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ARTICLE

Trash headlines: media portrayal of risks, response measures, and partisan differences in news coverage of space junk

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Abstract

As a recently emergent issue, public familiarity with orbital debris is likely low, and therefore especially susceptible to the influence of news media representations. To better understand media representations of orbital debris issues, a content analysis of all orbital debris news articles (N = 207) across four major U.S. media outlets (2011–2022) was conducted. It examines portrayals of risks associated with orbital debris, response measures, and terminology choices. Despite evidence that risks to satellite services are most consequential to everyday civilians, this risk was not a leading theme in any article. Instead, risks associated with falling debris to Earth was the most frequent leading theme across all news outlets. We also found differences across partisan outlets, including greater attention to space sustainability/safety risks and mitigation in a liberal outlet compared with a conservative outlet. Linguistically, the more colloquial "space junk" was more prominent than the more jargon-y "orbital debris".

Keywords

Environmental communication; Risk communication; Science and media

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1 ▪ Introduction

The number of objects launched into space has surged as technological advances have made space ventures more accessible and affordable, and space has become more commercial [Government Accountability Office, 2022]. With the emergence of a New Space economy, commercial space companies have launched thousands of new satellites and plan to launch tens of thousands more [European Space Agency, 2023]. This New Space era has come at a cost. Earth's orbits are now crowded with thousands of satellites and millions of pieces of orbital debris, including defunct satellites, discarded rockets, and fragments of human-made objects. These pieces of debris, or "space junk", can hurtle uncontrollably through low-Earth orbit at speeds of more than 15,700 miles per hour [NASA, n.d.], threatening crewed space missions, satellites and other spacecraft.

While we cannot assume that media coverage directly impacts public opinion, an analysis of orbital debris coverage in news media could help researchers gain some understanding of what content in the public domain may contribute to public perceptions of orbital debris. To efficiently produce stories that appeal to audiences and reduce issue complexity for understanding, journalists give selective attention to some attributes of an issue over others [McCombs, 2005]. Any given issue consists of a set of attributes (properties, characteristics or aspects) that can be used to evaluate or think about the issue [Kim et al., 2002]. In the context of science-related issues, researchers have analyzed media attention to issue attributes in coverage of technologies such as genetic engineering, ethanol and fracking [Gearhart et al., 2019; Oh et al., 2016; Kim et al., 2014] and complex environmental issues such as climate change [Vu et al., 2020]. In the context of climate change, research has found a media focus on attributes relating to effects, solutions and existence of the problem [Liu et al., 2008; Vu et al., 2020].

As a slow-building global pollution problem that could quickly escalate into a much larger problem if left unchecked, orbital debris is often compared with climate change [Adilov et al., 2022; Clormann & Klimburg-Witjes, 2022; Yap et al., 2023]. While orbital debris has not stirred controversy over its existence or human-causes, like climate change, orbital debris may be perceived as a distant problem [Yap et al., 2023]. It threatens the safety of current and future space-based activities but also poses risks directly relevant to Earthly affairs. Orbital debris could disrupt communication, GPS navigation and other satellite services, hobble the military, destroy buildings or even kill people on Earth [Defense Intelligence Agency, 2022; Government Accountability Office, 2022; National Institute of Standards and Technology, 2021]. Proposed response measures in many ways parallel solutions proposed to address climate change including mitigation, remediation technologies, adaptive strategies [Yap et al., 2023].

As a newly emergent issue, public familiarity with orbital debris is likely low. Public interpretations of orbital debris may therefore be especially susceptible to the influence of news media representations [Kim et al., 2017]. To the best of our knowledge, data on public awareness about orbital debris has yet to be published. Given that 42% of Americans report knowing little to nothing about commercial space exploration, however, we infer that familiarity with orbital debris is similarly low [Whitman Cobb, 2023]. Moreover, as an issue unfolding in space, members of the lay public cannot readily perceive the consequences of orbital debris and must derive most of what they know from experts and the media.

This study employs a content analysis of a census of news articles about orbital debris from 2011 to 2022 across four major U.S. media outlets: CNN, Fox News, *The New York Times*, and the *Washington Post* to better understand how orbital debris is being presented in news media coverage. We examine two sets of attributes in orbital debris news coverage. First, we look at media representations of orbital debris as a problem, by examining the presence of different orbital debris risks in articles and which is featured most prominently (effect-related attributes). We then also examine how frequently articles mention different types of potential response measures (solutions-related attributes).

In addition, we are interested in how news media representations of orbital debris may be shaped by news production routines and media outlet's partisan leanings [Engesser, 2017; Shoemaker & Reese, 2014]. We therefore explore how the orbital debris attributes emphasized in news coverage align with the kinds of news values that guide journalistic work and whether the attributes emphasized differ between partisan news outlets. Finally, space agencies, experts and the media often use "orbital debris", "space debris", and "space junk", interchangeably to refer to the issue. Given journalistic writing and editing routines influenced by norms around the use of accessible language, we assess whether the news media use "space junk" more frequently than "orbital debris" and "space debris".

2 · News production routines, partisan media and science news

News media representations of science and environmental issues are the outcome of newsroom decisions, which are influenced in part by news production routines and media outlet's partisan leanings [Engesser, 2017; Shoemaker & Reese, 2014]. News routines refer to the standardized, structured practices journalists and news organizations use in the production of news — practices shaped by institutional constraints and professional norms [Shoemaker & Reese, 2014]. News routines include practices such as the use of news selection criteria (news values) and traditional approaches to formatting and writing content. News values represent the practices journalists and editors use to determine what information is newsworthy and likely to appeal to audiences. What is considered newsworthy is determined in part by characteristics such as conflict, drama, well-understood story themes, recognizable personalities, proximity, timeliness and novelty [Price & Tewksbury, 1997].

Guided by these values, journalists and editors direct public attention to a limited set of issues and attributes of those issues as the most important of the day. As a concept, issue attributes originated in the literature on agenda-setting theory — which posits that media influence both the issues people think about and how they think about them by emphasizing specific attributes [McCombs, 2005; Kim et al., 2002]. When covering abstract, intangible environmental issues that do not easily fulfill news values, journalists may focus on certain issue attributes to meet newsworthiness thresholds and unwittingly perpetuate informational biases [Engesser, 2017; Boykoff & Boykoff, 2007]. Consequently, enduring problems and long-term consequences may get overlooked in favor of short-term crises or sensational aspects that sit at the surface of an issue [Boykoff & Boykoff, 2007].

Media coverage may also be biased toward particular attributes of an issue due to an outlet's political leanings [Engesser, 2017]. In the context of science news, research has identified partisan media differences in coverage of both politicized topics such as climate change and energy development [Engesser, 2017; Gearhart et al., 2019], and non-politicized topics such

as AI facial recognition and CRISPR technologies [Shaikh & Moran, 2024; Stapleton & Torres Yabar, 2023]. In an analysis of news coverage of AI facial recognition technologies, for example, researchers found a conservative media focus on security related attributes, including the possible abuse of the technology by foreign governments and its potential positive use by police [Shaikh & Moran, 2024].

Finally, news routines focused on content writing approaches and informed by professional norms on making news accessible to general audiences could shape linguistic presentations of science-related issues. Many news organizations use style guides, such as the Associated Press Stylebook, that emphasize clarity and avoidance of jargon and technical terms [Associated Press, 2018]. Avoiding jargon is one of the primary challenges journalists face in making news about scientific topics accessible for audiences. Veteran journalists and journalism educators often advise journalists in training on the importance of avoiding jargon in reaching non-expert audiences for science news [e.g., Blum et al., 2005; Pattani, 2018]. In A Field Guide for Science Writers, for example, Blum et al. describe good science writing as "bridging the jargon gulf" between the "sciencespeak of the researcher and the short attention spans of the public" [2005, p. vii]. In interviews with health journalists, researchers found journalists often talked about avoiding technical terms and using "the simplest language possible" [Hinnant et al., 2012]. Similarly, news coverage of issues such as electromagnetic fields and arboreal diseases has been found to favor terms drawing on simple language over technical terms and jargon [Claassen et al., 2012; D'Angelo et al., 2018]. In an analysis of news coverage of a bacterial disease afflicting the U.S. orange industry, for example, researchers found news stories favored the use of "citrus greening" to refer to the issue over less familiar or technical terms such as "Huanglongbing" or "Candidatus Liberabacter Asiaticus" [D'Angelo et al., 2018].

3 ▪ Orbital debris risks and response measures

As far back as the 1970s, scientists began raising concerns about the accumulation of dangerous amounts of debris in orbits around Earth [Kessler & Cour-Palais, 1978]. This debris poses a risk to *space safety and sustainability*, threatening the safe use of space by scientists, governments and commercial actors, including crewed and uncrewed missions [Government Accountability Office, 2022; NASA, 2024; Liou & Johnson, 2006]. Today, orbital debris is no longer just a concern for activities in space. Since the 1970s, modern society has become utterly reliant on space assets [Government Accountability Office, 2022; National Institute of Standards and Technology, 2021]. *Satellites services* support telecommunications, including phone, television and internet, help predict weather, and enable us to track natural disasters. Additionally, GPS satellites provide precise position, timing and navigation information. A loss of GPS services could cripple global financial systems and disrupt energy grids and safe travel by airplane, boat and train, among other critical infrastructure [National Institute of Standards and Technology, 2021].

Orbital debris also poses a more direct planetary risk — the risks posed by *falling debris* for people and property on Earth [Government Accountability Office, 2022; U.S. Government, 2019]. Most falling debris burns up in Earth's atmosphere or falls into the ocean or uninhabited areas. Historically, experts have considered falling debris risks negligible. But concern has grown as debris accumulates in orbit and large objects such as rocket stages are abandoned without plans for controlled descent [Byers et al., 2022].

Finally, as space's strategic value for defense, security, and warfare activities grows, orbital debris is also drawing concern as a *national security* issue [Boley & Byers, 2024; Hildreth & Arnold, 2014; Defense Intelligence Agency, 2022], As former U.S. Deputy of Defense William Lynn III has noted, without space assets "many of [the United States'] most important military advantages evaporate" [Hildreth & Arnold, 2014]. Orbital debris is both a threat to and product of national security activities. Orbital debris can damage or destroy satellites supporting U.S. national security activities. Meanwhile, space weapon tests also contribute to the mess. Space faring nations conducting anti-satellite (ASAT) missile tests targeting defunct satellites often generate large dangerous clouds of debris [Migaud, 2020].

To better understand how media present orbital debris as a problem, we explore the following research question about media portrayal of risk attributes in orbital debris news coverage:

RQ1: How common are four distinct risks across news articles about orbital debris, and which are featured most prominently?

In our analysis we also examined to what extent media coverage mentions three categories of potential responses for addressing orbital debris. U.S. government generally organizes response measures into three categories: preventing the creation of new debris (*mitigation*), using remediation technologies to clean up already exiting debris (*debris removal technology*), and tracking the debris population so space traffic can be managed to avoid collisions (*tracking/traffic management*) [Executive Office of the President, 2018; Locke et al., 2024; Office of Science and Technology Policy, 2022]. Mitigation includes things like designing satellites and other spacecraft to minimize debris creation, deorbiting spacecraft soon after their job is done, or limiting the number of objects launched into orbit [Migaud, 2020]. Meanwhile, aerospace engineers have been working on potential *debris removal technologies* such as robots that could capture debris with grappler arms, nets, or lasers that could nudge debris out of orbit [Mark & Kamath, 2019; Locke et al., 2024; Office of Science and Technology Policy, 2022]. Finally, *traffic management* refers to the coordination of space traffic to prevent satellites and other spacecraft from crashing into orbital debris and each other, which requires *tracking* of both debris and active spacecraft [Executive Office of the President, 2018; Locke et al., 2024].

To better understand media portrayals of how orbital debris issues might be addressed, we examine which of these three categories of response measures is most frequently mentioned in orbital debris news coverage. We also examine whether there is a relationship between the risk attribute featured most prominently and whether any response measures are mentioned. To explore these relationships, we pose the following two research questions:

RQ2: Does orbital debris news coverage mention *mitigation*, *debris removal technology* or *tracking/traffic management* most frequently?

RQ3: Is there an association between the risk featured most prominently in an article, and whether response measures are mentioned?

4 ▪ Politically partisan media

Selective emphasis of particular orbital debris risks and response measures may vary between media outlets with partisan leanings. Given what appears to be strong Republican

interest in U.S. security and military dominance in space, for example, conservative media might be more likely to emphasize national security in their orbital debris news coverage compared with liberal outlets. A 2022 survey found 70% of Donald Trump voters believe Space Force is essential for protecting American interests in space compared to 33% of Joe Biden voters [Outer Space Institute, 2022]. Trump voters were also more likely to oppose restricting U.S. anti-satellite testing over concerns that the U.S. maintain its military advantage (52% v. 31%).

Some orbital debris response measures may also resonate with Republican audiences more than others. For example, the use of active debris removal technologies offers a way to deal with the externalities of the space age, without interfering with commercial space activities [Yap et al., 2023]. Meanwhile mitigation measures focused on prevention are likely to increase satellite design and operation costs, which might resonate less with those more politically aligned with pro-business interests — which have already begun to push back against regulatory efforts to require mitigation practices [e.g., Stallmer, 2020; Federal Communications Commission, 2024]. Orbital debris news stories that discuss mitigation, and perhaps especially mitigation limiting debris generated by commercial activities, may resonate with Democratic audiences more compared with Republicans. Democrats are more likely to say private space companies are doing a "mostly bad job" at "limiting the debris from rockets, satellites and other human-made objects in space" compared with Republicans (34% v. 18%) and Biden voters are more likely to think there should be limits on the number of commercial satellites compared with Trump voters (74% v. 61%) [Kennedy & Tyson, 2023; Outer Space Institute, 2022]. To explore whether there are partisan differences in the risk attributes featured prominently and mentions of particular types of response measures, we pose the following two questions:

RQ4: Do partisan news sources differ in the risk attributes featured most prominently?

RQ5: Is there an association between news source partisanship and whether a news article mentions different types of response measures (*debris removal technology*, *mitigation*, or *tracking/traffic management*)?

5 ▪ Use of terminology

Terms often used to refer to the derelict objects littering Earth orbits include "orbital debris", "space debris", and "space junk". The space community appears to favor the terms orbital debris and space debris. NASA, for example, has an Orbital Debris Program Office, Orbital Debris Quarterly Newsletter and Orbital Debris Conference. On a webpage explaining orbital debris for non-experts [NASA, 2023], the agency uses all three terms interchangeably while putting space junk in quotation marks — a practice often used to introduce slang or an informal, colloquial term [American Psychological Association, 2013]. Given the emphasis on avoiding jargon in journalism in favor of accessible language [Associated Press, 2018; Blum et al., 2005; Pattani, 2018] we pose the following research question:

RQ6: Will orbital debris news coverage use the term "space junk" in more stories, than the terms "orbital debris" or "space debris"?

6 ▪ Methods

6.1 ▪ *Sample*

This study analyzed news stories published between Jan. 1, 2011, and Dec. 31, 2022, from two national U.S. newspapers (*Washington Post*, *The New York Times*) and two major U.S. cable networks (CNN, Fox News). The year 2011 was used as a starting point, as it is the year the U.S. National Academies of Science published a public policy advisory report underscoring the urgency of orbital debris. In the report, NAS warned space junk may be reaching a "tipping point" and the situation was in danger of snowballing [National Research Council, 2011]. The *Washington Post* and *The New York Times* were selected because of their large circulation and online presence. We also anticipated they would have multiple stories covering orbital debris, given that they both have reporters assigned to report on space-related topics. CNN and Fox News were chosen because they are among the most widely recognized U.S. news networks and have opposing political biases [Yang, 2023].

For CNN, Fox News and *Washington Post*, we used each organization's website search function to find news articles using the keywords "space junk", "space debris" and "orbital debris". *The New York Times* website search function did not allow us to specify the publication dates for which we wanted to retrieve articles. We therefore, used the LexisNexis news database to gather articles from *The New York Times*, while using the same keywords. The unit of analysis was a news article that mentioned space junk, space debris and/or orbital debris in the headline or body of the article. Articles collected for the study include only text-based stories from the online versions of these news outlets.

After reviewing for duplicate news stories from the same source or other non-news articles, the final population of messages that were coded was N = 207. Across the four sources, Fox News had the largest number of stories (N = 105), followed by CNN (N = 64), *The New York Times* (N = 23) and the *Washington Post* (N = 15). We also tracked the source of the reporting for each article (original reporting or wire service/outside news agency). Fox News published the greatest number of articles from other sources (N = 48). CNN and *The New York Times* each published one story from another source and *Washington Post* published two stories from other sources. The number of original reporting articles published each year ranged from 8 to 29 articles with coverage peaking in 2021. There did not appear to be any clear trend in the number of articles published per year over the selected time period.

6.2 ▪ *Codebook*

To answer our research questions, we employed a quantitative content analysis, a research technique that uses text analysis to collect information [Krippendorff, 2004]. We defined a preliminary set of codes drawing on a review of government reports [e.g., Hildreth & Arnold, 2014; Government Accountability Office, 2022; Office of Science and Technology Policy, 2022] and close reading of news coverage. We then refined the codebook through an iterative process during coder training. The final codebook included codes for four risk attributes (*space safety/sustainability*, *satellite services*, *falling debris*, and *national security*) and three response measures (*mitigation*, *debris removal technology*, and *tracking/traffic management*).

With respect to risk attributes, *space safety/sustainability* was defined by a focus on orbital debris as threatening the free and safe use of space by governments, commercial players,

astronauts, or the science community. *Satellite services* was defined by a focus on the possible disruptive effects of orbital debris on satellite services consequential to everyday civilians, such as GPS, banking operations, or communication. *Falling debris* was defined by a focus on risks of orbital debris falling to Earth, including possible destruction to property, danger of people being struck by debris and other dangers posed by debris that has landed on Earth (e.g., radioactive debris). Finally, *national security* was defined by a focus on orbital debris through a national security lens, including threats to military assets in space, the use of space-based weapons or anti-satellite tests (ASAT tests).

We coded for these four risk attributes in two ways, adapting a coding approach similar to that used in previous media content analyses [e.g., McComas & Shanahan, 1999; Nisbet et al., 2003]. First, we coded whether each risk was "present" or "not present" within the article. Second, we coded for whether it was a leading theme by looking at whether it was the most prominent risk featured in the article's headline and first five sentences. An option for multiple themes or not orbital debris related was also available.

With respect to the three categories of response measures, *debris removal technology* was coded as present if the article discussed the development of debris removal technologies, such as debris cleaning satellites or robots deployed into orbit. Debris *mitigation* was coded if the article mentioned solutions aimed at controlling the growth of orbital debris through policy or regulation, or satellite operations and designs that reduce the creation of new debris. *Tracking/traffic management* was coded as present if the article mentioned the use or need for debris tracking and/or space traffic management.

Finally, we also counted the number of articles containing each of our key terms — *orbital debris*, *space junk*, and *space debris*. The presence or absence of each term represents unambiguous manifest content. We therefore uploaded articles to the text analysis software MAXQDA to search for whether each term was present in any given article. For the remaining codes, results of intercoder reliability testing are reported below.

6.3 ▪ *Intercoder reliability*

Prior to final reliability testing, three coders worked through several rounds of pilot coding and codebook edits. Final reliability testing was completed across 12.5% of the population of messages coded, within the 10–20% of messages recommended to be coded by multiple coders [Neuendorf, 2019]. Reliability coefficients were calculated via ReCal OIR (available at https://dfreelon.org/). Krippendorf's alpha coefficients were calculated as coded by three coders. All variables were coded at the nominal level. All reported variables exceed .700, a commonly used cutoff point for intercoder reliability statistics.

7 ▪ Results

Research Question 1 asked how common four distinct risk attributes are across news coverage about orbital debris, and which is featured most prominently. This can be answered via descriptive statistics of several variables. First, we found that *space safety/sustainability* was mentioned most frequently. *Space safety/sustainability* was present in 49% of articles (n = 102), followed in frequency by *falling debris*, present in 35% of articles (n = 73). *National security* and *satellite services* were mentioned in 23% (n = 47) and 14% (n = 28) of articles

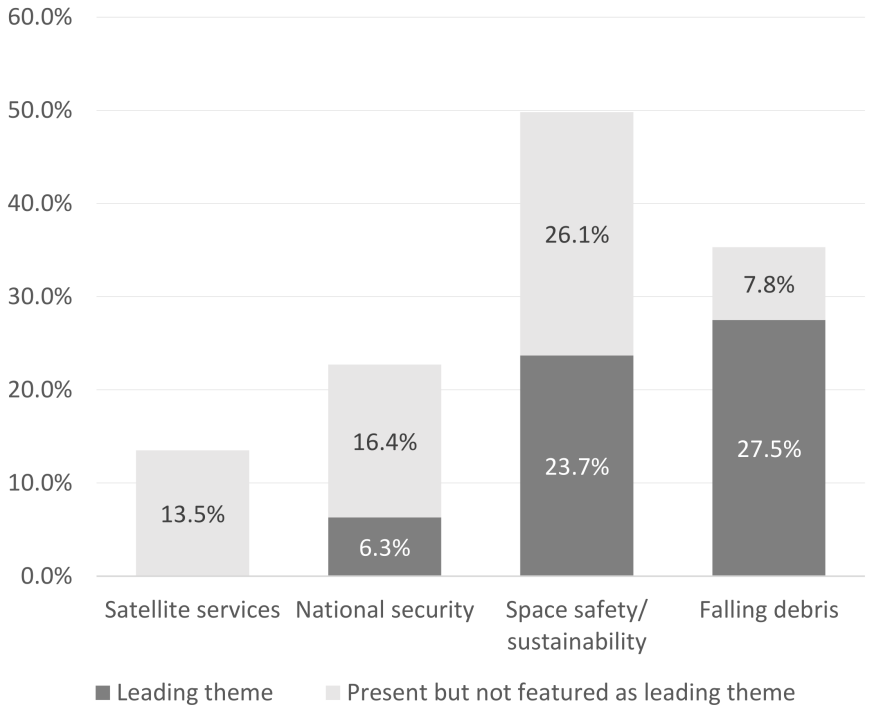

Figure 1. Percent of orbital debris articles in which each of four risk attributes were present, and the percent of articles featuring each risk as a leading theme.

respectively. While *space safety/sustainability* was most frequently present in orbital debris articles, *falling debris* was most frequently featured as an article's leading risk theme, 27.5% of all articles (n = 57), followed by *space safety/sustainability*, 23.7% of all articles (n = 48). Only 6.3% of articles (n = 13) featured *national security* as a leading risk theme and no stories used *satellite services* as a leading risk theme (see Figure 1).

Research Question 2 asked how common response measures falling into three categories (*mitigation*, *debris removal technology*, or *tracking/traffic management*) are in orbital debris news coverage. Descriptive data for the presence/absence of each type of response measure show that *tracking/traffic management* was the most frequently mentioned. However, the three response measures were mentioned with similar frequencies: *debris removal technology* was present in 20.3% of articles (n = 42), *mitigation* was present in 24.6% of articles (n = 51), and *tracking/traffic management* was present in 28% of articles (n = 58).

Research Question 3 asked whether there is an association between the risk featured most prominently in an article, and whether response measures are mentioned. A chi-square test was employed to explore differences across the leading risk themes and whether any response measures were mentioned. Articles without a clear leading risk theme were excluded from analysis. Results revealed differences in the presence of response measures mentioned across articles with different leading risk themes, $\chi^2(2, 118) = 13.47$, $p < .01$. There were fewer than the expected number of articles discussing response measures when *falling debris* risk was a leading theme (22 v. 29.9), and greater than the expected count of articles discussing response measures when *space safety/sustainability* risk was a leading theme (35 v. 25.2).

Research Questions 4 and 5 ask about the differences in orbital debris reporting between partisan news sources. To answer these two research questions, we conducted analyses comparing Fox News and CNN news articles that contained original reporting and excluded articles published from external news sources (e.g. wire services). Research Question 4 asked about differences in the types of risks Fox News and CNN used as leading themes. A chi-square test was employed to explore differences across the leading risk themes and the articles reported by Fox and CNN. Articles without a clear leading risk theme were excluded from analysis. The analysis revealed significant differences, $\chi^2(2, 72) = 12.48$, $p < .01$. The most common leading risk theme in Fox News articles was *falling debris*, while the most common leading risk theme in CNN was *space safety/sustainability*. The number of stories featuring *falling debris* as a leading risk theme was greater than expected for Fox News (21 v. 17) and fewer than expected for CNN (13 v. 17). Meanwhile, the number of stories featuring *space safety/sustainability* as a leading risk theme was greater than expected for CNN (21 v. 14) and fewer than expected for Fox News (7 v. 14). Finally, the number of stories featuring *national security* as a leading risk theme was greater than expected for Fox News (8 v. 5) and fewer than expected for CNN (2 v. 5).

Research Question 5 asked about whether there are differences in how frequently *debris removal technology*, *mitigation*, or *tracking/traffic management*, are mentioned in Fox News and CNN articles. Three chi-square analyses were employed to examine Fox News and CNN orbital debris articles and the presence of each type of response measure. Two of the three analyses revealed significant differences. We did not find a significant difference in Fox News or CNN for the presence of *debris removal technologies* in news articles. However, we found CNN articles were more likely to mention *mitigation*, $\chi^2(1, 120) = 5.893$, $p = .02$, and *tracking/traffic management* $\chi^2(1, 120) = 6.932$, $p < .01$. The number of stories mentioning debris *mitigation* was greater than expected for CNN (22 v. 15.75) and fewer than expected for Fox News (8 v. 14.25). Similarly, the number of stories mentioning *tracking/traffic management* was greater than expected for CNN (26 v. 18.9) and fewer than expected for Fox News (10 v. 17.1).

Finally, in a research question on the use of terms used in news stories (RQ6), we asked whether a greater number of articles would use the term “space junk” than the number articles using the term “space debris” or “orbital debris”. The results indicate a greater number of articles used the term “space junk”, compared with “orbital debris” and “space debris”. The greatest number of articles used “space junk” (n = 150), followed by “space debris” (n = 119). The number of articles using “orbital debris” was by far the lowest (n = 47).

8 · Discussion

Our results suggest the orbital debris issue attributes that mainstream news media are most likely to direct news audiences’ attention to are the risks of debris falling to Earth and debris threats to safe, sustainable operations in space. In our analysis, falling debris was most frequently featured as a leading theme followed by safe, sustainable space operations. More than half of the articles analyzed featured one of these two risks as a leading theme. Much less attention was given to orbital debris as a threat to national security or satellite services consequential to civilians. Particularly notable, was the lack of attention given to threats to satellite services. None of the articles in our analysis featured satellite service risks as a leading theme and only 14% mentioned it elsewhere.

This pattern of news coverage may underweight some risks while overweighting others. Falling debris concerns are growing as the amount of debris in orbit increases [Byers et al., 2022]. However, the likelihood of an individual being injured remains extremely small — 65,000 times lower than being struck by lightning [European Space Agency, 2024]. A major disruption in satellite services due to orbital debris, on the other hand, could upend the lives of many. As modern-day civilizations increasingly rely on satellite services, outages pose a real and widespread threat. Energy grids, financial transactions, emergency services and transportation all rely on satellites. If we were to lose GPS satellite services alone, it could cost the United States $1 billion a day [National Institute of Standards and Technology, 2021]. Scholars often argue that the broader public does not appreciate how reliant we have become on space infrastructure and the potentially disastrous consequences orbital gridlock due to debris could have [e.g., Clormann & Klimburg-Witjes, 2022; Garber & Rand, 2022; Madden & Koprowski, 2020]. Without widespread public appreciation for consequences, debris threats to satellite services might not easily convey the news values journalists use to turn complicated issues into compelling stories.

Threats due to falling debris and debris threats to space-based activities, on the other hand, check off multiple *newsworthiness* criteria including a well-understood story theme, drama, novelty, and timeliness [Price & Tewksbury, 1997]. Consequently, "a fireball of space junk" shooting across the sky or a piece of debris forcing astronauts "to scramble to their rescue vehicles" provides a useful tool for attracting news audiences [Earl, 2018; SkyNews, 2011]. Furthermore, a falling debris story can sometimes unfold over several days, heightening the drama and resulting in more news coverage. News coverage of the uncontrolled re-entry of a 100-foot Long March 5B Chinese rocket in 2021, for example, unfolded over several days as experts tried to anticipate where the rocket might land [Byers et al., 2022]. In our sample, coverage of the event began four days before the rocket landed in the Indian Ocean on May 8. Nine out of the 29 original reporting stories from that year covered the Chinese rocket re-entry, contributing to the 2021 peak in orbital debris coverage observed in our sample. Six stories covering a second event also contributed to that peak. On Nov. 15, Russia conducted an anti-satellite test generating 1,500 pieces of trackable debris — a major debris-generating event [Boley & Byers, 2024]. The debris generated also threatened astronauts on the International Space Station, which made maneuvers to avoid the debris. The safety of the ISS crew was a consistent theme in stories about the event and likely contributed to its coverage.

In our second set of analyses, we compared Fox News and CNN coverage and found differences in attention to both types of orbital debris risks and types of response measures. Articles with a leading risk theme focused on safe, sustainable space operations were overrepresented in CNN coverage and underrepresented in Fox News coverage. Meanwhile, leading risk themes focused on falling debris and national security were overrepresented in Fox News coverage and underrepresented in CNN coverage — a finding consistent with previous research finding a right-leaning media tendency to focus on security and public opinion data suggesting strong Republican interest in U.S. national security in space [Outer Space Institute, 2022; Shaikh & Moran, 2024].

With respect to orbital debris response measures, we found stories mentioning tracking or traffic management, and mitigation were underrepresented in Fox News stories and overrepresented in CNN stories. The observed difference in attention to mitigation is consistent with what polling data suggest about what is likely to resonate with CNN's

left-leaning audience compared with Fox News' right-leaning audience. Public opinion data suggest that left-leaning audiences have less confidence that private space companies will limit debris and are more likely to favor policy aimed at mitigating space industry debris [Funk & Strauss, 2018; Kennedy & Tyson, 2023; Outer Space Institute, 2022].

Before we conclude our discussion of results, we would like to acknowledge several limitations. First, news media do not represent the only information sources through which members of the public can learn about an issue like orbital debris, particularly in this age of social media. That said, the news media remain influential, and perhaps particularly for information on issues about which people may not know enough to seek out alternative sources of information. There are also a couple of limitations to note regarding our analysis of partisan coverage — which could have benefitted from a larger sample and additional news sources. Our analyses comparing partisan coverage included just 120 of the 207 total articles and included only Fox News and CNN. Future research should validate the results of the current study by including additional partisan sources to ensure the differences we observed are not limited to comparisons between these two sources.

We now turn to our results on the use of terms. While U.S. government agencies and scientific literature tend to use "orbital debris", our findings suggest journalists are not parroting their jargon. They are "bridging the jargon gulf" by instead using "space" and often "junk" [Blum et al., 2005]. Roughly three times as many news stories used "space junk" compared with "orbital debris". While "space debris" was used in fewer stories than "space junk", it also came out ahead of "orbital debris". Space junk replaces the less common word "orbital" with the more familiar "space" and uses fewer syllables — a practice often recommended as a way of translating technical writing into accessible language [e.g., Orritt & Powell, 2020; University of Michigan, n.d.].

One tradeoff in the translation of jargon into everyday language can be a loss of precision. When the media drop "orbital" in favor of "space", audiences might not understand that what is being referred to are derelict objects in orbit around Earth, rather than those drifting off into distant space. If audiences perceive the issue as primarily effecting distant space, they may underestimate its risks [Liberman & Trope, 2008]. On the other hand, "junk" may evoke more concern as it more clearly refers to human-generated waste, whereas "debris" might be interpreted as naturally occurring dust or meteoroids. Unnaturalness perceptions predict higher risk perceptions and whether terms convey (un)naturalness can influence public evaluations [e.g., Gonzalez Coffin et al., 2024; Lacroix et al., 2021]. For example, Americans perceive "natural gas" much more favorably than "methane gas", and are less likely to associate it with pollution even though it is 70–90% methane [Lacroix et al., 2021].

Orbital debris has thus far been overlooked in quantitative research on news media representations of science. In this study, the biggest difference we found was in the frequency and prominence of attention given to different types of risks. Perhaps most notably, was the distinct lack of attention given to the risk of satellite service outages due to orbital debris. Among the risk attributes we coded for, satellite service outages would be the most consequential for daily life on Earth but received the least media attention. This pattern of coverage overlaps with findings from research examining media representations of climate change. Previous research has found news media tend to present climate change as distant and abstract, rather than linking the issue to audiences' daily experiences [e.g., Guenther & Brüggemann, 2023; O'Neill, 2013]. A tendency to perceive climate change as an

abstract and distant phenomenon, is often proposed as a reason for why many members of the public do not perceive it as a major concern.

Orbital debris is not just a distant space problem, but it is not clear whether audiences appreciate the issue's Earthly relevance. Journalists who want to contribute to making orbital debris a greater priority among news audiences might consider giving more attention to the ways in which space infrastructure is inherently linked to Earth-based infrastructures. In a paper addressing the challenges of conveying the societal importance of space assets, Madden and Koprowski [2020] encourage science communicators to develop narratives that humanize the abstract and make space assets personally relevant and urgent. In the context of climate change, some experimental findings suggest more proximate and personally relevant representations may under some circumstances increase public concern and issue engagement [e.g., Jones et al., 2017].

Future research could build on the results of the present study by linking our findings back to audiences with survey and experimental studies. Experimental research could test whether journalistic narratives emphasizing the risks orbital debris pose to satellite services increase public concern about orbital debris. Experimental research could also test whether audiences perceive the issue differently depending on whether it is described using the term "space junk" or "orbital debris". Finally, existing public opinion data on orbital debris provide a piece-meal picture of public understanding, perceptions and attitudes [e.g., Funk & Strauss, 2018; Kennedy & Tyson, 2023; Outer Space Institute, 2022]. A survey substantially, or entirely, devoted to the topic of orbital debris could both provide a clearer picture of how various publics think about the issue, and how perceived salience of risks and proposed response measures might relate to media representations.

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