49.78%)	51.07%
Other	0 (0.00%)	0.81%
Income		
Less than \$30,000	934 (37.43%)	25.76%
Between \$30,000 and \$59,999	727 (29.14%)	25.24%
Between \$60,000 and \$149,999	695 (27.86%)	25.87%
\$150,000 or more	115 (4.61%)	14.31%
Prefer not to say	24 (0.96%)	8.82%
Age		
18–29	464 (18.60%)	21%
30–39	525 (21.04%)	15.61%
40–49	450 (18.04%)	14.78%
50–59	420 (16.83%)	16.41%
60–69	354 (14.19%)	18.89%
70+	282 (11.30%)	13.3%
Region		
Northeast	493 (19.76%)	21.55%
Midwest	486 (19.48%)	17.41%
South and Central	929 (37.23%)	38.23%
West	587 (23.53%)	22.81%
Party ID		
Democratic	1,120 (44.89%)	32.33%
Independent	343 (13.75%)	27.93%
Republican	939 (37.64%)	27.94%
Other	93 (3.73%)	11.8%
Education		
Some high school or less	82 (3.29%)	7.83%
High school graduate	749 (30.02%)	28.75%
Some college	485 (19.44%)	20.25%
2 year degree	168 (6.73%)	8.68%
4 year degree	694 (27.82%)	22.08%
Post-grad	298 (11.94%)	12.41%
Ethnicity		
White	1,735 (69.54%)	68.87%
Hispanic	125 (5.01%)	9.08%
Black	279 (11.18%)	13.22%
Indigenous	39 (1.56%)	0.75%
Asian	117 (4.69%)	4.77%
Other	189 (7.58%)	3.31%
Prefer not to say	11 (0.44%)	11 (0.44%)

3 Results tables

Table 2: Models used to produce Figures 1 and 2. Subsample of respondents assigned to zero death conditions.

	Kinetic attacks	Break ties	Cyber attacks	Sanctions
	(1)	(2)	(3)	(4)
(Intercept)	−0.03 (0.04)	0.28*** (0.04)	−0.04 (0.04)	0.14*** (0.04)
Treatment conditions (Baseline: Cyber attack against ground assets with long outage)				
Kinetic	0.06** (0.03)	0.02 (0.03)	0.02 (0.03)	−0.02 (0.02)
Space	0.02 (0.03)	0.04 (0.03)	0.04* (0.03)	0.00 (0.02)
Quick	0.01 (0.03)	0.02 (0.03)	0.02 (0.03)	0.00 (0.02)
Kinetic * Space	0.05 (0.04)	−0.04 (0.04)	0.00 (0.04)	0.04 (0.03)
Kinetic * Quick	−0.02 (0.04)	−0.01 (0.04)	−0.02 (0.04)	0.04 (0.03)
Space * Quick	−0.06 (0.04)	−0.03 (0.04)	−0.08** (0.04)	0.00 (0.03)
Kinetic * Space * Quick	0.04 (0.05)	0.06 (0.05)	0.09* (0.05)	−0.05 (0.05)
Demographic controls				
Support for Taiwan	0.06*** (0.01)	0.03*** (0.01)	0.05*** (0.01)	0.03*** (0.01)
Male	0.12*** (0.02)	0.02 (0.02)	0.15*** (0.02)	0.06*** (0.02)
Age	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.01*** (0.00)
Education	0.01 (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)
Num.Obs.	4864	4871	4863	4867
R2	0.061	0.029	0.077	0.115

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 3: Models used to produce Figure 3. Subsample of those assigned to kinetic attacks on ground-based assets.

	Kinetic attacks	Break ties	Cyber attacks	Sanctions
	(1)	(2)	(3)	(4)
(Intercept)	−0.02 (0.04)	0.29*** (0.04)	−0.05 (0.04)	0.14*** (0.04)
Treatment conditions (Baseline: Zero deaths)				
Five deaths	0.07*** (0.02)	0.02 (0.02)	0.05** (0.02)	0.02 (0.02)
Fifteenth deaths	0.12*** (0.02)	0.04** (0.02)	0.06*** (0.02)	0.04** (0.02)
Support for Taiwan	0.06*** (0.01)	0.03*** (0.01)	0.06*** (0.01)	0.04*** (0.01)
Male	0.11*** (0.02)	0.03 (0.02)	0.12*** (0.02)	0.06*** (0.02)
Age	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.01*** (0.00)
Education	0.01 (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)
Num.Obs.	3695	3696	3687	3689
R2	0.065	0.032	0.079	0.114

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4 Measuring Taiwan sentiment

To maximize efficiency we control for a number of pre-treatment variables that are likely to be associated with retaliatory preferences including age, gender, and education level (Clifford, Sheagley, and Piston 2021; Gerber and Green 2012). Since the scenario is about an attack by China, we also adjust for hawkishness towards China by asking about respondent's desire for the United States to respond militarily in the event of an invasion of Taiwan by China.

Consider how you might want to respond if China invaded its neighbor, Taiwan. Would you support or oppose the use of U.S. military forces (including troops on the ground in Taiwan) to push Chinese forces back out of Taiwan?

- Strongly support
- Somewhat support
- Neither support nor oppose
- Somewhat oppose
- Strongly oppose

5 Attention

We contracted with Lucid/Cint to recruit our sample. A number of scholars have highlighted problems with increased inattention among respondents on the Lucid/Cint platform after 2019 ([Ternovski and Orr 2022](#)). Encouragingly, Peyton, Huber, and Coppock ([2022](#)) show that a number of previously-published survey experiments replicate well on Lucid respondents recruited in the post-2019 period. To ensure our analysis is based on attentive respondents, we included two pre-treatment attention checks similar to those suggested by Berinsky, Margolis, and Sances ([2014](#)). The first asked read:

Everyone has a favorite color. Blue, green, red, yellow, purple, and orange are all great choices. To show that you're paying attention, however, please select the "red" answer below.

- Blue
- Green
- Red
- Yellow
- Purple
- Orange

Those who did not select "red" were re-directed back to the survey provider and did not complete the survey. 570 of 3,725 (15.3 percent) respondents failed this attention check. Later in the survey we asked respondents if they agreed with the statement that "Two is greater than one." We coded those who selected "agree" or "strongly agree" as attentive and include them in our analysis. We code all other responses as inattentive and exclude them from our analysis. 427 of the 2,922 respondents (14.6 percent) who made it to the second attention check failed this attention check. Our analysis sample consists of the 2,495 respondents who passed both attention checks.

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