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Go with the flow: testing the effects of emotional flow on attitudinal and behavioral changes

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Emotions are important constructs that affect the lives of everyone. Emotions play a particularly strong role in persuasion. This study examines the concept of emotional flow, a sequencing of specific discrete emotions in a strategic manner to affect attitudes and behaviors. An experiment was conducted using a public service announcement about melanoma that contained a sequence that flowed from humor to sadness to hope in order to understand the functions and applicability of emotional flow, specifically within health contexts. Using Mood Management Theory and Excitation Transfer Theory as guides, results showed that participants who viewed a humor-sadness-hope emotional flow had higher levels of arousal compared to those who viewed humor-sadness or humor-sadness-neutral emotional flows. The humor-sadness-hope emotional flow resulted in higher levels of pleasure compared to those who viewed the humor-sadness emotional flow. Arousal was identified as a mediator between emotional flow and both message engagement and risk perceptions. Additionally, sadness was found to moderate the relationship between emotional flow and both attitude and message engagement. Theoretical and practical implications highlight the role that sequential emotions can play in increasing emotional intensity and the importance for companies to recognize this role and plan their messaging accordingly.

KEYWORDS

emotional flow, arousal, valence, health communication, excitation transfer, mood management

Introduction

Emotions are an important mechanism that affect innumerable aspects of people's lives. Izard (1977) argued that the entirety of human behavior is motivated by emotions. Subsequently, there is no shortage of emotions-based research on an array of different topics. The role that emotions play in persuasion is utilitarian in its applicability to many different facets of life from consumer behavior and especially health habits. Nabi (2002) outlines extensive evidence that emotions play a strong role in influencing decision-making processes as well as attitudes and behaviors. Creating emotionally persuasive messages are an important way to both grab attention and encourage action in our constantly evolving media environment.

An emerging area in emotions research is mixed emotions. These are multiple emotions found in messages, often with opposing valences. For example, Mukherjee and Dube (2012) studied the mitigating affects that humor has on defensive responses in fear appeals and thus increases the persuasiveness of fear advertising. In their review of mixed emotions, Larsen and McGraw (2014) discuss different cases of people feeling different emotions simultaneously such as feeling both happy and sad after watching a particularly compelling film. Horror films were found to elicit fear and happiness because

the fear made people happy (Andrade and Cohen, 2007). A scene from the movie may elicit disgust however it was also found that the disgust was accompanied by feelings of amusement (Hewig et al., 2005; Hemenover and Schimmack, 2007). Although these studies are examining multiple emotions, from a broader viewpoint, the construct of mixed emotions is still an emerging field in mass communications and requires further attention.

Many studies that focus on mixed emotions measure these emotions in the aggregate, as an index of the felt emotions and their effect on attitudes and behavior. However, there is an overall lack of research that compares varied sequences of individual emotions within a single message. As a way to address this and focus more on the details of individual emotions within a single message, Nabi (2015) proposed the concept of emotional flow, a sequencing of specific discrete emotions in a strategic manner so that the flow of emotions affects certain behaviors.

Other studies that have used emotional flow tested the flow of emotions within the context of narratives. Alam and So (2020) used messages with a shift in valence (e.g. positive to negative or negative to positive) to show an increase in persuasion. Narrative structures play a particularly significant role in health communication. Sharma and Meena (2024) found that narrative transportation is used often to instruct and educate audiences especially in a post-COVID-19 world. Emotional shifts in health messages have also been shown to generate deeper message processing and behavior changes compared to single-valenced messages (Peinado and Nabi, 2024).

However, while studies on emotional flow do exist, they mainly focus on valence shift. A gap exists in the lack of empirical, experimental research that focuses on individual, discrete emotions. Because the concept of emotional flow itself is relatively new, researchers are still trying to understand how discrete emotions can act together in specific sequences, or flows, to affect physiological measures, attitudes and behaviors. This lack of research is important in any context but particularly in health centered messages which can promote positive health behaviors (e.g., cancer screening and early detection). Due to the prevalence of digital media and audience fragmentation, gaining attention and affecting consumer behaviors can be more difficult now. Utilizing narratives containing an emotional flow may be more successful at garnering that attention and affecting more positive health behaviors.

To address this gap, this study empirically tests emotional flow to understand how sequences of specific, discrete emotions organized into specific flows within a single message can affect emotional responses such as arousal and valence levels, as well as attitudes and behaviors, specifically in a health context. If different emotional flows affect these emotional responses in different ways, marketers and advertisers can more strategically incorporate emotions into their messaging strategies. Likewise, if various emotional flows have an effect on attitudes and behaviors, content creators can tactically use emotions to affect specific attitudes and behaviors such as information seeking and message engagement. In this case, the study focuses on videos using a narrative format because Hinyard and Kreuter (2007) believe narrative messages may successfully encourage positive health behaviors.

Literature review

Persuasion

Persuasion is an omnipresent function that is becoming even more so as society becomes more interconnected via technology like social media and targeted advertising. O'Keefe (2016) characterizes persuasion as a mechanism that influences an audience's mental state. Narrative messages are potent forms of persuasion, specifically when the viewer is able to relate to the message (Kim et al., 2025). Within health communication in particular, messages have shown to be effective in changing beliefs and attitudes, intentions, and behaviors (e.g., Ballard et al., 2021). One area lacking in persuasion research is in the specific emotions that these narrative emotions may trigger.

Emotion

Emotions are a distinct construct from moods. They are internal mental states that are valenced evaluations of a situation or object. They are typically viewed as short-lived, intense, and directed at external stimuli (Nabi, 2015). There are two distinct schools of thought in terms of research on emotion. The dimensional model is a more generalized way of looking at emotions that categorizes them into two dimensions of emotional response: valence (positive and negative) and arousal (high and low; Nabi, 2010). Discrete emotions are essentially categorical states of emotions that are based on cognitive appraisals of situations (Nabi, 2010; Winterich et al., 2010). While the discrete model is valuable for general research on emotions, DeSteno et al. (2004) feels the approach is too broad as it diminishes the ability to distinguish between negative emotions, such as anger and sadness, and positive emotions, like hope and joy which can all have different cognitive appraisals leading to different effects.

Though researchers do include dimensions of emotional valence (e.g., Morris et al., 2002, 2016), more current research is beginning to focus on discrete emotions as a dimensional only approach may preclude significant meanings that are specifically associated with individual discrete emotions (Hamby and Jones, 2022). Recent research is also exploring psychophysiological measures of discrete emotions. For example, Simmonds et al. (2024) used facial recognition to detect smiling, an indication of happiness in a study on using humor in obesity-prevention messages. Damiao de Paula et al. (2023) used electroencephalogram (EEG) and electrical conductance sensors to detect levels of joy and sadness in their study on motion induction in relation to beer advertisements. Studies like these suggest that research could benefit from moving beyond dimensional only emotion research and begin to focus on how discrete emotions can be used within persuasive frameworks.

Emotional flow

As discussed, most studies of mixed emotions that look at more than one emotion (e.g., happiness and fear from a horror movie)

measure the experiences in the aggregate or index of the emotions and how they affect attitudes and behavior (e.g., Andrade and Cohen, 2007). Building off of Oceja and Carrera (2009) framework of examining sequential patterns in mixed emotions, Nabi (2015) developed the concept of emotional flow as a way to examine those emotions individually within the message with a goal of strategically sequencing emotions within a message to affect certain attitudes and behaviors.

Other research indicated that emotional shifts within messages may have effects such as the mitigation of defensive processing and increased perceptions of self-efficacy (Carrera et al., 2010), while Fitzgerald et al. (2020b) found that restorative narratives that shift from threat to hope may promote greater prosocial behaviors.

Emotional flow research has continued to grow. Alam and So (2020) demonstrated that narrative health messages designed to evoke emotional shifts (positive-negative and negative-positive) enhanced message engagement which led to higher levels of persuasion. Emotional flows embedded in health narratives may improve affective forecasting accuracy (how a health event will make a patient feel) as well as increase message compliance, specifically with genetic testing or colonoscopies (Hundal et al., 2024). Likewise, Peinado and Nabi (2024) used emotional flow to show that emotional shifts with different valences (positive-negative and negative-positive) increased emotional intensity as well as increased message processing compared to messages containing only single valences. Though developing, current emotional flow research focuses on stimuli with shifts in valence (positive and negative) with an overall lack of experimental research testing emotional shifts with discrete emotions, specifically in health contexts including cancer prevention. In a theoretical paper proposing emotional flow, Nabi (2015) suggests that a flow of humor-sadness-hope can be an effective persuasive device since humor promotes attention to the message, sadness with its negative valence promotes deeper message processing, and hope motivates individuals to act.

Arousal

Emotional flow can enhance persuasion for two reasons. First, as discussed, emotions have unique effects on message processing depth and action tendencies and second, physiological arousal plays a very strong role in emotional experiences and emotions in one part of a message can influence emotional intensity in subsequent parts of the message (Nabi et al., 2018; Nabi and Myrick, 2019). Zillmann's (1983) excitation Transfer Theory illustrates that emotional experiences take time to dissipate and subsequent emotional responses can thus be more intense.

More recent research confirms arousal's role in the persuasion process. Baker, Qiao, and Zhou found that first-person narratives lead to higher levels of arousal, specifically with human narration (2019). Videos presented in a narrative style were found to have higher levels of arousal which was also associated with greater memorability (Ma et al., 2024). Research in advertising showed that in arousing ads, congruent messages led to greater processing and recall (Wang and Bailey, 2023). Also of note, emotional arousal has been identified as an underlying mechanism in the effect of attitudes and other behaviors within health contexts such as intention to donate blood (Balaskas et al., 2024). Though arousal has been studied continuously in different contexts, there are not many studies that examine how arousal manifests itself in a progression of separate, discrete emotions.

Positive valence

Humor is a discrete emotion with positive valence. Research shows that it can produce both positive affect as well as increase ad attitude (Eisend, 2009; Gulas and Weinberger, 2006). Sadness can result from feelings of loss and pain, as well as failure to achieve a goal (Izard, 1977; Lazarus, 1991; Plutchik, 1980; Tomkins, 1963). The action tendency of sadness can cause someone to enter a state of inaction or withdrawal (Frijda, 1986; Lazarus, 1991; Roseman et al., 1994). Like humor, hope is a positively valenced emotion, an antidote to sadness (Lazarus, 1991).

Mood Management Theory (MMT) argues that emotions are driven by hedonic motivations to keep positive feelings and alter negative emotions into more favorable ones (Zillmann, 1988). Though the focus of this study is not about mood but rather emotion, valence response is an important part of both. It is logical that when viewing a stimulus that elicits a positive emotion, an individual would want to keep the positive valence response when confronted with a negative emotion.

Hypotheses

Per the previous discussion, prior research shows that mixed emotions can play a significant role in persuasion (e.g., Andrade and Cohen, 2007; Oceja and Carrera, 2009; Mukherjee and Dube, 2012). Additionally, arousal can mediate behavioral responses to emotional messages (Balaskas et al., 2024). However, because these studies measure emotions as an aggregate, few studies have empirically tested the effects of sequences of specific, discrete emotions and their influence on attitudes and behaviors, particularly in health-related contexts. Thus, this study uses Nabi's (2015) emotional flow as a framework to test the effects of individual emotions sequenced within a message.

Emotional flow

Emotional flow is still an emerging and novel construct. Sequencing discrete emotions into specific, strategic "flows" across a narrative message may increase attention, deepen message processing, and affect behaviors. Other empirical studies have shown that emotional flow can improve health message compliance as well as overall engagement with health messages (Hundal et al., 2024; Peinado and Nabi, 2024). An emotional flow with three discreet emotions has not been tested. Since Nabi (2015) suggested a humor-sadness-hope sequence could be a potentially powerful persuasive sequence promoting positive health behaviors, this study attempts to fill a gap in the emotional flow research.

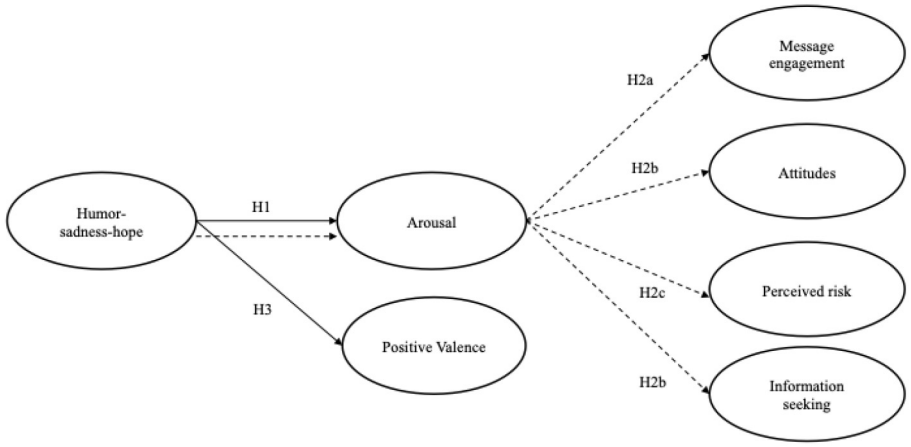

FIGURE 1
Research model. Note: Dotted lines represents mediation effects. Humor-sadness and humor-sadness-neutral conditions served as base groups.

Arousal

While studies have shown that that positive-negative emotional shifts could combine for more emotional intensity (e.g., Peinado and Nabi, 2024), studies have not tested if a third discrete emotion may cause even greater emotional arousal compared to a two-step flow. Thus:

H1: The humor-sadness-hope emotional flow will have higher levels of arousal response than the humor-sadness and humor-sadness-neutral emotional flows.

Including a neutral condition in a three-step flow further adds to the novelty of this research by directly examining whether or not the third emotion (hope) is responsible for increased arousal or if it's a time-based factor. Therefore, the hypotheses also tests whether or not a neutral segment may act as a buffer.

Existing literature has shown that emotional responses, including arousal, can mediate relationships between advertising content and attitudes and behaviors (e.g., Edell and Burke, 1987; Holbrook and Batra, 1987). Balaskas et al. (2024) also showed that emotions can mediate attitudes and behaviors within health contexts. Beyond only testing for mediation, this study attempts to show that arousal is a key underlying mechanism that explains how a complex, discrete emotional flow can affect different cognitive processes with the following hypothesis:

H2: Arousal response will mediate the relationship between the different emotional flows and (a) message engagement, (b) attitudes toward the video, (c) risk perceptions, and (d) information seeking.

Positive valence

Mood Management Theory and Excitation Transfer Theory (Zillmann, 1983, 1988) would suggest that the humor-sadness-hope sequence should create a positive valenced response. From an MMT standpoint, since individuals prefer more positive-valenced states, ending the sequence on a positive emotion should create that positive state. Additionally, the literature on restorative narratives, which highlight hope and resilience, has shown to be successful in persuasive efforts, particularly in health and prosocial endeavors (Fitzgerald et al., 2020b). Thus:

H3: The humor-sadness-hope emotional flow will have higher positive valence scores than the humor-sadness and humor-sadness-neutral emotional flows.

This not only tests whether using a third, positive emotion (hope) influences valence, it tests Mood Management Theory and the efficacy of a three-step flow in achieving that hedonic goal of a positive valence. See Figure 1 for conceptual model.

Methodology

Study design

This study employed a three-condition between-subject experimental design (3: humor-sadness-hope vs. humor-sadness vs. humor-sadness-neutral). The University Human Subjects Review Board approved all of the study procedures and protocols.

Study participants

The study utilized the social science experimental laboratory on the campus of a large, southeastern university, so participants were students from the school. Participants were recruited from across campus by contacting instructors of various courses in order to enlist students. Students were able to sign up for the study and participate for credit in their respective classes or a $10 Amazon gift card.

Based on a power analysis using G* Power software, a single factor experiment with three conditions yielding a large effect size ($f = 0.4$) and power of 0.8 suggested a total sample size of 52. As such, the study was able to secure 52 participants (44 females and 8 males). The mean age of participants was 21 ($SD = 3.20$). In terms of race, 82 percent ($N_{white} = 43$) were White, 13.5 percent ($N_{AfricanAmerican} = 7$) were African American, 1.9 percent ($N_{Asian} = 1$) were Asian and 1.9 percent ($N_{Multiracial} = 1$) were multiracial.

Stimuli development

The study used the video *Dear 16-Year-Old Me,* a public service announcement using a narrative structure that features individuals speaking to the camera about experiences with melanoma. Because Nabi (2015) proposed emotional flow in the context of health messages and narrative structures are shown to be successful in producing positive health outcomes (e.g. Miller-Day and Hecht, 2013) a PSA about testing early for signs of melanoma was chosen. The video is presented in a first-person narrative format (Baker et al., 2019). The video was also chosen because it contained distinct emotions within the narrative that were able to be isolated. The first segment of the video includes bits of humorous advice to their 16-year-old selves such as "There will be a new set of Star Wars movies coming out. Do not watch them, they ruin everything." The video then proceeds to focus on the symptoms of melanoma and the sadness that accompanies losing someone from melanoma. The video concludes with ways of preventing melanoma and treatments that provide hope to those who view it.

Pretest

To test for elicitation of the three specific emotions, the *Dear 16-Year-Old Me* PSA was divided into four separate segments: humor, sadness, hope, and neutral. A pretest (N = 75) was conducted among a group of *MTurk* participants who did not take part in the main experiment in order to assess the manipulation of the individual video segments. Each participant watched the respective segments in a random order and then answered several questions to indicate how the videos made them feel. A series of within-subject ANOVAs were conducted to test that each individual segment elicited the appropriate emotion. The humor video received the highest score on the humor scale ($M = 4.96$, SD $= 1.33$, $F\,(3, 300) = 7.41$, $p < 0.001$, $\eta_p^2 = 0.07$) compared to sadness ($M = 3.9$, SD $= 1.66$) and hope ($M = 4.31$, SD $= 1.33$). The sadness video received the highest score on the sadness scale ($M = 4.75$, SD $= 1.55$, $F\,(3, 300) = 7.83$, $p < 0.001$, $\eta_p^2 = 0.07$) compared to humor ($M = 3.56$, SD $= 1.75$) and hope ($M = 3.76$, SD $= 1.60$). The hope video received the highest score on the hope scale ($M = 5.42$, SD $= 1.14$, $F\,(3, 300) = 3.73$, $p < 0.001$, $\eta_p^2 = 0.04$) compared to sadness ($M = 4.85$, SD $= 1.50$). There was not a significant difference at the $p < 0.05$ level between hope and humor in the hope video. This was less concerning because they are both positively valanced emotions. There was not a significant difference at the $p < 0.05$ level between humor, hope, or sadness in the neutral video, which was the desired outcome as the neutral video was not meant to elicit any strong emotional response. Thus, all segments were successful.

To create the humor-sadness emotional flow, the video played the humor and sad clips combined and ran for 1:48. The humor-sadness-hope flow was a combination of the three clips and ran for 3:20. The humor-sadness-neutral flow consisted of the humor and sadness clips combined with a portion of the neutral informational video listing causes of melanoma. There was a transition between the sadness and neutral portion of the video that was a black screen containing the words "here are some causes of melanoma." This video ran for 3:28. The difference in time from the humor-sadness-hope and humor-sadness-neutral was due to the location of a natural cut-off point. For the neutral portion of the video, an informative clip about melanoma was chosen as opposed to a random neutral clip so it would relate to the subject matter of the entire video.

Experimental procedure

Participants were randomly assigned to one of the three emotional flow videos. After viewing the video, all participants completed a questionnaire containing the self-reported dependent measures of emotions, attitudes and behavioral intentions.

Dependent measures

Emotional responses

Self-reported measures for emotional response were collected using the Advertising Self-Assessment Manikin (AdSAM, Morris et al., 1994). AdSAM visually assesses the pleasure, arousal, and dominance dimensions (PAD) via a graphic character placed along a continuous nine-point scale (Morris, 2019). The first row includes the pleasure scale, and the figures range from a smiling happy face to a frowning unhappy face. The second row is the arousal scale and includes figures which range from extremely calm with eyes closed to excited figures with open eyes and raised eyebrows. The dominance scale represents changes in control via changes in size of the manikins from a large figure to small figure indicating levels of control (Morris, 2019). Emotional response measures are conceptualized as two-dimensional and only focuses on the pleasure and arousal dimensions of the PAD scale therefore the dominance scale was not analyzed.

Attitude

Attitude toward the public service announcement was measured with four items on a seven-point scale based on previous research examining issue involvement (Maheswaran and Meyers-Levy, 1990). The items measured included useful/extremely useful, favorable/extremely unfavorable, extremely bad idea/good idea, and not at all important/very important. The items were averaged to form a single reliable index ($M = 5.61$, SD $= 0.98$, Cronbach's $\alpha = 0.88$).

Perceived risk

Perceived risk was assessed based on scales adapted from health communication research (Pepper et al., 2015; Wong and Cappella, 2009). Perceived risk of melanoma was based on four items on a seven-point scale. Items included what participants thought the likelihood that sun exposure would cause them to develop melanoma, whether they worried about health risks of sun exposure, whether they think about the health risks of sun exposure, and whether they feel afraid about developing melanoma. The items were averaged to form a single reliable index ($M = 5.41$, SD $= 1.48$, Cronbach's $\alpha = 0.79$).

Information seeking

Information seeking was measured using two statements adapted from Griffin et al. (2008) on a seven-point scale. Those statements read "When it comes to the topic of melanoma, I am likely to go out of my way to get more information" and "When the topic of melanoma comes up, I will try to learn more about it." The items were averaged to form a single reliable index ($M = 4.32$, SD $= 1.76$, Spearman-Brown $\alpha = 0.80$).

Message engagement

Message engagement was measured using three statements on a seven-point scale. Those statements, based on research from Alhabash et al. (2015) were "If I see this ad on YouTube, I would 'like' it on YouTube," "If I see this ad on YouTube, I would share it with my friends," and "If I see this ad on YouTube, I would comment on it on YouTube." The items were averaged to form a single reliable index ($M = 3.54$, SD $= 1.67$, Cronbach's $\alpha = 0.74$).

Results

Manipulation check

Each individual emotion for each clip was examined during the pretest before combining them into their specific emotional flows. Hope is the main emotion that may differentiate responses in all three groups. Therefore, hope was used as the manipulation check to see how people perceived the entire emotional flow in each of the three conditions.

A one-way between-groups analysis of variance was conducted to determine if the humor-sadness-hope flow would have a significantly higher hope measure than the humor-sadness and humor-sadness-neutral flows. Participants were divided into three groups according to which emotional flow they viewed (Group 1: Humor-Sadness, Group 2: Humor-Sadness-Hope, Group 3: Humor-Sadness-Neutral). There was a statistically significant difference in the amount of hope felt in the humor-sadness-hope flow compared to the humor-sadness flow and humor-sadness-neutral flow (F (2, 49) $= 6.71$, $p = 0.03$, $\eta_p^2 = 0.22$). *Post-hoc* comparisons using the Tukey HSD test indicate that people had higher levels of hope when viewing the humor-sadness-hope emotional flow ($M = 5.13$, SE $= 0.37$) than those who viewed the humor-sadness-neutral ($M = 3.75$, SE $= 0.27$) emotional flow at the $p < 0.05$ level as well as the humor-sadness emotional flow ($M = 4.25$, SE $= 0.26$) but at a marginally significant level, $p = 0.06$. This can likely be attributed to the small sample size. The humor-sadness-hope emotional flow successfully produced more hope in participants and the manipulations were successful.

Hypothesis testing

Arousal

H1 proposed that the humor-sadness-hope emotional flow would have higher levels of arousal response than the humor-sadness and humor-sadness-neutral emotional flows. A one-way between-groups analysis of variance was conducted to determine if the humor-sadness-hope flow would have higher arousal responses than the humor-sadness and humor-sadness-neutral flows. There was a statistically significant difference at the $p < 0.05$ level in arousal level for the three different emotional flow sequences. F (2, 49) $= 4.87$, $p = 0.01$, $\eta_p^2 = 0.17$. *Post-hoc* comparisons using the Tukey HSD test indicate that people had higher levels of arousal when viewing the humor-sadness-hope emotional flow ($M = 5.41$, SE $= 0.48$) than those who viewed the humor-sadness ($M = 4.06$, SE $= 0.31$) or humor-sadness-neutral ($M = 3.88$, SE $= 0.33$) emotional flows. H1 is supported.

Mediation analysis

H2 stated that arousal response would mediate the relationship between the different emotional flows and (a) message engagement, (b) attitudes toward the video, (c) risk perceptions, and (d) information seeking behavior. To test for mediation effects of arousal, a multi-categorical mediation analysis with 5,000 bootstrapped samples was conducted using Model 4 of the PROCESS macro for SPSS (Hayes, 2017). Emotional Flow Group was the independent variable. There were three different emotional flows so two dummy variables were created using the humor-sadness flow as the reference level (X_1 indicated the difference between humor-sadness and humor-sadness-hope and X_2 indicated the difference between humor-sadness and humor-sadness-neutral flows). Message engagement, attitude, risk perceptions, and information seeking behavior were the dependent variables and the arousal score from the PAD scale was the mediator.

The mediation analysis indicates that when considering the difference between the humor-sadness and humor-sadness-hope flow, arousal response significantly mediates the relationship between emotional flow and message engagement (point estimate $= -0.34$, $SE_{boot} = 0.25$, 95% CI $= -0.94$ to -0.003). In the humor-sadness-hope emotional flow, higher levels of arousal response led to lower message engagement. This relationship was entirely indirect as the direct path leading from X_1 and arousal response was not statistically significant ($ß = 0.28$, SE $= 0.49$, 95% CI $= -0.70$ to 1.26). Analysis indicates that when considering the difference between the humor-sadness and humor-sadness-neutral flow, arousal response did not mediate the relationship between emotional flow and message engagement (point estimate $= -0.15$, $SE_{boot} = 0.46$, 95% CI $= -1.07$ to 0.78). H2a is supported.

Results of the mediation analysis indicate that when considering the difference between the humor-sadness and humor-sadness-hope flow, arousal response does not significantly mediate the relationship between emotional flow and attitude (point estimate $= 0.36$, $SE_{boot} = 0.26$, 95% CI $= -0.17$ to 0.88). When considering the relationship between the humor-sadness-hope emotional flow and the humor-sadness-neutral emotional flow, arousal response does not significantly mediate the relationship between emotional flow and attitude (point estimate $=$ 0.21, $SE_{boot} = 0.25$, 95% CI $= -0.28$ to 0.70). H2b is not supported.

Analysis shows that when considering the differences between the humor-sadness and humor-sadness-hope flow, arousal response significantly mediates the relationship between emotional flow and perceived risk (point estimate $= -0.29$, $SE_{boot} = 0.19$,

95% CI = −0.72 to −0.01). In the humor-sadness-hope emotional flow, higher levels of arousal lead to lower risk perceptions. Once again, this relationship was entirely indirect as the direct path leading from X_1 and arousal response was not statistically significant (β = 0.25, SE = 0.41, 95% CI = −0.58 to 1.08). When considering the difference between the humor-sadness and humor-sadness-neutral flow, arousal response did not mediate the relationship between emotional flow and perceived risk (point estimate = 0.25, SE_{boot} = 0.39, 95% CI = −0.54 to 1.03). H2c is supported.

Results also indicate that when considering the difference between the humor-sadness and humor-sadness-hope flow, arousal response does not significantly mediate the relationship between emotional flow and information seeking (point estimate = 0.74, SE_{boot} = 0.60, 95% CI = −0.47 to 1.95). When considering the relationship between the humor-sadness-hope emotional flow and the humor-sadness-neutral emotional flow, arousal response does not significantly mediate the relationship between emotional flow and information seeking (point estimate = 0.26, SE_{boot} = 0.57, 95% CI = −0.88 to 1.40). H2d is not supported.

Valence

H3 proposed that the humor-sadness-hope would have higher positive valence scores than the humor-sadness and humor-sadness-neutral emotional flows. A one-way between groups analysis of variance was conducted to determine if the humor-sadness-hope flow would have more positive valence response than the humor-sadness and humor-sadness-neutral sequences. There was a statistically significant difference at the $p < 0.05$ level in pleasure level for the three different emotional flows. F (2, 49) = 3.88, $p = 0.03$, $\eta_p^2 = 0.14$. *Post-hoc* comparisons using the Tukey HSD test indicate that people had higher levels of pleasure when viewing the humor-sad-hope emotional flow ($M = 4.53$, SE = 0.37) than those who viewed the humor-sadness ($M = 3.28$, SE = 0.18) emotional flow. The humor-sadness-neutral emotional flow ($M = 3.94$, SE = 0.39) did not differ significantly from the humor-sadness or humor-sadness-hope emotional flows. H3 is supported.

Discussion

This study is one of the first to test specific, discrete emotions in a specific health context using Nabi's (2015) emotional flow as a framework. It was successful in effectively structuring persuasive messages using first-person narratives, and in particular, affecting emotional responses like arousal and valence. The results further extend existing persuasive theories such as Excitation Transfer Theory and Mood Management Theory. Theoretical and practical implications are discussed below.

Previous research looked at emotions in the aggregate (e.g., Andrade and Cohen, 2007; Larsen and McGraw, 2014). Findings for this study support Nabi's (2015) assertion that specific sequences of discrete emotions can affect persuasion. In this case, those who viewed the humor-sadness-hope flow had stronger reactions compared to the humor-sadness flow and the humor-sadness-neutral flow. These results support emotional flow's application in influencing different persuasive outcomes in health contexts.

Higher levels of arousal occurred in participants viewing an emotional flow containing three emotions (humor-sadness-hope) compared to those who viewed humor-sadness or humor-sadness-neutral flows. These results extend Zillmann's (1983) Excitation Transfer Theory by showing that physiological arousal may take time to dissipate. Using three discreet emotions seemingly allowed the physiological arousal to compound as the next emotional segment began rather than the arousal dissipating. Each sequential emotion allowed for the intensity of arousal to continue.

Evidence to further bolster this argument is provided by the buffering effect of the neutral segment. Because the neutral segment was not associated with any specific emotion, physiological arousal levels in this condition were lower. The neutral segment potentially mitigated arousal levels, allowing for the arousal intensity felt during the first two emotions to dissipate. This can further our understanding of how the excitation transfer process works in messages containing multiple emotions.

Results from this study also have implications for Mood Management Theory. As the humor-sadness-hope emotional flow resulted in significantly higher mean scores for pleasure (positive valence) compared to the other two flows, one can argue, as Mood Management Theory suggests, that individuals are motivated by their hedonic desires and want to keep a positive valence (Zillmann, 1988). Evidence suggests that ending on a positive emotion, in this case hope, results in individuals keeping that positive valence and not letting a negative emotion override it. This also supports research that showed restorative narratives using hope and resilience were successful persuasive techniques, especially in health contexts (Fitzgerald et al., 2020a). In this case, it could be argued that hope is seen as a cure for sadness, as Lazarus suggested (1991).

Excitation transfer is further supported by the positive valence scores of the humor-sadness-hope emotional flow. The intensity of sadness may have been attenuated by the previous humor segment, but by ending with hope, a positively valenced emotion, there was a higher intensity of that positive emotion. This also extends Mood Management Theory by establishing the idea that using a third, positive discrete emotion is a useful technique when positive outcomes are desired.

The study also identified arousal as a crucial underlying process to explain how a complex emotional flow can affect cognitive processing. Specifically, in the humor-sadness-hope emotional flow, higher levels of arousal led to lower risk perceptions and lower message engagement. This may potentially be explained and show support for Lang (2000) Limited Capacity Model. Due to the fact that the humor-sadness-hope emotional flow resulted in higher arousal levels, that arousal response potentially distracted participants from fully attending to the message, reducing both engagement and focus on melanoma risks. The results are significant as they extend the Limited Capacity Model to mixed, sequenced emotions research and show that an emotional flow can compete with cognitive process and potentially reduce attention to the messages.

Sadness is a core emotion in this study as well as a significant portion of the emotional flow in all three conditions. In testing a model predicting attitude, there was a statistically significant interaction between emotional flow and sadness on attitudes F(2, 46) = 4.6, $p = 0.02$, $\Delta R^2 = 0.16$. When considering the difference

TABLE 1 Linear model of emotional flow predictors of attitude toward the video.

Variable	*B*	*SE B*	*t*	*p*
Constant	7.96	0.97	8.18	$p < 0.001$
Emotional flow group 1	−2.45	1.30	−1.88	$p = 0.06$
Emotional flow group 2	−3.44	1.24	−2.78	$p < 0.01$
Sadness	−0.54	0.29	1.98	$p = 0.05$
Emotional flow group 1 x sadness	0.57	0.29	1.98	$p = 0.06$
Emotional flow group 2 x sadness	0.78	0.26	3.03	$p < 0.01$

$R^2 = 0.18$.

TABLE 2 Linear model of emotional flow predictors of message engagement.

Variable	*B*	*SE B*	*t*	*p*
Constant	7.38	1.83	4.03	$p < 0.001$
Emotional flow group 1	−5.10	2.46	−2.08	$p = 0.04$
Emotional flow group 2	−6.73	2.33	−2.89	$p < 0.01$
Sadness	−0.81	0.39	−2.10	$p < 0.05$
Emotional flow group 1 x sadness	1.11	0.55	2.04	$p = 0.05$
Emotional flow group 2 x sadness	1.40	0.49	2.89	$p < 0.01$

$R^2 = 0.17$.

between the humor-sadness and humor-sadness-hope emotional flows, sadness did not moderate the relationship between emotional flow and attitude ($ß = 0.57$, SE = 0.29, 95% CI = −0.01 to 1.15). However, when considering the difference between the humor-sadness and humor-sadness-neutral flow, inspection of the effect of the humor-sadness-neutral flow at different levels of the moderator indicate that the humor-sadness-neutral flow produces more positive attitudes when sadness is higher ($ß = 0.78$, SE = 0.26, 95% CI = 0.26 to 1.30). See Table 1.

After further moderation analysis using sadness as a moderator, there was a statistically significant interaction between emotional flow and sadness on message engagement $F(2, 46) = 4.3$, $p = 0.02$, $\Delta R^2 = 0.16$. When considering the difference between the humor-sadness and humor-sadness-hope flow, sadness did not moderate the relationship between emotional flow and message engagement ($ß = 1.13$, SE = 0.55, 95% CI = 0.01 to 2.21). But when considering the difference between the humor-sadness and humor-sadness-neutral flow, probing the effect of the humor-sad-neutral flow at different levels of the moderator indicate that the humor-sadness-neutral flow produces lower message engagement scores when sadness is lower ($ß = 1.40$, SE = 0.49, 95% CI = 0.43 to 2.38). See Table 2.

Results suggest that the neutral segment of the video may have served a mitigating role in arousal, valence, and attitude responses. Lower sadness levels produced lower message engagement. This is not entirely surprising since sadness is associated with deeper message processing and greater elaboration (Izard, 1993; Nabi, 2015).

This research also provides several practical implications that advertisers and marketers can implement to assist in developing more effective messaging. Message strategies that focus on ad recall or reducing ad skipping during online advertisements might use emotional flows containing three discrete emotions. In this study, strategically sequencing a narrative PSA to include three separate discrete emotions (humor-sad-hope) created highly intense and arousing responses. This can lead to greater ad recall, especially if the messages are congruent to the consumer (Ma et al., 2024; Wang and Bailey, 2023). Highly arousing messages are also shown to reduce ad skipping in online content (Belanche et al., 2017). To increase performance, marketers should target consumers with content that is relevant to them since high-arousal videos have been shown to perform better when the content is congruent to the audience. This is especially important in different health contexts such as melanoma testing and detection.

Advertisers and marketers should also take into account their information strategy. Because high arousal inducing content potentially reduced message processing capacity, messages that involve higher involvement and deeper engagement (e.g., melanoma prevention) might benefit from a lower arousal emotional flow as high arousal could be harmful to the message. In this case, marketers might consider a univalenced message or one with fewer emotions involved in the emotional flow (e.g., humor-sadness).

One of the hallmark measures of advertising success is brand attitude. To generate positive feelings toward the brand or organization, advertisers and marketers should consider creating advertisements or PSAs sequenced to end with a positively valenced discrete emotion since, in this case, a humor-sadness-hope emotional flow resulted in more positively valenced responses.

Ultimately, this study was successful in providing empirical support for structuring persuasive messages using specific, discrete emotions in a strategic emotional flow. The focus of this particular study was on health communication, specifically melanoma protection and prevention. Future studies could focus on a variety of messaging campaigns using different commercial brands, non-profit organizations and CSR initiatives. Future studies could also test emotional flows with different discrete emotions as they all have distinct action tendencies. As this study relied on self-report measures, future research might consider using biometric measures such as galvanic skin response to measure arousal levels and facial expression analysis for different emotional detection. A significant advantage of using biometric measurements is it allows for the detection of physiological measures in real time, as they happen. The videos were different lengths so the longer sequences may have allowed for the dissipation of arousal before answering the questionnaire. By employing biometric measures and analyzing emotional expression in real time, researchers could more accurately gauge whether or not emotional flow length plays a role. If biometrics are not available, future research might utilize an experimental design that uses a standardized time delay between the conclusion of the respective emotional flow and the immediate self-reporting of emotional responses as a way to control for any arousal decay related to time. As emotional flow is still a younger framework, there are robust opportunities for research in a variety of contexts.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the University of South Carolina Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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Publisher's note

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