

If Others Care, I Will Fight Climate Change: An Examination of Media Effects in Addressing the Public Goods Dilemma of Climate Change Mitigation

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In line with social psychology research on pro-environmental behavior (PEB) and ecological economics research on the provision of public goods, this study applied an interdisciplinary approach to understand media effects in addressing the public goods dilemma of climate change mitigation. By integrating the influence of presumed media influence (IPMI) model and the theory of planned behavior (TPB), this study examined how perceived effects of environmental messages on others affect an individual's own reasoning for personal action in public goods provision. Findings from data collected from a national survey in Singapore demonstrated that respondents estimated others' attention to media messages about climate change based on their attention. The perception of others' media attention led them to project media influence on others. Furthermore, the more people believed that others were influenced by the message, the more likely they were to engage in PEB. The theoretical and practical implications of these findings are discussed.

Keywords: public goods dilemma, influence of presumed media influence, climate change mitigation

Considering the severe effects of climate change on both nature and human systems, alleviating climate change has become an urgent global issue. To minimize the negative effects from climate change,

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concerned governments worldwide are making enormous efforts, such as authorizing regulations to require businesses to increase energy efficiency or reduce greenhouse emissions, promoting the transition from fossil fuels to clean energy as the primary energy source for the domestic electricity supply, and launching tax programs to put a cost on carbon emissions. However, the exclusive reliance on government is far from sufficient to address climate change. Moreover, the overreliance on government can allow individuals to shirk their own responsibilities, which could be a vital barrier to bottom-up PEB (Detenber, Rosenthal, Liao, & Ho, 2016). Thus, promoting PEB in individuals is imperative for climate change mitigation.

Therefore, an understanding of why individuals take actions against climate change is important for policy makers and researchers who seek solutions to this issue. Correspondingly, many research efforts have been made to identify the determinants of individuals' PEB in the path to sustainability. In particular, a dominant body of literature on PEB is grounded in social psychological theories that focus on behavioral change, such as theory of planned behavior (Ajzen, 1991), reasoned action theory (Fishbein & Ajzen, 1977), and the value-belief-norm theory of environmentalism (Stern, Dietz, Abel, Guagnano, & Kalof, 1999). By linking social or psychological factors to behavioral change, these studies suggest that PEB originates from value, attitude, efficacy, and norms.

Despite the dominant role that social psychologists attribute to social or psychological factors for PEB, a number of researchers have indicated the need for an interdisciplinary approach to examine the determinants of PEB (e.g., Messick & Brewer, 1983; Van Liere & Dunlap, 1980). Notably, there is increasing attention to the economic models of the voluntary provision of public goods in the literature on PEB. From the perspective of ecological economics, PEB illustrates individuals' voluntary effort to provide environmental public goods (Clark, Kotchen, & Moore, 2003). However, the nonexcludability of environmental public goods can lead to the public goods dilemma, a situation in which people enjoy the benefit once the good is offered, even if they contribute nothing to the provision of the good. As noted by Olson (1965) in the analysis of public goods, the general result of such public goods dilemmas is that individuals have little incentive to provide the public goods. Rather, they choose to free-ride and enjoy the benefits of the public goods provided by others. Moreover, an individual's concern about these free-riders hold him or her back from taking interest or action (Ostrom, 2010).

Although the phenomenon of public goods dilemmas in fighting climate change has long been examined in ecological economics literature (e.g., Kotchen & Moore, 2007; Tam & Chan, 2018), very few environmental communication studies have addressed it from the perspective of the public goods dilemma. Consistent with social psychology literature, many communication research efforts thus far, however, have examined how media effects promote PEB by focusing on changing attitude, and enhancing values and norms (Ho, Liao, & Rosenthal, 2015; Lee, 2011; Yang, Chen, Wei, & Su, 2020; Zhang & Skoric, 2018). Given the need to understand PEB from an interdisciplinary approach, this study integrates elements from social psychology and ecological economics perspective to examine media effects in addressing the public goods dilemma of fighting climate change. Theoretically, our findings highlight the need for applying an interdisciplinary approach to understand the determinants of PEB. Practically, findings from our study will provide recommendations for policy makers and communicators to engage the public in climate change mitigation.

Literature Review

Theoretical Framework: The Influence of Presumed Media Influence Model

It is worth mentioning that in terms of recognition of the public goods dilemma in promoting PEB, ecological economics studies have underlined the calculus of individual decision-making in public goods provision (Adger, 2003; Heitzig, Lessmann, & Zou, 2011; Ostrom, 2010). In particular, many scholars have adopted the collective interest model to explain individuals' intentions to provide environmental public goods via personal actions (e.g., Dono, Webb, & Richardson, 2010; Lubell, 2002). By incorporating the demand for public goods into an individual's utility calculus without violating the logic of free-riding, the collective interest model suggests that individuals' decision to participate in public goods provision depends on their perception of others' performance (Finkel, Muller, & Opp, 1989). To be specific, this model argues that a perception of others' active involvement in public goods provision raises expectations that the action of the group as a whole is likely to be successful, which in turn increases individuals' intention to provide public goods via personal efforts.

Following the logic of the collective interest model, people will be willing to fight climate change when they perceive that others are taking actions. Such reasoning has been supported by empirical evidence as well. For example, in a survey on the barriers to engaging with climate change among the UK population, it was reported that inaction by others in society was one of the general concerns that people have (Lorenzoni, Nicholson-Cole, & Whitmarch, 2007). Another study conducted in Singapore also underscored that people took cues from their surroundings for decision-making in terms of performing PEB (Leung & Rosenthal, 2019). These studies illustrate that individuals' perception of others' performance is an important factor in their own decision-making in engaging with climate change. Correspondingly, to understand media effects in addressing the public goods dilemma for fighting climate change, we should take the perception of others into account.

One of the leading theories in communication research in terms of individuals' perception of others is the influence of presumed media influence (IPMI) model, which posits that in reasoning about how others would respond to media messages, individuals tend to adjust their behavior as a result of their perceptions of how others are influenced by media messages (Gunther & Storey, 2003). To be specific, this model assumes that on exposure to media messages, individuals tend to develop perceptions that these messages reach and influence a wider audience of others (presumed influence). The target corollary offers an explanation for this assumption, postulating that perceived exposure of a group to a message predicts perceived effects on this group (Eveland, Nathanson, Detenber, & McLeod, 1999). Beyond the perceptions of influence on others, people change their behavior as a result of such perceptions (influence of presumed influence), in that their behaviors are shaped by factors that include, but are not limited to, norms (Liao, Ho, & Yang, 2016), perceived others' attitudes (Cohen & Tsifti, 2009), and perceived prevalence of certain behaviors advertised by media messages (Gunther, Bolt, Borzekowski, Liebhart, & Dillard, 2006). For instance, in a study on the presumed influence of antismoking messages, Gunther and colleagues (2006) found that adolescents' perception of peers' exposure to prosmoking messages was positively related to perceived peer smoking prevalence, which in turn increased their intention to smoke.

Consistent with the collective interest model, the IPMI model also emphasizes that people adjust their behavior as a result of their perception of others. Moreover, empirical research on climate change communication suggests that audiences react to climate change messages based on how they think such messages will influence others (Liao et al., 2016; Rosenthal & Dahlstrom, 2019). Likewise, this study expects that people will be less likely to engage in action against climate change when they perceive that others do not pay attention to media messages about climate change, because of the lack of collective efficacy. In other words, the perception that the general others in a society are not interested in the issue of addressing climate change will frustrate people because these perceptions make them feel that they have little chance of influencing the collective outcome. On the contrary, people will be willing to engage themselves in the fight against climate change when they perceive that others are paying attention to media messages about climate change and being influenced by these messages, because these perceptions increase their collective efficacy in achieving the collective outcome. Accordingly, the IPMI model provides an ideal theoretical framework for understanding media effects in addressing the public goods dilemma of climate change mitigation, with a particular examination of individuals' perception of others.

As mentioned, prior studies have identified the need to integrate social psychology research on PEB and ecological economics research on the provision of public goods for a more complete framework to understand the determinants of PEB. Thus, this study incorporates psychological factors—such as attitudes, subjective norms, and efficacy toward fighting climate change—in our IPMI study of presumed media influence concerning climate change messages on others to provide a comprehensive framework for examining media effects in promoting private provision of environmental public goods. Figure 1 depicts the theoretical framework.

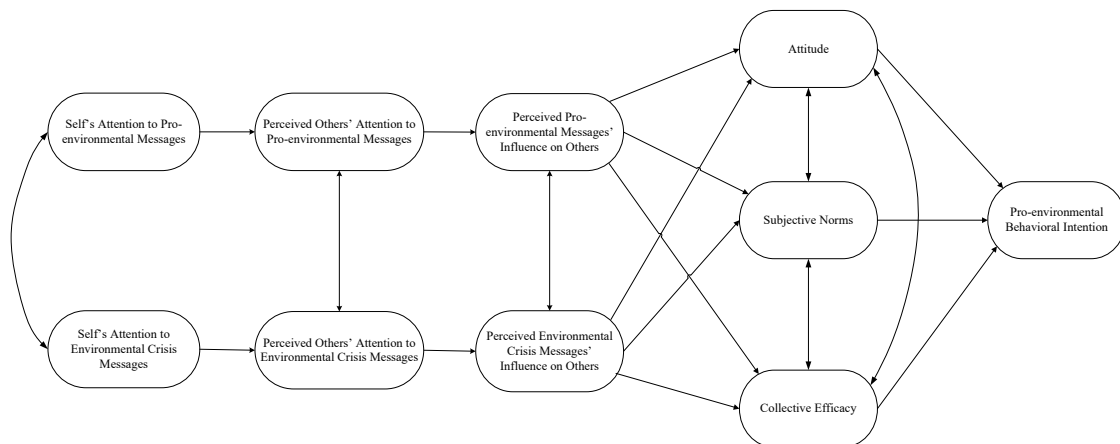


Figure 1. Hypothesized model.

Media Attention and Presumed Media Influence on Others

In this study, we attempt to examine presumed media influence of both pro-environmental messages and environmental crisis messages about climate change, given that they are both commonly

used in environmental communication campaigns (Hartmann, Apaolaza, D'Souza, Barrutia, & Echebarria, 2014). Specifically, pro-environmental messages about climate change focus on guiding the public on how to alleviate the effects caused by climate change, whereas environmental crisis messages describe the severe effects caused by climate change (e.g., rising sea levels). Though some scholars have examined the IPMI model in the context of climate change (Liao et al., 2016), they have failed to distinguish pro-environmental messages from environmental crisis messages in the estimates about its influence on others.

According to the presumed influence component of IPMI model, people deduce the reach and valence of media messages based on their own exposure to these messages (Gunther & Storey, 2003). As such, this study proposes that personal attention to media messages about climate change is positively related to an individual's perception of others' attention to these messages, irrespective of the content of the messages. Correspondingly, when people perceive others as the targets of climate change messages, their perceptions of these messages' influence on others increase as well. Thus, the following hypotheses are proposed:

H1a: Individuals' attention to pro-environmental messages about climate change is positively associated with perceived others' attention to these messages.

H1b: Individuals' attention to environmental crisis messages about climate change is positively associated with perceived others' attention to these messages.

H2a: Perceived others' attention to pro-environmental messages about climate change is positively associated with perceived influence of these messages on others.

H2b: Perceived others' attention to environmental crisis messages about climate change is positively associated with perceived influence of these messages on others.

Presumed Media Influence and Behavioral Intention

Previous studies reported that people's perceived media influence on others affects their own attitude toward the behavior and perceived subjective norms, which in turn leads to their behavioral change (Gunther et al., 2006; Liao et al., 2016; S. Y. Park, 2005). Additionally, past PEB research has identified attitudes and subjective norms to be the most salient factors in predicting individuals' behavioral change (Cialdini, Reno, & Kallgren, 1990; Goldstein, Cialdini, & Griskevicius, 2008; Whitmarsh & O'Neill, 2010).

Attitude Toward PEB

With regard to the effects of attitude in promoting behavioral change, dozens of studies have demonstrated that people's attitudes and behavior will be shaped by their perceptions of media influence on others (Cohen & Tsifti, 2009; Gunther et al., 2006; Jiang & Chia, 2009). For instance, in a study on promoting PEB, Liao and associates (2016) found that people adjusted their own attitudes to match up with their perception of media influence on others. The more people perceive that others are influenced by

media messages about environmental issues, the more likely they are to develop a positive attitude toward PEB, which in turn encourages them to take action.

Along the same line of reasoning, we propose that perceived influence of either pro-environmental messages or environmental crisis messages on others will affect individuals' own attitudes and behavioral intention to fight climate change. Specifically, perceived influence of pro-environmental messages on others might increase one's belief that others learn about how to combat climate change from these messages, while environmental crisis messages instruct people about the impacts of climate change. As the collective interest model suggests, one's perception of others' performance in fighting climate change will influence his or her attitude and behavioral decisions. According to this model, when people perceive that others are influenced by pro-environmental messages about climate change, they will form the perception that others' abilities to fight climate change are enhanced. When people perceive that others are influenced by environmental crisis messages, they will form the perception that others are worried about the issue. These beliefs about others might increase individuals' feeling of success in fighting climate change, which in turn enhances their positive attitude and intention to engage in fighting climate change. Hence, the following hypotheses are advanced:

H3a: Perceived influence of pro-environmental messages on others is positively associated with attitude toward PEB.

H3b: Perceived influence of environmental crisis messages on others is positively associated with attitude toward PEB..

H4: Attitude toward PEB is positively associated with intention to engage in PEB.

Subjective Norms

In addition to attitude, social influence also shapes people's behaviors. In particular, out of fear of social rejection, people's normative beliefs motivate them to act (Bamberg, Hunecke, & Blöbaum, 2007). People tend to perform behaviors that are consistent with a set of norms, or the social expectations that others have toward an individual (Cialdini et al., 1990). Normative influence is more salient in the context of public goods provision; people are more likely to develop fear of social rejection in collective settings than in an individual setting (Heckathorn, 1990; Louis, Taylor, & Douglas, 2005). Thus, we expect that subjective norms are an important determinant of individuals' engagement with climate change.

Moreover, a significant body of communication literature has documented that perceived subjective norms could be powerfully influenced by media. In particular, cultivation theory (Gerbner, Gross, Morgan, Signorielli, & Shanahan, 2002) explains media effects on perceived norms. This theory suggests that attention to media content aids social learning. Media representations reflect the social boundaries of what is acceptable or unacceptable in society (Eveland & Glynn, 2008). Correspondingly, pro-environmental messages about climate change advise what is acceptable, whereas environmental crisis messages demonstrate what is unacceptable. Perceptions of media influence on others lead people to feel that others are influenced by the values portrayed in media (Liao et al., 2016; Milkie, 1999). When

people perceive that others are influenced by these messages, they develop the beliefs that others might be shaped by these values and expect them to perform the PEB. Hence, we expect that people are likely to gather cues regarding the subjective norms toward PEB from their perception of media influence on others, which in turn affects their behavioral intention to take action. Therefore, the following additional hypotheses to test the role of subjective norms as a mediator are posited:

H5a: Perceived influence of pro-environmental messages on others is positively associated with subjective norms concerning fighting climate change.

H5b: Perceived influence of environmental crisis messages on others is positively associated with subjective norms concerning fighting climate change.

H6: Subjective norms concerning fighting climate change are positively associated with intention to engage in PEB.

Collective Efficacy Belief

Finally, previous studies have emphasized that collective efficacy, which refers to one's belief about the capabilities of his or her group to execute a particular behavior, is a pertinent factor in predicting individuals' engagement with environmental behaviors (Bandura, 1986, 2002; Chen, 2015). Collective efficacy is well situated in the context of public goods provision because it emphasizes the role of others in determining individuals' behavior. Furthermore, Bandura (2002) suggests that collective efficacy is an essential addition to the research on PEB because people are social beings who rely on each other to solve problems relevant to improving their quality of life. Thus, one's belief in other members' abilities to produce desired results is crucial to solving environmental issues such as climate change. Thus, we expect that presumed media influence on others would affect individuals' sense of collective efficacy, which in turn affects their behavioral intention to fight climate change.

Specifically, when people perceive that others are greatly influenced by media messages about climate change, they may believe that others are aware of the issue, take it seriously, and are willing to address the issue. Thus, people are likely to develop confidence in the society's conjoint capabilities to execute the courses of action required to fight climate change. Correspondingly, individuals' belief that others are influenced by media messages about climate change will increase their confidence that others not only are learning about the urgency of fighting climate change, but also have the ability to perform behaviors to cope with it. In other words, there is a positive relationship between presumed media influence on others and collective efficacy belief regarding addressing climate change.

In addition, the positive effects of collective efficacy have been empirically supported by cumulative evidence. For instance, findings from Homburg and Stolberg's (2006) study indicated that collective efficacy determines individuals' coping attempts and PEB. This suggests that people have more confidence in addressing climate change when people perceive that the whole of society has the ability to successfully address the issue, which in turn enhances their intention to perform PEB. Therefore, the following hypotheses are postulated:

H7a: Perceived influence of pro-environmental messages on others is positively associated with collective efficacy belief of fighting climate change.

H7b: Perceived influence of environmental crisis messages on others is positively associated with collective efficacy belief of fighting climate change.

H8: Collective efficacy belief is positively associated with intention to engage in PEB.

Method

Singapore appears to be a desirable place to test our model and hypotheses for two reasons: First, as a low-lying island nation, Singapore is directly influenced by the rising sea level caused by climate change. Unsurprisingly, the exigent need for mitigation and adaptation to climate change has become an important part of the public agenda in Singapore. The government is turning to social media for climate change communication campaigns. For example, the National Climate Change Secretariat established the Climate Change SG Facebook page to increase public awareness of climate change and encourage people to join in the fight against climate change.

Second, the prevalence of new media in Singapore is widespread. With a high Internet penetration of 91%, Singapore's new media landscape is evolving at a rapid pace (Müller, 2020). A recent report on digital news indicated that digital news sites and social media serve as Singapore's primary source of news, with three quarters of the country accessing news through smartphones (Goh, 2017). With the high popularity of Internet and social media use, the growth of new media has reshaped the way that people consume information (Tey, 2015). As these reports suggest, new media, which have increased the possibilities for how people send and receive information, are becoming the primary information source for the Singaporean public.

Furthermore, with the popularity of new media, the Web-based environmental NGOs and green virtual community are increasingly using new media to disseminate information about environmental issues (Sullivan & Xie, 2009). Thus, considering the severe effects of climate change on Singapore and the important role of new media in environmental activism, this study seeks to explore the effects of new media in addressing the public goods dilemma of climate change mitigation in Singapore.

Data Collection

This research adopted a nationally representative door-to-door survey in Singapore to collect data. To achieve a sample that is representative of the population, a stratified sampling procedure was performed. A team of 15 interviewers was recruited and trained for the survey. To maximize the response rate, interviews were conducted in either English or Chinese. This survey used the next birthday technique to randomly select respondents from each household (Link, Battaglia, Frankel, Osborn, & Mokdad, 2008).

Following this procedure, a valid sample of 705 respondents was obtained. The response rate was 46.6% based on AAPOR Formula 1. The age, gender distribution, education, and household income of the sample were comparable with those of the general population.²

Measurement

Attention to Media Messages About Climate Change on New Media

This variable was measured using items adopted from previous studies (Chaffee & Schleuder, 1986; Liao et al., 2016). Attention to positive messages and attention to negative media messages about climate change were measured separately. Specifically, *attention to pro-environmental messages about climate change* was measured by asking respondents to indicate how much attention they paid to pro-environmental messages related to climate change while they read/viewed such messages on the Internet and social media on a scale from 1 to 7 (1 = *no attention at all*, 7 = *very close attention*). *Attention to environmental crisis messages about climate change* was measured by asking respondents the preceding statements while replacing pro-environmental messages with environmental crisis messages related to climate change.

Perceived Others' Attention to Climate Change Messages on New Media

Items used to measure individuals' perception of others' media attention by Gunther and colleagues (2006) were adapted. *Perceived others' attention to pro-environmental* and *perceived others' attention to environmental crisis messages about climate change* were measured, respectively. To be specific, they were measured by asking the respondents how much attention they think other people pay to pro-environmental messages and environmental crisis messages related to climate change while they consumed such news on the Internet and social media.

Perceived Influence of Climate Change Messages on Others

The items used to measure individuals' perceived influence of media messages about climate change were adapted from previous studies (Liao et al., 2016; Stavrositu & Kim, 2014). *Perceived pro-environmental messages' influence on others* was measured by asking the respondents to indicate on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*) the extent to which pro-environmental media messages (1) "had an influence on others," (2) "made others more concerned about the environment,"

² Our sample demographics are similar in terms of age and gender distribution to the characteristics of the 2015 Singapore population census (Department of Statistics Singapore, 2019). The median age in our sample was 40 years as compared with 39.7 years in the census. In our sample, 54.5% of the respondents were female, while 50.9% were female in the census. The average household income reported in the 2015 Singapore census was \$4,001–\$5,000, whereas that of our respondents was \$4,001–\$5,000. The education variable exhibited a bit of difference. The median education level attained in the census was postsecondary education, whereas that of our respondents was "Diploma." These differences are not of major concern because they were regarded as control variables in this study.

and (3) "made others take the environment more seriously." *Perceived environmental crisis messages' influence on others* was measured by asking the respondents to rate how they perceived the environmental crisis messages related to climate change influenced others regarding the same three statements.

Attitude Toward Pro-Environmental Actions

To measure this variable, five items were adapted from prior research (Cordano & Frieze, 2000). Respondents were asked to indicate their agreement with the following statements on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*): "I think that engaging in PEB is (1) enjoyable, (2) beneficial, (3) important, (4) worthwhile, and (5) satisfying."

Subjective Norms

Three items were adapted from previous studies to measure individuals' subjective norms concerning environmental change (Liao et al., 2016; H. S. Park & Smith, 2007). On a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*), respondents were asked to indicate their agreement with three statements, such as "Most people important to me think that I should engage in PEB related to climate change mitigation." Responses to the statements were averaged to create the scales.

Collective Efficacy

We modified items used by Chen (2015) to measure collective efficacy. Respondents were asked to indicate their agreement with the four statements on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*), such as "Society as a whole is able to work together to cope with the problems related to climate change." Responses to the statements were averaged to create the scales.

PEB Intention

Eleven items were adopted from prior studies to measure PEB intention (Chen, 2015; Homburg & Stolberg, 2006). Respondents were asked to indicate their agreement with 10 statements on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*), such as "When possible, I would ride a bicycle or take public transportation to work or school in the next six months." Responses to the statements were averaged to create the behavioral intention score.

Control Variables

Demographics, which were used as control variables, include age (*Mdn* = 40, *M* = 41.73, *SD* = 14.83), gender (54.5% of the respondents were female), education (ranged from 1 = *No formal education* to 9 = *Postgraduate*; *Mdn* = 7, *SD* = 2.02), and household income (ranged from 1 = *SGD 1,000 and below* to 13 = *above SGD 12,000*; *Mdn* = 4, *M* = 5.01, *SD* = 3.22).

Analytical Approach

We used structural equation modeling to test the hypothesized model using maximum likelihood estimation Mplus 7 (Muthén & Muthén, 2017). Following a two-step analytical approach, confirmatory factor analysis was firstly performed to estimate the measurement model, and then the structural equation model was tested (Anderson & Gerbing, 1988).

Results

The results of the measurement model indicated that all factor loadings were over .50, and most exceeded .70. The factor loadings for all latent variables were significant at the $p < .001$ level. On the basis of these results, both the measurement model ($\chi^2 = 1304.27$, $df = 542$, $p < .001$; $\chi^2/df = 2.41$; CFI = .96; TLI = .95; RMSEA = .045) and structural model ($\chi^2 = 1547.99$, $df = 674$, $p < .001$; $\chi^2/df = 2.30$; CFI = .95; TLI = .94; RMSEA = .043) exhibited an acceptable fit. Table 1 represents the descriptive statistics and confirmatory factor analysis of model variables.

Table 1. Descriptive Statistics and Confirmatory Factor Analysis of Model Variables (N = 705).

Item	Factor loading	M	SD	CR	AVE
<i>Self's attention to pro-environmental messages about climate change</i>		4.47	1.74	.87	.77
Attention1	.96				
Attention2	.78				
<i>Self's attention environmental crisis messages about climate change</i>		4.77	1.71	.89	.81
Attention1	.97				
Attention2	.82				
<i>Perceived others' attention to pro-environmental messages about climate change</i>		4.73	1.50	.90	.81
Attention1	.95				
Attention2	.85				
<i>Perceived others' attention to environmental crisis messages about climate change</i>		4.81	1.44	.92	.85
Attention1	.96				
Attention2	.88				
<i>Perceived influence of pro-environmental messages on others</i>		4.77	1.05	.86	.68
Perceived influence1	.72				
Perceived influence2	.91				
Perceived influence3	.83				
<i>Perceived influence of environmental crisis messages on others</i>		4.82	1.06	.91	.77
Perceived influence1	.86				
Perceived influence2	.93				

Perceived influence3	.84				
<i>Attitude</i>		5.22	1.05	.89	.61
Attitude1	.75				
Attitude2	.81				
Attitude3	.74				
Attitude4	.88				
Attitude5	.72				
<i>Subjective norms</i>		4.31	1.24	.88	.71
Subjective norm1	.80				
Subjective norm2	.83				
Subjective norm3	.89				
<i>Collective efficacy</i>		4.65	1.03	.80	.50
Efficacy1	.74				
Efficacy2	.72				
Efficacy3	.70				
Efficacy4	.67				
<i>PEB intention</i>		4.99	1.00	.88	.40
Behavioral intention1	.50				
Behavioral intention2	.64				
Behavioral intention3	.66				
Behavioral intention4	.69				
Behavioral intention5	.74				
Behavioral intention6	.67				
Behavioral intention7	.66				
Behavioral intention8	.60				
Behavioral intention9	.64				
Behavioral intention10	.61				
Behavioral intention11	.51				

Note. Standardized factor loading estimates are reported; CR = composite reliability, AVE = average variance extracted.

Regarding the hypothesized relationship between personal media attention and perceived others' media attention, the results indicated that personal attention to pro-environmental messages on new media was positively related to perceived others' attention to these messages ($\beta = .58, p < .001$), thereby supporting H1a. The results also revealed a significant positive relationship between personal attention to environmental crisis messages and perceived others' attention to these messages ($\beta = .49, p < .001$), supporting H1b.

Perceived others' attention to pro-environmental messages about climate change on new media was found to be positively associated with perceived influence of these messages on others ($\beta = .50, p < .001$), which supported H2a. In addition, a significant positive relationship was found between perceived others' attention to environmental crisis messages and perceived messages' influence on others ($\beta = .51, p < .001$), which supported H2b.

With respect to the effects of presumed media influence on attitude toward PEB, the results revealed that both perceived pro-environmental messages' influence on others ($\beta = .14, p < .05$) and perceived environmental crisis messages' influence on others ($\beta = .29, p < .001$) were positively correlated with individuals' attitude toward PEB. Thus, H3a and H3b received support. Moreover, the results indicated that individuals' attitudes toward PEB had positive associations with PEB ($\beta = .43, p < .001$), thereby supporting H4.

In addition, the results revealed that both perceived pro-environmental messages' influence on others ($\beta = .15, p < .05$) and perceived environmental crisis messages' influence on others ($\beta = .22, p < .01$) were positively associated with individuals' perceived subjective norms toward performing PEB, which supported H5a and H5b. A significant relationship was found between subjective norms and individuals' PEBal intention ($\beta = .24, p < .001$), which supported H6.

Next, H7a and H7b were supported; both perceived pro-environmental messages' influence on others ($\beta = .29, p < .001$) and perceived environmental crisis messages' influence on others ($\beta = .23, p < .001$) were positively related to collective efficacy belief. The result indicated that collective efficacy belief was positively associated with intention to engage in PEB ($\beta = .12, p < .05$). Thus, H8 received support. Finally, the model explained 50% of the variance in PEB intention (see Figure 2), indicating that a set of correct variables were included.

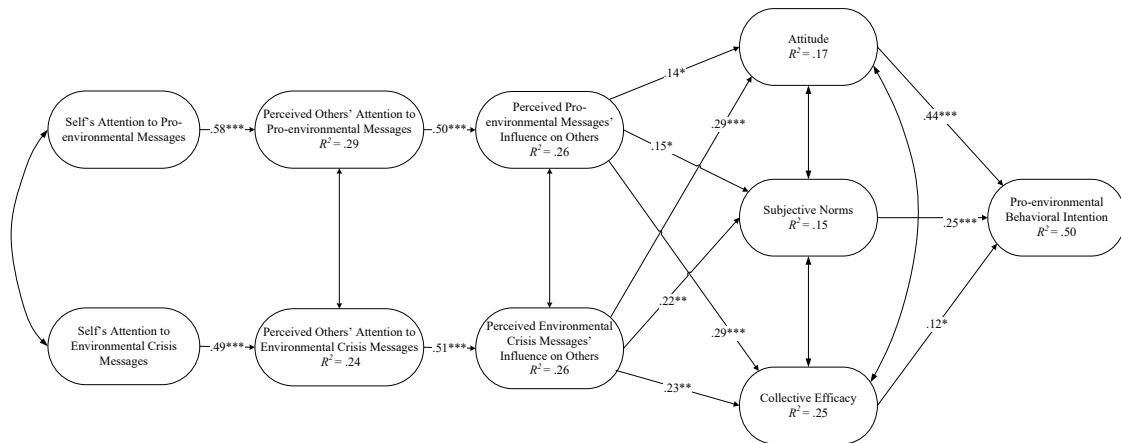


Figure 2. Structural equation model with standardized coefficients (N = 705). Exogenous variables controlled for include age, gender, educational level, and household income. The coefficients in the figure were directional standardized beta coefficient. *p ≤ .05, **p ≤ .01, *p ≤ .001.**

Discussion

By integrating social psychology literature on PEB and ecological economics literature on public goods provision, this study examined the effects of the media in addressing the public goods dilemma of climate change mitigation. Findings from this study suggest that presumed media influence on others

plays an important role in the decision-making regarding providing environmental good through personal effort; this is consistent with the collective interest model as applied to addressing the public goods dilemma. Moreover, the presumed media influence on others could enhance PEB intention via the paths of attitude, subjective norms, and collective efficacy.

In particular, this study employed the IPMI model as the basis of the theoretical framework to examine media effects in addressing the public goods dilemma of climate change mitigation. Consistent with existing IPMI research, it was found that people's attention to media messages about climate change affect their perception of others' attention to similar media messages, and their beliefs that others would be influenced by these messages. Notably, the presumed media influence on others exists in both pro-environmental messages and environmental crisis messages about climate change. In addition to the target corollary explanation (Eveland et al., 1999), the nature of environmental justice in fighting climate change could account for this finding as well. Focusing on the fair distribution of environmental benefits and burdens, environmental justice emphasizes that environmental issues inevitably influence everyone within one community or society, and thus, everyone should take action to address the issue (Bullard, 1994). Accordingly, people might perceive that others will be influenced by both pro-environmental and environmental crisis messages about climate change if others pay attention to these messages, given that pro-environmental messages are beneficial for informing others about how to alleviate climate change effects, and thus, environmental crisis messages are useful in alerting others of the hazards caused by climate change.

Moreover, these findings are consistent with the collective interest model, which posits that people estimate others' performance in their decision-making about engaging with climate change, given the positive relationships between perceived media influence on others and PEB intention. Specifically, this study obtained evidence that presumed media influence on others would produce behavioral outcomes, and the relationship between presumed media influence and behavioral intention to engage in PEB would be shaped by attitude, perceived subjective norms, and collective efficacy belief.

Regarding the positive path from presumed media influence on others to behavioral intention via attitude, our findings suggest that presumed media influence could eliminate people's worry about free-rider effects in fighting climate change. When people perceive that media messages about climate change have effects on others, they develop the belief that others are likely to be actively involved in addressing climate change; this in turn eliminates individuals' worry about free-rider effects. In this case, people are expected to develop a positive attitude toward performing PEB and to be willing to take action concerning mitigation and adaptation to climate change.

More important, the perceived influence of environmental crisis messages on others is more powerful in promoting individuals' attitude than perceived influence of pro-environmental messages on others. The distinction between these two types of messages about climate change could account for this finding. As mentioned, environmental crisis messages inform the public about the hazards related to climate change, such as melting glaciers and rising sea levels. The perceived influence of these messages on others makes people believe that others have learned about the urgency of fighting climate change and that they

will probably take action. This belief would be very helpful in eliminating people's worries about free-rider effects.

Comparatively, pro-environmental messages advise the public about actions that should be taken to fight climate change. One might develop the belief that others might not take action even though they know what to do. In other words, the perception of pro-environmental messages' influence on others cannot make people believe that others will take action. Accordingly, the perceived influence of pro-environmental messages on others is less effective in eliminating the concerns about free-rider effects. Therefore, perceived environmental crisis messages' influence on others works better in promoting an attitude toward fighting climate change when compared with the perceived pro-environmental messages' influence on others.

Our findings also confirm the relationship between presumed media influence and perceived subjective norms; people who believe that others are influenced by media messages about climate change would perceive others to be pro-environmental and perceive that others expect them to perform PEB. In turn, they tend to exhibit stronger intention to carry out PEB. This is consistent with previous studies on the influence of presumed media influence, which have highlighted the intervening role of subjective norms in the relationship between perceived media influence on others and behavioral outcomes (Ho, Poorisat, Neo, & Detenber, 2014; Hong & Kim, 2019; Liao et al., 2016). In particular, perceived influence of environmental crisis messages on others has stronger effects on subjective norms than does perceived influence of pro-environmental media messages. As mentioned, perceived influence of environmental crisis messages on others might be more effective in making people conceive that others will take action to fight climate change, as compared with pro-environmental messages about climate change. In other words, perceived environmental crisis messages' influence on others might lead to perceived prevalence of others' engagement with climate change. Literature on subjective norms has referred to the perception of prevalence as one source of normative beliefs (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Thus, it is not surprising that perceived environmental crisis messages' influence on others has stronger effects on subjective norms of performing PEB when compared with perceived pro-environmental messages' influence on others.

Likewise, our findings confirmed the hypothesized role of collective efficacy in promoting PEB intention—people's perception of climate change messages' influence on others would increase their beliefs of collective efficacy in combating climate change, in turn increasing their behavioral intention. The collective interest model could elucidate this path. When people feel that others are influenced by media messages about climate change, they are prone to believe that others take the issue seriously; this increases people's confidence that the actions of the society as a whole will be successful, resulting in an increasing collective efficacy. Notably, perceived influence of pro-environmental messages on others has a stronger association with collective efficacy than perceived influence of environmental crisis messages on others. One plausible explanation is that pro-environmental messages inform the public about how to alleviate climate change. The perception of others' being influenced by these messages would make people believe that others now have the capabilities to execute the behaviors, thus facilitating people's collective efficacy beliefs.

In terms of theoretical contributions, this study is among the first to highlight the public goods dilemma in promoting PEB, which has been mostly overlooked in prior communication studies. By integrating the social psychological literature and the ecological economic literature, this study underlined the need to examine PEB from an interdisciplinary approach. Furthermore, this study extended the IPMI model by examining the distinction between presumed media influence of pro-environmental messages and that of environmental crisis messages. The distinctive findings regarding the influence of presumed media influence of these two types of messages on attitude, subjective norms and collective efficacy suggest that future studies should pay attention to the presumed media influence of different messages.

Finally, this study yields important practical implications for planning pro-environmental campaigns. First, planners need to be aware of the public goods dilemma in the fight against climate change. To eliminate the negative effects related to public concern about free-riders, environmental campaigns should inform the public about others' performance in the fight against climate change. In particular, given the positive role of presumed media influence on others in promoting PEB intention, it would be beneficial for communication practitioners to leverage media influence on others. Cultivating people's perceptions that others will be motivated to take action because of exposure to and influence from persuasive pro-environmental media messages may motivate people to engage in PEB.

Moreover, it would be worthwhile to structure media content aimed at encouraging PEB in a way that would influence people's attitudes, perceived subjective norms, and collective efficacy belief. Campaigns should emphasize the prevalence of the behavior among others and nurture people's perceptions of social expectations toward this desirable behavior. Additionally, media messages should be designed to increase individuals' confidence in their society to fight climate change, which would foster their collective efficacy belief.

The limitations of the study should be acknowledged. First, we used a cross-sectional sample, so causality could not be inferred. Second, this research was conducted in Singapore, an Asian country that appreciates the value of collectivism. In this case, the findings generated from the sample may not be generalized to other countries that are characterized by their individualism. Given the cultural differences, future studies should examine the proposed model in other countries with different cultural backgrounds to test the external validity of the findings. Another limitation is that this study examined pro-environmental messages and environmental crisis messages explicitly, whereas many different messages are worth examining more closely. Finally, this study examined individuals' attention to media messages about climate change through new media. Thus, future studies should perform a more thorough examination by including various types of media messages across a variety of different platforms.

References

- Adger, W. N. (2003). Social capital, collective action, and adaptation to climate change. *Economic Geography*, 79(4), 387–404. doi:10.1111/j.1944-8287.2003.tb00220.x

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. doi:10.1016/0749-5978(91)90020-t
- Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103(3), 411. doi:10.1037/0033-2909.103.3.411
- Bamberg, S., Hunecke, M., & Blöbaum, A. (2007). Social context, personal norms and the use of public transportation. *Journal of Environmental Psychology*, 27(3), 190–203. doi:10.1016/j.jenvp.2007.04.001
- Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology*, 4(3), 359–373. doi:10.1521/jscp.1986.4.3.359
- Bandura, A. (2002). Social foundations of thought and action. In D. F. Marks (Ed.), *The health psychology reader* (94–106). London, UK: SAGE Publications. doi:10.4135/9781446221129.n6
- Bullard, R. D. (1994). Environmental justice for all. In R. D. Bullard (Ed.), *Unequal protection: Environmental justice and communities of color* (pp. 7–12). San Francisco, CA: Sierra Club.
- Chaffee, S. H., & Schleuder, J. (1986). Measurement and effects of attention to media news. *Human Communication Research*, 13(1), 76–107. doi:10.1111/j.1468-2958.1986.tb00096.x
- Chen, M. F. (2015). Self-efficacy or collective efficacy within the cognitive theory of stress model: Which more effectively explains people's self-reported pro-environmental behavior? *Journal of Environmental Psychology*, 42, 66–75. doi:10.1016/j.jenvp.2015.02.002
- Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, 58(6), 1015–1026. doi:10.1037/0022-3514.58.6.1015
- Clark, C. F., Kotchen, M. J., & Moore, M. R. (2003). Internal and external influences on pro-environmental behavior: Participation in a green electricity program. *Journal of Environmental Psychology*, 23(3), 237–246. doi:10.1016/s0272-4944(02)00105-6
- Cohen, J., & Tsfaty, Y. (2009). The influence of presumed media influence on strategic voting. *Communication Research*, 36(3), 359–378. doi:10.1177/0093650209333026
- Cordano, M., & Frieze, I. H. (2000). Pollution reduction preferences of U.S. environmental managers: Applying Ajzen's theory of planned behavior. *Academy of Management Journal*, 43(4), 627–641. <https://doi.org/10.2307/1556358>

- Department of Statistics Singapore. (2019). *Yearbook of Statistics Singapore*. Retrieved from https://www.singstat.gov.sg/-/media/files/publications/reference/yearbook_2019/yos2019.pdf
- Detenber, B. H., Rosenthal, S., Liao, Y., & Ho, S. S. (2016). Audience segmentation for campaign design: Addressing climate change in Singapore. *International Journal of Communication, 10*, 4736–4758.
- Dono, J., Webb, J., & Richardson, B. (2010). The relationship between environmental activism, pro-environmental behaviour and social identity. *Journal of Environmental Psychology, 30*(2), 178–186. doi:10.1016/j.jenvp.2009.11.006
- Eveland, W. P., Jr., & Glynn, C. J. (2008). Theories on the perception of social reality. In W. Donsbach & M. W. Traugott (Eds.), *The SAGE handbook of public opinion research* (pp. 155–163). London, UK: SAGE Publications.
- Eveland, W. P., Jr., Nathanson, A. I., Detenber, B. H., & McLeod, D. M. (1999). Rethinking the social distance corollary: Perceived likelihood of exposure and the third-person perception. *Communication Research, 26*(3), 275–302. doi:10.1177/009365099026003001
- Finkel, S. E., Muller, E. N., & Opp, K. D. (1989). Personal influence, collective rationality, and mass political action. *American Political Science Review, 83*(3), 885–903. doi:10.2307/1962065
- Fishbein, M., & Ajzen, I. (1977). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Boston, MA: Addison-Wesley.
- Gerbner, G., Gross, L., Morgan, M., Signorielli, N., & Shanahan, J. (2002). Growing up with television: Cultivation processes. In J. Bryant & D. Zillman (Eds.), *Media effects: Advances in theory and research* (pp. 43–67). Hillsdale, NJ: Erlbaum.
- Goh, P. C. (2017). Singapore. *Reuters Institute Digital News Report 2017*. Retrieved from <http://www.digitalnewsreport.org/survey/2017/singapore-2017/>
- Goldstein, N. J., Cialdini, R. B., & Griskevicius, V. (2008). A room with a viewpoint: Using social norms to motivate environmental conservation in hotels. *Journal of Consumer Research, 35*(3), 472–482. doi:10.1086/586910
- Gunther, A. C., Bolt, D., Borzekowski, D. L., Liebhart, J. L., & Dillard, J. P. (2006). Presumed influence on peer norms: How mass media indirectly affect adolescent smoking. *Journal of Communication, 56*(1), 52–68. doi:10.1111/j.1460-2466.2006.00002.x
- Gunther, A. C., & Storey, J. D. (2003). The influence of presumed influence. *Journal of Communication, 53*(2), 199–215. doi:10.1111/j.1460-2466.2003.tb02586.x

- Hartmann, P., Apaolaza, V., D'Souza, C., Barrutia, J. M., & Echebarria, C. (2014). Environmental threat appeals in green advertising: The role of fear arousal and coping efficacy. *International Journal of Advertising*, 33(4), 741–765. doi:10.2501/ija-33-4-741-765
- Heckathorn, D. D. (1990). Collective sanctions and compliance norms: A formal theory of group-mediated social control. *American Sociological Review*, 55(3), 366–384. doi:10.2307/2095762
- Heitzig, J., Lessmann, K., & Zou, Y. (2011). Self-enforcing strategies to deter free-riding in the climate change mitigation game and other repeated public good games. *Proceedings of the National Academy of Sciences*, 108(38), 15739–15744. doi:10.1073/pnas.1106265108
- Ho, S. S., Liao, Y., & Rosenthal, S. (2015). Applying the theory of planned behavior and media dependency theory: Predictors of public pro-environmental behavioral intentions in Singapore. *Environmental Communication*, 9(1), 77–99. doi:10.1080/17524032.2014.932819
- Ho, S. S., Poorisat, T., Neo, R. L., & Detenber, B. H. (2014). Examining how presumed media influence affects social norms and adolescents' attitudes and drinking behavior intentions in rural Thailand. *Journal of Health Communication*, 19(3), 282–302. doi:10.1080/10810730.2013.811329
- Homburg, A., & Stolberg, A. (2006). Explaining pro-environmental behavior with a cognitive theory of stress. *Journal of Environmental Psychology*, 26(1), 1–14. doi:10.1016/j.jenvp.2006.03.003
- Hong, Y., & Kim, S. (2019). Influence of presumed media influence for health prevention: How mass media indirectly promote health prevention behaviors through descriptive norms. *Health Communication*, 35(14), 1800–1810. doi:10.1080/10410236.2019.1663585
- Jiang, R., & Chia, S. (2009). The direct and indirect effects of advertising on materialism of college students in China. *Asian Journal of Communication*, 19(3), 319–336. doi:10.1080/01292980903039020
- Kotchen, M. J., & Moore, M. R. (2007). Private provision of environmental public goods: Household participation in green-electricity programs. *Journal of Environmental Economics and Management*, 53(1), 1–16. doi:10.1016/j.jeem.2006.06.003
- Lee, K. (2011). The role of media exposure, social exposure and biospheric value orientation in the environmental attitude-intention-behavior model in adolescents. *Journal of Environmental Psychology*, 31(4), 301–308. doi:10.1016/j.jenvp.2011.08.004
- Leung, Y. W., & Rosenthal, S. (2019). Explicating perceived sustainability-related climate: A situational motivator of pro-environmental behavior. *Sustainability*, 11(1), 231. doi:10.3390/su11010231

- Liao, Y., Ho, S. S., & Yang, X. (2016). Motivators of pro-environmental behavior: Examining the underlying processes in the influence of presumed media influence model. *Science Communication, 38*(1), 51–73. doi:10.1177/1075547015616256
- Link, M. W., Battaglia, M. P., Frankel, M. R., Osborn, L., & Mokdad, A. H. (2008). A comparison of address-based sampling (ABS) versus random-digit dialing (RDD) for general population surveys. *Public Opinion Quarterly, 72*(1), 6–27. doi:10.1093/poq/nfn003
- Lorenzoni, I., Nicholson-Cole, S., & Whitmarsh, L. (2007). Barriers perceived to engaging with climate change among the UK public and their policy implications. *Global Environmental Change, 17*(3), 445–459. doi:10.1016/j.gloenvcha.2007.01.004
- Louis, W. R., Taylor, D. M., & Douglas, R. L. (2005). Normative influence and rational conflict decisions: Group norms and cost-benefit analyses for intergroup behavior. *Group Processes & Intergroup Relations, 8*(4), 355–374. doi:10.1177/1368430205056465
- Lubell, M. (2002). Environmental activism as collective action. *Environment and Behavior, 34*(4), 431–454. doi:10.1177/00116502034004002
- Messick, D. M., & Brewer, M. B. (1983). Solving social dilemmas: A review. In L. Wheeler & P. Shaver (Eds.), *Review of personality and social psychology*, (Vol. 4, pp. 11–44). Beverly Hills, CA: SAGE Publications.
- Milkie, M. A. (1999). Social comparisons, reflected appraisals, and mass media: The impact of pervasive beauty images on Black and White girls' self-concepts. *Social Psychology Quarterly, 62*(2), 190–210. doi:10.2307/2695857
- Müller, J. (2020). *Social media in Singapore—Statistics & facts*. Retrieved from <https://www.statista.com/topics/5815/social-media-in-singapore/>
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus user's guide* (8th ed). Los Angeles, CA: Muthén & Muthén.
- Olson, M. (1965). *The logic of collective action: Public goods and the theory of groups*. Cambridge, MA: Harvard University Press.
- Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change, 20*(4), 550–557. doi:10.1016/j.gloenvcha.2010.07.004
- Park, H. S., & Smith, S. W. (2007). Distinctiveness and influence of subjective norms, personal descriptive and injunctive norms, and societal descriptive and injunctive norms on behavioral intent: A case of two behaviors critical to organ donation. *Human Communication Research, 33*(2), 194–218. doi:10.1111/j.1468-2958.2007.00296.x

- Park, S. Y. (2005). The influence of presumed media influence on women's desire to be thin. *Communication Research, 32*(5), 594–614. doi:10.1177/0093650205279350
- Rosenthal, S., & Dahlstrom, M. F. (2019). Perceived influence of proenvironmental testimonials. *Environmental Communication, 13*(2), 222–238. doi:10.1080/17524032.2017.1287112
- Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science, 18*(5), 429–434. doi:10.1111/j.1467-9280.2007.01917.x
- Stavrositu, C. D., & Kim, J. (2014). Social media metrics: Third-person perceptions of health information. *Computers in Human Behavior, 35*, 61–67. doi:10.1016/j.chb.2014.02.025
- Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review, 6*(2), 81–97.
- Sullivan, J., & Xie, L. (2009). Environmental activism, social networks and the Internet. *The China Quarterly, 198*, 422–432. doi:10.1017/s0305741009000381
- Tam, K. P., & Chan, H. W. (2018). Generalized trust narrows the gap between environmental concern and pro-environmental behavior: Multilevel evidence. *Global Environmental Change, 48*, 182–194. doi:10.1016/j.gloenvcha.2017.12.001
- Tey, Y. (2015, August 20). *The state of social media in Singapore*. Retrieved from <https://www.techinasia.com/talk/state-social-singapore/>
- Van Liere, K. D., & Dunlap, R. E. (1980). The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. *Public Opinion Quarterly, 44*(2), 181–197. doi:10.1086/268583
- Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology, 30*(3), 305–314. doi:10.1016/j.jenvp.2010.01.003
- Yang, X., Chen, L., Wei, L., & Su, Q. (2020). Personal and media factors related to citizens' pro-environmental behavioral intention against haze in China: A moderating analysis of TPB. *International Journal of Environmental Research and Public Health, 17*(7), 2314. doi:10.3390/ijerph17072314
- Zhang, N., & Skoric, M. M. (2018). Media use and environmental engagement: Examining differential gains from news media and social media. *International Journal of Communication, 12*, 380–403.