



Reading Machine-Written News: Effect of Machine Heuristic and Novelty on Hostile Media Perception

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Abstract. The use of artificial intelligence (AI) in news production has been increasing these days. Its inanimate nature might bring opportunities to suppress hostile media effect by reducing readers' emotional involvement. This study conducted an online experiment ($N = 175$) to examine how the identity of news writers, human vs. robot, might impact readers' perceptions of news and source credibility. Findings suggest that readers holding machine heuristic, i.e., those who saw machine as free of intention, experienced less emotional involvement when the news was purported to be written by a news writing algorithm, as compared with when reading human-written news. Lower level of emotional involvement further led to less perception of bias in the news and the extremity of news slant. However, perceived novelty associated with robot news writer, although enhanced positive perceptions of the news, intensified readers' emotional involvement, which further heightened hostile media perceptions. Findings in this study identified the mechanisms underlying effects of AI writer in the context of controversial news topics. Implications are discussed under theoretical frameworks of general information processing, hostile media effect and MAIN model.

Keywords: Robot journalism · Machine heuristic · Emotional involvement
Hostile media effect

1 Introduction

On February 1st, 2013, eight minutes after an earthquake of 3.2 magnitude shaking the coast of San Simeon in California, *The Los Angeles Times* published a news story written by their news algorithm about what just happened (Marshall 2013). More impressively, the news was not distinguishable from that written by journalists (Latar 2015). The algorithm was programmed to ask questions that an experienced journalist would ask. In the case of earthquake, for example, it was set with filtering criteria such as location (i.e., California) and earthquake magnitude to judge if the happening was newsworthy (Marshall 2013).

In order to manage cost of news production and boost profit margin, news organizations have been motivated to engage artificial intelligence (AI) in newsroom. As early as in 2006, Thomson Reuters decided to use algorithms to generate finance

news (Wired 2006). In 2010, algorithms were developed in university labs with the purpose to substitute human journalists (Latar 2015).

Technology-assisted news production is hardly any news as journalists used computers to help produce news stories since 1952 (Cox 2000; Örnebring 2010). However, the idea of replacing professional journalists with AI seems to be disturbing and has elicited concerns among both professional journalists and the public (Latar 2015; van Dalen 2012). In spite of all these concerns, the idea of machine writing news might not be all bad. As the public tends to think of machine as inanimate and thus free of intentions and biases (Minsky 2006; Sundar 2008; Sundar and Nass 2001; van Dalen 2012), recent advancement in AI and its application in journalism practice seems to bring some hope in suppressing hostile media effect (HME) by suppressing readers' emotional involvement (Matthes and Beyer 2015).

Although promising, research has not yet reached a unanimous conclusion on how well machine-written news is received by human judges and whether it can actually enhance fairer judgment on news content (e.g., Edwards et al. 2014; Gambino and Kim 2015; Van der Kaa and Krahmer 2014). Against the backdrop of the rapid development of AI and its application in news production (Latar 2015), this study aims to examine the impact of robot journalism on hostile media perceptions (HMPs) and explore the potential underlying mechanisms.

1.1 Hostile Media Effect

News coverage on controversial issues tends to induce HMP, especially for partisans with high issue involvement, i.e., the extent to which one perceives the issue as personally relevant (Cho and Boster 2005; Gunther and Liebhart 2006). News that "most nonpartisans find evenhanded and objective" is perceived as biased simply because partisans are "exerting pressure in the hope of more favorable media treatment" (Vallone et al. 1985, p. 578). Even in cases when the news is in favor of one's own side, they judge the magnitude of this favoritism as less compared with that judged by their opposing party (Gunther and Chia 2001; Gunther et al. 2001).

Besides issue involvement, research has found emotional involvement a crucial process above and beyond cognitive involvement through which HMP develops (Matthes 2013; Matthes and Beyer 2015; Vallone et al. 1985). Emotional involvement, characterized by both emotional arousal and experience of specific emotions (Matthes 2013), is defined as the emotional reactions associated with an attitude object (Wirth 2006).

1.2 Effects of Robot Journalism I: Machine Heuristic and Reduced Mind Attribution

The rise of robot journalism seems to bring some hope in suppressing HMP in that it is widely held that machine, given its inanimate nature, is free of intention and bias (Minsky 2006; Sundar 2008). Heuristics are mental short cuts or rules of thumb developed from experience and ready to be applied in judgements making (Bellur and Sundar 2014; Chen and Chaiken 1999; Kruglanski and Thompson 1999). Machine heuristic is

the association between inanimate technology and the qualities of being objective, free of bias, morally neutral and intentionless (Sundar 2008). As the MAIN model suggests, interface cues of digital media might trigger certain associated heuristics and influence users' impressions of the content quality and credibility (Sundar 2008). When reading machine-written news, readers' heuristics associated with this identity cue might be activated, influencing readers' evaluations of the source and the content.

For example, news story purported to be selected by a computer terminal was evaluated as of higher quality compared with the very same news purported to be suggested by news editors because machines were perceived as "truly random and hence representative" (Sundar and Nass 2001, p. 68). In the context of personal assistant, people were more willing to reveal their credit card information to Siri than to a human service agent who helped them book flight ticket because they believed that Siri, as a machine, was free of malicious intentions such as stealing and abusing the information (Kim and Sundar 2016).

Intention attribution also underlies the development of HMP. Research suggests that HME is more prominent when the source is deemed to have more potential in swaying public opinion towards the opposite side. For example, a news story written by a journalist triggered more HMP than the very same news purported to be written by a student (Gunther and Schmitt 2004; Gunther and Liebhart 2006) since a journalist is supposed to have higher motivation and ability to exert influence on public opinion than a student. Another study found football fans perceived news purported to be published on the newspaper of their rival university's town as more biased compared to that from hometown and neutral-town newspaper (Arpan and Raney 2003) as a newspaper from the rival's town is supposed to be more motivated to report in favor of their own university team. In persuasion literature, intention attribution is also regarded as the cause of reactance and arousal such that source's influence intention is perceived as a threat or restriction to the target's freedom. Attribution to persuaders' influence intention further leads to psychological reactance characterized by anger and negative cognitions (Brehm and Brehm 1981; Dillard and Shen 2005; Rains 2013) and defensive attitudes and behaviors (Grandpre et al. 2003; Miller et al. 2007; Shen 2011), such as derogating the source as biased and unfair (e.g., Worchel 1974), which also characterizes HMP (Hwang et al. 2008).

As machine is believed to be free of bias and intention, using AI to write news might reduce emotional reactions and general arousal by suppressing intention attribution. Therefore, the lack of intention attributed to robot writer might have the potential to reduce HMP by reducing readers' emotional involvement. Moreover, effects of robot writer on emotional involvement should only apply to those who hold the machine heuristic that robot is free of intentions and bias but not for those who do not.

1.3 Effects of Robot Journalism II: Novelty and Eeriness

Although machine's inanimate nature might suppress intention attribution and thus emotional involvement, machine-written news as a new phenomenon to the general public (Latar 2015) might induce perception of novelty and eeriness as suggested by existing research. Specifically, perceived novelty associated with robot writing news

might lead to positive psychological experience and positive evaluation (e.g., Gambino and Kim 2015; Sundar et al. 2014). Whereas perceived eeriness (Mori 1970; Stein and Ohler 2017) caused by inanimate agent presented with too much humanness, may further lead to negative perceptions in terms of the news' credibility and quality (e.g., Gambino and Kim 2015).

Besides the halo effect of novelty and eeriness on readers' overall evaluations of the news, novelty and eeriness associated with reading machine-written news might increase their emotional involvement while reading. Findings in neuroscience suggests that novelty stimulates affective reaction involving amygdala activation distinctively from stimuli's valence and arousing level (Moriguchi et al. 2011; Schomaker and Meeter 2015; Weierich et al. 2010). Eeriness, by definition is a repulsive response characterized by arousal and psychological discomfort experienced along with cognitive dissonance (Elliot and Devine 1994; Ferrey et al. 2015). Readers' emotional involvement might be enhanced by the sense of novelty and eeriness as a result of excitation transfer such that the arousal due to the novelty and eeriness associated with robot writing news might amplify one's emotional reaction to news content (Zillmann 1971), which further intensifies HMP.

Based on discussions above, we proposed the following hypotheses regarding the different mechanisms underlying effect of robot news writer on HMP.

- H1.** For individuals holding machine heuristic, robot writer leads to less emotional involvement as compared to human writer.
- H2.** Compared with human writer, robot writer leads to more perceived novelty, which further increases readers' emotional involvement.
- H3.** Compared with human writer, robot writer leads to more perceived eeriness, which further increases readers' emotional involvement.
- H4.** Compared with human writer, robot writer leads to less emotional involvement, which further reduces HMP.
- H5.** Compared with human writer, robot writer leads to more perceived novelty, which further reduces HMP.
- H6.** Compared with human writer, robot writer leads to more perceived novelty that further increases readers' emotional involvement, which intensifies HMP.
- H7.** Compared with human writer, robot writer leads to more eeriness, which further increases HMP.
- H8.** Compared with human writer, robot writer leads to more perceived eeriness that further increases readers' emotional involvement, which intensifies HMP.

1.4 Conceptualization and Operationalization of Hostile Media Perception

HMP is defined as the perception that news media are not in favor of one's own stand (Gunther 1992). However, in empirical studies, HMP has been operationalized in multiple ways. To better explore the effects of robot journalism on HMP, this study operationalized HMP in four different ways, namely (a) news slant extremity (Matthes and Beyer 2015), (b) bias perception, (c) news credibility (Appelman and Sundar 2016), and (d) source trustworthiness. As Matthes (2013) argues, although credibility

seems not to be a direct measure of HMP, “bias is often considered a marker of the larger construct of news credibility” (Arpan and Peterson 2008, p. 325) and reduced credibility has been considered as a direct outcome of HMP and has been found to be highly correlated to bias measures (Arpan and Peterson 2008; Choi et al. 2009; Tsfaty and Cohen 2005).

2 Method

2.1 Study Design

To examine the effect of robot news writer relative to its human counterpart, identity of news writer was manipulated. To avoid ending up with lack of variability on the dependent variables with a too simple news article, participants were randomly assigned to read either a short spot news article or a longer interpretive news article (DeMott 1973) about climate change purported to be written either by a human writer or by a news bot. Experiment was administered online with Qualtrics. All the news articles were embedded in the template of *The New York Times* and displayed as screenshots in the questionnaire.

2.2 Participants

Participants were 212 Mechanical Turkers. After manipulation check screening, only those who correctly identified the news writer’s identity were remained. The final sample was composed of 175 participants, aging from 18 to 74 years old ($M = 38.35$, $SD = 13.97$), with 42.70% males, and 77.13% ethnically affiliated as Caucasians, 8.00% Latino/Hispanic, 7.43% Asian/Pacific Islander, and 7.43% African American.

2.3 Stimuli Creation

We chose the topic of climate change issue for the following reasons. Climate change has been a controversial issue both domestically and internationally that attracts considerable amount of public attention (IPCC 2014; McCright and Dunlap 2011; Nisbet and Myers 2007). Although much scientific evidence suggests the happening of climate change and global warming (IPCC 2014), polarized voices come from mass media and celebrities, especially politicians, endorsing different sides regarding the existence of climate change, the urgency of taking measures, and what measures to take, if necessary at all (Nisbet and Myers 2007). Past research has also found the occurrence of HME on climate change issue (Feldman et al. 2015).

Source manipulation appeared in three places on the screenshot of the news article (see Fig. 1). Specifically, for human-written news, under the article title, it says “By Andrew C. Revkin,” a name made up by the researchers. Below the article where introduction and contact of the author often appear, it writes “Andrew C. Revkin is a correspondent for The New York Times” and “Email: ARevkin@nytimes.com; Twitter:

@AREvkinNYT.” For news purported as robot-written, changes were made accordingly as shown in Fig. 1.



Fig. 1. Sample stimulus.

To enhance the external validity, news articles were composed of excerpts from existing news reports on climate change published on mainstream media outlets such as *CNN*, *Los Angeles Times*, *Townhall*, etc. In the news stimuli, factual information endorsing each side was equally presented to maintain a neutral standing. For example, the side in favor of climate change activism was backed up with research findings suggesting taking immediate measures to stop climate change. The side against climate change activism was endorsed by including findings denying the happening of climate change or suggesting the unnecessary of human intervention. A short spot news was first created with the above-mentioned criteria being met, based on which we created the longer interpretive news article by adding elaborations derived from the factual information. The spot news article ended up with 236 words whereas the interpretive news had 681 words. Two news articles were pretested and found to be different in perceived amount of interpretation but are identical in terms of their neutral standing.

2.4 Measurement

Manipulation Check. Participants were asked to answer “The news you just read was written by” by choosing among “human,” “robot,” and “I don’t know.” Only those answered this question correctly were remained for further data analyses.

Measure of Key Variables. Unless specified, all items were measured on a 7-point Likert-type scale.

News Slant Extremity. News slant extremity is the perceived *extremity* of the news' slant or the *magnitude* of bias and was measured with the same method as in Gunther and Schmitt (2004). Participants were first asked three questions regarding the standing of the news by choosing one of the three choices, (a) pro-action, (b) against-action, (c) neutral. For those who answered neutral, they were coded as "0" on this question; for those who chose (a) or (b), a follow-up question was asked regarding the degree to which the news story was endorsing the side they chose on a 7-point Likert scale. Values on this follow-up question was remained as the score one had on that question. Final news slant extremity score was calculated by averaging the scores of these three questions (Cronbach's $\alpha = .84$).

Bias Perception. Bias perception was measured with two items "How much do you think the news is (a) biased; and (b) objective on reporting climate issues" (Cronbach's $\alpha = .79$).

News Credibility. News credibility was measure by measures adapted from Appelman and Sundar's study (2016). Participants were asked to answer questions "How much do you think the news you just read is (a) accurate, (b) authentic, and (c) believable" (Cronbach's $\alpha = .94$).

Source Trustworthiness. Source trustworthiness was measured with 5 semantic differential items adapted from McCroskey and Teven (1999), Ohanian (1990) that are applicable to both human and robot writer such as "Undependable - Dependable" and "Dishonest - Honest" (Cronbach's $\alpha = .93$).

Belief in Machine Heuristic. One's belief in machine heuristic was measured with the following three items "Compared with human, robot (a) has no intentions, (b) is more objective, and (c) has no bias" (Cronbach's $\alpha = .74$).

Novelty. Novelty was measured with 10 items adapted from Wells et al. (2010), and the originality subscale from Sundar et al. (2014), such as "I found reading the news written by the news bot (writer) to be a novel experience" (Cronbach's $\alpha = .94$).

Eeriness. Eeriness was measured by the 8-item semantic differential scale developed by Ho and MacDorman (2010), with items such as "reassuring - eerie" and "predictable - thrilling" (Cronbach's $\alpha = .90$).

Emotional Involvement. Emotional involvement was measured with three items adapted from Matthes (2013). Participants were asked to indicate their agreement with the following statements, "Reading this news aroused my feelings," "I emotionally reacted to the issue of climate change while reading," and "I feel really emotionally involved while reading this news" (Cronbach's $\alpha = .92$).

Issue Involvement. Issue involvement was measured with seven items adapted from the value-relevant involvement scale developed by Cho and Boster (2005), such as “The values that are the most important to me determine my stand on climate change issues” (Cronbach’s $\alpha = .89$).

Attitudes Towards Climate Change Activism. Participants’ attitude towards climate change activism was assessed with three items, “In terms of whether human has caused climate change, which side do you take?”, “In terms of the seriousness of climate change, which side do you take?” and “In terms of how urgent human should take any actions, which side do you take?” with higher score meaning more activist attitude (Cronbach’s $\alpha = .96$).

Attitude Extremity. Attitude extremity score was calculated by folding the attitude measure, specifically by subtracting 4 (the middle point on a 7-point scale) from one’s attitude score than taking the absolute value, which varies on a 0 to 3 scale.

3 Results

3.1 Manipulation Check

After reading the assigned news article, participants answered the question who the news writer was by choosing from (a) A human writer, (b) news robot, (c) I don’t know. Among 212 participants, 175 correctly identified the purported identity of the writer. Therefore, only these 175 participants were included in further analyses.

3.2 Effects of Robot News Writer

In response to the overarching question of this study, i.e., whether news writer’s identity would cause any perceptual differences among news readers, multivariate analysis of covariance (MANCOVA) test was conducted with independent variable being news writer identity (robot vs. human), dependent variables being perceived emotional involvement, novelty, eeriness, news slant extremity, bias perception, news credibility, and source trustworthiness. Individual differences in issue involvement, attitudes to climate change issue, attitude extremity, and news type, were controlled for throughout the analyses in this study if not specified.

Writer’s identity had an effect on the perceptual variables, Wilks’ $\Lambda = .68$, $F(8, 157) = 9.29$, $p < .001$, partial $\eta^2 = .32$. Following univariate analyses results showed that writer identity had an effect on perceived novelty and news credibility. Reading robot-written news was perceived as more novel ($M = 4.78$, $SE = .16$) than reading human-written news ($M = 3.44$, $SE = .16$), $F(1, 164) = 36.17$, $p < .001$, partial $\eta^2 = .18$. In terms of news credibility, robot-written news was perceived as less credible ($M = 4.23$, $SE = .18$) than human-written news ($M = 4.78$, $SE = .18$), $F(1, 164) = 4.44$, $p = .04$, partial $\eta^2 = .03$. Although we found no effect of writer identity on other measures of HMP, hypotheses on news writer’s effects on HMP suggest the existence of counterbalancing mechanisms which might drive the total effect of news writer on other HMP measures non-significant.

We conducted the following mediation analyses to probe the mechanisms as we have hypothesized using PROCESS Macro (Hayes 2013).

3.3 Mechanisms of Robot Writer Effect

Effects on Emotional Involvement. To test H1-3 about how robot writer influences readers' emotional involvement via counterbalancing mechanisms, the model shown in Fig. 2 was tested using PROCESS Macro (Hayes 2013), Model 5, with 5,000 bootstrapping samples and 95% bias-corrected confidence intervals (CI) estimated, with news writer as independent variable, emotional involvement as the dependent variable, eeriness and novelty as parallel mediators. Meanwhile, in order to test H1, one's belief in machine heuristic was tested as the moderator of the direct path, examining the effect of robot's inanimate nature on emotional involvement.

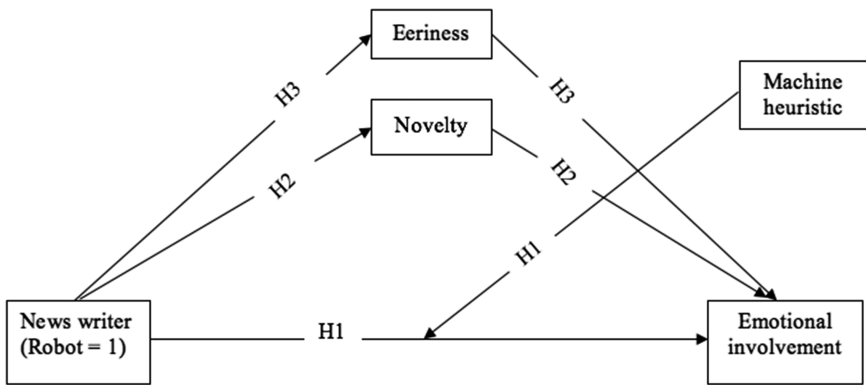


Fig. 2. Model of H1-H3.

In support of H1, results revealed a significant moderation effect of machine heuristic on robot's direct effect on emotional involvement, such that only for those who highly (belief > 6.17, one standard deviation above the mean) or moderately (belief = 4.82, mean) believed in machine heuristic, robot had a significant negative direct effect on emotional involvement (high believers: $B = -.67$, $SE = .29$, 95% CI $[-1.25, -.10]$; moderate believers: $B = -.43$, $SE = .21$, 95% CI $[-.84, -.02]$). For those who did not believe in machine heuristic (belief = 3.46, one standard deviation below the mean), effect of robot in reducing readers' emotional involvement was not statistically significant, $B = -.18$, $SE = .27$, 95% CI $[-.71, .35]$.

In support of H2 that robot writer enhances readers' emotional involvement via perception of novelty, results showed a significant positive indirect effect of robot on emotional involvement via novelty, $B = .30$, $SE = .13$, 95% CI $[.06, .57]$. Disconfirming H3, indirect effect of robot writer via perceived eeriness was not statistically significant, $B = .04$, $SE = .08$, 95% CI $[-.12, .21]$.

Indirect Effect of Robot Writer on HMP via Novelty. To test H4-6 regarding effects of robot writer via novelty and emotional involvement on readers' HMP, Model 6 in PROCESS Macro (Hayes 2013) was tested with news writer as independent variable, with novelty as first mediator, and emotional involvement as the second mediator in the mediation serial, with four different measures capturing HMP as dependent variables respectively.

News Slant Extremity. As shown in Fig. 3, in support of H4a that robot writer reduces emotional involvement which further reduces HMP, effect of robot writer via this specific path was significant, $B = -.18$, $SE = .11$, 95% CI $[-.46, -.02]$. Not supporting H5a, the indirect effect of news writer via novelty on news slant extremity was not significant, $B = -.01$, $SE = .21$, 95% CI $[-.47, .39]$. In support of H6a that novelty associated with robot writer enhanced emotional involvement, which further increased perception of news slant extremity, results showed that the indirect effect of robot writer via this specific path was significant, $B = .15$, $SE = .08$, 95% CI $[.01, .35]$.

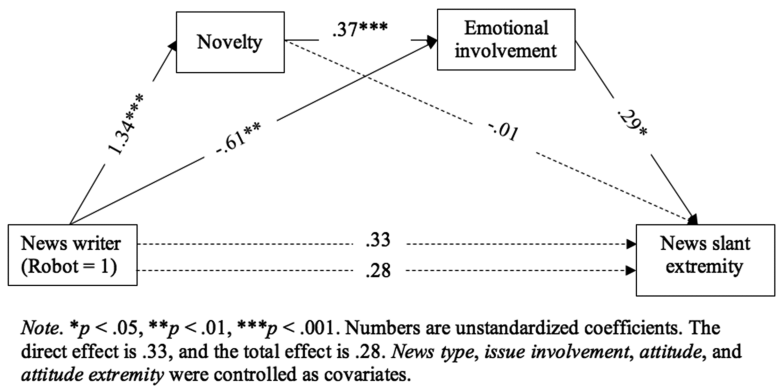
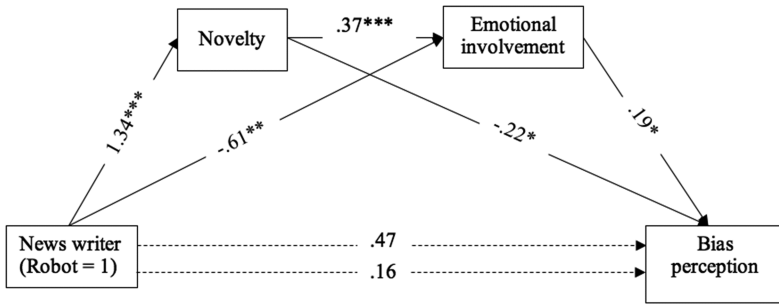


Fig. 3. Mechanisms underlying effect of news writer on news slant extremity.

Bias Perception. A similar pattern was found for bias perception as well. As shown in Fig. 4, in support of H4b, the path that robot writer reduces emotional involvement which further reduces HMP was significant, $B = -.12$, $SE = .08$, 95% CI $[-.33, -.00]$. In support of H5b, readers perceived robot writers as more novel, which led to reduced bias perception, $B = -.29$, $SE = .14$, 95% CI $[-.62, -.07]$. In support of H6b, novelty associated with robot writer enhanced emotional involvement, which further increased perception of news slant extremity, $B = .10$, $SE = .06$, 95% CI $[.00, .23]$.

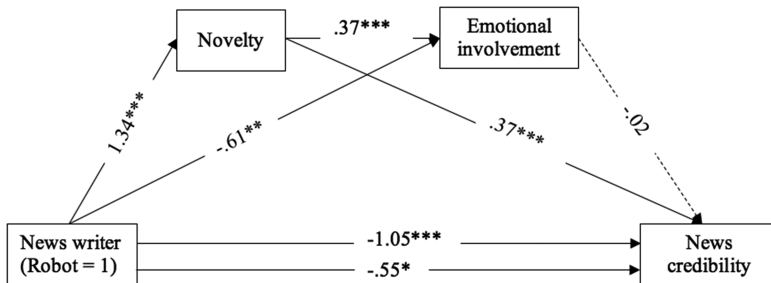
News Credibility. As shown in Fig. 5, only the path suggested by H5c that robot writer elicits novelty which further enhances one's evaluations of news credibility was found significant, $B = .49$, $SE = .17$, 95% CI $[.21, .88]$. The indirect path suggested by H4c that robot writer decreased emotional involvement and thus reduced perceived news credibility was not significant, $B = .01$, $SE = .08$, 95% CI $[-.15, .19]$, neither was the path suggested by H6c that novelty associated with robot writer enhanced emotional



Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Numbers are unstandardized coefficients. The direct effect is .47, and the total effect is .16. News type, issue involvement, attitude, and attitude extremity were controlled as covariates.

Fig. 4. Mechanisms underlying effect of news writer on bias perceptions.

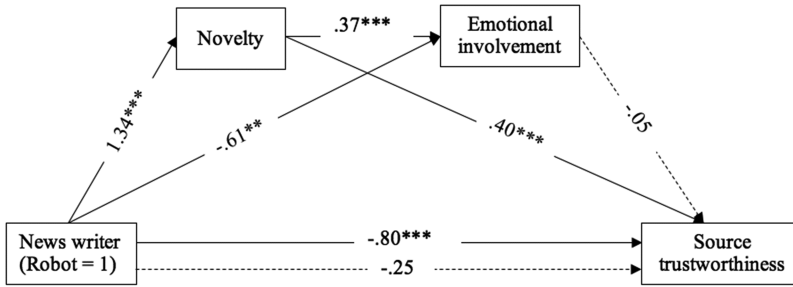
involvement, which further increased perceived news credibility, $B = -.01$, $SE = .06$, 95% CI $[-.13, .13]$.



Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Numbers are unstandardized coefficients. The direct effect is -1.05 ($p < .001$), and the total effect is -.55 ($p < .05$). News type, issue involvement, attitude, and attitude extremity were controlled as covariates.

Fig. 5. Mechanisms underlying effect of news writer on news credibility.

Source Trustworthiness. Effect of robot writer on perceived source trustworthiness had the same pattern as that on perceived news credibility. As shown in Fig. 6, only the path suggested by H5d that robot writer elicits novelty which further enhances perceived source trustworthiness was found to be significant, $B = .54$, $SE = .14$, 95% CI $[.30, .87]$. However, the indirect path suggested by H4d that robot writer decreased emotional involvement and thus reduced perceived source trustworthiness was not significant, $B = .03$, $SE = .06$, 95% CI $[-.08, .18]$, neither was the path suggested by H6d that novelty associated with robot writer enhanced emotional involvement, which further increased perceived source trustworthiness, $B = -.02$, $SE = .05$, 95% CI $[-.12, .07]$.



Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Numbers are unstandardized coefficients. The direct effect is $-.80$ ($p < .001$), and the total effect is $-.25$. News type, issue involvement, attitude, and attitude extremity were controlled as covariates.

Fig. 6. Mechanisms underlying effect of news writer on source trustworthiness.

Indirect Effect of Robot Writer on HMP via Eeriness. To test H7 and H8 regarding effects of robot writer via perceived eeriness on readers' HMP, Model 6 in PROCESS Macro (Hayes 2013) was tested with news writer as independent variable, with perception of eeriness as first mediator, and emotional involvement as the second mediator in the mediation serial, with four different measures capturing HMP as dependent variables respectively. Disconfirming H7 and H8, neither of the hypothesized paths was statistically significant for all the dependent variables.

Table 1. Summary of hypotheses testing results

Hypotheses	
Supported	H1 Machine heuristic moderates Robot writer → emotional involvement
Supported	H2 Robot writer → novelty → emotional involvement
Unsupported	H3 Robot writer → eeriness → emotional involvement
	H4 Robot writer → emotional involvement → HMP
Supported	a Robot writer → emotional involvement → news slant extremity
Supported	b Robot writer → emotional involvement → bias perception
Unsupported	c Robot writer → emotional involvement → news credibility
Unsupported	d Robot writer → emotional involvement → source trustworthiness
	H5 Robot writer → novelty → HMP
Unsupported	a Robot writer → novelty → news slant extremity
Supported	b Robot writer → novelty → bias perception
Supported	c Robot writer → novelty → news credibility
Supported	d Robot writer → novelty → source trustworthiness
	H6 Robot writer → novelty → emotional involvement → HMP
Supported	a Robot writer → novelty → emotional involvement → news slant extremity
Supported	b Robot writer → novelty → emotional involvement → bias perception
Unsupported	c Robot writer → novelty → emotional involvement → news credibility
Unsupported	d Robot writer → novelty → emotional involvement → source trustworthiness
Unsupported	H7 Robot writer → eeriness → HMP (a, b, c, d)
Unsupported	H8 Robot writer → eeriness → emotional involvement → HMP (a, b, c, d)

3.4 Summary of Findings

As summarized in Table 1, robot writer induced less emotional involvement due to the machine heuristic held by readers that machines are free of intention and bias, which further reduced perceived news slant extremity and news bias, but not news credibility and source trustworthiness.

Results also showed that higher novelty elicited by robot writer, on one hand, led to evaluations that are more positive, i.e., lower bias perception, higher news credibility, and higher source trustworthiness, but made no difference on perceived news slant extremity. On the other hand, sense of novelty enhanced emotional involvement, which further increased perceived news slant extremity and bias perception, but did not change news credibility and source trustworthiness. Not as hypothesized, perception of eeriness was not found to play a role in news writer effect on all the measures of HMP.

4 Discussion

4.1 Discussion

Informed by research on the mechanisms of HME (e.g., Matthes 2013; Matthes and Beyer 2015) and MAIN model (Sundar 2008), this study examined the potential of applying AI in news production to reduce HMP and to evoke fairer evaluations of news given the pervasively held belief that machine is free of intentions and unbiased. Results showed that the label of robot writer had impact on readers' bias perception and credibility evaluation via multiple mechanisms.

One major finding of this study is that robot written news reduced readers' emotional involvement for those who believe in machine heuristic, suggesting machine heuristic was triggered by the identity cue, i.e., the ontological nature of the news source, which supports the MAIN model that for online news consumers, not only news content influences their judgments, but also other peripheral cues embedded in the interface by triggering relevant heuristics associated with those cues (Sundar 2008).

The lack of intention attribution for machine-written news led to less emotional involvement and therefore, less perceived news slant and bias perceptions. Such findings are in line with implications from extant studies that the influence intention attributed to the source might result in HMP by inducing affective reactance and arousal. The findings also corroborate that emotional involvement is a significant predictor of HMP independent from issue involvement (Matthes 2013; Matthes and Beyer 2015). As shown in the results, the more affectively involved the news readers were, the more they perceived the news as biased.

Another important finding of this study is the halo effect of novelty elicited by robot writer. As found in the current study, sense of novelty was associated with reduced bias perception, higher perceived news credibility and source trustworthiness. Consistent with existing findings on automated journalism (Gambino and Kim 2015) and findings in new technology adoption (Wells et al. 2010), sense of novelty associated with use of new technology can often enhance positive perceptions globally towards the experience with it.

Although the sense of novelty is associated with positive evaluations of the news, it seems to be a double-edged sword in the context of controversial news topics, which has not been quite tested in existing studies on automated journalism. On one hand, enhanced novelty promoted positive evaluations of the news and the source. On the other hand, sense of novelty also increased readers' emotional involvement, which further increased readers' news slant extremity and bias perception.

In contrast to findings in past studies, robot-written news was not perceived as eerier than that written by human writer as found in past studies (e.g., Gambino and Kim 2015). First, most studies that found eeriness associated with robotic agents were conducted with embodied robotic agents (Kätsyri et al. 2015; Seyama and Nagayama 2007). Second, perceived eeriness of machine-written news might only occur for news of certain topics (Gambino and Kim 2015). Given the current topic, i.e., climate change, is in the domain of hard science, machine writing on this topic may not be as uncanny as its writing on more personal topics (Gambino and Kim 2015).

This study used four measures to capture HMP. However, effects of news writer were found to be different on these four measures. As shown in the results, perceived news slant extremity and news bias (i.e., traditional HMP measures) were influenced by emotional involvement, whereas credibility measures (news credibility, and source credibility) were not found to be impacted by emotional involvement but more impacted by news writer and novelty directly. Findings suggest that evaluating news credibility and source trustworthiness is more than judging whether the news or the source is biased against or in favor of a side, but also involves other aspects (Arpan and Peterson 2008).

Besides theoretical contribution, this study, motivated by the goal of reducing HMP by applying AI in news production, also has practical implications on robot journalism. The overall findings seem to suggest that robot writer has two opposite effects that turn out to cancel each other out on HMP. Heightened sense of novelty leads to more favorable judgements overall but intensifies emotional involvement and therefore, HMP. To amplify the positive utility of robot writer in reducing HMP, news organizations might consider taking measures to trigger machine heuristic, enhance novelty, but tuning down the overall emotional involvement at the same time.

4.2 Limitations and Future Work

This study also has several shortcomings. First, we only tested the hypotheses with the climate change issue. However, existing research has suggested that perceptions of machine-written news could be contingent on news topics. For example, health news written by AI was less acceptable than finance news (Gambino and Kim 2015). In light of this, future research should expand the variety of news contexts.

Secondly, this study did not provide much explanation for why besides the positive effect brought by novelty, robot writer was perceived not as good as its human counterpart on credibility measures. As found in the study, no direct effect of robot was found to have on news slant extremity and bias perception but there was a negative direct effect of robot writer on the credibility measures. It suggests that being objective is not enough for news to be perceived as credible and source to be trustworthy. Future research should

investigate the existence and the effect of other heuristics related to AI that matter in news production.

Thirdly, we did not address the potential impact of news organization. In the context of a controversial political issue, readers might question that the opposite party could manipulate the algorithm to intentionally seek or create information unfavorable to their side and in favor of the opponent's side (Carroll 2017), as partisans may naturally engage in defensive processing of incoming information (Gunther and Liebhart 2006). However, because we only had *the News York Times* in all the conditions, we could not assess the effect of news organization.

5 Conclusion

In conclusion, this study finds the use of AI in news production could be a double-edged sword in terms of its effect on HMP. On one hand, because of the widely held machine heuristic that machine is inanimate and therefore it must be free of intention, robot writer reduces readers' emotional involvement, which further reduces HMP. However, novelty associated with machine-written news, although enhances perception of credibility, also intensifies one's emotional involvement, which further increases bias perception. We suggest that by emphasizing the mechanical nature of robot, enhancing the novelty in the reading experience, and tuning down other factors that might intensify emotional arousal, news producers are able to reduce defensive reactions from readers, and foster positive evaluations of the news products.

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