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RESEARCH REPORT

Robots or humans for disaster response? Impact on consumer prosociality and possible explanations

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Abstract

Hurricanes, wildfires, pandemics, and other disasters have taken millions of lives in the past few years and caused substantial economic losses. To tackle these extraordinary circumstances, governments, organizations, and companies seek assistance from both humans and high-technology machines such as robots. This research report documents how highlighting robots' (vs. humans') helping behaviors in disaster response can affect consumers' prosociality, explores driving mechanisms, and tests solutions. Study 1 found that consumers donated fewer items of clothing after watching news highlighting robots' (vs. humans') assistance in a mudslide disaster. Featuring the COVID-19 pandemic, Study 2 further showed that this decrease in prosociality occurred because reading about robots' assistance felt less encouraging/inspiring to consumers. Studies 3A-3C (and a supplemental study) explored multiple mechanisms and identified a key driver for the backfire effect—a lower perception of courage in disaster response robots. Accordingly, Study 4 tested three theory-driven solutions to raise the perceived courage in robots to increase consumer prosociality.

KEYWORDS
disaster response, donation, pandemic, prosociality, robots

INTRODUCTION

Robots are machines or devices programmed by human beings to perform intended tasks (Kurfess, 2004). Whereas years ago, robots were mainly seen in industrial automation, these days more and more robots are deployed in service domains, such as disaster response, to improve the well-being of consumers (United Nations, 2002). For example, robots searched for missing people during 9/11 (Casper & Murphy, 2003), helped put out the fire in Notre Dame Cathedral (Holley, 2019), and assisted in large-scale disaster rescue and recovery (Boyette, 2015). Appendix A provides examples of disaster response robots in various consumer safety domains.

The coronavirus pandemic further accelerated the deployment of robots worldwide (Shen et al., 2021; Yang et al., 2020) and increased public interest in these robots. News stories about robots in the COVID-19 battle, providing assistance from disease prevention to clinical and nonclinical care, appeared in top media outlets such as *Forbes* and *The New York Times* as well as social media (see Appendix B for examples). While consumers show high interest in news stories about disaster response robots, it remains unknown whether reading about robots' (vs. humans') helping behaviors will induce positive or negative responses from consumers.

Recent research on service robots and our examination

Recent research has examined consumers' responses to service robots (vs. humans) across various domains, including health care (Hudson et al., 2017; Longoni et al., 2019), education (Fernández-Llamas et al., 2018), retail (Garvey et al., 2021; Granulo et al., 2021), and

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catering (Mende et al., 2019). Interestingly, this growing research has uncovered mixed, domain-specific effects, and mechanisms. For example, Fernández-Llamas et al. (2018) found that a robot teacher versus a human teacher made *no difference* in students' motivation to learn. On the contrary, consumers liked robotic labor *less* than human labor when consuming products with high symbolic value (Granulo et al., 2021), and consumers reacted *more favorably* to an unfair price offer from a robotic agent rather than a human agent because of the lack of autonomy in robotic agents (Garvey et al., 2021).

Adding to the growing literature, this research report investigates consumers' reactions to disaster response robots. We found that reading about robots' (vs. humans') assistance in a variety of disaster domains *negatively* affects consumers' feelings of encouragement/inspiration and their subsequent prosocial contributions. We further explored mechanisms that uniquely drive consumers' perceptions in the domain of disaster response. Leveraging the driving mechanisms, we tested three solutions to help alleviate the backfire effect of disaster response robots.

Disaster response robots discourage prosociality

When a disaster happens, consumers' first responses are often fear and helplessness (Murphy, 2015). The disaster response agents help consumers feel safe again by resolving the source of the disaster (e.g., putting out a fire), providing real-time rescue (e.g., pulling people out of a collapsing building), facilitating discovery of solutions (e.g., analyzing virus samples), and constructing postdisaster remedies (e.g., disinfecting contaminated places). These virtuous behaviors can encourage and inspire observers (Brohmer et al., 2019; Erickson & Abelson, 2012; Klein & O'Brien, 2017); importantly, such feeling of encouragement/inspiration can become an energizing emotion that motivates the observers to behave prosocially (Liang et al., 2016).

There is reason to believe that when the disaster response agents are robots (vs. humans), this feeling of encouragement and the resulting prosociality can be *amplified* because outstanding abilities of others serve as a powerful source of inspiration (Thrash & Elliot, 2004). Thus, heroes in classic stories not only rescue people but also often possess superior abilities (Franco et al., 2011). Given that robots are powered by advanced technologies and are highly effective (Shen et al., 2021), it is possible that reading about robots' outstanding abilities to quickly put out wildfires or disinfect hospitals during a pandemic will encourage viewers to contribute more. While we indeed found evidence of this mechanism (i.e., perceived technology effectiveness, Study 3), our results showed that another force can be even more dominant, canceling this positive pathway, and driving consumers to feel overall *demotivated* by disaster response robots: the perception of courage—or lack thereof—in disaster response robots.

While consumers can feel encouraged and inspired by observing others' exceptional abilities in tackling a disaster, another important source of encouragement is the *perceived courage* in others' actions (Brohmer et al., 2019; Erickson & Abelson, 2012; Klein & O'Brien, 2017). Indeed, the word "encourage" originates from old French word *encoragier*, composed of *en-* (make, put in)+*corage* (courage, heart). Psychologists have converged on three essential components that define courage: (1) autonomy, (2) facing substantial risk or danger, and (3) a noble end (Howard & Alipour, 2014; Peterson & Seligman, 2004; Rate et al., 2007; Woodard & Pury, 2007; Yuan et al., 2021). While robots' assistance in disaster response can certainly lead to a noble end, robots lack the human-unique capacity of thinking, planning, and action control (Botti et al., 2009; Gray et al., 2007; Kulow et al., 2021), and thus their behaviors are perceived as lacking autonomy (Garvey et al., 2021). In addition, robots are less susceptible to harm than humans and thus face much less danger when tackling a disaster. Taken together, we hypothesize that highlighting robots' (instead of humans') assistance in disaster response would remove the elements of human involvement and human courage (i.e., the courage arising from humans' high autonomy in facing risk/danger), decreasing consumers' feelings of encouragement and thus undermining their prosociality.

Four studies and one supplemental study tested these predictions. Detailed stimuli, measures, pretests, and supplemental analyses are reported in the MDA. Data are available at https://osf.io/sabzm/?view_only=1e48d9ea7b244f7c8c07aaeca83fb003.

STUDY 1: MUDSLIDE AND DONATING USED CLOTHING

Study 1 provides an initial test of our main hypothesis that consumers would be less willing to contribute prosocially after reading a news report highlighting robots' (vs. humans') assistance in disaster response. We captured participants' actual donations through a used-clothing donation drive.

Method

This study followed a one-factor, two-level (featured agent: robot vs. human) between-subjects design. Two hundred and thirty-nine undergraduate students (M_{age} = 25.82 years, 23.8% males) at a U.S. university completed this study.

The study lasted two weeks and consisted of two parts. For the first part, participants completed a 10-min study in the laboratory in which they watched a PowerPoint news presentation on a mudslide. We used the PowerPoint

display to mimic multimedia news formats where dynamic visuals accompany narratives. The news presentation described the mudslide and reported that teams of robots (vs. human workers) had been providing help to the victims and would continue to support follow-up recovery work (MDA A1). After watching the news presentation, participants answered a series of filler questions (e.g., "How clear was the description of the event?"). There was no difference between conditions on these scales.

After participants completed the laboratory study, the exit page informed them of a donation drive that the laboratory would be conducting in the coming 2 weeks to collect used clothing for a local nonprofit organization—Hope Services—to help disadvantaged families (MDA A2). A donation site was set up in front of the laboratory on weekdays from 8 a.m. to 5 p.m.; all donated clothing was recorded and matched with participants' responses and experimental conditions via email address. At the end of 2 weeks, 222 items had been collected and donated to Hope Services.

Results and discussion

To examine consumer prosociality, we analyzed both donation rate and amount. Three outliers with donation amount higher than three standard deviations from the mean (Meyvis & van Osselaer, 2017) were removed from analysis. The three outliers were from the human condition, including these outliers yielded consistent results. A logistic regression of donation decision (0 = not donate, 1 = donate) on featured agent (0 = human, 1 = robot) revealed that participants in the robot condition were less likely to make a donation (2.5%) than those in the human condition (11.9%; $b = -1.64$, SE = 0.65, $\chi^2 = 6.37$; $p = 0.012$). The same pattern emerged with the actual number of items donated ($M_{robot} = 0.12$, $SD = 0.84$ vs. $M_{human} = 0.68$, $SD = 2.09$; $b = -1.74$, SE = 0.32, $\chi^2 = 30.12$, $p < 0.001$, estimated with negative binomial regression due to significant dispersion in items donated [Chen & Berger, 2013]).

The results from this 2-week donation drive demonstrated that reading about robots' (vs. humans') helping behaviors in disaster response led to lower donation contributions. We note that Study 1 enlisted actual disaster photos, which were not perfectly comparable across conditions. This left several potential confounds unresolved, such as the perception of a team, perceived damage of the mudslide, and perceived victim harm. Study 2 remedied these concerns.

STUDY 2: COVID-19 PANDEMIC AND DRIVING ROLE OF FELT ENCOURAGEMENT

Study 2 featured several improvements over Study 1. First, this study made the human and robot stimuli more equivalent. Second, while Study 1 did not have a neutral baseline, Study 2 included a disaster-only condition as the neutral baseline to shed light on the direction of the effect. Third, Study 2 tested whether the reduced feeling of encouragement from reading about robots' assistance led to lower consumer prosociality. Fourth, Study 2 used a different disaster—the COVID-19 pandemic—and tested multiple prosocial campaigns.

Method

This study followed a 3 (featured agent: robot-highlighted vs. human-highlighted vs. disaster-only baseline; between-subjects) × 3 (prosocial campaigns; within-subjects) mixed design. Due to the stimuli in this study, we restricted recruitment to people who lived in the United States but not in New York State (which was the epicenter of the pandemic at the time the study was conducted). Three hundred and seventy-two adults recruited from a U.S. university subject pool completed this study online; participants who passed the residence prescreening by providing false information ($n = 18$) were removed from analysis, leaving a final validated sample of 354 ($M_{age} = 24.23$ years, 36.4% males).

Disguised as a study on consumers' thoughts about various social issues, participants read a general news update about the COVID-19 pandemic. Then participants in the *robot-highlighted* and *human-highlighted* conditions read, "To combat the COVID-19 pandemic, many parties, including people and service robots, have provided assistance and made contributions. We have prepared several news stories for you to read today." Following this general introduction, participants in the *robot-highlighted* (vs. *human-highlighted*) condition read an additional news story about how robot cleaners (vs. human cleaners) helped to disinfect hospitals (narratives adapted from actual news reports; see MDA B1). This treatment ensured that participants in both conditions were aware of the assistance from robots and humans—an accurate depiction of reality and a conservative test for our theory; the only difference was that they were randomly assigned to read one specific news story in greater depth. After reading the news story, participants reported their perceptions of the severity of the pandemic and the progress of pandemic relief efforts as filler questions. Participants in the disaster-only baseline condition did not read about the relief efforts (they read only the general news about the pandemic) and directly responded to the filler questions (MDA C1 details the measures and results).

Next, participants were told to examine three prosocial campaigns that needed their attention and help. The three campaigns were presented in a randomized order: helping senior people with grocery shopping during the pandemic, helping under-resourced students receive STEM education, and helping reduce marine pollution

and protect marine animals (MDA B2). For each campaign, we assessed participants' prosocial intentions with three items ("How interested are you in contributing to this campaign?" "How willing are you to donate to this campaign today?" and "How willing are you to sign up to be a volunteer for this campaign today?" 1 = *not at all*, 9 = *very much*; αs ≥0.80; Kristofferson et al., 2014; Small & Cryder, 2016). Afterward, participants in the robot- and human-highlighted conditions were asked to recall the disaster news story and indicate their feelings of encouragement using a 3-item scale ("I admire / I am encouraged by / I am motivated to do considerate things for other people because of these [robot] cleaners that provided assistance and contributions to combat COVID-19" α = 0.82, adapted from Algoe & Haidt, 2009). Participants also responded to a series of exploratory measures (MDA C2 details the measures and results). The session ended with demographic questions.

Results and discussion

Prosocial intentions

A mixed-ANOVA of featured agent (between-subjects), prosocial campaign (within-subjects), and their interaction on consumer prosociality revealed a main effect of featured agent ($F(2, 351) = 5.90$, $p = 0.003$, $\eta_p^2 = 0.03$) and a main effect of campaign ($F(2, 702) = 34.84$, $p < 0.001$, $\eta_p^2 = 0.09$). There was no interaction ($F(4, 702) = 0.95$, $p = 0.43$); hence, we pooled participants' responses to the three campaigns to form a composite prosociality score.

Supporting our hypothesis, participants in the robot-highlighted condition ($M = 4.69$, $SD = 1.52$) were significantly less willing to contribute than those in the human-highlighted condition ($M = 5.08$, $SD = 1.45$) or those in the disaster-only baseline condition ($M = 5.35$, $SD = 1.45$), $ps \leq 0.047$, $ds \geq 0.26$; the latter two conditions did not differ statistically ($p = 0.16$; we will return to this point in the General Discussion). Hence, reading a news story highlighting service robots demotivated participants to contribute to prosocial campaigns.

Felt encouragement

Consistent with our hypotheses, participants felt less encouraged by the robot cleaners than by human cleaners ($Ms = 4.06$ (1.33) vs. 5.78 (1.20), $F(1, 235) = 110.147$, $p < 0.001$, $d = 1.36$). A bias-corrected bootstrapping mediation analysis (PROCESS, model 4; Hayes, 2017) further revealed that the indirect effect of featured agent (0 = human, 1 = robot) on consumer prosociality through felt encouragement was significant ($b = -0.48$, 95% CI [−0.64, −0.33]).

In sum, Study 2 showed that highlighting robots' assistance in disaster response decreased consumers' prosocial intentions, compared with highlighting humans' assistance or not reading about any relief efforts. Consistent with prior research (e.g., Liang et al., 2016), the decrease in prosociality was driven by a lowered feeling of encouragement. Study 3 explored multiple factors that could drive this feeling of encouragement.

STUDIES 3A–3C: MULTIPLE DRIVERS OF FELT ENCOURAGEMENT

As noted earlier, news featuring robots' (vs. humans') assistance in disaster response may be *more* encouraging/inspiring due to the high perceived efficacy of robots, or *less* encouraging due to the low autonomy, low risk/sacrifice, and thus low perceived courage of robots. We tested these possibilities across three different disasters and response efforts.

Method

Studies 3A–3C (preregistered at https://aspredicted.org/QVB_D95) each followed a one-factor, two-level (featured agent: robot vs. human) between-subjects design with the dependent measure of felt encouragement. A total of 150, 149, and 150 Prolific workers completed these three studies, respectively. Eight participants who answered the location of the disaster event incorrectly were removed from analysis as preregistered. The final sample sizes were 146, 149, and 146 (M_{age} = 41.52 years, 50.3% males).

The procedures of Studies 3A–3C were identical. First, participants indicated their age and gender. Then, with the study disguised as being on consumers' thoughts on various societal events, participants read a news report about a recent disaster (the Notre Dame fire and subsequent rebuilding efforts in Study 3A, the COVID-19 pandemic and hospital cleaning efforts in Study 3B, and a Colorado wildfire and rescue efforts in Study 3C; MDA D). Afterward, participants reported their feeling of encouragement on the same scale as used in Study 2 (αs ≥ 0.72). Then, we measured several factors that can drive felt encouragement: (1) perceived agent courage (αs ≥ 0.95), (2) perceived agent autonomy (αs ≥ 0.89), (3) perceived risk/sacrifice (αs ≥ 0.86), (4) perceived effectiveness of technology (γs ≥ 0.83), and (5) perceived need for humans (γs ≥ 0.74; MDA E1 details the mechanism measures). These variables were presented in randomized order to avoid contamination. The session ended with a recall question about the location of the disaster described in the news report.

Results and discussion

Felt encouragement and other perceptions

Replicating the results from Study 2, we again found in each study that reading about robots' (vs. humans') assistance in a disaster response was less encouraging for consumers ($ps < 0.001$, $ds \geq 0.70$). In addition, participants perceived robots' (vs. humans') assistance to be less autonomous, lower in courage, lower in risk/sacrifice, and higher in perception of technology effectiveness ($ps < 0.001$, $ds \geq 0.89$). Finally, participants perceived a lower need for human contribution after reading about robots' (vs. humans') assistance ($ps < 0.09$, $ds \geq 0.28$). Table E1 in MDA E2 presents the full statistics.

What drives encouragement?

To investigate what drives the effect of featured agent (0 = human, 1 = robot) on felt encouragement, we conducted a mediation analysis (model 4) with perceived agent courage, perceived autonomy, perceived risk/sacrifice, perceived technology effectiveness, and need for humans as parallel mediators. The analysis revealed a significant and negative indirect effect via perceived agent courage in each study. The analysis also revealed a significant and positive indirect effect via perceived technology effectiveness in Studies 3A and 3C but not in Study 3B. Table E2 in MDA E2 presents the full statistics.

To compare the absolute strength of the two significant indirect effects (i.e., ignoring the sign), we conducted a pairwise comparison using the contrast command in the PROCESS macro (Hayes, 2017). This analysis showed that the negative indirect effect through perceived agent courage was stronger than the positive indirect effect through technology (Study 3A: $b = 0.56$, 95% CI: [0.04, 1.04]; Study 3C: $b = 0.73$, 95% CI: [0.05, 1.52]); perceived agent courage thus was the stronger driver.

Cross-study meta-analysis

Cross-study meta-analysis that combined these three datasets replicated both the significant effect of featured agent on felt encouragement ($F(1, 435) = 111.37$, $p < 0.001$) and the strongest mediating role of perceived agent courage ($b = -0.36$, $p < 0.01$).

Given that Studies 3A–3C isolated perceived agent courage as the strongest driving mechanism, we conducted a supplemental study to verify the serial mediational pathway from reading about the disaster response agents (robot vs. human) ➔ perceiving lower courage in the robotic agents ➔ feeling less encouraged by these agents' actions ➔ lower prosociality; MDA G details the methods and the results of this supplemental study.

STUDY 4: THREE THEORY-DRIVEN SOLUTIONS TO BOOST PERCEIVED COURAGE OF ROBOTS

So far, we have found that because robots are perceived as less courageous than humans when assisting in disaster response activities, their assistance is less encouraging for consumer prosociality. Based on the three dimensions of courage discussed in prior research (i.e., autonomy, substantial risk/danger, and a noble end; Rate et al., 2007; Woodard & Pury, 2007) and the exploratory analyses that validated these dimensions using data in Studies 3A–3C (see MDA E3), we hypothesize that an increase in perceived agent autonomy or perceived sacrifice due to risk could help to make robots' actions seem more courageous. Study 4 tested these possibilities. For comprehensiveness, Study 4 also tested a hybrid solution to lift both perceived autonomy and risk.

Method

This study (preregistered at https://aspredicted.org/LB9_NF1) used a one-factor, four-level (robot news: control vs. high-autonomy vs. high-risk vs. hybrid) between-subjects design. Four hundred and seven participants from a university pool completed the study. Participants who had participated in prior studies ($n = 11$) were removed from analysis as preregistered, leaving a final sample size of 396 ($M_{age} = 20.99$ years, 30.3% males).

Participants first read a news report about the 2021 Colorado wildfire. The description of the wildfire was the same as in Study 3C. Participants read further about how firefighting robots helped in this disaster response. The *high-autonomy* condition highlighted the autonomy of the robots (autonomous and self-directed); the *high-risk* condition highlighted the risk and sacrifice faced by the robots (vulnerable to prolonged heat); the *hybrid* condition highlighted both dimensions; and finally, the *control* condition presented neutral information about the robots with no autonomy or risk manipulation (MDA F1). An independent pretest (MDA F2) verified that the autonomy, risk, and hybrid interventions successfully increased the perceived courage of robots and did not affect the perception of technology effectiveness.

Next, participants were given an ostensibly unrelated task about how people make decisions. Participants imagined that they had 2 h of free time, which they could allocate to four activities presented in randomized order (adapted from Park et al., 2021; Winterich et al., 2009). Two of the activities were for their own benefit, while the other two were for the benefit of others; the total amount

of time allocated to the two activities benefiting others served as an index of consumer prosociality (MDA F3 and F4 detail the prosociality measure and its pretest).

Results

A one-way ANOVA of condition on participants' prosociality revealed a significant main effect, $F(3, 392) = 3.29$, $p = 0.021$, $\eta_p^2 = 0.03$. Planned contrasts as preregistered further revealed that participants in the three intervention conditions on average displayed greater prosociality than those in the control condition (contrast code of [−3, 1, 1, 1], $t(392) = 2.86$, $p = 0.004$, $d = 0.33$); specifically, compared with those in the control condition ($M = 41.75$, $SD = 19.26$), participants in the high-autonomy condition (contrast code of [−1, 1, 0, 0], $M = 46.79$, $SD = 19.36$, $t(392) = 1.79$, $p = 0.074$, $d = 0.26$), high-risk condition (contrast code of [−1, 0, 1, 0], $M = 50.36$, $SD = 20.91$, $t(392) = 3.06$, $p = 0.002$, $d = 0.43$), and hybrid condition (contrast code of [−1, 0, 0, 1], $M = 47.75$, $SD = 19.38$, $t(392) = 2.15$, $p = 0.032$, $d = 0.31$) each demonstrated an increase in prosociality, with the high-risk condition showing the strongest effect.

GENERAL DISCUSSION

Over the last two decades, robots have been widely deployed in disaster response to ensure consumer safety. Adding to the mixed findings on human-technology interactions in marketing (e.g., Fan et al., 2022; Hoffman & Novak, 1998, 2017; Kim & Duhachek, 2020; Longoni et al., 2019; Zhang et al., 2022), this research finds that virtuous behaviors by robots (vs. humans) in the disaster response domain harm consumer prosociality, and that perceived lack of courage drives this effect.

Importantly, highlighting robots' autonomy or the danger faced by robots can enhance the perceived courage of these robots, resulting in greater consumer prosociality. Future research can explore other means to increase consumers' perceptions and prosociality. For instance, emphasizing that technology is created by humans and thus needs continuous human support can help to infuse robots with humanlike autonomy and sacrifice. In addition, an anthropomorphic robot design (e.g., Chen et al., 2022) or a "communal" robot team may make robots seem more like humans and thus more courageous. Building on the consumer-brand-relationship theories (Fournier, 1998; Kim & Kramer, 2015), disaster response robots can also "partner" with humans, increasing the perceived autonomy and courage of the response team as a whole.

Future research is also needed to investigate boundary conditions. Past research has shown that people faced with enormous devastation tend to feel powerless because what one person can contribute is only "a drop in the bucket," which discourages people to help (the pseudo-inefficacy effect; Västfjäll & Slovic, 2020). In Study 3, we found that the increased perception of technology effectiveness in the robot condition produces a positive impact on consumers. Future research can investigate how this positive perception of technology effectiveness brought about by robots can counteract the pseudo-inefficacy effect and motivate prosocial behaviors.

Finally, we note that humans' virtuous behaviors in disaster response did not appear to amplify observers' prosociality relative to the baseline in Study 2. We speculate that this is because human involvement and sacrifice are regarded as default when a disaster occurs. In addition, to reduce confounds, we used unidentified human workers across our studies (no clear faces or names were shown). Should we make the human workers more identifiable, they might evoke stronger feelings of encouragement and inspiration (e.g., Small et al., 2007). Future research can dive deeper into consumers' default reactions to disaster response; if positive, the task of the media is to not disrupt consumer prosociality with mismatched news stories, and to feature response robots with suitable intervention messages.

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REFERENCES

Algoe, S. B., & Haidt, J. (2009). Witnessing excellence in action: The 'other-praising' emotions of elevation, gratitude, and admiration. *Journal of Positive Psychology*, *4*(2), 105–127.

Botti, S., Orfali, K., & Iyengar, S. S. (2009). Tragic choices: Autonomy and emotional responses to medical decisions. *Journal of Consumer Research*, *36*(3), 337–352.

Boyette, C. (2015). Robots, drones, and heart-detectors: How disaster technology is saving lives. *CNN.com*. Retrieved August 24, 2015 from https://edition.cnn.com/2015/08/24/us/robot-disaster-technology/index.html

Brohmer, H., Fauler, A., Floto, C., Athenstaedt, U., Kedia, G., Eckerstorfer, L. V., & Corcoran, K. (2019). Inspired to lend a hand? Attempts to elicit prosocial behavior through goal contagion. *Frontiers in Psychology*, *10*(1), 1–16.

Casper, J., & Murphy, R. R. (2003). Human-robot interactions during the robot-assisted urban search and rescue response at the world trade center. *IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics)*, *33*(3), 367–385.

Chen, F., Sengupta, J., & Zheng, J. F. (2022). When products come alive: Interpersonal communication norms induce positive word of mouth for anthropomorphized products. *Journal of Consumer Research*. Advance online publication. https://doi.org/10.1093/jcr/ucac027

Chen, Z., & Berger, J. (2013). When, why, and how controversy causes conversation. *Journal of Consumer Research*, *40*(3), 580–593.

Erickson, T. M., & Abelson, J. L. (2012). Even the downhearted may be uplifted: Moral elevation in the daily life of clinically depressed and anxious adults. *Journal of Social and Clinical Psychology*, *31*(7), 707–728.

Fan, L., Rucker, D. D., & Jiang, Y. (2022). Preference heterogeneity moderates consumers' reaction toward artificial intelligence. Working paper, School of Business, Hong Kong University of Science and Technology, Hong Kong.

Fernández-Llamas, C., Conde, M. A., Rodríguez-Lera, F. J., Rodríguez-Sedano, F. J., & García, F. (2018). May I teach you? Students' behavior when lectured by robotic vs. human teachers. *Computers in Human Behavior*, *80*, 460–469.

Fournier, S. (1998). Consumers and their brands: Developing relationship theory in consumer research. *Journal of Consumer Research*, *24*(4), 343–373.

Franco, Z. E., Blau, K., & Zimbardo, P. G. (2011). Heroism: A conceptual analysis and differentiation between heroic action and altruism. *Review of General Psychology*, *15*(2), 99–113.

Garvey, A. M., Kim, T., & Duhachek, A. (2021). Bad news? Send an AI. Good news? Send a human. *Journal of Marketing*. Advance online publication. https://doi.org/10.1177/00222429211066972

Granulo, A., Fuchs, C., & Puntoni, S. (2021). Preference for human (vs. robotic) labor is stronger in symbolic consumption contexts. *Journal of Consumer Psychology*, *31*(1), 72–80.

Gray, H. M., Gray, K., & Wegner, D. M. (2007). Dimensions of mind perception. *Science*, *315*(5812), 619.

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.

Hoffman, D. L., & Novak, T. P. (1998). Bridging the racial divide on the internet. *Science*, *280*(5362), 390–391.

Hoffman, D. L., & Novak, T. P. (2017). Consumer and object experience in the internet of things: An assemblage theory approach. *Journal of Consumer Research*, *44*(6), 1178–1204.

Holley, P. (2019). Firefighters had a secret weapon when Notre dame caught fire: A robot named 'Colossus'. *The Washington Post*. Retrieved April 17, 2019 from https://www.washingtonpost.com/technology/2019/04/17/firefighters-had-secret-weapon-when-notre-dame-caught-fire-robot-named-colossus/

Howard, M. C., & Alipour, K. K. (2014). Does the courage measure really measure courage? A theoretical and empirical evaluation. *The Journal of Positive Psychology*, *9*(5), 449–459.

Hudson, J., Orviska, M., & Hunady, J. (2017). People's attitudes to robots in caring for the elderly. *International Journal of Social Robotics*, *9*(2), 199–210.

Kim, H. C., & Kramer, T. (2015). Do materialists prefer the 'brand-as-servant'? The interactive effect of anthropomorphized brand roles and materialism on consumer responses. *Journal of Consumer Research*, *42*(2), 284–299.

Kim, T. W., & Duhachek, A. (2020). Artificial Intelligence and persuasion: A construal-level account. *Psychological Science*, *31*(4), 363–380.

Klein, N., & O'Brien, E. (2017). The power and limits of personal change: When a bad past does (and does not) inspire in the present. *Journal of Personality and Social Psychology*, *113*(2), 210–229.

Kristofferson, K., White, K., & Peloza, J. (2014). The nature of slacktivism: How the social observability of an initial act of token support affects subsequent prosocial action. *Journal of Consumer Research*, *40*(6), 1149–1166.

Kulow, K., Kramer, T., & Bentley, K. (2021). Lady luck: Anthropomorphized luck creates perceptions of risk-sharing and drives pursuit of risky alternatives. *Journal of the Association for Consumer Research*, *6*(3), 383–393.

Kurfess, T. R. (2004). *Robotics and automation handbook*. CRC Press.

Liang, J., Chen, Z., & Lei, J. (2016). Inspire me to donate: The use of strength emotion in donation appeals. *Journal of Consumer Psychology*, *26*(2), 283–288.

Longoni, C., Bonezzi, A., & Morewedge, C. (2019). Resistance to medical artificial intelligence. *Journal of Consumer Research*, *46*(4), 629–650.

Mende, M., Scott, M. L., van Doorn, J., Grewal, D., & Shanks, I. (2019). Service robots rising: How humanoid robots influence service experiences and elicit compensatory consumer responses. *Journal of Marketing Research*, *56*(4), 535–556.

Meyvis, T., & van Osselaer, S. M. (2017). Increasing the power of your study by increasing the effect size. *Journal of Consumer Research*, *44*(5), 1157–1173.

Murphy, R. R. (2015). These robots come to the rescue after a disaster [video file]. *TED Women*. Retrieved September 19, 2015, from https://www.ted.com/talks/robin_murphy_these_robots_come_to_the_rescue_after_a_disaster

Park, J. H., Huang, S. C., Rozenkrants, B., & Kupor, D. (2021). Subjective age and the greater good. *Journal of Consumer Psychology*, *31*(3), 429–449.

Peterson, C., & Seligman, M. E. (2004). *Character strengths and virtues: A handbook and classification*. Oxford University Press.

Rate, C. R., Clarke, J. A., Lindsay, D. R., & Sternberg, R. J. (2007). Implicit theories of courage. *The Journal of Positive Psychology*, *2*(2), 80–98.

Shen, Y., Guo, D., Long, F., Mateos, L. A., Ding, H., Xiu, Z., Hellman, R. B., King, A., Chen, S., Zhang, C., & Tan, H. (2021). Robots under COVID-19 pandemic: A comprehensive survey. *IEEE Access*, *9*, 1590–1615.

Small, D. A., & Cryder, C. (2016). Prosocial consumer behavior. *Current Opinion in Psychology*, *10*, 107–111.

Small, D. A., Loewenstein, G., & Slovic, P. (2007). Sympathy and callousness: The impact of deliberative thought on donations to identifiable and statistical victims. *Organizational Behavior and Human Decision Processes*, *102*, 143–153.

Thrash, T. M., & Elliot, A. J. (2004). Inspiration: Core characteristics, component processes, antecedents, and function. *Journal of Personality and Social Psychology*, *87*(6), 957–973.

United Nations (2002). United Nations and the international federation of robotics. In *Proceedings of the world robotics 2002*. United Nations.

Västfjäll, D., & Slovic, P. (2020). A psychological perspective on charitable giving and monetary donations: The role of affect. In T. Zaleskiewicz & J. Traczyk (Eds.), *Psychological perspectives on financial decision making* (pp. 331–345). Springer Nature.

Winterich, K. P., Mittal, V., & Ross, W. T., Jr. (2009). Donation behavior toward in-groups and out-groups: The role of gender and moral identity. *Journal of Consumer Research*, *36*(2), 199–214.

Woodard, C. R., & Pury, C. L. (2007). The construct of courage: Categorization and measurement. *Consulting Psychology Journal: Practice and Research*, *59*(2), 135–147.

Yang, G. Z., Nelson, B. J., Murphy, R. R., Choset, H., Christensen, H., Collins, S. H., Dario, P., Goldberg, K., Ikuta, K., Jacobstein, N., & Kragic, D. (2020). Combating COVID-19: The role of robotics in managing public health and infectious diseases. *Science Robotics*, *5*(40), eabb5589.

Yuan, Z., Cockburn, B. S., Astrove, S. L., & Buis, B. C. (2021). Sacrificing heroes or suffering victims? Investigating third parties' reactions to divergent social accounts of essential employees

in the COVID-19 pandemic. *Journal of Applied Psychology*, *106*(10), 1435–1447.
Zhang, K., Huang, Z. T., & Zhu, M. (2022). Consumer adoption of artificial intelligence: Perceived nature-connectedness as a facilitator. Working paper, School of Business, Shanghai University, China.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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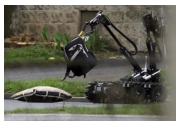
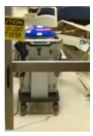
APPENDIX A

Selected examples of service robots in hazardous or emergency situations (Presented in chronological order)

News outlet	Event	News article title	Picture of the service robot
National Science Foundation	Hurricane Katrina, U.S., 2005	Small, Unmanned Aircraft Search for Survivors in Katrina Wreckage	
NBC News	Oil spill, Gulf of Mexico, 2010	Underwater Robots Attack Spill like Superman	
MIT Technology Review	Fukushima nuclear leak, Japan, 2011	Robots to the Rescue in Japan	
Quartz	Boston marathon bombings, U.S., 2013	These Are the Robots Scouring the U.S. for Bombs	
The Telegraph	Missing airplane MH370, Malaysia, 2014	Malaysia Airlines MH370: Undersea Robot Hunts for Missing Plane	
CNN	Ebola pandemic, U.S., 2014	Germ-zapping Robot Gigi Sets Its Sights on Ebola	
New Scientist	Fight fires, U.S., 2014	Robot Firefighter Puts Out Its First Blaze	
DJI Technology	Assist in aerial and ground search missions for people who have gone missing, U.S., 2015	DJI Stories - Search and Rescue	 https://www.youtube.com/watch?v=IbkTzDchrzE
Jet Propulsion Laboratory-NASA	Disaster response, U.S., 2016	Researchers Prepare RoboSimian for Tasks Beyond Disaster Response	

News outlet	Event	News article title	Picture of the service robot
The Washington Post	Fighting the Notre Dame Cathedral fire, France, 2019	Firefighters Had a Secret Weapon When Notre Dame Caught Fire: A Robot Named 'Colossus'	 https://www.youtube.com/watch?v=6G-79XpzgNc&feature=youtu.be
University of California, Berkeley	Coronavirus pandemic, 2020	At UC Berkeley's New COVID-19 Testing Facility, Robots Do the Dirty Work	
The Conversation	Coronavirus pandemic, 2020	Robots Are Playing Many Roles in the Coronavirus Crisis—and Offering Lessons for Future Disasters	

APPENDIX B

Selected news reports on robots used in the COVID-19 battle (Presented in chronological order)

News outlet	Publish date	Country of use	Article title
Berkeley News	March 2020	U.S.	UC Berkeley Scientists Spin Up a Robotic COVID-19 Testing Lab
The Korea Herald	March 2020	South Korea	Robots Deployed to Help Fight Coronavirus Contagion
Straits Times	April 2020	Singapore	UV Disinfecting Robots to Be Deployed In Fighting COVID-19
World Economic Forum	May 2020	Africa	How Drones Are Helping to Battle COVID-19 in Africa—and Beyond
The New York Times	May 2020	U.S.	A City Locks Down to Fight Coronavirus, But Robots Come and Go
The Guardian	November 2020	Japan	Japan Shop Deploys Robot to Check People Are Wearing Face Masks
Forbes	January 2021	U.S.	Robots Have Become an Essential Part of the War against COVID-19
Franceinfo	March 2021	Belgium	Easy to Use, Ultra-Efficient: Covid-19 Killer Robots Roam the Corridors of Belgian Hospitals
CTV News	September 2021	Canada	Made-in-Canada Cleaning Robots Increasingly Visible amid Pandemic
Science Daily	December 2021	U.S.	COVID-19 Mobile Robot Could Detect and Tackle Social Distancing Breaches
The New York Times	February 2022	Mainland China	Inside Beijing's Olympic Bubble: Robots, Swabs, and a Big Gamble
The New York Times	April 2022	U.S.	Can Robots Save Nursing Homes?
The Washington Post	April 2022	Mainland China	Shanghai's COVID Siege: Food Shortages, Talking Robots, Starving Animals
WPI News	April 2022	U.S.	Inspired by Pandemic Needs, Humanoid Nursing Robots under Development at WPI Could Help Medical Staff Care for Patients
Forbes	June 2022	U.S.	Robots Play Pivotal Role in Keeping Travel Safe during COVID-19 Era