Newspaper Coverage of Mars

in the United States and the United Kingdom 2011-2016

MASTERS AWARD SUBMISSION

Submitted to the Graduate Student Interest Group

Association for Education in Journalism and Mass Communication

Chicago

August 2017

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Abstract

A content analysis of three elite print newspapers in the United States and three in the United Kingdom found that the framing and tone of articles about Mars were deployed similarly 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, NASA, National Aeronautics and Space Administration, print newspapers, tone, United Kingdom, United States

Introduction

Mars garnered much media attention worldwide between 2011 and 2016. After the National Aeronautics and Space Administration (NASA) retired the Space Shuttle program in 2011, the space agency focused on preparing for human exploration of Mars in the 2030s (Obama, 2010). In November 2011, NASA launched the Curiosity rover, which landed successfully on 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, Britain won its second astronaut a spot in the European Space Agency 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 colonists to Mars, narrowed its pool to 100 candidates (Hartmann, 2015). In September, NASA announced the discovery of liquid water on Mars (Chang, 2015). October saw the release of *The Martian* movie, which told the story of a lone astronaut stranded on Mars, his struggle to survive, and the mission to rescue him. 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-long mission in space to study the effects of long-term spaceflight on the human body and mind (Strickland, 2016). The first flower—a zinnia—sprouted on the International Space Station, helping scientists learn more about growing food for the journey to Mars (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. Extensive research (e.g., Byrnes, 1994; Chaikin, 2007; Kauffman, 1994; Neal, 2007) exists on how the media in the United States framed the Apollo missions, the Space Shuttle program, and NASA's public image since the space agency's beginning in 1958. However, only a few scholars (Dittmer, 2007; Hogan, 2009; Slobodian, 2015) have examined media framing of Mars news, especially in the context of human exploration, and no other studies have compared coverage of Mars by American and British media.

The current study will attempt to fill those gaps by comparing coverage of Mars from 2011 through 2016 in three print U.S. newspapers and three print U.K. newspapers with a science section. *The New York Times, The Wall Street Journal,* and *USA Today* were chosen to represent American media, while *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 large audiences.

The value of spaceflight might be perceived differently in a country whose space exploration funding is not tied to NASA. The United Kingdom Space Agency has launched astronauts with American and Russian space agencies but has no plans for human spaceflights on its own (Associated Press, 2010). Most of its spending supports the European Space Agency and human exploration of the solar system (European Space Exploration Programme Aurora, n.d.).

Analyzing media coverage of events related to the 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).

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. 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: communicator, text, reader, and 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 how frames function. The first level is the communicator—the journalists, politicians, or NASA officials who make framing judgments when they choose what to say and how to say it about human spaceflight and the exploration of Mars. The second level of framing is the text. Certain words, phrases, images, and sources act as scaffolding to present a 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). 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). Building on Goffman's 1974 study, Neal (2007) illuminated how framing helped Americans "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 acceptable to the public.

Framing the space race

When the Soviet Union launched Sputnik I into Earth orbit on October 4, 1957, the space race was on. 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 [frames] resonated with the American public's hopes, fears, and values" (Neal, 2007, p. 67).

The nationalism frame persisted through the 1960s (Neal, 2007). It appealed to pride, patriotism, and prestige by presenting the United States as a superpower (Byrnes, 1994). The space program highlighted U.S. 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 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 understood by Americans. The frontier narrative explained why Americans continued to push boundaries by heading into space, making it a useful way for the media to frame NASA 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 harked back to 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).

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 Challenger disaster in 1986 (Neal, 2007).

Framing the Space Shuttle era

After the moon landings, the space race slowed. The new era and business frames emerged with the dawn of the Space Shuttle era in 1981 (Byrnes, 1994; Neal, 2007). 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). This frame echoed America's successful history with railroads, cars, and airplanes—all of which profoundly affected society.

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 maintain its popularity by appealing to as many facets of society and government as possible, such as business, science, and the military. This pragmatic frame highlighted how transportation had expanded the American economy in the past (Byrnes, 1994). The media framed the Space Shuttle era in a way that could be measured by productivity, by cost, and with data (Neal, 2007).

As the media, politicians, and the public became aware that the Space Shuttle was never going to be as regular as airliners, NASA began to frame spaceflight in a new, engaging way, especially after the Challenger disaster in 1986 (Byrnes, 1994). The Space Shuttle often carried scientists who used it as a temporary orbital research station to study the effects of 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).

After the Challenger disaster, NASA and the media sought to give meaning to such a risky endeavor as spaceflight through the emotional hero frame, which depicted 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 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).

Mars: The planet of many frames

In recent years Mars has become the planet of many frames. When Mars Pathfinder landed on Mars 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 in the floundering government program (Dittmer, 2007). The media relied on three main frames while covering the rover (Dittmer, 2007). The first was scientific advancement, which included the search for evidence of 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 public support and continued funding for sending rovers to Mars (Dittmer, 2007). For example, a NASA representative commented on how she and broadcast journalist Katie Couric greeted the rover like a person (Dittmer, 2007).

Fear is frequently used to frame human exploration and colonization of Mars. Fear-based narratives in fiction, entertainment, and the press portray Mars as a place where humanity could escape overpopulation and global warming (Dittmer, 2007; Slobodian, 2015). The fear frame is effective because it works within a particular culture or 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 survival (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 colonizing another planet would solve many of humanity's problems (Slobodian, 2015).

Creation of frames

NASA plays a key role in shaping perceptions of space exploration by choosing frames that appeal to the public and bolster legislative support for funding its programs (Byrnes, 1994; Markley, 2005). When NASA needs funding, it returns to an emotional narrative and focuses on Mars exploration (Markley, 2005). NASA tries 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 and legislative perceptions of NASA.

Some scholars (e.g., Slobodian, 2015) have observed that the news 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," and in that way they support the space program so that one day, humanity can find utopia and purpose on another planet (Slobodian, 2015, p. 98). Conversely, other scholars (e.g., Ostman & Babcock, 1983) have found that the media are not biased in favor of the space program.

Although the news media and public opinion contribute to frame creation (Entman, 1993), they are only moderately important in ultimately shaping space policy (Hogan, 2009). The most influential U.S. government leader in space policy is the president, and the most influential nongovernmental group are industry leaders, such as those in the aerospace field (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 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 exploratory study will attempt to fill this gap. The U.K. was chosen for comparison because it is invested in space exploration through the European Space Agency and is not tied to NASA.

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 articles change from 2011 through 2016 in relation to scientific milestones?

RQ3: How did the tone of the Mars 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 quality 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. (Beaujon, 2014). *USA Today* had an average Monday-through-Friday print circulation of 1,083,200. *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. *The Wall Street Journal* averaged 2,276,207 subscribers from Monday through Friday (Beaujon, 2014). In September 2014 *The Financial Times* had a daily circulation of 217,121, *The Guardian* reached 180,731 subscribers, and *The Independent* had 63,135 readers ("ABCs," 2014).

Newspapers in both countries were accessed through the ProQuest Newsstand database. Search keywords included "Mars exploration," "Mars space exploration," "Mars water," "Mars atmosphere," "Mars AND NASA," "Mars AND SpaceX," and "Mars AND Mars One."

Unit of analysis

The unit of analysis was a news article or feature story that mentioned Mars in the headline, deck, and/or lead. Newswire stories as short as 50 words were included, but reviews, opinion pieces, and editorials were not.

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 that NASA successfully landed Curiosity on the Red Planet. The year 2016 was selected as the end date because it provided a symmetrical one-year cushion after another year of major discoveries.

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. The article data include the name of the newspaper, date the article was published, length of the article, author, and topic. Tone refers to whether the article is supportive of, against, or neutral toward the topic. Positive 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.

The following frames were selected from the literature (e.g., Byrnes, 1994; Chaikin, 2007; Dittmer, 2007; Kauffman, 1994; Neal, 2015; Slobodian, 2015) and adapted for this study:

- **Nationalism,** which was NASA's main frame in the late 1950s and '60s, emphasizes patriotism and support of the space program because "space capability helps American national pride, prestige, national strength (both military and economic), and peaceful international relations" (Byrnes, 1994, p. 3).
- 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 in the 1950s and '60s, this frame was championed by President Kennedy and recycled by the media to re-engage public support for NASA (Chaikin, 2007; Neal, 2007).

- The **business** frame highlights the material and economic benefits of space travel, such as generating new products, technologies, and transportation (Byrnes, 1994; Neal, 2007).
- The **scientific knowledge** frame justifies space exploration through the scientific method and discoveries (Byrnes, 1994; Neal, 2007).
- The **settlement** frame incorporates new trends in technology and science to achieve the ultimate goal of human colonies on Mars (Byrnes, 1994; Neal, 2007).
- 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 (Byrnes, 1994; Dittmer, 2007; Neal, 2007).
- The **fear** frame often focuses on a do-or-die perspective of why humans should invest resources in Martian exploration and colonization. On the flip side, the fear frame can be used to deter people from exploring and colonizing Mars (Slobodian, 2015).
- The **life** frame speculates about how alien life might be found on Mars or if it existed in the past or present. This new frame was identified while pretesting the codebook.

Intercoder reliability

To ensure intercoder reliability, the second coder coded a random subsample of 37 of the 320 total articles (11.6%). Holsti's simple agreement ranged between 94.6% and 100% for each variable: publication name (100%), date (100%), article length (100%), headline (100%), deck (100%), author (100%), topic (94.6%), frame (97.3%), and tone (97.3%). Scott's pi ranged

between 0.94 and 1 for each variable: publication name (1.0), date (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.) The largest number of articles (82, or 25.6%) appeared in 2012, which was the year the NASA rover Curiosity landed on Mars. (See Table 2.)

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 2.) The exploration frame occurred most often in 2012 (22, or 26.8%). In 2016 it appeared just as often as the scientific knowledge frame (10 each, or 23.8%), which was popular in each period. The life frame appeared most often in 2013 (19, or 29.2%), the year after Curiosity landed on Mars.

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.) 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 matched closely in their overall use of frames except 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 times (7.5%) in U.K. 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:

1. *Pre-Curiosity*—1/1/2011–8/7/2012: This period encompasses the end of the Space Shuttle program and the beginning of the Orion program, which was designed to facilitate human exploration of asteroids and Mars. Curiosity was on its way to Mars.
2. *Age of Curiosity*—8/8/2012–11/4/2013: This period includes Curiosity's successful landing, test drive, and early discoveries on Mars. Private companies announced plans to colonize Mars, and researchers began looking into the health implication of space travel.
3. *Many Missions*—11/5/2013–9/8/2014: This period saw the successful launches of India's Mars Orbiter Mission (MOM), which entered Martian orbit, and NASA's MAVEN orbiter, designed to study the planet's atmosphere. Curiosity found evidence of ancient lakes on Mars, continuing to fuel excitement for the presence of life.
4. *Future Settlers*—9/9/2014–9/27/2015: During this period, the prospect of launching settlers to Mars dominated the news. 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: During this period, Curiosity detected the presence of liquid water on Mars, an ingredient necessary for life. *The Martian* movie was released, and Scott Kelly spent a year in space.

The exploration frame dominated during two periods: Pre-Curiosity (22 articles, or 32.8%) and Future Settlers (18, or 26.9%). (See Table 4.) Scientific knowledge was the most popular frame in the Many Missions period (13, or 32.5%) and The Martian period (14, or 27.5%). The life frame appeared most often during the Age of Curiosity (28, or 29.5%).

U.S. newspapers published the most Mars articles during the Age of Curiosity (50 out of the 161 total articles, or 31.3%), which also saw a spike in the life frame (16, or 32.0%) and the exploration frame (11, or 22.0%). (See Table 5.) The life frame stayed in the news during most periods, except for The Martian, where ironically it was not used. The exploration frame was used frequently throughout the study period except the Many Missions period. The scientific knowledge and the business frames appeared fairly consistently over the study period.

U.K. newspapers also published the most Mars articles during the Age of Curiosity (45 out of the 159 total articles, or 28.3%). (See Table 6.) The most common frames during this period were life (12 articles, or 26.7%), scientific knowledge (10, or 22.2%), and exploration (9, or 20%). The life and the scientific knowledge frames appeared consistently during the study period. Exploration was used the most in the Pre-Curiosity period (14, or 38.9%) and the Future Settlers period (11, or 28.2%). Nationalism spiked in the Many Missions period (6 articles, or 31.6%). The business frame did not appear during two periods: Many Missions and The Martian. The settlement frame was used the most often (5, or 25%) 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.) The year 2012 contained both the greatest number of positive articles (23, or 28%) 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 the highest percentage of negative articles for any year (8, or 23.5%). Overall, articles became increasingly neutral as time went on when considering percentages and not just raw numbers. Articles in the U.S. newspapers were slightly

more neutral overall (107 articles, or 66.5%) than those in the U.K. newspapers (99, or 62.3%). (See Table 8.) Articles in the U.K. newspapers were slightly more positive overall (39, or 24.5%) than those in the U.S. newspapers (34, or 21.1%), and articles in both countries 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.) U.S. newspapers carried the largest number of negative articles during the Age of Curiosity (7, or 14% 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).

U.K. newspapers were also neutral during most of the study period but tended to be more positive overall than the U.S. newspapers. 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% 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 period (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 (10, or 25.6% of the 39 total articles).

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.

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 that the rover would take after landing. The frame was synonymous with adventure and painted exploration as a worthy goal. Historically, the exploration frame was used during times of distress, such as after the Challenger and Columbia disasters. The excitement of adventure was an intense emotion that could regain the support of the American people for human exploration in space under trying situations (Neal, 2007).

The exploration frame might be popular with journalists because it is an engaging way to write about science. Articles framed as exploration read more like narratives than news reports. One writing technique that made the Mars rovers more relatable and understandable to readers was anthropomorphism. Both U.S. and the U.K. newspapers described 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 it 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 experienced on Mars.

Although the exploration frame was synonymous with adventure, the Pre-Curiosity period included the highest percentage of negative articles. Many 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 and its nervous excitement about Curiosity's daredevil landing on Mars. NASA dubbed the landing "seven minutes of terror" because the rover could not be 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 during the next period—the Age of Curiosity (8/8/2012–11/4/2013). This frame, which uses scientific discoveries to make the case that life had existed or might still exist on Mars, was popular during the entire study period. It might have peaked during the Age of Curiosity because the rovers on Mars could detect conditions suitable for life. The media focused on whether the episodic discoveries of evidence for water indicated life on Mars. When life was not found despite mounting evidence, hope diminished. By The Martian period, the life frame appeared only three times.

The tone of most articles published during 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 Curiosity's

role in determining if the conditions existed in the past for life *to have* lived on Mars or if the rover is capable of *actually* discovering life. This lack of clarity, which is characteristic of this frame, misleads readers by making them think 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 it was used to justify NASA's new goal of establishing a human colony on Mars by first conducting scientific experiments.

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

Interestingly, NASA astronaut Scott Kelly was often featured in stories framed as scientific knowledge. In the past Kelly would likely have been portrayed as a pioneer, as many of his predecessors were. Now, the media framed Kelly as 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 as nationalism featured India's first mission to Mars. First-time events like this

are staples of media coverage, especially something as groundbreaking as India's orbital exploration of Mars, which had been accomplished by only a handful of nations.

By contrast, only two articles about the U.S. space program fell within the nationalism frame during this period. The U.S. media had not engaged this frame since the Apollo era. 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.). Despite this sharp drop, the U.S. still spends billions of dollars more each year on space programs than any other nation. 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. 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. 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 mission, 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 criticize during these early stages. This optimism might have influenced the positive tone of the U.S. and U.K. articles. For example, a story 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, 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 humans or robots, the exploration frame dominated. Of note is the different use of the business frame during the study period compared with the Space Shuttle era. The original frame stressed the development of infrastructure and the routine exploration of space by NASA (Neal, 2007). During the current study, NASA, the media, and the public no longer viewed space exploration as a regular occurrence. Instead, the business frame stressed the feasibility, cost, and risk of missions carried out by private companies and governments.

One of the differences between U.S. and U.K. newspapers was their application of the business frame. U.S. newspapers published between four and seven business-framed articles in each period, for a total of 29 articles—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. Some of the articles initially coded as scientific knowledge were moved to the life frame because the research conducted with the Mars rovers might help scientists discover evidence of life on the Red Planet.

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. The health frame was popular during The Martian period, as preliminary studies began investigating the feasibility of 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 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 in space, Kelly ran experiments to see if produce could be grown in microgravity. At the same time, 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 and Simulation, for example, crewmembers were locked inside a dome in Hawaii for 120 days. Periodic HI-SEAS missions continue to this day.

In addition, two other frames emerged—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 broadcasting a song by pop singer will.i.am from Mars. This frame was operationalized by coding for topics about social media, NASA's collaboration with pop culture figures, and 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 hires women, these articles celebrated women in science and positions of power by highlighting their accomplishments and providing background on their lives and qualifications. This frame was operationalized by coding for topics about gender equality, the power of women, and changing expectations of society. Keywords, phrases, and concepts include "talent," "equality," "diversity," 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, invest large amounts of money in space programs. In addition, China has a competitive relationship with the U.S. in space 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.

Only the print editions of six elite U.S. and 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, or broadcast news. Future studies could examine these types of publications. In addition, the emergence of social media and digital media provides opportunities for future studies about news coverage of Mars on these platforms.

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 framed as a modern scientist rather than a brave pioneer of the past. 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 grows red romaine lettuce in space and shares 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.

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Tables

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

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

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

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

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

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

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

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

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

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

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

	Exploration	Scientific Knowledge	Life	Business	Other	Nationalism	Settlement	Legacy	Fear	Total
Pre-Curiosity 1/1/2011–8/7/2012	14 (38.9%)	7 (19.4%)	5 (13.9%)	6 (16.7%)	2 (5.6%)	1 (2.8%)	0 (0.0%)	1 (2.8%)	0 (0.0%)	**36**
Age of Curiosity 8/8/2012–11/4/2013	9 (20.0%)	10 (22.2%)	12 (26.7%)	6 (13.3%)	2 (4.4%)	3 (6.7%)	1 (2.2%)	1 (2.2%)	1 (2.2%)	**45**
Many Missions 11/5/2013–9/8/2014	0 (0.0%)	5 (26.3%)	5 (26.3%)	0 (0.0%)	1 (5.3%)	6 (31.6%)	2 (10.5%)	0 (0.0%)	0 (0.0%)	**19**
Future Settlers 9/9/2014–9/27/2015	11 (28.2%)	5 (12.8%)	7 (17.9%)	6 (15.4%)	6 (15.4%)	2 (5.1%)	1 (2.6%)	1 (2.6%)	0 (0.0%)	**39**
The Martian 9/28/2015–12/31/2016	3 (15.0%)	5 (25.0%)	3 (15.0%)	0 (0.0%)	4 (20.0%)	0 (0.0%)	5 (25.0%)	0 (0.0%)	0 (0.0%)	**20**
Total	**37 (23.3%)**	**32 (20.1%)**	**32 (20.1%)**	**18 (11.3%)**	**15 (9.4%)**	**12 (7.5%)**	**9 (5.7%)**	**3 (1.9%)**	**1 (0.6%)**	**159**

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

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

Table 8
Tone of Mars coverage in U.S. and. U.K. newspapers 2011-2016 (N=320)

	Positive	Neutral	Negative	Total
U.S. Newspapers	34 (21.1%)	107 (66.5%)	20 (12.4%)	**161**
U.K. Newspapers	39 (24.5%)	99 (62.3%)	21 (13.2%)	**159**
Total	**73 (22.8%)**	**206 (64.4%)**	**41 (12.8%)**	**320**

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

	U.S. Newspapers				U.K. Newspapers			
	Positive	**Neutral**	**Negative**	**Total**	**Positive**	**Neutral**	**Negative**	**Total**
Pre-Curiosity 1/1/2011–8/7/2012	7 (22.6%)	18 (58.1%)	6 (19.4%)	31	3 (8.3%)	25 (69.4%)	8 (22.2%)	**36**
Age of Curiosity 8/8/2012–11/4/2013	11 (22.0%)	32 (64.0%)	7 (14.0%)	50	16 (35.6%)	28 (62.2%)	1 (2.2%)	**45**
Many Missions 11/5/2013–9/8/2014	5 (23.8%)	13 (61.9%)	3 (14.3%)	21	7 (36.8%)	11 (57.9%)	1 (5.3%)	**19**
Future Settlers 9/9/2014–9/27/2015	5 (17.9%)	22 (78.6%)	1 (3.6%)	28	11 (28.2%)	18 (46.2%)	10 (25.6%)	**39**
The Martian 9/28/2015–12/31/2016	6 (19.4%)	22 (71.0%)	3 (9.7%)	31	2 (10.0%)	17 (85.0%)	1 (5.0%)	**20**
Total	**34 (21.1%)**	**107 (66.5%)**	**20 (12.4%)**	**161**	**39 (24.5%)**	**99 (62.3%)**	**21 (13.2%)**	**159**