Research Note

"Siri, Show Me Scary Images of AI": Effects of Text-Based Frames and Visuals on Support for Artificial Intelligence

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Abstract

This research note examines how framing influences attitudes toward artificial intelligence (AI). It uses an experiment embedded in a nationally representative online survey to test the effects of text-based frames and visuals on opinion about developing, funding, and banning AI. Participants exposed to a "social progress" frame reported greater support for AI than those exposed to a "Pandora's box" frame. Images (virtual assistants, personal robots, menacing movie AIs, or none) did not influence opinion by themselves but interacted with textual frames to do so. The results extend our understanding of framing effects on public attitudes toward emerging technologies.

Keywords

artificial intelligence, framing, images, media effects, public opinion

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Artificial intelligence (AI)—defined as a computer program or system that mimics human thought (Russell & Norvig, 2003; Turing, 1950)—has been portrayed in media messages as both a tool of social progress and a Pandora's box filled with dangers (Chuan et al., 2019; Obozintsev, 2018). For the past half century, films such as *2001: A Space Odyssey* (1968), *The Terminator* (1984), *The Matrix* (1999), and *I, Robot* (2004) have depicted AIs that menace humanity (Perkowitz, 2007). In recent years, however, AI has emerged as a part of everyday life with widespread applications ranging from virtual assistants such as Siri and Alexa to medical diagnostic tools. Given the growing prominence of AI, it is important to understand not only how members of the public view the technology but also what shapes their opinions about it (Fast & Horvitz, 2017; Neri & Cozman, 2019).

Several national surveys have shown that the U.S. public holds mixed views of AI, seeing it as both promising and potentially threatening (Northeastern University & Gallup, 2018; West, 2018; Zhang & Dafoe, 2019). The same studies highlight how demographics, political orientations, and religiosity predict opinions about the technology. For example, these surveys show that men, people with college degrees, young people, Democrats, and less religious people hold more positive views toward AI than do women, people without college degrees, older people, Republicans, and religious people, respectively. By contrast, research has paid less attention to whether—and, if so, how—media messages shape views of AI. Yet findings of media influence on public opinion about other emerging forms of technology, including biotechnology (Priest, 1994) and nanotechnology (Brossard et al., 2009; Lee & Scheufele, 2006), suggest that such messages may play important roles in fostering support for or opposition to AI.

With this in mind, the present research note draws on theories of framing and public opinion about science and technology (Nisbet, 2009; Nisbet & Mooney, 2007) to explore how different sorts of messages shape support for AI. In particular, it builds on previous findings regarding news coverage of AI (Chuan et al., 2019; Obozintsev, 2018) in testing the effects of two frames for the issue: a pro-AI "social progress" frame and an anti-AI "Pandora's box" frame. The study also builds on research into competitive framing (Chong & Druckman, 2007a, 2007c; Nisbet et al., 2013) by testing the effects of exposure to competing frames for AI. At the same time, it departs from most framing studies (see Bolsen et al., 2019; Feldman & Hart, 2018; Hart & Feldman, 2016; Powell et al., 2015) by examining how images—in this case, of real-world virtual assistants, real-world personal robots, and scary movie AIs—shape opinion about AI, both by themselves and in conjunction with text-based frames.

To address these topics, the present study uses original data from an experiment embedded in a nationally representative online survey. Participants received one of four textual framing treatments (no frame, a social progress frame, a Pandora's box frame, or both frames) as well as one of four image treatments (no image, virtual assistants, personal robots, or menacing film AIs). The results suggest that textual framing can affect support for AI, as can imagery in conjunction with textual frames (but not imagery by itself). As such, the findings extend previous research on how framing shapes public opinion about emerging technologies while also carrying implications for understanding the potential trajectory of public opinion about AI.

Media Frames, Images, and Artificial Intelligence

As one influential definition puts it, a frame is "a central organizing idea or story line that provides meaning to an unfolding strip of events . . . The frame suggests what the controversy is about, the essence of the issue" (Gamson & Modigliani, 1987, p. 143). The framing process, in turn, involves "*select[ing] some aspects of a perceived reality and mak[ing] them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation* for the item described" (Entman, 1993, p. 52; italics in the original.)

Previous research has identified an array of common frames in media messages about science and technology (Nisbet et al., 2003; Nisbet & Mooney, 2007). One such frame is the social progress frame, which presents science and technology as solving problems and/or improving people's lives (Nisbet, 2009). By contrast, the Pandora's box frame—also labeled as the "Frankenstein's monster" or "runaway science" frame—casts science and technology as potentially out of control and leading to disaster (Nisbet, 2009). Both of these frames appear in media messages on a range of topics, including nuclear energy, climate change, and nanotechnology (Nisbet, 2009; Nisbet & Scheufele, 2009). Furthermore, recent studies have shown that social progress and Pandora's box frames frequently appear in media messages about AI (Chuan et al., 2019; Obozintsev, 2018).

A large body of literature demonstrates that exposure to framing can shape audience members' opinions (Chong & Druckman, 2007b; Iyengar, 1991; Nelson et al., 1997). Most members of the public possess relatively little firsthand knowledge about science and technology; thus, media frames provide them with ways to interpret—and evaluate—topics such as nanotechnology (Cobb, 2005; Druckman & Bolsen, 2011) and genetically modified foods (Druckman & Bolsen, 2011). Given previous findings of framing effects on

opinion about emerging technologies, the present study hypothesizes the following:

> *Hypothesis 1a*: Participants exposed to a social progress frame will report greater support for AI than those who receive no frame.
> *Hypothesis 1b*: Participants exposed to a Pandora's box frame will report less support for AI than those who receive no frame.
> *Hypothesis 1c*: Participants exposed to a social progress frame will report greater support for AI than those exposed to a Pandora's box frame.

Competitive framing (Chong & Druckman, 2007a) refers to communication environments where two contrasting frames are present, such as the social progress and Pandora's box frames. Research suggests that whereas one-sided framing can shift opinion in the direction suggested by the frame in question, two-sided framing can neutralize framing effects on opinion (Chong & Druckman 2007a, 2007c; but see Nisbet et al., 2013) and lead receivers toward the "middle ground" of an issue (Detenber et al., 2018, p. 189). Thus, the present study tests the following hypotheses:

> *Hypothesis 1d*: Participants exposed to both social progress and Pandora's box frames will report less support for AI than those exposed to only a social progress frame.
> *Hypothesis 1e*: Participants exposed to both social progress and Pandora's box frames will report greater support for AI than those exposed to only a Pandora's box frame.

A small but growing body of research has explored how images can produce framing effects, both independently and in combination with textual frames. For example, Powell et al. (2015) found that textual and visual frames not only produced independent effects but also interacted in shaping opinion, with congruent combinations exerting the strongest effects. In the context of science communication, Hart and Feldman (2016) found that images of technology (solar panels) and text-based frames influenced attitudes regarding climate change. Looking at the same issue, Bolsen et al. (2019) showed that images reinforced textual framing effects on climate change opinions. By contrast, Feldman and Hart (2018) found no evidence that textual and visual frames interacted in shaping emotional responses to climate change. Given these findings, the interplay between text- and image-based framing warrants further investigation.

Analyses of media messages about AI suggest that visual framing of the topic often relies on images of menacing examples from popular films or

television programs (Obozintsev, 2018; Perkowitz, 2007). However, recent developments in the field of AI have provided alternative images of real-world applications, many of them more mundane and benign. These include common virtual assistants, such as Amazon's Alexa and Apple's Siri, along with medical applications (Obozintsev, 2018). Thus, the present study addresses the following hypothesis and research question:

> *Hypothesis 2*: Exposure to images of benign real-world AIs will increase support for AI, whereas exposure to images of menacing film AIs will reduce support for AI.
> *Research Question 1*: Do text-based frames and images interact in shaping support for AI?

Method

The present study uses data from a nationally representative online survey conducted in English between March 17 and March 27, 2020, by the National Opinion Research Center (NORC).[1] A sample of U.S. adults ($N = 1{,}936$) in the AmeriSpeak Panel participated in the survey.[2] To encourage study cooperation, NORC sent email reminders to sampled panelists on March 17, March 20, and March 25.[3] Panelists were offered US$3 for completing the survey. The study design was approved by the institutional review boards of NORC and the authors' institution.

Experimental design

A 4 × 4 (four text conditions × four image conditions) experiment was embedded in the survey (see Gaines et al., 2007) to test the effects of frames and images on support for AI. Before providing their opinions, each participant received the following definition of AI (drawn from a previous survey conducted by Monmouth University Polling Institute, 2015):

> Artificial intelligence is the ability of computers and machines to carry out decision-making and thought processes similar to humans, sometimes referred to as computers being able to think for themselves.

Along with this definition, participants randomly received one of four textual framing treatments: no frame for AI (the control group; $n = 469$), a social progress frame ("Some say that artificial intelligence can make people safer, improve lives, and solve many of the world's problems"; $n = 504$), a Pandora's box frame ("Some say that artificial intelligence brings

many dangers, will disrupt lives, and could spell the end of humanity"; $n = 490$), or both frames (presented in random order; $n = 473$).[4] The frames were selected based on previous research examining news coverage of science and technology issues (Nisbet, 2009), including AI (Chuan et al., 2019; Obozintsev, 2018), and the wording of each frame drew from recent news stories about AI.

In addition to the text manipulations, participants were randomly assigned to one of four image conditions.[5] One group received no imagery accompanying the definition of AI and the framing treatments, if any ($n = 461$). A second group ($n = 453$) received images related to two popular real-world virtual assistants: a photograph of an Amazon Echo Dot and the logo for Apple's Siri (see Perez, 2020). A third group ($n = 474$) received images of two real-world personal robots—one produced by SoftBank Robots (Tobe, 2016) and the other by Huawei (Yee, 2019)—that were anthropomorphic but not enough so to fall in the "uncanny valley" (in which a close resemblance to humanity elicits uneasiness; see Mori, 1970). The final group ($n = 548$) received images of menacing AIs from popular movies (see Fleming, 2016; Perkowitz, 2007): the Skynet logo along with a Terminator robot from the *Terminator* film franchise and Ultron from *Avengers: Age of Ultron*, a film in the Marvel Cinematic Universe franchise.

Measures

After receiving the definition of AI and any treatments to which they were assigned, participants were asked a series of questions about whether they strongly supported (coded as 4), somewhat supported (3), neither supported nor opposed (2), somewhat opposed (1), or strongly opposed (0) "the development of artificial intelligence," "public funding for research on artificial intelligence," and "banning artificial intelligence altogether." The third item was reverse-coded. The three items were averaged to create an index ($M = 2.65$; $SD = 0.74$; $\alpha = .77$) of support for AI.

Results

A two-way between-subjects ANOVA (analysis of variance) tested the effects of the textual framing and image manipulations on support for AI. As Table 1 shows, there was a significant main effect of text-based frame on opinion, $F(3, 1908) = 3.67$, $p = .01$. This effect was small ($\eta_p^2 = .01$; see Lakens, 2013). Post hoc Bonferroni comparisons revealed no significant difference in opinion between the participants who received the social progress frame ($M = 2.59$, $SD = 0.91$) and the control group ($M = 2.50$, $SD = 0.93$),

Table 1. Two-way Analysis of Variance Table for Framing Experiment.

	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model	31.11	15	2.07	2.53	.01	.02
Intercept	11930.69	1	11930.69	14531.53	<.001	.88
Frame	9.04	3	3.01	3.67	.01	.01
Image	3.42	3	1.14	1.39	.25	.002
Frame*image	18.85	9	2.09	2.55	.01	.01
Error	1566.51	1908	0.82	—	—	—
Total	13669.33	1924	—	—	—	—
Corrected total	1597.62	1923	—	—	—	—

or between those who received the Pandora's box frame ($M = 2.41$, $SD = 0.93$) and the control group. Thus, Hypothesis 1a and Hypothesis 1b were not supported. Nor did Hypothesis 1d and Hypothesis 1e receive support, given that opinion in the "both frames" conditions ($M = 2.55$, $SD = 0.86$) did not differ significantly from opinion in the social progress frame condition or the Pandora's box frame condition. However, participants who received the social progress frame held significantly more positive opinions toward AI than did those who received the Pandora's box frame ($p < .05$; Cohen's $d = .17$). Thus, the results supported Hypothesis 1c.

There was no statistically significant main effect of images on support for AI, contradicting Hypothesis 2. In answer to Research Question 1, the textual frame × image interaction was significant, $F(9, 1908) = 2.55$, $p = .01$.[6] Thus, textual frames and images worked in conjunction to shape opinion about AI. Like the main effect for text-based framing, this interactive effect was small ($\eta_p^2 = .01$). Figure 1 illustrates opinion toward AI across each textual frame × image combination. Support ranged from 2.70 ($SD = 0.78$) among those who received the social progress frame and the Alexa/Siri images to 2.22 ($SD = 0.90$) among those who received the Pandora's box frame and the Skynet/Ultron images, a difference of around half a point on a 5-point scale.

Conclusion

This study sought to extend our understanding of how textual framing and visuals shape attitudes about an emerging technology. In terms of the former, the text-based part of the experiment yielded a significant effect of social progress framing versus Pandora's box framing on respondents' opinions.

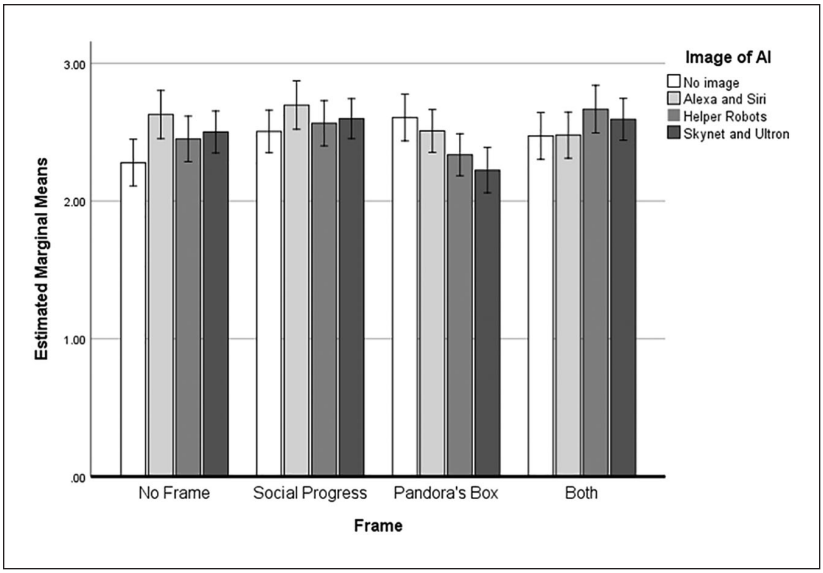

Figure 1. Support for AI (artificial intelligence) based on textual frame and image.
Note. Higher numbers on the (y-axis) indicate greater support for AI. Error bars indicate 95% confidence intervals.

Given that both frames often appear in media messages about AI (Chuan et al., 2019; Obozintsev, 2018), this result highlights the potential for media framing to influence public opinion about the topic. However, the small size of the effect suggests that the role of framing was modest here. This may help account for the absence of clear effects for social progress framing relative to no framing and Pandora's box framing relative to no framing. Similarly, it may help explain the failure to find evidence that competitive framing neutralized framing effects for AI (see Chong & Druckman 2007a, 2007c).

The findings of limited textual framing effects may reflect the modest nature of the study's treatments, which consisted of single exposures to brief question wording manipulations rather than repeated exposures to stronger framing manipulations (e.g., frames embedded in news stories; see Brewer & Gross, 2010). Research on public opinion about other forms of technology, such as nanotechnology, also suggests that framing may produce stronger effects when it highlights specific risks or benefits to individuals, rather than broader risks or benefits (as in the present study; see Cobb, 2005).

Unlike the textual framing treatments, the image treatments produced no clear main effects on opinion about AI. Whereas previous studies (e.g.,

Feldman & Hart, 2018; Hart & Feldman, 2016) have demonstrated the power of visual framing to shape opinions on scientific issues, the results of the present study highlight the potentially conditional nature of such effects. Although the images used in this study are common in media messages about AI (Obozintsev, 2018; Perkowitz, 2007), it may be that they did not suggest clear implications to respondents for what opinions they should hold on the topic due to either unfamiliarity or ambiguous valences.

The results also speak to the growing body of research on whether—and, if so, how—text-based frames and visuals in science communication work together to shape opinion. The present study found a small but clear interaction between the textual and visual treatments, a result that is consistent with some recent research (Bolsen et al., 2019) but stands in contrast to other recent research (Feldman & Hart, 2018). In particular, the pattern of results dovetails with Powell et al.'s (2015; see also Bolsen et al., 2019) argument that congruent combinations of text and imagery can reinforce framing effects. Here, support for AI was greatest among respondents who received the benign, mundane images of Alexa and Siri with the social progress frame and lowest among those who received the menacing images of Skynet and Ultron with the Pandora's box frame. One possibility is that the resonances between these pairings helped audience members interpret their implications for evaluating the issue—an outcome consistent with previous findings that contextual information about a new form of technology can facilitate framing effects (Schütz & Wiedemann, 2008). If respondents were not familiar enough with AI to interpret the images alone, then pairing images and frames with similar cultural meanings may have facilitated the intended interpretations, yielding the interactive effect.

In drawing conclusions from the study's results, it is important to consider the limitations of its design. To begin with, the experiment revolved around a limited set of text-based frames and images. The selection of the treatments followed previous research on science framing, in general, (Nisbet, 2009) and media framing of AI, in particular (Chuan et al., 2019; Obozintsev, 2018; Perkowitz, 2007), but future research could explore the effects of other frames for the issue as well as the effects of longer text-based frames and visuals in video formats. Another limitation revolves around the setting for the study. Although it drew on a large, nationally representative sample, the experiment captured framing effects in a single context (the United States). Thus, it would be worthwhile to explore framing effects on opinion about AI among other publics. Given that the present study focused on the immediate effects of framing, future research could also examine both the durability of these effects and the impact of repeated exposure to frames for AI (see, e.g., Chong & Druckman, 2007a, 2007b, 2007c).

Within the bounds of these caveats, the findings of the present study suggest that media frames for AI may help bolster public acceptance of it—or, alternatively, fuel greater opposition to it. More broadly, the results speak to both the potential for and limits of text-based and visual framing effects on public opinion about emerging technologies.

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Notes

1. A total of 27 pretest interviews were conducted before the main study.
2. For details on the AmeriSpeak panel, see https://amerispeak.norc.org/about-amerispeak/Pages/Panel-Design.aspx. The data were weighted by age, sex, education, race/ethnicity, housing tenure, telephone status, and census division to reflect U.S. population values. The results reported in this study did not differ substantively depending on whether the analyses used weighted or unweighted data.
3. NORC removed 53 cases from the final set of completed interviews based on three cleaning rules (counts are overlapping): 43 speeders (i.e., those who completed the survey in less than 1/3 the median duration), nine respondents with high refusal rates (i.e., those who skipped or refused more than 50% of the eligible questions), and 14 straight-liners (i.e., those who straight-lined all eligible grid item questions).
4. An independent samples *t* test assessed the potential effect of receiving the social progress frame before the Pandora's box frame or vice versa. The results showed no significant difference in support for AI between those who received the social progress frame first and those who received the Pandora's box frame first.
5. The image treatments are available from the authors on request.

6. A series of three-way ANOVAs tested whether the treatments interacted with gender, education (college degree vs. no degree), age (<45 years vs. ≥45 years), party identification (Democrat, independent, or Republican), and attendance at religious services (low vs. high). These analyses revealed significant main effects for four of the five background factors in the expected directions (see Northeastern University & Gallup, 2018; West, 2018; Zhang & Dafoe, 2019): men, those with a college degree, Democrats, and less religious respondents held more favorable views toward AI than did women, those without a degree, Republicans, and more religious respondents, respectively. In addition, several significant interactions emerged: frame × gender, image × gender, frame × image × gender, frame × image × age, and frame × attendance at services.

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