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# Young Adults' Intentions toward the Prevention of Microplastic Pollution in Taiwan: Examining Personality and Information Processing in Fear-Appeal Communication

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**Abstract:** This study adopted the extended parallel process model (EPPM) and dual process models to examine how recipients' reactance proneness affected the appraisal of threat and efficacy, which, in turn, influenced their use of information-processing modes, attitudes, and behavioral intentions regarding the mitigation of microplastic pollutions in Taiwan. An experiment was conducted using 362 college students as the subjects. The results yielded three conclusions: (1) Fear-induced communication was an effective persuasive approach because this approach was more likely to guide the recipients to adopt a systematic mode to process messages. (2) Recipients' reactance proneness was discovered to first affect their perceived threat and perceived efficacy, which, in turn, influenced their attitudes and behavioral intention regarding the prevention of microplastic pollution, demonstrating that individual differences mediate fear-appeal messages to affect persuasive outcomes. (3) Perceived threat was important for fear-appeal messages to obtain persuasive outcomes.

**Keywords:** fear appeals; microplastic pollution; information processing modes; the extended parallel process model; recipients' reactance

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**Citation:** Li, S.-C.S.; Zeng, H.-K.; Lo, S.-Y. Young Adults' Intentions toward the Prevention of Microplastic Pollution in Taiwan: Examining Personality and Information Processing in Fear-Appeal Communication. *Sustainability* **2022**, *14*, 14336. https://doi.org/10.3390/su142114336

Academic Editors: Ying Zhou and Junyu Guo

Received: 14 September 2022
Accepted: 1 November 2022
Published: 2 November 2022

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## 1. Introduction

Since the 1950s, fear-appeal communication has been applied to examine various issues in health and environmental information campaigns, and this approach has proven effective in correcting people's risky behaviors [1–3]. Several theories, including drive theories, the parallel response model, motivation protection theory, and the EPPM (the extended parallel process model), have been developed to explain the effects of fear appeals on individuals' adoption of adaptive behaviors [1,2]. The EPPM, the most recent fear-appeal communication model, integrates several previous theories into one model and is considered better than the previous theories because it differentiates the factors resulting in the adoption of danger-control processes from those resulting in the adoption of fear-control processes [2,4,5].

Although the EPPM has been shown to be useful for effectively applying the fear appeal approach to risk information campaigns [6–8], it has also received several criticisms. One criticism that scholars frequently have of the EPPM is that there is a missing link between fear appeal messages and recipients' subsequent information-processing modes, such as systematic or heuristic information-processing modes. Critics argue that the EPPM needs to explain the link between fear appeal messages and their subsequent information-processing modes to help scholars evaluate the effectiveness of fear-appeal communication [9,10]. Another aspect of the EPPM that has been frequently criticized is its proposition that individual differences such as personality or demographics interact with individuals' appraisal of threat and efficacy, which, in turn, affect their attitudes and behaviors [11]. According to Popova's review (2012), this proposition has not found conclusive support [2].

To fill the gap in the literature, this study examines whether personality traits interact with the two elements of fear appeals—perceived threat and perceived efficacy—to affect information processing, attitudes, and behavioral intentions regarding the mitigation of microplastic pollution in Taiwan. Furthermore, college students are found to be the least concerned population about environmental issues, but they are also the most malleable group in terms of raising environmental consciousness [12]. Therefore, this study uses the EPPM and dual process models [13,14] to examine this issue among college students.

A recent study [15] showed that fear-appeal messages are frequently used in Taiwan's news stories to frame the phenomenon of microplastic pollution. Therefore, it is important to understand how the use of the fear-appeal approach affects individuals' attitudes and behavioral intentions toward this issue.

Microplastics are pieces of plastic that are smaller than 5 mm and are able to pass through most water filtration systems. Microplastic pollution has become a severe environmental threat in Taiwan and is caused by the use of plastics in everyday life. Microplastics come from various sources, predominantly plastic debris that gradually decomposes into tiny pieces. These tiny pieces are able to pass through water filtration systems, which then drain into oceans, lakes, and rivers and have seriously negative effects on human health. Specifically, these tiny plastic pieces are lipophilic and easily absorb poisonous organic compounds on ocean surfaces, such as endocrine-disrupting chemicals and dioxin. As a consequence, these poisonous organic compounds become part of the human food chain. According to several media reports, these poisonous organic compounds, when accumulated in large quantities in the body, have detrimental effects on human health. Starting in 2002, the government in Taiwan instituted several policies to restrict the use of plastic products to mitigate the effect of microplastic pollution. However, the microplastic pollution rate in Taiwan is still high. For example, a recent investigation in Taiwan showed that the amount of tap water that contains microplastics ranged from 44% to 61% and that all water in the ocean contains microplastics [16,17].

## 2. Literature Review and Hypotheses

### *2.1. Fear Appeals and the EPPM*

This study adopted two theories—the EPPM and dual process models—as theoretical frameworks. The EPPM assumes that two variables—perceived threat and perceived efficacy—are essential for fear-appeal communication to produce persuasive outcomes. Perceived threat consists of perceived severity and perceived susceptibility, while perceived efficacy is comprised of perceived response efficacy and perceived self-efficacy. According to the EPPM, messages require a high level of threat to gain individuals' attention. Once individuals start to process fear-appeal messages, two processes are elicited: danger-control and fear-control processes. Danger-control processes are the expected outcomes of fear-appeal communication in which receivers try to reduce the danger presented and accept the solutions suggested in the messages. Fear-control processes are the unexpected outcomes of fear-appeal communication in which receivers try to reduce the fear aroused by the messages and become defensive to discredit the messages. Two conditions are necessary for receivers to employ danger-control processes: the first is for receivers to feel a high level of threat and efficacy of the messages. The second is for receivers to perceive a higher level of efficacy than that of threat [1,3,18,19].

### *2.2. Personality and the EPPM*

According to Witte (1992) [11], individual differences such as prior experiences, culture, and personality traits affect the appraisal of threat and efficacy, and thus, a fear-appeal message often produces different perceptions among individuals with different backgrounds. As proposed in the EPPM, individuals' personality traits and demographics interact with the perceived threat and perceived efficacy of fear appeals to affect the individuals' attitudes and behaviors [11]. Nevertheless, Popova (2012) found that

this proposition has not received conclusive support [2]. Previous research [1,2,20–22] has applied a variety of variables to examine how individual differences influence the appraisal of threat and efficacy. For example, Millar and Houska (2007) investigated individuals' masculinity and found a significant interaction between masculinity and argument types; for fear-reducing messages, subjects with a high level of masculinity were more likely to perform the recommended behavior, while for informational messages, no significant differences were found between the high- and low-masculinity subjects [21]. Conversely, the study by Witte and Morrison (2000) found no significant interaction between subjects' trait anxiety and the strength of fear appeal when examining the issue of AIDS [22]. Nevertheless, there have been no studies thus far that use the personality trait of reactance proneness to investigate the effect of individual differences on perceived threat and perceived efficacy among individuals. Furthermore, the reason this study uses this personality trait—reactance proneness—is that individuals with high degrees of reactance are concerned with individual freedom of choice and do not like to be told how to handle things. Fear-appeal messages rely on highly threatening information to scare people and then provide an efficacious solution to correct their risky behaviors, and this approach is regarded as severely infringing on individuals' freedom of choice [23,24]. Hence, it is important to understand how this type of personality trait affects the effectiveness of fear-appeal messages. The findings on this personality trait will add to the existing literature on the best persuasive approaches when targeting individuals who are highly reactant.

The concept of reactance proneness originates from psychological reactance theory. Brehm and Brehm (1981) originally considered psychological reactance to be activated only by situations and not by a specific trait [25]. However, they later discovered that individuals' level of need for autonomy and self-determination differ; thus, Brehm and Brehm conceived of the idea of reactance proneness as a personality trait. Empirical studies have shown that individuals with high levels of reactance are characterized by being autonomous, self-determined, rebellious, and independent [23,26]. Highly reactant individuals prefer to have sufficient freedom to make decisions and dislike being told how to handle things. In particular, highly reactant individuals tend to do the exact opposite of what they are instructed to do by others. Prior research has shown that reactance proneness is a better indicator than other personality traits, such as sensation seeking, of predicting the adoption of risky behaviors [23]. For example, Miller and Quick (2010) discovered that highly reactant individuals were more likely to use tobacco products and adopt risky sex behaviors than their less reactant counterparts [27]. Furthermore, highly reactant individuals were more sensitive to variations in language and tended to be more affected by linguistic variations than their less reactant counterparts. In addition, most studies have measured this personality trait—reactance proneness—by using the scale developed by Hong and Faedda (1996) [28], which contains two dimensions—reacted perceptions and reacted behavioral intentions, whereas the concept of psychological reactance in psychological reactance theory (Shen and Dillard, 2005) contains two dimensions—anger and negative cognition. Therefore, the two concepts—psychological reactance and reactance proneness—differ greatly from one another [29].

One assumption of the EPPM is that threat messages are used to grab recipients' attention and efficacy messages are used to alleviate fear, which, in turn, leads the recipients to accept the adaptive behaviors recommended in the messages [30–32]. Therefore, fear appeal messages contain both negative (threat) and positive (efficacy) messages. As indicated in the literature review, highly reactant individuals pay less attention to threat messages than to efficacy messages because the former describe the terrible consequences of unhealthy behaviors, which threatens their freedom of choice. In contrast, they pay more attention to efficacy messages because these messages provide solutions for recipients and do not pose any threat to their freedom of choice. Therefore, highly reactant individuals will be more affected by efficacy messages and less affected by threat messages. In line with this reasoning, the first hypothesis was developed as follows:

**Hypothesis H1:** *Respondents' reactance proneness is less related to their perceived threat but more and positively related to their perceived efficacy.*

### *2.3. Information Processing and the EPPM*

One criticism that scholars bring against the EPPM is that it does not explain how the processing of fear-appeal messages affects recipients' subsequent modes of information processing. In a meta-analysis on fear appeals, de Hoog, Stroebe, and de Wit (2007) used dual processes models to explain the importance of linking fear-appeal messages with their subsequent information-processing modes [10]. According to dual processes models [13,14], individuals adopt either a heuristic mode or a systematic mode to process information. If a systematic mode is employed, individuals make a great deal of cognitive effort to process messages, such as examining the logic carefully and retrieving related information from memory to evaluate the message quality. The attitudes resulting from the use of a systematic mode are persistent and better able to resist counter-persuasion. Therefore, if a fear-appeal approach allows recipients to adopt systematic modes, then it can prove that this approach is an effective persuasive model. In contrast, if a heuristic mode is employed, individuals make less cognitive effort but use superficial cues to process the messages. The attitudes resulting from the use of a heuristic mode are transient and easy to change [2,9,10].

According to the literature, fear is evoked when individuals experience an approaching threat that is serious and highly likely to threaten their physical or psychological well-being. Therefore, a major emotion elicited from fear-appeal communication is fear, which is characterized by a low level of certainty and controllability [5,20,33,34]. Prior research has shown that risk judgment is mainly determined by two dimensions, certainty and situational controllability; thus, the lower the degree of certainty and situational controllability that individuals perceive, the higher the degree of risk they will judge a threat to carry. According to Nabi (2003), emotions have a framing effect because different types of emotions guide individuals to adopt different information-processing modes, which, in turn, influence their final judgments [34,35]. For example, past studies found that when low-certainty emotions were aroused, people tended to adopt a systematic information-processing mode because they did not know what would happen next and tended to examine information carefully to avoid harm. In contrast, when high-certainty emotions are elicited, people are surer about what will happen next and are, thus, more likely to use a heuristic information-processing mode [35].

As mentioned previously, the EPPM assumes that highly threatening messages are used to grab recipients' attention and efficacy messages are used to assuage recipients' fear to allow them to adopt danger-control processes [1,30–32,36,37]. That is, recipients' perceived threat and perceived efficacy must work together to make fear-appeal communication effective. Therefore, in the initial stages of fear-appeal communication, recipients should perceive a higher level of threat than that of efficacy. Moreover, fear-appeal messages always present threat messages first, and efficacy messages are presented afterward. With this reasoning, this study predicts that recipients' perceived threat and perceived efficacy are both positively related to the adoption of a systematic mode of information processing and that recipients' perceived threat will exert a greater effect on the adoption of a systematic mode than their perceived efficacy does. In contrast, in the later stages, recipients' perceived threat will be lower than their perceived efficacy, as this allows them to adopt adaptive behaviors. Hence, this study hypothesizes that recipients' perceived efficacy exerts a greater effect on their adaptive behavioral intentions than perceived threat does. In line with this reasoning, the following hypotheses were developed:

**Hypothesis H2a:** *Recipients' perceived threat will have a higher impact than their perceived efficacy on the adoption of a systematic information-processing mode.*

**Hypothesis H2b:** *Recipients' perceived efficacy will have a higher impact than their perceived threat on their behavioral intentions*.

According to de Hoog et al. (2007), the formation of attitudes differs from that of behaviors because individuals form their attitudes solely based on their cognitive understanding, whereas individuals' behaviors can be activated from either their cognitive understanding or their affective perceptions [10]. More specifically, past research has shown that individuals establish attitudes following an objective approach involving the thorough evaluation of the information at hand; hence, the meta-analysis conducted by de Hoog et al. (2007) found that individuals' perceived severity had a much greater effect on their attitudes than their perceived susceptibility did because a message about severity describes the degree of severity of a risk, which is an objective message, whereas a susceptibility message emphasizes individuals' personal involvement with a risk, which is a type of affective involvement [10]. Similarly, our previous study (2020) also discovered that the emotions evoked by fear appeal messages, including fear and anxiety, did not exert any effects on the respondents' attitudes but had a significant effect on their behavioral intentions toward colorectal cancer prevention [38]. Given these findings from the literature review, the following hypothesis was developed:

**Hypothesis H2c:** *Respondents' perceived threat will have a higher impact on their attitudes than their perceived efficacy does*.

### *2.4. Information Processing and Attitudes/Behavioral Intentions*

As indicated by dual process models [13,14,39,40], individuals use either a systematic mode or a heuristic mode to process information. When systematic modes are adopted, people allocate a great deal of cognitive resources to scrutinizing the information, including evaluating the logic, reasoning, and evidence provided to judge the quality of the information. Therefore, the resulting attitudes are persistent and not easily changed. In contrast, when heuristic modes are employed, individuals use superficial cues and allocate few cognitive resources to analyzing the information, and the attitudes that result are fragile and susceptible to counter-persuasion. Several empirical studies demonstrated that when individuals adopted systematic modes to process information, they were more likely to be persuaded by messages with high-quality arguments, which, in turn, affected their attitudes. Furthermore, as indicated in the theory of planned behavior, behaviors or behavioral intentions are derived from attitudes [41–43]. Conversely, when heuristic modes were adopted, individuals tended to establish their attitudes based on superficial cues such as the majority or expert opinions rather than the quality of the argument in the messages [14,44,45]. This study adopted three types of fear appeal messages—high threat/high efficacy (HH), high threat/low efficacy (HL), and low threat/low efficacy (LL). When the recipients received the HH messages, highly threatening messages regarding the microplastic pollutions were described; thus, it was likely that the recipients would adopt a systematic mode to process the messages. Moreover, the HH messages provided efficacious solutions to allow the recipients to adopt a danger-control process. In contrast, when the respondents received HL or LL messages, a low degree of efficacy of the solution caused them to adopt a fear-control process, which resulted in a boomerang effect. In line with this reasoning, the following hypotheses were developed:

**Hypothesis H3a:** *Respondents' use of systematic modes will be positively associated with their attitudes, which, in turn, positively affect their behavioral intentions regarding the prevention of microplastic pollution*.

**Hypothesis H3b:** *Respondents' use of heuristic modes will be negatively associated with their attitudes, which, in turn, negatively affect their behavioral intentions regarding the prevention of microplastic pollution*.

The relationships among major variables of this study are summarized in the Figure 1 for Investigation.

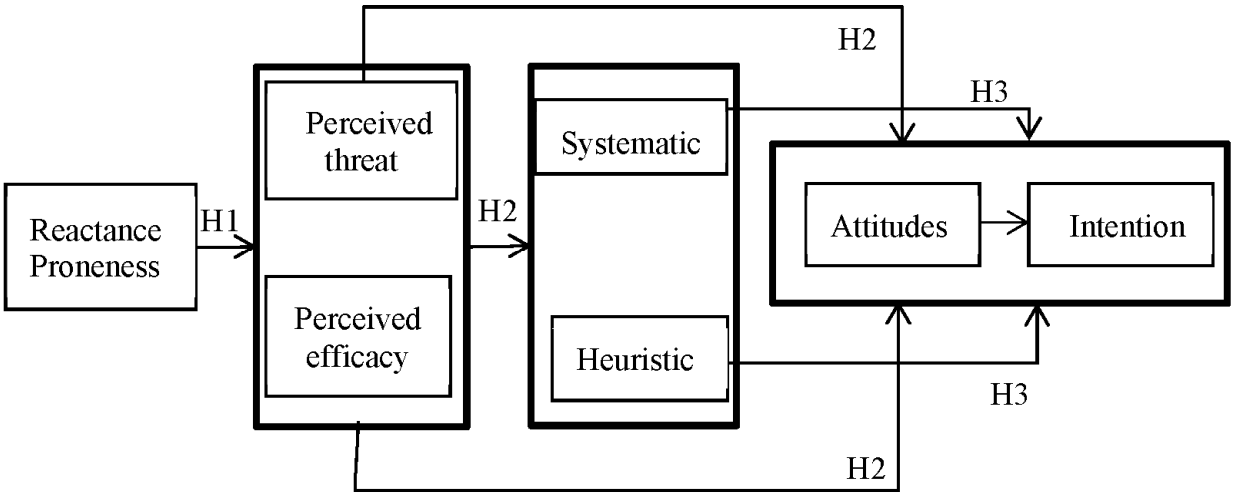



**Figure 1.** Figure for Investigation.

## 3. Research Methodology

### *3.1. The Experiment*

An experiment was conducted with college students who were recruited from nine courses offered by three universities, two in northern Taiwan and one in southern Taiwan. Specifically, this study involved three types of questionnaires randomly distributed to the subjects in each of the nine courses: 118 subjects received the questionnaire with an HH (high-threat/high-efficacy) message, 115 subjects received the questionnaire with an HL message, and 129 subjects received the questionnaire with an LL message. The three types of questionnaires were similar overall and differed only in their fear appeal messages. Among the 362 subjects, 46% were male and the remaining 54% were female. Approximately 98% of the sample were between 18 and 22 years old, and only 7 subjects indicated that they were older than 22 years old. Among the 362 subjects, 184 were from a private university in northern Taiwan, 86 were from a national university in northern Taiwan, and the remaining 92 were from a national university in southern Taiwan.

The EPPM assumes that it is the appraisal of threat and efficacy rather than the objective degrees of threat and efficacy that affect changes in the recipients' attitudes and behaviors. According to Witte (1992), in addition to fear appeals, individuals' prior experiences, culture, and personality traits can all affect their appraisal of threat and efficacy [1]; thus, the same fear-appeal message that causes person A to perceive high threat and high efficacy may cause person B to perceive high threat and low efficacy. Therefore, the three message groups—HH, HL, and LL—were used only to stimulate different degrees of perceived threat and perceived efficacy. Following the procedures in prior studies, the means of perceived threat and perceived efficacy were used to divide all subjects into four perception groups—HH (high threat with high efficacy), HL (high threat with low efficacy), LH (low threat with high efficacy), and LL (low threat with low efficacy) [38,46]. Among the 362 subjects, there were 138 subjects in the perceived HH group, 68 subjects in the perceived HL group, 59 subjects in the perceived LH group, and 97 in the perceived LL group.

The data collection procedure for this study was approved by the Research Ethics Committee for Human Subject Protection by the authors' university. The approval number is NCTU-REC-108-088W.

### *3.2. Major Variables*

Four sets of variables were examined, the first of which was reactance proneness. Reactance proneness was measured by using the scale developed by Hong and Faedda (1996), which contains nine items [47]. The second set of variables comprised the four elements of the EPPM, including perceived severity, perceived susceptibility, perceived response efficacy, and perceived self-efficacy. The four elements were assessed by twelve items adapted from Witte (1994), with each element assessed by three items [48]. The third major set of variables involved information-processing modes (systematic and heuristic), which were measured by seven items used in the studies by Griffin and colleagues [49,50]. The fourth set of variables included attitudes and behavioral intentions toward preventing microplastic pollution, both of which were measured by three items. The attitude items asked the subjects to indicate whether reducing the use of plastic products (1) is important, (2) can make the environment better, and (3) ought to be promoted to everyone. The behavioral intentions items were similar to those for attitudes but asked the subjects to indicate their willingness to take action. All the variables were measured by a 7-point Likert scale. The means, standard deviations, and reliability scores of the major variables are summarized in Table 1.

**Table 1.** Mean, standard deviations, and reliability for the major variables.

| Variable | Number of Items | Mean | SD | Cronbach's Alpha |
|---|---|---|---|---|
| Reactance Proneness | 9 | 3.96 | 1.01 | 0.823 |
| Perceived threat | 6 | 5.65 | 1.10 | 0.929 |
| Perceived efficacy | 6 | 4.61 | 1.13 | 0.852 |
| Systematic processing | 3 | 5.08 | 0.97 | 0.613 |
| Heuristic processing | 4 | 3.27 | 1.34 | 0.842 |
| Attitude | 3 | 5.75 | 1.19 | 0.910 |
| Behavioral intentions | 3 | 5.06 | 1.29 | 0.801 |

All variables were measured by using a Likert scale of 1–7.

### *3.3. Development of Stimulus Messages*

The following steps were used to select three types of fear appeal messages for this study: (1) This study analyzed 128 news articles on the issue of microplastic pollution that were reported by Taiwan's major newspapers in 2018. This study chose sixteen news articles as stimulus messages. (2) A focus group was conducted with five communication graduate students, who were asked to review the sixteen news articles and gave reasons why a given article was perceived to be high or low in either perceived threat or perceived efficacy. Using the results from the focus group, this study selected the four news articles—high/low threat messages and high/low efficacy messages. (3) Finally, two pilot studies were conducted to ensure the differences between the high- and low-threat messages as well as the differences between the high- and low-efficacy messages. This study recruited sixty college students for the first pilot study, with 30 students for the high-threat message and the other 30 for the low-threat message. For the second pilot study, 82 college students answered the questionnaires with 41 students for the high-efficacy message and the other 41 for the low-efficacy message. Four t-tests were performed and the results showed that (1) the high-threat message differed significantly from the low-threat message on perceived severity ($M$ = 6.11 vs. $M$ = 5.30, $p$ = 0.007) and perceived susceptibility ($M$ = 6.30 vs. $M$ = 5.36, $p < 0.001$), and (2) the high-efficacy message differed significantly from the low-efficacy message in terms of perceived response efficacy ($M$ = 5.04 vs. $M$ = 4.25, $p$ = 0.005) and perceived self-efficacy ($M$ = 5.32 vs. $M$ = 4.20, $p < 0.001$).

The high-threat message describes microplastics as being plastic pieces smaller than 5 mm that are able to pass through most water filtration systems and, thus, become part of the human food chain. Due to their lipophilicity, microplastics tend to absorb poisonous organic compounds in rivers and lakes, which have a seriously harmful effect on human health. The high-threat message also cites a recent study showing that 44 to 61% of Taiwan's tap water contained microplastics. The low-threat message uses a news story from Italy on the issue of microplastic pollution. This news story cites a recent study showing that most tap water, rivers, and lakes in Italy contain microplastics. However, this news story described interviews with medical experts who suggested that this is not a serious issue but that if people are concerned, they can install water filters to remove microplastics. The high-efficacy message first states the numerous policies that the government in Taiwan has enacted to restrict the use of plastic products as well as the effectiveness of these policies. Then, the high-efficacy message offers several solutions for individuals to effectively reduce their use of plastics in everyday life, such as bringing reusable bags when shopping, not purchasing bottled water, and separating different types of waste. The low-efficacy message first describes the difficulty encountered by the Taiwanese government in reducing people's use of plastic products and then provides several solutions that may be difficult for individuals to carry out, such as not using toothpaste when brushing their teeth or not purchasing any food with plastic containers.

### *3.4. Manipulation Check*

This study included two t-tests to examine the differences between the HH and LL message groups. The results, summarized in Table 2, showed that the HH message group differed significantly from the LL message group in terms of perceived threat ($t = 4.00$, $M = 35.35$ versus $M = 32.02$, $p < 0.001$) and perceived efficacy ($t = 2.87$, $M = 28.81$ versus $M = 26.26$, $p < 0.001$), demonstrating that the manipulation in the fear appeal messages was successful.

**Table 2.** Manipulation tests for the differences between the HH and LL message groups.

| **Perceived Threat** | | | | | |
|---|---|---|---|---|---|
| **Message Groups** | ***N*** | ***Mean*** | ***SD*** | ***t*-Value** | ***p*** |
| 1. HH | 129 | 35.35 | 5.50 | 4.05 | 0.000 |
| 2. LL | 118 | 32.16 | 7.36 | | |
| **Perceived Efficacy** | | | | | |
| Message Groups | *N* | *Mean* | *SD* | *t*-Value | *p* |
| 1. HH | 129 | 28.81 | 6.02 | 2.91 | 0.004 |
| 2. LL | 118 | 26.26 | 7.73 | | |

Then, a chi-square test was conducted to examine how the three message groups (HH, HL, and LL) were distributed into the four perception groups. The results, summarized in Table 3, demonstrated that for the subjects who received the HH message, 50% were classified into the perceived HH group and 21.2% were classified into the perceived LL group. For the subjects who received the LL message, 38% were in the perceived LL group and 27.1% were in the perceived HH group. The chi-square test was significant ($p = 0.001$), indicating that the manipulation in the fear appeal messages was successful.

**Table 3.** Differences between the message and perceived groups.

| Message Groups | | Perceived Groups | | | | |
|---|---|---|---|---|---|---|
| | | **HH** | **HL** | **LH** | **LL** | **Total** |
| HH | frequency | 59 | 21 | 13 | 25 | 118 |
| | % | 50.0% | 17.8% | 11.0% | 21.2% | 100% |
| HL | Frequency | 44 | 26 | 22 | 23 | 115 |
| | % | 38.3% | 22.6% | 19.1% | 20.0% | 100% |
| LL | frequency | 35 | 21 | 24 | 49 | 129 |
| | % | 27.1% | 16.3% | 18.6% | 38.0% | 100% |

$\chi 2$ (3) = 22.24, $p$ = 0.001.

### 3.5. Statistical Analyses

To examine the hypothesized relationships among the variables, this study used structural equation modeling (SEM) analyses using Mplus 7.4 [51]. Three criteria recommended by statisticians were adopted to measure the model fit: RMSEA (<0.08), SRMR (<0.08), and CFI (>0.90) [52,53]. The results from the SEM demonstrated that RMSEA = 0.081, SRMR = 0.03, and CFI = 0.975, indicating that the model fit was good.

## 4. Research Findings

The data in Figure 2 show that respondents' reactance proneness was positively associated with their perceived threat ($\gamma$ = 0.132, $p$ < 0.05) and perceived efficacy ($\gamma$ = 0.195, $p$ < 0.01). Moreover, the $R^2$ for reactance proneness on the perceived threat was only 0.6% and the $R^2$ for reactance proneness on the perceived efficacy was 1.8%. Therefore, H1 was supported.

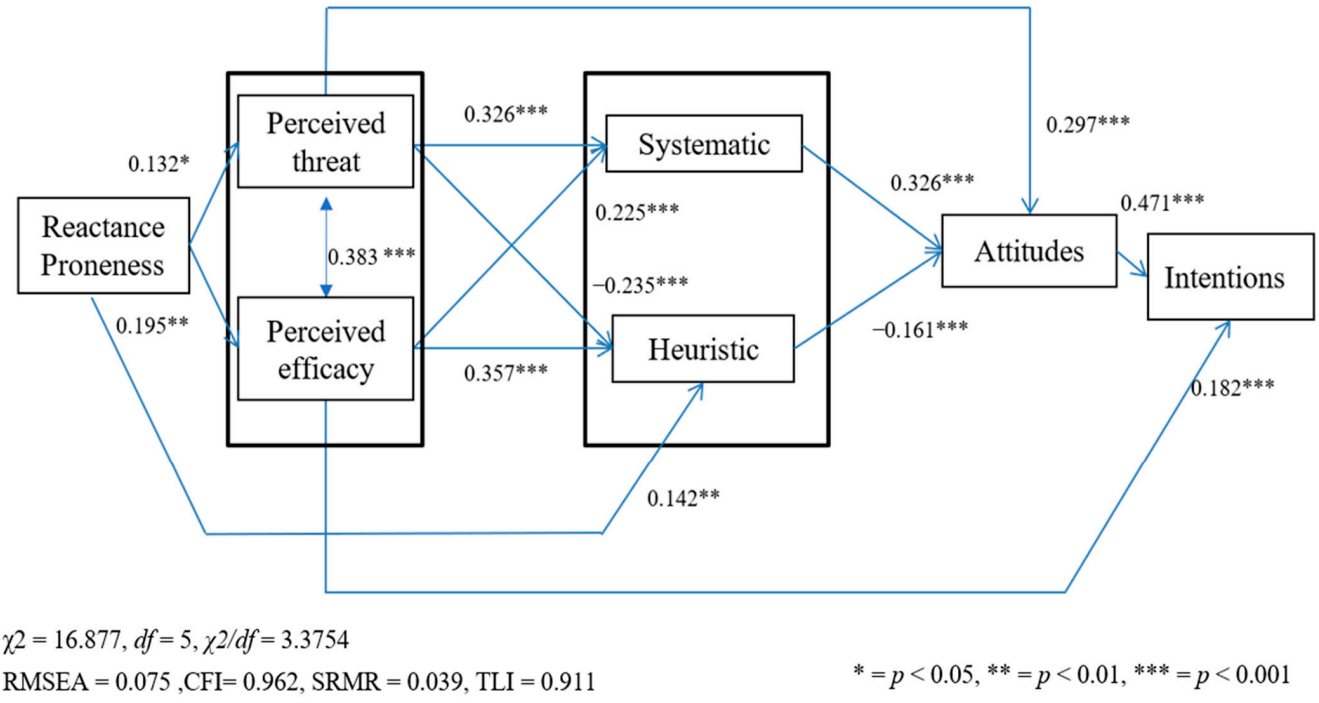



**Figure 2.** SEM for personality traits, information-processing modes, fear appeals, and attitudes/intentions.

As indicated in Figure 2, recipients' perceived threat and perceived efficacy were positively related to their adoption of a systematic mode for information processing, but recipients' perceived threat ($\gamma$ = 0.326, $p$ < 0.001) had a greater effect on adoption than

perceived efficacy ($\gamma = 0.225$, $p < 0.001$) did. Furthermore, the $R^2$ for the perceived threat on the adoption of a systematic mode was 17.6%, and the $R^2$ for the perceived efficacy on the adoption of a systematic mode was only 9.8%. Therefore, H2a was supported. For attitudes and behavioral intentions, Figure 2 indicates that recipients' perceived efficacy ($\gamma = 0.182$, $p < 0.001$) significantly affected their behavioral intentions regarding the prevention of microplastic pollution, while perceived threat did not. In contrast, recipients' perceived efficacy did not have a significant impact on their attitudes, but recipients' perceived threat did ($\gamma = 0.297$, $p < 0.001$). Hence, both H2b and H2c were supported.

For H3a and H3b, Figure 2 indicates that the adoption of a systematic information-processing mode was positively associated with attitude changes ($\gamma = 0.326$, $p < 0.001$), which, in turn, positively influenced changes in behavioral intentions ($\gamma = 0.471$, $p < 0.001$) regarding the prevention of microplastic pollution. In contrast, the use of a heuristic mode of information processing ($\gamma = -0.161$, $p < 0.001$) exerted a negative effect on attitude change. Hence, both H3a and H3b were supported.

In addition, Figure 2 indicates that recipients' reactance proneness had a positive and direct effect on the adoption of heuristic information-processing modes ($\gamma = 0.142$, $p < 0.001$), which, in turn, negatively affected their attitudes and behavioral intentions.

## 5. Discussion

### *5.1. Personality and Fear Appeals*

As hypothesized in H1, respondents' reactance proneness was positively associated with both their perceived threat and perceived efficacy, but their reactance proneness was less related to their perceived threat than to their perceived efficacy. These results are congruent with past studies' findings, demonstrating that highly reactant individuals do not like to be given instructions but prefer to have more decision-making freedom and, thus, pay more attention to efficacy messages than threat messages. Past studies have showed that highly reactant individuals do not like threat messages that make them feel that their freedom of choice is being infringed upon [23,26]. Therefore, this study predicted that highly reactant individuals would pay less attention to and, therefore, not be affected by threat messages. However, this study discovered that individuals' reactance proneness still exerted a significant impact on their perceived threat, indicating that threat messages also played a significant role in the responses of highly reactant individuals. A possible explanation for this unexpected finding is that fear appeal messages contained both threat and efficacy messages; thus, when threat messages were used together with efficacy messages, their perceived infringement on freedom of choice might have been greatly reduced, and hence, this study found that reactance proneness exerted a positive impact both on perceived threat and perceived efficacy.

This study discovered that respondents' reactance proneness did not directly affect their use of a systematic information-processing mode but had an indirect effect via perceived threat and perceived efficacy on the use of a systematic mode of processing. However, this study found that respondents' reactance proneness had a direct effect on the use of a heuristic information-processing mode. Past studies [1,30,31] showed that perceived efficacy alone did not allow fear-appeal messages to obtain intended outcomes and that perceived efficacy had to work together with perceived threat to achieve the most persuasive outcomes. This study found that although reactance proneness tended to guide individuals to adopt a heuristic mode to process information, individuals' reactance proneness was also positively associated with their perceived threat and perceived efficacy, both of which led reactant individuals to use a systematic information-processing mode. Therefore, fear appeal messages could still work well when encountering individuals who tend to be highly reactant.

According to the EPPM, perceived threat and perceived efficacy are essential factors in making fear-appeal messages effective. In particular, highly threatening and efficacious messages are necessary to obtain the most persuasive outcomes. This study found that perceived threat not only positively affected recipients' adoption of

systematic information-processing modes but also negatively influenced their use of heuristic information-processing modes, which positively changed their attitudes and behavioral intentions. This study discovered that individuals' reactance proneness was less associated with their perceived threat than with their perceived efficacy, but the association with perceived threat was significant. Therefore, these findings indicate that fear-induced communication is applicable to a group of people who are highly reactant.

In general, this study found that recipients' reactance proneness first affected the appraisal of threat and efficacy and then influenced their adoption of information-processing modes, which, in turn, impacted their attitudes and behavioral intentions regarding the prevention of microplastic pollution. These findings demonstrate that individuals' differences first influenced their appraisal of fear-appeal messages and then affected persuasive outcomes of the messages. That is, individual differences first impacted the elements of the EPPM and then influenced recipients' attitudes and behavioral intentions.

### *5.2. Effects of Fear Appeals on Information Processing, Attitudes, and Intentions*

As predicted by H2a, respondents' perceived threat exerted a greater effect on their adoption of a systematic information-processing mode than their perceived efficacy did. The assumption of the EPPM is that messages with a high degree of threat are used to grab people's attention, and when people process fear-appeal messages, efficacy messages alleviate people's fear to allow them to employ danger-control processes [1,3,31,36,37]. Consistent with this assumption, respondents' perceived threat played a more essential role in the initial stages than their perceived efficacy did, which led the respondents to adopt systematic information-processing modes. Figure 2 shows that the respondents' perceived threat was not only positively related to their use of systematic modes but also negatively associated with their use of a heuristic information-processing mode, indicating that when the respondents perceived a higher level of threat, they were more likely to use a systematic information-processing mode and less likely to adopt a heuristic mode.

As hypothesized by H2b, respondents' perceived efficacy exerted a significant effect on their behavioral intentions, and respondents' perceived threat had no impact on their behavioral intentions. These findings are congruent with the assumption of the EPPM, demonstrating that once the respondents processed the fear appeal messages, their perceived degree of efficacy had to be higher than their perceived degree of threat to allow them to adopt adaptive behaviors. Therefore, respondents' perceived efficacy was discovered to exert a greater effect on behavioral intentions than perceived threat did [1,31].

In line with the prediction of H2c, this study found that the respondents' attitudes were solely affected by their perceived threat and were not influenced by their perceived efficacy, which is congruent with the findings of prior research. Previous studies have shown that individuals' attitudes are formed based on their cognitive understanding, but their behaviors and behavioral intentions can be activated either by cognitive understanding or affective involvement [10]. These findings also indicate that behavioral intentions that were activated by cognitive understanding were more stable and persistent because these behavioral intentions were formed through thoroughly articulated processes.

### *5.3. Information Processing, Attitudes, and Intentions*

As predicted by H3a and H3b, respondents' use of a systematic information-processing mode exerted a positive effect on their attitudes and behavioral intentions, while respondents' use of a heuristic mode had a negative effect on their attitudes and behavioral intentions. These findings are congruent with this study's hypothesis that the respondents who perceived a high level of both threat and efficacy were more likely to use a systematic information-processing mode, while the respondents who perceived a low level of both threat and efficacy were more likely to adopt a heuristic

information-processing mode. Two one-way ANOVAs were conducted to further verify this prediction by comparing the four perceived groups—HH, HL, LH, and LL—in terms of the use of a systematic or heuristic information-processing mode. The results showed that the four groups differed significantly regarding their use of a systematic ($F = 15.42$, $p < 0.001$) or heuristic information-processing mode ($F = 3.73$, $p = 0.012$). The post hoc analyses showed that the perceived HH group had the highest score in the use of a systematic mode, followed by the perceived HL and LH groups, which did not differ from each other; the analyses further showed that the perceived LL group had the lowest score. For the score of the heuristic modes, this study found that the HH and LL groups did not significantly differ and that the HL group had the lowest score in the use of a heuristic mode, which was significantly lower than those of the HH, LH, and LL groups. These findings indicated that the level of perceived threat was positively associated with the use of a systematic mode. In addition, this study found that when the respondents perceived a high level of threat but a low level of efficacy, they were less likely to use a heuristic information-processing mode.

In summary, this study found that when recipients encountered a highly threatening message accompanied by a highly efficacious message, they were more likely to adopt a systematic mode to process information, which, in turn, positively impacted their attitudes and behavioral intentions regarding the prevention of microplastic pollution. In particular, perceived threat was discovered to play an essential role in the adoption of systematic information-processing modes. These findings are consistent with the propositions of the EPPM and further indicate that fear-appeal communication is, in fact, an effective persuasive approach because it allows recipients to use a systematic mode to process fear appeal messages. The attitudes and behaviors resulting from this approach are more stable and better able to resist counter-persuasion.

## 6. Conclusions

This study adopted the EPPM and dual process models to examine how recipients' reactance proneness affected the appraisal of threat and efficacy, which, in turn, influenced their use of information-processing modes, attitudes, and behavioral intentions regarding the mitigation of microplastic pollutions in Taiwan. An experiment using three types of fear appeal messages was conducted using 362 college students as the subjects. Three conclusions can be drawn from this study's findings:

(1) The results of this study indicate that fear-induced communication is, in fact, an effective persuasive approach because the attitudes and behaviors resulting from the adoption of a systematic mode are more stable and better able to resist counter-persuasion than those resulting from a heuristic processing mode.
(2) Recipients' reactance proneness was discovered to first affect their perceived threat and perceived efficacy, which, in turn, influenced their attitudes and behavioral intention regarding the prevention of microplastic pollution, demonstrating that individual differences mediate fear-appeal messages to affect persuasive outcomes.
(3) This study found that perceived threat was important for fear-appeal messages to obtain persuasive outcomes. Furthermore, this study found that reactance proneness affected recipients' perceived threat; thus, fear-induced communication allowed this group of people who were highly reactant to make intended changes.

This study's contribution to the current literature is that it clarifies the role of individual differences in the EPPM. That is, this study found that reactance proneness first affected recipients' perceived threat and perceived efficacy and then influenced respondents' information-processing modes, attitudes, and behavioral intentions, which is congruent with the proposition of the EPPM but differs from the conclusion reached by Witte and Allen (2000) [1]. Future studies are needed to ascertain the role of individual differences in fear-induced communication. Another contribution of this study is to understand the relationships between perceived threat/perceived efficacy and information-processing modes. Consistent with the proposition of the EPPM, this study

discovered that perceived threat and perceived efficacy worked together to lead recipients to adopt a systematic mode for processing fear-appeal messages, which is considered an effective persuasion approach.

This study has its limitations, one of which is that there were no measurements of subjects' prior attitudes and personal involvement with the issue of microplastic pollution. Future studies should be conducted with a pretest and posttest experimental design to measure subjects' prior attitudes and personal involvement with this issue and to better understand the effectiveness of fear-appeal approaches. Furthermore, another limitation of this study is to rely on only one personality trait—reactance proneness—to understand the impact of individual differences on fear appeals. Future studies can be conducted by adopting two or more personality traits to better elucidate how personality traits interact or moderate the elements of fear appeals to affect individuals' attitudes and behaviors. For example, empirical studies have shown that among the five-factor model, extraversion and neuroticism are the two contrasting personality traits because extraverted individuals pay more attention to positive messages, while their neurotic counterparts focus more on negative messages [43,54]. Similarly, conscientiousness and agreeableness are found to be the contrasting personality traits in that conscientious people are work-oriented, whereas their agreeable counterparts are relationship-oriented [41–43]. Therefore, by comparing two contrasting personality traits, scholars will be able to further understand the role of individual differences in the EPPM.

**Author Contributions:** Conceptualization, S.-Y.L.; Data curation, S.-C.S.L. and H.-K.Z.; Formal analysis, S.-C.S.L., H.-K.Z. and S.-Y.L.; Funding acquisition, S.-C.S.L. and S.-Y.L.; Investigation, S.-C.S.L. and S.-Y.L.; Methodology, S.-C.S.L. and H.-K.Z.; Project administration, S.-C.S.L.; Supervision, S.-C.S.L.; Validation, H.-K.Z. and S.-Y.L.; Visualization, H.-K.Z.; Writing—original draft, S.-C.S.L.; Writing—review & editing, S.-C.S.L. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was supported by the Higher Education Sprout Project of National Yang. Ming Chiao Tung University (NYCU), the Ministry of Education of Taiwan, as well as the Ministry of Science and Technology of Taiwan (grant number: MOST 111-2423-H-A49-002 to S.-C.S.L.).

**Institutional Review Board Statement:** The whole procedure for this study was approved by the university's research committee for human subject protection before data were collected, and the approval number is NCTU-REC-108-088W.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Please contact the corresponding author for the information of data availability.

**Conflicts of Interest:** The authors declare no conflict of interest.

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