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Audience Segmentation for Campaign Design:
Addressing Climate Change in Singapore

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A nationally representative telephone survey (n = 1,006) was conducted to understand how different groups of Singaporeans regard the issue of climate change and their inclination toward action in dealing with it. We measured attitudes, knowledge, and perceptions of the problem of climate change and the role of various stakeholders in addressing it. The data were subjected to a latent class analysis to produce three distinctive segments of the population: the *concerned,* the *disengaged,* and the *passive*. These segments stand in contrast to those discovered in the United States, Australia, Germany, and India and suggest different strategies for public engagement campaigns. The results also clarify the need to account for national idiosyncrasies when promoting adaptation to, or mitigation of, climate change in different parts of the world.

Keywords: climate change, communication behavior, national survey, public opinion, segmentation analysis

Climate change poses significant risks to the stability of Earth's natural systems and threatens sustainable human development. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2013) describes several changes in the natural environment, including increased atmospheric concentration of carbon dioxide, rise in global mean surface air temperatures, and more variable weather. Furthermore, warming ocean temperatures and melting glaciers and polar ice sheets are likely to exacerbate sea level rise, which may be as high as 0.98 meters over the course of the 21st century and threaten low-lying areas (IPCC, 2013, Chapter 13). Other difficulties that humans may face include regional food insecurity (Challinor et al., 2014) and additional pressures on water resources (Taylor et al., 2013).

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There is a well-established linkage between rising air temperature and increased levels of carbon dioxide, a greenhouse gas (e.g., Solomon, Plattner, Knutti, & Friedlingstein, 2009). Human uses of fossil fuels for energy, transportation, industrial, and agricultural needs have contributed largely to the elevated levels of carbon dioxide associated with climate change (IPCC, 2013, Chapter 2). Historically, developed economies have contributed the bulk of carbon dioxide emissions, but contributions from developing regions are increasing as they make socioeconomic gains (Stephenson, Newman, & Mayhew, 2010). The causes and potential harms of climate change warrant prompt intervention to mitigate and adapt to it.

However, the issue of climate change is a global problem that requires coordination among multiple governments, organizations, individuals, and other stakeholders. Conflicts among different stakeholders about the definition and causes of climate change hampers decisions that might otherwise approach resolution to the problem. Successful mitigation of climate change demands proactive efforts on the part of multiple stakeholders. Governments need to implement and provide institutional support for practical public policies, while businesses and citizens need to adopt changes in their behaviors. To the extent that citizens themselves play a role in reducing the problem of climate change, one challenge is to mobilize various segments of the population to (a) recognize the nature and severity of the problem and (b) change specific behaviors to reduce carbon emissions. To make campaigns more effective, it is important to have a good understanding of the target audience, and one way to do that is through a segmentation analysis.

This study aims to understand the Singapore population in terms of their beliefs and behaviors related to the issue of climate change. We use latent class analysis to identify audience segments within the Singapore population and develop a model of how Singaporeans regard and respond to climate change. In particular, we examine communication behaviors related to climate change as well as risk perceptions and views on the relative role that government, business, and individual citizens should play in mitigating climate change. The aim of this analysis is to identify target subgroups for a public engagement campaign. While segmentation analysis is quite common in market research, it has only been used in the context of climate change in a handful of studies across four countries, none of which are in East or Southeast Asia. Thus, this study contributes to existing literature by applying a sophisticated technique for understanding audiences in a novel context and in relation to a dire problem. Additionally, our findings highlight the need for segmentation analysis to be performed in a culturally informed way. That is, we suggest that other crucial variables should be considered when distinguishing audience segments in different countries with regard to climate change.

Campaigns, Social Marketing, and Segmentation Analysis

Governments and environmental organizations typically use public engagement campaigns to provide information to citizens to educate them about the impact and risks of climate change, and encourage behavior change that will benefit the environment. However, the effectiveness of these campaigns is contingent on a number of factors, including attributes of the target audience. Climate researchers have called for more public understanding and engagement with the issue (IPCC, 2007). Hence, it is important for policymakers, researchers, and communication practitioners to conduct effective

campaigns. To achieve this goal, we need greater insight into how people perceive the problem of climate change and process information about it.

Research on communication campaigns has examined and positively evaluated the use of audience segmentation to achieve success across various domains such as commercial marketing (Kotler & Keller, 2008), politics (Phillips, Reynolds, & Reynolds, 2010), and public health (Maibach, Weber, Massett, Hancock, & Price, 2006). Audience segmentation refers to the process of identifying groups of individuals in a larger population of interest who share similar characteristics (e.g., attitudes, beliefs, behaviors) based on particular criteria and with regard to the specific objectives of a communication campaign or intervention. Thus, segmentation analysis presents policymakers, researchers, and communication practitioners with comprehensive and detailed knowledge of the target population and its subgroups.

As the foundational component of the study, segmentation analysis provides us with greater understanding of how various factions within societies regard and respond to the issue of climate change and mitigation efforts in the present and future. Consequently, our findings yield advantages in terms of tailoring messages for the intended audience that encourage policy support and behavioral change. For example, different subgroups might need information of a different nature or at varying levels in order to adopt certain behaviors promoted in a public engagement campaign. Thus, we believe this method of segmenting the audience will be constructive in the design and targeting of public campaigns about climate change.

This study is guided by the concept of social marketing, which has evolved from the application of marketing principles and practices to improve individual well-being to become the foremost approach to engender positive social change (Dibb & Carrigan, 2013). Social marketing involves targeting, informing, and persuading audiences to change their attitudes and behaviors, namely, to encourage socially desirable and responsible behaviors and eliminate undesirable behaviors (e.g., Slater & Flora, 1991). Similar to commercial marketing, the success of social marketing is contingent on our grasp of the target audience's motivations, beliefs, and values. Campaigns and interventions to motivate pro-environmental behavioral change require information to be effectively and appropriately disseminated to the intended audience (Geller, 1989). By grouping audience members on relevant attributes, segmentation analysis facilitates better campaign targeting, and is thus well suited for social marketing (Wedel & Kamakura, 2000).

Maibach, Leiserowitz, Roser-Renouf, and Mertz (2011a) were one of the first research teams to use audience segmentation analysis in the context of climate change in their "Six Americas" study. Through a nationally representative survey, they used a 36-item screening tool to identify and segment Americans by their beliefs and attitudes related to climate change. Findings indicated six distinct segments of the American population, which also differed in terms of demographics and values. Maibach et al. termed the six segments the *alarmed*, *concerned*, *cautious*, *disengaged*, *doubtful*, and *dismissive*. These groups represent the wide range of positions people take in relation to climate change and reflect different patterns of media use and pro-environmental behaviors. The segments have been validated as predictors of public support for nine specific policies for reducing greenhouse gas emissions and have been shown to be stronger predictors than demographics and political ideology (Leiserowitz et al., 2014).

Researchers in Australia conducted three similar segmentation studies. Ashworth, Jeanneret, Gardner, and Shaw (2011) used cluster analysis of a similar screening tool to differentiate four segments: *engaged*, *concerned and confused*, *disengaged*, and *doubtful*. In a separate study, Hine et al. (2013) identified five segments—*alarmed, concerned*, *uncertain*, *doubtful*, and *dismissive*—that differed in terms of people's responses to climate change and support for public policies aimed at climate change mitigation and adaptation. Despite using different measurement items to define the segments, the results of these studies are similar to those of Maibach et al. (2011a), which suggests that Australians and Americans have similar belief structures and attitudes with regard to climate change. Additional support for the assertion of similarity comes from a study by Morrison, Duncan, Sherley, and Parton (2013). They replicated the findings of Maibach et al. in Australia, identifying the same six segments with similar population proportions as in the United States.

Recently, a segmentation analysis related to climate change was conducted in Germany. Using secondary data and cluster analysis, Metag, Füchslin, and Schäfer (2015) found five of the six groups identified in the Six Americas studies, albeit with different proportions and somewhat different characterizations. For example, the *alarmed* group expressed the greatest concern over climate change, but they were less likely to engage in energy conservation than the *concerned activists.* Notably absent in the segmentation analysis was any kind of *dismissive group* that refutes the fact that climate change is occurring, as had been found in Australia and the United States. This reflects a less contentious political context in Germany in terms of the environment and global warming (Metag et al., 2015).

Prior to the current study, there had only been one segmentation analysis in Asia. Given social, economic, and cultural differences between Asian and Western publics, Leiserowitz, Thaker, Feinberg, and Cooper (2013) modified the U.S. screening tool and used latent case analysis to identify six segments of the Indian public—the *informed, experienced*, *undecided*, *unconcerned*, *indifferent*, and *disengaged*—who differed in terms of their awareness, understanding, and beliefs about global warming.

These studies illustrate the fluidity of audience segmentation in the context of climate change. Changes in public awareness of, and commitment to, climate change adaptation and mitigation may become pronounced in the aftermath of major climate events (Leiserowitz et al., 2013) or shifts in public priorities. For example, Maibach et al. (2011a) documented changes in the size of audience segments over time, with people shifting away from segments that are concerned about climate change and motivated to change their behaviors. They suggest changing economic conditions during that period may be related to the shift, which highlights the need, not only to set a baseline segmentation analysis, but also to update the analysis periodically. More recently, the segments have shown relative stability (Leiserowitz, Maibach, Roser-Renouf, Feinberg, & Rosenthal, 2015), but special events like Pope Francis's visit to the United States have been shown to influence public opinion and communication patterns related to climate change (Maibach, 2015). The current study seeks to set the baseline in Singapore and lay the groundwork for future segmentation analyses.

Another reason motivating the study is the fact that knowledge of people's orientations to social issues clarifies how they approach, process, and respond to information in the media and exchange information with others interpersonally. The communication mediation model (CMM) applies the

orientation-stimulus-orientation-response (O-S-O-R) approach from social psychology to communication and political socialization (McLeod, Scheufele, & Moy, 1999; McLeod, Scheufele, Moy, Horowitz et al., 1999; McLeod, Sotirovic, & Holbert, 1998; Rojas & Puig-i-Abril, 2009). Specifically, the first "O" in the model highlights the structural, cultural, and motivational orientations in people, which in turn shape their subsequent news consumption and interpersonal communication (the "S" in the model). The second "O" refers to "what is likely to happen between reception of the message and the response of the audience member" (McLeod, Kosicki, & McLeod, 1994, pp. 146–147). This second orientation process often involves the audience's cognitive processing of media messages and an integration of the information with their preexisting orientations. Finally, "R" refers to the attitudinal and behavioral outcomes in the model.

Research based on the CMM delineates the indirect effects of communication between people's orientations and their behaviors. More notably, it highlights the importance of understanding people's social contexts and initial orientations in the communication process. This framework provides us with an impetus for a segmentation analysis of the Singapore public with respect to climate change and, ultimately, climate change communication. Through understanding the characteristics of the audience, we can have a better sense of what communication channels, message style and content are aligned with their belief structures and information needs. Such understanding can inform the development of campaigns that address climate change.

The Singapore Context

Singapore is a sovereign city-state with a dense population of 5.5 million people, of which 74.3% are Chinese, 13.3% are Malays, 9.1% are Indians, and 3.2% are other racial minorities (Singapore Department of Statistics [SDS], 2015). Singapore is also a multireligious country, with 83% of the population practicing Buddhism, Taoism, Christianity, Islam, and Hinduism, while 17% report having no religious affiliation. As one of the most globalized and cosmopolitan cities in the world ("Global Cities Index," 2010; Kearny, 2015), Singapore reflects a Westernized outlook that is tempered by its Asian heritage and orientation. The government asserts and promotes a set of shared "Asian values," which includes respect for, and deference to, authority and a preference for social order, consensus, and the collective well-being of the society (Dalton & Ong, 2005). While the exact meaning and applicability of Asian values have been hotly debated (Myers, 2011), it is safe to say that Singaporeans are a diverse group exhibiting a range of cultural orientations that influence their behaviors, beliefs, and opinions (Mathews, Khamsya, & Teo, 2014).

As a small, low-lying island country, Singapore recognizes its vulnerability to the negative effects of climate change. According to Singapore's Ministry of the Environment and Water Resources (MEWR), the potential impacts of climate change on Singapore include increased flooding, accelerated coastal land loss, water resource scarcity, resurgence of disease, heat stress, increased energy demand, and decreased biodiversity (MEWR, 2008). The National Climate Change Secretariat (NCCS) noted that Singapore has already observed rises in sea levels and temperatures, and changes in weather patterns may lead to increased occurrence of prolonged droughts and intense rain (NCCS, 2012).

Given these developments, in 2010 Singapore took a proactive approach toward mitigating climate change by establishing the NCSS, a dedicated agency founded to coordinate Singapore's domestic and international policies and strategies regarding climate change. In addition to pledging full government support for efforts to reduce carbon emissions and develop alternative energy sources as part of its long-term plans for sustainable development (MEWR, 2015), Singapore actively participates in key multilateral initiatives to tackle climate change through regional and international platforms such as the Asia-Pacific Economic Cooperation (APEC) and the Association of Southeast Asian Nations (ASEAN). Given that the mass media in Singapore are predominantly state owned ("Freedom of the Press," 2015), media coverage of climate change is generally in line with government policy. The national newspaper of record, *The Straits Times*, is a founding partner of the global Climate Publishers Network, which aims to promote awareness of climate change (Rehki, 2015). Thus, Singaporeans get very little conflicting information about climate change and its causes, unlike people in the United States.

A recent public opinion poll (NCCS, 2014) found that most Singaporeans are concerned about climate change, feel that individuals can help reduce climate change, and believe they are doing their part in taking action on climate change. A smaller group of Singaporeans feel that the government is mainly responsible for taking action on climate change, which is of similar proportion to those who attribute responsibility to individuals. However, polling suggests that this latter proportion has decreased over time. While the government can, and will, take steps to deal with climate change, the role of citizens is crucial.

Although Singaporeans are well aware of the problems associated with global warming and climate change (Rosenthal, Lee, Ho, & Detenber, 2013), getting them to take action may be challenging for a variety of reasons. Effecting behavioral change through campaigns can be extremely difficult, and the success rate is often quite low (Rice & Atkin, 2012). In addition to individual and interpersonal level factors, the sociopolitical and cultural context can create obstacles to pro-social behavioral change. Singapore has a strong, central government and an effective system of public administration (Quah, 2010). Over the decades, the government has been so effective in managing the city-state's natural resources and infrastructure that it has created the impression among many citizens that it can solve most problems and individuals need not act themselves. This perception and overreliance on government action can lead to a kind of "nanny state syndrome," whereby people become apathetic. A disinterested and unmotivated public can be a serious impediment to bottom-up pro-environment behaviors, like recycling. Therefore, our survey gauges public views on the government's ability to address climate change and its consequences, as well as the ability of citizens themselves and of businesses to achieve that end. In addition, it measures people's perceptions of how their family and friends regard their own views in an effort to include some aspects of social support.

The results of the 2014 NCCS survey imply that the public is indeed segmented; however, the basis of such segmentation is merely descriptive. The current study evaluates the public in terms of their concern about climate change and beliefs about responsibility for mitigation, and it uses a robust analytic approach to distinguish among segments. In addition to having a more conceptually and methodologically sound approach, the findings have policy implications. That is, the results delineate the publics' orientation to various policies and outreach efforts that promote climate change mitigation on individual and institutional levels. This analysis also has theoretical implications because it provides an additional, non-

Western perspective on factors that motivate public views of climate change, environmental sustainability, and pro-environmental behaviors.

Method

Sample

Trained undergraduate students conducted random-digit-dial surveys of Singapore residential landlines over a two-week period in March 2014. Within households, interviewers asked for the youngest male over the age of 21 who was home at that time or, if no males were available, the oldest female at home. Prior research in Singapore has used this technique to achieve age and gender distributions that closely match official census figures (Ho, Detenber, Rosenthal, & Lee, 2014; Rosenthal, Detenber, & Rojas, 2015), and we are unaware of a better method for obtaining a probability-based sample with representative coverage in Singapore. Notably, in June 2014, the fixed-line household penetration rate was 99.0% (Info-communications Development Authority of Singapore, 2015).

The interviewers completed 1,006 interviews, with a response rate of 32%. The response rate calculation used formula 3 of the American Association for Public Opinion Research. Respondents had a median age of 43.50 (*M* = 42.73; *SD* = 15.01), which is slightly above the national median age of 39.3 (SDS, 2015), and there were slightly more females (53.0%) than males (47.0%). The majority of respondents gave their ethnicity as Chinese (74.6%), followed by Indian (8.9%) and Malay (8.4%). The median educational attainment was "Diploma," which is comparable to an associate's degree in the U.S. system. Respondents reported a median monthly household income in Singapore Dollars of S$4,001–5,000.

Measures

The survey instrument contained 88 items to measure respondents' attitudes, beliefs, and behavioral intentions related to global warming, as well as demographics. Fifteen of the items were based on the survey instrument used to segment the U.S. public (Maibach, Leiserowitz, Roser-Renouf, Mertz, & Akerlof, 2011b). Additional items were included to gain a more nuanced portrait of the Singapore public by considering perceptions of different stakeholder groups (e.g., citizens, businesses, government) and different consumer and communication behaviors related to global warming.

Missing Data and Imputation

In part because it was the last question asked in the survey and also because it may be a sensitive question, missingness was high on the measure of income (21.5%). Otherwise, missingness of variables did not exceed 10%. Little's missing completely at random (MCAR) test was significant (*p* < .001), which suggests the values are not MCAR. Nonetheless, we made the liberal assumption that values were missing at random (MAR) and imputed missing values using the expectation maximization algorithm in SPSS (Newman, 2014; Pigott, 2001).

Analysis

We conducted a three-step analysis in Latent Gold 5.0. The first step is to develop a latent class cluster model, which places observed cases into groups based on unobserved clusters. This step is similar to factor analysis in that the clusters reflect indicators, each of which has a loading for each cluster, the collection of which reflect the explained variance of the indicator. Latent class cluster models differ from factor models in that the final cluster solution contains categorical data, whereas latent factors contain continuous data. The first step alone is sufficient for identifying audience segments based on a selection of indicators.

We began the first step with the full set of survey items and estimated models with three, four, five, and six clusters. Based on statistical output and visual analysis of a profile plot, we were able to identify items that could be excluded, combined, or truncated so as to maximize explanatory power while maintaining parsimony. This process was partly data driven and partly intuitive. With respect to data, we retained items for which the clusters explained more than 10% of the variance. As for other items, we discussed whether their inclusion might add some nuance to the model or if there were similar items whose inclusion would likely account for that nuance. For example, the three-cluster model explained about 4% of the variance in perceived scientific consensus. We retained this item in the final model because we felt such beliefs, even if largely invariant among Singaporeans, are an important basis of opinion on climate change. For another example, the three-cluster model explained about 9% of the variance in the belief that climate change will harm Singaporeans. We were comfortable excluding this item because the final model retained items measuring (a) the belief that climate change will harm the self and (b) beliefs about the immediacy of harm to Singaporeans. In this case, the two items we retained offered sufficient conceptual coverage of the one we excluded. The final model contained 23 indicators that differentiated three clusters (see Table 1). Compared with other solutions, this model's bootstrap solution had the likelihood ratio (L^2) with the largest p value (L^2 = 51637.72, p = .47), which suggests an adequate model fit.

In the second step, we reestimated the latent class cluster model, this time saving the classification information in a new data set. The purpose of this step is simply to prepare the data for the third step, in which we entered the classification information (i.e., the three cluster variables) as predictors and four measures of behavioral intention as dependent variables. The results show the predicted mean score for each dependent variable in each cluster, as well as an omnibus effect size.

Results

We conducted a preliminary segmentation analysis by applying the 15-item instrument and algorithm utilized by Maibach et al. (2011b). The results indicated that the vast majority (95%) of Singaporeans fall into three of the six categories established by the U.S. researchers—*alarmed*, *concerned*, and *cautious*. The findings reflect (a) a widespread acceptance of the seriousness of climate change as a global problem, (b) an understanding that human actions are largely the cause, and (c) general support for something being done to mitigate the problem. However, it was also clear that the model used to fit the data from the U.S. sample was not well suited to distinguish subgroups within the

Singapore population. Thus, to be able to better differentiate potential target audiences for a campaign, we assessed the contribution of other measures. These measures included the 23 items mentioned previously, and described as Indicators in Table 1.

Table 1. Indicator and Criterion Variables—Wording,
Response Range, and Descriptive Statistics.

Indicator	Wording	Response Range	*M* (*SD*)
Age	May I know your age?	Numeric (21 to 88)	42.73 (15.01)
Edu	What is your highest level of education completed?	1 = No formal education 9 = Postgraduate	6.41 (2.03)
Inc	May I know your average monthly household income?	1 = S$1,000 or less 11 = Above S$10,000	5.71 (3.19)
TradMed	How much attention do you pay to [television news; printed newspapers] for information about global warming?	0 = No attention at all 10 = Very close attention	3.29 (1.14)
NewMed	How much attention do you pay to [blogs; social media] for information about global warming?	0 = No attention at all 10 = Very close attention	2.12 (1.46)
EnvCom	Over the past 12 months, how often, if ever, have you [looked for information about the environmental impact of different products and/or foods; discussed a company's irresponsible environmental behavior with family and/or friends; talked to family and/or friends about the environmental impact of different products; spread information about a company's irresponsible environmental behavior through the Internet or the media]?	1 = Never 4 = Often	2.15 (0.83)

Certain	Do you think that global warming is happening [and] would you say you are [extremely sure . . . not at all sure]?	-2 = No, extremely sure 0 = Not sure 2 = Yes, extremely sure	1.65 (0.74)
Cause	Some people believe global warming is mainly due to human activities while others believe it is due to natural causes. Do you think global warming over the past 150 years is:	1 = Caused mostly/entirely by natural changes in the environment 2 = Caused by human activity and natural changes in the environment about equally 3 = Caused mostly/entirely by human activities	2.44 (0.60)
Worry	How worried are you about global warming?	1 = Not at all worried 5 = Very worried	2.82 (0.91)
Thought	How much have you thought about global warming before today?	1 = Not at all 4 = A lot	2.63 (0.97)
Harm	How much do you think global warming will harm you personally?	1 = Not at all 4 = A great deal	2.87 (0.92)
Future	When do you think global warming will start to harm people in Singapore?	1 = They are being harmed now 2 = In 10 years 3 = In 25 years 4 = In 50 years 5 = In 100 years 6 = Never	4.84 (1.37)
Consens	To the best of your knowledge, what percentage of climate scientists think that human-caused global warming is happening? (Percentages collapsed into six groups.)	0 = < 50: Gross underestimation 1 = 50 – 59: Very large underestimation 2 = 60 – 69: Large underestimation 3 = 70 – 79: Moderate underestimation 4 = 80 – 89: Slight underestimation 5 = 90 – 100: Correct	2.43 (1.68)
CitAct	How much do you think citizens themselves should be doing to address global warming?	1 = Much less 5 = Much more	4.04 (0.98)

GovPri	Do you think global warming should be a very low, low, medium, high, or very high priority for the government?	1 = Very low 5 = Very high	3.74 (0.85)
FFShare	How many of your family and/or friends share your views on global warming?	1 = None 5 = All	2.87 (1.20)
FFCare	To what extent do you agree that [friends; family] care about what you think about global warming?	1 = Strongly disagree 5 = Strongly agree	3.15 (1.00)
FFTrust	How trustworthy do you think [friends; family] are as sources of information are about global warming?	1 = Can't be trusted at all 5 = Can be trusted completely	3.09 (0.91)
GovCare	To what extent do you agree that the government cares about what you think about global warming?	1 = Strongly disagree 5 = Strongly agree	3.48 (1.10)
GovTrust	How trustworthy do you think the government is as a source of information are about global warming?	1 = Can't be trusted at all 5 = Can be trusted completely	3.55 (1.01)
CitAble	To what extent do you agree that citizens themselves are able to reduce global warming?	1 = Strongly disagree 5 = Strongly agree	3.52 (1.08)
BusAble	To what extent do you agree that businesses are able to reduce global warming?	1 = Strongly disagree 5 = Strongly agree	3.52 (1.18)
GovAble	To what extent do you agree that the government is able to reduce global warming?	1 = Strongly disagree 5 = Strongly agree	4.03 (0.99)

Criterion	Wording	Response Range	M (SD)
	Over the next 12 months, do you intend to do the following more frequently, less frequently, or at the same level as you do now?		
Seek	Look for information about the environmental impact of different products and/or foods.	1 = Less frequently 2 = At the same level 3 = More frequently	2.31 (0.65)
Talk	Talk to family and/or friends about the environmental impact of different products.	1 = Less frequently 2 = At the same level 3 = More frequently	2.24 (0.64)
Discuss	Discuss a company's irresponsible environmental behavior with family and/or friends.	1 = Less frequently 2 = At the same level 3 = More frequently	2.17 (0.67)
Spread	Spread information about a company's irresponsible environmental behavior through the internet or the media.	1 = Less frequently 2 = At the same level 3 = More frequently	2.06 (0.67)

Three Segments

The first step of the analysis returned three clusters, or segments, which contained 50%, 35%, and 15% of the observed cases, respectively. The following three sections below give a brief profile of each segment, which is displayed in Figure 1.

The concerned (50%). Members of this segment are younger (M = 39.91 years) and better educated than average. They also have the highest incomes. Although their attention to global warming in traditional news media is only slightly above average, they have engaged in a fair amount of pro-environmental communication, such as looking for information about the environmental impacts of different products. Compared with other Singaporeans, they have directed the most thought to the issue of global warming, express the greatest general worry about global warming, and hold the strongest belief that global warming will harm them personally. Moreover, they are the most likely to hold an accurate belief about the degree of scientific consensus about global warming. They emphasize the role of citizens over the government in addressing global warming but still believe global warming should be a government priority. They hold neutral beliefs that their friends, family, and the government care about what they think about global warming. They also hold neutral beliefs that friends, family, and the government are trustworthy sources of information about global warming. Finally, they hold moderately positive beliefs that citizens and the government are able to do what is needed to address global warming.
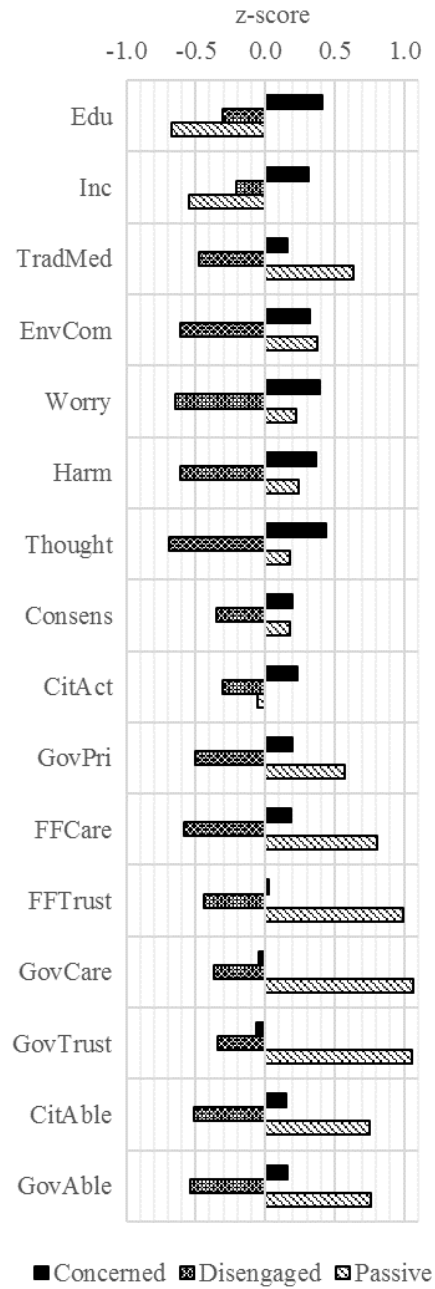
Figure 1. Indicator z scores among the three segments.
See Table 1 for item wording.

The disengaged (35%). Members of this segment are slightly older than the concerned segment (M = 42.84 years) and have below average education and income. They pay the least attention to global warming in traditional news media and have engaged in the least amount of pro-environmental communication. They have given little thought to global warming, are not worried about it in general, and do not believe it will harm them personally. Moreover, they are the most likely to hold grossly inaccurate beliefs about the degree of scientific consensus about global warming. Unsurprisingly, members of this cluster are the least likely to believe that citizens should do more to address global warming and that global warming should be a high government priority. They are the least likely to view friends, family, and the government as being caring about their position on global warming and also as trustworthy sources of information about global warming. Finally, they hold neutral beliefs that citizens and the government are able to do what is needed to address global warming.

The passive (15%). Members of this segment are the oldest (M = 51.77 years), least educated, and have the lowest incomes. However, they pay the most attention to global warming in traditional news media and have engaged in the greatest amount of pro-environmental communication. Despite their attention to the issue in the media, they have thought only a moderate amount about global warming, express moderate general worry about it, and hold a moderate belief that it will harm them. They are similar to the concerned segment in having accurate beliefs about scientific consensus; however, they diverge in strongly emphasizing the role of government in addressing global warming. They are the most likely to believe that friends, family, and especially the government care about their thoughts about global warming and are trustworthy sources of information on that topic. Finally, they hold the strongest beliefs that citizens and the government are able to do what is needed to address global warming.

Predictive Validity

Step 3 in the data analytic procedure is a means of validating the cluster model by predicting values of criterion variables using the specified clusters. This analysis included four separate dependent variables, which were related to pro-environmental communication behaviors. We compared mean scores on the criterion variables using an analysis of variance (ANOVA), the results are presented in Table 2.

The concerned. The concerned consistently had higher scores than the disengaged on all four criterion variables. Furthermore, they were the most likely, of all three segments, to say they would seek out information about the environmental impacts of consumer products. On the remaining criterion variables—intention to talk to friends and family about these impacts, discuss a company's irresponsible environmental behavior with family and/or friends, and spread information about a company's behavior— the 95% confidence intervals suggest their z scores were significantly greater than zero. This segment had its highest mean score on the information-seeking variable.

The disengaged. This segment had the lowest means for all four communication variables. The patterns of z scores were roughly the inverse of those for the concerned group; though, scores were consistently centered on the middle response option of 2, which indicates no intended communication behavior change.

The passive. This segment fell in between the first two segments in terms of mean scores on the dependent variables. Mean scores were the highest on the variable of representing information seeking and talking with family and/or friends. However, this segment also had a lot of variance about its scores on the criterion variables, as the wide confidence intervals suggest.

Table 2. Means of Criterion Variable Z-scores by Cluster with 95% CIs.

	Seek	Talk	Discuss	Spread
Concerned	0.28 ± 0.08	0.21[a] ± 0.08	0.23[b] ± 0.09	0.14[c] ± 0.09
Disengaged	-0.41 ± 0.10	-0.33 ± 0.10	-0.34 ± 0.09	-0.21 ± 0.09
Passive	0.04 ± 0.17	0.09[a] ± 0.17	0.03[b] ± 0.18	0.03[c] ± 0.18
(2,1003)	56.80***	33.05***	35.89***	13.52***

Note. Superscripts indicate values that are not significantly different ($p > .05$), using Sidak correction. ***$p < .001$.

Discussion

The segmentation analysis yielded three distinct groups of Singaporeans in terms of their thoughts and feelings related to climate change. While the majority understands that global warming is occurring and believes something should be done, there are meaningful differences among the three segments. An important contribution of this analysis is that it provides information for campaigners to use on message design to mobilize people to become more engaged with the issue and possibly change their behavior. The implications of this study are largely practical; however, in many instances, the segmentation aligns with theoretical perspectives, and such considerations may provide additional validation of the model. We suggest that, given its data-driven nature, segmentation analysis is not ideal for theory testing; rather, it may highlight the intersection of theory and practice.

The largest group, the concerned, appears to be already engaged at a high level and comfortable with the idea that citizens can and should do more to reduce emissions of greenhouse gases. They tend to be well equipped to engage with the issue due to their higher education and income levels. They also expect to become engaged in the future, based on their intended communication behaviors. The concerned segment constitutes a large group that would be relatively easy to persuade given their already high level of engagement with the issue. Moreover, they have the greatest amount of resources at their disposal and a conviction that individuals should be doing more to combat global warming. This characterization is consistent with recent findings that individuals who have high environmental issue involvement and a good ability to process environmental information are more likely to elaborate on such information when they encounter it and also more likely to engage in pro-environmental behavior (Wilson, 2014).

Thus, this group represents a kind of "low-hanging fruit" that could be fairly easily harvested through a targeted communication campaign. Campaigners should concentrate their effort to translate Singaporeans' concerns toward climate change into pro-environmental actions. These efforts should

continue to frame climate change as an issue that can lead to personal harm so as to sustain the level of worry among the concerned. More notably, campaigners should provide information that conveys government or corporate initiatives that enhance the ease with which this group of Singaporeans can take action. For example, recycling bins are already easily accessible for the public and many energy-efficient products are readily available in Singapore. Campaign messages should therefore enhance the level of efficacy of the concerned public by highlighting the ways in which they could sort out the household materials for recycling and the ways in which they could identify and purchase energy-efficient products. In addition to advocating pro-environmental behaviors, a campaign may also have the objective of turning members of the segment into change agents and opinion leaders to galvanize others, especially the passive and disengaged segments of the population, into action.

Brief visual examination of the mean scores for the indicator and dependent variables may suggest a contradiction: Whereas members of the passive segment pay the most attention to global warming coverage in traditional news media, they do not have the greatest intention to engage in pro-environmental communication behaviors. On the other hand, the concerned segment, which has the greatest intention to engage in pro-environmental behaviors, pays only moderate attention to global warming coverage in traditional news media. Yet, what distinguishes these segments is, not so much that one uses communication tools and the other does not, but rather that one segment is more passive in how it uses these tools.

Media dependency theory (Ball-Rokeach & DeFleur, 1976) may help explain the findings regarding the concerned segment. A recent national survey of Singaporeans (Ho, Liao, & Rosenthal, 2015) found that respondents who relied more on the media for surveillance (e.g., learning more about climate change) and social utility (e.g., learning about how others deal with climate change) had stronger green buying intention and pro-environmental civic engagement intention. Notably, this positive effect of media dependency was strongest given low levels of attention to media, which seems to comport with our characterization of the concerned segment. On the surface, it may seem contradictory that some individuals would report moderate past media use for learning about climate change, yet have relatively strong intention for such media use in the future. The answer to this paradox may be that members of the concerned segment have learned about climate change from nonmedia sources, such as members of their social network, yet they recognize the value of media sources for information seeking. Specifically, they may recognize the role of media as a means of surveillance and gaining information that has social utility. Future segmentation analysis should consider specific media dependency variables, which may help further differentiate the concerned and passive segments.

In addition, the passive segment constitutes the smallest group, and the one with the lowest level of resources at their disposal. Therefore, they might be considered less of a priority when it comes to targeting a campaign. However, given the respect that elders are accorded in Singapore families, this group may be in a unique position to influence others. If a campaign targeting this group were to be attempted, it would need to qualify the role of government and emphasize individual action. The latter would require taking into account differing levels of personal efficacy. In addition to believing that it is the responsibility of government to take the lead on environmental action, the passive group may have little faith in their own ability to effect change. The current study did not include efficacy measures, but future

research could and social cognitive theory (Bandura, 2001) might provide a fruitful perspective on the issue.

The role of social support could also be leveraged to help influence the passive segment. Specifically, norm-based messages might be useful to engage the passive segment. Studies have shown that descriptive norms (individuals' perception that pro-environmental behaviors are prevalent among the public) and subjective norms (individuals' perception that most of their close friends and family members are supportive of them engaging in pro-environmental actions) can encourage people to take up environmentally responsible behaviors (e.g., Ho et al., 2015). Therefore, a norms-based approach for messaging might be suitable for the passive segment.

If communicators hope to engage the disengaged segment, then the distinction between active and passive media users might not bear fruit. Rather, the focus should be on media nonusers. This is not to say that members of the disengaged segment do not use communication in their lives, but that they are cognitively and emotionally disengaged with the issue of global warming, at least relative to other Singaporeans. This group acknowledges that global warming is happening, but is unconcerned and unmotivated to learn more about it. These findings highlight challenges and opportunities to connect with this segment, which represents more than one-third of Singaporeans.

The disengaged segment would require an entirely different strategy to both reach and persuade, tasks that face at least two challenges. First, there is no clear path to reach this segment, as its members do not pay attention to the issue of climate change in the media. Looking to the model of risk information seeking and processing (Griffin, Dunwoody, & Neuwirth, 1999; Kahlor, Dunwoody, Griffin, & Neuwirth, 2006), a campaign could work to raise an appropriate level of concern and amplify the perceived credibility of secondary information channels. Such efforts, according to the model, could enhance information seeking and systematic processing. Second, this segment lacks definition with regard to their personal values that climate change may impinge. It would be useful, for example, to know if this segment is more altruistic or egoistic in their environmental beliefs, or their agreement with the new ecological paradigm (Dunlap, Van Liere, Mertig, & Jones, 2000). Understanding this segment in such terms would offer a straightforward starting point to develop communication campaigns that frame the issue of climate change in a way that (a) promotes a gain or loss aversion frame and offers attitudinal or behavioral changes that (b) have the greatest prospect of achieving a desired outcome.

In order to reach the disengaged segment, there is a need for further research on the different forms of communication in which its members engage, which would help overcome the challenges and build on the lessons learned in the process. Our results suggest that members of this segment do not pay attention to climate change in traditional news media, but that is not to say that they ignore mediated (or interpersonal) information sources altogether. Thus, connecting with and motivating this segment to engage more with the issue of climate change will require linking messages with their values and disseminating these messages via the communication channels they use and trust. Such a statement may come across as a platitude, but it gives clear direction to future research of the Singapore public, and will form the basis of research efforts in the near future.

Assuming an effective method for reaching the disengaged could be developed and deployed, one objective might be to make the risk posed by climate change salient and personally relevant. For most people, impersonal risk is often discounted and does not motivate reflection or action (Johnson & Levin, 2005; Leiserowitz, 2005). Thus, appeals might emphasize potential harms to future generations, or other outcomes that are personally relevant and easy to call to mind. Another objective might be to improve the sense of efficacy among the disengaged. To avoid deepening the "nanny state syndrome" messages should emphasize self-efficacy rather than system efficacy. Perhaps another approach might be to incentivize the disengaged through a mix of subsidies and attractive promotions. For example, using gift vouchers to entice consumers to purchase government-certified energy-efficient home appliances and providing discounts at grocery stores when consumers bring their own reusable bags. Campaign messages may reinforce the availability of these promotions through communication channels.

Notably, unlike in the United States, our analysis did not distinguish a "doubtful" segment among Singaporeans. The absence of this segment is an interesting contrast to both the United States and Germany, nations in which a significant proportion of the public holds inaccurate beliefs about the level of scientific consensus on climate change. This finding could be explained by the generally high trust in official sources among Singaporeans when it comes to information about the environment. This explanation suggests that environmental campaigns need not focus on dispelling Singaporeans' misperceptions about whether climate change is occurring or not. Rather, campaigners can channel more effort in motivating the concerned, the disengaged, and the passive segments of the population.

Limitations and Conclusion

This study has at least three notable limitations. First, our indicator variables omitted a direct measurement of environmental values. If we had included measures of awareness of consequences (Stern, Dietz, & Kalof, 1993), the new ecological paradigm (Dunlap et al., 2000), or a similar index, we may have been able to identify additional variance to differentiate among the segments and provide a more complete understanding of them from a psychological perspective.

Second, although the median age of our sample was higher than the median age in Singapore, our sample had an age floor of 21 years. Thus, it is likely that we oversampled younger demographics. When excluding Singaporeans under the age of 20 (based on available data from SDS, 2015), the estimated mean age is 46 years. Given the small age differences among the segments, it is probable that our analysis overestimates the size of the concerned segment and underestimates the size of the passive segment.

Third, the passive group had high variance on the criterion variables, which resulted in their scores overlapping with those of the concerned group. This overlap presents a challenge to isolating differences between those two groups. While it may be that the passive group is not different from the concerned group with respect to environmental communication intention, a more likely situation is that the passive group could be segmented further. As the passive segment was already the smallest of the three, further segmentation might not be worthwhile.

Even with these limitations, our segmentation analysis provides a useful guide to the target audiences for message producers and campaign designers. A better understanding of how Singaporeans approach the issue of climate change and communicate about it should help to maximize the effectiveness of campaigns. The research also lays the groundwork for cross-national comparisons, and provides a baseline for future research on shifts occurring among the segments.

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