NEWSPAPER COVERAGE OF MARS
IN THE UNITED STATES AND THE UNITED KINGDOM 2011-2016

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With Gratitude

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Dedication

For my mom and dad.

Thank you for your encouragement and support as I continue my education.
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Newspaper Coverage of Human Exploration of Mars in the United States and the United Kingdom 2011-2016

Abstract

The news media have documented the missions of the National Aeronautics and Space Administration (NASA) since its formation in 1958. Little of that coverage, however, has focused on Mars exploration and colonization, which has only recently become a serious target of interest for NASA. The current study examines how three elite print newspapers in the United States and three in the United Kingdom framed Mars coverage between 2011 and 2016. A content analysis found that most of the frames were similar to those observed in previous studies, such as exploration, scientific knowledge, business, nationalism, settlement, legacy, and fear. New frames, including life, health, social justice, and social engagement, emerged from the current study. The framing and tone of Mars articles were deployed similarly in U.S. and U.K. newspapers despite the different objectives of each country’s space program. From the Apollo moon shots to human exploration of Mars, each successive era of spaceflight has been framed in a logical progression from concept to completion that resonates with the values of the times.

Keywords: framing, Mars, National Aeronautics and Space Administration (NASA), print newspapers, tone, United Kingdom, United States
Introduction

Mars garnered much media attention worldwide between 2011 and 2016. Until 2010, the main mission of the National Aeronautics and Space Administration (NASA) was to deliver supplies to the International Space Station via the Space Shuttle and then to send astronauts back to the moon with the Constellation program. But after President Barack Obama redirected NASA’s mission to develop a substitute for Constellation, the space agency retired the Space Shuttle program in 2011 and focused on preparing for Mars exploration in the 2030s, which remains one of NASA’s goals (Obama, 2010). In November 2011 NASA launched the Mars Science Laboratory. Better known as the Curiosity rover, it landed successfully on the surface of the Red Planet in August 2012. Since then, Curiosity and the rover Opportunity, launched in 2003, have been roaming Mars and making headlines with their scientific discoveries. NASA is the only space agency in the world to have landed not just one, but seven rovers on Mars. Other organizations have tried but failed, including the European Space Agency with Beagle 2 in 2003 and Schiaparelli in 2016 (Wall, 2016).

In 2013 China landed a probe on the moon, Britain won its second astronaut a spot in the European Space Agency’s manned space program, and NASA announced many discoveries by Curiosity, including evidence of past water on Mars (Connor, 2013). NASA’s Mars Atmosphere and Volatile Evolution Mission (MAVEN) and India’s Mars Orbiter Missions (MOM) arrived at the Red Planet in 2014 (Amos, 2014; Kramer, 2014). Also that year, NASA installed Veg-01 on the International Space Station, which enabled astronauts to grow produce in microgravity (Hobson, 2016).

In 2015 Mars One, a Netherlands-based nonprofit that plans to send a group of colonists to Mars, narrowed its selection pool to 100 candidates (Hartmann, 2015). In September 2015
NASA announced the discovery of liquid water on Mars (Chang, 2015). On October 2 *The Martian* movie was released. It told the story of a lone astronaut stranded on Mars, his struggle to survive on the hostile planet, and the mission to rescue him. Later that year, NASA announced data suggesting that billions of years ago, strong solar wind from the newborn sun stripped away the thick Martian atmosphere and its water (Feltman, 2015). In December NASA opened its astronaut program to applicants for a manned mission to Mars (Visser, 2015). In 2016 astronaut Scott Kelly returned from a year in space to study the effects of long-term spaceflight on the human body and mind (Strickland, 2016). NASA focused much research on growing food in space and on Mars (Daniels, 2016). The first flower—a zinnia—sprouted on the International Space Station (Taylor, 2016).

As NASA ramps up its space missions in an attempt to reach Mars by the 2030s, the news media will help shape the coverage of human exploration of Mars. Extensive research (e.g., Byrnes, 1994; Chaikin, 2007; Kauffman, 1994; Neal, 2007) exists on how media in the United States framed the Apollo program, the Space Shuttle program, and NASA’s public image from the space agency’s beginning in 1958 through recent years. However, only a few scholars (e.g., Dittmer, 2007; Hogan, 2009; Slobodian, 2015) have examined how the media framed Mars news, especially in the context of human exploration, and no other researchers have compared U.S. media coverage of Mars with foreign media coverage.

The current study will attempt to fill those gaps by examining coverage of Mars from 2011 through 2016 in three print U.S. newspapers and three print U.K. newspapers with a science section, even if the article was not published in that section. Including newspapers with a science section ensured that the newspapers had staff who specialized in quality science journalism. *The New York Times, The Wall Street Journal*, and *USA Today* were chosen to
represent U.S. media, and The Guardian, the Financial Times, and The Independent were selected to represent British media. These newspapers are considered top-tier newspapers in their respective countries and reach a large audience. (For more information on the selection of these newspapers, see the “Study sample” section.)

Analyzing media coverage of events related to human exploration of Mars is important because the press helps shape the public’s understanding of those milestones, which will have consequences for future expeditions to Mars and other parts of the solar system. In a democracy, public support of a government agency’s actions affects funding. This is particularly true for NASA, which is an independent agency in the executive branch that oversees the civilian space program in the United States. NASA relies on the annual federal budget for funding proposed by the president and passed by Congress (Heniff, Lynch, Keith, Schick, & Tollestrup, 2012).

In 2015 NASA announced plans to land humans on Mars by the 2030s, a goal stated in the NASA Authorization Act of 2010 and also in the 2010 U.S. National Space Policy (Daines, 2015):

Mars is a rich destination for scientific discovery and robotic and human exploration as we expand our presence into the solar system. Its formation and evolution are comparable to Earth, helping us learn more about our own planet’s history and future. Mars had conditions suitable for life in its past. Future exploration could uncover evidence of life, answering one of the fundamental mysteries of the cosmos: Does life exist beyond Earth? (Daines, 2015)

The American people, however, have never agreed on the value of human space exploration because of their conflicting attitudes toward the risks and cost of spaceflight (Neal, 2007).
The current study compares the press coverage of Mars in the United States, which is NASA’s home country, and the United Kingdom, which has launched astronauts with American and Russian space agencies but has no plans for human spaceflights on its own (Associated Press, 2010). The U.K.’s first astronaut and the first one to stay in the International Space Station was Tim Peake (“Tim Peake launch,” 2015). In 2010 the U.K. replaced the British National Space Centre with the United Kingdom Space Agency, which is “responsible for all strategic decisions on the UK civil space programme and provide[s] a clear, single voice for UK space ambitions” (“About Us,” n.d.). Most of the agency’s space spending supports the European Space Agency (Associated Press, 2010) and human exploration of the solar system (European Space Exploration Programme Aurora, n.d.). The value of spaceflight might be perceived differently in a country with funding tied to human exploration endeavors other than NASA.

**Literature Review: A History of Spaceflight Frames**

**Framing theory**

Framing serves as a central organizing concept, value, expectation, or idea that helps give a story meaning and context. “Framing essentially involves selection and salience” (Entman, 1993, p. 52). When the media frame, they select certain perceptions of the reality of a situation and make those perceptions salient by presenting it in a story (Entman, 1993). Salience makes texts more noticeable and memorable by “placement or repetition, or by associating them with culturally familiar symbols” (p. 53).

Framing occurs at four levels: the communicator, the text, the reader, and the culture (Entman, 1993). The current study focuses on framing at the textual level, but understanding how the four levels work together gives a clear idea of what frames are, how they are deployed,
and how they function. The first level is the communicator—the journalists, politicians, or NASA officials who make framing judgments when they choose what to say about human exploration of Mars and how to say it. The second level of framing is the text. Certain words and phrase, images, and sources act as scaffolding to present the story’s facts from a certain angle (Entman, 1993). The third level occurs within the reader of a text. Everyone has a framework of how the world works as a way to navigate everyday life (Entman, 1993). Some texts might resonate with a person’s preexisting frames, while others might be dissonant with his or her understanding of the world (Entman, 1993). The most successful textual frames are widespread because they resonate with the preexisting frames of a large number of people (Benford & Snow, 2000). The fourth level of framing occurs at a cultural level, where many people share common frames (Entman, 1993). Space exploration as a new frontier is, in part, an extension of Manifest Destiny and westward expansion into the untamed West.

Building on Goffman’s study of frames (1974), Neal (2007) illuminated how framing helped Americans understand human forays into space: “These frames helped society make sense of the costly, risky endeavor of human spaceflight by anchoring it in traditions and values that matter to citizens” (p. 88). Frames are malleable and can evolve with the changing social and political climate or certain events (Benford & Snow, 2000). Frames are most effective in terms of credibility and salience when they appeal to as broad an audience as possible (Benford & Snow, 2000). As the literature suggests, each successive era of spaceflight has been framed in a way that resonates with the values of the times (Benford & Snow, 2000), thus making it understood by and acceptable to the public.
Framing of NASA

Scholars (e.g., Byrnes, 1994; Dittmer, 2007; Neal, 2007; Slobodian, 2015) have examined NASA’s framing of activities and events, such as the Apollo missions, the implementation of the Space Shuttle and International Space Station, the Columbia and the Challenger disasters, and the Mars rovers. Some of these scholars refer to “narratives” and “images,” but for consistency they will be called “frames” in the current study.

It is in NASA’s best interest to rally support so it can be a successful agency of the U.S. government. To make its goals and values understandable and relatable to the American people, NASA shaped three frames between its founding in 1958 and the early 1990s—nationalism, romanticism, and pragmatism (Byrnes, 1994). These frames changed in response to the social and political climate of the times and have continued to evolve (Benford & Snow, 2000; Byrnes, 1994). The nationalism frame, which is also used in the current study’s content analysis, promoted the idea that the space agency was necessary for building national pride and establishing the United States as a world leader during the Cold War. The other two frames—romanticism and pragmatism—were split into narrower frames and combined with the work of other scholars in the following sections. The emotional appeal of the romanticism frame was based on the assumption that humans have a basic impulse to explore and seek adventure: “Romanticism has invited the public to participate vicariously in NASA’s exciting and heroic activities” (Byrnes, 1994, p. 47). This frame was especially useful in times of distress and failure, such as after the Challenger disaster (Neal, 2007). Finally, the pragmatism frame, which justified the use of the Space Shuttle to transport people and equipment to and from space, reinforced the practical benefits of the space program (Byrnes, 1994).
Framing the space race

When the Soviet Union launched Sputnik I into Earth orbit on October 4, 1957, the space race was on. The U.S. suddenly found itself rallying against communist supremacy in spaceflight. Politicians and presidents, especially John F. Kennedy, promulgated the nationalism and the new frontier frames, which the press picked up on to justify space missions during a time of national urgency (Byrnes, 1994; Neal, 2007). “Both [of these frames] resonated with the American public’s hopes, fears, and values” (Neal, 2007, p. 67).

The nationalism frame emerged in the late 1950s and persisted through the 1960s (Neal, 2007). “Steeped in cold war anxieties about a possibly mortal adversary, citizens could understand the importance of an all-out thrust into space” (p. 67). Nationalism appealed to patriotism, pride, and prestige by presenting the United States as a superpower (Byrnes, 1994). The nationalism frame held that the space program demonstrated leadership in science and technology, “which demonstrates an especially potent type of national prestige because it reflects military and economic might” (Byrnes, 1994, p. 9). The nationalism frame was a powerful anchor, especially during the turbulent 1960s.

The new frontier frame, which grew out of Kennedy’s rhetoric about landing a man on the moon, won the support of the American public. “The New Frontier included many of the constituents of the old frontier: adventurous and independent pioneers willing to battle evil enemies and tame a hostile, unknown environment” (Kauffman, 1994, p. 5). Frederick Jackson Turner had introduced the “frontier thesis” in 1894, so this frame was easily recognized and understood by Americans. For most of American history, the population had moved westward into wilderness—or the new frontier. The blending of civilization with wilderness bred the distinctive American character and permeated American culture (Turner, 1894). Some words and
phrases associated with the new frontier frame include “curious,” “restless heroes,” “pioneers,” and “adventurers endowed with skill, tenacity, and individuality” (Kauffman, 1994; Turner, 1894). The frontier narrative explained why Americans continued to push boundaries by heading into space, making it a useful way for the media to frame space missions (Neal, 2007).

The media and NASA also painted images of heroes within the new frontier frame by presenting astronauts as “all-American heroes with rock solid temperaments, heartland opinions, and unwavering morals” (Chaikin, 2007, p. 60). Astronauts paralleled the brave, morally righteous pioneers of America’s past. Media coverage emphasized the power of individuals, such as astronauts and scientists, to overcome challenges. For example, the media portrayed John Glenn, the first American to orbit Earth, as the ideal pioneer (Kauffman, 1994).

This presentation of humans taking command over nature with intelligence and skill contradicted the reality that the first astronauts could not pilot their craft. The lack of control resulted from the design of the capsule, not a lack of skill. This interface between technology and humans led to a minor frame of the new frontier frame: man versus machine (Kauffman, 1994). In this frame, humans commanded the physical universe using their technological wisdom. Eventually, technology allowed astronauts to control their spacecraft. By drawing parallels between the space program and America’s early pioneers, the media and NASA continued to foster the frontier narrative (Byrnes, 1994; Kauffman, 1994; Neal, 2007).

Frames can morph as the social and political climate changes (Benford & Snow, 2000). The new frontier frame fell out of favor in the 1970s, when astronauts became less popular after the moon landings (Chaikin, 2007). “The Apollo missions took place at a time when the antihero was on the rise, as exemplified by such films as Cool Hand Luke (1967), Bullitt (1968), and
"Midnight Cowboy (1969)" (Chaikin, 2007, p. 60). The next time astronauts were framed as heroes was immediately after the Columbia and the Challenger disasters (Neal, 2007).

Framing the Space Shuttle era

After the United States landed men on the moon and the space race slowed, the old frames of nationalism and the new frontier became incongruous with public and political expectations of human spaceflight. “America’s decisive victory in the race to the moon greatly eased Americans’ fear of Soviet space domination and, in the process, made NASA’s [and the media’s] image of nationalism much less compelling” (Byrnes, 1994, p. 113). Not even the romantic new frontier frame could reverse diminishing political support of NASA’s activities (Byrnes, 1994).

Two new frames—the new era and business—emerged with the dawn of the Space Shuttle era (Byrnes, 1994; Neal, 2007). The Space Shuttle program began in 1981 to transport astronauts and supplies to and from Earth orbit. To some extent, both NASA and the media framed this program as a new era of spaceflight characterized by “routine transportation to space” (Neal, 2007, p. 71). One of the first journalists to adopt the Shuttle-era frames was John Noble Wilford, the influential director of science news at *The New York Times* (Neal, 2007).

The new era frame was characterized by America’s identity as a new world where innovation thrives, especially in the field of transportation (Neal, 2007). This frame harks back to America’s successful history with railroads, cars, and airplanes—all of which have profoundly affected society. NASA and the media portrayed the new era as socially transformative and ultimately hoped to record it in history books as humanity’s maturation during the dawn of the space age, as defined by routine space travel (Neal, 2007).
The business frame sought to validate the resources being poured into NASA (Byrnes, 2007; Neal, 2007). After the climactic lunar landings, NASA shed its pioneering image and tried to continue its popularity by appealing to as many facets of society and government as possible, such as business, science, and the military. The pragmatic business frame highlighted how transportation had expanded the American economy in the past (Byrnes, 1994). The media began to refer to the Space Shuttle as the “space truck” that would, among other things, semi-routinely deliver cargo into Earth orbit to build a U.S. space station (Neal, 2007).

However, the business frame turned out to be NASA’s Achilles heel because it invited easy criticism. Rather than relying on emotional and moral frames, such as the new frontier, the media framed the Space Shuttle era in a way that could be measured by productivity, by cost, and with data (Neal, 2007). Criticism by the media, politicians, and the public soared when Space Shuttles failed to measure up to the hype and productivity of past NASA missions. The design problems with the Space Shuttle, such as defective tiles that fell off during re-entry and faulty O-rings that caused the Challenger failure, also signaled to the public that human spaceflight was still riddled with problems (Neal, 2007). When the business frame started to become dissonant in the late 1980s and early 1990s, the media, journalists such as Wilford, and the American public realized that it was much harder to justify the space program than it was back in the day when Apollo astronauts were exploring the new frontiers of space (Neal, 2007).

**Framing the acquisition of scientific knowledge**

As the new era and business frames became increasingly dissonant, NASA needed a new frame to engage the public. This time, it involved the Space Shuttle’s role in acquiring scientific knowledge (Neal, 2007). As the media, politicians, and the public became aware that the Space Shuttle was never going to be as regular as airliners, which was often NASA’s comparison,
NASA began to frame spaceflight in a new, engaging way, especially after the Challenger Space Shuttle disaster in 1986 (Byrnes, 1994).

The scientific knowledge frame emerged after the Space Shuttle launched in 1981 and construction of the International Space Station began in 1984 (Neal, 2007). The shuttle often carried scientists who used it as a temporary orbital research station to study the properties of materials and processes in microgravity as well as how humans reacted to time in space. This frame suggested that “the purpose of human spaceflight on the space station was to advance science, which would yield discoveries for benefits on earth and enable future exploration” (Neal, 2007, p. 79).

Although the media picked up the scientific knowledge frame introduced by NASA, the press also used it as a way to critique the agency. New York Times’ editorials were critical of the scientific knowledge frame when applied to human spaceflight, pointing out worries about cost versus risk, necessity, and utility (Neal, 2007). Even space scientists voiced their objections to the International Space Station. For example, American physicist James A. Van Allen suggested using automated robots and probes instead of humans for space missions (Neal, 2007).

Some scholars (e.g., Cirino, 1971; Kauffman, 1994) have found that media coverage of the space program was misleading and did not accurately portray other options that NASA could have pursued. The media “‘intentionally’ failed to inform the public that most of those who opposed manned space exploration favored unmanned space exploration” (Kauffman, 1994, p. 51, in reference to Cirino, 1971). While Cirino’s research (1971) applied to the Apollo era, some journalists, scientists, scholars, politicians, and members of the public throughout NASA’s history have also disapproved of its use of certain frames, such as scientific knowledge, new era, and business (Byrnes, 1994; Kauffman, 1994; Neal, 2007). Despite dissent, the scientific
knowledge frame persisted at least into the 1990s. It was used by NASA and perpetuated by the media as older frames became irrelevant and scientists and teachers began taking trips into space (Neal, 2007).

**Framing disaster: Humanity’s heroes**

The scientific knowledge frame was secondary to the business and the new era frames during the Space Shuttle program. The new era frame was popular until 1986, when “[t]he Challenger accident shattered the new era frame of routine spaceflight” (Neal, 2007, p. 81). Suddenly, exploration seemed worth humanity’s effort rather than the routine use of the Space Shuttles as the harbinger of a new era. The hero frame became dominant as NASA and the media sought to give meaning to such a risky endeavor as spaceflight (Neal, 2007). For a while, the only way NASA and the media could justify the loss of human lives was through the emotional hero frame, which focused on the explorers’ bravery. The hero frame drew key phrases and ideas from the new frontier frame but amplified the heroic pioneer by depicting the astronauts as brave, patriotic, and able (Byrnes, 1994; Neal, 2007). This frame added elements of sorrow, sacrifice, faith, and martyrdom in response to tragic events (Neal, 2007). By the mid-2000s the news media were framing human spaceflight “more lyrically, as exploration resonant with mystery, curiosity, adventure, and reinvigoration after a long stay in Earth orbit” (Neal, 2007, p. 87).

**Framing human exploration of space**

The press reinforced the exploration frame, which was a hybrid of two older frames—the romantic new frontier and the pragmatic new era (Neal, 2007). Partly as a knee-jerk reaction to the Challenger disaster in 1986, NASA pushed this exploration frame in its quest for approval after the national tragedy (Neal, 2007). The exploration frame echoed the new frontier frame
from the 1960s but took it even further than reaching the moon by focusing “on exploration and settlement within the solar system as the extended home of humanity” (Neal, 2007, p. 84). This vision included the “massive infrastructure” of transportation technologies that would carry people and equipment to bases on the moon and Mars (Neal, 2007, p. 84). The exploration frame, especially when employed by NASA, “frequently referred to exploration and its importance to the human spirit” (Byrnes, 1994, p. 48). The push into space was often portrayed as a biological imperative and an innate craving of human nature.

In the late 1980s serious talks about Mars exploration re-engaged the exploration frame. Mars had been absent from most news articles in the 1960s because the world was transfixed by the lunar missions, and in the 1970s the media focused on the Space Shuttle (Hogan, 2009). The 1980s ushered in more talk about Mars exploration, and by the end of the decade, President George H. W. Bush had introduced the Space Exploration Initiative (Hogan, 2009). Included were plans for the construction of the International Space Station, development of a base on the moon, and eventually human exploration of Mars. NASA was pushing a “vision of productive industry on Mars,” emphasizing the business frame rather than the more romantic frames (Neal, 2007, p. 85). In 1987 astronomer Carl Sagan wrote a piece, “It’s Time to Go to Mars,” for The New York Times that was beginning to accept the vision of humanity’s future on Mars. This new target gave NASA a chance to put the past, including failures such as the Challenger, in the rearview mirror. In the article Sagan harked back to the imagery, appeal, and romanticism of NASA’s new frontier days as well as a new era appeal in which he argued that humanity could become a “multiplanet species” (p. A27). John Noble Wilford also reported positively on the initiative in The New York Times, suggesting that the American public accepted the exploration frame (Neal, 2007).
In the early 1990s Mars was attracting the most media attention since 1969, but Mars coverage did not spike, as it had in in 1969, when NASA was reaching for the moon and still looking beyond (Hogan, 2009). When it became evident that the Space Exploration Initiative would never come to fruition, the press grew critical and waved it off as nothing more than rhetoric by President Bush (Neal, 2007). Media attention plummeted right after the Space Exploration Initiative ended in the early 1990s and NASA abandoned human forays to the moon and Mars. The initiative was replaced with NASA’s “faster, better, cheaper” strategy of space exploration (Spear, n.d.). As a consequence, probes made it to Mars, but humans did not. In the mid-1990s fewer than ten U.S. news articles were published each year about Mars manned missions (Hogan, 2009). Instead, the media focused on the construction of the International Space Station (Hogan, 2009).

**Mars: The planet of many frames**

Historically, the news media promulgated the widespread belief that Mars was home to an ancient, sprawling civilization. In the late 1800s amateur astronomers received a lot of media attention when they identified Mars as a planet similar to Earth, and a few professional astronomers theorized that man-made canals had been constructed across the Martian landscape to provide water for a dying civilization (Dittmer, 2007). Despite scientific opposition, this view persisted in the public eye until Mariner 4 became the first spacecraft to reach Mars. It took close-up images of the planet’s surface in 1965 and proved the canals were geological structures (NASA—Missions to Mars, 2006).

Humans have continued to send probes to Mars, with the media acting as a bridge between NASA and the public. In recent years Mars has become the planet of many frames. When Mars Pathfinder landed on Mars on the U.S. Independence Day in 1997, NASA had two
mission objectives for the rover as it explored the planet’s surface: confirming the imaging data it gathered with physical experiments, and rekindling public interest to save the floundering government program (Dittmer, 2007). The media relied on three main frames while covering the Mars Pathfinder rover (Dittmer, 2007). The first was scientific advancement, which included the search for life. The second was the naming of Martian places, and the third was analogies between the Earth and Mars. These frames “converge in a language of colonialism” that harks back to the new frontier frame as an extension of Manifest Destiny and the pioneer, which in this case is Pathfinder (Dittmer, 2007, p. 112).

The media and NASA adopted anthropomorphic descriptions of the Mars Pathfinder rover to evoke a sense of colonialism and exploration in an attempt to gain continued funding and public support for sending rovers to Mars (Dittmer, 2007). For example, during an interview NASA representative Donna Shirley commented on how she and broadcast journalist Katie Couric greeted the rover like a person (Dittmer, 2007, p. 126).

Fear is frequently used to frame media coverage of human exploration and colonization of Mars. For example, fear-based narratives in fiction, entertainment, and the news media portray Mars as a place where humanity could escape overpopulation and global warming (Dittmer, 2007; Slobodian, 2015). By reminding audiences about these problems on Earth, private industries that want to colonize Mars fostered a fear-based, escapist mentality (Slobodian, 2015). The species survival frame assumes that humans must settle beyond Earth in order to flourish (Slobodian, 2015). The example of an asteroid hitting the Earth is often used to justify moving all of humanity’s eggs out of one basket and into another. The utopian frame assumes that Earth’s systems are old and faltering, so colonizing another planet would solve many of humanity’s problems (Slobodian, 2015). The fear frame is effective because it works within a
particular culture or a certain perception of reality, such as black-and-white thinking (Entman, 1993; Slobodian, 2015). Much of the rhetoric about going to Mars is “do or die” with respect to humanity’s longevity (Slobodian, 2015).

Creation of frames

NASA plays a key role in shaping space exploration by choosing frames that appeal to the public and bolster legislative support for funding the space program (Byrnes, 1994; Markley, 2005). When NASA needs funding, for example, it returns to an emotional narrative and focuses on Mars exploration (Markley, 2005). Information subsidies are a way for NASA to control the framing of events via press releases and press conferences that might include certain material and omit other information (Gandy, 1980). The press can adopt NASA’s frames or generate their own, but ultimately this information cascade will influence public perception of NASA.

Some scholars (e.g., Slobodian, 2015) claim that the media play an active role in the push to explore space and colonize Mars. Reporters acknowledge the risks of sending people into space “but then move on to talk about inspiring our children.” Thus, the media support the space program so that one day, humanity can overcome Earth’s restraints, both political and gravitational, and find utopia and purpose on another planet (Slobodian, 2015, p. 98).

Conversely, other scholars (e.g., Ostman & Babcock, 1983) have found that the media were not biased in favor of the space program, specifically during the Apollo era.

Although the news media and public opinion contribute to frame creation (Entman, 1993), they are only moderately important in ultimately influencing space policy (Hogan, 2009). The most influential U.S. government leader in space policy is the president, and the most influential nongovernmental group is industry leaders, such as the aerospace industry (Hogan, 2009). With regard to media attention, public interest is the driving factor (Hogan, 2009).
Declines in overall media attention to space exploration appear to be correlated with periods of poor economic performance and the tightening of the federal budget (Hogan, 2009).

**Tone of space coverage**

The tone—positive, negative, or neutral—of articles about exploration of the Red Planet plays a large role in the public’s reception of an event or issue (Hogan, 2009). Although not many articles were written about Mars exploration during the Apollo era, 90 percent of them were supportive and had a positive tone (Hogan, 2009). In fact, most news coverage during this era was so positive that the U.S. press has been criticized for cheerleading the Apollo missions (Cirino 1971; Kauffman, 1994). But during the Space Shuttle years, when the new era and the business frames dominated coverage, a negative tone was much more evident as the media began to criticize the promises of routine spaceflight and its economic benefits (Neal, 2007).

Mars did not comprise a significant amount of media coverage again until President George H. W. Bush announced the Space Exploration Initiative in the late 1980s. The tone of the articles continued to be mostly positive until the initiative ended (Hogan, 2009). Since then, no studies have been conducted on the tone of Mars news coverage.

**Research Questions**

The lack of research on the framing and tone of media coverage of Mars is surprising, given the Red Planet’s popularity in news and entertainment from 2011 through 2016. This study will attempt to fill a gap in the scholarly literature about Mars coverage by examining the frames and tone used by newspapers in the United States and the United Kingdom with a science section. The United Kingdom was chosen because it is invested in space exploration through the
European Space Agency and is not tied to NASA. United Kingdom newspapers are printed in English and accessible through the ProQuest Newsstand database.

**RQ1:** How did three elite U.S. newspapers and three elite U.K. newspapers frame the coverage of Mars from 2011 through 2016?

**RQ2:** How did the framing of Mars change from 2011 through 2016 in relation to scientific milestones?

**RQ3:** How did the tone of the articles change from 2011 through 2016 in relation to scientific milestones?

**Methodology**

**Study sample**

The selection of three top-tier newspapers from both the United States and the United Kingdom was based on their large circulation (Boykoff, 2007), reputation, and inclusion of a science section staffed with science journalists. From April through September 2014, USA Today, The New York Times, and The Wall Street Journal were the top three newspapers by circulation in the U.S., according to a Poynter article citing a report compiled by the Alliance for Audited Media (Beaujon, 2014). USA Today had an average Monday-through-Friday print newspaper circulation of 1,083,200 in September 2014. The New York Times had an average Sunday print circulation of 1,181,160 and an average Monday-through-Friday print circulation of 639,887 in September 2014. The Wall Street Journal averaged 2,276,207 subscribers from Monday through Friday (Beaujon, 2014). No information was freely available on the Sunday print circulations for The Wall Street Journal and USA Today. In September 2014 The Financial Times had a national daily circulation of 217,121, The Guardian reached 180,731 subscribers,
and The Independent had 63,135 readers as reported by the Audit Bureau of Circulations ("ABCs," 2014). In addition, each of these newspapers has a science section and appeals to readers with different political leanings. The New York Times and The Guardian have mostly left-leaning audiences. The Financial Times and The Wall Street Journal are business-oriented newspapers with a mixed readership that skews conservative. USA Today and The Independent and The Independent on Sunday are moderate. The political leanings of the U.S. newspapers were based on a Pew Research Center (2014) study. The leanings of the U.K. newspapers were determined by editorials endorsing political candidates in the 2015 election. For example, The Financial Times supported the Conservative party, The Guardian endorsed the Labour party, and The Independent and The Independent on Sunday favored the Conservative party and the Liberal Democrats (Croucher, 2015).

Each newspaper was accessed using ProQuest Newsstand. Publications were first searched and selected to obtain a publication identification, which was a number. A "pubID" was then listed in the search box, along with the search keywords, including "Mars exploration," "Mars space exploration," "Mars AND NASA," "Mars AND SpaceX," "Mars AND Mars One," "Mars water," and "Mars atmosphere." These terms reflect the scientific discoveries that could lead to human exploration on Mars. Keyword search results were filtered by date range (2011-2016) and document type (news, article, and feature). Documents were chosen if Mars was a prominent subject, as determined by assessing the headline, deck, and lead.

Despite these strict criteria, some off-topic documents were collected, such as stories about Bruno Mars or Mars as a location to orient the reader (e.g., the asteroids located between Jupiter and Mars). These articles were excluded. So were instructional pieces about stargazing. Articles about art exhibits were included only if they focused on Mars the planet. Four articles
collected using these keywords did not fit the original criteria of having “Mars” mentioned in the headline, deck, or lead. They were included, however, because the phrase “Red Planet” or “deep space exploration” indicated that the article was about Mars, which was then named later in the story. Associated Press wire stories as short as 50 words were included, but one-sentence briefs were not.

**Unit of analysis**

The unit of analysis was a news or feature article that mentioned Mars in the headline, deck, and/or lead. The lead, which tells a reader what the article is about, can appear at the beginning of the story or in the first few paragraphs (Kille, 2009). Cartoons, photographs, captions, reviews, opinion pieces, and editorials were not included.

**Study period**

This exploratory study focused on articles published between 2011 and 2016. The year 2011 was selected as the start date because it gave a one-year cushion before 2012, the year NASA successfully landed Curiosity, its largest rover, on the Red Planet using a daredevil landing mechanism. The year 2016 was selected as the end of the study period because 2015 was also a big year for Mars news, and 2016 provided a symmetrical one-year cushion at the end of the study period. During this period NASA reported many major discoveries about Mars, such as finding liquid water on its surface and modeling what caused Mars to lose its ancient atmosphere. In addition, private companies, such as Mars One and SpaceX, announced plans to colonize Mars in the near future. Wealthy CEOs, such as Dennis Tito of Inspiration Mars and Jeff Bezos of Amazon and Blue Origin, revealed plans to develop technology that might help NASA reach Mars by the 2030s. The Red Planet was noticeable in pop culture after the October
2015 release of *The Martian* movie. Also in 2015, NASA opened up applications for the astronaut program, bringing in a record number of prospects (Garcia, 2016).

**Coding the content**

The author trained a second coder, and together they conducted a pre-test to make sure the codebook was comprehensive and the instructions were clear. The author then coded all 320 relevant newspaper articles for nine variables grouped into three sections: article data, tone, and frame. (See Appendix.)

- **The article data** section includes the name of the newspaper, the date the article was published, the length of the article, the headline and deck, the author, and the topic. The date of publication provides context in relation to scientific milestones. For example, articles written before the announcement of the discovery of water on Mars might frame any life on Mars as romantic science fiction, but after the announcement, pragmatic frames might portray the idea of life on Mars more seriously. The author could be a staff member, wire service reporter, freelance journalist, or scientist. The topic refers to the focus of each article based on the main subject in the headline, deck, and text. The topics coded include science, life on Mars (past, present or future), exploration and/or settlement of Mars, technology, entertainment, private company or business person involved in the creation of technology to reach and live on Mars, and nation or government agency.

- **Tone** indicates whether the article is supportive of, against, or neutral toward the topic. Supportive articles contain favorable content or quotes that show belief, enthusiasm, excitement, or trust. Negative articles include content or quotes that highlight disbelief, impatience, distrust, or opposing views. Neutral articles have
matter-of-fact sources, dispassionate quotes, and straightforward facts. Hogan (2009) determined tone by asking one question: Would an advocate of an American human space exploration program, managed by a civilian sector agency, be happy or unhappy with the title of the article? This method was applied to the current study by asking a similar question about Mars: Would the headline, deck, and text of this article make an advocate for the topic of the article (as coded in the codebook) feel that the tone is positive, neutral, or negative? If the tone of the headline and deck differed from the tone of the text, then the tone of the text was coded. The word choice can indicate the tone. A positive article might mention “hope” or describe a celebratory scene. A neutral article does not evoke a reaction from the reader and might be purely explanatory. A negative article is pessimistic or defeatist when reporting on costs or risks and includes words such as “hope fades” or “problems.” The tone can provide insights into how the media are deploying a frame. For example, two articles might use the business frame, but one has a negative tone that focuses on the reasons why Mars exploration is a bad thing, while the other piece has a positive tone that describes why it is a good thing. The frame is the same, but the message is different.

**Framing Mars coverage**

The author identified common frames found in previous analyses of space coverage by the news media (e.g., Byrnes, 1994; Chaikin, 2007; Dittmer, 2007; Kauffman, 1994; Neal, 2015; Slobodian, 2015). Byrnes (1994) identified three frames: nationalism, pragmatism, and romanticism. Nationalism, which is described below, is defined by specific keywords and phrases. However, pragmatism and romanticism are conceptually broad and, therefore, were
broken down further based on recent events tied to Mars, such as the private sector joining the government on space missions and the buzz about future colonization. In addition, some past frames were combined, such as the hero frame and the new frontier frame. While scholars have often separated them, there is much overlap in their keywords, phrases, and concepts.

The following frames were selected from the body of literature and adapted for the current study of Mars media coverage:

1. Nationalism frame (Byrnes, 1994; Neal, 2007)
2. Legacy frame—Based in part on the romantic frame and the hero frame (Byrnes, 1994; Chaikin, 2007; Kauffman, 1994; Neal, 2007; Turner, 1894)
3. Business frame (Neal, 2007)—Based in part on the pragmatic frame (Byrnes, 1994)
4. Scientific knowledge frame (Neal, 2007)—Based in part on the pragmatic frame (Byrnes, 1994)
5. Settlement frame—Based in part on the new era frame and the romantic frame (Byrnes, 1994; Neal, 2007)
6. Exploration frame—Based in part on the exploration frame, the romantic frame, and anthropomorphism (Byrnes, 1994; Dittmer, 2007; Neal, 2007)
7. Fear frame (Slobodian, 2015)
8. Life frame—A new frame identified during the pretest of the codebook for this study

- Nationalism, which was NASA’s main frame in the late 1950s and ’60s, emphasized patriotism and argued that the space program should be supported because “space capability helps American national pride, prestige, national strength (both military and economic), and peaceful international relations” (Byrnes, 1994, p. 3). This frame was operationalized by coding for topics about the United States gaining an advantage over
other countries (think space race and Cold War), pushing boundaries, and leading in science. Keywords, phrases, and concepts include “patriotism,” “national pride,” “dominance,” and “prestige.”

- The **legacy** frame is based on the new frontier frame, which “include[s] many of the constituents of the old frontier: adventurous and independent pioneers willing to battle evil enemies and tame a hostile, unknown environment” (Kauffman, 1994, p. 5). Popular during the 1950s and ’60s, the new frontier frame was championed by President Kennedy and often recycled by the media to re-engage public support. What makes the legacy frame different is that now, the media can hark back to the Apollo Era, which in turn pulled themes from the old frontier. The legacy frame was operationalized by coding for topics about America’s history of exploration, the shaping of its culture and character by Manifest Destiny, and heroic undertones that justify the risks of human exploration in space. Keywords, phrases, and ideas include “pioneers,” “explorers,” “adventurers,” “bravery,” “sacrifice,” “skill,” “tenacity,” “intelligence,” “Manifest Destiny,” curious and restless individuals, outer space to tame and conquer, and the human need to explore—even on a spiritual or biological level.

- The **business** frame highlights the material and economic benefits of space travel, such as generating new products, technologies, and transportation (Byrnes, 1994). This frame was operationalized by coding for topics about the colonization of Mars from a business perspective, such as the economic benefits, financial harm, profit, money, technology, and the activities of private industry and CEOs related to Martian activities. Keywords, phrases, and ideas include “measurement,” “performance,” “technological spinoffs,” “productivity,” “efficiency,” “power,” “cost,” “problem,” “delay,” and monetary figures.
• The scientific knowledge frame justifies space exploration through the scientific method and discovery. It also explains the science discussed in the article. This frame was operationalized by coding for topics about acquiring knowledge, improving scientific techniques, and conducting research. Keywords, phrases, and ideas include “discovery,” “research,” “knowledge,” “puzzle,” “evidence,” “search,” “uncover,” and universities designing missions or research, improving scientific understanding, and improving models.

• The settlement frame incorporates new trends in technology and science to achieve the ultimate goal of colonies on Mars. This frame conveys the sense that settlement of Mars is long overdue, especially considering that humans reached the moon almost 50 years ago. This frame envisions the development of massive trans-planetary transportation to carry people and equipment to bases on the moon and Mars. This frame was operationalized by coding for topics about technology, science, techniques, businesses, or resources that give Mars settlement a socially transformative purpose. Keywords, phrases, and ideas include civilians on Mars, travel to Mars, references to a new era or brighter future, terraformation (making Mars’ environment more like Earth’s), “adventure,” “inspiration,” “purpose,” “worth the danger,” overdue opportunities for settlement, colonization technology, livable conditions on Mars, and construction terms such as “blueprints” and “architecture” applied to either actual physical structures or abstract social ideals.

• The exploration frame describes the journey of humans or rovers to Mars and the technology, techniques, or businesses that allow humans or rovers to explore its surface. Unlike the settlement frame, which stresses colonization, this frame focuses on the
transitory aspects of exploration. Keywords, phrases, and ideas include “exploration,”
“journey,” “mission,” “travel,” distances, and descriptions of the voyage to Mars or
explorations of its surface.

- **The fear** frame often focuses on a do-or-die perspective of why humans should invest
more time, money, and resources in Martian exploration and colonization. On the flip
side, the fear frame might be used to deter people from exploring and colonizing Mars.
This frame was operationalized by coding for topics about human exploration as a way to
save humankind. Keywords, phrases, and ideas include references to ways the world
could end, “overpopulation,” “climate change,” “nuclear war,” “loss of ecosystems,”
“last resort,” visions of a dystopian future, or an escape from problems on Earth.

- **The life** frame stresses how alien life might be found on Mars or how it might have
existed in the past or present. This frame is speculative. Scientists still do not know the
state of life on Mars, past or present, but this frame uses scientific evidence to make the
case for life. Keywords and phrases include “life,” “Martians,” “microbial life,” “aliens,”
and quotes from scientists speculating about the state of life on Mars.

- **Other** refers to a frame not listed above.

In addition, three new frames emerged based on the results of the coding. (See the Discussion.)

**Intercoder reliability**

Codebook instructions are reliable when different researchers can produce significantly
similar results (Neuendorf, 2017). To ensure intercoder reliability, the second coder coded a
random subsample of 37 of the 300 total articles (12.3%). Intercoder reliability was calculated
for each variable using both Holsti’s (1969) formula for simple agreement and Scott’s pi
(Lovejoy, Watson, Lacy, & Riffe, 2016).
Holsti’s simple agreement ranged between 94.6% and 100% for each variable: publication name (100%), date of publication (100%), article length (100%), headline (100%), deck (100%), author (100%), topic (94.6%), frame (97.3%), and tone (97.3%).

Scott’s pi results ranged between 0.94 and 1 for each variable: publication name (1.0), date of publication (1.0), article length (1.0), headline (1.0), deck (1.0), author (1.0), topic (0.94), frame (0.96), and tone (0.94).

Findings

This study examined 320 articles about Mars collected from three elite U.S. newspapers and three elite U.K. newspapers from 2011 through 2016. Of that total, 102 (31.9%) appeared in The New York Times, followed by 67 (20.9%) in The Guardian, 58 (18.1%) in The Independent on Sunday, 34 (10.6%) in The Financial Times, 32 (10.0%) in USA Today, and 27 (8.4%) in the Wall Street Journal. (See Table 1 and Figure 1.) The largest number of articles (82, or 25.6%) appeared in 2012, which was the year the NASA Mars rover Curiosity landed on Mars.

Framing of Mars coverage from 2011 through 2016

The first research question asked how three elite U.S. newspapers and three elite U.K. newspapers framed their coverage of Mars from 2011 through 2016. In both countries the most frequently used frame was exploration (71 articles, or 22.2%), followed by scientific knowledge (62, or 19.4%) and life (61, or 19.1%). (See Table 1 and Figure 1.) The least used frames were fear (5, or 1.6%) and legacy (3, or 0.9%). The exploration frame occurred most often in 2011 (9, or 26.5%) and 2012 (22, or 26.8%), and in 2016 it appeared just as often as the scientific knowledge frame (10 each, or 23.8%). (See Table 2 and Figure 2.) The life frame appeared most often in 2013 (19, or 29.2%), which was the year after Curiosity landed on Mars. The scientific
knowledge frame was most popular in 2014 (12, or 26.7%) and 2015 (11, or 21.2%).

Nationalism was used seven times in 2012 (8.5%) and 2013 (10.8%) and five times in 2014 (11.1%).

The newspapers in each country published almost the same number of articles on Mars—161 in the U.S. and 159 in the U.K. (See Table 3 and Figure 3.) The exploration frame was the most popular in both the U.S. (34, or 21.1%) and the U.K. (37, or 23.3%). All the newspapers match closely in their overall use of frames except for business. U.S. newspapers ran 11 more business articles (29, or 18.0%) than the U.K. newspapers (18, or 11.3%). The nationalism frame was used 11 times (6.8%) in U.S. newspapers and 12 (7.5%) times in U.S. newspapers.

Framing of Mars coverage in relation to scientific milestones

The second research question asked how the framing of Mars coverage changed from 2011 through 2016 in relation to scientific milestones, which were grouped into five periods determined by the researcher:

1. Pre-Curiosity—1/1/2011 (beginning of study period)–8/7/2012: This period encompasses changes in Obama’s mission outline to NASA, including the end of the Space Shuttle program and the beginning of the Orion program. During this period, Curiosity was on its way to Mars but had not yet landed.

2. Age of Curiosity—8/8/2012–11/4/2013: This period includes the successful landing and test drive of Curiosity and discoveries by the rover, such as proof of an ancient streambed, lack of methane in the atmosphere, and the existence of complex substances. Private companies announce plans to colonize Mars, and researchers begin looking into the health implication of space travel.
3. Many Missions—11/5/2013–9/8/2014: This period saw successful launches to and arrivals on the Red Planet. India’s Mars Orbiter Mission (MOM) successfully launched and entered Martian orbit. NASA’s MAVEN (Mars Atmosphere and Volatile Evolution Mission) orbiter, designed to study the atmosphere of Mars, also successfully launched. Many future missions were announced by the United States, other countries, and private companies. In addition, Curiosity found evidence of ancient lakes on Mars, continuing to fuel excitement for the presence of life on the Red Planet in the past and possibly the present.

4. Future Settlers—9/9/2014–9/27/2015: During this period, launching settlers to Mars dominated the news. Mars One narrowed its pool of settlers, Orion was test launched, NASA experimented with secluding people in Mars living-habitat simulations, Texas was betting on a future economy driven by the space industry, NASA announced that it could reach Mars only if it teamed up with a private company, the European Space Agency lander (lost since 2003) was finally found on the surface of Mars, the United Arab Emirates announced a mission to Mars, and Google and Fidelity invested one billion dollars in SpaceX. On Mars, Curiosity found methane, a gas usually given off by bacteria, again igniting the hope for life on Mars.

5. The Martian—9/28/2015–12/31/2016 (end of study period): During the final period of the current study, Curiosity detected the presence of liquid water on Mars, an ingredient necessary for the existence of life. The Martian movie was released, NASA continued to study the health effects of deep space on astronauts, NASA tried growing potatoes in a simulated Mars environment, and NASA announced plans to have a colony on Mars by the 2030s. Scott Kelly spent a year in space, and SpaceX began test launching rockets to
propel people to Mars. The ESA orbiter successfully reached Mars, but the accompanying lander crashed on entry.

In all six newspapers the exploration frame dominated during two periods: Pre-Curiosity (22 articles, or 32.8%) and Future Settlers (18, or 26.9%). (See Table 4 and Figure 4.) Scientific knowledge was the most popular frame during the Many Missions period (13, or 32.5%) and The Martian period (14, or 27.5%). Life was the most frequently used frame during the Age of Curiosity (28, or 29.5%).

It is important to note that in the U.S., the most articles (50, or 31.3% of the 161 total) were written in the Age of Curiosity (8/8/2012–11/4/2013). (See Table 5 and Figure 5.) That period also saw a spike in the life frame (16, or 32.0%) and the exploration frame (11, or 22.0%). The life frame stayed in the news during most time periods, except for The Martian period (9/28/2015–12/31/2016), where ironically the life frame was not used. The exploration frame was used frequently throughout the study period except during the Many Missions period (11/5/2013–9/8/2014), where it dropped to only 1 article (4.8% of the 21 total for that period). The scientific knowledge frame appeared fairly consistently over the study period, with a slight rise (9 articles, or 23.0% of the 31 total articles) in The Martian time period. It was the least common in the Pre-Curiosity period (1/1/2011–8/7/2012), with only 2 articles, or 6.5% of the 31 total articles. U.S. use of the nationalism frame reached its highest point in the Many Missions period, with 5 articles (23.8% of the 21 total articles, or 45.5% of all nationalism frames).

U.K. newspapers published the most Mars articles during the Age of Curiosity (45 out of the 159 total articles, or 28.3%). (See Table 6 and Figure 6.) The most common frames during this time were the life frame (12 articles, or 26.7%), scientific knowledge (10, or 22.2%), and exploration (9, or 20.0%). The life frame appeared consistently during the study period, but it
dropped to its lowest use during The Martian period (3 articles, or 15% of the 20 total articles). The scientific knowledge frame was also used frequently throughout the study period, other than a dip (proportionally) during the Future Settlers period (5, or 12.8% of the 39 total articles). Exploration was used the most in the Pre-Curiosity period (14, or 38.9% of the 36 total articles) and the Future Settlers period (11, or 28.2% of the 39 total articles). Nationalism spiked in the Many Missions period (6 articles, or 31.6% of the 19 total articles, or half of all the nationalism articles studied). The business frame was not used at all during two periods: Many Missions and The Martian. The settlement frame was only used frequently (5, or 25% of the 20 total articles) in The Martian period.

**Tone of Mars coverage in relation to scientific milestones**

The third research question asked how the tone of the articles changed from 2011 through 2016 in relation to scientific milestones. Of the 320 articles coded, 206 (64.4%) were neutral, 73 (22.8%) were positive, and 41 (12.8%) were negative. (See Table 7 and Figure 7.) The tone was mostly neutral throughout the study period, with 2016 having the most neutral articles (31, or 73.8%). The year 2012 contained both the greatest number of positive articles (23, or 28.0%) and the greatest number of negative articles (9, or 11.0%). It is important to note that 2012 is the year that the most articles (82, or 25.6%) were published. On the other hand, 2011 saw one fewer negative article published (8), but those articles made up the highest percentage of negative articles for any year (23.5%). Overall, articles became increasingly neutral as time went on when considering percentages and not just raw numbers. The U.S. newspapers were slightly more neutral overall (107 articles, or 66.5%) than the U.K. newspapers (99, or 62.3%). (See Table 8 and Figure 8.) The U.K. newspapers were slightly more positive overall (39, or 24.5%) than the
U.S. newspapers (34, or 21.1%), and both were almost equally negative (U.S. 20, or 12.4%; U.K. 21, or 13.2%).

Although U.S. articles about Mars were neutral most of the time, they were the most positive in terms of the number of articles during the Age of Curiosity (11, or 22% of the 50 total articles) and in terms of the percentage of articles during Many Missions (5, or 23.8% of the 21 total articles). (See Table 9 and Figure 9.) U.S. newspapers carried the most negative articles about Mars during the Age of Curiosity (7, or 14.0% of the 50 total articles), but proportionally they were the most negative in the Pre-Curiosity era (6, or 19.4% of the 31 total articles). During the Future Settlers period, only 1 negative article was written (3.6% of the 28 total articles). Future Settlers was the most neutral percentage-wise (22, or 78.6% of the 28 total articles).

U.K. newspapers were also neutral during most of the study period but tended to be more positive overall than the U.S. newspapers. (See Table 10 and Figure 10.) In terms of the number of articles, Pre-Curiosity was the most neutral period (25, or 69.4% of the 36 total articles), but proportionally, The Martian period was the most neutral (17, or 85.0% of the 20 total articles). The largest number of positive articles appeared in the Age of Curiosity (16, or 35.6% of the 45 total articles). However, the largest percentage of positive articles was written in the Many Missions era (7, or 36.8% of the 19 total articles). The most negative period, in terms of both number and percentage of articles, was the Future Settlers period (10, or 25.6% of the 39 total).

**Discussion**

As the literature suggests, each successive era of spaceflight has been framed in a way that resonates with the values of the times (Benford & Snow, 2000), thus allowing frames to be understood and accepted by the public. Key events that shaped the use of frames during the study
period include the landing of the Curiosity rover on Mars, India’s orbiter mission to Mars, announcements by private companies to colonize the Red Planet, and NASA studies of the effects of space exploration on the human body. The press in both countries covered most of the same events, which might help explain why the framing was similar.

**Pre-Curiosity: Exploration frame predominates**

The news media often used exploration to frame space travel from 1986 to the 1990s and again after the 2003 Columbia disaster (Neal, 2007). During the Pre-Curiosity period (1/1/2011–8/7/2012), the exploration frame was again popular. Articles focused on Curiosity’s journey to Mars and described the excursion the rover would take after landing. The frame was synonymous with adventure and painted exploration as a worthy goal for the future. Historically, the exploration frame was used during times of distress, such as after the Challenger explosion in 1986 and the Columbia disaster in 2003. The excitement of adventure was the only intense emotion that could regain the approval of the American people for human exploration in space under trying situations (Neal, 2007).

The exploration frame may be popular with journalists because it is an engaging way to write about science. Articles framed as exploration read more like narratives than reports. One writing technique that made the Mars rovers more relatable and understandable to readers was anthropomorphizing their actions. Both U.S. and the U.K. newspapers framed the rovers’ excursions as “journeys” to Mars, their experiments on the planet’s surface as “discoveries,” and the pictures they took as objects and landscapes they “saw.” One article in *The New York Times* (January 24, 2014) compared the Opportunity rover, which had been on Mars since 2004, to an aging person with arthritis. Readers felt as though they were on Mars because they could “ride” with the rover and experience what the rover experienced. Cameras strapped to a set of wheels
while lugging a suite of lab equipment was as close to human exploration as people have ever
gotten to on Mars.

Although the exploration frame was synonymous with adventure, the Pre-Curiosity period included the highest percentage of negative articles. Many of them described the Russians losing control of their Mars probe Phobos-Grunt. On the other hand, articles about Curiosity were framed positively despite NASA’s belt-tightening during these years and its nervous excitement about the daredevil maneuver that Curiosity would have to pull off to land on Mars. NASA dubbed the landing “seven minutes of terror” because the rover could not be directly controlled during that time. Although this slogan dominated the headlines, coverage remained positive. This finding reinforces Neal’s (2007) observation that exploration is an “ambitious and optimistic” frame that journalists can easily jump onboard with (p. 84).

Age of Curiosity: Life frame peaks

The life frame dominated both U.S. and U.K. newspaper articles about Mars during the next period—the Age of Curiosity (8/8/2012–11/4/2013). Although the life frame relied heavily on speculation, it was unexpectedly popular during the entire study period. This frame uses scientific discoveries to make the case that life might exist or has existed on Mars. The life frame might have peaked during the Age of Curiosity because the rovers on Mars could detect conditions suitable for life. Ever since robots began roaming the Red Planet, the episodic discoveries of evidence for water kept making scientists more and more hopeful about finding life. The media focused on whether these discoveries indicated life on Mars, especially in the first year after Curiosity landed on Mars. When life was not found despite mounting evidence, hope diminished and the life frame became dissonant. By The Martian period, the life frame appeared only three times.
The tone of most articles published in the Age of Curiosity was positive but perhaps overly optimistic. For example, a headline in *The Guardian* (November 25, 2011)—“Is there life on Mars? Nasa’s Curiosity seeks the answer”—misrepresented Curiosity’s mission objectives, which were to scientifically observe and record the composition of the rover’s surroundings on Mars (“Mars Science Laboratory,” n.d.). Headlines like this grabbed readers’ attention by sensationalizing the science, even though journalists in both counties interviewed scientists as sources. The author of *The Guardian* article perpetuated the inaccuracy: “First among the 23-month mission’s objectives is to see whether there is life on Mars, or, in NASA’s words, ‘to assess whether the landing area has ever had, or still has, environmental conditions favourable to microbial life’” (Luscombe, 2011, para. 4). The reporter does not distinguish between determining if the conditions existed in the past for life to have lived on Mars and if life was actually discovered there. This lack of clarity, which is characteristic of this frame, misleads readers by making them feel confident that Curiosity might find life on Mars.

**Many Missions and The Martian periods: New uses for scientific knowledge frame**

The scientific knowledge frame was popular in the 1990s, when the International Space Station opened to astronauts and their research. Back then, this frame justified the risk of human life in space by promising knowledge. The scientific knowledge frame was again popular during the Many Missions period (11/5/2013–9/8/2014), when the news media and NASA seemed to use it to justify NASA’s new goal of establishing a human colony on Mars by showing that astronauts and scientists were preparing for missions by conducting scientific experiments.

Scientific knowledge was also the most-used frame during The Martian period (9/28/2015–12/31/2016), which was dominated by announcements of future missions by private companies and the United Arab Emirates. Experiments were conducted on Earth with human
subjects living in simulated Mars conditions, which further supported the new use for the scientific knowledge frame.

Interestingly, NASA astronaut Scott Kelly was often featured in stories framed as scientific knowledge. The early astronauts were acclaimed as young, athletic heroes with the “right stuff.” Kelly was portrayed as the quintessential intellectual scientist, a scientific leader, a scientific explorer, and, in one case, a science experiment. A USA Today headline (March 3, 2016) read: “Scott Kelly returns 2 inches taller: NASA astronaut is back in the USA where he’ll face the poking and prodding of scientists who will compare the space traveler with his twin who stayed on Earth.”

Many Missions period: India’s space program framed as nationalism

The nationalism frame appeared only 23 times during the study period. Both U.S. and U.K. newspaper turned to this frame mainly in the Many Missions period, when nine of the 11 articles framed India’s first mission to Mars as nationalism. First-time events like this are important elements of media coverage, especially something as groundbreaking as India’s orbital exploration of Mars, which has been accomplished by only a handful of nations. It is also important to note that the sources were Indian officials involved in the space program.

By contrast, only two articles about the U.S. space program fell within the nationalism frame during the Many Missions period. The U.S. media have not used this frame much since the Apollo era. The U.S. does not face competition from other countries to reach Mars because it already leads the world in Mars exploration. Of the many attempts to land rovers on the Red Planet, only the U.S. has succeeded, and it has done so seven times. By fiscal year 2015, NASA’s percentage of the federal budget had dropped below 0.5 percent from a peak of almost 4.5 percent in 1966 (DataBlog, 2010; NASA FY 2017 budget request, n.d.). Although this drop
is drastic, the U.S. still spends billions of dollars more than any other nation on space programs. The U.S. press does not need to encourage public support by beating the nationalism drum. India, on the other hand, is competing with other Asian nations, namely China and Japan for dominance in space. India is also trying to justify spending money on its space program when it faces many other pressing needs.

Mars articles published during the Many Missions period conveyed a positive tone. This period was full of hopeful announcements and tests for future Mars missions, including India’s robotic mission launch and landing, MAVEN’s launch, and plans to colonize Mars by Netherlands-based Mars One and Elon Musk’s SpaceX. These missions were at least a decade in the future, so there was little to be critical of during these early stages. This optimism might have influenced the positive tone of the U.S. and U.K. newspapers. For example, a positive article in *The Independent* (December 10, 2013) ran this optimistic headline: “Britain can help send astronaut to Red Planet within 30 years.”

**Future Settlers period: Changing use of business frame**

Although the business frame appeared in every period during the current study, it was never the most popular. Even during the Future Settlers period (9/9/2014–9/27/2015), when many institutions developed plans to reach Mars with either humans or robots, the exploration frame dominated. Also during this period, many experiments were underway to test how humans would cope on a mission to Mars.

Of note is the difference between the business frame during the study period compared with its original use during the Space Shuttle era, when many of NASA’s missions were framed from a business perspective. The original frame stressed the development of infrastructure and the routine exploration of space (Neal, 2007). Regularity was a key characteristic of the original
business frame. During the current study, NASA, the media, and the public did not view space exploration as a regular occurrence, nor did they expect Mars exploration to come anytime soon. Instead, the current use of the business frame stressed the feasibility, cost, and risk of missions by private companies and governments.

One of the biggest differences between U.S. and U.K. newspapers was their application of the business frame. U.S. newspapers published between 4 and 7 business-framed articles during each period, for a total of 29—11 more than the U.K. newspapers. By using the business frame, U.S. newspapers took a pragmatic look at missions to Mars. The U.K. newspapers did not run any business-framed articles during the Many Missions or The Martian periods, which is surprising because private companies were planning missions. Instead, U.K. articles about these companies were often framed as exploration or settlement, which are the end-goals of enterprises not yet close to realization.

Emergence of new frames: Life, health, social engagement, and social justice

Four new frames emerged during this study. The life frame, which was one of the most dominant frames, was added as a result of pretesting the codebook. Initially, many articles were coded as scientific knowledge, but a subset of these articles contained an added element—how the research being conducted with the Mars rovers might help scientists discover evidence of life on the Red Planet. This observation signaled a new frame independent of scientific knowledge.

Human health was one of the three new frames that emerged from the content analysis. A total of 23 articles in both U.S. and U.K. newspapers stressed the mental, physical, and emotional health of the explorers who might someday go to Mars—19 of the 72 articles (26%) in the exploration frame and 4 of the 62 articles (6%) in the scientific knowledge frame. The health frame was popular during The Martian period, as preliminary studies began about sending people
to Mars. The human health frame was operationalized by coding for articles about the preparation for human space travel and life on Mars, the risks to body and mind, and possible solutions. Keywords, phrases, and concepts include “growing food in space,” “sustainability,” “psychological health,” “exercise,” “radiation,” and generally any kind of bodily damage.

The human health frame highlights NASA’s preparation for human exploration of Mars in the coming decades and the pressing concerns about the risk of deep space exploration on the human body and psyche. The journey to Mars will take at least nine months in a small spaceship with many people but limited resources. Sleep cycles might alter, radiation will harm the body, fresh food will be extremely difficult to grow, personal space will be scarce, and interpersonal relationships might be strained. On March 1, 2015, during the Future Settlers period, astronaut Scott Kelly returned from a year-long stay in the International Space Station. A precursor of Mars exploration, this NASA study examined the effects of long stays in space on the human body. While Kelly was in space, he ran experiments to see if produce could be grown in microgravity. At the same time, several studies on Earth were examining how humans cope mentally in small spaces with many other people to simulate the living conditions on Mars voyages. During the HI-SEAS: Hawai’i Space Exploration Analogue & Simulation, for example, crew members were locked inside a dome in Hawaii for 120 days. Periodic HI-SEAS missions continue to this day.

In addition, two other frames emerged during the current study—social engagement and social justice. Six articles featured NASA’s social engagement in Mars exploration, including discussions of NASA’s social media presence and public relations stunts, such as pop singer will.i.am broadcasting a song he produced from Mars. Of these six articles, four were published in the Pre-Curiosity period, one in the Age of Curiosity period, and one in the Future Settlers
period. This frame was operationalized by coding for topics about social media, NASA’s collaboration with pop culture figures, and other public relations activities. Keywords, phrases, and concepts include “Facebook,” “Twitter,” other social media, and activity on social media (or in real life) that incorporates references to music, movies, or other facets of pop culture in attempts to engage with the public about Mars exploration and science.

Two articles about female astronauts recruited by NASA indicate the emergence of the social justice frame. Both articles were published in the Age of Curiosity. Even though NASA has hired women in the past, these articles celebrated women in science and positions of power by highlighting their accomplishments and providing background on their lives and qualifications. The social justice frame was operationalized by coding for topics about gender equality, changing expectations of society, and the power of women. Keywords, phrases, and concepts include “equality,” “diversity,” “talent,” qualifications, and statistics, such as “the highest percentage of female recruits.”

**Limitations and Future Studies**

The current study was limited to newspapers printed in English, which precluded comparisons with Russian, Indian, or Chinese press coverage of Mars. Such comparisons would be interesting because these countries, like the United States, spend large amounts of money on space programs. In addition, China has a competitive relationship with the U.S. and is a communist state. Although relationships between the U.S. and Russia were tense during the study period because of Russia’s advances into Ukraine, the two countries’ space agencies continue to work together. Russia launches U.S. astronauts, who work with Russian astronauts and those from other countries, on the International Space Station, often on the same projects. In
addition, this study did not examine the non-NASA perspective. Scientists working in related fields, such as astronomy, might not see Mars as a priority despite NASA’s stated goals, so future studies could look into why this is the case.

Only the print editions of three large-circulation elite U.S. newspapers and three large-circulation elite U.K. newspapers were analyzed. The results of this study, therefore, cannot be generalized to other types of publications, such as online newspapers, print or online magazines, broadcast news, or small newspapers. Future studies could examine these types of publications. The print newspapers selected for study were limited to those in the ProQuest Newsstand database, which does not include some smaller publications. In addition, search keywords were sometimes too vague for the ProQuest Newsstand database. Irrelevant hits related to Mars, such as the candy company, were filtered out by combining search keywords, such as “Mars” and “exploration,” but this technique might have missed some relevant articles.

Moreover, the sources of the articles were not coded, possibly causing a blind spot in understanding the flow of information subsidies between difference agencies and institutions and the news media. Understanding if the news media act as an echo chamber or if they produce original reporting would add depth to this study. A future study might also examine if the news media are acting as cheerleaders for Mars exploration.

The rapid shift from print to social media and digital media provides opportunities for future studies about media coverage of Mars on these platforms (Barthel, 2015). Some stories, for example, are published online but not in print.
Conclusion

The current study of how six elite U.S. and U.K. newspapers framed news coverage of Mars highlights the changing values of audiences in the early 21st century. For example, the most famous U.S. astronaut today, Scott Kelly, is not framed as a heroic pioneer but as a modern scientist. This shift indicates that American and British readers may no longer be looking for heroes with “heartland opinions, and unwavering morals,” as they were during the Apollo era (Chaikin, 2007, p. 60). Instead, newspapers are giving readers the curious scientist who will grow food in space and share his experiences on Instagram.

The study findings indicate a logical progression of frames as Mars missions mature from planning and preparation to voyage, landing, and discovery. The business frame, which analyzes risks, costs, and feasibility, appeared often in the Pre-Curiosity period, when the Curiosity rover was on its way to Mars. The journey to the Red Planet and the trek after landing lend themselves to the exploration frame, which also peaked during the Pre-Curiosity period and was often used during the Age of Curiosity. Lastly, the mission completes its goals by gathering scientific knowledge. This frame was popular in the Age of Curiosity as the rover made discoveries. These finds might include evidence of the existence of life on the Red Planet and, therefore, appear in the life frame.

The nationalism frame did not figure prominently in the current study. Nationalism works best when it resonates with people’s hopes, fears, and values (Benford & Snow, 2000). However, the U.S. is a different place today than it was in the 1960s. It is the world leader in Mars exploration, so the press did not need to emphasize patriotism and drum up public support.

On the other hand, both U.S. and U.K. newspaper turned to nationalism to frame India’s first expedition to Mars, which paralleled NASA’s early moon shots. Competition with the
Soviet Union spurred the U.S. to enter the space race in 1957. India found itself in a similar situation in the early 21st century as it tried to beat its competitors, mainly China and Japan, to Mars. Similar to what studies of NASA’s moon missions have shown (Byrnes, 1994; Neal, 2007), coverage of India’s fledgling space endeavors relied heavily on the nationalism frame. The words “pride” and “prestige” appeared frequently. India achieved its goal, despite criticism that it should have spent the money on raising its people out of poverty and fixing its broken infrastructure, including systems as basic as electricity and water. Indian officials maintained that investing in space science would stimulate innovation and have more economic, social, and military impact than throwing money at some of the country’s problems.

Each successive era of spaceflight has been framed in a way that resonates with the values of the times (Benford & Snow, 2000), thus making it understood by and acceptable to the public. After the loss of Columbia in 2003, NASA shifted its attention from human to robotic exploration of Mars, with the Spirit and Opportunity rovers touching down on the Red Planet in 2004. The landing of Curiosity in 2012 marked the last wave of enthusiasm for robots on Mars. Renewed interest in human exploration re-emerged, along with technological preparations, health and spacecraft experiments, and simulations of human subjects living in Mars-like conditions on Earth. The current study highlights the corresponding shift in media frames from the nationalism of the Apollo era to the reimagining of Mars exploration as a public-private partnership with the goal of human exploration of the Red Planet.
Tables and Figures

Both tables and figures are used to present the findings. The tables show more detail because they contain both numbers and percentages, while the figures allow quick analysis and comparison of the data.

Table 1
Framing of Mars coverage by individual newspapers in U.S. and U.K. 2011-2016 (N=320)

<table>
<thead>
<tr>
<th></th>
<th>Exploration</th>
<th>Scientific Knowledge</th>
<th>Life</th>
<th>Business</th>
<th>Other</th>
<th>Nationalism</th>
<th>Settlement</th>
<th>Fear</th>
<th>Legacy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The New York Times</strong></td>
<td>20 (19.6%)</td>
<td>25 (24.5%)</td>
<td>17 (16.7%)</td>
<td>22 (21.6%)</td>
<td>8 (7.8%)</td>
<td>5 (4.9%)</td>
<td>2 (2.0%)</td>
<td>1 (1.0%)</td>
<td>2 (2.0%)</td>
<td>102</td>
</tr>
<tr>
<td><strong>The Wall Street Journal</strong></td>
<td>4 (14.8%)</td>
<td>1 (3.7%)</td>
<td>5 (18.5%)</td>
<td>4 (14.8%)</td>
<td>3 (11.1%)</td>
<td>5 (18.5%)</td>
<td>5 (18.5%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>27</td>
</tr>
<tr>
<td><strong>USA Today</strong></td>
<td>10 (31.3%)</td>
<td>4 (12.5%)</td>
<td>7 (21.9%)</td>
<td>3 (9.4%)</td>
<td>5 (15.6%)</td>
<td>1 (3.1%)</td>
<td>1 (3.1%)</td>
<td>1 (3.1%)</td>
<td>0 (0.0%)</td>
<td>32</td>
</tr>
<tr>
<td><strong>The Guardian</strong></td>
<td>18 (26.9%)</td>
<td>14 (20.9%)</td>
<td>12 (17.9%)</td>
<td>6 (9.0%)</td>
<td>6 (9.0%)</td>
<td>4 (6.0%)</td>
<td>3 (4.5%)</td>
<td>3 (4.5%)</td>
<td>1 (1.5%)</td>
<td>67</td>
</tr>
<tr>
<td><strong>The Financial Times</strong></td>
<td>8 (23.5%)</td>
<td>7 (20.6%)</td>
<td>4 (11.8%)</td>
<td>7 (20.6%)</td>
<td>3 (8.8%)</td>
<td>5 (14.7%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>34</td>
</tr>
<tr>
<td><strong>The Independent (on Sunday)</strong></td>
<td>11 (19.0%)</td>
<td>11 (19.0%)</td>
<td>16 (27.6%)</td>
<td>5 (8.6%)</td>
<td>6 (10.3%)</td>
<td>3 (5.2%)</td>
<td>6 (10.3%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>58</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>71 (22.2%)</td>
<td>62 (19.4%)</td>
<td>61 (19.1%)</td>
<td>47 (14.7%)</td>
<td>31 (9.7%)</td>
<td>23 (7.2%)</td>
<td>17 (5.3%)</td>
<td>5 (1.6%)</td>
<td>3 (0.9%)</td>
<td>320</td>
</tr>
</tbody>
</table>

Figure 1
Framing of Mars coverage by individual newspapers in U.S. and U.K. 2011-2016 (N=320)
Table 2
Framing of Mars coverage by all newspapers in U.S. and U.K. by year 2011-2016 (N=320)

<table>
<thead>
<tr>
<th>Year</th>
<th>Exploration</th>
<th>Scientific Knowledge</th>
<th>Life</th>
<th>Business</th>
<th>Other</th>
<th>Nationalism</th>
<th>Settlement</th>
<th>Fear</th>
<th>Legacy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>9 (26.5%)</td>
<td>6 (17.6%)</td>
<td>8 (23.5%)</td>
<td>6 (17.6%)</td>
<td>4 (11.8%)</td>
<td>0 (0.0%)</td>
<td>1 (2.9%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>34 (10.6%)</td>
</tr>
<tr>
<td>2012</td>
<td>22 (26.8%)</td>
<td>13 (15.9%)</td>
<td>18 (22.0%)</td>
<td>11 (13.4%)</td>
<td>8 (9.8%)</td>
<td>7 (8.5%)</td>
<td>0 (0.0%)</td>
<td>1 (1.2%)</td>
<td>2 (2.4%)</td>
<td>82 (25.6%)</td>
</tr>
<tr>
<td>2013</td>
<td>11 (16.9%)</td>
<td>10 (15.4%)</td>
<td>19 (29.2%)</td>
<td>10 (15.4%)</td>
<td>5 (7.7%)</td>
<td>7 (10.8%)</td>
<td>2 (3.1%)</td>
<td>1 (1.5%)</td>
<td>0 (0.0%)</td>
<td>65 (20.3%)</td>
</tr>
<tr>
<td>2014</td>
<td>11 (24.4%)</td>
<td>12 (26.7%)</td>
<td>7 (15.6%)</td>
<td>7 (15.6%)</td>
<td>1 (2.2%)</td>
<td>5 (11.1%)</td>
<td>1 (2.2%)</td>
<td>1 (2.2%)</td>
<td>0 (0.0%)</td>
<td>45 (14.0%)</td>
</tr>
<tr>
<td>2015</td>
<td>8 (15.4%)</td>
<td>11 (21.2%)</td>
<td>8 (15.4%)</td>
<td>9 (17.3%)</td>
<td>7 (13.5%)</td>
<td>3 (5.8%)</td>
<td>5 (9.6%)</td>
<td>1 (1.9%)</td>
<td>0 (0.0%)</td>
<td>52 (16.2%)</td>
</tr>
<tr>
<td>2016</td>
<td>10 (23.8%)</td>
<td>10 (23.8%)</td>
<td>1 (2.4%)</td>
<td>4 (9.5%)</td>
<td>6 (14.3%)</td>
<td>1 (2.4%)</td>
<td>8 (19.0%)</td>
<td>1 (2.4%)</td>
<td>1 (2.4%)</td>
<td>42 (13.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>71 (22.2%)</td>
<td>62 (19.4%)</td>
<td>61 (19.1%)</td>
<td>47 (14.7%)</td>
<td>31 (9.7%)</td>
<td>23 (7.2%)</td>
<td>17 (5.3%)</td>
<td>5 (1.6%)</td>
<td>3 (0.9%)</td>
<td>320 (100.0%)</td>
</tr>
</tbody>
</table>

Figure 2
Framing of Mars coverage by all newspapers in U.S. and U.K. by year 2011-2016 (N=320)
Table 3
Framing of Mars coverage by all newspapers in U.S. vs. U.K. 2011-2016 (N=320)

<table>
<thead>
<tr>
<th></th>
<th>Exploration</th>
<th>Scientific Knowledge</th>
<th>Life</th>
<th>Business</th>
<th>Other</th>
<th>Nationalism</th>
<th>Settlement</th>
<th>Fear</th>
<th>Legacy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U.S. Newspapers</strong></td>
<td>34 (21.1%)</td>
<td>30 (18.6%)</td>
<td>29 (18.0%)</td>
<td>29 (18.0%)</td>
<td>16 (9.9%)</td>
<td>11 (6.8%)</td>
<td>8 (5.0%)</td>
<td>2 (1.2%)</td>
<td>2 (1.2%)</td>
<td>161</td>
</tr>
<tr>
<td><strong>U.K. Newspapers</strong></td>
<td>37 (23.3%)</td>
<td>32 (20.1%)</td>
<td>32 (20.1%)</td>
<td>18 (11.3%)</td>
<td>15 (9.4%)</td>
<td>12 (7.5%)</td>
<td>9 (5.7%)</td>
<td>3 (1.9%)</td>
<td>1 (0.63%)</td>
<td>159</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>71 (22.2%)</td>
<td>62 (19.4%)</td>
<td>61 (19.1%)</td>
<td>47 (14.7%)</td>
<td>31 (9.7%)</td>
<td>23 (7.2%)</td>
<td>17 (5.3%)</td>
<td>5 (1.6%)</td>
<td>3 (0.9%)</td>
<td>320</td>
</tr>
</tbody>
</table>

Figure 3
Framing of Mars coverage by all newspapers in U.S. vs. U.K. 2011-2016 (N=320)
Table 4
Framing of Mars coverage in U.S. and U.K. newspapers by period 2011-2016 (N=320)

<table>
<thead>
<tr>
<th></th>
<th>Exploration</th>
<th>Scientific Knowledge</th>
<th>Life</th>
<th>Business</th>
<th>Other</th>
<th>Nationalism</th>
<th>Settlement</th>
<th>Fear</th>
<th>Legacy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Curiosity 1/1/2011-8/7/2012</td>
<td>22 (32.8%)</td>
<td>9 (13.4%)</td>
<td>12 (17.9%)</td>
<td>13 (19.4%)</td>
<td>7 (10.4%)</td>
<td>2 (3.0%)</td>
<td>1 (1.5%)</td>
<td>1 (1.5%)</td>
<td>0 (0.0%)</td>
<td>67</td>
</tr>
<tr>
<td>Age of Curiosity 8/8/2012-11/4/2013</td>
<td>20 (21.1%)</td>
<td>15 (15.8%)</td>
<td>28 (29.5%)</td>
<td>13 (13.7%)</td>
<td>9 (9.5%)</td>
<td>6 (6.3%)</td>
<td>1 (1.1%)</td>
<td>1 (1.1%)</td>
<td>2 (2.1%)</td>
<td>95</td>
</tr>
<tr>
<td>Many Missions 11/5/2013-9/8/2014</td>
<td>1 (2.5%)</td>
<td>13 (32.5%)</td>
<td>7 (17.5%)</td>
<td>4 (10.0%)</td>
<td>2 (5.0%)</td>
<td>11 (27.5%)</td>
<td>2 (5.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>40</td>
</tr>
<tr>
<td>Future Settlers 9/9/2014-9/27/2015</td>
<td>18 (26.9%)</td>
<td>11 (16.4%)</td>
<td>11 (16.4%)</td>
<td>12 (17.9%)</td>
<td>6 (9.0%)</td>
<td>3 (4.5%)</td>
<td>4 (6.0%)</td>
<td>2 (3.0%)</td>
<td>0 (0.0%)</td>
<td>67</td>
</tr>
<tr>
<td>The Martian 9/28/2015-12/31/2016</td>
<td>10 (19.6%)</td>
<td>14 (27.5%)</td>
<td>3 (5.9%)</td>
<td>5 (9.8%)</td>
<td>7 (13.7%)</td>
<td>1 (2.0%)</td>
<td>9 (17.6%)</td>
<td>1 (2.0%)</td>
<td>1 (2.0%)</td>
<td>51</td>
</tr>
<tr>
<td>Total</td>
<td>71 (22.2%)</td>
<td>62 (19.4%)</td>
<td>61 (19.1%)</td>
<td>47 (14.7%)</td>
<td>31 (9.7%)</td>
<td>23 (7.2%)</td>
<td>17 (5.3%)</td>
<td>5 (1.6%)</td>
<td>3 (0.9%)</td>
<td>320</td>
</tr>
</tbody>
</table>

Figure 4
Framing of Mars coverage in U.S. and U.K. newspapers by period 2011-2016 (N=320)
Table 5
Framing of Mars coverage by U.S. newspapers by period 2011-2016 (N=161)

<table>
<thead>
<tr>
<th>Period</th>
<th>Exploration</th>
<th>Scientific Knowledge</th>
<th>Life</th>
<th>Business</th>
<th>Other</th>
<th>Nationalism</th>
<th>Settlement</th>
<th>Legacy</th>
<th>Fear</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Curiosity 1/1/2011–8/7/2012</td>
<td>8 (25.8%)</td>
<td>2 (6.5%)</td>
<td>7 (22.6%)</td>
<td>7 (22.6%)</td>
<td>5 (16.1%)</td>
<td>1 (3.2%)</td>
<td>1 (3.2%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>31</td>
</tr>
<tr>
<td>Age of Curiosity 8/8/2012–11/4/2013</td>
<td>11 (22.0%)</td>
<td>5 (10.0%)</td>
<td>16 (32.0%)</td>
<td>7 (14.0%)</td>
<td>7 (14.0%)</td>
<td>3 (6.0%)</td>
<td>0 (0.0%)</td>
<td>1 (2.0%)</td>
<td>0 (0.0%)</td>
<td>50</td>
</tr>
<tr>
<td>Many Missions 11/5/2013–9/8/2014</td>
<td>1 (4.8%)</td>
<td>8 (38.1%)</td>
<td>2 (9.5%)</td>
<td>4 (19.0%)</td>
<td>1 (4.8%)</td>
<td>5 (23.8%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>21</td>
</tr>
<tr>
<td>Future Settlers 9/9/2014–9/27/2015</td>
<td>7 (25.0%)</td>
<td>6 (21.4%)</td>
<td>4 (14.3%)</td>
<td>6 (21.4%)</td>
<td>0 (0.0%)</td>
<td>1 (3.6%)</td>
<td>3 (10.7%)</td>
<td>0 (0.0%)</td>
<td>1 (3.6%)</td>
<td>28</td>
</tr>
<tr>
<td>The Martian 9/28/2015–12/31/2016</td>
<td>7 (22.6%)</td>
<td>9 (23.0%)</td>
<td>0 (0.0%)</td>
<td>5 (16.1%)</td>
<td>3 (9.7%)</td>
<td>1 (3.2%)</td>
<td>4 (12.9%)</td>
<td>1 (3.2%)</td>
<td>1 (3.2%)</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>34 (21.1%)</td>
<td>30 (18.6%)</td>
<td>29 (18.0%)</td>
<td>29 (18.0%)</td>
<td>16 (9.9%)</td>
<td>11 (6.8%)</td>
<td>8 (5.0%)</td>
<td>2 (1.2%)</td>
<td>2 (1.2%)</td>
<td>161</td>
</tr>
</tbody>
</table>

Figure 5
Framing of Mars coverage by U.S. newspapers by period 2011-2016 (N=161)
Table 6
Framing of Mars coverage by U.K. newspapers by period 2011-2016 (N=159)

<table>
<thead>
<tr>
<th>Period</th>
<th>Exploration</th>
<th>Scientific Knowledge</th>
<th>Life</th>
<th>Business</th>
<th>Other</th>
<th>Nationalism</th>
<th>Settlement</th>
<th>Legacy</th>
<th>Fear</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Curiosity 1/1/2011-8/7/2012</td>
<td>14 (38.9%)</td>
<td>7 (19.4%)</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>Age of Curiosity 8/8/2012-11/4/2013</td>
<td>9 (20.0%)</td>
<td>10 (22.2%)</td>
<td>12</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>Many Missions 11/5/2013-9/8/2014</td>
<td>0 (0.0%)</td>
<td>5 (26.3%)</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>Future Settlers 9/9/2014-9/27/2015</td>
<td>11 (28.2%)</td>
<td>5 (12.8%)</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td>The Martian 9/28/2015-12/31/2016</td>
<td>3 (15.0%)</td>
<td>5 (25.0%)</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>37 (23.3%)</td>
<td>32 (20.1%)</td>
<td>32</td>
<td>18</td>
<td>15</td>
<td>12</td>
<td>9</td>
<td>3</td>
<td>1</td>
<td>159</td>
</tr>
</tbody>
</table>

Figure 6
Framing of Mars coverage by U.K. newspapers by period 2011-2016 (N=159)
Table 7
Tone of Mars coverage by all newspapers in U.S. vs. U.K. by year 2011-2016 (N=320)

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Neutral</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>6 (17.6%)</td>
<td>20 (58.8%)</td>
<td>8 (23.5%)</td>
<td>34</td>
</tr>
<tr>
<td>2012</td>
<td>23 (28.0%)</td>
<td>50 (61.0%)</td>
<td>9 (11.0%)</td>
<td>82</td>
</tr>
<tr>
<td>2013</td>
<td>14 (21.5%)</td>
<td>43 (66.2%)</td>
<td>8 (12.3%)</td>
<td>65</td>
</tr>
<tr>
<td>2014</td>
<td>12 (26.7%)</td>
<td>27 (60.0%)</td>
<td>6 (13.3%)</td>
<td>45</td>
</tr>
<tr>
<td>2015</td>
<td>11 (21.2%)</td>
<td>35 (67.3%)</td>
<td>6 (11.5%)</td>
<td>52</td>
</tr>
<tr>
<td>2016</td>
<td>7 (16.7%)</td>
<td>31 (73.8%)</td>
<td>4 (9.5%)</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>73 (22.8%)</td>
<td>206 (64.4%)</td>
<td>41 (12.8%)</td>
<td>320</td>
</tr>
</tbody>
</table>

Figure 7
Tone of Mars coverage by all newspapers in U.S. vs. U.K. by year 2011-2016 (N=320)
Table 8
Tone of Mars coverage by newspapers in U.S. vs. U.K. 2011-2016 (N=320)

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Neutral</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Newspapers</td>
<td>34 (21.1%)</td>
<td>107 (66.5%)</td>
<td>20 (12.4%)</td>
<td>161</td>
</tr>
<tr>
<td>U.K. Newspapers</td>
<td>39 (24.5%)</td>
<td>99 (62.3%)</td>
<td>21 (13.2%)</td>
<td>159</td>
</tr>
<tr>
<td>Total</td>
<td>73 (22.8%)</td>
<td>206 (64.4%)</td>
<td>41 (12.8%)</td>
<td>320</td>
</tr>
</tbody>
</table>

Figure 8
Tone of Mars coverage by newspapers in U.S. vs. U.K. 2011-2016 (N=320)
Table 9
Tone of Mars coverage in U.S. newspapers by period 2011-2016 (N=161)

<table>
<thead>
<tr>
<th>Period</th>
<th>Positive</th>
<th>Neutral</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Curiosity 1/1/2011-8/7/2012</td>
<td>7 (22.6%)</td>
<td>18 (58.1%)</td>
<td>6 (19.4%)</td>
<td>31</td>
</tr>
<tr>
<td>Age of Curiosity 8/8/2012-11/4/2013</td>
<td>11 (22.0%)</td>
<td>32 (64.0%)</td>
<td>7 (14.0%)</td>
<td>50</td>
</tr>
<tr>
<td>Many Missions 11/5/2013-9/8/2014</td>
<td>5 (23.8%)</td>
<td>13 (61.9%)</td>
<td>3 (14.3%)</td>
<td>21</td>
</tr>
<tr>
<td>Future Settlers 9/9/2014-9/27/2015</td>
<td>5 (17.9%)</td>
<td>22 (78.6%)</td>
<td>1 (3.6%)</td>
<td>28</td>
</tr>
<tr>
<td>The Martian 9/28/2015-12/31/2016</td>
<td>6 (19.4%)</td>
<td>22 (71.0%)</td>
<td>3 (9.7%)</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>34 (21.1%)</td>
<td>107 (66.5%)</td>
<td>20 (12.4%)</td>
<td>161</td>
</tr>
</tbody>
</table>

Figure 9
Tone of Mars coverage in U.S. newspapers by period 2011-2016 (N=161)
Table 10
Tone of Mars coverage in U.K. newspapers by period 2011-2016 (N=159)

<table>
<thead>
<tr>
<th>Period</th>
<th>Positive</th>
<th>Neutral</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Curiosity 1/1/2011–8/7/2012</td>
<td>3 (8.3%)</td>
<td>25 (69.4%)</td>
<td>8 (22.2%)</td>
<td>36</td>
</tr>
<tr>
<td>Age of Curiosity 8/8/2012–11/4/2013</td>
<td>16 (35.6%)</td>
<td>28 (62.2%)</td>
<td>1 (2.2%)</td>
<td>45</td>
</tr>
<tr>
<td>Many Missions 11/5/2013–9/8/2014</td>
<td>7 (36.8%)</td>
<td>11 (57.9%)</td>
<td>1 (5.3%)</td>
<td>19</td>
</tr>
<tr>
<td>Future Settlers 9/9/2014–9/27/2015</td>
<td>11 (28.2%)</td>
<td>18 (46.2%)</td>
<td>10 (25.6%)</td>
<td>39</td>
</tr>
<tr>
<td>The Martian 9/28/2015–12/31/2016</td>
<td>2 (10.0%)</td>
<td>17 (85.0%)</td>
<td>1 (5.0%)</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>39 (24.5%)</strong></td>
<td><strong>99 (62.3%)</strong></td>
<td><strong>21 (13.2%)</strong></td>
<td><strong>159</strong></td>
</tr>
</tbody>
</table>

Figure 10
Tone of Mars coverage in U.K. newspapers by period 2011-2016 (N=159)
Table 11
Tone of Mars coverage in U.S. and U.K. newspapers by period 2011-2016 (N=320)

<table>
<thead>
<tr>
<th>Period</th>
<th>U.S. Newspapers</th>
<th>U.K. Newspapers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Neutral</td>
</tr>
<tr>
<td>Pre-Curiosity 1/1/2011–8/7/2012</td>
<td>7 (22.6%)</td>
<td>18 (58.1%)</td>
</tr>
<tr>
<td>Age of Curiosity 8/8/2012–11/4/2013</td>
<td>11 (22.0%)</td>
<td>32 (64.0%)</td>
</tr>
<tr>
<td>Many Missions 11/5/2013–9/8/2014</td>
<td>5 (23.8%)</td>
<td>13 (61.9%)</td>
</tr>
<tr>
<td>Future Settlers 9/9/2014–9/27/2015</td>
<td>5 (17.9%)</td>
<td>22 (78.6%)</td>
</tr>
<tr>
<td>The Martian 9/28/2015–12/31/2016</td>
<td>6 (19.4%)</td>
<td>22 (71.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>34 (21.1%)</td>
<td>107 (66.5%)</td>
</tr>
</tbody>
</table>

Figure 11
Tone of Mars coverage in U.S. and U.K. newspapers by period 2011-2016 (N=320)
Appendix: Codebook Protocol for Mars Coverage

ARTICLE DATA

VAR 01: Media outlet [pub]
1. The New York Times
2. The Wall Street Journal
3. USA Today
4. The Guardian
5. Financial Times
6. The Independent, and The Independent on Sunday

VAR 02: Date of publication [date]
Determining the date of publication will give context in relation to cultural and scientific milestones. The dates of the articles range from January 1, 2011, to December 31, 2016. Enter day/month/year.
Example: April 23, 2015, would be entered as 4/23/2015.

VAR 03: Length of article [length]
The length of the article indicates its importance.
1. 0-250 words
2. 251-500 words
3. 501-1,000 words
4. More than 1,000 words

VAR 04: Headline [head]
Enter the entire headline: ________________

VAR 05: Deck [deck]
Enter the entire deck: ________________

VAR 06: Author [auth]
1. Staff member
2. Wire service reporter
3. Freelance journalist
4. No byline
5. Other: Enter the type of reporter: ________________

VAR 07: Topic [topic]
Determine the focus of each article by identifying the main subject referred to in the headline, deck, and/or lead. The lead is defined as the first few paragraphs (Kille, 2009). If a story contains more than one topic, such as science and technology, only code the dominant topic, which should be highlighted in the headline, deck, or lead.

1. Science of the planet, including geology, biology, and atmospheric science (but not possible life on Mars past or present).
Possible life on Mars past or present but not future
Mars exploration and settlement in the past, present, and future
Technology that would make any interaction with Mars possible, including traveling to the planet and sustaining human life there
Entertainment, such as movies, songs, and TV shows
Private company or business person, such as a CEO working to create technology to reach and/or colonize Mars
Nation or government agency, such as India, NASA, or the European Space Agency
Other: Enter topic _________________

FRAMES

RQ1: How did three elite U.S. newspapers and three elite U.K. newspapers frame the coverage of Mars from 2011 through 2016?
RQ2: How did the framing of Mars change from 2011 through 2016 in relation to scientific milestones?

To answer the first two research questions, the author will code the dominant frame, which is the one emphasized in the headline, deck, and text.

VAR 08: Frame [frame]

1 Nationalism
This frame has roots in the Apollo era. It emphasizes pride in your country and frames the space program as vital to America’s role as a superpower, its economic strength, and its military might. Keywords, phrases, or ideas include patriotism, national pride, international leadership, advantage over other countries, military might, and economic strength.

2 Legacy
This frame draws from America’s history of exploration and the conquest of nature. Through the use of romantic rhetoric, it seeks to justify the risks of space exploration. Keywords, phrases, or ideas include curious and restless individuals, brave pioneers battling the elements and overcoming obstacles (that are not manmade or science related), and references to American history, traditions, Manifest Destiny, and the idea that there is outer space to explore—even on a spiritual or biological level.

3 Business
This frame justifies space exploration from a monetary perspective by highlighting economic and technologic gains. Keywords, phrases, or ideas include industrial and economic benefits, such as the generation of products and the transportation of people and goods. Often mentioned are private or public industries, CEOs, and equipment such as rockets that is measured by productivity and performance.

4 Scientific knowledge
This frame justifies space exploration through discoveries and the acquisition of scientific knowledge but not from a business or economic perspective. This frame might also be explanatory when talking about science. Keywords, phrases, or ideas include “discovery,” “research,” “knowledge,” “puzzle,” “evidence,” “cutting-edge science,” “world-class laboratory,” “frontiers of knowledge,” “education,” “scientific method,” and universities designing missions or research, improving scientific understanding, and improving models.

5 **Settlement**

This frame conveys the sense that Mars settlement is overdue and paints a picture of what a future on Mars might look like. Keywords, phrases, or ideas include human settlement of the moon and Mars, construction words applied to either actual physical structures or abstract social ideals, overdue opportunities for settlement, colonization technology, livable conditions on Mars, terraformation (making Mars’ environment more like Earth’s), civilians on Mars, recreational activities on Mars, and a brighter future or a new era that will one day exist.

6 **Exploration**

This frame stresses future exploration but not settlement of Mars. Articles in this frame discuss what a certain discovery, technology, company, nation, or idea might mean for reaching the Red Planet. Keywords, phrases, or ideas include “journey,” “mission,” “travel,” the voyage across space or on the surface of Mars. Distances traveled might also be cited. This frame can apply to rovers or humans exploring the surface of Mars.

7 **Fear**

This frame justifies Mars exploration as a do-or-die scenario for humanity. Keywords, phrases, or ideas include problems on Earth, such as overpopulation, climate change, nuclear war, loss of ecosystems, and diminished food production. Mars is painted as a utopia, a last resort, or a place to which humans can escape.

8 **Life**

This frame speculates how alien life might have existed or does exist on Mars despite the fact that scientists still do not know for sure if organisms have lived or do live on Mars. Keywords, phrases, or ideas include “life,” “Martians,” “microbial life,” “aliens,” and quotes speculating about life on Mars.

9 **Other** Enter and describe repetitive keywords, phrases, or ideas that suggest the use of a frame not listed above: ________________

**TONE**

**RQ3:** How did the tone of the articles change from 2011 through 2016 in relation to scientific milestones?

To answer the third research question, the tone of each article will be determined by asking this question: Would the wording and phrases in the headline, deck, and text of an article make an
advocate for the topic (such as those listed in the codebook above) feel that the tone is positive, neutral, or negative?

VAR 9: TONE [tone]
1  **Positive tone:** A Mars exploration advocate would be happy with the headline, deck, and text of the article. The words used in the article evoke a sense of positiveness and optimism.
2  **Neutral tone:** A Mars exploration advocate would be neutral about the headline, deck, and text of the article. The words used evoke little reaction, and/or the writing is straightforward or simply explanatory.
3  **Negative tone:** A Mars exploration advocate would be unhappy with the headline, deck, and text of the article. The words used evoke defeat, pessimism, and/or an anticlimactic result.
References


European Space Exploration Programme Aurora. (n.d.). The European Space Agency. Retrieved from
http://www.esa.int/Our_Activities/Human_Spaceflight/Exploration/The_European_Space_Exploration_Programme_Aurora


*Presidential Studies Quarterly, 13*(1), 111–120.


