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**Complementary versus Competitive Framing Effects in the Context of
Pro-environmental Attitudes and Behaviors**

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Complementary versus Competitive Framing Effects in the Context of Pro-environmental Attitudes and Behaviors

Abstract

This study examined the effects of complementary and competitive framing environments on people's support for and attitudes toward pro-environmental behaviors (PEBs) and green energy technologies (GETs). Results suggest that frames have different effects on attitudes and policy support. Relative to the control group, complementary anti- climate action frames lowered attitudes toward PEBs and GETs. Competitive frames led to attitudes toward GETs that were significantly different from the complementary pro- and anti- frame conditions. For support, significant differences were found between the complementary pro- and anti- frames, and between the competitive and complementary pro- climate action frames for PEBs.

Keywords: framing theory; climate change communication; competitive framing; pro-environmental behavior; green energy technology

Complementary versus Competitive Framing Effects in the Context of Pro-environmental Attitudes and Behaviors

Framing theory and effects are the subject of a large body of literature in the field of communication, and many studies have examined the influence of message framing on people's attitudes and behaviors. Frames can be defined as "organizing principles that are socially shared and persistent over time, that work symbolically to meaningfully structure the social world" (Reese, Gandy, & Grant, 2001, p.11). Frames give prominence to certain aspects of an issue and increase their saliency in our minds (Brewer & Gross, 2005; Entman, 1993). Importantly for the present study, frames are used as interpretative shortcuts by media consumers, and they influence how people think, discuss, and argue about issues.

Early framing studies typically used single-message treatments (Chong & Druckman, 2007a; Hansen, 2007; Sniderman & Theriault, 2004). This has prompted criticism of the ecological validity of framing experiments, for real-world issues are often multi-faceted and openly contested. Even when issue positions are generally uncontested, as is the case with climate change in Singapore, multiple frames using different frame emphases are usually present. This is an example of a relatively homogenous message environment, where complementary frames that support the same issue position through different frame emphases dominate the media sphere. On the other hand, there also exist competitive framing environments where opposing frames vie for individual attention and attempt to hold sway. Such an environment related to climate change action can be found in the United States, where strong pro- and anti- camps compete to influence public opinion and support for climate-change-related policies. Therefore, framing effects are more meaningfully studied in the context of multiple frames to better reflect the actual message environment to which individuals are exposed.

This study is one of the first to examine the effects of both competing and complementary frames. Complementary frames provide equivalent points of comparison for the competitive frame conditions – a consideration that is often neglected in competitive framing studies. In explaining competitive framing effects, there is a lack of exposition about the independent contributions of key frame attributes such as frame direction and frame emphasis, as well as the differences between the various types of frame competition. Recognizing these gaps, this study aims to investigate the effects of competitive and complementary frames on attitudes and expressions of support through planned comparisons.

Pro-environmental Behaviors and Green Energy Technologies

In this study, we examine how competitive and complementary frames evoking a cost-benefit analysis will influence people's attitudes and support for pro-environmental behaviors (PEBs) and green energy technologies. PEBs are broadly defined as behaviors that can impact the environment by either minimizing damages or maximizing benefits to the environment (Steg & Vlek, 2009). For example, changing one's consumption behaviors to purchase green products or engaging in environmental civic engagement are two actions that can be undertaken by individuals (Fielding, McDonald, & Louis, 2008). In line with the theory of planned behavior (Ajzen, 1991), attitudes toward PEBs have been found to be an important antecedent to engaging in PEBs (Ho, Liao, & Rosenthal, 2015). Similarly, support for PEBs has been found to be a significant predictor of PEBs (Kennedy, Krahn, & Krogman, 2013; Wolters, 2012).

Green energy technologies (GETs) are defined as “the development and application of products, equipment and systems used to conserve the natural environment and resources, which minimizes and reduces the negative impact of human activities” (Asia Pacific Economic Cooperation, 2010, p.2), such as those that harness wind, solar and geothermal energy. As GETs often need both market incentives and government-based support to

flourish, positive attitudes and public support are coveted resources for pro-environmental programs that rely on technologies to address climate change (Stern, Dietz, Abel, Guagnano, & Kalof, 1999).

Attitudes and support for GETs and PEBs are interrelated, but distinct constructs. Attitudes have both affective and cognitive components, and generally represent an evaluation that a person has for something (i.e., an attitude object). Attitudes often motivate behaviors that are consistent with them. That is, people sometimes take action based on their attitudes (Fazio, 1990). Since behavior can be difficult to gauge in many research contexts, researchers often measure behavioral intentions as a kind of proxy (e.g., Barr, 2006). Although behavioral intentions are not a perfect predictor of behavior, they are positively associated to a moderate degree (Webb & Sheeran, 2006). Expression of support for something (e.g., a behavior or government policy) can be regarded as a precursor to action in a way that is similar to behavioral intention. Indeed, in the domain of environmentalism, attitudes have been shown to predict support for pro-environmental policies (Rauwald & Moore, 2002). Dreyer, Polis, and Jenkins (2017) argue that policy support is a construct that combines both elements of attitude and behavior to action. According to the hierarchy of effects paradigm, people are influenced over time through a linear process of changes in their knowledge, attitudes, and eventually behaviors (Smith, Chen, & Yang, 2008). Since policy support goes a step further by involving a host of other pragmatic concerns and considerations (Olsen, 1981) as well as potential behavioral costs (Dreyer, Polis, & Jenkins, 2017), there might be differing effects of message framing on attitude and policy support. Therefore, it is worthwhile to consider attitude and policy support separately in the context of pro-environmental behaviors and green energy technologies.

Complementary Frames

Wise and Brewer (2010) were the first to articulate the concept of complementary frames. Complementary frames are multiple frames that reinforce each other by using different frame emphases to support the same issue position. This is distinguished from frame repetition, which uses the same emphasis to support the same issue position. Therefore, two pro-abortion frames using different emphases of individual rights and health, for example, would be considered complementary, but two pro-abortion frames using the same emphasis of individual rights would be considered frame repetition. As complementary frames are unidirectional, supporting either the “pro-” or “anti-” issue positions, they are non-competitive in nature and should elicit traditional framing effects. That is, they will push individuals in the direction advocated by the frame. However, this theoretical relationship remains speculative at this point, as complementary frames have yet to be tested. Therefore, we propose the following hypotheses:

H1: Individuals exposed to complementary pro-climate action frames will express more favorable a) attitudes and more b) support for (i) GETs and (ii) PEBs than those exposed to complementary anti-climate action frames.

H2: Individuals exposed to complementary pro-climate action frames will express more favorable a) attitudes and more b) support for (i) GETs and (ii) PEBs than the control group.

H3: Individuals exposed to complementary anti-climate action frames will express less favorable a) attitudes and less b) support for (i) GETs and (ii) PEBs than the control group.

Studying complementary frames is essential for a more complete theory of framing, as they may lead to stronger framing effects when compared to single-message frames.

However, the main purpose of examining complementary frames in this study is to provide

equivalent points of comparisons for our competitive framing conditions. In this way, the effects of frame direction can be studied, while keeping frame emphasis constant. The importance of this point shall be elaborated upon in the next section.

Competitive Framing Environments

The effects of single-message framing have been well established. In general, single-message frames have the ability to push individual attitudes in the direction advocated by the frame (Bizer, Larsen, & Petty, 2011; Druckman & Nelson, 2003; Lecheler & de Vreese, 2011). For example, Druckman and Nelson (2003) found that those exposed to free-speech frames showed increased support for rallies. In addition, single-message frames have also been found to be effective in many contexts such as health communication (Jones, Sinclair, & Courneya, 2003), politics (Druckman & Nelson, 2003), and social issues (Brewer, 2003). These suggest that framing effects are robust and can influence individuals on many levels.

In recent years, researchers have questioned single-framing studies for their lack of ecological validity because issues are seldom presented from a single point-of-view (Nisbet, Hart, Myers, & Ellithorpe, 2013). Social actors typically fight to define issues and influence public opinion, resulting in multiple and opposing frames being presented to the public (Scheufele & Tewksbury, 2007). Therefore, competitive framing studies arose to examine framing effects in diverse opinion climates.

There are two main differences between competitive framing studies and single-frame studies. First, competitive studies expose individuals to multiple frames. Second, competitive studies expose individuals to frames that espouse incompatible issue positions. For example, in the context of climate action, a single-frame study will expose individuals to either pro- or anti- climate action frames. On the other hand, competitive framing studies will expose individuals to both pro- and anti- climate action frames. Thus, the defining quality of competitive framing studies is the presence of opposing frames.

Competitive framing research is relatively new, and has generally employed emphasis framing, which attempts to increase the salience of certain issue considerations in the minds of individuals and adjust their priorities to be in line with the frame (Chong & Druckman, 2007b; Druckman, 2001). Wise and Brewer (2010) proposed that frame competition could take two forms: (1) when different frame directions appeal to audiences using the same emphasis and (2) when different frame directions evoke different emphases. In the present context, frame direction refers to pro- or anti- issue positions, while emphases refer to the organizing ideas used. An example of the first type of frame competition would be the study by Wise and Brewer (2010) that examined the effects of competitive frames on the issue of banning trans-fat in food products. In their study, both pro- and anti- ban frames advocated the protection of public health. An example of the latter competition type would be a recent study by Nisbet et al. (2013), which pitted pro- and anti- climate change mitigation frames using different types of emphases. For the pro-frame, participants were exposed to either national security or biodiversity protection emphases, and for the anti-frame they were exposed to an economic emphasis.

A chronological review of existing competitive framing literature can be found in Table 1, which summarizes the effects of manipulating frame directions and/or emphases. Under the heading Study Results, “middle ground” indicates that participants were pulled to a position somewhere between the pro-only and anti-only frame conditions; “framing effects” indicates that individuals were pulled unidirectionally from the baseline; while “followed prior dispositions” refers to no significant changes from the individual’s baseline attitudes.

[Insert Table 1 about here.]

Competitive framing studies have mainly focused on different frame directions evoking different emphases. However, examining this type of competition alone can be problematic on a conceptual level because the respective effects of frame direction and frame

emphasis may be confounded. In other words, these studies can only attest to the effects of this type of competition. They cannot explain how competitive framing effects come about, and whether these effects are a result of frame direction, frame emphasis or an interaction of the two. To answer this question, a more systematic investigation of frame competition as well as complementary framing conditions are needed.

Furthermore, keeping the frame emphasis constant is important for commensurability and helps to ensure that the considerations advocated by the frames are equally accessible and available to individuals, regardless of the frame direction. In other words, study results can be attributed to frame competition, instead of differences in frame availability and accessibility between the pro- and anti- frame. Highlighting this concern, Chong and Druckman (2007b) acknowledged that their study might have been influenced by differences in frame accessibility between their strong pro- and strong anti-urban growth frames. They noted that individuals with low political knowledge might have found their strong anti-frame more accessible than their strong pro-frame. This difference in frame accessibility might explain why framing effects for the strong pro-frame could only be seen after frame repetition. Therefore, keeping frame emphasis constant is especially pertinent to single-exposure experiments — the most common design in competitive framing studies — that are attempting to examine the effects of equally strong opposing frames.

To address the above issues, our study attempts to clarify the effects of frame direction and frame emphasis by examining complementary environments, and the two types of competitive framing environments. This will allow us to make equivalent comparisons across conditions in order to tease out the effects of frame direction and frame emphases. In particular, to see the effects of frame direction, we will compare complementary conditions to competitive conditions that use the same emphases. To see the effects of frame emphasis, we will compare the two competition types (competitive frames evoking the same emphasis

versus competitive frames evoking different emphases). For each of these comparisons, either frame direction or frame emphasis varies, but never both at the same time. In this way, we can avoid potential confounds and make more nuanced conclusions about the separate effects of frame direction and frame emphasis.

Out of the 11 studies reviewed in Table 1, three used the same emphases in their competitive frames. Brewer (2003) and Brewer and Gross (2005) applied equality-value frames to the context of gay rights and school vouchers respectively, while Wise and Brewer (2010) studied business and public health-goal frames in the context of trans-fat bans. All of them found that competitive conditions dampen framing effects and pulled opinions toward the middle ground. These results are largely in line with other competitive framing studies that have utilized opposing frames with different emphases for each direction (Borah, 2011; Chong & Druckman, 2007b). Given that complementary frames should yield classic framing effects and the results from competitive conditions should fall on the middle ground, we propose the following hypotheses:

H4: Individuals exposed to competing frames will express less favorable a) attitudes and less b) support for (i) GETs and (ii) PEBs than those exposed to complementary pro-frames.

H5: Individuals exposed to competing frames will express more favorable a) attitudes and more b) support for (i) GETs and (ii) PEBs than those exposed to complementary anti-frames.

The similarity in the results of the competitive studies reviewed could mean that there are no significant differences in the two types of frame competition described earlier (i.e., competing frames having the same or different emphases). This notion is supported by Wise and Brewer (2010), who found non-significant differences between the two types of competition. However, their results should be interpreted with caution as there may have

been discrepancies in frame strength between the pro- and anti- frames for particular sets of competitive frame conditions. Of the four sets of frames used in the competitive conditions, only their pro-ban public health frame had significant results against the control group. This suggests that this particular frame might be more effective than the rest, and therefore their results may only apply to asymmetric competitive framing environments, where frames of unequal strengths co-exist.

Taking these results into consideration, we attempt to test the differences between the two types of frame competition. Although both types of competition should yield middle ground findings, we expect a significant difference between the two competition types. This is because competing frames with different emphasis allow individuals to side with the thematic emphasis that is most in line with their predispositions or values. On the other hand, individuals exposed to opposing frames evoking the same emphasis are likely to experience value-conflict or ambivalence because the same emphasis is used as the basis for two incompatible issue positions. Previous studies have shown that issues that are incompatible with individuals' attitudes can result in ambivalence (Alvarez & Brehm, 1995; Feldman & Zaller, 1992; Zaller, 1992). Individuals often have to weigh and balance the required trade-offs between the two incompatible issue positions (Grant & Rudolph, 2003). Consequently, these individuals are expected to report positions that fall in-between the complementary-pro and complementary-anti positions. In light of this, we propose the following hypothesis:

H6: There will be a significant difference in a) attitudes and b) support for (i) GETs and (ii) PEBs between individuals exposed to opposing frames using the same emphasis and those exposed to opposing frames using a different emphasis.

Context of Study

Media in Singapore are generally supportive of the pro-climate-change action position because major news sources such as the government, non-governmental organizations

(NGOs), and communication practitioners have aligned themselves. In 2015, *The Straits Times*, the most widely circulated newspaper in Singapore, founded the global Climate Publishers Network to promote climate change awareness (Rekhi, 2015). The Singapore government leads a nation-wide pro-climate-change action effort through its National Climate Change Secretariat, and NGOs such as The Asia-Pacific Media Alliance for Social Awareness,¹ Earth Hour, World Wide Fund for Nature and the Wildlife Conservation Society actively promote pro-climate actions and awareness through their Singapore offices (Feng, 2012; The Media Alliance, 2015).

The pro-climate change inclination of media and major news sources has resulted in a robust pro-climate change slant in the communication of climate change issues in Singapore. This is likely to have contributed to the Singapore public's strong support for pro-climate change actions (Authors, 2015), which are practiced regularly by a large majority of Singapore residents (National Climate Change Secretariat, 2013). For example, about 80% of Singapore residents regularly avoid food wastage, and switch off electrical appliances at the mains when they are not in use (National Climate Change Secretariat, 2013).

The treatment of climate change in Singapore lies in contrast to the situation in the U.S., where the issue is defined by multiple independent voices in the news. Boykoff and Boykoff (2007) found that the majority of major U.S. print outlets attempted to adopt a "roughly" balanced (albeit not necessarily accurate) approach toward the coverage of anthropogenic climate change issues over a 15-year period. Indeed, a separate study of high-circulation U.S. newspapers revealed the presence of anti-climate change, balanced and pro-climate change statements reflected in articles published from 1998 to 2005 (Dolšak & Houston, 2014). More recently, Feldman, Maibach, Roser-Renouf, and Leiserowitz (2012) found that across cable news channels, a range of perspectives on climate change exists that are mostly aligned the political orientation of the news outlet. Thus, U.S. media coverage of

climate issues is comparatively more two-sided than media coverage in Singapore.

Competing messages and framing relating to climate are also found on social media (Jang & Hart, 2015), and Americans' access to a spectrum of opinions on climate change explains, in part, why U.S public opinion on the issue is polarized (Feldman et al., 2012).

Method

We conducted a posttest-only control group design experiment with 525 undergraduates from a large public university in Singapore. The participants were randomly assigned to one of seven experimental conditions, with approximately 75 participants per condition, except for the Mixed Frame Direction and Mixed Frame Emphasis condition, which combined two cells (+E -S and +S -E) to maintain treatment exposure (i.e., two messages per person) and counterbalance for order effects. The seven cells included both types of framing environments, complementary and competition, as well as a control group. We studied three different combinations of frame direction — complementary pro (+ +); complementary anti (- -); and competing (+ -). We also used three different combinations of frame emphases — economic emphasis (E) only; survival emphasis (S) only; a mix of economic and survival emphases.

Cells containing frames that go in opposite directions, anti- and pro-, are considered competitive framing environments. Competitive framing environments comprised two types of frame competition. With reference to Table 2, these two types are 1) opposing framings that have the same emphasis (+E -E, +S -S) and 2) opposing frames that have different emphases (+E -S, -E +S).

[Insert Table 2 about here.]

Cells containing frames that go in the same direction are considered complementary frame conditions (i.e., either both messages are anti- or both pro-). The cells are set up to allow direct comparisons between groups, which are used to distill the effects of frame

direction and frame emphasis on the dependent variables (DVs). Referring to Table 2, cells +E +S and -E -S are the two complementary frames conditions.

Keeping all else constant, the effects of frame direction can be seen by comparing down the Mixed Frame Emphasis column (-E -S, +E +S, +E -S and -E +S), while the effects of frame emphasis can be seen by comparing across the Mixed Frame Direction row (+E -E, +S -S, +E -S and -E +S). Using planned contrasts reduces the risk of potential confounds between frame direction and frame emphasis, as only one of these frame attributes will vary for each contrast (more details about the planned contrasts can be found in the Results section).

Stimulus Material

Each participant was shown two separate online articles, approximately 400 words long that corresponded to their assigned condition before completing the survey. The articles were created to look like opinion pieces for the popular online news aggregator, Yahoo! News². Participants were informed prior to reading them that they were written by climate change experts to establish the articles as credible. The control group received two articles on basic climate change facts, with no persuasive elements. From Nisbet's (2009) list of common frame emphases used in climate change communication, we adopted the economic development and competitiveness frame, as well as the Pandora's Box frame. While the former touched on the economic costs and benefits of going green, the latter explored the pros and cons of climate change from a human survival perspective. These emphases were chosen to ensure high frame accessibility and frame strength comparability. They also provide good instantiations of climate change outcomes in terms of gains and losses, which are the frames used in prospect theory (Kahneman & Tversky, 1984), the original psychological explanation for framing effects. For each emphasis, strong positive and negative versions were created to operationalize frame valence, or direction.

Procedure

Upon arrival at a campus computer lab, participants were briefed and provided their informed consent. The study was conducted using Qualtrics, an online survey platform, with each article appearing on-screen for 1.5 minutes before the “Next” button appeared. The duration was intended to increase the probability that participants would read the articles instead of simply skipping through the treatment. This decision was based on data gathered during pretesting. After the experiment, participants were debriefed about the purpose of the study and remunerated SGD\$8 for their participation.

Participants

The participants’ age ranged from 18 to 29 years old, with the vast majority being 19 to 22 years old, and pursuing a Bachelor’s degree. More than half of the participants (59.2%) indicated they were female; 94.3% were Chinese; 1.9% were Malay; 1.7% were Indian, 0.4% were Eurasian; and 1.7% were of other races. The median monthly household income was in the range of “S\$3501 - S\$5000,” which is close to the national average. The participants were also of diverse education disciplines: 34.5% were from the College of Business, 26.3% were from the College of Engineering; 32.8% were from the College of Humanities, Arts and Social Sciences; and 6.1% were from other faculties (i.e., science, medicine, and education).

Support Towards GETs and PEBs

We adapted five GET items (i.e., solar-, wind-, hydropower-, biofuel, and geothermal- energy), as well as the measure of support, from Howell, Shackley, Mabon, Ashworth, and Jeanneret (2014). Participants were asked, “To what extent do you support the following?” and responded with a 7-point scale (1 = *Not at all*, 7 = *Fully*). These five items formed a composite measure for support of GETs ($M = 5.18$, $SD = 0.93$), which was deemed reliable (Cronbach’s $\alpha = .80$).

The same stem ("To what extent do you support the following?") and response scale were used to measure participants' support of PEBs. Participants were presented with 17 items (Kaiser, Doka, Hofstetter, & Ranney, 2003; Korkala, Hugg, & Jaakkola, 2014; National Climate Change Secretariat, 2012), which were classified into four environmentally significant domains of personal PEB actions (Ministry of National Development & Ministry of the Environment and Water Resources, 2014). The four domains were 1) waste mitigation behavior, 2) green buying behavior, 3) green lifestyle choices, and 4) environmental civic engagement. These 17 items ($M = 4.66$, $SD = .86$) formed a composite measure for support of PEBs that had very good reliability (Cronbach's $\alpha = .90$).

Attitudes Toward GETs and PEBs.

Five semantic differential items were adapted from the theory of planned behavior (Ajzen, 2006) and measured on a 7-point scale. Participants' were asked if GETs and PEBs are *harmful-beneficial*; *pleasant-unpleasant*; *good-bad*; *worthless-valuable*; *enjoyable-unenjoyable*. Two of the five items were reverse-coded — *harmful-beneficial*, and *worthless-valuable*. These five items formed a composite measure for attitudes towards GETs ($M = 5.74$, $SD = .82$) that was reliable (Cronbach's $\alpha = .81$). Similarly, the five items formed a composite measure for attitudes toward PEBs ($M = 5.41$, $SD = .78$) that had excellent reliability (Cronbach's $\alpha = .93$).

Results

We used one-way analysis of variance (ANOVA) with planned comparisons to test our hypotheses (i.e., one model per DV). Contrasts specified *a priori* are generally preferred over *post-hoc* tests because they reduce the number of significance tests needed to make comparisons and help control for inflated Type-I error. Seven planned contrasts were included in each of the four ANOVA models (Table 3).

[Insert Table 3 about here.]

The first ANOVA indicated framing had a significant main effect on attitude toward GETs, $F(5,519) = 3.18, p < .01, \eta^2 = .03$. The contrasts revealed a significant difference between the complementary pro- ($M = 5.93, SD = .77$) and complementary anti- ($M = 5.46, SD = .88$) frame conditions ($p < .001$); complementary anti- ($M = 5.46, SD = 0.88$) and control ($M = 5.81, SD = .77$) frame conditions ($p < .01$); complementary pro- ($M = 5.93, SD = .77$) and competitive ($M = 5.69, SD = .81$) frame conditions ($p < .05$); as well as complementary anti- ($M = 5.46, SD = .88$) and competitive frame ($M = 5.69, SD = .81$) conditions ($p < .05$). H1a(i), H3a(i), H4a(i), and H5a(i) were supported. All other contrasts for attitude toward GETs did not yield significant results at $p < .05$.

Next, we tested the effect of framing condition on support for GETs. The results were non-significant, $F(5, 519) = 1.70, p = .13, \eta^2 = .02$. In addition, none of the planned comparisons yielded significant results at $p < .05$.

The one-way ANOVA for the effect of framing condition on attitude toward PEBs was significant $F(5,519) = 2.47, p < .05, \eta^2 = .02$. Planned comparisons revealed a significant difference between the complementary pro- ($M = 5.54, SD = 0.79$) and complementary anti- ($M = 5.18, SD = .71$) frame conditions ($p < .01$); and complementary anti- ($M = 5.18, SD = .71$) and control ($M = 5.52, SD = .80$) frame conditions ($p < .01$). H1a(ii) and H3a(ii) were supported. All other contrasts for attitude towards PEBs did not yield significant results at $p < .05$.

The final model tested the effect of framing condition on support for PEBs. The one-way ANOVA test result was significant, $F(5, 519) = 2.37, p < .05, \eta^2 = .02$, which suggests that our framing treatment had a main effect on support for PEBs. Planned contrasts revealed significant differences between the pro-complementary ($M = 4.91, SD = .79$) and anti-complementary ($M = 4.55, SD = .83$) frame conditions ($p < .05$), as well as between the pro-complementary ($M = 4.91, SD = .79$) and competitive ($M = 4.59, SD = .85$) frame conditions

($p < .01$). Thus, H1b(ii) and H4b(ii) were supported. All other contrasts for support of GETs did not yield significant results at $p < .05$.

Discussion

This study clarified the roles frame direction and frame emphasis play in competitive framing effects. To our knowledge, it is the only study aside from Wise and Brewer (2010) to do so. Our experiment design used contrasts to tease out the separate effects that frame direction and emphasis have on influencing individuals' attitudes and support decisions. As mentioned earlier, competitive framing is a relatively new domain of research and most studies reviewed have focused on competitive environments that employ different frame emphases. However, this is problematic on a conceptual level because frame direction and frame emphasis can be confounded, and there may be asymmetries in frame availability and accessibility.

We found evidence of classic framing effects for our complementary frame conditions. Complementary frames pushed individuals to the advocated frame direction (See Table 4), which is similar to the effects of single-message frames. Individuals exposed to complementary pro-climate action frames expressed more favorable attitudes toward GETs (H1ai) and PEBs (Haii), and greater support for PEBs (H1bii) as compared to those exposed to complementary anti-climate action frames. Moreover, individuals exposed to complementary anti-frames reported significantly less favorable attitudes toward GETs (H3ai) and PEBs (H3aii) as compared to the control group. So in the absence of contradictory messages (i.e., a different frame direction), the two emphases of complementary frames seem to work together to form a persuasive case for the direction they are advocating.

[Insert Table 4 about here.]

In addition, our study found that attitudes toward GETs and PEBs tend to be more affected by framing differences than participants' level of support. While the complementary

anti-frame group reported less favorable attitudes toward both GETs and PEBs than the control group (H3ai and H3aai), there were no significant differences between the two groups for measures of support (H3bi and H3bii). This is in line with previous studies that show that message framing can have differing impacts on attitudes and policy support for climate change mitigation (e.g., Howell, Capstick, & Whitmarsh, 2016), and fits with prior research that shows framing affects attitudes but not support for public policy (DeVreese, 2004). To the extent that policy support encompasses elements of behavior (Dreyer, Polis, & Jenkins, 2017), and can be construed as a precursor to action, it is a step further down the chain of outcomes from attitudes within the hierarchy of effects (Smith, Chen, & Yang, 2008). So while attitudes can be difficult to change, changing the level of support for environmental policies may be even more difficult. The distinction between attitudes and policy support is an important one, especially in the context of science communication, and future studies would do well to further examine these concepts both as they relate to each other and how they are influenced by message framing.

Non-significant differences were found between the complementary pro-frames and the control group for the DVs examined (H2ai, H2aai, H2bi, and H2bii). The control group's position closely mirrored the complementary pro-frame group. A likely explanation is that a strong pro-environmental stance and self-efficacy in environmental issues pervade our respondents' age range. In a survey by the National Environmental Agency of Singapore (2010), 80% of youths aged 15 to 29 displayed high environmental consciousness and believed that they could contribute to a greener environment in Singapore. The average attitude and support scores of our control group, which range from 4.78 to 5.81 on a seven-point scale, indicate that this is indeed the case. This situation contrasts with previous competitive framing studies conducted in the United States, where the issue of climate change is highly polarized (Hart & Nisbet, 2011). As a result, the control groups of these

studies are closer to neutral positions (Chong & Druckman, 2007a; Chong & Druckman, 2007c; Jerit, 2009; Nisbet et al., 2013). Thus, assuming the control group represents the average pre-treatment position on PEBs and GETs, it may have been quite difficult for the complementary pro-climate action frames to move the participants further up the scale from an already high position. In other words, ceiling effects are likely to have occurred. This is not surprising given the pro-environmental views of most Singaporeans, and ceiling effects of this kind are less likely to be an issue where environmental views are much more heterogenous (e.g., in the U.S.).

Alternatively, our results for our complementary framing conditions may be explained by negativity bias. According to the theory, individuals are likely to attend more to negative information or events than positive ones, and act more efficaciously toward them (Liu, Xin & Lin, 2014). If a negativity bias was occurring, the complementary anti-frame might be seen as more salient than the complementary pro-frame, even when frame strength is kept constant. This is consistent with Chong and Druckman (2007c), who pointed out that negative arguments are generally more accessible to people. In this way, it could be that the negative versions of the frames had a stronger impact on the participants, cognitively speaking. On the other hand, there may have been some idiosyncrasies in the manipulations (see below for further discussion of this point). Notwithstanding these explanations, it is also possible that opposing views can have an effect even in homogenous environments, where issues are relatively uncontested.

In line with existing literature, our competitive conditions (H4 and H5) showed evidence of middle ground findings. In particular, individuals exposed to the competitive conditions reported significantly more favorable attitudes toward GETs than those exposed to the complementary anti-frames, and significantly less favorable attitudes towards GETs than those exposed to the complementary pro-frames. Furthermore, individuals exposed to the

competitive conditions also expressed significantly less support for PEBs, as compared to individuals exposed to the complementary pro-condition. Although not significantly different, the mean scores for the other DVs also fell somewhere between the complementary pro- and complementary anti-frames.

The middle ground findings are largely in line with other competitive framing studies (Borah, 2011; Brewer, 2003; Chong & Druckman, 2007c; Wise & Brewer, 2010). Competitive conditions dampened framing effects and as a result, participants' opinions were pulled to the space in between. Further testing using planned comparisons revealed that there were no significant differences between individuals exposed to the control group and those exposed to the competitive conditions for all four DVs. This lends support to the notion that competing frames may neutralize each other (Brewer & Gross, 2005), and cause individuals to revert back to their predispositions.

There were two significant findings from our competitive conditions (H4 and H5) that ran counter to our proposed theoretical relationships. Despite finding no significant differences on attitudes toward PEBs between the competing and complementary pro-conditions (H4a_{ii}), significant differences were found between these conditions in terms of support for PEBs (H4b_{ii}). It appears in this case that framing may have influenced policy support without changing attitudes. However, since our significant findings consistently reflect the hierarchy of effects paradigm, we believe that this specific finding is anomalous. Second, a deeper look into the results for the attitudes DVs reveals that significant differences were only found for attitudes toward GETs and not attitudes toward PEBs. One reason for this is that all of our frames featured GETs heavily, but did not mention personal PEBs. Therefore, framing effects had a greater influence on attitudes towards GETs than for PEBs.

The study also produced no significant differences between those exposed to opposing frames invoking the same emphasis and those exposed to opposing frames invoking

different emphasis for the DVs examined (H6). This finding is in line with Wise and Brewer (2010), who arrived at the same conclusion that there are no significant differences between the two competition types.

Coupled with the results from the one-way ANOVA, this suggests that participants reacted in the same way when presented with either one of the two competition types. Therefore, it may be the case that the two competition types (i.e., competitive frames evoking the same emphasis versus competitive frames evoking different emphases) have similar effects — they result in participants reporting middle ground positions. Given these results, it is likely that middle ground findings will hold, regardless of the frame emphasis used and that opposing frame directions are the main determinants of middle ground positions.

Limitations and Conclusion

As is the case with virtually all research, our study was limited in some ways. First, the varied connotations of the word “support” may have led participants to have different interpretations of the term. Participants were asked, “To what extent do you support the following?” In the absence of a specific definition (e.g., if they would vote in favor of a policy, pay more taxes, or sign a petition), they may have answered differently based on their own interpretations. Kennedy, Beckley, McFarlane and Nadeau (2009) conceptually defined support to broadly include “basic values, environmental beliefs and lack of knowledge/information” (p. 153). Hence, future studies could either include specific definitions or form a composite measure for this concept. Another alternative would be to conceptualize and operationalize support in a more behavioral manner (e.g., providing the participants with research funds to purchase GETs).

The possibility that frame strengths differed across the message treatments may cloud the interpretation of some of the findings. Since the primary purpose of the study was to compare competitive versus complementary framing, and to see if their influence varies

with consistent or inconsistent frame emphasis, we did not take steps to ensure precise frame strength equivalence. In preparing the stimuli, the goal was to create clear valence differences for the two frame emphases, and while care was taken to balance the framing, we cannot assert that there was perfect symmetry. Even so, we do not think frame strength varied in a systematic or significant way for several reasons. First, differences in frame strength did not alter the essential character of the independent variables. That is, frame strength did not change the consistency of the frame emphasis; participants were exposed to either two different emphases (E-S), or the same (E-E or S-S). Similarly, frame strength did not change the consistency of the frame valence; they were either complementary (+/+ or -/-) or competitive (-/+). Another reason why we don't think strength of the framing is a confound of consequence is that the majority of contrasts made mixed comparisons, so any variations in frame strength that may have been present in the stimuli were likely to be washed out. Finally, the pattern of results also suggests that frame strength did not vary systematically in an appreciable way. The one instance where not knowing definitively whether frame strength was equivalent may have clouded interpretation of the results is in the non-significant findings for H2 compared to the significant effects for H3. While this may reflect a negativity bias, it may also reflect some idiosyncrasies in the manipulations, so that interpretation is offered with this possible alternative in mind.

Our study design was unable to identify any influence of frame emphasis. Our results show that there were no significant differences between the two competition types on all the DVs examined. However, this does not necessarily imply that frame emphases had no effect. It could be the case that frame direction had such an overriding effect that the more subtle effects of frame emphases could not be seen. To further clarify the impact of frame emphasis on competitive framing environments, future studies can consider a pre-test post-test design to examine if there are significant changes in the DVs, and if the mean-score of

these changes are significantly different for the two competition types. Other types of scales could also be used to see if measurement issues played a part in the pattern of findings or null results. Similarly, thought listing procedures or other methods that might be sensitive to framing influences could be attempted.

Although we were able to make meaningful comparisons of theoretical interest, resource constraints lead to an unbalanced experimental design. A full factorial experiment with frame direction and frame emphasis as true independent variables could not be conducted. For this study, each frame simultaneously varied on both frame direction and frame emphasis. Future studies should devise a design to test the main effects and possible interaction effects of these attributes using a two-way ANOVA.

Finally, some might be concerned about the use of a non-representative sample of university students as participants in the study. Our view is that the primary concern for experimental studies such as this centers on internal validity, and while there are a few limitations in this regard (noted above), the study adequately demonstrates causal influence. As for external validity, Druckman & Kam (2009) note that concerns over student samples are sometimes overly simplistic and misguided. The matter of generalizability does not rest on a single study, and more research clearly needs to be done, so we do not regard the student participants as a severe limitation.

If we are to speculate about whether the pattern of results the study yielded would be found with other populations, the issue would seem to depend on a number of things. Aside from individual differences, a key factor is whether long-term or cumulative exposure to a particular type of message and framing environment (e.g., homogeneous or competitive) would make people more or less likely to be influenced by competing frames related to climate change. This is an empirical question that can be addressed by future research. Assuming that message environment matters, it helps to put the present study into a global

context. Public opinion about climate change in Singapore closely resembles that found in parts of Latin America, Africa, and in Asian countries such as India, the Philippines, and Vietnam where concern is high and support for action is strong (Authors, 2015, Pew Research Center, 2015). In many parts of the world, climate change is not a political wedge issue, and the message environments are likely to be fairly homogenous, as they are in Singapore. In these places, it seems reasonable to surmise that the results would replicate. In contrast, political partisanship underpins differing views of climate change in the U.S., and to a somewhat lesser extent in Australia, Canada, Germany and the U.K. (McCright & Dunlap, 2011; Pew Research Center, 2016). Even though political differences create issue polarization in these countries, the message environments vary across them from highly competitive (e.g., in the U.S.; Feldman et al., 2012) to more homogenous (e.g., Germany; Schäfer, 2016). There are likely to be other relevant factors too, so the findings may generalize to some Western countries, but perhaps not all.

This study has contributed to current competitive framing literature by studying the independent effects of frame direction and frame emphasis through a series of planned comparisons. Middle ground findings seem to persist even in relatively homogenous issue environments, and frame competition has the ability to pull individuals away from their predispositions. In addition, it seems that frame direction may be the main determinant of middle ground findings. Classic framing effects were also found to persist in complementary framing environments. Finally, results reflect the hierarchy of effects (Smith et al., 2008) paradigm, as framing effects were mostly seen on the attitudinal level, and rarely on the support level.

In conclusion, it can be said that individuals are affected by the aggregate effects of frames, as opposed to being drawn to a single frame that is closer to their initial position. A spectrum of message environments ranging from homogenous to fully competitive exist in

the real-world, and it is clear that the presence of multiple frames can either mitigate or bolster the effects of a single frame put out by science communicators. Ultimately, science communication will need to acknowledge the limited effects of their frames, especially at inducing change beyond the attitudinal level. However, it should be noted that counter frames, even in relatively homogenous message environments, can reduce the effectiveness of a competitor's message. Given that opposing frames have similar effects across competitive framing environments, science communicators should stick to their strongest and most convincing frame emphases, instead of spending resources to fight fire with fire. Moreover, as message framing might have stronger effects on attitude than policy support for GETs and PEBs, science communicators should be aware of the nuances between the two constructs and set more realistic goals for their messaging strategy.

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Endnotes

1. The Media Alliance is a multi-sector collaboration among commercial organizations and international media partners, including news, advertising and public relations firms that promote regional awareness of climate change as one of its projects.
2. The stimulus materials are available upon request from the first author, at tdetenber@ntu.edu.sg.

Table 1

Summary of competitive framing studies

Year	Authors	Subject Matter	Frame Direction	Frame Emphasis	Study Results
2014	Niederdeppe, Gollust & Berry	Tax on Unhealthy Beverages	Pro	Health	Middle ground
			Anti	Protecting Young Lack of scientific reasoning Government overreach	
2013	Nisbet	Climate Change Mitigation	Pro	Environment	Framing effects
			Anti	National Security Economic	
2012	Lecheler & Vreese	EU Enlargement	Pro	Economic (Risk/Opportunities)	Framing effects
			Anti		
2011	Borah	Civil Liberties Conflict	Pro	Free speech	Framing effects
			Anti	Public Safety	
2010	Wise & Brewer	Trans fat ban	Pro	Business Public Health	Middle ground
			Anti		
2007	Hansen	Danish Education	Positive	Spending per student	Followed prior dispositions
			Negative	Poor reading skills	
2007b	Chong & Druckman	Urban Growth	Pro	Preserve open space	Middle ground
			Anti	Build community Economic cost Voter competence	
2007a	Chong & Druckman	Hate Rally	Pro	Free speech	Middle ground
			Anti	Public safety	
2005	Brewer & Gross	School Vouchers	Pro	Equality	Middle ground
			Anti		
2003	Brewer	Gay Rights	Pro	Equality	Middle ground
			Anti		

Table 2

Experimental design

Frame Direction	Frame Emphasis		
	Economic	Survival	Mixed
Negative (-)	—	—	-E -S
Positive (+)	—	—	+E +S
Mixed (+ -)	+E -E	+S -S	+E -S -E +S

Note: E = economic frame; S = survival frame.

Table 3

Planned contrasts used in ANOVA

Contrasts	Framing Condition						Hypothesis tested
	Complementary Pro- climate action (+E +S)	Complementary Anti- climate action (-E -S)	Survival Competition (+S -S)	Economic Competition (+E -E)	Competitive (+E -S, -E +S)	Control	
C1	1	-1	0	0	0	0	H1
C2	1	0	0	0	0	-1	H2
C3	0	1	0	0	0	-1	H3
C4	1	0	0	0	-1	0	H4
C5	0	1	0	0	-1	0	H5
C6	0	0	0	1	-1	0	H6
C7	0	0	1	0	-1	0	H6

Note: E = economic frame; S = survival frame.

Table 4
Summary of findings

Hypotheses and Contrasts		<u>Attitude</u>		<u>Support</u>		Comparisons	
		GETs	PEBs	GETs	PEBs		
H1	C1	√	√		√	+E +S	-E -S
H2	C2					+E +S	Control
H3	C3	√	√			-E -S	Control
H4	C4	√			√	+E +S	+E -S, +S -E
H5	C5	√				-E -S	+E -S, +S -E
H6	C6					+E -E	+E -S, +S -E
	and C7					+S -S	+E -S, +S -E

Notes: “√” indicates significant findings at $p < .05$; E = economic frame; S = survival frame.