

## Abstract

Title of Dissertation                    EXPLORING THE UTILITY OF VISUAL COMMUNICATION  
ON PROBLEM RECOGNITION AND CONSTRAINT  
RECOGNITION: AN EXTENSION OF THE SITUATIONAL  
THEORY OF PUBLICS

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This study applied visual communication to the Situational Theory of Publics (STP) by testing the effects of environmental campaign visuals in different frames (i.e., problem and solution) on individuals' problem recognition and constraint recognition. Besides, this study explored the predicting roles of negative and positive affect in influencing individuals' information seeking and processing, the dependent variables in STP. Also, this study revealed how information seeking and processing were related to behavioral intention to take advocated action, and how perceived visual effectiveness moderated this relationship.

A between-subjects experiment (frames: problem, solution, control,  $n = 600$ ) was conducted to test the effects of visual messages regarding the waste pollution issue. The principal component analysis (PCA) revealed two components that participants experienced when exposed to visual messages: negative affect, and positive affect. The mediation analyses confirmed that strategic visual messages had indirect effects on people's problem recognition and constraint recognition through the induction of affect. However, the direct impacts of visuals on problem recognition and constraint recognition, and the causal relationships between affective responses and problem recognition and constraint recognition remained not fully explored. Furthermore,

according to recent studies related to the situational theory of public which involved affect, this study continued to explore the associations between affect and information seeking and processing. An extended structural equation model based on STP including negative and positive affective responses as predictors of information seeking and information processing showed that the new model explained significantly more variances of the outcomes (i.e., information seeking & information processing). In addition, a series of multiple regressions showed that information seeking and information processing were both positively associated with behavioral intention to take advocated action. Moderation analyses revealed the moderating role of perceived visual effectiveness (PVE) on the relationship between information processing and behavioral intention to take advocated action. A comprehensive structural equation model was built based on the original situational theory of publics, with the meaningful inclusions of affect and behavioral intention to take advocated action. The textual analysis revealed participants' sense-making of the messages in different visual frames. Theoretical and practical implications, future research, and limitations were discussed.

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RECOGNITION AND CONSTRAINT RECOGNITION:  
AN EXTENTION OF THE SITUATIONAL THEORY OF PUBLICS

by

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## Dedication

*This dissertation is dedicated to my parents for their endless love, support, and encouragement through my pursuit of dreams.*

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## CHAPTER 1: INTRODUCTION

What can exist at the bottom of the world's deepest ocean trench, Mariana Trench, at a depth of 36,000 feet? At this depth with great pressure (1,100 standard atmospheres), no life has been found so far. However, there lies a plastic bag, the kind mostly commonly used by grocery stores (Gibbens, 2019). No place in this world can hide from plastic trash.

In 2015, more than 380 million tons of plastic were produced, roughly equivalent to the mass of two-thirds of the world's population. Also, in the same year, about 55% of global plastics were discarded, an estimated 25% were incinerated, and another 20% were recycled (Ritchie, 2018). The low rate of plastic recycling has posed a threat to the ecological system. The situation for glass is similar. Glass is widely used in people's lives while experiencing a low recycling rate. According to a report from the United States Environmental Protection Agency (United States Environmental Protection Agency, 2020), only 3,060 out of 12,250 tons of glass were recycled in 2018, occupying less than 25% of glass produced. Scientists have found that drinking and merchandise glasses may contain more than 1,000 times the limit level of lead and up to 100 times the limit level of cadmium (Turner, 2018). Meanwhile, glass can be recycled, and the products made by the recycled glass are of the same quality. Therefore, recycling glasses is beneficial. Paper and aluminum cans have better stats concerning recycling. According to EPA (2020), approximately 46 million tons of paper and paperboard were recycled in 2018, for an overall recycling rate of 68.2%. In 2018, the total recycling rate of aluminum containers and package materials was 34.9%, including beverage and containers, foil, and other aluminum packaging.

These data show that the recycling rate has a great potential to increase. The great amount of production and the low recycling rate have posed a severe threat to our planet. On the one hand, the production of these materials has consumed natural resources, many of which are not renewable but can be reused. On the other hand, the low rate of recycling has left a tremendous amount of waste landfilled, causing threats to the environment, such as poisoning the earth and threatening ocean lives. Therefore, it is critical to manage and recycle wastes effectively and efficiently so as to maintain a sustainable living environment.

Most of these wastes are from people's everyday life. Public's recycling behaviors are essential to increasing the recycling rate and protecting the environment. To improve this situation, the government and advocacy organizations need to increase publics' recognition of the waste pollution problem and reduce their perceived constraints to recycling, which can help solve this problem. This study explores how to improve publics' problem recognition and constraint recognition using visual images, which may encourage actions to recycle.

Organizations are using visual elements and short videos in their communication with publics frequently, with the growing use of YouTube Channels, Facebook pages, and TikTok accounts. However, public relations scholars have not adequately studied how visual messages can be effective. Therefore, research on visuals and how they may influence important variables in behavioral changes is a promising area. Understanding how visuals impact people's perception of an issue and their communication and problem-solving behaviors will be critical to helping strategic communication practitioners design messages and communicate with publics effectively. On the issue of recycling, different visuals may help the organization increase publics' awareness of this issue and may ultimately lead them to take action. This study uses the

situational theory of publics to examine how two types of visuals (problem framed visuals and solution framed visuals) about the environmental issue of waste pollution can influence publics' problem recognition and constraint recognition, two critical predictors of communication behaviors and other behavioral intentions. Besides, it explores how the utility of visual communication can extend the model of the situational theory of publics.

The situational theory of publics (STP, Grunig & Hunt, 1984) is a well-tested theory (Zoch & Collins, 2002) in public relations research that identifies and segments publics and predicts publics' information processing and seeking behaviors. In more than three decades since its creation, STP has been used to understand publics and provide guidance on how to communicate with publics and design messages (e.g., Aldoory et al., 2018; Aldoory & Grunig, 2012; Grunig, 1997; Kim & Grunig, 2011). According to STP, individuals' problem recognition, constraint recognition, and level of involvement determine the formation of publics and predict publics' active and passive communication behaviors (i.e., information seeking and information processing). In environmental campaigns, it is important to convince individuals that a certain environmental problem exists, that this problem is related to their life, and that they can make some contributions to the problem-solving. Therefore, the situational theory serves as a solid theoretical foundation to help organizations realize their communication goals.

Visual messages depict a subject by making various elements salient. For issues presented visually, two primary facets in the content of visuals are the seriousness and solution. Visual messages can frame a problem either by emphasizing the problem itself, or by advocating a solution to the problem and calling for action. In their segmentation of frames, Snow and Benford (1988) suggested several frames of an issue: diagnostic, prognostic, and motivational

frames. Journalism scholars classified news visuals to represent social issues into two general categories: problem-oriented and solution-oriented (e.g., Dahmen et al., 2019; Lough & McIntyre, 2018). Problem-oriented images typically show the existence or the seriousness of the problem by sad or worrisome pictures, and solution-oriented images focus on presenting the desired way or behaviors to solve a social problem. In this study, I will examine how visuals in problem and solution frames may impact people's problem recognition and constraint recognition, two independent variables in the situational theory of publics.

In environmental campaigns, organizations use strategically designed visuals to present environmental problems and call publics to take actions. Although scholars have explored how different elements in visuals could impact communication effects, such as the inclusion of human characters (So & Nabi, 2013), the use of color (e.g., Gerend, 2019; Wang et al., 2020), metaphor (e.g., Meijers et al. 2019), and level of vividness (e.g., Ophir et al., 2019), the research on visual messages in public relations has been far less (e.g., Lee & Chung, 2018; Dhanesh, 2017; Krause & Bucy, 2018; Pressgrove et al., 2018). This study will employ STP as the theoretical framework to test whether visual images can influence a public's problem recognition and constraint recognition.

## **Conceptualizations**

The below section offers conceptualizations of the key topics under study.

### ***Environmental Communication***

Antonopoulos and Karyotakis (2020) suggested that environmental communication can be defined narrowly or broadly. As a narrow area, environmental communication is defined as "the dissemination of information and the implementation of communication practices that are

related to the environment” (p. 551). However, nowadays, environmental communication has become “a broad field that includes research and practices regarding how different actors (e.g., institutions, states, people) interact with regard to topics related to the environment and how cultural products influence society toward environmental issues” (p. 552). Considering that the experimental manipulation in this study is strategic visual messages advocating recycling, this study will follow the narrow definition of environment communication and fit in the strategic communication scope. So, in this study, environment communication is defined as the strategic use of messages and communication practice to influence people’s perceptions and behaviors related to environmental issues.

### ***Visual Communication***

According to McWhirter and Hoffman-Goetz’s (2014) definition of visual health communication, visual communication in this study is defined as the area of research and practice that involves visual imagery (e.g., photographs, illustrations, maps, graphs, diagrams, motion images) to convey information about certain issues to improve people’s knowledge, to influence their recognition of the specific problem, and to encourage them to take communicative and behavioral actions to solve the problem or improve the situation.

### ***Visual Framing and Frames***

In this study, the definition of visual framing followed Entman’s (1993) argument, which is the strategic selection and use of visual elements to make certain aspects of an issue salient so as to promote viewers’ problem recognition, causal interpretation, moral evaluation, and/or solution to the problem. A problem can be represented in messages from different aspects, primarily from the problematic aspect or the solutionist aspect. Based on Snow and Benford’s

(1988) discussion in their frame analysis, the problem frame is defined as a frame that emphasizes the problematic aspect of an issue. The solution frame is defined as a frame that focuses on the demonstration to solve the problem and the advocacy to take action.

### ***Public Relations***

Grunig and Hunt (1984) defined public relations as “the management of communication between an organization and its publics” (p. 4). PRSA (2022) defined public relations as “a strategic communication process that builds mutually beneficial relationships between organizations and their publics.” Although these two definitions are both organization-centered, they both regard PR as a strategic communication process to influence publics and achieve a mutually beneficial goal. This study focuses on publics and the how they are influenced by messages. Therefore, the definition of PR is slightly adjusted to emphasize publics and their communication, which is defined as *the communication process of designing, managing, and disseminating strategic information to the public to change their perceptions of and behaviors on issues or involved organizations.*

### ***Public***

Dewey (1927) regarded a public as a group of people who face a similar problem, recognize it, and organize themselves to address the problem. Based on Dewey’s definition of publics, Grunig (1997) defined a public as a homogeneous social collectivity that identifies a similar problem and works together toward a problem resolution. These scholars’ definitions of the public underline the situational nature and regard the public as a social collectivity as well. However, in the more recent studies based on situational theories (particularly studies using surveys), publics have been treated as individuals, instead of collectivities, with a certain level of problem recognition, constraint recognition, and involvement. In this study, publics are

examined individually in their relationship with the issue and are not grouped into several segments. Therefore, public in this study is defined *as individuals with a certain perception (i.e., problem recognition, constraint recognition, and level of involvement) of a particular issue (in this study, waste pollution), who may take communicative and behavioral actions to solve the problem.*

### ***Affect***

Affect is an important concept in this study, as a meaningful addition to the original STP model. Different from discrete emotions, affective responses are more general. The conceptualization of affect in this study follows Ekkekakis and Petruzzello's (2000) discussion of affective response and it is defined as *a general psychological state of an individual, including but not limited to emotions and mood, within a given situation.* Different from discrete emotions (e.g., fear, anger, empathy, etc.), affect describes an individual's subjective experience of all valenced responses (primarily negative and positive). The concept of affect, instead of discrete emotions, is used in this study considering individuals' subjective interpretations and feelings about visual messages. In many studies, affective responses and emotions are commonly examined interchangeably. Studies examining the effects of emotions are highly related to the influence of affective responses. Considering that the number of studies particularly about affective responses is limited, in the literature review, I heavily relied on research on emotions and compared the similarities and differences between emotions and affective responses, and explain why the concept of affect was taken, instead of emotion.

### ***Behavioral Intention to Take Advocated Action***

In the original STP, the outcomes of the three independent variables are people's active (information seeking) and passive (information processing) communication behaviors. However,

in the practice of strategic communication and advocacies (e.g., health communication, environmental communication, crisis communication), it is not enough to examine publics' communicative behaviors. In these communication activities, the aim of messages and campaign designs is to call publics to take advocated action. So, this study developed the outcomes in the situational theory of publics, from information seeking and processing to publics' behavioral intention to take advocated action. In this study, people's behavioral intention to take advocated action is defined as publics' willingness and likelihood of taking actions to solve the problem (i.e., recycling in this study). Publics' behavioral intention to take advocated action in this study was regarded as a subsequent behavior of communicative behaviors in STP.

### ***Perceived Visual Effectiveness***

Perceived visual effectiveness in this study is developed from the concept of perceived message effectiveness. Perceived message effectiveness is theorized as audience's perception of whether candidate messages will or will not achieve their objectives (e.g., Baig et al., 2018; O'Keefe, 2018). In this study, the construct of perceived visual effectiveness was conceptualized in the visual communication context, as individuals' perception of whether visual messages have achieved the communication goals. Perceived visual effectiveness was examined as a moderator in the relationships between people's information seeking and behavioral intention to take advocated action, and between people's information processing and behavioral intention to take advocated action.

### **Summary of Research Method**

This study conducted a between-subjects experiment ( $n = 600$ ) to examine how publics' problem recognition and constraint recognition of an environmental problem--waste pollution--could be affected by problem-framed and solution-framed visual messages. Additionally, this

study extended the situational theory of publics by adding affective responses into the original model. Besides, in environmental campaigns and advocacy, people's behavioral intention to take advocated action should be a critical outcome. Therefore, this study further explored the associations between people's communication behaviors and the behavioral intention to take advocated action.

The first part of this study involved the effects of visual messages on people's problem recognition and constraint recognition, and the potential mediating role of affect. Earlier studies have repeatedly confirmed the mediating role of affect (in some studies, emotions). Thus, visual messages in certain frames should induce people's affective responses (e.g., fear, anger, affective injustice), which would be associated with their perception of the issue. The second part was about extending STP by including affect as another potential predictor of people's communication behaviors, and behavioral intention to take advocated action as a critical outcome of environmental campaigns. One's behavioral intention to take advocated action was different from information seeking or processing in the original STP because the outcomes in STP are communicative actions, instead of behaviors to solve the problem. The second part was to reveal meaningful associations between important variables on the issue of waste pollution, which was exploratory based on rationales and findings in earlier studies.

In the second part of this study, I did not focus on the effects of affective responses on problem recognition or constraint recognition (or the other way around) for two reasons. First, in the mediation analysis, not all mediator-outcome covariates could be controlled. Thus, it would be risky to conclude the causality between affective responses and the outcome (i.e., problem recognition or constraint recognition). Second, earlier studies involving the relationship between affect and issue perception (e.g., problem recognition, risk perception) did not provide consistent

and solid rationales about the cause-effect relationship between these two factors. However, studies have consistently shown that affect can be a predictor of people's behavioral intentions (in STP, information seeking and processing). Thus, in the second part, I mainly focused on the associations between affective responses and people's behavioral intentions, treating affect as a predictor of information seeking and processing. Besides, I tested the correlations between communication behaviors and behavioral intention to take advocated action, and the moderating role of perceived visual effectiveness in these correlations. In this process, STP was developed in the visual communication context.

Last, at the end of the experiment, with several open-ended questions, participants were invited to write down their feelings when viewing the visuals, and the interpretation and evaluation of the visual messages. A textual analysis was conducted to unpack people's emotional expression, interpretation, and evaluation of these visuals, providing qualitative evidence for the experimental findings and implications for environmental communication visual designing.

### **Implications of Study**

This study contributed to the situational theory of publics in three ways. First, it explored the effects of visual messages on people's problem recognition and constraint recognition, which may affect the formation of publics. Second, it extended the STP model by adding three important constructs: negative affect, positive affect, and behavioral intention to take advocated action, making the STP model a more comprehensive and applicable model in environmental communication (e.g., advocacy and campaigns). Third, the study testing how publics were influenced by visual messages can expand the application of the situational theory of publics to the visual communication context.

## **Organization of Dissertation**

The current chapter (Chapter 1) provides the background information of the social issue studied in this dissertation, introduces the public relations theory as the theoretical foundation of this study, and defines the key concepts in this study. Chapter 2 provides a systematic review of the situational theory of publics and visual communication, as well as the argument for the relationship between key concepts. This chapter ends with hypotheses and research questions developed from the argument in the literature review. Chapter 3 introduces the research method, including the measurement, sampling and participants, procedure, data analysis, and validity of the study. Chapter 4 presents the results of the experiment and textual analysis. Chapter 5 is the discussion of the study, including the findings, limitations and future research, and conclusion. Appendix A includes the questionnaire in the online experiment. Appendix B presents the six sample visuals in this experimental design.

## CHAPTER 2: LITERATURE REVIEW

### Overview of the Situational Theory of Publics

Grunig built the concept of publics on Dewey's definition of the term public, as the foundation of the situational theory of publics (Grunig & Hunt, 1984). According to Dewey's argument (Dewey, 1927), publics arise when individuals meet a similar problem, recognize the problem, and organize to solve the problem. The emergence of an issue is the prerequisite of the rise of publics. According to the situational theory of publics, publics can be identified and segmented by three variables, problem recognition, constraint recognition, and level of involvement. These independent variables explain and predict publics' active (information seeking) and passive (information processing) communication behaviors and develop cognition, attitudes, and behaviors related to the organization.

### *Independent Variables and Dependent Variables in STP*

By definition, problem recognition refers to when "people detect that something should be done about a situation and stop to think about what to do" (Grunig, 1997, p. 10). There are two conditions in the conceptualization of problem recognition: (1) individuals have the ability to detect a problem, and (2) they recognize the lack of an immediate solution to the problem (Kim & Grunig, 2011). Constraint recognition is defined as "people perceive that there are obstacles in a situation that limit their ability to do anything about the situation" (Grunig, 1997, p. 10). According to the situational theory of publics, people with high constraint recognition are less likely to conduct communication behaviors than those with low constraint recognition because of the perceived inability to make a difference. The concept of constraint recognition is similar to efficacy, but the former relies more on situations while the latter is more about one's

perceived quality or trait. Level of involvement means “the extent to which people connect themselves with a situation” (Grunig, 1997, p. 10). The higher level of involvement, the more likely for publics to develop communication behaviors. The most active publics have a high problem recognition, low constraint recognition, and high level of involvement.

These three variables can determine whether and how publics engage in communicative behaviors. According to the situational theory of publics (Grunig, 1997; Grunig & Hunt, 1984), there are two types of communication behaviors, information seeking and information processing. Information processing is an active communication behavior, and it occurs when individuals actively search for information about a certain issue, develop cognitions, generate attitudes, and take actions about this issue. Information processing is the process during which individuals passively pay attention to a message and absorb some of it, intentionally or subconsciously (Aldoory & Sha, 2007).

### **Elaboration and Extension of STP**

The situational theory of publics (SPT) has become a fundamental theory in public relations since its creation. Scholars have made great efforts to test, elaborate, and develop the theory, creating a body of publics research from the situational perspective.

### ***Problem Recognition***

Scholars have repeatedly proved the role of problem recognition in predicting people’s communicative behaviors and explored how publics’ problem recognition can be influenced. For example, Hamilton (1992) conducted a survey to test the situational theory of publics using the case of the 1990 governor race in Kansas and found that problem recognition accurately predicted different levels of communication activity about the election. Kim and Grunig (2011)

developed the situational theory of publics to the situational theory of problem-solving. They confirmed the predictive role of the problem recognition for individuals' situational motivation in problem-solving and the consequent behaviors, which they called communicative actions. Later, scholars conducted various studies (e.g., Chen et al., 2017; Chon & Park, 2019a; Chon & Park, 2019b; Jiang et al., 2017; Lim et al., 2015; Shen et al., 2019) from the situational perspective and found problem recognition effectively predicted the publics' communication behaviors. In addition, Aldoory et al.'s (2018) study about a national text message campaign among pregnant women revealed that the construct of problem recognition was frequently used in the message design. They claimed that the use of single constructs (i.e., problem recognition and constraint recognition) in the message design could be a useful approach for health interventions, which needs further evaluation of its effects. Besides, related studies also found that problem recognition had other communication effects, such as influencing people's information memory. For example, Cameron (1992) applied the STP to the context of investor relations to test the cognitive effects of the situational theory and found problem recognition significantly associated with participants' memory of the message stimuli. Slater et al. (1992) revealed the impact of problem recognition on individuals' cognitive responses. Their experiment results suggested that situational theory and cognitive response approaches could be usefully combined to fully understand publics' response to messages, as well as for communication practitioners to better design message strategies in communication campaigns.

Problem recognition is not only a predictor of publics' communication behaviors, but also can be an outcome shaped by various factors. In recent years, to make the situational theory applicable for organizations to strategically design messages, scholars have started to explore

how problem recognition can be influenced. Aldoory et al. (2010) conducted an experiment and revealed that when the messages contained the portrayals that triggered participants' shared risk experience with portrayals in news coverage, there was an increase in participants' problem recognition. Sha (2006) found that individuals' racial-ethnic identification predicted their problem recognition, influencing information processing and seeking. However, there still are not many empirical studies exploring how to effectively impact people's problem recognition. The research direction still has a large space to explore.

### ***Constraint Recognition***

In STP, constraint recognition is defined as people's perceived obstacles in a situation that limit their ability to solve the problem (Grunig & Hunt, 1984). It is individuals' evaluation of the potential outcome of their cognitive or behavioral resource investment. Studies mentioned above testing the situational theory also proved the predictive power of people's constraint recognition on their communicative behaviors.

However, when constraint recognition was treated as an outcome of communication, Grunig and Ipes (1983) found it not easy to change. They found that the campaigns had very limited impacts on people's constraint recognition, and they concluded that "for a campaign to move people to develop organized cognitions and perhaps to change their behavior, it must show people how they can remove constraints to their personally doing anything about the problem" (p. 51).

The core of constraint recognition is people's perceived obstacle which limits their capacity to deal with the situation. The sources of the obstacle can be either internal or external. When the obstacle is internal, it is mainly about one's perceived or actual efficacy (e.g., knowledge) to take actions. The external obstacle is usually something in the real-world

environment, such as the relationship between publics and the organization and something that is very difficult to change (e.g., policy). Few studies have been found to discuss the difference between these two sources of the perceived obstacles, which determine people's constraint recognition. In studies using situational theory, scholars often mix the internal and external aspects of constraint recognition in the measure (e.g., Chen et al., 2017; Jiang et al., 2017).

In studies that successfully explored how to influence constraint recognition, some scholars (e.g., Aldoory et al., 2018; Anderson, 1995; Campbell et al., 2001) interchangeably use the concepts of constraint recognition and self-efficacy. For example, Campbell et al.'s study (2001) suggested that messages with low complexity which encouraged small and specific changes could be successful in decreasing one's constraint recognition (i.e., increasing the self-efficacy). Besides, Lee et al. (2011) investigated midwives' cell phone use and found that their access to peer resources by mobile technology could decrease their constraint recognition. These studies successfully explored how constraint recognition could be affected. The most important similarity of these studies about constraint recognition is that they tried to influence the constraint recognition from the internal aspect of obstacles, that is, by changing people's perceived capability in a certain issue (e.g., providing specific instructions, knowledge, and support), rather than from the external aspect. Therefore, if message designers set realistic goals of communication and provide specific solutions or support to publics, which increase their self-efficacy, constraint recognition can be lowered.

### ***Level of Involvement***

Scholars have discussed and elaborated the conceptualization of the level of involvement in the situational theory of publics. In most other studies testing and developing STP, just like problem recognition, level of involvement has been proved to be an effective predictor of

individuals' communication behaviors (e.g., Aldoory & Van Dyke, 2006; Hamilton, 1992; Grunig & Kim, 2011; Lim et al., 2015).

Scholars have also treated the level of involvement as a communication effect and explored the method to influence people's level of involvement. Roser and Thompson (1995) integrated STP with Rogers' protection-motivation theory (Rogers, 1983) to expand the predictive power of the situational theory. They tested the effect of fear appeal in public formation by examining publics' cognitive and emotional responses and involvement in the issue. Results showed that both cognition and affect mediated publics' responses to a fear-appeal message, therefore contributing to the creation of active publics who are encouraged to take actions on a problem. Aldoory (2001) conducted focus groups and interviews with women from various ethnic, class, educational, and sexual backgrounds to explore antecedent factors that might predict involvement. Findings revealed that women's consciousness of everyday life, source preference, self-identity, a consciousness of personal health, and cognitive analyses of message content might influence their involvement with health messages. Aldoory and Van Dyke (2006) found that some strategic messages could create a sense of shared involvement for publics. Specifically, when participants believed the source of information shared some similarities with them, they were more likely to pay attention to the information. Aldoory et al. (2010) had similar findings in their experiment, which revealed that people's perceived shared risk with the information source and portrayals in the message could change their level of involvement. Besides, Sha's (2006) study revealed that people's level of involvement could be influenced by their racial-ethnic identification.

Among these predictors of level of involvement in the situational theory of publics, one important characteristic in common is that most predictors are about a state, an identity, and

personal traits of individuals. In other words, predictors of level of involvement tend to be something stable in an individual. With message stimuli, however, individuals' level of involvement in an issue (i.e., perceived personal connection with this issue) may be not likely to be easily influenced. Level of involvement is something that depends on individuals' personal life experience and their evaluation of the relationship between the issue and themselves. Level of involvement should be impervious to change based on viewing several visual messages depicting the problem or the solution of an issue. Therefore, in this study, level of involvement is excluded from the dependent variables that are influenced by visual messages.

In summary, the three independent variables in the situational theory of publics have multiple determinants. However, not all of them can be influenced with the equal communication efforts. Problem recognition and constraint recognition are more likely to be influenced by carefully designed messages, while level of involvement is more determined by one's internal characteristics (e.g., identity). Therefore, strategic communication designers and organizations can consider changing people's problem recognition and constraint recognition with carefully designed messages.

### **Application of STP**

The situational theory of publics has been widely applied in public relations research to segment publics and test the effects of message design on publics' communication behaviors. The areas of the application of STP closely related to this study include environmental communication and health communication.

### ***Environmental Communication***

At the beginning of the establishment of the situational theory of publics, Grunig (1989) analyzed the utility of STP in environmental communication. He claimed that environmental

communicators in public relations would communicate more effectively with their audience if they could segment publics effectively using the three independent variables in STP. Therefore, Major (1993) classified publics with the three variables in STP and examined different publics' communicative behaviors in response to the landfill issue messages. The results showed that for a landfill issue, the problem-facing public (high problem recognition and low constraint recognition) and the constrained public (high problem recognition and high constraint recognition) were more likely to conduct information seeking regardless of their level of involvement. Also, Major (1998) conducted a study to test the utility of STP in the environmental communication context (predicting earthquakes). She tested publics' responses to earthquake predictions and found that people's personalized risk was positively associated with their constraint recognition, regardless of belief in the prediction messages. So, she concluded that messages targeting the publics of high constraint recognition should emphasize specific actions that they can take, which might reduce publics' perceived constraints and personalized risk.

In recent years, Lim et al. (2015) found that in a municipal watershed protection project, publics' problem recognition was the key to both information seeking and processing behaviors. Besides, they found a significant association between communication behaviors and public engagement, mediated by the use of organizational media in information seeking. Xifra (2015) found that climate change deniers and groups utilized their knowledge of publics' problem recognition, constraint recognition, and level of involvement regarding climate change to determine their communication strategies to strengthen climate change denial arguments.

Although scholars have proved the importance of these three variables in predicting publics' communication behaviors on environmental issues, and suggested message design strategies, there are few studies exploring how to influence publics' problem recognition and constraint recognition on environmental issues. Research on STP in health communication provides some inspiration in the possibility of these changes.

### ***Health Communication***

Scholars have proved the validity of STP in predicting people's health communication behaviors. For example, Lee and Rodriguez (2008) tested the situational theory of publics to examine how citizens recognized bioterrorism as well as predicted their communication and protective behaviors. The result showed that problem recognition was positively related to information seeking and processing while constraints recognition was negatively related to information seeking and processing. Involvement was positively related to information seeking.

From the perspective of message design, Grunig and Ipe (1983) conducted a study of campaigns that aimed to prevent publics from drunk driving. They concluded that messages should not only present the problem itself to publics, but also show them how to remove constraints of doing anything about a problem, therefore decreasing publics' constraint recognition in a problem and encouraging them to take actions. Similarly, in Anderson's (1995) study about drunk driving using STP, the researcher found that symbolic modeling in messages brought greater efficacy expectations (lower level of constraint recognition) and higher behavioral intention than did persuasive information. These studies confirmed the necessity to differentiate publics according to the level of involvement and constraint recognition and to

provide specific information about how to remove the constraints. Aldoory and Bonzo (2005) also recommended using STP in message designs of injury prevention campaigns.

More recently, Meng et al. (2016) suggested message designers integrate appropriate situational factors in the situational theory in message strategies to promote publics' communication behaviors such as active health information seeking. So, it is meaningful to revisit the three dependent variables in the situational theory, to explore how to design messages to influence these three variables effectively, and to develop STP to be more applicable in strategic communication practice.

Aldoory et al.'s (2018) study about the national text message campaign among pregnant women provided a great start to this kind of exploration. In their study, they investigated how the meaning of prenatal health was constructed from the constructs of problem recognition and constraint recognition in text messages and found these two constructs important in this campaign, but the effectiveness of single constructs (e.g., constraint recognition) had not been tested. Following this direction, the current study tests how visual messages influence publics' problem recognition and constraint recognition of an environmental issue, as well as how publics' information seeking, information processing and behavioral intention to take advocated action are changed simultaneously. Also, most studies (e.g., Aldoory et al., 2010; Aldoory et al., 2018; Grung & Ipe, 1983) examining the effectiveness of messages were conducted in the textual message context while it might have some limitations (Aldoory et al., 2018). Therefore, this study expanded the research lens to a more popular and less explored form of messages, visual messages, which may overcome some limitations in texts as mentioned.

Before further discussing the visual message design, it is important to understand the goal for organizations to communicate with publics. STP is developed to segment publics and predict their communication behaviors according to situational factors. For organizations, their communication practice may influence the formation of publics and their communication behaviors. From the perspective of message designers (e.g., organizations), the goal of their practice to influence publics depends on the type of problems.

### **Two Types of Problems**

Kim and Ni (2013) discussed the relationship between problems, publics, and organizations, and they divided problems into two different types: (1) public-initiated PR (PPR) problems, which start when publics recognize a problem in organizational decisions or actions, and (2) organization-initiated PR (OPR) problems, which arise when an organization detects potential problems related to publics' or the organization's interests.

Different from public-initiated PR problems, where there are usually interest conflicts between publics and organizations, organization-initiated problems commonly involve no interest conflict. Instead, OPR problems are more about routine PR activities such as campaigns to increase publics' awareness of a certain issue, to produce a new cognitive frame, and to advocate certain behaviors, especially among certain subsegments of a general population. Shortly, PR practice in PPR problems is to calm down activist/active/aware publics to a nonpublics status, while PR practice dealing with OPR problems is to create publics.

In campaigns and advocacy activities, the general goal is to design strategic messages to effectively communicate with publics who do not have adequate awareness of the specific problem and to advocate benevolent behaviors among these people, such as skin cancer

prevention, vaccination, and environmental protection (e.g., Gerend & Sias, 2009; Overton, 2018; Parrott et al., 1998; Pența & Băban, 2017).

Regarding the formation of publics, PR practice with OPR problems is to create publics by influencing the antecedents (i.e., problem recognition, constraint recognition, and level of involvement) of publics' communication activities. Although PR scholars (e.g., Grunig & Ipe, 1983; Grunig, 1997; Kim et al., 2012) argue that influencing publics' attitude or behavior is very difficult if not impossible, it is still practical for organizations to influence publics' perceptual variables in certain issues (e.g., Aldoory et al., 2010; Aldoory et al., 2018; Campbell et al., 2001; Lee et al., 2011; Kim & Ni, 2013; Roser & Thompson, 1995; Lee et al., 2011). Therefore, this study will test how visual messages can influence individuals' problem recognition and constraint recognition, which influence their information seeking and processing, and behavior intention to take advocated action.

### **Visual Communication**

Studies in different areas of communication, such as health communication, risk communication, and environmental communication, have shown that visuals are effective in decreasing people's uncertainty, arousing their emotions, increasing the issue perception or awareness, and influencing people's decision making (e.g., Burnside et al., 2007; Johnson & Slovic, 1995; King et al. 2019; Skurka et al., 2018; Witt, 2020). In environment campaigns, visuals are often used, with the aim to increase publics' awareness of a particular issue and encourage their engagement or behaviors, but the effectiveness of these visual messages on publics have not been fully explored, such as how visuals impact publics' problem recognition, constraint recognition, and their consequent communicative and behavioral intents.

### *Framing Theory and Visuals*

Framing theory suggests that the way something is presented to the audience (the frame) can influence how people process that information and their interpretation of reality (Scheufele, 1999). However, the concepts of frame and framing keep vague in the development and application of the framing theory. Different scholars conceptualized framing from different focal points and made to framing “a scattered conceptualization” (Entman, 1993, p. 51). For example, Goffman (1974) defined framing as a schema of interpretation for individuals, groups, and societies to organize, perceive, and communicate about social reality. However, Entman defined framing as a process “to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described” (Entman, 1993, p. 52). These two definitions reflected two constructs of framing in Scheufele’s (1999) model. Scheufele argued that a frame could be regarded as both a media frame and an audience frame. A media frame refers to how media selects and uses information, and an audience frame is the result of the media frame. Framing is the process that the media frame shapes the audience frame. So, Scheufele argued that framing is a media effect.

The current conceptualization of visual framing follows framing theory. Schwalbe (2006) described visual framing as a “continuous winnowing process. It begins with the choice of events to cover, followed by the selection of what pictures to take, how to take them (angle, perspective, assumptions, biases, cropping, and so forth), and which ones to submit (p. 269).” In this definition, visual framing is the framer’s effort of visual creation. Coleman’s (2010) definition of visual framing involves both the creation and use of images: “the selection of one view, scene, or

angle when making the image, cropping, editing or selecting it. When a journalist chooses which photograph or piece of video to use, it is an act of framing (p. 237).” These two definitions of visual framing both take the framer’s perspective and emphasize the purpose of using visual messages. This approach matches with the core of message designing in strategic communication and public relations. Therefore, it is meaningful to reveal how to frame visual messages in PR practice, so to achieve the goal of influencing publics’ problem recognition, constraint recognition, and the consequent communicative and behavioral intentions.

However, the conceptualization of visual framing is still vague. The vagueness of visual framing may stem from the blurriness of framing. Fahmy admitted that there was “an overall vague conceptualization of framing, as several scholars have tried to define what constitutes a media frame” (2014, 53). Similarly, Cacciatore, Scheufele, and Iyengar (2016) argued that framing had become a vague, meaningless construct, and they called for a more specific conception for framing (priming, agenda-setting, or related labels). Still, they restated that frame should be regarded as media effects, which required closer and nuanced scrutiny.

Therefore, scholars have explored to better theorize visual frame, emphasizing the visual aspect. Rodriguez and Dimitrova (2011) developed a four-tiered model of identifying and analyzing visual frames which considered different dimensions of visual messages, including visual content (visuals as denotative systems), style (visuals as stylistic-semiotic systems), symbolism (visuals as connotative systems), and ideology (visuals as ideological representations). This typology provided an overall understanding of the way to unpack visual communication from different perspectives. From the standpoint of strategic communication, the most operationalizable dimension of visual framing is the content of visuals. At the visual

content level, the visual frame is determined by enumerating the objects and discrete elements in the visual. Viewers organize or combine visual elements and sensations into certain themes.

Therefore, visual framing is the result of viewers' recognition of the artifacts in visuals.

Theorizing visual frames at the visual content level is close to the media effect paradigm because it directly involves both message artifacts and viewers' sense-making of these elements.

Bock (2020) conducted a systematic review of visual framing studies and proposed a model that theorized visual framing into three major constructs: selection, creation, and solution. The selection construct theorizes how an image is re-contextualized in artifacts, whose meaning is contingent upon its context. Studies conceiving visual framing as selection are mostly descriptive and interpretive. The selection construct of visual framing is commonly found in journalism studies that describe how photos were selected and how they interact with textual themes. For example, Reynolds and Barnett (2003) conducted a frame analysis of CNN's televised coverage of the 9/11 attacks and found that the photo selection in certain frames served to justify a military response. Fahmy and Neumann (2011) analyzed photo selections in coverage of the conflict in Gaza, in terms of war versus peace journalism, and they argued that photo selection would ultimately have an impact in shaping public opinion and influencing perceptions of news events.

The solution construct primarily examines the role of images in visual framing effects studies, where the frame is assumed to be interpreted and memorized by viewers. Most visual communication studies using experiments utilized this construct of visual frames and tested the communication effects elicited by certain visual content. For example, in an experiment using visual messages, von Sikorski et al. (2012) found that when individuals saw images of disabled

athletes with a cheering crowd in the background, they were more likely to appreciate the accomplishments of these athletes. In addition, in an experiment by Powell et al. (2015)., they found that the mere presence of an image with a news article could inspire stronger behavioral intentions.

The creation construct theorizes visual frame based on the attributes of the visual such as distance, angle, composition during the creation of an image. Studies about visual creation are not commonly seen in the study area of communication effects or strategic communication.

The main goal of this study is to test the communication effects of different visual messages on publics' environmental problem recognition and constraint recognition. So, from the perspective of strategic communication and message design, the framing of visuals takes the construct of "selection" in this study. To be specific, I am interested in examining how the selection of visual messages in environmental campaigns may impact publics' situational perceptions of a certain issue and explore the mechanism in this communication effect. In this study, the definition of visual framing followed Entman's (1993) argument, which is *the strategic selection and use of visual elements to make certain aspects of an issue salient so as to promote viewers' problem recognition, causal interpretation, moral evaluation, and/or solution to the problem.*

### ***Problem and Solution Visual Frames of Issues***

The situational theory is problem centered. Regarding the approach to visualizing problems and issue, scholarship in journalism imagery has made tremendous contributions. In journalism, pictures are commonly used in reporting social problems such as gun violence, terrorism, climate change, racial injustice, or poverty. Scholars found that news images play a

significant role in framing the news (Dahmen, 2009), setting public agenda (Miller & Roberts, 2010), which, as a result, influence how people understand the issue (Coleman & Banning, 2006).

News images can be categorized into problem-oriented and solution-oriented (Dahmen et al., 2019). Problem-oriented images usually use shocking images to show the seriousness of the problem. These problem-oriented images have “attention-grabbing capacity” (Ewbank et al., 2009, p. 127) and often trigger the audience’s emotional reactions, such as empathy, guilt, and fear, which influence people’s narrative engagement and behavioral intention (Dahmen et al., 2019). However, for journalists, it is not enough to raise people’s attention or awareness of certain social problems. The goal of news reports of social problems, and problem-centered communication activities (e.g., campaigns), is to call for actions to solve the problem.

Therefore, scholars have suggested that it is important to use solution-oriented news images to inspire audiences to discuss the issue and follow the instructions to make their own contributions to the problem-solving (Goodman, 2016; Jones, 2018; Lough & McIntyre, 2018). The solution-oriented news images have been proved to be effective in several studies. For example, Dahmen (2016) found that solution-orientated visuals focusing on recovery and community resilience contributed to audiences’ civic life and engagement. In communication, Sontag’s (2018) study about people’s perception of the mental health issue also revealed that the recovery frame visuals made participants desire to be like the model in the image and intent to take care of their mental health.

In this study, when the issue is visualized in the problem frame, the environmental problem is depicted from the perspective that emphasizes the problematic aspect of the issue by

the worrisome status or the sad consequences. By contrast, in the solution frame, visual messages emphasize the possible solutions to the problem and call for action to solve it. Specifically, on the issue of recycling, visual messages in the problem frame should emphasize the threats caused by waste pollutions and the disastrous consequences, whereas the solution frame will demonstrate what people can do to improve this situation, and what the reality will be like when the problem is solved.

Based on the argument of visual frames, it can be concluded that the use of visual messages in different frames (i.e., the problem frame and the solution frame) may influence viewers' perceptions and attitudes regarding the involved issue. Then, how does this change happen? What is the mechanism behind the exposure to visual messages and the consequent effects? Scholars have found that emotions, or sometimes called more generally, affective responses, play a key role in this process.

### ***The Mediating Role of Affect in Visual Communication***

Affect, sometimes called affective responses or emotions, have been proved to be an important mediator in the relationship between visual exposure and perception, attitude change, and engagement (e.g., Batra & Ray, 1986; Derbaix, 1995; Flemming et al., 2018; Skurka et al., 2018). In this part, I will review some studies involving affect in the visual communication and the role of affect in the situational theory of publics.

In Sontag's (2018) study about people's response to visual messages about mental health in different frames, she found that participants who viewed messages with the visual frames of recovery reported greater positive affect and increased aspiration to be like the models in the visuals, while those who viewed suffering-related visual frames reported greater negative affect

and decreased aspiration to be like the models. Positive affect mediated the relationship between recovery-related visual frames and aspiration.

Skurka et al. (2018) investigated the effectiveness of fear or humor appeals in videos to influence publics' affective responses, perceived risk, and behavioral intention on the climate change issue. They also discussed the benefits and tradeoffs of different emotional appeals. They found that people's affective responses were elicited by the visual messages in both emotional appeals. Viewing the fear or humor appeal both produced greater climate change activism intentions, but only the fear appeal directly affected risk perceptions. Mediation analyses highlighted tradeoffs for fear and humor appeals. So, affect is an important outcome of people's exposure to visual messages and plays various roles in influencing their attitudes and behavioral intention.

Moore and Yang (2019) conducted an experiment to test the impacts of eco-guilt and empathy on people's intention to protect the environment through a video game setting. They found that both eco-guilt and empathy significantly predicted participants' environmental behavioral intention. Besides, exposure to a trailer for the video game increased environmental behavioral intention among adult participants who reported less pro-environment attitude. Their study revealed the effectiveness of moral affective responses triggered by visuals in influencing people's environmental protection intentions. Also, visuals were particularly effective among individuals who normally do not recognize the problem well.

Journalism research on visuals has also revealed the interplay of the audience's affective responses and cognitions influenced by visual messages. For example, Brantner et al.'s (2011) study compared human-interest versus political visual frames in news stories about the 2009

Gaza conflict and found that human-interest frames elicited stronger affective responses and higher evaluation of communicative quality. Pfau et al. (2006) found that visual frames in war stories that emphasized war casualties elicited stronger negative affect toward the war, and then led to the news audience's decreased support for the U. S. military presence in Iraq. Other scholars revealed that news visual frames that focused on the causes of certain negative events, such as diseases and traffic accidents, increased the audience's risk perceptions (e.g., Fahmy et al., 2006; Edwards, 2002; Gibson & Zillmann, 2000; Zillmann et al., 1999). Besides, negative visual frames in news stories about social protests that emphasized violence as a result of the protests produced feelings of negativity toward the reasons behind the protests (e.g., Arpan et al., 2006).

In recent years, scholars (e.g., Aldoory et al., 2010; Aldoory & Grunig, 2012) have been exploring the role of affect in influencing people's problem recognition and constraint recognition. One early study examining the effects of affect on publics in the situational theory of publics was Roser and Thompson's (1995) study. In their study, they found that affective responses mediated information receivers' responses to a fearful message, and then lead to the increase of publics' issue involvement and behavioral intention. In Aldoory and Grunig's (2012) qualitative interviews, they revealed the rise and fall of hot-issue publics. The results of this study showed that latent and aware publics who feel anxiety and fear about an issue tend to care more about the media coverage of this issue and perceive the issue as more personally relevant. These findings confirmed that affect could be associated with the independent variable(s) in the situational theory of publics.

## **Affect as A General Concept in Visual Communication**

In studies investigating the effects of visual messages, the terms of emotion and affect (or affective response) were blurrily used. Some scholars examined the impacts of discrete emotions (i.e., fear, anger, guilt, empathy) on attitudes and behavioral intentions. However, other scholars adopted more general terms: negative or positive affect (i.e., affective responses), and explored how they changed people's attitude or behavioral intentions. Next, I will review different approaches to studying and conceptualizing affect and analyze why to conceptualize this concept as general affect, instead of emotion, in this study.

Watson and Spence (2007) summarized three research approaches of affect (which they called emotion) on people's reactions: categories, dimensions, and cognitive appraisals. The categories approach classified affect based on their similarities and explored the association between these groups of discrete emotions and the corresponding reactions (e.g., attitude toward advertisement). However, the categories approach did not determine the causes of the affective responses while simply describing the correlation between discrete emotions and the responding actions. The dimensions approach relied on valence and arousal to differentiate affective responses. Specifically, there were two dimensions of affect: valence, and arousal. Valence describes whether the affective response was positive or negative, while the level of arousal could range from high to low. Although the dimensions approach seemed too parsimonious, Watson and Spence suggested that it was difficult to distinguish between discrete emotions of similar valence and arousal levels, such as the highly negative feelings of shame, fear, and anger. The cognitive appraisals approach offered a more in-depth method to examine the subtle nuances

of emotions, which aimed to predict what discrete emotions should be elicited in a given context as well as how these affective responses should influence people's behaviors.

In recent years, in the studies related to affect, discrete emotions (e.g., anxiety, anger, fear, guilt) are commonly examined separately (e.g., Chon & Park, 2019a; Liu et al., 2019; Moore & Yang, 2020; Xie et al., 2010), and these emotions have been proven to be effective in influencing individuals' perceptions and behavioral intentions in various contexts. However, in these studies, different emotions played similar roles. These discrete emotions may share similarities in their relationship with the involved issue. Besides, some scholars adopted more general concepts to describe people's affective responses to issues, such as negative emotions (e.g., Shin & Han, 2016), negative affect (Cooper & Nisbet, 2016), and affective injustice (e.g., Chon & Park, 2019b). In this study, I followed the dimensions approach and classify people's discrete emotions into positive and negative affect, and gauged the levels of positivity and negativity.

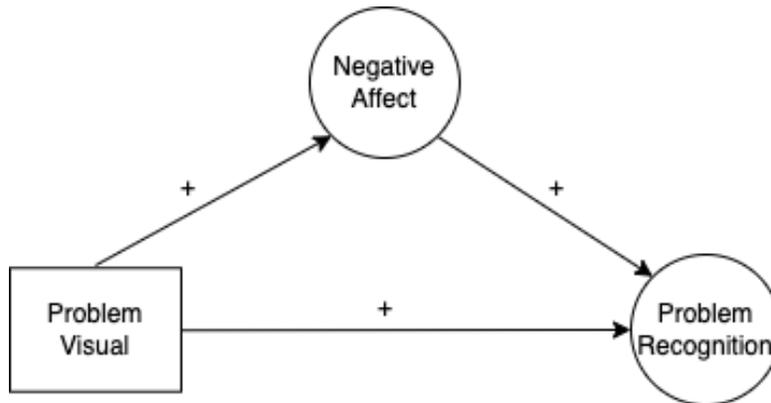
In the context of visual communication, because of the interpretative nature of individuals' sense-making of visual information, visuals may not necessarily elicit a certain discrete emotion in different viewers. Besides, in the situational theory of publics, the conceptualization of problem is general. This has determined that publics' emotions involved in the problem-solving process heavily depend on the specific problem. Among the limited number of studies about the role of affect in the situational theory, most of them proved that discrete emotions involved in the studies were positively related to publics' situational motivation in problem-solving, whatever the emotion was. For example, in different problematic situations, scholars explicitly examined the role of discrete emotions in the situational theory such as fear

(Chon & Park, 2019a), anxiety and anger (Shin & Han, 2016). However, in Chon and Park's (2019b) another study related to the situational theory (in the context of social media activism), they constructed a new variable, affective injustice, to describe publics' emotional experience about the issue, and found affective injustice effectively predicted publics' social media activism (i.e., active and passive communication), and publics' social media activism was positively associated with their offline activism intents (i.e., behavioral intention). Different from fear and anxiety, affective injustice is a more general emotion. Therefore, it is still not clear whether the impacts of discrete emotions (e.g., fear, anger) on publics' communicative and behavioral intentions were substantially different. Also, considering that different framed visual messages, instead of discrete emotions, is the protagonist of this study, and that visual messages have an interpretative nature, this study will employ the general terms, affect (i.e., positive and negative affect), to explore the mechanism of visual messages' effects on people's situational perceptions.

Based on the analyses of visual frames, the mediating role of affect (or affective response), and affect as a general concept, two hypotheses are proposed below. Figures 1 and 2 show the path diagram proposed in H1 and H2.

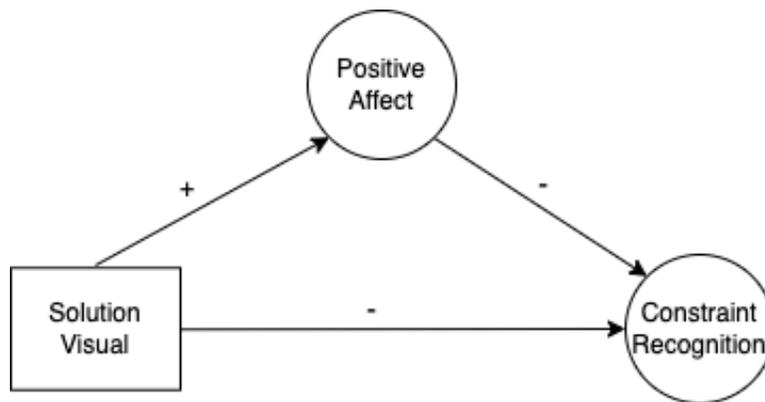
H1: A visual message in the problem frame will induce people's negative affect, and negative affect is positively associated with people's problem recognition.

Figure 1. *Path Diagram of the Mediation Analysis of H1*



H2: A visual message in the solution frame will induce people's positive affect, and positive affect is negatively associated with people's constraint recognition.

Figure 2. *Path Diagram of the Mediation Analysis of H2*



### **Affect as A Predictor of Information Seeking and Processing**

In recent years, more studies have been conducted in the framework of the situational theory of problem-solving (STOPS), while the core structures of STP and STOPS are the same. Scholarly findings in STOPS have provided evidence that emotions may influence people's communication motivations and actions. In Shin and Han's (2016) study, they confirmed the role of negative emotions in the situational theory of problem-solving. On the sex crime issue in South Korea, Shin and Han found that publics' negative emotions had a meaningful effect on

people's situational motivation of problem-solving and the consequent communicative action. Similarly, Chon and Park (2019a) found that individuals' negative affect (i.e., fear) about a public health issue positively predicted their communicative actions (i.e., information acquisition and information transmission) and willingness to follow the CDC's instructions to cope with the issue. In the same year, their (Chon & Park, 2019b) study about social media activism confirmed that individuals' affective injustice effectively predicted publics' social media activism and offline activism intents. Another related study examining the role of affect in the situational theory was Kim and Hong's (2021) study, in which they tested the impacts of anger and fear on publics' situational motivation in problem-solving and information behavior, and confirmed fear as an effective predictor while anger was not. So, it has been evident that publics' affect about an issue can be a factor that influences people's subsequent communicative actions.

Other theoretical frameworks have also reflected the potential role of affect in influencing people's communicative and behavioral intentions, such as the appraisal theories of emotion (e.g., Lazarus, 1991, 2001), risk information seeking and processing (RISP, Griffin et al., 1999), and the planned risk information seeking model (PRISM, Kahlor, 2010). The appraisal theories of emotion suggest that individuals' emotional responses to events emerge from their cognitive appraisal of a situation, and these affective responses impact their behavior in line with the emotions' appraisal themes (Raghunathan & Pham 1999; So et al. 2015). According to the RISP model (Griffin et al., 1999), people's risk perception will influence their affective responses, which positively predict active information seeking. Research findings showed that negative affective responses change people's information behaviors directly or indirectly through the perception of information insufficiency (Griffin et al., 2008; Yang & Kahlor, 2013). Similarly, according to PRISM (Kahlor, 2010), scholars found significant relationships between affect and

information seeking intent regarding personal health risk, and between affect and perceived knowledge insufficiency. More recently, based on PRISM, Hubner and Hovick (2020) assessed Zika virus-related information behaviors and found people's affective risk response effectively (i.e., worry, anxiety, and fright) predicted their information seeking intention.

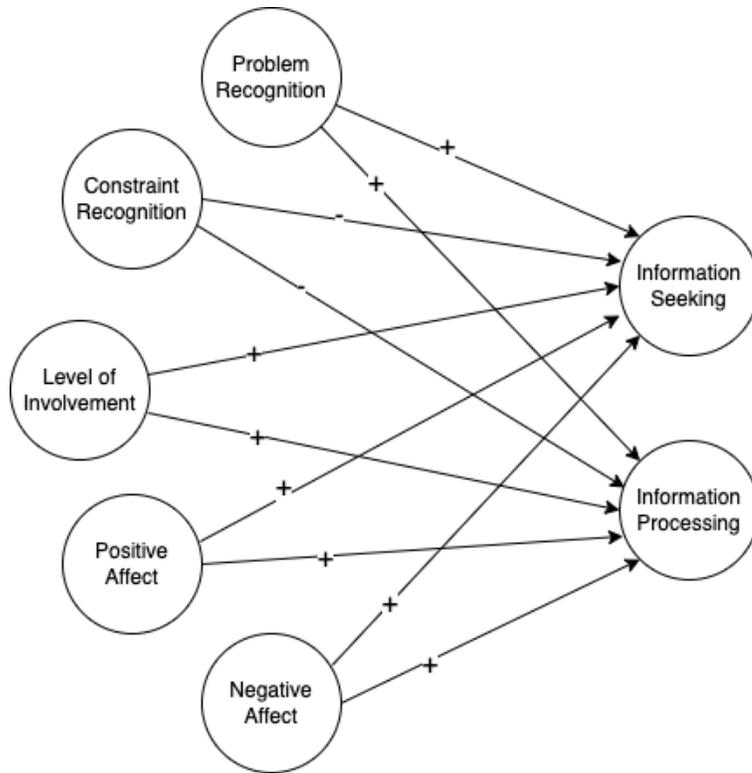
These findings provide empirical evidence for the ubiquitous covariances between people's affective responses to issues, information seeking and processing, providing research foundation for the development of the situational theory of publics. Based on the argument of the predicting role of affect in peoples' subsequent behaviors, this study proposes that that participants' affective responses to the visual information will positively predict their communication behaviors (i.e., information seeking and information processing). Affect should be a significant addition to the model of the situational theory of publics. Based on these arguments, the hypotheses below are proposed to test the original STP model and examine the role of affect as another predictor of participants' information seeking and processing intents. The diagram (See Figure 3) shows the paths and the developed model of H3-H6.

H3: Problem recognition (H3a) and level of involvement (H3b) are positively associated with people's information seeking intention, and constraint recognition (H3c) is negative associated with people's information seeking intention.

H4: Problem recognition (H4a) and level of involvement (H4b) are positively associated with people's information-processing intention, and constraint recognition (H4c) is negative associated with people's information-processing intention.

H5: Affective responses elicited by visual messages are positively associated with people's information seeking (H5a) and information processing (H5b) intentions.

Figure 3. *Path Diagram of the Addition of Affective Responses to the STP Model*



As argued above, affective response should be a significant addition to the STP model and meaningfully develops the original STP model. Thus, this study proposed the hypothesis below.

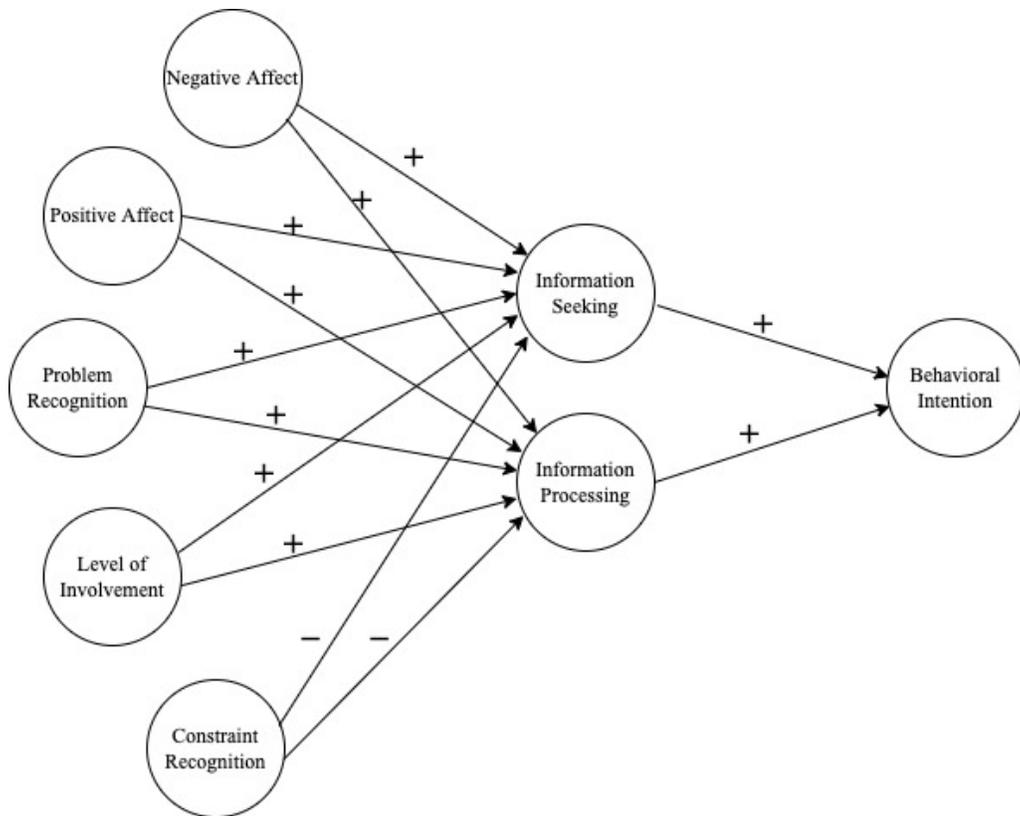
H6: The construct of affect (both negative and positive), problem recognition, constraint recognition, and level of involvement in an issue, explain significant more variances in people's active and passive communication behaviors, than the variances explained by problem recognition, constraint recognition, and level of involvement in an issue.

In addition, in the studies involving the situational theory and risk communication, information seeking and processing are commonly related to the behavioral intention to take protective or advocated actions. In several of their studies, Chon and Park (2019a, 2019b) have

confirmed the positive relationship between people’s communicative actions and behavioral intentions to take action (e.g., follow the government’s guidance, participate in social activism). Therefore, the hypothesis below is proposed. Figure 4 depicts the comprehensive model with the additions of affect and behavioral intention to take advocated action into the original STP model.

H7: People’s information seeking intention (H7a) and information processing intention (H7b) are positively associated with their behavioral intention to take advocated action.

Figure 4. *Comprehensive Model Combining Affective Responses and Behavioral Intention into STP*



**Perceived Visual Effectiveness as A Moderator**

As discussed in the literature regarding the interplay of affective response and communicative actions, individuals’ sensemaking of visuals has an interpretive nature and how individuals subjectively perceive and evaluate the visual message may vary. The difference in individuals’ evaluation of visual messages can be a factor that influences one’s subsequent

communicative and behavioral intentions regarding the theme of the visual messages. Scholars have created a concept to theorize this potential influence, perceived message effectiveness (PME). PME is theorized as audience's perception of whether candidate messages will or will not achieve their objectives (e.g., Baig et al., 2018; O'Keefe, 2018). Scholars have revealed that the perceived message effectiveness can be a positive predictor of the actual effectiveness of the message (e.g., Davis & Duke, 2018; Dillard et al., 2007; Nabi, 2018; Noar et al., 2018a; Zhao et al., 2020). Furthermore, scholars have found that messages varying in PME had predictable moderating effects on individuals' consequent behaviors regarding the messages, such as memory (Lee & Cappella, 2013), visual attention (Sanders-Jackson et al., 2011), physiological responding (Kang et al., 2009), attitudes toward the ad and the brand, and purchase intention (Manuel et al., 2012). In the visual communication context, this concept is often modified to perceived visual informativeness. For example, King et al. (2014) suggested that perceived visual informativeness is a modifiable variable and it is an important variable to assist in the evaluation and testing of visual messages in campaign and intervention materials promoting informed decision making and behavior change. However, not much research has been conducted to test the effect of perceived visual informativeness on people's attitudes, decision-making, or behavior change on issues. In this study, perceived message effectiveness (adjusted to perceived visual effectiveness) should be examined as an important covariate. Meanwhile, perceived message effectiveness of the visuals may impact the strength of the relationships between information seeking and behavioral intention to take advocated action, and between information processing and behavioral intention to take advocated action. In other words, perceived visual effectiveness may be a moderator on the relationships between these variables.

Thus, the hypothesis was proposed to test the moderating role of perceived visual effectiveness in visual communication.

H8: Perceived visual effectiveness (PVE) is a moderator on the relationships between information seeking and behavioral intention to take advocated action (H8a) and between information processing and behavioral intention to take advocated action (H8b).

As analyzed in the literature review, people's visual information process is interpretative in its nature. To better understand how visuals influence people's problem recognition, constraint recognition, communicative and behavioral intention, this study plans to unpack participants' sense-making of these visual messages and provide qualitative support and explanation for findings in the hypotheses with results in participants' sense-making. A textual analysis was conducted to answer this research question.

RQ: How do people make sense of these visuals in different frames?

### **Hypotheses and Research Questions**

All the hypotheses and research questions are listed below.

H1: A visual message in the problem frame will induce people's negative affect, and negative affect is positively associated with people's problem recognition.

H2: A visual message in the solution frame will induce people's positive affect, and positive affect is negatively associated with people's constraint recognition.

H3: Problem recognition (H3a) and level of involvement (H3b) are positively associated with people's information seeking intention, and constraint recognition (H3c) is negative associated with people's information seeking intention.

H4: Problem recognition (H4a) and level of involvement (H4b) are positively associated with people's information-processing intention, and constraint recognition (H4c) is negative associated with people's information-processing intention.

H5: Affective responses elicited by visual messages are positively associated with people's information seeking (H5a) and information processing (H5b) intentions.

H6: The construct of affect (both negative and positive), problem recognition, constant recognition, and level of involvement in an issue, explain significant more variances in people's active and passive communication behaviors, than the variances explained by problem recognition, constraint recognition, and level of involvement in an issue.

H7: People's information seeking intention (H7a) and information processing intention (H7b) are positively associated with their behavioral intention to take advocated action.

H8: Perceived visual effectiveness is a moderator on the relationships between information seeking and behavioral intention to take advocated action (H8a) and between information processing and behavioral intention to take advocated action (H8b).

RQ: How do people make sense of these visuals in different frames?

## CHAPTER 3: METHOD

To test the proposed hypotheses and answer the research questions, I conducted a between-subjects experiment. The experimental manipulations were embedded in an online survey using Qualtrics. The research question was exploratory, so it was answered using qualitative textual analysis. This chapter provides the measurement, sampling and participants, procedure, the plan of data analysis, and validity of the study.

### **Measurements**

#### *Independent Measures*

The frame of the visuals in the messages was the independent variable. The frame of the visuals was operationalized into two different types: the problem-frame and the solution-frame. For a control, I used what I call informational visuals. The informational visuals in this study the basic information about the issue, without using visual framing strategy (i.e., problem and solution).

The researcher selected photos for the two experimental conditions--the problem frame condition and the solution frame condition--and a control group. I downloaded 300 photos in the two frames (i.e., problem and solution) and the control condition (100 for each) of an environmental problem using keywords in a Google image search. The keywords included “waste pollution,” “plastic pollution,” “recycling,” and “plastic recycling,” to name a few. The visuals were from environmental problem news, environmentalism campaign websites, and/or related advocacy organization websites. Starting from extensive search assured the ecological validity of these visual messages.

Next, I narrowed the selection to 14 visuals for the two treatment conditions that depicted the problem or the solution to this issue. Five raters evaluated 42 images. For each image, raters responded to two statements to evaluate the image, with a 7-item Likert scale to indicate 1=Strongly disagree to 7= Strongly agree: “This image emphasizes the seriousness of the environmental problem of waste pollutions; this image emphasizes the solution to the environmental problem of waste pollutions.” At last, two problem-framed images and two solution-frame images with the highest scores of each category were selected. Two images with low scores of both categories were selected for the control group. The reason I used two informational images for a control group instead of simple texts or blank images was to rule out the explanation of pictorial superiority (if simple texts were used) or simple information exposure (if blank images were used). The same amount of exposure to informational images for participants in the control group would ensure that the effects on participants’ problem recognition, constraint recognition, and subsequent communicative and behavior intentions, should be caused by the different visual frames. Zhao and Fink’s (2020) study about the boomerang effect of persuasion supported my control design. In their study, participants in the control conditions were informed of the status of the issues in the study (i.e., legal drinking age, marriage age). These messages in their control condition did not use any persuasive strategy, but the participants still obtained the basic information related to the issues, which set the baseline to test the effects of the message design strategies.

Next, I tested the effectiveness of the visual frames in another 50 raters to test the validity of the manipulations. These raters read the same two statements after viewing each of the six visuals. Table 1 shows the result of the six visuals in the two different frames.

Table 1. *Mean ratings for problem-framed and solution-framed images*

Image	Problem Frame	Solution Frame
	Mean (SD)	Mean (SD)
Problem Image 1	6.321 (1.182)	2.901 (1.356)
Problem Image 2	6.475 (1.068)	2.766 (1.276)
Solution Image 1	2.326 (1.734)	6.067 (1.988)
Solution Image 2	2.477 (1.525)	5.973 (1.825)
Control 1	2.578 (1.329)	2.938 (1.775)
Control 2	2.794 (1.558)	2.880 (1.811)

To prevent the possibility that some participants might have viewed these visuals previously, I worked with a visual designer to adjust these visuals to new ones while keeping the original themes, styles, and elements of these selected six images. At the same time, no textual messages (e.g., slogans) were included to avoid potential interference by texts. The only texts in the visual messages were the name of the fictitious organization called “Clean the Planet” in the icon and a website address located at the bottom of these visuals. The logo and website address were kept in the message to assure face validity (Gravetter & Forzano, 2012) of the messages and were located at the same positions for all visuals, with the same color and size.

The six visual messages were presented in the form of public service announcements (PSAs). A logo of a fictitious environmental non-government organization (“Clean the Planet”) was inserted into the corner of each image. In the problem-frame condition, the first image depicted the waste pollution floating on the sea. The second visual showed that waste pollution had ruined the living environment of ocean lives. In this visual, a sea lion was trapped by the trash in the sea, looking painful and desperate. In the solution-frame condition, the first image

showed an airplane recycled from soda cans. The second solution-framed visual showed some beach tables and chairs made of plastic water bottles. In the control group, the first visual presented some empty plastic water bottles, and the second visual showed some empty soda cans. There was no implication as to whether these bottles and cans would be dumped or recycled.

### ***Dependent Measures***

**Problem Recognition.** The measure of problem recognition was from Chen et al.'s research (2017). Four items are used to measure problem recognition: (1) I feel the waste pollution issue is a serious social and national problem. (2) The government and related institutes should take the waste pollution issue more seriously and take action. (3) Something should be done immediately to improve the waste pollution issue. (4) I see a huge gap between what it should be and what it is now about the waste pollution issue.

**Constraint Recognition.** The three items to measure constraint recognition were adjusted from measures of constraint recognition (e.g., Jiang et al., 2017) to fit the issue of waste pollution: (1) I feel my daily efforts can help in resolving the waste pollution issue. (2) I believe my recycling actions matter to the waste pollution issue. (3) I can make a difference in the way the waste pollution issue is solved.

**Information Seeking Intention.** The measure of individuals' active communication (information seeking) intention was adapted from Jiang et al.'s (2017) study. In their measure of comitative actitation in problem-solving (CAPS), items emphasizing the active communitive (i.e., information seeking) were selected and adapted to the context of this study. As a result, information seeking intention was measured by these four items: (1) I would like to search for

more information about the waste pollution issue online. (2) I intend to read news articles or postings related to the waste pollution issue. (3) I would like to spend some time and effort knowing more about the waste pollution issue (i.e., the status, causes, solutions). (4) I will actively discuss the waste pollution issue with others.

**Information Processing Intention.** The measure of individuals' passive communication (information processing) intention was also adapted from Jiang et al.'s (2017) study. Similarly, in their measure of comitative actitation in problem-solving (CAPS), items emphasizing passive communication (i.e., information processing) were selected and adapted to the context of this study. Therefore, individuals' passive communication (i.e., information processing) intention was measured by four items: (1) These visuals make me think thoroughly about the waste pollution issue. (2) If I see these kinds of visual messages somewhere else, I will stop and think about the waste pollution issue. (3) If I see these kinds of visual messages on social media, I intend to share them with others. (4) If I see these kinds of visual messages on social media, I intend to click the "like" button.

**Behavioral Intention to Take Advocated Action.** Individuals' behavioral intention to recycle was measured by three items, adjusted from Dahmen et al.'s (2019) study: (1) I would like to try my best to sort and recycle in my life from now on. (2) I'd like to be a volunteer to improve the waste pollution issue. (3) I will encourage others (i.e., family and friends) to sort and recycle in their daily life.

### ***Mediator***

**Affect.** As argued above, this study did not examine participants' discrete emotions elicited by visual messages. Instead, their emotions were measured and examined as affective

responses. Taking the dimensions approach (two dimensions: valence and intensity) of emotions, I measured participants' affective responses to the visual messages in two valences (positive and negative) and the intensity of the affective responses. Thomas and Diener's (1990) measure of affective response was used. Participants were asked to rate their affect when viewing the visual message on 7-point scales with five positive and five negative affective terms (i.e., positive: happy, joyful, pleased, fun, hopeful; negative: sad, upset, guilty, angry, worried). Several negative terms were slightly adapted based on the findings related to affective responses in environmental communication studies.

### ***Covariate Measures***

Earlier studies of the situational theory of publics (e.g., Aldoory, 2001; Hamilton, 1992) have shown the relationship between the situational variables and participants' personal characteristics such as one's lifestyle, media use, and demographics. Thus, several covariates were measured in this study.

**Level of Involvement in the Waste Pollution Issue.** One important covariate was one's level of involvement in the waste pollution issue. An individual's involvement in an issue is a factor that can influence one's perception of that issue, as well as the consequent communicative and behavioral intentions when one is exposed to information related to this issue. For example, in their study of how publics interpret visual messages of hydraulic fracturing, Krause and Bucy (2018) found that people's existing opinion on this issue (support, opposition, or indecision about fracking) segmented them into different groups and shaped their interpretations of environmental risk and economic benefit. Thus, it is reasonable to predict that individuals who firmly believe in the seriousness of waste pollution (which means they believe this issue is of

great importance) would respond to the visual message about the waste pollution problem differently from those who do not care about this issue. Therefore, one's level of involvement in the waste pollution issue should be a meaningful covariate to explore. Considering that the waste pollution issue was not a controversial one, the measure of involvement was slightly different from the commonly used one in the situational theory studies. This study adopted Zaichkowsky's (1985, 1994) measure of involvement to measure individuals' level of involvement in this environmental issue. Individuals' level of involvement in the waste pollution issue was measured by four items: (1) In my daily life, the waste pollution issue is important to me. (2) In my daily life, the waste pollution issue is of concern to me. (3) In my daily life, the waste pollution issue is relevant to me. (4) In my daily life, the waste pollution issue means a lot to me.

**Environmental Engagement.** In their study, Jiang et al. (2017) found a significant relationship between individuals' communication behaviors and the actual environmental engagement. Therefore, one's lifestyle may correlate with people's information processing and seeking. Another example is that Andrews et al.'s (2014) studies about the effectiveness of graphic visual health warnings (smoking) revealed that the effects of these visual warnings were attenuated for those who smoked the most. Thus, individuals' current lifestyle related to recycling may play a meaningful role in influencing their information processing and behavioral intention changes after viewing the visual messages. So, participants' environmental engagement related to recycling was measured as another covariate. The measure of recycling engagement behavior was adopted from Jiang et al.'s (2017) measure of environmental engagement: In the past 12 months, how often did you sort and recycle in your daily life?

**Perceived Visual Effectiveness.** To rule out the impact of other aspects of visuals (e.g., vividness, style, etc.) on the outcome variables, I measured participants' perceived visual effectiveness and treated it as a covariate in the multiple regressions, and as a moderator in the relationships between information seeking and the behavioral intention to take advected action, and between information processing and the behavioral intention to take advected action. Perceived visual effectiveness was measured by these four items developed by Noar et al. (2018) and Cappella (2018): (1) These visual messages are convincing. (2) These visual messages are effective. (3) These visual messages are compelling. (4) These visual messages are vivid.

**Demographics.** Individuals' demographics, including age, education, ethnicity, gender, were measured as covariates.

The research question about the sense-making of the visual messages was answered in three open-ended questions at the end of the survey, separately about participants' affective response, interpretation, and evaluation of the visual messages. These responses could not only provide qualitative evidence to support the findings in the previous hypotheses and research questions, but also could reveal participants' nuanced understanding of these visuals, which should be beneficial for strategic communication practice, especially for the visual message design. These open-ended questions were: (1) Please tell me your feeling(s) when viewing these visuals. (2) How do you interpret the meaning of these visuals? (3) Overall, how do you evaluate this public service announcement (PSA)?

### **Participants and Sampling**

63 participants were recruited on MTurk for the pilot study. I scrutinized participants' geographical information in the pilot study and found some potential bias of participants'

nationality. The majority of participants had highly homogeneous IPs in India. Other scholars (e.g., O'Brochta & Parikh, 2021) have noticed and discussed anomalous responses from India on MTurk. Considering that nationality can be a factor that influence people's environmental engagement and behaviors (e.g., Eeden et al., 2020), I changed the sampling frame of the main study, in which I required all participants to be in the United States. This change should be proper because the situational theory of publics was established in the western context. The pilot study opened on November 15, 2021 and closed on November 17, 2021.

In the main study, I recruited another 600 effective participants from the United States (639 in total, with 39 rejected). Each participant from MTurk was provided with \$1.5 as an incentive for participating. However, I rejected those responses under these circumstances: a. completed at an unrealistic pace (less than 2 minutes), b. multiple responses using the same IP or longitude and latitude, c. answers in the open-ended questions being completely irrelevant; d. highly similar choices across all the questions in a single response (e.g., all "strongly agree"). MTurk's participation policy ensured that each participant did not take the survey more than once. The full-scale study was opened on January 10, 2022 and closed on January 20, 2022. The Institutional Review Board at the University of Maryland, College Park, granted approval for study procedures.

Study participants (N=600) ranged from 18 to 74 years old (M=37.69, SD=11.70) and consisted of 46.2% females. Caucasian/White made up 68.3% of the sample, followed by 11.8% Asian/Pacific Islander, 8.2% Hispanic/Latino, 7.7% African American, 0.8% Native American or American Indian, and the remaining 3.2% consisted of other races (See Table 2).

Table 2. *Participant demographics (N=600)*

	% (n)
Age (year)	
Mean (SD)	37.69 (11.70)
Sex	
Female	46.2 (277)
Male	53.8 (323)
Ethnicity	
African American	7.7 (46)
Asian/Pacific Islander	11.8 (71)
Caucasian/White	68.3 (410)
Hispanic/Latino	8.2 (49)
Native American or American Indian	0.8 (5)
Other	3.2 (19)
Education	
Some high school, no diploma	0.8 (5)
High school, with diploma	0.5 (3)
Some college credit, no degree	7.1 (43)
Associate degree	12.8 (77)
Bachelor's degree	52.8 (317)
Master's degree	19.5 (117)
Professional degree	3.3 (20)
Doctorate degree	3.0 (18)

## Procedure

After reading and accepting the consent form, all participants were randomized into one of the two conditions and the control group (problem-framed, solution-framed, and control). After answering the questions of their level of involvement in waste pollution, participants viewed the two visuals in their assigned condition. The two visuals were randomly displayed for each participant in the two treatment groups to rule out the effect caused by the order. Previous studies (e.g., Powell et al., 2015) have demonstrated that 30 seconds is long enough for participants to process the stimuli message and short enough to prevent fast readers from being frustrated. Therefore, in this study, both visuals in the treatment condition (i.e., problem frame and solution frame) and the control group were displayed on the screen for 30 seconds before

processing (60 seconds in total) to the next page. Next, participants answered all the items that measure the dependent variables and covariates: problem recognition, constraint recognition, affect, information seeking, information processing, behavioral intention to take advocated action, environmental engagement (recycling), perceived visual effectiveness, and demographics. At the end of the study, three open-ended questions were displayed for participants.

### **Data Analysis**

To test hypotheses 1 and 2, I conducted two mediation analyses, using PROCESS (Hayes, 2022) in SPSS, with bootstrapping of 5,000. The independent variable (X) was categorical (3 categories), and the mediator (M) and outcome (Y) were both continuous. Covariates in the relationship between the mediator and outcome included age, gender, education, ethnicity, level of involvement, and perceived visual effectiveness.

One structural equation model (SEM) was built to test hypotheses 3 and 4 (the original STP model). Another SEM model was created to test hypothesis 5, including negative and positive affect into the original model as new predictors of information seeking and processing. To test hypothesis 6, the original STP model in H3 and H4 was compared with the new SEM model created in H5. These two nested SEM models were compared by the chi-square test.

One OLS multiple linear regression was conducted in SPSS to test hypothesis 7 (covariates: age, gender, education, ethnicity, level of involvement, perceived visual effectiveness), separately revealing the association between information seeking and people's behavioral intention to take advocated action (H7a), and the association between information processing and people's behavioral intention to take advocated action (H7b).

To test hypothesis 8, two moderation analyses were conducted to examine the moderating role of perceived visual effectiveness (PVE) in associations between information seeking and behavioral intention, and between information-processing and behavioral intention.

To answer the research question, participants' responses in the open-ended questions were analyzed through textual analysis. The textual analysis aimed to further explore participants' emotional expression regarding the visual messages, their understanding and interpretation (i.e., sense-making) of the visual messages, and the evaluation of the visual messages. First, the textual analysis provided a summary of the themes of participants' interpretation of the visuals in the two treatment groups. Next, these themes and responses were analyzed to reveal how participants' sense-making of these visual messages reflected and explained the findings in the previous hypotheses and model. At last, I conducted some exploratory analysis to reveal extra interesting findings from participants' sense-making. In this process, I used Linguistic Inquiry and Word Count (LIWC) 2022, a tool for text analysis, to assist with textual analysis (especially for sentiment analysis).

## **Validity**

Validity refers to the approximate truth of an inference (Shadish et al., 2002). In experimental designs, there are four types of validity: internal validity, external validity, static validity, and construct validity.

Internal validity refers to inferences about whether the observed covariance between A and B reflects a causal relationship from A to B in the forms where the variables are manipulated and measured (Shadish et al., 2002). Mill claimed that the existence of causal inference should meet these three conditions: the cause precedes the effect; there is covariance between the cause

and the effect, and rival explanations of the cause-effect relationship are eliminated (Holland, 1986). In this study, all three conditions were met because the randomization of the assignment of participants in different groups ruled out the systematic differences in participants' level of involvement, affect, and other demographics. As a result, the differences in their affective responses in the post-test were due to the exposure to the visual messages. However, expect the affective responses, the changes in other dependent variables (i.e., problem recognition, constraint recognition, information seeking, information processing, behavioral intention to take action) were not completely the effects of visual messages. These dependent variables could be influenced by other variables that were not randomly assigned in this study. For example, participants' problem recognition should be influenced by their negative affect, but the affect was not randomly assigned. Moreover, not all mediator-outcome covariates could be controlled in the study design. Thus, the part regarding the effect of visual messages on people's affect was causal, but the rest of hypotheses were about correlations between variables.

External validity means the inferences about the extent to which a causal relationship keeps valid over various persons, settings, treatments, and outcomes. It should be confident to confirm that the results hold in people in the United States because this study does not set special criteria for participants. However, Henrich and Norenzayan (2010) argued that samples in current social science research had a similar profile: participants are mostly from western, educated, industrialized, rich, and democratic (WEIRD) societies, which causes the lack of representativeness of studies using these samples. In this study, the participants may have similar characteristics to that of these WEIRD samples.

Statistical validity involves two related statistical inferences that affect the covariation component of causal inference. Specifically, they are: (1) whether the presumed cause and effect covary and (2) how strongly they covary. The statistical validity of this study can be assured by power analysis to calculate the minimum sample size required for good power and by using more samples than required. Besides, approximately equal size cell sample sizes will be used in this study because unequal cell splits may affect power when they exceed 2:1 (Pocock, 1983), and for some effects, unequal sample size splits can make the effect more powerful than it actually is (McClelland, 1997). In addition, well-developed items from other studies are used and adjusted properly to this study. Good measurement can improve statistical validity.

Construct validity refers to the degree to which a test measures what it claims, or purports, to be measuring (Cronbach & Meehl, 1955). In this study, the key variable to be manipulated and measured is visuals in different frames: the problem frame and the solution frame. When designing the study, I fully explicated the meanings of the problem and solution in visuals representing social issues. With careful explication, I selected the proper images in the manipulation conditions. Also, texts are removed from the visuals to rule out the potential confounding factors. Other threats to construct validity are carefully checked to secure the construct validity. Furthermore, the experimental treatment materials (the six images) have been evaluated by 50 raters, which ensures that these visuals effectively present the two different frames of the waste pollution issue (i.e., problem and the solution), as well as the control condition.

## CHAPTER 4: RESULTS

### **Preliminary Analysis of the Pilot Study ( $n = 63$ )**

The aim of a pilot study is to ensure the feasibility of a design that is to be used in a larger scale study. Specifically, a pilot study helps scholars assess the feasibility of participant recruitment, assignment randomization, and the procedures (Leon et al., 2011). According to a report by NIH, the goal of a pilot study is not to test hypotheses about the effectiveness of a treatment (NIH, n.d.). Therefore, after the pilot study, I carefully checked the data and preliminarily analyzed the data to decide whether I should make changes in the main study. My evaluations consisted of these aspects: a. participant recruitment, b. feasibility of procedures, c. reliability of measurements, and d. effectiveness of manipulation.

Regarding the participant recruitment, I found a large proportion of participants from India. Also, the highly homogenous IPs, and longitude and latitude of responses showed some concerns about the integrity of MTurk workers' participation in this study. Scholars already noticed this phenomenon and expressed some concerns about this kind of anomalous responses on MTurk (O'Brochta & Parikh, 2021). Besides, considering that nationality may be a factor that influence people's perception and behavioral intentions on environmental issues (Eeden et al., 2020), I decided to recruit participants only from the United States. This minor change in the sampling frame should be acceptable because the recruitment of participants in the US is commonly seen in other communication studies. Besides, the situational theory of publics was created and developed mainly in the western context. Therefore, testing and developing the STP using data from the US should be feasible.

To ensure the feasibility of the procedures, I checked participants' responses in open-ended questions. I noticed that some participants did not answer these open-ended questions, or

randomly wrote something irrelevant (e.g., sentences irrelevant to this study or random numbers). Based on these findings from my observation, in the main study, I required the MTurk workers to have an approval rate of 95% or higher and clarified the criteria of response rejection in the consent form.

To test the reliability of measurements, I preliminarily conducted the confirmative factor analysis and calculated the Cronbach's alpha in SPSS. The results showed that the measurements of the involved variables had satisfactory reliability. The factor loadings of all items ranged from 0.78 to 0.97, and the Cronbach's alpha ranged from 0.79 to 0.96. Therefore, the measurement of the variables in this study was good enough for the full study.

To check whether the manipulation was successful, I conducted ANOVA tests to compare the means of affective responses induced by visuals in different groups. The result showed that the visuals in the problem group induced higher level of negative affect than that in the solution group and the control group. Similarly, the visuals in the solution group induced higher level of positive affect than that in the problem group and the control group. Thus, the manipulation should be successful (See Table 3). Moreover, to further improve the ecological validity of the visuals, after some discussion with the committee members, I made one minor change in the visuals: I added a website address at the same location of all the visuals in the main study. Besides, I added two questions to directly check the manipulation by asking participants to rate the degree they perceived the visuals to be about the problem or the solution.

Table 3. *Post Hoc Analysis of the Polit Study*

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Positive Affect	1	2	-3.14143*	.42693	<.001	-3.9954	-2.2874
		3	-1.92673*	.41687	<.001	-2.7606	-1.0929
	2	1	<b>3.14143*</b>	<b>.42693</b>	<b>&lt;.001</b>	<b>2.2874</b>	<b>3.9954</b>
		3	<b>1.21470*</b>	<b>.42217</b>	<b>.006</b>	<b>.3702</b>	<b>2.0592</b>
	3	1	1.92673*	.41687	<.001	1.0929	2.7606
		2	-1.21470*	.42217	.006	-2.0592	-.3702
Negative Affect	1	2	<b>2.75571*</b>	<b>.49655</b>	<b>&lt;.001</b>	<b>1.7625</b>	<b>3.7490</b>
		3	<b>2.09481*</b>	<b>.48485</b>	<b>&lt;.001</b>	<b>1.1250</b>	<b>3.0647</b>
	2	1	-2.75571*	.49655	<.001	-3.7490	-1.7625
		3	-.66091	.49102	.183	-1.6431	.3213
	3	1	-2.09481*	.48485	<.001	-3.0647	-1.1250
		2	.66091	.49102	.183	-.3213	1.6431

\*. The mean difference is significant at the 0.05 level.

### Manipulation Check of the Main Study ( $n = 600$ )

Manipulation check ensured that the experimental manipulations were successful. The manipulation check for this study consisted of two items, separately asking participants to rate the frames they perceived in visuals they viewed with the 7-point Likert scale. The one-way between-subjects ANOVA test and the LSD post hoc test to check the effectiveness of the problem-framed visuals revealed significant differences both between the problem condition ( $M = 6.393$ ,  $SD = 0.921$ ) and the control group ( $M = 3.998$ ,  $SD = 1.863$ ).  $F(2, 659) = 232.259$ ,  $p < 0.001$ . (See Table 4 and Figure 5). The mean difference between the problem condition and the control group was 2.395 ( $SE = 0.149$ ). Similarly, the one-way between-subjects ANOVA test and the LSD post hoc test to check the effectiveness of the solution-framed visuals revealed significant differences both between the solution condition ( $M = 5.108$ ,  $SD = 1.662$ ) and the

control group ( $M = 3.024$ ,  $SD = 1.807$ ).  $F(2,659) = 215.98$ ,  $p < 0.001$  (See Table 5 and Figure 6). The mean difference between the solution condition and the control group was 2.083 ( $SE = 0.153$ ). This meant participants correctly perceived, interpreted, or reacted to the stimulus. The experimental manipulation was successful.

Table 4. *Post Hoc Analysis of the Manipulation Check (Problem Frame)*

Dependent Variable: Problem Perception

LSD

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	3.071*	.150	<.001	2.78	3.37
	3	2.395*	.149	<.001	2.10	2.69
2	1	-3.071*	.150	<.001	-3.37	-2.78
	3	-.676*	.149	<.001	-.97	-.38
3	1	-2.395*	.149	<.001	-2.69	-2.10
	2	.676*	.149	<.001	.38	.97

\*. The mean difference is significant at the 0.05 level.

Figure 5. *Line Chart of the Problem Frame Manipulation*

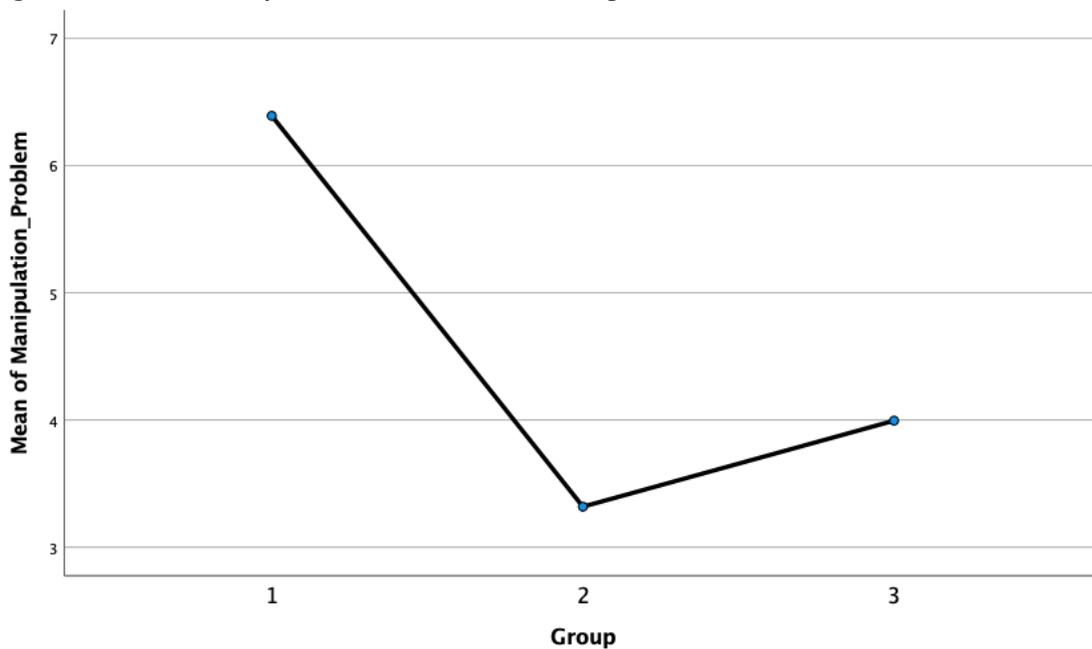


Table 5. *Post Hoc Analysis of Manipulation Check (Solution Frame)*

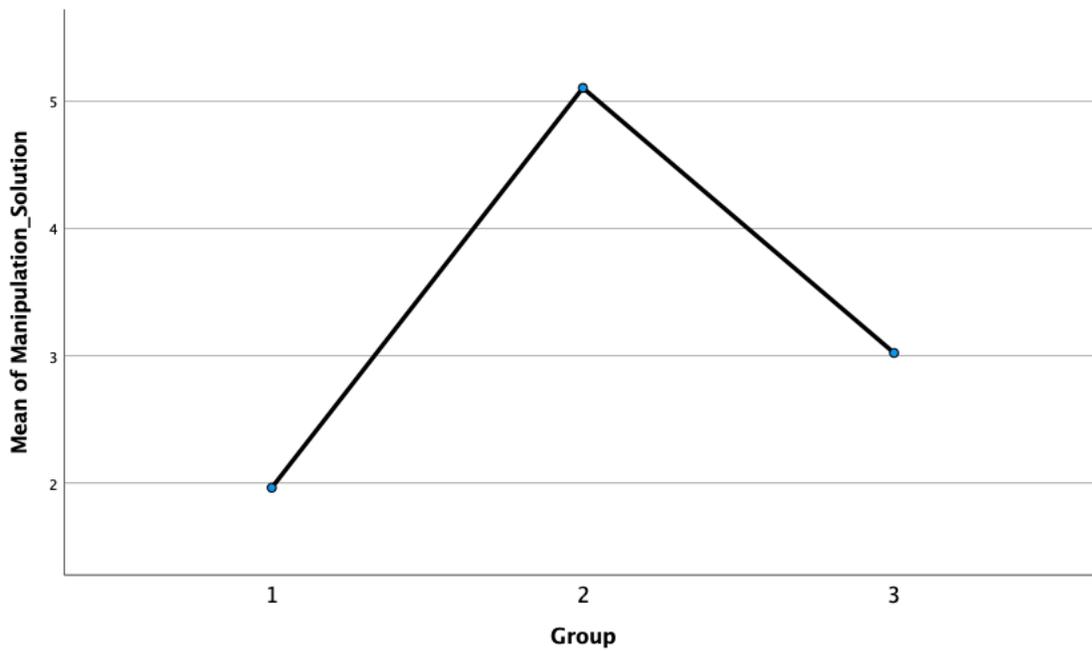
Dependent Variable: Solution Perception

LSD

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
1	2	-3.142*	.154	<.001	-3.44	-2.84
	3	-1.059*	.153	<.001	-1.36	-.76
2	1	<b>3.142*</b>	<b>.154</b>	<b>&lt;.001</b>	<b>2.84</b>	<b>3.44</b>
	3	<b>2.083*</b>	<b>.153</b>	<b>&lt;.001</b>	<b>1.78</b>	<b>2.38</b>
3	1	1.059*	.153	<.001	.76	1.36
	2	-2.083*	.153	<.001	-2.38	-1.78

\*. The mean difference is significant at the 0.05 level.

Figure 6. *Line Chart of the Solution Frame Manipulation*



## Principal Component Analysis for Affect

Two principal component analyses (PCA) were conducted to ensure participants' negative and positive affective responses elicited by visual messages were two components, instead of multiple discrete emotions. The PCA for the negative affect revealed only one component, which accounted for 81.83% of covariances in the measures. Similarly, the PCA for the positive affect showed one component accounting for 87.62% covariance in the measures. High loadings in the PCA results demonstrated that these original variables were highly correlated and belong to a single construct. When these 10 items were mixed, the principal component analyses with oblique rotation showed two distinguished components, which counted for 85.13% covariance in the total measures. This meant, in this study, participants' affective responses elicited by visual messages should be described by two components, namely, negative and positive affect. Table 6 and Table 7 showed the pattern matrix of the components, structure matrix of the components, and the correlation between the two components. The correlation between two components was -0.49.

Table 6. Principal Component Analysis of Affective Response: Pattern Matrix<sup>a</sup>

	Component	
	1	2
Happy	.955	-.012
Joyful	.970	.033
Pleased	.950	-.023
Fun	.921	-.006
Hopeful	.888	.028
Sad	-.139	.837
Upset	-.088	.898
Guilty	.181	.920
Angry	.002	.911
Worried	-.013	.925

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Table 7. *Principal Component Analysis of Affective Response: Structure Matrix*

	Component	
	1	2
Happy	.961	-.483
Joyful	.954	-.446
Pleased	.962	-.492
Fun	.924	-.461
Hopeful	.874	-.411
Sad	-.552	.906
Upset	-.531	.941
Guilty	-.273	.830
Angry	-.448	.910
Worried	-.469	.931

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

In addition, in other communication studies, negative and positive affective responses are treated as two distinct constructs (e.g., Ji, 2021). Therefore, in this study, negative affective response and positive affective response are analyzed as two components.

### **H1: Effect of Problem Framed Visuals on Problem Recognition**

H1 was supported. The mediation analysis with a categorical independent variable (three groups: problem, solution, control) was conducted with PROCESS in SPSS (Hayes, 2022). The result showed that when compared with solution frame visuals, problem frame visuals had no direct effect on participants' problem recognition. However, there was a relative indirect effect of visual frame (problem vs solution) on people's problem recognition, which was 0.181 (with 5,000 bias-corrected, bootstrapped CIs). When the covariates (i.e., gender, ethnicity, education, perceived visual effectiveness, level of involvement) were controlled, the coefficient between problem visual (vs solution visual) and negative affect was 2.7172 (SE = 0.1451,  $p < 0.001$ ), and the coefficient between negative affect and problem recognition was 0.0665 (SE = 0.0231,  $p < 0.05$ ).

Similarly, when compared with the visuals in the control group, problem frame visuals had no direct effect on participants' problem recognition. However, there was a significant relative indirect effect by visual frame (problem vs control) on people's problem recognition, which was 0.120 (with 5,000 bias-corrected, bootstrapped CIs). When the covariates (i.e., age, gender, ethnicity, education, perceived visual effectiveness, level of involvement) were controlled, the coefficient between problem visual (vs control group) and negative affect was 1.7965 (SE = 0.1669,  $p < 0.001$ ), and the coefficient between negative affect and problem recognition was 0.0665 (SE = 0.0231,  $p < 0.05$ ). The results were summarized in Table 8.

Table 8. *Direct, indirect, and total effects of problem visual frame on problem recognition*

Relative total effects of X on Y:						
	Effect	SE	t	p	LLCI	ULCI
X1 (Problem vs Solution)	.1789	.0814	2.1994	.0282	.0191	.3387
X2 (Problem vs Control)	.2175	.0936	2.3251	.0204	.0338	.4013
Omnibus test of total effect of X on Y:						
R <sup>2</sup> change	F	df1	df2	p		
.0064	3.2859	2	583	.0381		
Relative direct effects of X on Y						
	Effect	SE	t	p	LLCI	ULCI
X1 (Problem vs Solution)	-.0018	.1023	-.0179	.9857	-.2028	.1991
X2 (Problem vs Control)	.0980	.1018	.9628	.3361	-.1019	.2980
Omnibus test of direct effect of X on Y:						
R <sup>2</sup> change	F	df1	df2	p		
.0016	.8317	2.000	582.000	.4358		
Relative indirect effects of X on Y						
Problem Visuals → Negative Affect → Problem Recognition						
	Effect	BootSE	BootLLCI	BootULCI		
X1 (Problem vs Solution)	.1808	.0648	.0527	.3081		
X2 (Problem vs Control)	.1195	.0439	.0345	.2067		

Note: X1 = Problem vs Solution (1: problem visuals; 0: solution visuals), X2 = Problem vs Control (1: problem visuals; 0: control visuals), M= negative affective response, Y= problem recognition. Number of bootstrap samples for bias corrected bootstrap confidence intervals = 5,000. Level of confidence for all confidence intervals: 0.95. A bias-corrected bootstrap confidence interval does not include zero, indicating a significant mediator effect.

## **H2: Effect of Solution Framed Visuals on Constraint Recognition**

H2 was partially supported. The results from PROCESS showed that, when compared with problem frame visuals, solution frame visuals had no direct effect on participants' constraint recognition. However, there was a relative indirect effect by visual frame (solution vs problem) on people's constraint recognition, which was -0.223 (with 5,000 bias-corrected, bootstrapped CIs). When the covariates (i.e., gender, ethnicity, education, perceived visual effectiveness, level of involvement) were controlled, the coefficient between solution visual (vs problem visual) and positive affect was 2.9142 (SE = 0.1388,  $p < 0.001$ ), and the coefficient between positive affect and constraint recognition was -0.0765 (SE = 0.0355,  $p < 0.05$ ). This meant that positive affective response fully mediated the relationship between solution visuals (vs problem visuals) and constraint recognition.

Similarly, when compared with the visuals in the control group, solution frame visuals had a relative indirect effect by visual frame (solution vs control) on people's constraint recognition, which was -0.057 (with 5,000 bias-corrected, bootstrapped CIs). When the covariates (i.e., gender, ethnicity, education, perceived visual effectiveness, level of involvement, behavioral engagement) were controlled, the coefficient between solution visuals (vs control visuals) and positive affect was 0.7404 (SE = 0.1409,  $p < 0.001$ ), and the coefficient between positive affect and constraint recognition was -0.0765 (SE = 0.0355,  $p < 0.05$ ). However, in this comparison, there was a significant positive direct effect of solution visuals on participants' constraint recognition, which was opposite against the expectation ( $\beta = 0.402$ , SE = 0.1236,  $p < 0.05$ ). Thus, H2 was partially supported. The results were summarized in Table 9.

Regarding the unexpected direct effect in H2, the mediation analysis indicated that some important covariates might have not been controlled. It was risky to claim causal relationship

between positive affect and constraint recognition. Even, affect could be a collider, as a result influenced by both visual messages and problem recognition and constraint recognition.

Therefore, I would be cautious and conservative to conclude the potential causal relationship between visuals and people’s communication behaviors.

Table 9. *Direct, indirect, and total effects of solution visual frame on constraint recognition*

Relative total effects of X on Y:						
	Effect	SE	t	p	LLCI	ULCI
X1 (Solution vs Problem)	-.2776	.1194	-2.3255	.0204	-.5121	-.0432
X2 (Solution vs Control)	.3449	.1212	2.8461	.0046	.1069	.5829
Omnibus test of total effect of X on Y:						
R <sup>2</sup> change	F	df1	df2	p		
.0220	10.3176	2	583	.0000		
Relative direct effects of X on Y						
	Effect	SE	t	p	LLCI	ULCI
X1 (Solution vs Problem)	-.0547	.1577	-.3471	.7286	-.3645	.2550
X2 (Solution vs Control)	.4015	.1236	3.2476	.0012	.1587	.6443
Omnibus test of direct effect of X on Y:						
R <sup>2</sup> change	F	df1	df2	p		
.0146	6.8609	2.000	582.000	.0011		
Relative indirect effects of X on Y						
Solution Visuals → Positive Affect → Constraint Recognition						
	Effect	BootSE	BootLLCI	BootULCI		
X1 (Solution vs Problem)	-.2229	.1080	-.4303	-.0081		
X2 (Solution vs Control)	-.0566	.0310	-.1233	-.0019		

Note: X1 = Solution vs Problem (1: solution visuals; 0: problem visuals), X2 = Solution vs Control (1: solution visuals; 0: control visuals), M= positive affective response, Y= constraint recognition. Number of bootstrap samples for bias corrected bootstrap confidence intervals = 5,000. Level of confidence for all confidence intervals: 0.95. A bias-corrected bootstrap confidence interval does not include zero, indicating a significant mediator effect.

Before testing H3 to H5, I conducted a confirmational factor analysis (CFA) to check the validity of measurements regarding the latent variables, problem recognition, constraint recognition, level of involvement, positive affect, and negative affect. As shown in Table 10, item loadings ranged from 0.74 to 0.96. The overall measurement also indicated a good model fit ( $\chi^2(406) = 17316.712$ ; CFI = 0.954; RMSEA = 0.061; SRMR = 0.048). The measurement showed a generally satisfactory model fitness based on one of the most conservative criteria of Hu and Bentler (1999) (CFI  $\geq$  0.95, RMSEA  $\leq$  0.06, and SRMR  $\leq$  0.08). Therefore, this allowed me to proceed to test the proposed research model.

Table 10. *Measurements and item factor loadings*

Variable	Measurement items	Item loading	Cronbach's $\alpha$
Problem Recognition	1. I feel the waste pollution issue is a serious social and national problem.	0.870	0.918
	2. The government and related institutes should take the waste pollution issue more seriously and take action.	0.893	
	3. Something should be done immediately to improve the waste pollution issue.	0.911	
	4. I see a huge gap between what it should be and what it is now about the waste pollution issue.	0.767	
Constraint Recognition	1. I feel my daily efforts can help in resolving the waste pollution issue*(reversed).	0.867	0.910
	2. I believe my recycling actions matter to the waste pollution issue* (reversed).	0.861	
	3. I can make a difference in the way the waste pollution issue is solved* (reversed).	0.901	
Level of Involvement	1. In my daily life, the waste pollution issue is important to me.	0.923	0.947

	2. In my daily life, the waste pollution issue is of concern to me.	0.884	
	3. In my daily life, the waste pollution issue is relevant to me.	0.866	
	4. In my daily life, the waste pollution issue means a lot to me.	0.930	
Positive Affect			0.964
	Please rate the extent to which you experienced the following emotions when you viewed these visual messages. Your answer should describe your feelings about these posters instead of your general mood today. You feel _____.		
	1. Happy	0.957	
	2. Joyful	0.952	
	3. Pleased	0.956	
	4. Fun	0.900	
	5. Hopeful	0.830	
Negative Affect			0.944
	Please rate the extent to which you experienced the following emotions when you viewed these visual messages. Your answer should describe your feelings about these posters instead of your general mood today. You feel _____.		
	1. Sad	0.903	
	2. Upset	0.947	
	3. Guilty	0.737	
	4. Angry	0.879	
	5. Worried	0.911	
Information Seeking			0.933
	1. I would like to search for more information about the waste pollution issue online.	0.911	
	2. I intend to read news articles or postings related to the waste pollution issue.	0.916	
	3. I would like to spend some time and effort knowing more about the waste pollution issue (i.e., the current status, causes, solutions).	0.930	
	4. I will actively discuss the waste pollution issue with others.	0.777	
Information Processing			0.883

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1. These visuals make me think thoroughly about the waste pollution issue.	0.836
2. If I see these kinds of visual messages somewhere else, I will stop and think about the waste pollution issue.	0.831
3. If I see these kinds of visual messages on social media, I intend to share them with others.	0.822
4. If I see these kinds of visual messages on social media, I intend to click the “like” button.	0.750

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### **H3: Problem Recognition, Constraint Recognition, Level of Involvement and Information Seeking**

H3 was supported. To test H3, the original model of the situational theory of publics was built with structural equation modelling. The structural equation model showed a good model fit (CFI = 0.954; TLI = 0.945; RMSEA = 0.069; SRMR = 0.042). Consistent with the argument in STP, individuals’ information seeking was positively associated with problem recognition (H3a:  $\beta = 0.329$ , SE = 0.076,  $p < 0.001$ ) and level of involvement (H3b:  $\beta = 0.351$ , SE = 0.065,  $p < 0.001$ ), and negatively with constraint recognition (H3c:  $\beta = - 0.425$ , SE = 0.047,  $p < 0.001$ ).

### **H4: Problem Recognition, Constraint Recognition, Level of Involvement, and Information Processing**

H4 was supported. Similarly, from the SEM of the original model of STP, individuals’ information processing was positively associated with problem recognition (H4a:  $\beta = 0.190$ , SE = 0.086,  $p < 0.05$ ) and level of involvement (H4b:  $\beta = 0.224$ , SE = 0.074,  $p < 0.01$ ), and negatively with constraint recognition (H4c:  $\beta = - 0.404$ , SE = 0.053,  $p < 0.001$ ).

### **H5: Affective Responses in STP**

H5 was supported. To test H5, I built another SEM with all factors and paths in the original SPT, and negative and positive affective responses as another two variables associated

with information seeking and processing. The new SEM model showed a good model fit (CFI = 0.954; TLI = 0.948; RMSEA = 0.061; SRMR = 0.048). This model showed that negative affective response was positively associated with both information seeking ( $\beta = 0.102$ , SE = 0.032,  $p < 0.01$ ) and processing intentions ( $\beta = 0.396$ , SE = 0.036,  $p < 0.001$ ). Similarly, positive affective response was positively associated with both information seeking ( $\beta = 0.138$ , SE = 0.036,  $p < 0.001$ ) and processing intentions ( $\beta = 0.355$ , SE = 0.039,  $p < 0.001$ ). The results were shown in Figure 7.

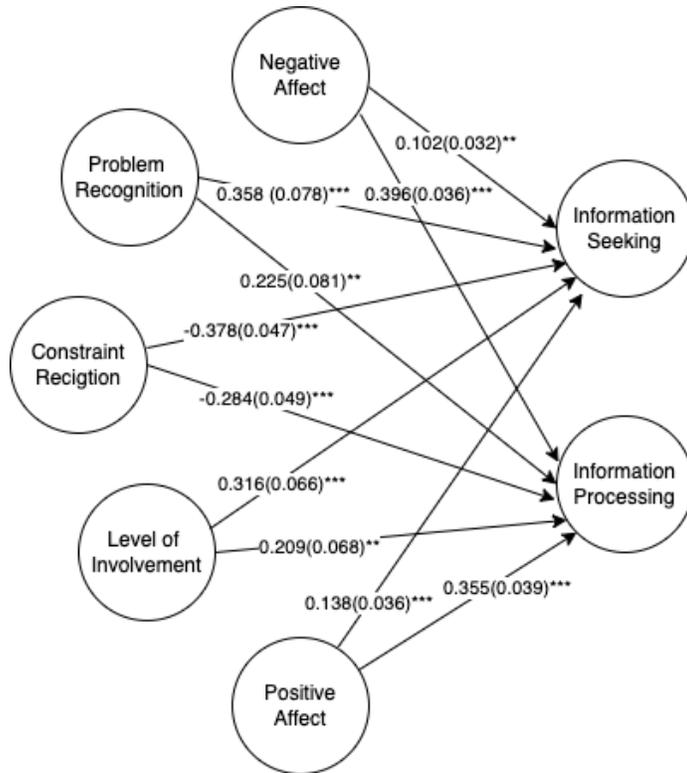
#### **H6: Extending STP by Including Affective Responses**

H6 was supported. To test H6, I compared the model created in H5 with the model of the original SPT. Since all parameters in the original model were kept in the developed model, and the new model contained several new parameters regarding affective responses, these two SEM models were nested. Particularly, the original STP model was nested in the developed model with affective responses.

As mentioned in H3, the original model of the situational theory of publics yielded to an acceptable model fit (CFI = 0.954; TLI = 0.945; RMSEA = 0.069; SRMR = 0.042). This model explained 52.2% of variances in information seeking and 34.4% of variances in information processing. When positive and negative affect were included into the original SPT model as another two variables associated with information seeking and processing, the new model yielded to a good model fit (CFI = 0.954; TLI = 0.948; RMSEA = 0.061; SRMR = 0.048). In this model, 54.0% of variance in information seeking was explained, and 52.5% of variances in information processing was explained (See Figure 7). These changes meant that negative and positive affective responses might play meaningful roles in explaining people's information seeking and processing. Therefore, people's information seeking and processing behaviors were

not only predicted by their problem recognition, constraint recognition, and level of involvement, but also were meaningfully associated with their affective responses to the situation and messages.

Figure 7. *Structural Equation Model Including Affective Responses in STP*



CFI = 0.954; TLI = 0.948; RMSEA = .061 (90% CI: 0.057 to 0.065); SRMR = .048;  $R^2_{\text{info seeking}} = 54.0\%$ ;  $R^2_{\text{info processing}} = 52.5\%$ .

The chi-square test was conducted to compare these two nested models (the original STP model and the new model including affective response). The chi-square test referred to as a “likelihood ratio test,” was the difference between the full model and the reduced model, using the difference in degrees of freedom as the degrees of freedom for the test.

The degree of freedom of the original model was 142, and the Chi-square was 593.07. The degree of freedom of the developed model (H6) was 356, and the Chi-square was 1133.88.

$$\Delta df_{diff} = 356 - 142 = 214$$

$$\Delta \chi^2_{diff} = 1133.88 - 593.07 = 540.81$$

When the degree of freedom was 214 and the Chi-square was 540.81, the  $p$ -value was < 0.001. Besides, the new model explained more variances in people's information seeking and information processing intentions than the original STP mode. Therefore, the new model was significantly stronger than the original model in explaining the variances in individuals' communication behavior. Thus, the inclusion of affective responses as another two independent variables for information seeking and information processing had meaningfully developed the situational theory of publics.

### **H7: Information Seeking and Processing, and Behavioral Intention to Take Advocated Action**

H7 was supported. To test these two hypotheses, a multiple linear regression (OLS) in SPSS was conducted. The result showed that both information seeking and processing were positively associated with participants' behavioral intention to take advocated action ( $\beta_{\text{info seeking}} = 0.455$ ,  $SE = 0.035$ ,  $p < 0.001$ ;  $\beta_{\text{info processing}} = 0.118$ ,  $SE = 0.042$ ,  $p < 0.001$ . See Table 9). Meanwhile, information seeking seemed to have a stronger positive association than information processing with people's behavioral intention to take advocated action. However, the slope comparison did not show a significant difference between these two slopes (no significant interaction between information seeking and information processing).

Table 9. *Coefficients<sup>a</sup> of H7*

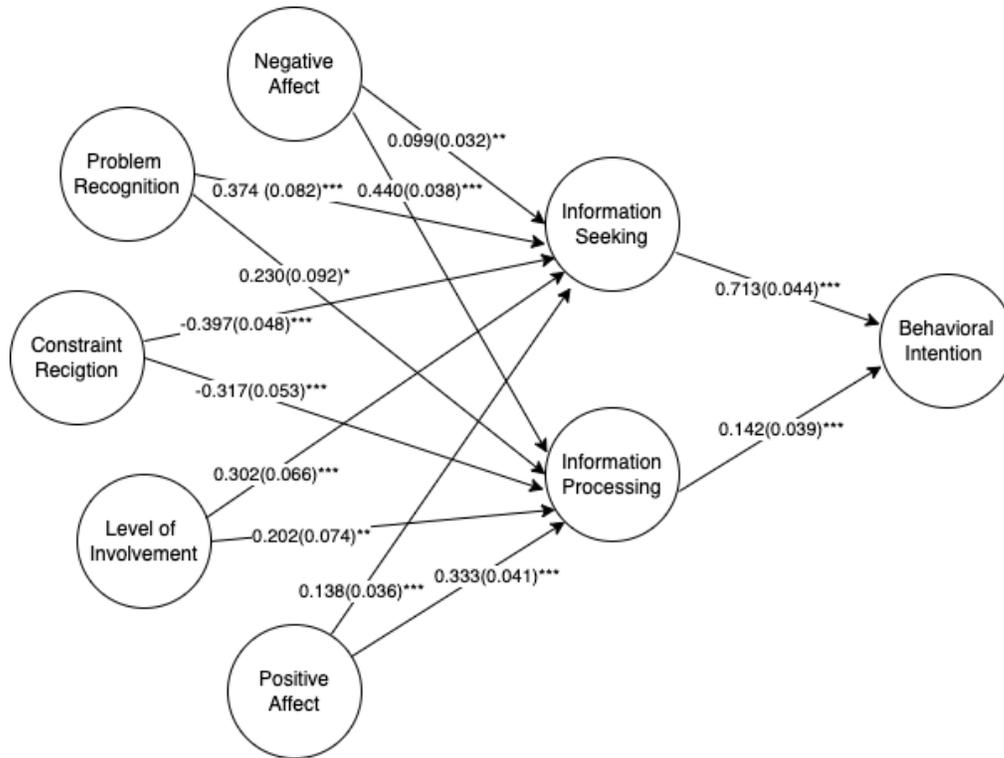
Model		Unstandardized		Standardized	t	Sig.
		Coefficients		Coefficients		
		B	SE	Beta		
Predictor	(Constant)	.318	.251		1.270	.204
	<b>Information Seeking</b>	<b>.455</b>	<b>.035</b>	<b>.486</b>	<b>12.834</b>	<b>&lt;.001</b>
	<b>Information Processing</b>	<b>.118</b>	<b>.042</b>	<b>.132</b>	<b>2.797</b>	<b>.005</b>

Covariates	Age	-.011	.003	-.089	-3.568	<.001
	Gender (Female: 1)	.117	.070	.042	1.675	.095
	Education	.064	.026	.062	2.447	.015
	Ethnicity (White: 1)	.027	.039	.018	.699	.485
	Level of Involvement	.265	.035	.246	7.640	<.001
	PVE	.023	.032	.027	.703	.482
	Behavioral Engagement	.048	.021	.059	2.246	.025

a. Dependent Variable: Behavioral Intention to Take Advocated Action

To develop the situational theory of publics to a more comprehensive and practically meaningful model in the environmental communication context, I added the paths between information seeking and behavioral intention to take advocated action and between information processing and behavioral intention to take advocated action into the model built from H5. The comprehensive model kept all the factors in the original situational theory of publics, and negative and positive affect and behavioral intention to take advocated action. The model fit of the comprehensive model was satisfactory (CFI = 0.950; TLI = 0.944; RMSEA = 0.061; SRMR = 0.058; see Figure 8). A comparison (Chi-square test) between the original model and the comprehensive model showed that the comprehensive model was a stronger model than the original one ( $\Delta df_{diff} = 270$ ,  $\Delta \chi^2_{diff} = 715.2$ ,  $p < 0.001$ ).

Figure 8. *Structural Equation Model of the Comprehensive STP Model*



CFI = 0.950; TLI = 0.944; RMSEA = 0.061(90% CI: 0.058 to 0.065); SRMR = .058;  $R^2_{\text{info seeking}} = 56.3\%$ ;  $R^2_{\text{info processing}} = 53.9\%$ ;  $R^2_{\text{BI}} = 65.6\%$ .

### H8: Perceived Visual Effectiveness as A Moderator

H8 was partially supported. To test the moderating role of perceived visual quality, two moderation analyses were conducted in SPSS. The result showed no significant interaction between perceived visual effectiveness and information seeking (H8a:  $\beta_{\text{interaction}} = 0.008$ , SE = 0.014,  $p = 0.575$ ). Thus, H8a was not supported. However, there was a significant positive interaction between perceived visual effectiveness and information processing (H8b:  $\beta_{\text{interaction}} = 0.090$ , SE = 0.018,  $p < 0.001$ , see Tables 10, 11, 12). H8b was supported.

The positive interaction between perceived visual effectiveness and information processing indicated that, when the perceived visual effectiveness was relatively higher, the association between information processing and behavioral intention to take advocated action

was stronger than when the perceived visual effectiveness was relatively lower. In other words, the relationship between individuals' information processing and the behavioral intention to take advocated action would be influenced by their perceived visual effectiveness. However, the relationship between information seeking and behavioral intention to take advocated action was not influenced by individuals' perceived visual effectiveness.

Table 10. *Model Summary of H8b*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.588 <sup>a</sup>	.346	.345	1.12879	.346	315.961	1	598	<.001
2	.620 <sup>b</sup>	.385	.382	1.09619	.039	19.045	2	596	<.001

a. Predictors: (Constant), Information Processing

b. Predictors: (Constant), Information Processing, Perceived Visual Effectiveness, Interaction

Table 11. *ANOVA Result of H8b<sup>a</sup>*

Model		Sum of Squares	df	Mean Square	F	Sig.
1 <sup>b</sup>	Regression	402.587	1	402.587	315.961	<.001 <sup>b</sup>
	Residual	761.950	598	1.274		
	Total	1164.537	599			
2 <sup>c</sup>	Regression	448.358	3	149.453	124.374	<.001 <sup>c</sup>
	Residual	716.179	596	1.202		
	Total	1164.537	599			

a. Dependent Variable: Behavioral Intention to Take Advocated Action

b. Predictors: (Constant), Information Processing

c. Predictors: (Constant), Information Processing, Perceived Visual Effectiveness, Interaction

Table 12. *Coefficients<sup>a</sup> of H8b*

Model		Unstandardized		Standardized	t	Sig.
		Coefficients		Coefficients		
		B	Std. Error	Beta		
1	(Constant)	2.513	.135		18.547	<.001
	Processing	.523	.029	.588	17.775	<.001
2	(Constant)	4.074	.305		13.367	<.001
	Processing	.209	.095	.234	2.186	.029
	PVE	-.466	.076	-.558	-6.164	<.001
	<b>Interaction</b>	<b>.090</b>	<b>.018</b>	<b>.828</b>	<b>5.045</b>	<b>&lt;.001</b>

a. Predictors: (Constant), Information Processing, Perceived Visual Effectiveness, Interaction

## **RQ: Textual Analysis and Participants' Visual Information Sense-making**

### *Affect*

Participants' responses in the open-ended question regarding their feeling when viewing the visual messages in the experiment provided a detailed description of their general affect. Overall, participants' expression of their feelings matched with the frame in the visual messages in the treatment groups and the control group. Besides, some participants' comments on the visual design in the responses reflected the important role of perceived visual effectiveness in visual information processing. In the responses from participants in the problem frame group, the words such as "sad," "angry," "upset," "annoyed," and "negative," appeared frequently and dominantly. This phenomenon demonstrated that the problem-framed visuals elicited negativity in participants.

For those assigned to the solution frame group, representative expressions were "comfortable," "hopeful," "surprised," "intrigued," and "motivated." However, some participants commented on the design of the visual messages. For example: "I thought of recycling and how clean the images were. I also thought the images were quite creative, especially the first image of the tables and chairs. Overall, I had a feeling of pleasantness." Besides, some negativity still appeared in the response, while it was not the main theme.

In the control group, participants used words such as "neutral," "had no feeling," "felt absolutely nothing," and "not impactful" to describe their feelings. Some participants mentioned that they were confused about these images because these visuals were not impactful. Although participants in the control group also had some negative tone, their negativity was mainly caused by participants' evaluation of the visual messages, instead of by the waste pollution issue. Besides, some participants elaborated on their feelings by adding their thoughts on recycling.

Several typical responses are listed below. The first response represented those who only showed the emotions, while the second response reflected a further thought or planned behavior beyond emotions.

“I felt pretty sad and hopeless. It makes me scared that we’ve abused our oceans and environment so much.” (Frame: Problem)

“The images made me feel a bit motivated to recycle more. At the same time, it made me realize that it’s not just up to me and others have to recycle too. The colors were nice, and it made me feel a bit happy while seeing the colors.” (Frame: Solution)

Besides, the vocabulary of participants’ feelings was diverse. For those assigned to the problem frame, although the overall feeling when viewing the visual messages was negative, various words describing different emotions emerged from the responses. Typical words included: sad, angry, upset, disgusted, ticked off, concerned, hopeless, and guilty. Similarly, the typical words in the solution frame group were “comfortable,” “hopeful,” “surprised,” “intrigued,” and “motivated.” This result supported the earlier argument about the interpretative nature of visuals. The same visual may induce various emotions, instead of one discrete emotion, among its viewers. Therefore, it is better to use positive and negative affect, to gauge the emotional changes in viewers, than to use discrete emotions. Table 13 showed the results of the sentiment analysis of participants’ affective repression in the open-ended question. The sentiment analysis was completed by LIWC2022. This result was consistent with previous findings. Also, the problem-framed visuals induced a higher level of affect than the solution-framed visuals.

Table 13. *Sentiment analysis of participants' emotional expressions*

Frame	Affect	PosTone	NegTone	Emotion	PosEmo	NegEmo
Problem	<b>10.33</b>	1.37	<b>8.40</b>	<b>7.31</b>	0.23	<b>6.50</b>
Solution	7.29	<b>4.98</b>	1.94	4.21	<b>2.37</b>	1.49
Control	6.01	2.10	3.21	3.52	0.52	2.28

### *Interpretation of the Visual Messages*

Participants' interpretation of these visuals reflected participants' problem recognition and constraint recognition regarding the waste pollution issue.

**Problem Frame Visuals.** In this group, the theme of participants' interpretation was the awareness of the waste pollution problem and the recognition to solve this problem. Participants' recognition of the problem of waste pollution involved different aspects of the problem, such as the causes of the problem, entities responsible for solving the problem, the potential consequence of the problem. For example, several participants wrote: "We are causing irreparable harm to our environment" (cause); "I saw that there was a lot that needs to be done to clean up the ocean. It will take a lot of effort from governments and corporations to solve this problem" (entities responsible to solve the problem); and "The visuals were to bring into sharp focus the problem with not recycling. It also pointed out how dangerous not recycling can be for the life of all creatures" (the potential consequence). Such interpretation emphasizing the problematic nature of this issue prevailed in the responses. Meanwhile, some participants also mentioned the constraints to solve this problem, primarily about the personal inability to solve this problem (e.g., "Everyone can do their part!") and the attitude toward governments and corporations' determination to take actions (e.g., "I am not that optimistic that it - governments and corporations' efforts - will get done." However, responses concerning constraints were not dominant.

**Solution Frame Visuals.** In the group who viewed the visuals in the solution frame, the main theme was recycling. Not many participants mentioned the problem of the waste or the internal connection between this solution and the problem. Therefore, it was apparent that these visuals in the solution frame did not influence individuals' problem recognition. As for the responses concerning constraint recognition, they were sporadic. Most responses mentioning the constraint recognition involved one's self-efficacy to solve this problem, without involving other organizations or social entities. For example, one participant wrote: "These visuals helped me to understand that I can do my part to help save the environment." Another one said: "We have the ability to turn our waste into beautiful things that we need." While these responses reflected the impact of these visuals on individuals' constraint recognition of the waste pollution issue, these responses were not commonly seen in the interpretation. The majority of the interpretation in this group focused on describing the content in these visuals and concluding that recycling was important. At the same time, the creativeness of these visuals caused participants' perceived uncertainty. Besides, in the responses of interpretation, many participants in this group started with hesitation, such as "I wasn't sure how to interpret the ad" and "I'm not 100% sure on the exact message." This uncertainty might explain why these solution-framed visuals had no significant direct impact on people's constraint recognition.

### *Evaluation of the Visual Messages*

**Problem Frame Visuals.** Generally, participants' evaluation of the visual messages was good. These visual messages were assessed as effective. Adjectives such as "impressive," "effective," "vivid," "heartbreaking" dominated the evaluation, reflecting participants' recognition of the effectiveness of these visual messages. At the same time, participants also came up with some suggestions to improve the visuals, from the perspective of the content and

style. For example, several participants mentioned that some texts should be added to the visuals to make the visual messages more straightforward. Another critique was that it was not enough to emphasize the problem. Instead, the inclusion of solutions was needed to address this problem. Several participants mentioned the necessity to provide a QR code for them to scan and know more about this issue. In addition to that, a considerable number of participants still mentioned the seriousness of the problem.

**Solution Frame Visuals.** Overall, the elevation of the visual messages in the solution frame was positive but not as positive as those in the problem frame. The mainstream of the words to describe participants' evaluation of these visuals included "fine," "OK," "pretty good," "love them," while words reflecting participants' extremely high rating were rare. At the same time, some slightly negative words were common as well, such as "outdated," "were not clear," "confusing." In addition, participants also mentioned several approaches to improve the visuals, such as including texts in the visuals, posting the visuals on different social media platforms with texts. Noticeably, several participants mentioned that these visual messages should emphasize the problem of this issue and induce negative emotions. One participant mentioned that "I found them to be visually interesting but had mixed emotions about this issue." This result might indicate participants' preference of congruence between the nature of the issue and the visual frame to represent the issue.

## CHAPTER 5: DISCUSSION

This study applied the Situational Theory of Publics (STP) to visual messaging by testing the effects of visuals in different frames (i.e., problem and solution) on problem recognition and constraint recognition, and explored the additions of three factors to develop STP in the environmental communication context: negative affect, positive affect, and behavioral intention to take advocated action. STP was developed with multiple findings, including the indirect effects of visuals on problem recognition and constraint recognition, meaningful inclusion of affective responses and behavioral intention to take advocated action to STP. Besides, visual communication was examined in the context of public relations and strategic communication and the findings included the moderating role of perceived visual effectiveness (PVE), and viewers' sense-making of visual messages.

### **Findings**

The principal component analysis (PCA) showed that participants experienced various discrete emotions, both positive and negative, when exposed to visual messages. Therefore, emotions should be treated generally as negative or positive affective responses in this study.

H1 and H2 addressed the potential indirect effects of affective responses on people's problem recognition and constraint recognition. The mediation analyses confirmed that visual messages in the problem frame would be indirectly associated with individuals' problem recognition, fully mediated by negative affect. Thus, H1 was supported. Visual messages in the solution frame had an indirect negative effect on individuals' constraint recognition through positive affect, but the direct effect of solution visuals was not significant when compared with the problem group and opposite to expected when compared with the control group. Therefore, H2 was partially supported. These findings should be interpreted carefully regarding the causal

inference between affective responses and the outcomes (problem recognition and constraint recognition), which is elaborated in the next part.

H3, H4, H5, and H6 were about the paths in the original STP model and the additional paths related to affective responses. The structural equation modeling (SEM) confirmed the effectiveness of the original SPT model. Besides, the data demonstrated that both positive and negative affective responses were important predictors of people's information seeking and processing. In addition, the model comparison (Chi-squared test) revealed that the inclusion of affective responses into the situational theory of publics significantly improved the explained variances in information seeking and information processing. Therefore, H3, H4, H5, and H6 were all supported.

H7 proposed the positive association between information seeking and processing and people's behavioral intention to take advocated action (i.e., to recycle). A series of multiple regressions showed that individuals' information seeking and processing intentions were both positively associated with their behavioral intention to take advocated action. H7 was supported.

H8 were about the moderating role of perceived visual effectiveness in the relationship between people's communicative actions (i.e., information seeking and processing) and behavioral intention to take advocated action (i.e., to recycle). The moderation analysis confirmed the moderating role of perceived visual effectiveness (PVE) on the relationship between information processing and behavioral intention to take advocated action. There was a positive interaction between perceived visual effectiveness and visual information processing, but no interaction between perceived visual effectiveness and visual information seeking. H8 was partially supported.

In summary, in H1 and H2, I tested the effect of visual messages on people's problem recognition and constraint recognition and found that affect might be a mediator in the indirect effect. However, there was not enough evidence to prove the causal relationship between affect and problem recognition or constraint recognition. Therefore, in the rest of the hypotheses, I did not focus on the relationship between affect and problem recognition and constraint recognition. Instead, I explored how the inclusion of affect to STP could develop the original model. From H3 to H7, I added three meaningful concepts to STP, negative affect, positive affect, and behavioral intention to take advocated action, and created a comprehensive structural equation model. The model fit of the comprehensive was satisfactory.

To understand participants' sense-making of visual messages, I conducted a textual analysis. The textual analysis revealed participants' affective responses to, and interpretations and evaluations of the visual messages. Overall, visuals in the problem frame and solution frame both induced a higher level of affective response than those in the control group, which meant both solution and problem frames were effective. However, problem-framed visuals tended to be more effective than solution-framed visuals because of humans' sensitivity to negative feelings. The findings in the textual analysis were consistent with the findings in the experiment.

## **Theoretical Linkages and Implications**

### ***Affective Response as a General Concept in Visual Communication***

In this study, I found that various discrete emotions emerged in individuals' cognition processes when they processed visual information. The principal component analysis revealed two distinct components among these discrete emotions: positive affect and negative affect. This result implied that although individuals' affective responses to visual messages may be heterogeneous, these discrete emotions tend to converge to negative and positive affective

responses. In other words, individuals may feel generally negative or positive (or both) when viewing specific framed visuals. Although individuals' negative affect may contain subtle emotions such as sadness, anger, worry, or guilt, these emotions were not essentially different. Similarly, their positive affect might contain emotions such as happiness, joy, or hope, which were not essentially distinct in the process of viewing visual messages.

In many quantitative studies examining individuals' affective responses to designed messages, scholars targeted and measured one or two emotions but did not rule out the potential existence and impact of other emotions (e.g., Chon & Park, 2019a; Liu et al., 2019; Moore et al., 2019; Oh et al., 2020; Skurka et al., 2018). Also, their findings illustrated that the impacts of different discrete negative emotions (e.g., fear and anger) on individuals' risk perception or behavioral intention might not be essentially different. Noticeably, many other scholars have begun to adopt the more general concept of affective response in communication research (e.g., affective injustice, Chon & Park, 2019b; risk-related affect, Moon et al., 2022; negative emotions, Shin & Han, 2016). In this study, my goal was not to test the influence of a discrete emotion on people's problem recognition and constant recognition. Instead, I hope to test the different effects of visual messages in different frames. Therefore, in the visual communication context, scholars may consider using a general term, affective response, to accurately describe participants' feelings after viewing strategically framed visuals, instead of focusing on one discrete emotion. Responding to the classification approaches of emotions, this study has proved that scholars studying visual communication probably should follow the dimensions approach (two dimensions: valence and intensity, Watson & Spence, 2007) to theorize and measure affective responses as a media effect elicited by visuals, unless the researchers are particularly interested in the effect of a specific emotion.

Because of the fact that individuals' interpretation of visual stimuli may be subjective and heterogeneous, it is not realistic to expect a pure emotion (e.g., sadness or happiness) without inducing other related emotions using strategically designed visual messages. However, despite the absence of pure emotion in participants' interpretation of and affective response to the visual messages, what is worth studying is which factors have contributed to these slightly different responses to these stimuli. With the same visual messages in the problem frame, some participants used the word "sad" to describe their feeling, while others used "disgusted" or "angry." These different subtitle responses to visual messages may stem from personal traits, visual literacy, and other subjective factors. According to appraisal theories, there are six appraisal dimensions for forming a specific emotion: anticipated effort, attention activity, certainty, control, pleasantness, and responsibility (Smith & Ellsworth, 1985). The value of these six dimensions may vary across individuals. Thus, people may experience slightly different affective responses even with the same information stimuli because of these dimensional differences among individuals. Therefore, the formation of discrete emotions in response to visual messages is worth investigating in the future.

### ***Impacts of Visuals on Problem Recognition and Constraint Recognition***

As for the impacts of framed visuals on individuals' problem recognition and constraint recognition, the mediation analyses have revealed that affective responses might play as mediators for such influences. This finding was consistent with earlier studies involving emotions, mood, and assessment of events. Scholars (e.g., Popova et al. 2017; Schwarz & Clore, 1983; Oh et al., 2020) have confirmed the mediating role of affect in individuals' assessment of events. For example, Popova et al. (2017) suggested that the representation of issues in the human mind is inextricably associated with feelings and that individuals rely on the associated

feelings when making judgments. Schwarz and Clore (1983) claimed that individuals refer to their current emotional state (mood) in a heuristic way to make assessments as long as the experienced emotions were perceived relevant to the target that they assess. In risk and crisis communication, Oh et al. (2020) found that fear and anger played as mediators between social media information exposure and personal-level risk perception. In their studies, the concept of personal-level risk perception was essentially similar to problem recognition. Similarly, in their Integrated Crisis Mapping (ICM) model, Jin et al. (2012) found that during a crisis, individuals' emotions functioned as an anchor of the public's interpretation of the crisis event. This means individuals' affective response to visual messages about an issue can play as a mediator between information exposure and their assessment of this issue (i.e., problem recognition and constraint recognition).

However, the mediator role of positive affect on the relationship between solution-framed visual exposure and constraint recognition was not as apparent as the mediating role of negative affect. Although the mediation analysis revealed some indirect negative effect of solution-framed visuals on people's constraint recognition through positive affect, the direct effects of were either insignificant (solution vs problem) or opposite against expected (solution vs control).

These results may have two implications. First, this result might imply a persuasive edge for the problem visual frame over the solution frame of visual messages in environmental campaigns. One explanation for this difference may be the negativity bias. Social psychologists have found an asymmetry in how humans process and use positive versus negative information. Humans tend to be more attentive to and influenced by negative than positive information (e.g., Baumeister et al., 2001; Rozin & Royzman, 2001; Vaish et al., 2008). Simply, bad is stronger than good. In communication, scholars have similar findings in the research on the use of fear

appeals and humor appeals, in which scholars confirmed that the fear appeals outperformed humor appeals (e.g., Kim et al., 2009; Skurka, 2018; Struckman-Johnson et al., 1994). Thus, this study has confirmed the possible negative bias in visual strategic communication. In summary, although visuals in both problem frame and solution frame can effectively influence individuals' problem recognition and constraint recognition, visuals emphasizing the seriousness of the problem may win by a narrow margin over visuals concentrating on the solution(s).

The second implication is that scholars should be cautious to conclude the causal inference between people's affective responses to strategic visual messages and their problem recognition and constraint recognition. Although the paths from the mediation analysis have supported the hypothesis that affective responses can fully mediate the relationship between framed visual messages and problem recognition and constraint recognition, it is not clear why there was not expected direct effect of visual messages on participants' perception. In fact, in mediation analysis, it is very difficult, if not impossible, to rule out all the mediator-outcome confounding variables. Therefore, the causal inference between the mediator (negative affect in H1, positive affect in H2) and the outcome (problem recognition in H1, constraint recognition in H2) should be interpreted with caution. In this study, there might be some important covariates, which were not controlled in the mediation analysis (e.g., ecological awareness, subjective norms, socioeconomic status, cultural background and identity, visual literacy, etc.), and the uncontrolled important covariates might have weakened the direct effect of visuals on people's problem recognition and constraint recognition. Also, the changes in participants' affective responses, problem recognition, and constraint recognition, might have occurred simultaneously when they saw the visuals, which may make it difficult to infer causalities between these variables. Even, if participants' affective responses were caused by their problem recognition and

constraint recognition, which was proposed in several other situational studies (Shin & Han, 2016; Chon & Park, 2019a; Chon & Park, 2019b), the affective response would have played the role as a collider. In this case, adding the paths from negative affect to problem recognition, and from positive affect to constraint recognition, can suppress the real direct effect of visual messages on problem recognition and constraint recognition. Therefore, scholars should continue to explore more covariates among important variables in visual communication. Besides, it is worth exploring the causality between affect and problem recognition and constraint recognition, to figure out which is the cause, and which is the effect.

Let me come back to STP. Aldoori et al.'s (2018) study explored the meaning construction in the production of textual campaign messages in the theoretical framework of situational theory of publics and suggested understanding how meaning played out in the messages to a useful framework for text message campaigns. Responding to their study, I have proved the potential mediating role of affective response. It can be concluded that in the visual message campaigns, people's problem recognition and constraint recognition can also be influenced in the production of visual messages. Visual messages emphasizing the problematic nature of the issue may have some advantage over those focusing on solutions or viewers' efficacy. Regarding affective responses, I would tentatively claim affect may be a mediator in the relationship between visual message exposure and perception changes. However, more studies remain to be conducted in the future, regarding the role of affect, and the causal relationship between affect and problem recognition and constraint recognition.

### ***Influence of Affect on Information Seeking and Processing***

Although there is not solid evidence to prove the causality between affect and problem recognition and constraint recognition, past studies have repeatedly proved that people's

affective response to messages or issues can be a predictor of their subsequent behavioral intention. Therefore, to develop the STP model, I treated negative and positive affective responses as predictors of people's information seeking and processing intentions. The results in the structural equation modeling have revealed that, the intensity of both negative and positive affect, induced by visual messages, is positively related to information seeking and processing intentions. Therefore, the concept of affect should be a critical addition to the situational theory of publics, to predict publics' information seeking and processing intents. The findings respond to Slater et al.'s (1992) suggestion that situational theory and cognitive response approaches could be combined to fully understand publics' response to messages, and to better design message strategies in communication campaigns. These results were consistent with earlier studies involving the relationship between affective responses and communication intents. Several recent STOPS studies involving affective responses have confirmed that people's negative emotions in an issue would be positively associated with their situational motivation of problem-solving. While the concept of situational motivation in problem-solving was not included in STP, the positive relationship between affect and situational motivation of problem-solving in these studies has endorsed the mechanism of affect influencing people's communicative intentions. This means, the findings in this study are in line with these recent studies of the situational theory. Meanwhile, earlier studies have mainly explored the impact of negative affect such as fear, anger on publics' situational motivation of problem-solving (e.g., Chon & Park, 2019a; Shin & Han, 2016), and affective injustice on social media activism intents (Chon & Park, 2019b). This study has not only confirmed these findings, but also demonstrated the effectiveness of positive affect such as happiness, joy, and hope in changing individuals'

communication intents. Therefore, both negative and positive affective responses are positively associated with individuals' information seeking and processing intents.

Although H1 and H2 showed that visuals in different frames might have indirect impacts on problem recognition and constraint recognition through the induction of affect, the causal inference between these variables remain unclear. However, the results in H3, H4, and H5 showed that people's affective response can be directly associated with their communication behaviors. This result is consistent with Tannenbaum et al.'s (2015) meta-analytic finding that emotional appeals (e.g., fear appeal) can be effective without conveying risk and efficacy explicitly. Besides, the association between people's affective responses and information seeking and processing intention may be explained by the Appraisal Theory, which states that people's affective response is determined by cognitive appraisals or evaluations of a situation, and affective responses can predict their communicative and behavioral intentions. Therefore, affect may serve as an independent predictor of people's behaviors in a situation. In summary, public's information seeking and processing are not only determined by the situational evaluation (problem recognition, level of involvement, and constraint recognition) of the problem, but also are positively associated with their affect at the moment of decision-making.

### ***Relationships Between Information Seeking and Processing, and Behavioral Intention to Take Advocated Action***

In addition to identifying the role of affect in influencing public's information seeking and processing intents, this study has also revealed the positive relationships between information seeking and behavioral intention to take advocated action, and information processing and behavioral intention to take advocated action. This finding is consistent with many other studies involving communicative and behavioral intentions (e.g., Chon & Park,

2019a; Yang et al., 2017; Yoo et al., 2016). Although this finding is not new, especially in health and risk communication, it has expanded the outcome in the situational theory of publics to the actual behavioral intention to take advocated action in the visual communication context with an environmental issue. In advocacy and campaigns, when the aims of message design are to create publics and promote a certain action, the outcome of behavioral intention to take advocated action should be as important as information seeking and processing, if not more so. Thus, the extension from information seeking and processing to behavioral intention to take advocated action is a significant development in the situational theory of publics, especially when the problem is an organization-initiated PR (OPR) problem (Kim & Nan, 2013).

### ***Perceived Visual Effectiveness as A Moderator***

Furthermore, this study has found that in visual communication, the strength of the relationship between information processing and behavioral intention to take advocated action is moderated by the perceived visuals effectiveness (PVE). There is a positive interaction between information processing and perceived visual effectiveness. The higher PVE is, the stronger the relationship between information processing and behavioral intention to take advocated action is. Meanwhile, this interaction is not detected between information seeking and PVE. In recent years, scholars have called for attention to the critical role of perceived message effectiveness in persuasion (e.g., Nabi, 2018; Noar, 2018; O’Keefe, 2018). Currently, there are still few studies exploring the moderating role of perceived message effectiveness in persuasion or strategic communication. The only one that proved the moderating role of PME is Manuel et al.’s (2012) study, in which they confirmed the moderating role of perceived message quality of the relationship between information processing and behavioral intention in the context of the domain of cause-related marketing. This study has adopted the concept of perceived message

effectiveness to perceived visual effectiveness, to make it better suitable for visual communication. The result in this study responded to scholars' call for attention to the role of perceived visual effectiveness. Besides, it has demonstrated that individuals' perceived visual effectiveness influences the relationship between information processing and behavioral intention to take advocated action in visual communication. However, the moderating effect did not exist between information seeking and behavioral intention to take advocated action. This difference should be due to the difference between information seeking and processing. Information seeking is an active communicative action and in this imagined process, people should not have a certain target message. Instead, the information they intend to seek should be all types of messages related to the issue. Therefore, the relationship between information seeking and behavioral intention to take advocated action should not be altered by perceived visual effectiveness of the visual stimuli. However, information processing is passive, in which individuals tend to intake some information, and this process typically involves some available information, especially in the experimental setting. As a result, while the definitions and measures of information seeking and processing both involve all information related to the issue, in the experiment, when asked about information processing, participants should be more likely to refer to the messages they viewed in the manipulation condition. Therefore, the relationship between information processing and behavioral intention to take advocated action is moderated by perceived visual effectiveness.

### ***Participants' Sense-making and Evaluation of Visual Messages***

Another meaningful finding is the formation of people's perceived visual effectiveness, which was reflected in participants' evaluation of these visual messages in the open-ended question. In these responses, many participants mentioned that it was necessary to combine

visual messages with some texts and QR codes, so that the meaning of the PSA would be less confusing and more engaging. This recommendation indicated the importance of multimodality and interactivity of messages in this new media era. By creating fashionable and interactive visual messages, message designers may increase viewers' perceived visual effectiveness, which can enlarge the magnitude of the influence of information processing on behavioral intention to take advocated action. Also, participants' evaluations of these visual messages have implied the potential effects caused by visual elements besides the frame, such as visual cues, texts, and style. These qualitative findings respond to Geise and Baden (2014) suggestion to treat visual frame as part of a multi-modal message in information processing.

### **Implications for Visual Designs in Environmental Communication**

This study has revealed that visual messages depicting an environmental issue in both problem and solution frames were effective in influencing publics' problem recognition and constraint recognition through the induction of affect. Particularly, the problem frame visuals increased publics' problem recognition. This positive relationship was fully mediated by people's negative affect. The solution frame visuals decreased publics' constraint recognition. There was no direct influence of solution frame on publics' constraint recognition. However, the mediation analysis conducted by PROCESS showed a significant indirect impact of the solution frame on people's constraint recognition, through the induction of positive affect. Thus, for visual campaign designers, visuals in both problem and solution frames should be more effective than visuals in the control group. Designers may either emphasize the problem or the solution, depending on the primary goal of the campaign. However, the problem frame may have a slight advantage over the solution frames because its impact on problem recognition was more evident than the impact of solution frame visuals on constraint recognition. The result in the textual

analysis also revealed that negative affect tended to be easier to be induced than positive affect. The slight advantage of the problem frame may be due to humans' negativity bias.

In addition to the choice of visual messages in public relations and strategic communication, another important implication stemmed from the moderator of perceived visual effectiveness. The moderation analysis showed a positive interaction between information processing and perceived visual effectiveness. This indicated that the positive relationship between information processing and behavioral intention to take advocated action should be stronger when individuals perceived the visuals of high quality than it is when individuals perceived the visuals to be of low quality. Thus, to turn individuals' information processing into behavioral intention to take advocated action, campaign visual message designers should ensure a high quality of visual messages. In addition, the results in the textual analysis suggested that including texts, QR codes, and social media icons may improve the quality of visual messages. These responses suggested the necessity of multimodality and interactivity of visual messages. Besides, some participants mentioned that they knew the visuals were manipulated. This might cause some resistance to the message. Therefore, it is important for the visual designers to make the style of the visuals less manipulating.

### **Limitations and Future Research**

There are several limitations of this study. First, participants' one-time mere exposures to the visual information in this experiment may not ensure long-lasting changes in their problem recognition and constraint recognition, as well as their affective response to this issue. So, the persistence of the findings in this study remains questionable. However, fortunately, most of these findings in the experiment were consistent with findings in other survey studies in the situational theory (i.e., the situational theory of publics, the situational theory of problem), risk

communication, health communication, and environmental communication. Therefore, the survey findings regarding the associations of issue perceptions, affect, and communicative and behavioral intentions should be stable. Thus, the findings in this experiment should be replicable.

The second limitation of this study is that it only examined the use of visual messages in the environmental campaign context, with a single issue. It remains unexplored whether these findings, especially the moderating role of perceived effectiveness, remain the same on other issues in the same content (i.e., the climate change issue) and other issues in another context (i.e., health communication and science communication). The literature review provided a large amount of research across different areas with similar findings. So, scholars may be confident that the findings in the environmental campaign context regarding the waste pollution issue should also apply to other related issues.

The third limitation is related to the content choice and design style of the visual messages in the experimental manipulation. In one of the problem-framed visuals, there was a wild animal, while animals were not present in other visuals. This difference might cause some confounding. Scholar have found the inclusion of animals in environmental advocacy (e.g., Fernández, 2019; von Essen & Allen, 2017) may have some impacts on people's affect and cognition. Animals can be human proxy representatives (von Essen & Allen, 2017) and may cause participants' moral shock and empathy (Fernández, 2019). Therefore, the inclusion of animals in one image but not in others may cause some bias in the manipulation. Besides, the style of messages in the solution group was slightly different from the other two groups. The two visuals in the solution group were creative and fake images, while the other four images in the other two groups were real. These different styles may cause participants' different levels of transportation in the messages. However, this limitation may be inevitable in visual designs

when the theme and the topic were both fixed, and high ecological validity is required. For example, in this study, it is unrealistic to visualize solutions to the waste pollution issue with real photos, without human characters. In the search of such photos when I designed the study, I found almost all real photos showing the solution to the waste pollution issue contained human characters (those who are happily recycling). Most solution images without human characters were creatively designed and fake. Therefore, I chose those creatively designed images in the solution group. To control the confounding caused by the various contents and styles, I measured participants' perceived visual effectiveness and treated it as a covariate (and the moderator in H8). Despite this, more delicate visuals should be designed, and more potential covariates should be measured in the future research. Interdisciplinary collaboration with visual designers and researchers would be helpful to produce visual materials of high validity and quality for experimental studies in the future.

The fourth limitation is about the sample. The convenience sampling and the choice of MTurk may cause some concerns regarding the representativeness of participant. First, convenience sampling has undermined the representativeness of the samples without randomness. Considering that I have limited access to conducting probability sampling, I utilized convenience sampling, which I admit has some limitations. Second, the data in the pilot study showed a problem of geographical bias of the sample. The latitude and longitude on each response from MTurk revealed that more than half of the participants in the pilot study were from Indian, and the locations of the responses showed high homogeneity. Studies have shown that nationality may be a factor that influences people's environmental engagement and behaviors (e.g., Eeden et al., 2020). However, I did not plan to make some intercultural or international comparisons in this study. Therefore, in the full-scale data collection, I limited the

participants' recruitment in the United States. This change should be proper because the situational theory of publics was established in the western context. Despite of this, I still admit the sampling method is not perfect, and I would encourage other scholars (and myself) to set a specific sampling frame and choose other more reliable data collection services.

The fifth limitation is the weakness of the control group. As mentioned in the results, the control group might not be purely neutral. Instead, from the manipulation check and textual analysis, the difference between the problem frame visuals and the control group visuals was larger than that between the solution frame visuals and the control group visual. Thus, the control group might be slightly closer to the solution frame.

The final limitation of this study is the limited causal inference. In the mediation analyses to test H1 and H2, it was difficult, if not impossible, to control all the covariates. Therefore, the relationships between negative affect and problem recognition, and between positive affect and constraint recognition should be correlational, instead of causal. Besides, the hypotheses in the structural mode models were about correlations between variables, instead of causalities. Despite this, in strategic communication research, it is common to build structural equation models in survey experiments. The correlations between important variables are still valuable.

With the findings, discussions, and limitations, scholars may be inspired to conduct more studies to further apply visual communication to the situational theory of publics in the future. One important task is to generalize the findings in this study to different issues and contexts by replicating this study. Another promising direction is to clarify the formations of publics' subtle emotions in the exposure of visual messages and future elaborate on the impacts of affective response on problem recognition, constraint recognition, and information seeking and processing. There may be some interplay between affect and other important variables, such as

peoples' level of involvement, age, education level, visual literacy, cultural background, which were not examined in this study. Besides, perceived visual effectiveness has been proven to be a moderator in the relationship between information processing and behavioral intention to take advocated action. Therefore, it is promising to scrutinize the role of perceived visual effectiveness in strategic communication, and the way to modify it.

## **Conclusion**

This study applied visual communication into the Situational Theory of Publics (STP) by testing the impacts of environmental campaign visuals in different frames (i.e., problem and solution) on individuals' problem recognition and constraint recognition. Besides, this study further explored how information seeking and processing, the dependent variables in STP, were related to behavioral intention to take advocated action in the visual communication context.

The findings showed that participants experienced various discrete emotions when exposed to visual messages. Two components were extracted from these emotions: negative affect and positive affect. Participants viewing visuals in the problem frame experienced a higher level of negative affect than those viewing visuals in the solution frame group and the control group, whereas those viewing visuals in the solution frame experienced a higher level of positive affect than those viewing visuals in the problem frame and the control group. Mediation analyses revealed that visual messages in the solution frame had an indirect negative impact on individuals' constraint recognition through positive affect. Visual messages in the problem frame increased individuals' problem recognition, which was fully mediated by negative affect. The structural equation modeling (SEM) illustrated that the inclusion of negative and positive affect into the situational theory of publics significantly improved the explained variances in information seeking and processing, with affect playing another independent variable. The

multiple regression showed positive correlations between participants information seeking and processing intents and their behavioral intention to take advocated action. The moderation analysis revealed the moderating role of perceived visual effectiveness (PVE) on the relationship between information processing and behavioral intention to take advocated action. There was a positive interaction between perceived visual effectiveness and visual information processing. A comprehensive structural equation model was built, and it showed a good model fit, with the additions of affective responses and behavioral intention to take advocated action into the situational theory of publics. The textual analysis revealed participants' sense-making of visual messages by analyzing their affective responses, interpretations, and evaluations of the visual messages. Overall, visuals in the problem frame and solution frame were both more effective than those in the control group, whereas problem-framed visuals tend to be more effective than solution-framed visuals because of humans' sensitivity to negative feelings. The findings in the textual analysis were consistent with the findings in the experiment.

In recent years, the mainstream of strategic communication tends to be the organization-public relationship, while this tendency is gradually stepping away from the core of strategic communication and public relations, the problem, and the subject of problem-solving, publics. This study revisited the classical PR theory, the situational theory of publics and explored how, if at all, publics can be created or influenced by visual messages. The results have shown that visuals in different frames can indirectly influence individuals' problem recognition and constraint recognition through the affective response elicited by visual messages. However, when the concept, affective response, is included in the whole model of the situational theory of publics, it serves as an independent predictor of individuals' information seeking and processing intentions, influencing their behavioral intention to take advocated action.

## Appendix A

Please indicate whether you disagree or agree on the statements below. 1 means strongly disagree and 7 means strongly agree.

**Level of Involvement in the Issue of Waste Pollution** (Adjusted from Zaichkowsky, 1985, 1994)

In my daily life, the waste pollution issue (is) \_\_\_ to me.

1. Important
2. Of concern
3. Relevant
4. Means a lot

### **Manipulation Check: Problem/Solution Frame**

Thinking about the visual messages you just reviewed, to what extent do you agree or disagree with the following statements?

1. These visuals about the waste pollution issue are solution-focused and emphasize the positive aspect of this issue.
2. These visuals about the waste pollution issue are problem-focused and emphasize the negative aspect of this issue.

### **Affective Response** (Thomas & Diener, 1990)

Please rate the extent to which you experienced the following emotions when you viewed these visual messages. Your answer should describe your feelings about these posters, instead of your general mood today.

You felt \_\_\_.

1. Happy

2. Joyful
3. Pleased
4. Fun
5. Hopeful
6. Sad
7. Upset
8. Guilty
9. Angry
10. Worried

**Problem Recognition** (Adjusted from Chen et al., 2017)

1. I feel the waste pollution issue is a serious social and national problem.
2. The government and related institutes should take the waste pollution issue more seriously and take action.
3. Something should be done immediately to improve the waste pollution issue.
4. I see a huge gap between what it should be and what it is now about the waste pollution issue.

**Constraint Recognition** (Adapted from Jiang et al., 2017)

1. I feel my daily efforts can help in resolving the waste pollution issue\*.
2. I believe my recycling actions matter to the waste pollution issue\*.
3. I can make a difference in the way the waste pollution issue is solved\*.

\* to be reversed

**Information Seeking**

1. I would like to search for more information about the waste pollution issue online.

2. I intend to read news articles or postings related to the waste pollution issue.
3. I would like to spend some time and effort knowing more about the waste pollution issue (i.e., the current status, causes, solutions).
4. I will actively discuss the waste pollution issue with others.

### **Information Processing**

1. These visuals make me think thoroughly about the waste pollution issue.
2. If I see these kinds of visual messages somewhere else, I will stop and think about the waste pollution issue.
3. If I see these kinds of visual messages on social media, I intend to share them with others.
4. If I see these kinds of visual messages on social media, I intend to click the “like” button.

### **Behavioral Intention to Take Advocated Action (Adjusted from Dahmen et al., 2019)**

1. I will donate to help with the waste pollution issue.
2. I'd like to be a volunteer to improve the waste pollution issue.
3. I will encourage others (i.e., family and friends) to sort and recycle in their daily life.

**Environment Engagement (Adjusted from Jiang et al., 2017):** 1 means never and 7 means very frequent.

In the past 12 months, how often have you talked about waste pollution, recycling, and related issues with others?

### **Perceived Visual Effectiveness**

1. These visual messages are convincing.
2. These visual messages are effective.
3. These visual messages are compelling.

4. These visual messages are vivid.

**Open-ended Questions:**

Please answer these questions by typing your responses.

1. Please tell me your feeling(s) when viewing these visuals.
2. How do you interpret the meaning of these visuals?
3. Overall, how do you evaluate this public service announcement (PSA)?

**Personal Demographics:**

What is your age?

What gender do you identify yourself?

- a. Female
- b. Male
- c. Other or prefer not to say

What is your education level?

- a. Nursery school to some high school, no diploma
- b. High school graduate, diploma or the equivalent (for example: GED)
- c. Some college credit, no degree
- d. Associate degree
- e. Bachelor's degree
- f. Master's degree
- g. Professional degree
- h. Doctorate degree

Please specify your ethnicity.

- a. African American
- b. Asian/Pacific Islander
- c. Caucasian/White
- d. Hispanic or Latino
- e. Native American or American Indian
- f. Other

## Appendix B

Sample manipulation: problem frame



Sample manipulation: solution frame



Sample manipulation: control group



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