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FEAR APPEALS AND PERSUASION: TESTING FOR WITHIN-PERSON EFFECTS

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Abstract

Fear appeals have an extensive history in social scientific research. One of the earliest theories, the drive model, predicts that the fear-persuasion relationship is characterized by an inverted U-curve. Meta-analyses have firmly established that a between-persons curvilinear relationship between fear and persuasion is empirically unsupported. But, these studies cannot assess the within-person curvilinear predictions advanced by the drive model. Instead, the distinction between between-persons and within-person is often conflated in the literature. To assess this relationship, a methodology that can adequately test the within-person curvilinear prediction is outlined, and the results of a study which utilizes this methodology are presented. The current analysis finds empirical support for a within-person curvilinear relationship between dynamic fear arousal and persuasion, and experimental manipulation of fear response across different groups indicates that different fear curves differentially predict persuasion. The implications of these findings and potential future research are discussed.

Keywords: Curvilinear hypothesis, emotion, fear, fear appeals, persuasion

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Introduction

Fear appeals are a prevalent feature of persuasive message campaigns (Hale & Dillard, 1995; Ruiter, Abraham, & Kok, 2001; Yzer, Southwell, & Stephenson, 2012). These campaigns may benefit from a more nuanced understanding of the discrete emotional processes that influence the relationship between emotions and behavior (Consedine & Moskowitz, 2007). Although their effectiveness has been called into question, general findings indicate that fear appeals have the ability to persuade (Hastings, Stead, & Webb, 2004; Witte & Allen, 2000). However, the factors which define this relationship remain a matter of debate. One factor that has been neglected in the literature is the structural form of fear arousal over time within a given individual (Shen & Dillard, 2014). Fear, like other emotions, is generally recognized as a state of temporary affect, such that the extent to which an individual experiences fear may vary throughout a short amount of time (Batson, Shaw, & Oleson, 1992; Dillard & Anderson, 2004). Notably, the shape of this change may be a key explanatory variable within the fear-persuasion relationship.

Given their widespread use, it is no surprise that a number of theoretical predictions have been developed which attempt to describe the relationship between fear and persuasion (Hovland, Janis, & Kelley, 1953; Leventhal, 1970; Witte, 1992). One theoretical prediction that has fallen out of general acceptance is the curvilinear hypothesis, first proposed by Hovland, Janis, and Kelley in their work on the drive model (1953). This rejection is a result of extensive empirical evidence, which indicates that the fear-persuasion relationship is linear and not curvilinear (Boster & Mongeau, 1984; Mongeau, 1998; Witte & Allen, 2000). This hypothesis predicts that the relationship between the strength of a fear appeal and persuasion is characterized by an inverted curvilinear relationship, such that individuals who are exposed to fear appeals of moderate strength are more receptive to persuasion than individuals who are exposed to weak or strong fear appeals. However, one of the major theoretical assumptions of the drive model entails a second curvilinear relationship that is explicitly concerned with the structural form of within-persons fear arousal overtime. Notably, this second relationship remains untested, as the majority of fear appeal studies are designed to assess between-person effects (Shen & Dillard, 2014). Thus, there is an urgent need for new empirical research that can sufficiently address the within-person curvilinear predictions made by the drive model.

The following thesis attempts to address this need. First, I briefly discuss the definition of fear, fear appeals, and the components of fear appeals. Then, I summarize some of the major theoretical developments in fear appeal research including the curvilinear hypothesis, and I report the empirical research that rejects this hypothesis. Next, I discuss why the existing literature cannot fully address the curvilinear hypothesis, and I describe an experimental design which can test this prediction. Finally, I present the results of an empirical study which satisfies the conditions this design, and I discuss the theoretical implications of this study on the current body of research.

Fear and Fear Appeals

Emotions are generally recognized as intense, discrete, and complex affective states which are short in duration (Batson et al., 1992). Out of all the discrete emotions, fear has received the most consideration in the literature on persuasion (Nabi, 2002). The perception of imminent danger is predicted to be the primary cognitive antecedent of fear arousal (Dillard & Nabi, 2006). Fear results from a cognitive appraisal of the likelihood of bodily or psychological harm. Although the overwhelming emphasis on fear may be seen as a potential limitation in the discrete emotion-persuasion literature, special attention is paid to fear because it is persuasive.

For example, when compared to other discrete negative emotions, the positive persuasive influence of fear is considerably greater (Dillard & Peck, 2001). This makes fear an attractive choice for persuasive campaign designers, and this has led to a large body of research on the topic of fear appeals.

In a general sense, a fear appeal is any persuasive message that attempts to arouse fear (Mongeau, 2013). But, fear appeals do not necessarily arouse fear. In fact, many fear appeals do not arouse fear at all (Dillard, Plotnick, Godbold, Freimuth, & Edgar, 1996). Rather, fear appeals are better distinguished by the unique message features which are predicted to arouse fear and promote persuasion. This has led some to reject the term fear appeal and replace it with the term threat appeal (O'Keefe, 1990). Although I do not adopt that terminology in this thesis, the rejection may indeed be appropriate, as the use of distinct message features has characterized much of the literature on fear appeals. Usually, these features consist of two components, typically referred to as a threat and an efficacy component. These components are typically presented in a problem-solution format, such that individuals are first presented with a threat, and then exposed to a means of addressing said threat (Witte, 1992).

Theoretical Developments in Fear Appeal Research

Fear appeals are persuasive, but the mechanisms which explain this relationship are less clear. A number of theoretical models have been used to predict the persuasive effects of fear appeals, including the drive model (Hovland et al., 1953), the parallel response model (Leventhal, 1970), protection motivation theory (Rogers, 1975), and the extended parallel processing model (Witte, 1992). The development of these models is largely dependent on previous explanations, as each model incorporates and adapts various characteristics of its theoretical predecessors (Mongeau, 2013). But, each model varies in the degree to which within-person emotional arousal is given consideration as a theoretically important predictor. In the next section, I outline the rationale and predictions for each model.

The Drive Model

The drive model was the first major theoretical explanation of fear appeals in social scientific literature, and it predicts that intense negative emotions, including but not limited to fear, act as a functional drive that individuals are motivated to reduce or eliminate (Hovland et al., 1953). Negative emotions are expected to function as a drive state that is structurally similar to physiological motivations like sleep or hunger. The model identifies two sets of factors which influence the persuasiveness of a fear appeal: "1) factors which make for successful arousal of emotional tension, and 2) factors which make for successful rehearsal and reinforcement of the communicator's reassuring recommendations" (p. 66). Given these two factors, the drive model predicts that it is the desire to reduce or eliminate fear, and not the presence of fear itself, that is persuasive.

In this paradigm, a fear appeal is only persuasive to the extent that it is capable of arousing and reducing an emotional drive. Message recommendations which successfully reduce fear are experienced as rewarding, and individuals will continue to engage in these behaviors. But, if a fear appeal arouses an emotional drive without subsequently reducing that drive, then the drive model predicts that a message may interfere with persuasion (Hovland, et al., 1953). Drawing from Janis and Feshbach's (1953) data that looked at the effects of various dental health messages, the drive model identifies three types of interference, such that high levels of fear and anxiety are predicted to result in inattention to a message, aggression towards the communicator, and defensive avoidance of the threat message. From this, it follows that individuals who are capable of managing their fear arousal are more receptive to persuasion, while individuals who cannot reduce their fear engage in strategies which are counter-productive to persuasion. This rationale led to the development of the curvilinear hypothesis.

It is important to recognize that the drive model entails two separate formulations of the curvilinear hypothesis. The first formulation is concerned with the effects of between-person differences, such that individuals who experience varying levels of fear arousal may experience varying levels of persuasion. Here, the curvilinear hypothesis predicts that persuasion will be greatest among individuals who are presented with a fear appeal of moderate strength, opposed to individuals who are exposed to weak or strong appeals (Hovland et al., 1953). Moderate appeals are anticipated to best exemplify the two defining factors of persuasive fear appeals; specifically, moderate appeals make for the successful arousal and subsequent reduction of fear. In contrast, weak fear appeals fail to arouse fear, whereas strong fear appeals arouse fear without reducing it. Thus, the between-person relationship between the strength of a fear appeal and persuasion is predicted to assume the form of an inverted U-curve.

The second formulation considers the intrapersonal structural form of the fear-persuasion relationship, and attempts to predict the effect of within-person differences. In this formulation of the hypothesis, fear is understood to be a variable which has the potential to change from before, during and after exposure to a fear appeal. Here, it is the dynamic of this change that is the independent variable of consideration. Hovland, Janis, and Kelly (1953) make this prediction explicit, stating “a threat appeal is most likely to induce an audience to accept the communicator’s conclusion if a) the emotional tension aroused during the communication is sufficiently intense to constitute a drive state; and b) silent rehearsal of the recommended belief or attitude is immediately followed by reduction of tension” (p. 62). Notably, this formulation of the curvilinear hypothesis would also suggest that fear arousal is most persuasive when it resembles an inverted U-shaped curve. This curve would occur when an individual with low pre-message fear is aroused into a state of high fear during exposure to a threat component of a message, followed by a sharp decline in fear after exposure to a recommendation component.

Although the drive model implies two distinct curvilinear predictions, later theoretical developments did little to address the second formulation. For instance, Levanthal and Singer (1966) attempted to test the prediction that the reduction of fear is persuasive. But, their methodology ultimately relies on a between-persons assessment of fear arousal. Another example is Janis’ (1967) family-of-curves, which proposes that a fear appeal arouses two competing states of vigilance and hypervigilence. These two states are predicted to facilitate or hinder persuasion respectively, such that an individual will be more persuaded until they reach their optimal point of vigilance. Again, this optimal point is predicted to be a between-persons difference, varying from person to person as a function of individual differences or message features. Notably, this between-persons focus has been carried over into subsequent theoretical perspectives of fear appeals.

The Parallel Response Model

Leventhal's (1970) parallel response model marks a dramatic shift in the history of fear appeal research. Whereas the drive model was largely concerned with the affective process of emotional arousal, this model maintains that cognitive information processing is the primary cause of persuasion in response to a fear appeal. This model suggests that emotional and cognitive responses are arranged in a parallel relationship, such that "if a situation is interpreted as dangerous, the interpretation can give rise to coping efforts to minimize the impact of the danger, and it can simultaneously give rise to feelings or emotions of fear" (Leventhal, 1971, p. 1210). Fear appeals are predicted to arouse multiple evaluations, which are divided into two distinct categories: danger control and fear control.

The parallel response model identifies danger control as an adaptive process (Leventhal, 1970). When an individual undergoes danger control processing, they attempt to mitigate an external threat by incorporating a variety of cognitive or behavioral strategies. These strategies often entail the acceptance of a message recommendation, and the danger control process is conceptualized as the foundation of persuasion. On the other hand, fear control is a maladaptive process. An individual engaged in fear control attempts to reduce their emotional tension. Fear control processes are predicted to promote defensive and avoidant strategies that are reminiscent of Hovland et al.'s (1953) understanding of interference.

Although Leventhal (1970) predicts that danger and fear control processes can operate independently from one another, he notes that one process may overshadow the other under different conditions. When this occurs, the parallel response model predicts two separate fear-persuasion relationships. When danger control dominates, the relationship between the strength of a fear appeal and persuasion is positive and linear, and strong fear appeals increase the likelihood that an individual will attend to message recommendations. But, when fear control processes dominate, the relationship will be negative and linear, such that strong fear appeals inhibit elaboration and acceptance of the message recommendation. In general, the model predicts that the association between the strength of a fear appeal and persuasion is positive and linear, but the relationship between the intensity of emotional fear and persuasion is negative and linear. Notably, both predictions are wholly concerned with the effects of between-persons differences.

Protection Motivation Theory

Concerned about the "intractable pattern of conflicting results," protection motivation theory attempts to specify the constituent components of a fear appeal (Rogers, 1975, p. 94). Drawing from Hovland et al.'s (1953) two sets of factors that make for persuasive fear appeals, protection motivation theory defined these factors as threat and efficacy components. Rogers' (1983) later theorized that the threat and efficacy components are both constructed from two subcomponents. The threat component includes material that is relevant to the undesirable consequences of an external threat (severity), and information that references the likelihood that the individual will experience these consequences (susceptibility). The efficacy component is composed of instructions for an effective response to an external threat (response efficacy), in addition to material concerning an individual's ability to execute that response (self-efficacy). These components are predicted to result in a series of cognitive, rather than emotional judgments.

Earlier models of protection motivation promoted a multiplicative effect (Rogers, 1975). Cognitive threat and efficacy evaluations combined to form a variable termed protection motivation which replaced the role of fear as a mediating explanatory variable. In this model, the persuasiveness of a fear appeal results entirely from cognitive assessments, and emotional fear is only persuasive to the extent that it influences our cognitive perceptions of threat and efficacy.

Extended Parallel Processing Model

Disturbed by the lack of attention given to emotional fear, Witte's (1992) Extended Parallel Processing Model (EPPM) attempts to focus on both cognitive and emotional explanations of persuasion. The model predicts that individuals have the potential to make multiple appraisals when they are exposed to a fear appeal. The first or primary appraisal in this model is concerned with the relative threat of a message. If a message is deemed to be threatening, an individual may then make a secondary appraisal. In this secondary appraisal, an individual assesses their ability to manage the presented threat. These appraisals incorporate the four components of a fear appeal defined by Rogers (1983), such that the first appraisal includes perceptions of severity and susceptibility, and the second appraisal includes perceptions of response efficacy and self-efficacy.

Drawing heavily from Leventhal's (1970) parallel response model, EPPM predicts that one of two types of processing strategies will result from these two appraisals (Witte, 1992). The first processing strategy is referred to as danger control processing. This occurs when individuals perceive a significant threat and believe that they have the ability to address said threat. The second processing strategy is referred to as fear control processing, and it occurs if an individual's threat evaluation outweighs their efficacy evaluation. Like the earlier parallel response model, fear control processing is predicted to interfere with cognition and persuasion, while danger control processing is thought to be conducive to persuasion.

A topic of special concern for this model is the issue of the critical point (Witte, 1994). "When persons realize that they cannot prevent a threat from occurring, either because they believe the response to be ineffective or because they believe themselves to be incapable of performing the recommended response, fear control processes will begin dominate over danger control processes" (p. 116). This logic is reminiscent of Janis' (1967) understanding of the optimal point, and EPPM makes predictions based upon where the critical point occurs within an individual. Under conditions of low efficacy, the critical point is predicted to occur immediately, and the relationship between the strength of an appeal and the acceptance of a message is predicted to be negative and linear. When perceptions of efficacy are perceived to be high, it is expected that individuals will never reach a critical point, and the relationship becomes positive and linear. And, under conditions of moderate efficacy, the critical point is expected to occur when messages present a moderate threat, such that the relationship between fear and persuasion will be curvilinear. Notably, the logic behind these predictions states that the critical point occurs at a specific point in time during exposure to the message. But, the predictions themselves are explicitly made between individuals with varying perceptions of efficacy.

Current Empirical Knowledge

It is safe to say that the first formulation of the curvilinear hypothesis has been thoroughly rejected by the empirical literature (Boster & Mongeau, 1984; Mongeau, 1998; Witte & Allen, 2000). Available meta-analyses indicate that between-person differences in fear arousal and persuasion exist, and they suggest that this relationship is positive and linear. Messages that induce higher levels of fear are found to be more persuasive. For instance, Boster and Mongeau (1984) found that individuals who experience greater fear arousal report greater changes in their attitudes (r = .21) and behavior (r = .10), and a subsequent analysis by Mongeau (1998) found similar effects for fear on attitudes (r = .20) and behavior (r = .17). These results were confirmed by Witte and Allen's (2000) meta-analyis for attitudes (r = .14), intentions (r = .11) and behavior. (r = .15). Conversely, Witte and Allen (2000) found no support for an inverted U-shaped curvilinear relationship between the strength of a fear arousal and persuasive outcomes (t = -.054, p = .999). The competing predictions can be seen in Figure 1, which depicts both linear and curvilinear between-person hypotheses. In the curvilinear hypothesis, moderate strength fear appeals are the most effective. However, in the empirically supported linear hypothesis, high strength fear appeals are the most persuasive. The results of these meta-analyses provide valuable insight into the fear-persuasion relationship, and they reliably indicate that the between-persons relationship between fear arousal and persuasion is linear and not curvilinear (Boster & Mongeau, 1984; Mongeau, 1998; Witte & Allen, 2000). But, they cannot adequately test the effects of within-person fear.

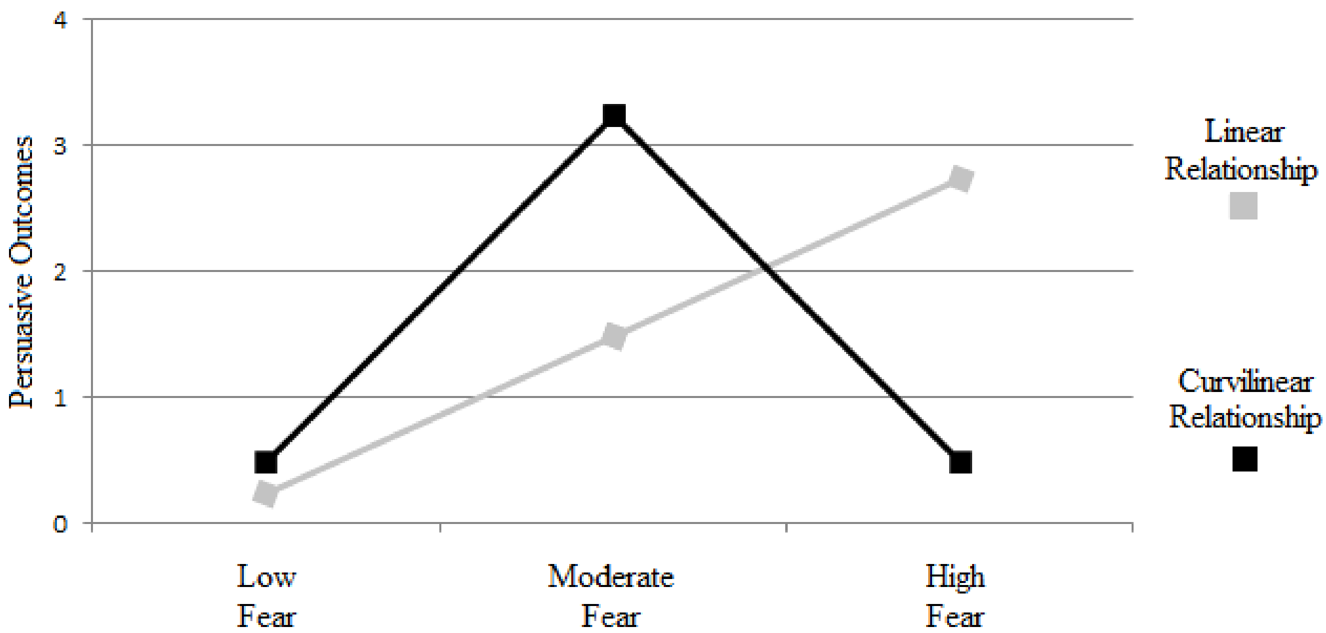

Figure 1. Linear and Curvilinear Hypotheses for Fear Arousal and Persuasion

The underlying rationale of the drive model asserts that the fear-persuasion relationship is the result of an internal, dynamic process of emotional arousal (Hovland et al., 1953). For a fear appeal to be persuasive, the message must first cause an individual to experience an onset of fear in response to a threat, followed by a subsequent offset of fear in response to a recommendation. In other words, the drive model predicts that the relationship between the strength of a fear appeal and persuasive outcomes is mediated by the structural form of fear over time, such that the message will persuade when within-person fear arousal resembles an inverted U-shaped curve. This is the second formulation of the curvilinear hypothesis.

Consider Figure 2, which depicts a longitudinal measure of fear arousal at three separate time points: before (t_0), during (t_1), and after (t_2) exposure to a fear appeal (Shen & Dillard, 2014). Each panel tracks a fictional person alongside their change in fear across these three periods in time. Although these panels may appear superficially similar to the curvilinear hypothesis presented in Figure 1, note that Figure 2 represents a repeated measures within-person design, such that the degree of fear arousal is shown along the Y axis, opposed to the between-persons design that measures fear arousal along the X axis. Panels A and B demonstrates the second formulation of the curvilinear hypothesis: a) fear is aroused during exposure to a threat message, and b) subsequently reduced after exposure to an efficacy message. This mirrors the within-person structural form of persuasive fear arousal proposed by the drive model. However, current evaluations of fear appeal effects have routinely failed to address the within-person curvilinear hypothesis made explicit by the drive model (Hovland et al, 1953).

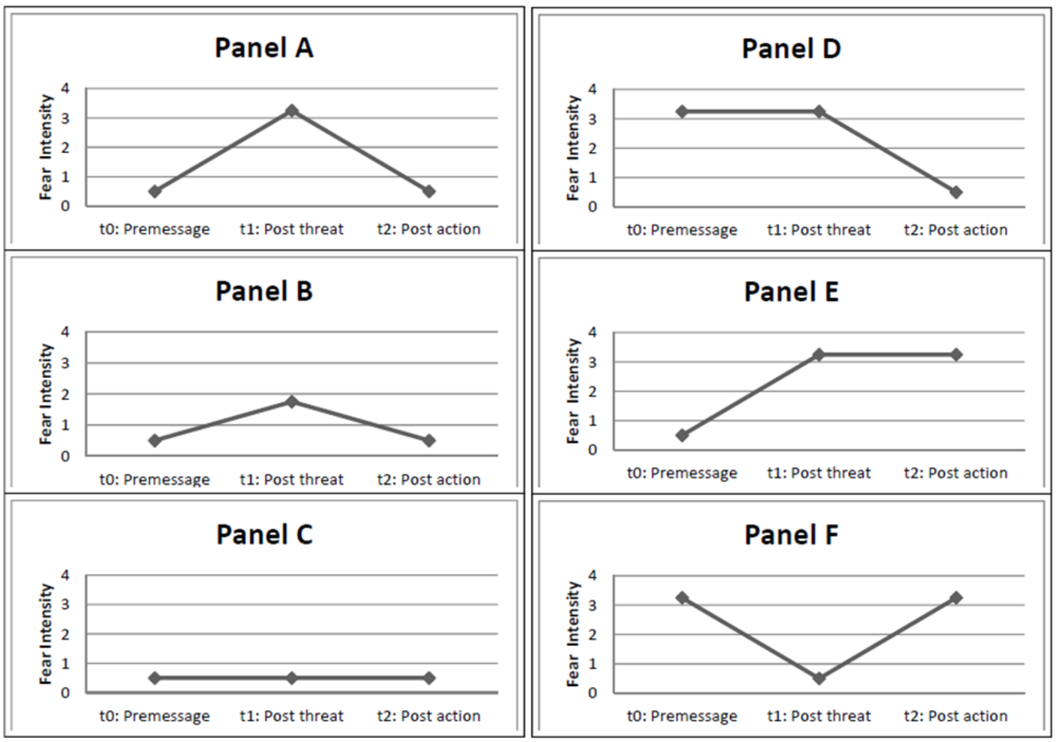

Figure 2. Hypothesized Functional Forms of Within-Persons Fear

Notably, Figure 2 illustrates that there is room for considerable variation when fear arousal is operationalized as a longitudinal within-persons measure. This variation can result from a difference in magnitude; for example, Panel A represents a greater increase followed by a greater decrease in fear when compared to panel B, but both panels depict an inverted U-shaped curve. But, within-person fear arousal may also vary in its structural form, such that a message may arouse no fear within an individual (panel C), an individual may experience fear before exposure to a message (panel D), an individual may still feel frightened after exposure to a message (panel E), or an individual may experience fear before, after, but not during a message (panel F). While researchers can claim with confidence that the between-persons relationship between fear and persuasion is positive and linear, the nature of the within-persons fear-persuasion relationship remains unclear.

This oversight may be the result of methodological limitations (Mongeau, 2013; Shen & Dillard, 2014). Fear arousal is most frequently treated as a manipulation check to assess the effects of experimental manipulation (Witte & Allen, 2000). As a result, the majority of fear appeal studies operationalize fear as a single post-test measure, although a few designs incorporate pre-test and post-test measures (Dillard & Anderson, 2004; Mongeau, 2013; Shen & Dillard, 2014). Both designs are capable of testing for between-person effects, and the inclusion of a pre-test measure makes it possible to adjust for pre-message fear to obtain presumably more accurate results. But, neither design can capture the onset and offset of fear in response to a message.

This is problematic for two reasons. First, the results of a post-test only measure are ambiguous. For example, individuals may report their peak level of fear arousal during exposure to a threat component, they may report their current emotional state after exposure, or they may report some combination of the two. Rossiter and Thornton (2004) calculated a summary index of correspondence using Kendall's tau and found that there was a strong correlation between post-test evaluations of fear and measures of peak emotional tension during exposure to a fear appeal ($\tau = .71$, $p = .02$). But, this is a single study, and even if it can be said with certainty that these post-test measures highly correspond with individual's peak emotional arousal, this information does little to further our understanding of the within-persons structural form of fear and its influence on persuasion. To demonstrate this, note how four out of the six panels in Figure 2 depict equal levels of peak fear intensity. A post-test only design may not distinguish between panels A, D, E and F. This is unsettling, as one can plainly see that these panels depict radically different responses to a fear appeal. Without the adoption of new research designs, it becomes impossible to evaluate the effects of a within-person curvilinear relationship between fear and persuasion.

Testing Within-Person Effects

To empirically address the second formulation of the curvilinear hypothesis, it is necessary to design a study which is capable of testing within-persons fear arousal. Shen and Dillard (2014) outline four criteria which must be met to accomplish this task. The first and most vital criterion is the data must be capable of generating a curve. To express this curve, a minimum of three measurements of fear arousal must be observed. This methodology is best demonstrated by Dillard and Anderson’s (2004) study on fear appeals, which assesses fear arousal before, during and after exposure to a fear appeal. Continuous assessments of fear arousal, including physiological and self-report measures, are also capable of generating a curve (Mewborn & Rogers, 1979; Rossiter & Thornton, 2004).

But, it is not enough to use a design that is capable of generating a curve. Rather, an inverted-U curve must be represented in at least some the data. This is the second requirement outlined by Shen and Dillard (2014). If there is no curve, then it is impossible to test if the inverted-U shape curve predicted by the drive model will actually predict persuasion. If the data can and does generate a curve, then a third criterion becomes apparent. This criterion stipulates that between-persons variation in fear arousal must exist. With no variation, one cannot assess if the shape of the curve has any impact on persuasion. This variation can be a result of interindividual differences, experimental manipulation, or both. If the first three criteria are met, then the fourth criterion becomes apparent. It is necessary to utilize an analytical method which is capable of assessing the relationship between the curve of a repeated-measures independent variable (e.g., fear arousal) and an outcome variable (e.g., behavioral intention). Earlier attempts to measure the effect of fear arousal over time were limited by their inability to capture both the onset and offset of a curve in a single measure (Dillard & Anderson, 2004). Latent growth curve

(LGC) analysis offers a chance to fully model the curve, and thus presents an opportunity to assess the relationship between within-person fear arousal and persuasion (Hancock & Lawrence, 2006).

To date, only one study has met all four of these criteria. Dillard and Anderson's (2004) study included the first three criteria, but the results were limited by their inability to capture both the onset and the offset of a curve. However, a subsequent analysis of the data using LGC modeling provides some empirical support for the second formulation of the curvilinear hypothesis (Shen & Dillard, 2014). By comparing linear and quadratic models, they found that within-persons change of fear over time was best represented by a negative quadratic term in their sample. This suggests that the form of fear over time in their sample resembled an inverted-U. And, when entered into a larger structural equation model, the relationship between the quadratic term and attitudes was positive ($\beta = .16$, $p < .05$).

In other words, these results are consistent with the second formulation of the curvilinear hypothesis, which suggests that persuasion is precipitated by the onset and offset of fear within a given individual (Shen & Dillard, 2014). This indicates that the widespread rejection of the curvilinear hypothesis may be premature, and it warrants a closer examination of the theoretical components of drive theory (Hovland et al. 1953). But, this is only a single study, and additional samples are needed to truly assess the effects of within-person fear arousal over time. This leads to the following hypothesis:

H1: Change in fear over time is positively associated with persuasion when it resembles an inverted-U curve.

As demonstrated in Figure 2, measuring fear over time leaves room for substantial diversity. Drive theory explicitly states that a fear appeal is persuasive when the structural change in fear arousal resembles an inverted-U curve (Hovland et al. 1953). This gives us a reason to test the first hypothesis. But, there is also reason to suspect that the magnitude of fear arousal is consequential. The theory asserts that it is the desire to reduce or eliminate emotional tension that drives message acceptance, and presumably fear appeals generate this desire by arousing fear. But, the degree of emotional arousal must be “sufficiently intense to constitute a drive state” (p. 62). From this logic, it follows that fear reduction is bounded by the maximum onset of fear during exposure to the message. This would suggest that individuals who experience greater fear are more likely to be persuaded, provided that these individual also experience a greater decrease in fear. Thus, the following hypothesis is presented:

H2: The shape of inverted-U curves will differentially predict persuasion, such that more peaked curves will be more strongly associated with persuasion.

As mentioned earlier, between-persons variance is needed to assess the effects of within-person fear arousal. One way in which this variance might be observed is through individual differences. To test for these differences, it is necessary to identify and observe variables that are theoretically expected to influence the fear curve. Individual sensitivity towards different motivational activation systems may constitute one such example (Dillard & Anderson, 2004).

Theories of motivation identify two systems that are predicted to drive emotional arousal: approach and inhibition (Gray, 1990; Watson, Scholer & Higgins, 2008; Weise, Vaidya, & Tellegen, 1999). The behavioral approach system (BAS) motivates individuals to seek desirable outcomes. BAS is most often associated with reward positive affective responses. The behavioral inhibition system (BIS) motivates individuals to avoid undesirable outcomes. BIS is associated with punishment and generally stimulates negative affect. Some individuals may be more sensitive towards certain reward or punishment stimuli than others (Gray, 1990). Oftentimes, these indicators are compared to stable personality characteristic, such as neuroticism or extraversion (Bolger & Schilling, 1991, Depue & Collins, 1999).

If motivational system sensitivity is understood to be a generally stable, trait-like characteristic, then it becomes apparent that this trait may constitute an individual difference of theoretical importance in a study of fear appeals. Fear appeals depict a message in which the recommended behavior is framed as a means of avoiding the undesirable consequences of a given threat (Hovland et al., 1953). Such a message would be predicted to activate an individual's behavioral inhibition system, which would lead to a subsequent increase in fear arousal. If certain individuals are predisposed towards BIS activation, then these individuals may experience a different fear response over time. More specifically, these individuals are likely to report greater levels of fear across all three time points.

H3: High levels of chronic BIS activation are positively associated with t_0 fear, t_1 fear, and t_2 fear.

Although chronic BIS activation is expected to influence fear, less is certain about how this might affect the overall curvature of the fear response. It may be the case that BIS sensitivity has a positive association with fear that is equal across all three time points. If this is true, then BIS sensitivity may only generate a noticeable difference on the intercept of the curve, whereas the curvature of fear arousal would remain relatively constant. In other words, the two curves would parallel one another, differing only in their vertical placement in the graph. Alternatively, it is possible that higher levels of BIS sensitivity might influence the offset of the fear response. Individuals that report high chronic levels of BIS activation may be less likely to experience a reduction in fear arousal at t_2. Such a curve might resemble the panel 5 depicted in Figure 2. Given these two equally plausible possibilities, we offered competing hypotheses:

H4a: The association between BIS and fear is such that persons who are in a state of high chronic BIS activation will show higher mean levels of fear at t_0, t_1, and t_2, but the fear curves will not vary in shape.

H4b: The association between BIS and fear is such that persons who are in a state of high chronic BIS activation will show higher mean levels of fear at t_0, t_1, and t_2, but the fear curves will vary in shape such that low BIS persons will show a sharper decline in fear from t_1 to t_2.

Although there is some uncertainty regarding the nature of the relationship between trait-like BIS and the functional form of the fear response curve, there is reason to suspect that these curves might generate distinct persuasive effects. But, the nature of these effects depends how BIS moderates the fear curve. There is no theoretical reason to suspect that the curves will predict persuasion differentially if the data support H4a. Although the overall means are higher in this scenario, the onset and offset of the fear response would remain relatively constant. In contrast, if the data follow the pattern suggested by H4b we should expect that a failure to reduce fear at t_2 among high-BIS participants would diminish persuasion. Hence, we offered a pair of conditional hypotheses that were dependent on the results of H4.

H5a: To the extent that the BIS-moderated fear response curve resembles H4a, there will be no difference between high- and low-BIS conditions.

H5b: To the extent that the BIS-moderated fear response curve resembles H4b, the high-BIS curve will be more weakly or negatively associated with persuasion.

Context and Advocacy: Promoting Flossing Behavior

Fear appeals are frequently used as a form of public health advocacy (Yzer, Southwell, & Stephenson, 2012). Oftentimes, a specific threat and behavior is identified to a specific audience.

Thus, most fear appeals are confined by their context. For the purpose of this study, the context of interest is dental health and flossing. The reasons for this decision are twofold. First, this is an advocacy message that is relevant to the population of interest (young adults). One study by Segelnick (2004) found that adults under the age of 31 were significantly less likely to floss frequently (12.2%) when compared to adults between the ages of 31 and 60 (47%, $p < .001$. Developing health habits at an early stage in life is likely to have long-term benefits in terms of morbidity and mortality. And second, fear appeals have a history that is deeply rooted in messages of advocacy for dental health (Goetz, 2010). More specifically, the predictions made by the drive model were based in part on data obtained by Janis and Feshbach (1953), who specifically chose dental health "as a suitable topic for investigating the influence of fear appeals was precisely because discussions of this topic readily lend themselves to quantitative and qualitative variations" in fear arousal (p. 80).

Method

Participants

Three hundred and seventy eight undergraduate students at The Pennsylvania State University participated in this study. Participants were recruited from a subject pool of students enrolled in an entry level communication course. Students received 2% of course credit for their participation in this study. Three participants were removed from the final sample as a result of missing data. In the final sample, 160 (42.8%) were male and 214 (57.2%) were female, with ages ranging from 18 to 28 years old (M = 19.25, SD = 1.41). Three hundred and one (80.5%) participants identified as white, 12 (3.2%) as black or African American, 49 (13.1%) as Asian or Pacific Islander, 15 (4%) as Hispanic, 4 (1.1%) as "other" without specifying their ethnicity, and 3 (.8%) declined to answer. In an attempt to obtain a relevant sample, the majority of participants were screened prior to their participation in the study. Two screening questions were implemented to assess the frequency of their weekly flossing behavior, with the intention of screening out students that flossed >4 days during the average week. However, 51 participants failed to complete these screening questions beforehand. To retain these participants, it became necessary to obtain an additional measure of weekly flossing frequency in the laboratory portion of the study. This replaced the initial screening question and was then treated as a control variable for the entire sample.

Procedure

After being recruited for this study, participants were asked to attend a laboratory session by scheduling a time which was convenient for them. The number of participants in these sessions ranged from 1 to 12. After obtaining informed consent, participants were directed to complete an experimental survey. Figure 3 depicts the two-by-two repeated measure factorial design that was used for this study. This design was intended to induce between-persons variation in participant fear arousal. First, participants responded to a brief questionnaire which measured their pre-message flossing behavior. Next, participants completed a Life Event Inventory Task (Schwarz & Clore, 1983). This task, which constituted the first factor in the experimental design, consisted of a single open-ended question in which participants were asked to spend five to ten minutes writing about a personal experience. Random assignment was used to prompt individuals to describe an event which made them feel either frightened or peaceful. Participants were then asked to evaluate their emotional arousal in response to this writing task. The purpose of this was to create experimental variation in fear arousal at t_0. Following this, participants were randomly assigned to receive one of two threat messages which illustrated the consequences of periodontal disease. These threat messages varied in their content to promote variation in t1 fear arousal, such that one threat was presented as significantly more severe than the other. Again, participants were asked to evaluate their emotional arousal in response to the message before receiving a second message which encouraged them to floss. After reading this message, participant's rated their emotional arousal for a third time and responded to a series of measures designed to measure the persuasive effect of the message.

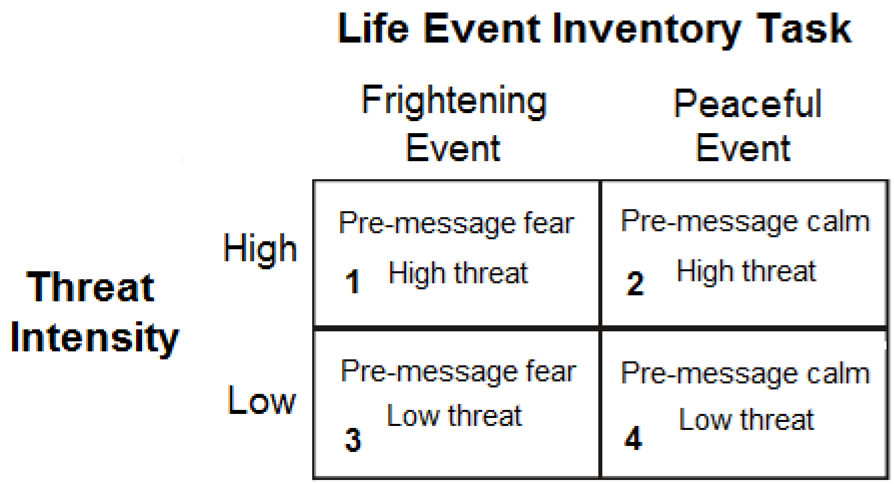

Figure 3. A 2 x 2 Experimental Design was used to Manipulate Fear Arousal

Message Content

Information from the CDC, the National Institute of Dental and Craniofacial Research, the American Academy of Periodontology, and the American Dental Association was compiled to create a two-part message which included a threat component and an action component. In the threat component, participants received information about their susceptibility to periodontitis, the causes of the disease, the consequences, a personal testimony, and a video description of a surgery that is commonly used to treat moderate to severe periodontitis. To manipulate participant fear response, participants were randomly assigned to either a high threat or a low threat condition. Following their exposure to the threat component of the message, participants were asked to view an action component. This message contained information about the importance of flossing, step by step instructions for proper flossing technique, and the ease with which an individual may begin flossing. The full content of the high threat, low threat and action component messages is provided in Appendices 1, 2 and 3 respectively.

Threat component conditions. Multiple techniques were used to manipulate the high and low threat component conditions. In the high threat condition, more instances of second-person language (e.g., “Could you be at risk for periodontitis?”) were used in comparison to the low threat condition (e.g., “Who is at risk for periodontitis?”). Similarly, the high threat condition contained information which was more personally relevant to the target audience (e.g., “Stress is one important factor. It is often produced by moving from one town to another or by a big change in a person’s social situation. Sounds a lot like going to college, doesn’t it”) when contrasted with the low threat condition (e.g., “Stress is one important factor. Lifestyle factors, including smoking, can influence the progression of the disease. Genetics may also play a role”). These changes reflect an attempt to increase participant levels of self-referencing, which in turn are predicted to lead to higher levels of information processing (Burnkrant & Unnava, 1995; Escalas, 2007). Additional changes were made to manipulate perceptions of susceptibility. For example, the wording in the high threat condition (e.g., “As the disease progresses, it begins to destroy tissue and bone,”) was presented as more certain than the wording used in the low threat condition (e.g., “As the disease progresses, it may damage tissue and bone”). The final and most notable difference was the use of more graphic visual imagery, which is predicted to influence both fear response and persuasion (Janis & Feshbach, 1953; Mazzocco & Brock, 2006). The visual content that accompanied the two conditions of the message differed, such that the high threat condition presented images which depicted more severe cases of periodontitis, as seen in Figure 4. Additionally, although both threat components used the same audio clip, the high threat video message showed an actual surgical procedure, while the low threat video message presented an animated portrayal of this same surgery.

1) High-Threat Condition

2) Low-Threat Condition

Figure 4: Sample Images presented in the 1) High-Threat and 2) Low-Threat Condition

Measures

Pre-message flossing behavior. Two items were used to determine the frequency in which participants flossed prior to receiving the message. Participants were asked to estimate both the number of days (0 to 7) that they had flossed in the past week and the number of days that they typically floss in any given week. These two items were then averaged into a single scale (M = 1.17, SD = 1.94, α = .96). This scale was also included as a pre-screening question to ensure that the message would be relevant to our sample, but analysis of the data indicates that 51 participants were included without responding to the pre-screening question.

BIS and BAS. To assess the potential effects of individual differences on the fear curve, an adaption Carver and White's (1994) scale was used to measure chronic BIS and BAS activation. BIS activation (e.g. "I worry about making mistakes") was measured using seven 7-point Likert items (M = 4.04, SD = .92, α = .80). Five items measured BAS activation (e.g. "When I get something I want, I feel excited and energized"), M = 5.07, SD = .66, α = .80). Item responses ranged from 0 (*strongly disagree*) to 6 (*strongly agree*).

Emotional response. Three items – fearful, afraid, and scared – assessed participant fear response, and an overall score for each participant was obtained using the average measure of these three items (Dillard & Anderson, 2004). The response scale was anchored at 0 (*none of this feeling*) and 4 (*a great deal of this feeling*). This measure was repeated at three separate times in the survey: pre-message fear at t_0 (*M* = 0.29, *SD* = .62, α = .91) was measured after participants completed the Life Event Inventory Task, post-threat fear (*M* = 1.20, *SD* = 1.11, α = .94) was measured after participants were exposed to the threat component at t_1, but before they were exposed to the efficacy component, and post-efficacy fear at t_2 (*M* = .54, *SD* = .80, α = .93) was taken after exposure to the entire message.

Perceived threat. The Risk Behavior Diagnosis (RBD) scale was used to determine the threat response following exposure to the message (Witte, Cameron, McKeon & Berkowitz, 1996). Six 7-point Likert items ranging from 0 (*strongly disagree*) to 6 (*strongly agree*) were used to assess perceptions of severity (*M* = 4.75, *SD* = 1.10, α = .87) and susceptibility (*M* = 2.99, *SD* = 1.27, α = .81) in response to periodontal disease. Both scales used three items to measure severity (e.g., "I believe that periodontitis is extremely harmful") and susceptibility (e.g., "I am at risk of getting periodontal disease").

Perceived efficacy. A six item 7-point Likert scale adapted from the RBD estimated perceptions of efficacy in response to the message (Witte, Cameron, McKeon & Berkowitz, 1996). Items ranging from 0 (strongly disagree) to 6 (strongly agree) and evaluated perceptions of self-efficacy and response efficacy in response to periodontal disease. Three items (e.g., "I am able to floss once a day to prevent periodontitis") were used to assess self-efficacy (*M* = 4.88, *SD* = 1.07, α = .84). A semi-confirmatory factor analysis presented in Table 1 eliminated one of the three response efficacy items (i.e., "If I floss once a day, I can stop periodontitis from ever happening"). Two remaining items (e.g., "I am at risk of getting periodontal disease") were used in the final analysis (*M* = 5.27, *SD* = 0.76, α = 0.85).

Behavioral intention. Participants reported three 7-point Likert items, and the mean was used to assess their intention to floss (e.g., “I intend to floss my teeth once a day, every day for the next month), ranging from 0 (*strongly disagree*) to 6 (*strongly agree*). Item scale statistics suggest strong reliability (M = 3.58, SD = 1.75, α = .95). For the purpose of this study, behavioral intention was used as the dependent variable of interest.

Missing Data

Three cases were dropped from the final analysis as a result of excessive missing data. A pattern analysis of the remaining data found that 47 (60.3%) variables and 67 (17.9%) cases had instances of missing data, although the total amount of missing values from the data was small (0.27%). Out of the 80 missing values, 78 (97.5%) were replaced by calculating the participant’s average score for a given scale. For instance, if a participant reported feeling moderately fearful (2) and extremely afraid (4), their score for the item scared would be imputed as the mean of these two scores (3). Although this method is less rigorous than multiple imputation techniques, mean imputation may produce equally accurate estimates when reliability is high and the amount of missing data is small (Shafer & Graham, 2002). Both conditions held in the current data.

Plan for Analysis

Through latent growth curve (LGC) analysis, it becomes possible to measure the growth trajectory of emotional arousal within an individual over time (Hancock & Lawrence, 2006). This trajectory represents the rate and direction of change for a repeated measures variable as a function of time. LGC analysis offers a means of determining the structural form of within-persons fear arousal for a given set of data, such that it will be possible to determine whether the observed data is best represented by a linear or a quadratic function. More specifically, “LGM techniques can describe individuals’ behavior in terms of reference levels (e.g., initial amount) and their developmental trajectories to and from those levels (e.g., linear, quadratic)" (Hancock & Lawrence, 2006, p. 172). And, by extending these trajectories into a structural equation model, it becomes possible to assess the relationship between the growth trajectory and various predictor or outcome variables.

By measuring the growth trajectory of emotional arousal, the viability of the first hypothesis can be assessed. In a linear model, the mean intercept represents the initial amount of fear arousal at t_0, and the mean slope indicates rate of change over time across all three time points (originating at t_0, passing through t_1 and ending at t_2). In the quadratic model, the mean intercept represents t_0 fear arousal, the mean linear slope represents the slope of the tangent line of the curve, and the quadratic component indicates the rate of change over the three time points. Next, these two functions are entered into an extended structural equation model that includes measures of behavioral intention, and the path coefficients between the growth trajectory of fear arousal and behavioral intention will be examined across all participants. This will constitute the test of the first hypothesis. To test the results of the second hypothesis, the data will be partitioned by group condition and analyzed. If there is a significant relationship between group condition and t_1 fear arousal, then separate analyses would be able to assess the differential effects of a more peaked growth trajectory. A similar procedure was used to assess the potential effects of chronic BIS activation by dichotomizing along the median.

Results

Measurement Model

To evaluate the factor structure of the independent and dependent variables in the extended model, principal axis factoring with direct oblimin rotation was used was to assess indices of message structure and effects alongside flossing frequency, and the solution was constrained to six expected factors (severity, susceptibility, response efficacy, self-efficacy, flossing frequency, and behavioral intention). This analysis eliminated one of the response efficacy items, and is shown in Table 1. A subsequent confirmatory factor analysis which included message structure and effects items, flossing frequency, BIS, BAS, and t_1 fear produced fit statistics as follows: χ^2 = 569.97 (398, N = 374), $p < .001$, CFI = .97, TLI = .97, RMSEA = .034 (90% CI = .028 – .040). This indicated that the measurement model was an adequate representation of the data (Browne & Cudek, 1993; Kline, 1998). Standardized factor loadings were generally high: flossing frequency (.94 to .99), BIS (.44 to .68), BAS (.62 to .77), severity (.81 to .88), susceptibility (.68 to .90), response efficacy (.85 to .87), self-efficacy (.78 to .83), t_1 fear (.90 to .93), and behavioral intention (.90 to .96). Additional descriptive statistics are shown in Table 2, which presents the means, standard deviations, and Cronbach's alpha scores of the variables in the measurement model.

Induction Checks

In contrast to previous research (e.g., Yan, Dillard, & Shen, 2012), the Life Event Inventory task failed to create any significant difference in fear arousal prior to the message. A 2-tailed independent-samples *t*-test found no difference between conditions at t_0, $t(372) = .10$, $p = .92$, $d = .01$. Similarly, this manipulation failed to significantly impact subsequent assessments of fear arousal following exposure to the threat component at t_1, $t(372) = .60$, $p = .55$, $d = .06$, and efficacy components of the message at t_2, $t(372) = .24$, $p = .81$, $d = .02$. Thus, we concluded that it was inappropriate to split the data using the Life Event Inventory task, as this manipulation failed to generate any significant difference in fear arousal across any of the three time points.

Testing the within-persons curvilinear hypothesis requires a fear response that resembles an inverted U-curve. And, preliminary analysis indicates that the message was successful in generating a mean fear response that resembles this form. Mean fear increased from .29 to 1.20 between t_0 and t_1, and a paired samples t-test identifies this difference as significant, $t(373) = 17.30$, $p < .001$, $d = .98$. This indicates that the message was capable of generating a fear response. And, following exposure to the efficacy component, fear significantly decreased from 1.20 to .54, $t(373) = -14.25$, $p < .001$, $d = -.78$. This rise and fall in fear intensity is suggestive of a within-persons curvilinear relationship and is depicted in Figure 5. Descriptive statistics also suggest that the data show between-persons variation in fear arousal across all three time points. This is demonstrated by the observed standard deviations at t_0 ($SD = .62$), t_1 ($SD = 1.11$), and t_2 ($SD = .80$). This indicates that it is possible to assess H1 using the observed data.

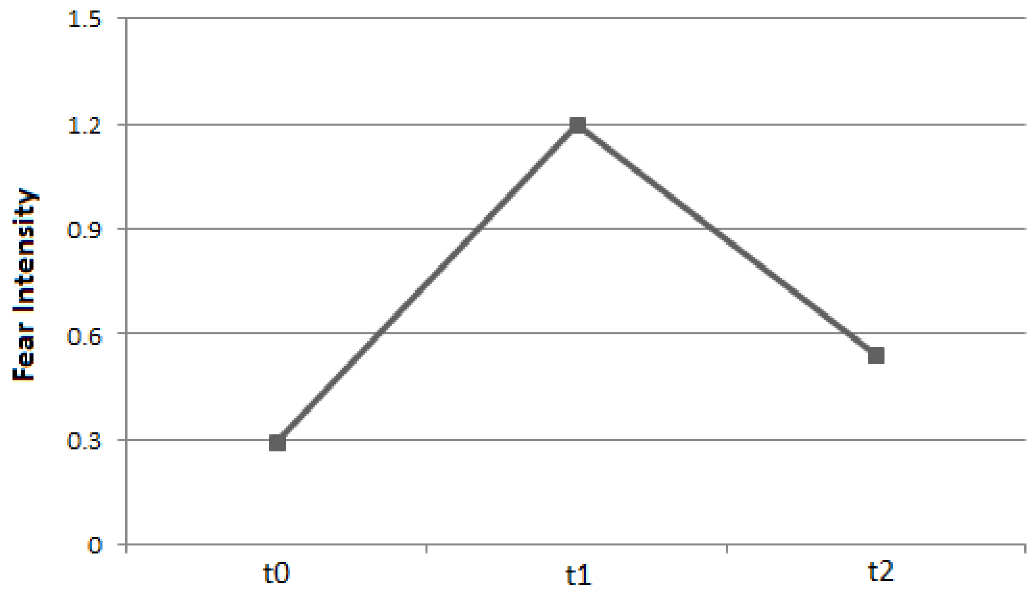

Figure 5. Mean Fear Intensity across Three Time Points

Although the Life Event Inventory failed to produce between-groups variation in fear arousal, the manipulation of the threat component was more successful. There was no significant difference in t_0 fear arousal between the high-threat (*M* = .32) and low-threat (*M* = .26) conditions, $t(372) = .87$, $p = .385$, $d = .09$ This was expected, because individuals had not yet been exposed to the threat manipulation. However, individuals who were exposed to the high-threat message reported an average difference in t_1 fear arousal (*M* = 1.51) that was greater than those in the low-threat condition (*M* = .89), and this effect was significant, $t(366.74) = 5.63$, $p < .001$, $d = .59$. Individuals in the high-threat condition also reported greater overall levels of t_2 fear arousal (*M* = .68) when compared to the low-threat condition (*M* = .41), despite the fact that the efficacy component of the message was the same across all conditions, $t(342.98) = 3.38$, $p < .001$, $d = .37$. The results of the obtained fear means are presented in Figure 6.

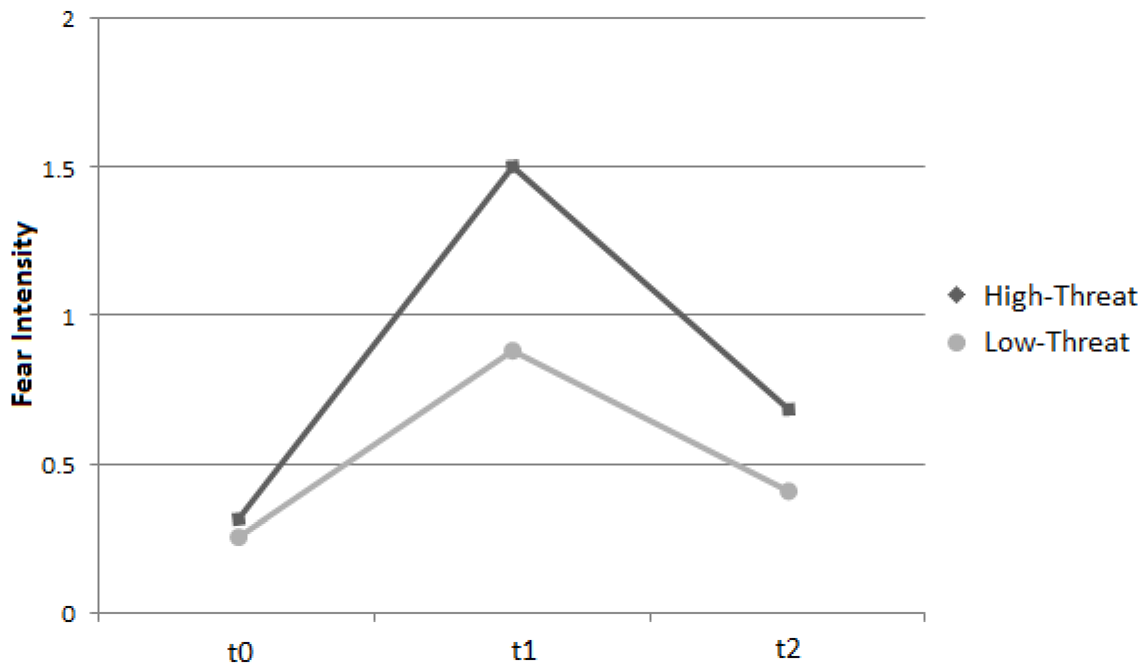

Figure 6. Within-persons Mean Fear Intensity by Experimental Condition.

Further analysis suggests that the two groups significantly differed on cognitive indices of message effect. In the high-threat condition, mean perception of severity was significantly higher (*M* = 5.08) than the low-threat condition (*M* = 4.43), $t(348.19) = 6.08$, $p < .001$, $d = .65$, whereas susceptibility was lower in the high-threat condition (*M* = 2.86) when compared to the low-threat condition (*M* = 3.12), $t(372) = -1.989$, $p = .047$, $d = -.21$. This confirms that the message manipulation was successful in inducing between-groups variability in fear arousal.

Although both conditions resemble an inverted U-curve, the high-threat condition suggests a more peaked curve. In the high-threat condition, the mean difference in fear arousal between t_0 and t_1 was .56 greater when compared to the low-threat condition. Individuals experienced a greater increase in fear in response to the high-threat message condition. Similarly, the mean difference between t_1 and t_2 was .34 greater in the high-threat than the low-threat condition. These individuals experienced an overall greater decrease in fear arousal when compared to the low-threat condition, even though the average mean at t_2 was significantly higher in the high threat condition. Thus, it is possible to assess H2 by comparing the effects of within-persons fear arousal between experimental conditions.

Input Matrix

One goal of the current project was to estimate the effect of a message on behavioral intention. Because the behavior of interest – flossing-- was ongoing for research participants to varying degrees, it was important to control for the effects of pre-message behavior on post-message intentions. This was accomplished by using a matrix of partial covariances as input to subsequent analyses (Table 3).

Establishing the Shape of the Growth Curve

Although the means presented in Figure 5 suggest that the data constitutes an inverted U-curve, a linear growth model was tested to rule out the possibility that a linear function could adequately represent the data. In the linear model, two latent variables were created to represent the intercept and linear components of the fear function. The three fear variables at t_0, t_1, and t_2, were each specified as having a 1.0 factor loading on the latent intercept, and the latent slope was specified with factor loadings of 0, 1.0, and 2.0 at t_0, t_1, and t_2 respectively. These values are used to represent a function of positive linear growth with equal intervals between time points. The intercept and linear components were allowed to associate, although their respective error terms were not. The observed model produced the following fit statistics: $df = 1$, $\chi^2 = 244.61$, RMSEA = .69, CFI = .31, GFI = 1.00, BIC = 238.68. The majority of these statistics indicate a poor fit, and the discrepancy between GFI and other fit indices reinforces this point. In other words, the evidence suggests that a linear function cannot adequately represent within-persons fear arousal in the data.

It was impossible to produce fit statistics for the simple quadratic model because the degrees of freedom are equal to 0. Thus, we moved directly to an estimation of the extended model. In the extended quadratic model, intercept loadings were fixed at 1.0, linear component factor loadings were fixed at 0, -1.0, and -2.0, and the quadratic component loadings were fixed at 0, -1.0, and -4.0 for fear at t_0, t_1, and t_2. In this case, the quadratic component indicates a square function, and the function is negative because the hypothesized U-curve is inverted. Covariance between the latent intercept, linear and quadratic components were allowed, but the error terms were not allowed to covary. Independent predictor variables and dependent outcome variables were identified as latent constructs with error terms fixed at their respective error variances.

Analysis of the extended model produced the following fit statistics: $df = 9$, $\chi^2 = 27.12$, RMSEA=.07, CFI=.96, GFI=.98, BIC = -26.20. These statistics suggest that the extended model is a good fit to the data. To evaluate the estimated quadratic growth curve in the extended model, the mean intercept was fixed at .29 (which was the obtained mean for t_0 fear). The linear component was 2.52, and the quadratic component was -1.19.

In this function, the linear component represents the slope of the tangent line of the curve at t_0, while the quadratic component indicates the rate of change over time. In other words, the linear component indicates the direction and magnitude of the curve after t_0, while the quadratic component reflects the change in curvature per unit change of time. Larger values in the linear component suggest steeper curvature, while larger values of the quadratic component reflect a more rapid change. Given the positive value of the linear component and the negative value of the quadratic component, we can interpret this function in the shape of an inverted U-curve.

Testing the Fear-Persuasion Relationship

With the first three criteria firmly established, it becomes possible to assess the relationship between the latent growth curve of within-person fear arousal and persuasion. Severity and susceptibility were entered as predictors of the linear and quadratic components of fear arousal, which in turn predicted behavioral intention. Self-efficacy and response efficacy were cast as direct predictors of intention. Standardized path coefficients from the extended model are presented Figure 7 after removing nonsignificant variables and paths. Notably, the path coefficient between the quadratic function and behavioral intention is positive and significant $\beta = .13$, $p < .05$. Given that the specified quadratic function is an inverted U-curve, this model provides support for the first hypothesis: change in fear over time is positively associated with persuasion when it resembles an inverted U-curve.

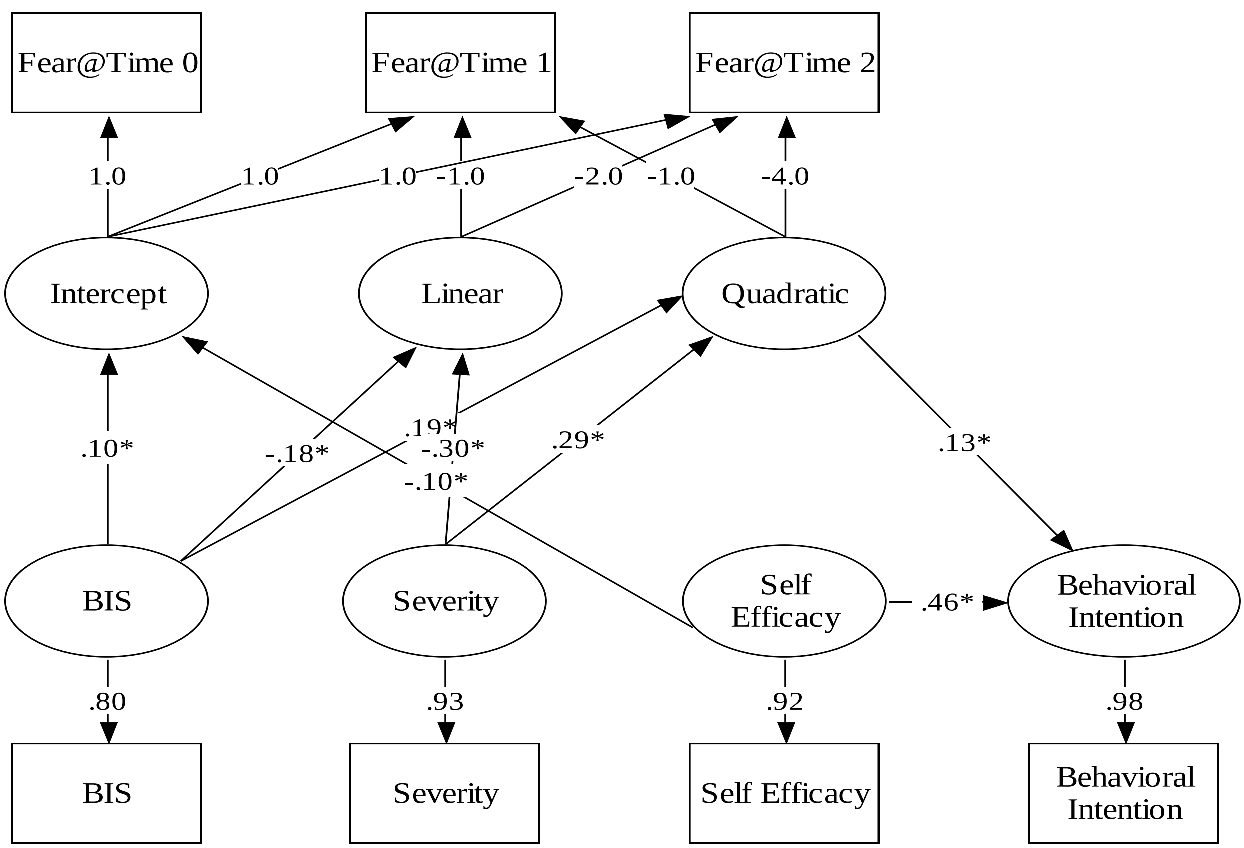

Figure 7. The Extended Latent Growth Curve Model

To assess the results of the second hypothesis, the data was dichotomized by group condition, such that separate extended models were used to separately assess the high-threat and low-threat group conditions. These models were generated using the same specifications as the first model. In the high-threat condition (*N* = 187), the extended model was produced the following fit statistics: *df* = 10, χ^2 = 13.74, RMSEA=.04, CFI = .99, GFI = .98, BIC = -.38.57. This indicates that the overall model was a good fit. Similarly, fit statistics for the low-threat condition (*N* = 187) were also determined to be acceptable, *df* = 10, χ^2 = 22.48, RMSEA=.08, CFI = .95, GFI = .97, BIC = -.29.83. Separate latent quadratic growth functions were obtained for each condition. In the high-threat condition, the growth curve is expressed with the following equation: $y = 0.32 + 3.54x - 1.67x^2$. In the low-threat condition, the function is as follows: $y = 0.26 + 1.51x - .72x^2$. The obtained models are presented in Figures 8 and 9 respectively.

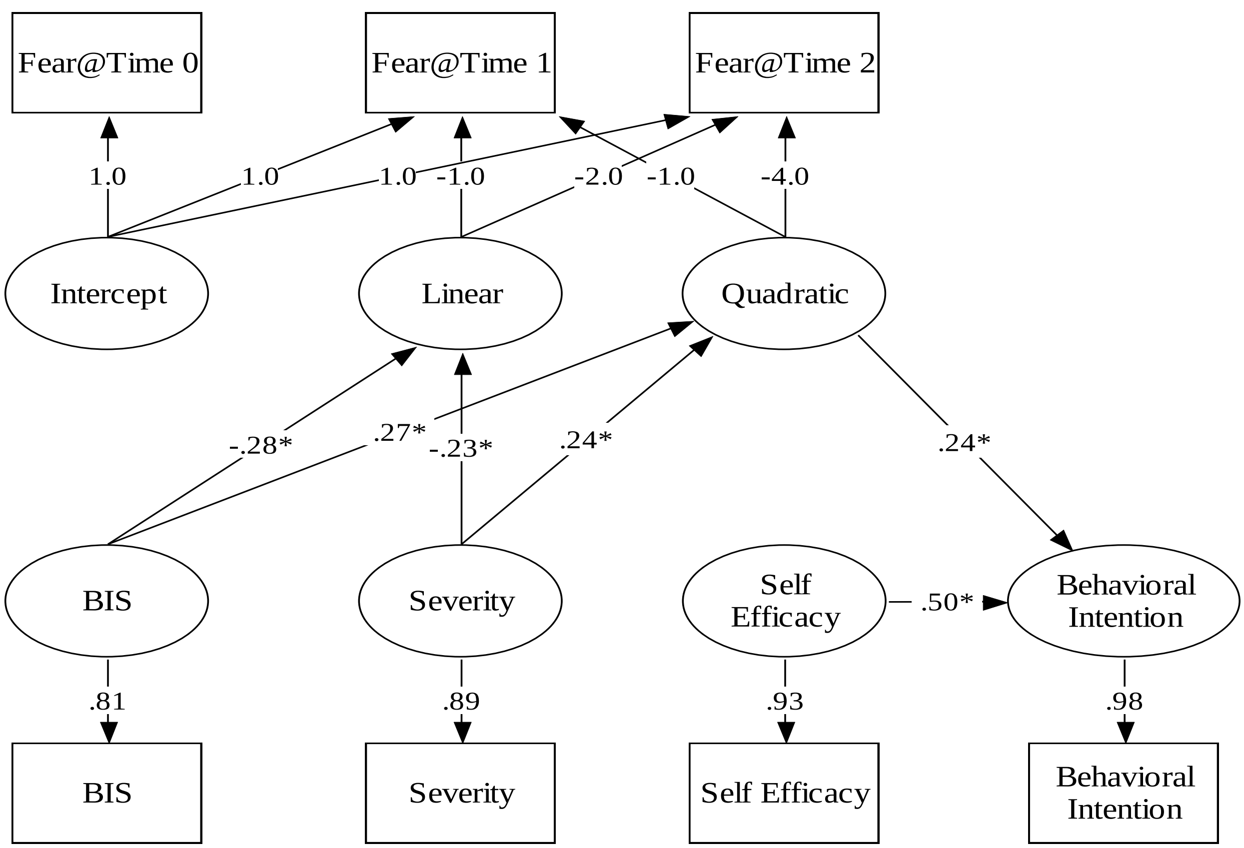

Figure 8. Extended Latent Growth Curve Model for High-Threat Condition

To interpret these equations, recall that the slope of the linear component indicates the initial direction and magnitude of the curve after t_0, while the quadratic component reflects the change in curvature over time. Again, the positive linear and negative quadratic components in both equations suggest that the two curves are best expressed by an inverted U-curve. However, the magnitudes of the linear and quadratic components reveal that the curve in the high-threat condition is more peaked than the curve in the low-threat condition.

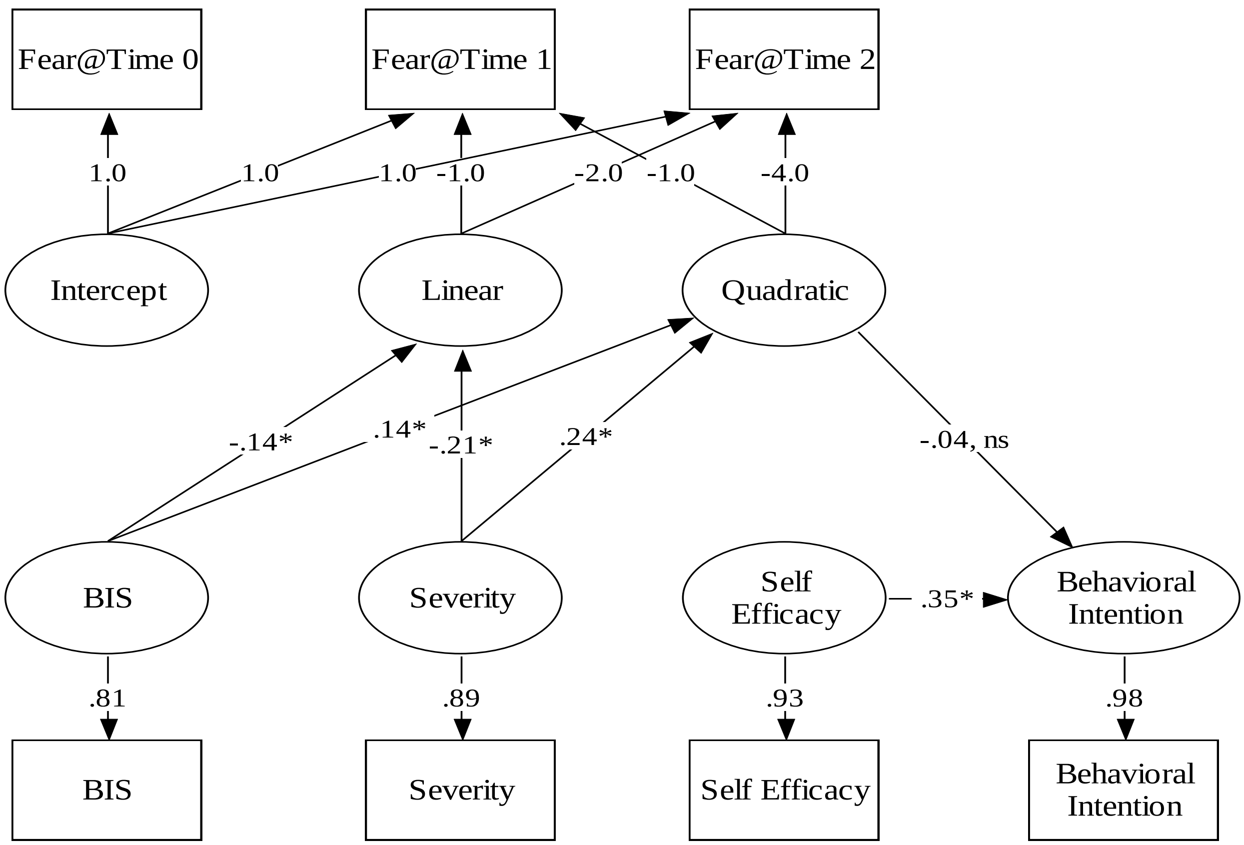

Figure 9. Extended Latent Growth Curve Model Low-Threat Condition

Notably, the path coefficient from the quadratic component to behavioral intention in the high-threat condition was positive and significant, $\beta = .24$, $p < .05$. But, the same path coefficient from the quadratic term to behavioral intention in the low-threat condition was negative and nonsignificant, $\beta = -.04$, $p > .1$. Within-persons fear arousal was persuasive in the high-threat condition, but not the low-threat condition. The more peaked curve predicts, while the flatter curve does not. This finding provides direct support for the second hypothesis.

H3 predicted that a trait-like BIS reactivity would be positively associated with fear arousal at all three time points. The partial correlation controlling for pre-message flossing behavior presented in Table 3 assesses this prediction. Positive and significant correlations were found between BIS reactivity and pre-message fear at t_0, $r(371) = .22$, $p < .001$, post-threat fear at t_1, $r(371) = .24$, $p < .001$, and post-efficacy fear at t_2, $r(371) = .14$, $p = .006$. These findings offer support to the third hypothesis and suggests that trait-like BIS constitutes an individual difference variable that may influence the fear curve.

H4a and H4b present competing hypotheses. Although it was predicted that participants who report higher BIS reactivity would experience greater fear arousal in response to the message, there was uncertainty about how this might affect the curvilinear function. H4 predicted similar curves with a higher intercept, whereas H5 predicted a curve with a higher intercept and less fear offset at t_2. To test this, a median split (4.14) was used to partition the data, and extended models were generated for the two groups. In the high-BIS group ($N = 176$), fit statistics indicate that the model is acceptable, $df = 7$, $\chi^2 = 9.78$, RMSEA=.05, CFI = .98, GFI = .98, BIC = -.26.41. Similar fit statistics were produced in the low-BIS group, $N = 169$, $df = 7$, $\chi^2 = 8.84$, RMSEA=.04, CFI = .98, GFI = .98, BIC = -.27.07. The observed quadratic function for the high-BIS group was $y = 0.43 + 1.16x - .59x^2$, whereas the function for the low-BIS group was $y = 0.18 + 1.64x - .69x^2$.

To test if these two functions constitute significantly different curves, a comparison can be made by examining their respective standard errors of the intercept, linear, and quadratic components for each curve. Critical values were calculated by dividing the difference between parameter estimates by the average standard error. These values are presented in Table 4. For the high-BIS function ($y = 0.43 + 1.16x - .59x^2$), the standard errors were .06, .73, and .34 for the intercept, linear, and quadratic components. For the low-BIS function ($y = 0.18 + 1.64x - .69x^2$), the components' respective standard errors are .03, .73, and .35. As shown in the bottom row of Table 4, the intercepts of the two curves were significantly different ($p < .01$), but the linear and quadratic terms were not. This provides support for the hypothesis presented in H4a.

Testing H5 was conditional on the results of H4. H5a predicted no difference in the persuasive impact if the curves differed only with regard to the intercept. H5b predicted that if partitioning the fear data on BIS produced differently shaped curves, then we should expect differential persuasive impact for those curves. Path coefficients between the quadratic term and behavioral intention were compared for the high-BIS ($\beta = .11$, $p > .05$) and low-BIS ($\beta = .11$, $p > .05$) conditions, and these values were not significantly different. Given identical values it was obvious that the coefficients were not significantly different. Thus, the data conformed to the no-difference prediction of H5a.

Discussion

The drive model is notable for placing fear as the central mechanism in the persuasion process (Hovland et al., 1953). This can be contrasted with more recent theories that advance cognitive variables as central mechanisms in the relationship between fear appeals and persuasion (Rogers, 1983; Witte, 1992). For all intents and purposes, the drive model has been rejected by the literature. This rejection stems from the failure to find a curvilinear relationship between fear and persuasion. But, our current study demonstrates that rejection of the drive model is premature, and there are a number of valuable theoretical implications that can be taken from this research.

First and foremost are the results presented in Figure 7; in the overall model, the relationship between the quadratic component of the within-person fear arousal function and behavioral intention was positive and significant, such that persuasion was the result of an inverted-U fear response. This finding echoes the results of Shen and Dillard (2014) that established a similar relationship between the quadratic component of fear arousal over time and attitude change. And, it directly supports the within-person curvilinear hypothesis that is predicted by the drive model. Notably, the extended model identifies within-person fear arousal as a central explanatory mechanism that underlies the relationship between fear appeals, cognitive threat, and persuasion. This contradicts fear appeal theories that place cognitive variables as the central explanatory mechanism between fear appeals and persuasion (Rogers, 1983; Witte, 1992).

Additional ramifications can be drawn from the results of the second hypothesis. The observed fear functions presented in Figure 8 and 9 are both expressed as an inverted U-curve. But, only one of these curves had a significant impact on persuasion. The quadratic component of the more peaked curve ($-1.67x^2$) predicts behavioral intention, whereas the quadratic component of the less peaked curve ($-.72x^2$) does not. These values reflect differing rates of fear reduction, such that fear is reduced faster in the peaked condition. Thus, we can conclude that a reduction in fear arousal is not sufficient to cause persuasion; rather, the arousal of fear must also be “sufficiently intense to constitute a drive state” (Hovland et al., 1953, p. 62). Again, this finding is consistent with the drive model. But, it is inconsistent with models that predict a negative relationship between fear and persuasion.

Another notable implication is made apparent when one considers the means of fear arousal at t_2 for the high-threat and low-threat conditions. Although the difference is small, residual fear at t_2 was significantly higher in the high-threat condition. Cognitively focused explanations of fear appeals would suggest that higher aggregate levels of residual fear lead to defensive avoidance and run counter to persuasion. “Fear directly causes maladaptive responses, but that fear can be indirectly related to adaptive responses, as long as it is cognitively appraised” (Witte, 1992, p. 345). But, our findings reveal a direct relationship between fear and persuasion when fear is operationalized as a within-person measure. This demonstrates the importance of recognizing fear as a dynamic emotion which varies over time. Post-test only evaluations can test for the effects of residual fear, but these evaluations cannot accurately model the arousal and inhibition of the fear response that constitutes the central explanatory mechanism of the drive model.

This point is further demonstrated by the BIS-moderated fear curves. As predicted, chronic BIS activation is positively associated with the fear response. But, the result of H4 indicates that this association does not moderate the shape of the curve. Instead, BIS only influences the value of the intercept. Given the fact that the resulting curves fail to differentially predict persuasion, this reinforces the notion that it is the shape of the curvilinear function that predicts persuasion, and not necessarily the initial, peak, and residual levels of fear arousal.

While this research is primarily concerned with advancing our theoretical understanding of the relationship between fear appeals, fear, and persuasion, the results present a practical implication of considerable importance. Practitioners of health communication are right to be cautious about the applicability of this research in the field. Measuring fear arousal over time may be cost-prohibitive, and these measures may interrupt the message. However, a compelling reason to adopt such an approach becomes apparent when one considers the relationship between the quadratic term and behavioral intention in Figure 8. In the overall model, the effect size of the relationship between rate of reduction and intention is no different than the results of prior meta-analysis (Witte & Allen, 2000). It would seem that the shape of the curve is no better of a predictor than static measures of fear. But, when one considers the results of the second hypothesis, it becomes apparent that this is not the case, as the effect of the more peaked curve nearly doubles in size. Thus, one may conclude that a dynamic assessment of fear arousal can account for more of the variance in persuasion than a static approach, provided that the message can sufficiently arouse and reduce fear. At the very least, practitioners who utilize fear appeal messages should consider the incorporation of a pretest that can capture dynamic fear arousal.

Limitations

The methodology used in this paper allows for the testing of within-person curvilinear effects. Consequently, using this methodology is a key component of this research. However, the adoption of a dynamic measure that assesses fear throughout the message is subject to certain limitations, the most notable of which is the potential discrepancy between dynamic and static measures of fear arousal. There is little evidence that static and dynamic fear measures are capturing the same theoretical construct. Thus, it becomes difficult to make inferences about the validity of other theoretical perspectives that place cognition, rather than static emotion, as the central mechanism between fear appeal messages and persuasion. A second limitation raised by the methodology is the potential for testing effects. By assessing emotion at three separate time points, subsequent emotional judgments may be affected by prior reports. Without the use of a control group, it is impossible to estimate these effects.

Directions for Future Research

The findings of this research suggest that within-person fear arousal is an important theoretical construct that has direct ramifications for future research on fear appeals. Currently, there are no modern theoretical perspectives on fear appeals that adequately explain these results. Although the drive model is suggestive of such a relationship, the model offers no specification concerning the rate of reduction in fear arousal that could account for these effects. Thus, there is a pressing need for the development of new theoretical perspectives that can explain the within-person effects that were observed in this study. There is also a need for future fear appeal studies to adopt a methodology that can assess within-person effects of emotional arousal. The vast majority of studies concerning fear appeal research cannot test for the effects of dynamic fear arousal. Given the theoretical importance of this construct, it would be valuable for more researchers to adopt designs that can measure these effects.

Another direction for future research relates to the structure of fear appeal messages. The EPPM specifies that fear appeals follow a problem-solution structure (Witte, 1992). But, less is known about how this structure might contribute to persuasion. The results of this research reveal that the traditional problem-solution structure may consequential, as this structure is likely to produce an inverted curvilinear fear response. If the shape of the fear curve drives persuasion, then one might conclude that the traditional problem-solution structure is a necessary feature of effective fear appeals. However, this question lacks a definitive answer in the research. Witte and Allen (2000) conclude “strong fear appeals work only when accompanied by equally strong efficacy messages” (p. 606). But, would such an appeal work if the presentation of the threat and efficacy messages was reversed? This problem is compounded by the fact that each component is formed from two constituent sub-components which could be presented in a variety of arrangements. Future research should be directed towards understanding how the ordering of message components influences the relationship between fear appeal messages, the shape of the fear curve, and persuasion.

Finally, future understanding of the relationship between within-person emotional arousal and persuasion may be advanced by adopting a discrete emotional perspective. The drive model posits that any negative emotional tension may act as a drive state (Hovland et al., 1953). Fear is conflated with basic physiological emotions like hunger, and disgust and other negative emotions are predicted to motivate in ways that are similar to fear. But, with the exception of fear, our current knowledge regarding the relationship between other emotions and persuasions is restricted to static measures of emotional arousal. Just as it is necessary to consider studying dynamic fear arousal, it is necessary for researchers to consider studying other emotions as a dynamic process.

Summary

A large body of fear appeal research demonstrates that the between-persons relationship between fear and persuasion is linear and positive. But, current theoretical perspectives fail to account for within-person curvilinear effects. This study tests the assumptions of an existing theory and demonstrates that the functional form of fear over time influences persuasion when it resembles an inverted U-curve. Future developments in fear appeal research will benefit from a closer examination of this relationship, and it becomes necessary to consider the broader theoretical implications of this finding on the current body of literature.

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Appendix: Tables

Table 1

Factor Loadings for Principle Axis Factoring with Direct Oblimin Rotation of Indices for Measurement

Item	Severity	Susceptibility	Self-Efficacy	Response Efficacy	Behavioral Intention	Flossing Pre-Behavior
I believe that periodontitis is extremely harmful	**-.923**	-.010	-.030	.045	.028	.011
I believe that periodontitis has serious negative consequences	**-.812**	.000	.013	-.005	.022	.010
I believe that periodontal disease is severe	**-.763**	.006	.020	-.053	-.061	-.029
I am at risk of getting periodontal disease	.004	**.883**	.144	.057	.035	-.033
It is possible that I will get periodontitis	-.010	**.713**	-.044	-.111	.080	.050
It is likely that I will get periodontitis	.008	**.697**	-.078	.048	-.089	-.049
I have the time to floss once a day to stop periodontal disease	.016	-.059	**.790**	-.015	.000	-.023
I can easily floss once a day to avert periodontitis	-.032	.052	**.786**	.027	-.051	.011
I am able to floss once a day to prevent periodontitis	.000	.008	**.747**	-.097	.010	.038
Flossing once a day is an effective way to protect myself from periodontal disease	.008	-.030	.033	**-.835**	-.017	-.011
Flossing once a day works to prevent periodontitis	-.031	.039	.027	**-.834**	-.016	.008

I plan to floss my teeth once a day, every day for the next month	.016	-.012	-.038	-.061	**-.975**	-.005
I intend to floss my teeth once a day, every day for the next month	-.001	-.006	.021	-.028	**-.925**	-.011
I am going to floss my teeth once a day, every day for the next month	-.034	.006	.065	.066	**-.855**	.068
In the past week, estimate the number of days that you used dental floss to clean your teeth.	-.003	-.012	.011	.027	.014	**.969**
In a typical week, estimate the number of days that you use dental floss to clean your teeth.	.008	.002	-.007	-.019	-.042	**.946**

Note. N = 374. Factor loadings > .60 are in boldface.

Table 2

Descriptive Statistics for the Measurement Model

Scale	*M*	*SD*	*α*
Pre-Message Flossing	1.17	1.94	.96
BIS	4.04	.92	.80
BAS Drive	4.18	.95	.75
BAS Reward	5.07	.67	.80
Severity	4.75	1.10	.87
Susceptibility	2.99	1.27	.81
Response Efficacy	5.27	.76	.85
Self-efficacy	4.88	1.07	.84
t_0 Fear	.29	.62	.91
t_1 Fear	1.20	1.11	.94
t_2 Fear	.54	.80	.93
Behavioral Intention	3.58	1.75	.95

Note. N = 374

Table 3

Partial Correlations among Motivational Systems and Indices of Message Effect controlling for Pre-Message Flossing Behavior

	1	2	3	4	5	6	7	8	9	10
1. BIS	1.00									
2. BAS Reward	.33**	1.00								
3. Severity	.07	.13*	1.00							
4. Susceptibility	.10	-.05	.04	1.00						
5. Response Efficacy	.14**	.24**	.27**	.11*	1.00					
6. Self-Efficacy	.03	.18**	.23**	.03	.62**	1.00				
7. t_0 Fear	.22**	.12*	.13*	.21**	.07	.01	1.00			
8. t_1 Fear	.24**	.14**	.31**	.13*	.09	.06	.42**	1.00		
9. t_2 Fear	.14**	.11*	.15**	.13*	.05	.01	.39**	.61**	1.00	
10. Behavioral Intention	.08	.09	.24**	-.02	.23**	.42**	.07	.18	.09	1.00

N = 374

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4

Critical Values for the Low- and High-BIS Moderated Functions

	Intercept	*Linear*	*Quadratic*
High-BIS	.43(.06)	1.16(.73)	-.59(.34)
Low-BIS	.18(.03)	1.64(.73)	-.69(.35)
Difference	.25	.48	.10
Mean SE	.045	.73	.345
Critical Value	5.55*	.66	.29

Note. In the High-BIS Condition, N = 176. In the low-BIS condition, N = 169. Standard errors for the high and low-BIS conditions are presented in parentheses.