Article

Effect of Extraneous Affect on Health Message Reception

Personality and Social Psychology Bulletin
2020, Vol. 46(2) 270–284

DOI: 10.1177/0146167219855042
journals.sagepub.com/home/pspb
SAGE

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Abstract

People often avoid paying attention to health messages. One reason is that health messages can evoke negative affect, which produces avoidance. Prior efforts to reduce disengagement focused on changing message content or buffering the self from threat, producing mixed effects. The present studies test whether inducing positively valenced, low-arousal affect independently of the message or the self, labeled *extraneous affect*, promotes health message receptivity. Across four studies (total $N = 1{,}447$), participants who briefly meditated (vs. a control listening task) paid more attention to messages (Study 1). Increased positive valence facilitated attention, which subsequently increased message comprehension (Studies 2-4), whereas reduced arousal directly increased message comprehension. These effects generalized across extraneous affect manipulations, settings, information domains, and levels of message threat. Taken together, extraneous affect can be leveraged to promote message receptivity. This contributes to a theoretical understanding of how affect impacts persuasion.

Keywords

message reception, extraneous affect, selective attention, mindfulness meditation

Received April 11, 2018; revision accepted May 6, 2019

Health messages often fail to reach their intended audience. Even when information is successfully presented to audiences, they may avoid paying attention (Earl, Crause, Vaid, & Albarracín, 2016; Kessels, Ruiter, & Jansma, 2010). This is more likely when health messages evoke high-arousal negative emotions like fear or shame (Earl & Albarracín, 2007; Earl, Nisson, & Albarracín, 2015) or when they implicate existing beliefs and behaviors (Kessels et al., 2010; Sherman, Nelson, & Steele, 2000), which is experienced as an aversive, negatively arousing affective state (Aronson, 1969; Festinger & Carlsmith, 1959; Harmon-Jones, 2000). The motivation to downregulate this negative affect drives attention away from unpleasant or threatening information (Earl & Hall, 2019; Jonas, Graupmann, & Frey, 2006; Ochsner & Gross, 2005). Yet, reducing negative affect alone may not be sufficient to increase engagement with health messages, particularly when audiences are unmotivated to attend to messages, or when there is competition for attentional resources (Fiske & Taylor, 1984; Petty & Cacioppo, 1986). However, as affect can drive avoidance, affect can also facilitate approach (Carver, 2003). This article proposes that extraneous affect, or affect that is independent of a message, can be leveraged to increase attention to and comprehension of health messages. We argue that delineating the specific stage of the persuasion process being targeted (reception vs. yielding), the source of affect (message-based vs. extraneous), and the components of affect (arousal vs. valence) can clarify the disparate effects of affect on persuasion. Specifically, we use meditation to target both the valence and arousal of extraneous affect to understand how each may impact attention and comprehension. In doing so, we aim to contribute to a nuanced theoretical account of affect and persuasion.

To understand the effects of affect on persuasion, it is important to first model the process by which persuasion unfolds. McGuire's (1968, 1972) reception-yielding model splits persuasion into two general stages, reception and yielding, each composed of three substages. Message reception refers to whether or not recipients take in a message, such as (a) initial message exposure, (b) message attention, and (c) message comprehension. Message yielding refers to attitudinal and behavioral changes in line with a persuasive message, such as (a) message acceptance, (b) message retention, and (c) message-consistent behavior. Importantly, evidence suggests that affect may have divergent effects on message reception and yielding. For instance, people tend to show greater attitude change after reading more fear-inducing

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messages (yielding; Tannenbaum et al., 2015), but are less likely to select or attend to these emotionally evocative messages (reception; Derricks & Earl, 2019; Earl & Albarracín, 2007; Earl et al., 2016; Gainsburg & Earl, 2018). Negative affect can thus either facilitate or impede persuasion depending on the specific stage of the persuasion process under investigation (see also Janis, 1967).

The effect of affect on persuasion can be further disambiguated by considering the source of affect. Of particular interest, affect elicited by a message (message-based affect) and affect elicited by external factors independent of the message (extraneous affect) may differentially impact persuasion. Much of the research on message-based affect in health contexts has focused on defensive processing of threatening or negatively arousing messages (Sweeny, Melnyk, Miller, & Shepperd, 2010). The work on fear appeals discussed above is one example of defensive reactions to negatively arousing content that motivates avoidance (Earl et al., 2007). However, extraneous affect can also impact persuasion. To date, much of this work has focused on message yielding (e.g., Kumkale & Albarracín, 2004; Schwarz & Clore, 1983) or was not designed to delineate between reception and yielding (e.g., Wegner, Petty, & Smith, 1995). What the research on extraneous affect on yielding (e.g., message agreement) suggests is that as long as people do not reflect too deeply on the source of affect, they tend to misattribute it to the object or message being evaluated (Kumkale & Albarracín, 2004). This is in part because people use their existing affective states to inform their evaluations (Schwarz & Clore, 1983).

Whether extraneous affect would also impact message reception is a separate question. Some work suggests that positive extraneous affect promotes reception, specifically information selection, by buffering against self-relevant threats that otherwise prompt avoidance (Jonas et al., 2006). This aligns with research showing that positive, self-relevant thoughts reduce avoidance of threatening health messages (Falk et al., 2015; Raghunathan & Trope, 2002). Other work suggests that extraneous affect impacts people's motivation to scrutinize unpleasant messages (Wegner et al., 1995) or their capacity to process messages (Lang, 2000; Mackie & Worth, 1989). However, this past research focused more on understanding affective processes, with reception and yielding often examined jointly and broadly as message processing. An integrated, conceptual understanding of the effect of extraneous affect on message reception remains sparse.

Finally, any such conceptualization may benefit from considering both the valence and arousal of extraneous affect. Most of the theoretical work on affect and persuasion is centered around valence effects, but valence and arousal are frequently conflated (see Monahan, 1995). It is unclear what proportion of these effects are attributable to valence, as typically theorized, or to arousal, which may affect processing capacity directly (Lang, 2000; Storbeck & Clore, 2008). The current research diverges from the extant literature by using a meditation intervention to target both the valence and arousal of extraneous affect and promote reception to health messages.

Prior Approaches for Promoting Reception

Prior research has promoted message reception by (a) changing message content or (b) buffering people against self-relevant threats. Changing the content of a message can reduce avoidance when features of the message elicit negative affect (Rothman, Salovey, Antone, Keough, & Martin, 1993). For example, messages can be framed to highlight gains rather than losses (Rothman & Salovey, 1997) or to evoke less fear or shame (Ruiter, Abraham, & Kok, 2001). However, if the topic itself is what elicits negative affect (e.g., HIV information), then adjusting the message content may only go so far.

An alternative is to target psychological processes external to the message. Researchers have done this with self-affirmation interventions, which inoculate people against messages that threaten prior beliefs and behaviors (Reed & Aspinwall, 1998; Sherman et al., 2009). After completing self-affirmation interventions, people select, attend to, and respond less defensively to health information (Falk et al., 2015; Howell & Shepperd, 2012). However, there are limitations to such interventions. Self-affirmation tends to be less effective when people are aware that the intervention is supposed to help them (Sherman et al., 2009) and may also be less helpful when disengagement is driven by something other than self-threats, such as disgust or fear (e.g., Leshner, Bolls, & Thomas, 2009). Given that affect plays a role when the self is threatened as well as when it is not, it may instead be effective to directly target affect. It is worth noting that although much of the prior research has focused on the presence or absence of defensiveness via threat, it is also possible that affect may impact message processing along a broader continuum of defensiveness to receptivity. Even without active avoidance, motivation and capacity to process messages may still impact the extent to which people engage with or approach information (Fiske & Taylor, 1984; Petty & Cacioppo, 1986). Although some work has used affect to reduce avoidance (Jonas et al., 2006), affect may also facilitate approach (Carver, 2003).

Meditation and Affect

Mindfulness meditation is one way to manipulate affect (Feldman, Greeson, & Senville, 2010). Although long-term mindfulness interventions have specific benefits beyond mood effects, brief meditation sessions are primarily effective at increasing positive valence and decreasing arousal (Baer, 2003; Johnson, Gur, David, & Currier, 2015). Because the affective states most known for impeding attention are

negatively valenced and highly arousing, an intervention like meditation, which induces positive, low arousal affect, may be more effective.

Overview

The present research tests whether increasing positive valence and decreasing arousal prior to message exposure promotes message reception. Four studies used a meditation intervention to induce positive, low arousal extraneous affect and examine its effects on attention and comprehension. Study 1 tested whether a mindfulness meditation session increased attention to physical health messages. Study 2 tested whether meditation impacts message reception specifically through premessage valence and arousal. Study 3 tested whether the effects from the previous studies generalize to other types of extraneous affect manipulations (progressive relaxation) and to other types of information (mental health). Although Studies 1 to 3 were designed to test threat-buffering effects in line with much of the prior literature, Study 4 directly tested whether extraneous affect works by reducing defensiveness to threatening messages or whether it promotes receptivity more broadly.

Study 1

Study 1 tested whether listening to a guided mindfulness meditation (compared with control audio) would impact self-reported attention and time spent reading health messages.

Method

Participants and Procedure

The University of Michigan Institutional Review Board approved all study protocols. A total of 81 college students (55 female) participated in exchange for course credit. Sample size was selected based on best practices at the time Study 1 was designed (Simmons, Nelson, & Simonsohn, 2011). Although a priori power analyses are preferable, post hoc sensitivity analyses using G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) indicated 80% power to detect an effect size of $|d| = .63$.

Participants arrived at a computer lab individually and were told that they would be participating in a study on auditory and visual information processing. Participants were randomly assigned to listen to a 10-min guided mindfulness meditation clip ($n = 42$) or a 10-min control clip with historical information about Michigan (e.g., the indigenous peoples of Michigan, French colonization, U.S. statehood, and development of the state's automotive industry; $n = 39$). The guided meditation was derived from prior research (Erisman & Roemer, 2010) and broken up into four clips. The first two described and guided participants through meditation on physical sensations. The next two focused on noticing thoughts and emotions.[1] An experimenter used a hidden camera to unobtrusively observe whether participants followed instructions. After listening to the audio clips, participants read information about flu, cancer, HIV, herpes, and gonorrhea. Each message was split into four paragraphs and presented on separate pages. To maximize the chance of detecting an effect, Study 1 strengthened the manipulation by adding reminders about the meditation exercises between health messages.

Measures

Attention was assessed with self-report and time spent reading. Participants indicated on a scale of 1 (*not at all*) to 9 (*very much*) how much attention they paid and how well they could concentrate on each of the five messages ($M = 5.66$, $SD = 1.43$; $\alpha = .94$). Although time spent reading the messages can be somewhat noisy and challenging to interpret (see Earl & Hall, 2019), we included it as a complement to self-report ($M = 405.6$ s, $SD = 141.3$; $\alpha = .95$). Time spent reading is reported in raw values but was log-transformed for analyses to correct for positive skew and reduce the influence of outliers.[2]

This study was initially designed to measure affect using the Self-Assessment Manikin (SAM; Bradley & Lang, 1994). Due to a programming error, the SAM data after the manipulation were not collected in the control condition, meaning that mediation by extraneous affect could not be assessed in Study 1.[3]

Results and Discussion

Participants in the mindfulness condition reported significantly more attention to health information ($M = 6.09$, $SD = 1.21$) than those in the control condition, $M = 5.17$, $SD = 1.52$; $t(78) = 3.00$, $p = .004$; Cohen's $d = .67$, $CI_d = [0.21, 1.12]$. Participants who meditated also spent almost a minute more reading the messages (mindfulness: $M_{seconds} = 43.2$, $SD = 14.0$; control: $M_{seconds} = 37.6$, $SD = 13.8$). However, there was no significant difference in the log-transformed scores, $t(78) = 1.36$, $p = .18$; Cohen's $d = .30$, $CI_d = [–0.14, 0.75]$. Overall, Study 1 gives some preliminary evidence that meditation can promote attention to health messages. However, the specific affective processes that may underlie these effects remain untested.

Study 2

Study 2 tested whether extraneous affect impacts message reception by measuring both valence and arousal. Study 2 also removed the reminders about the meditation between health messages. This may reduce effect sizes, but provides a purer test of extraneous affect by manipulating it exclusively before message exposure. Finally, Study 2 expanded our investigation of message reception by assessing indirect effects on both attention and comprehension.

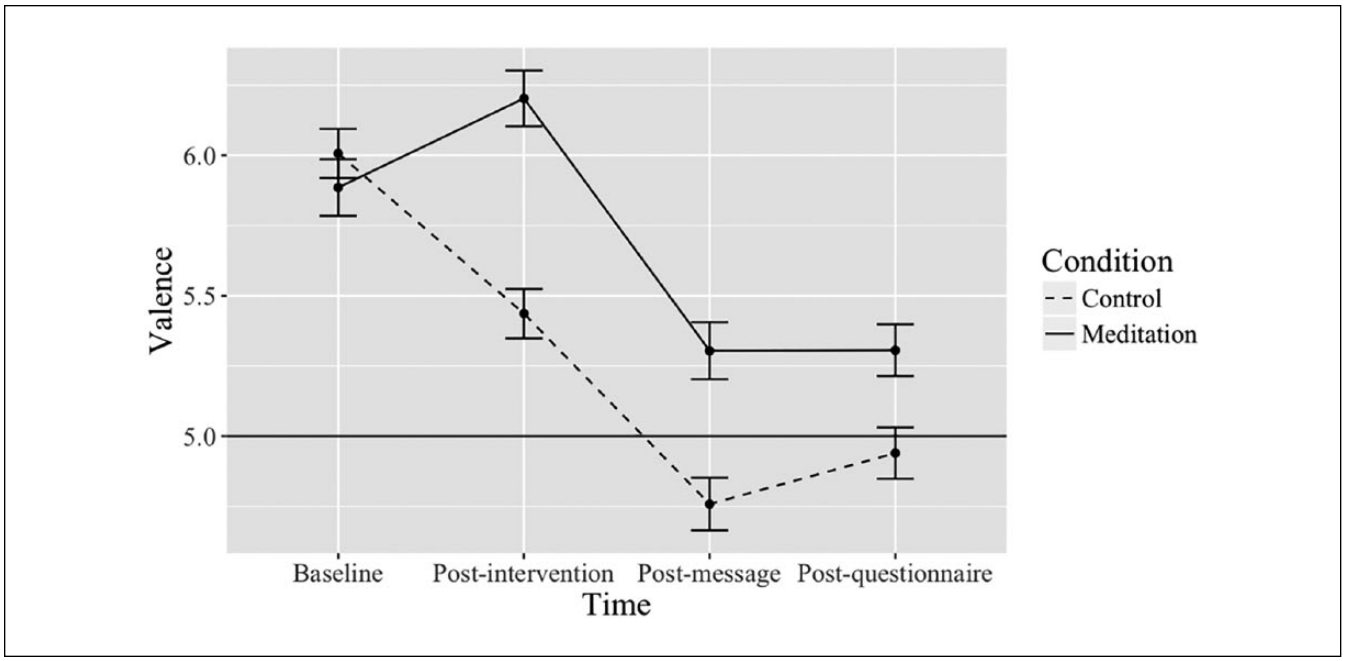

Figure 1. Valence across time by condition (Study 2).
Note. Error bars are standard errors. The horizontal line represents the midline on a bipolar scale of 1 (*extremely negative*) to 9 (*extremely positive*).

Method

Participants

A total of 297 introductory psychology students participated for course credit. Post hoc sensitivity analyses indicated 80% power to detect an effect size of $|d| = .33$ for the main effect between the mindfulness ($n = 148$) and neutral control conditions ($n = 149$) and $|r| = .16$ for the regression in the model with most predictors (i.e., fewest degrees of freedom).

Procedure

Participants completed the study in groups of up to eight, with headphones and at their own computer stations. The rest of the procedure was the same as Study 1, but with affect measured at four time points: (a) at baseline, (b) after the intervention, (c) after the health messages, and (d) after the dependent measures.

Materials

Study 2 used the SAM to measure affect (Bradley & Lang, 1994). For this pictorial measure, participants rated their arousal and valence separately on a scale of 1 to 9 using cartoon images with varying degrees of arousal (depicted by the size of an explosion inside the cartoon image) or valence (depicted by the how much the cartoon image was frowning or smiling).

Study 2 also used the messages from Study 1 except for the herpes information, which was excluded to shorten the study. Attention was measured the same way as in Study 1. In addition, comprehension was measured by testing recognition of factual health information on eight multiple choice questions (e.g., "What may be recommended to slow the process of HIV replication and therefore the progression of HIV?").

Finally, Study 2 included another factor manipulating the type of threat emphasized by the HIV messages (social vs. physical threat). This did not impact any of the outcome measures or moderate any of the results and are not discussed further.

Results

We first tested whether the manipulation impacted extraneous affect as expected. After the intervention, participants in the mindfulness condition (compared with control) felt significantly more positive, $t(294) = 4.10$, $p < .001$, $d = 0.48$, $CI_d = [0.24, 0.71]$, and less arousal, $t(294) = -2.96$, $p = .003$, $d = -0.34$, $CI_d = [-0.57, -0.11]$. Additional analyses confirmed that within the meditation condition, affect changed from baseline for both valence, $M_{Difference} = 0.32$, $t(147) = 2.52$, $p = .013$, and arousal, $M_{Difference} = -0.99$, $t(147) = -7.80$, $p < .001$; see Figures 1 and 2. Although mean valence was always above the midpoint, it did become less positive following the control condition, $M_{Difference} = -0.57$, $t(148) = -6.71$, $p < .001$, whereas arousal remained unchanged, $M_{Difference} = -0.10$, $t(148) = -0.91$, $p = .36$; see Figure 1.[4] Unlike Study 1, however, there were no total effects of the manipulation on attention, $t(294) = 1.36$, $p =$

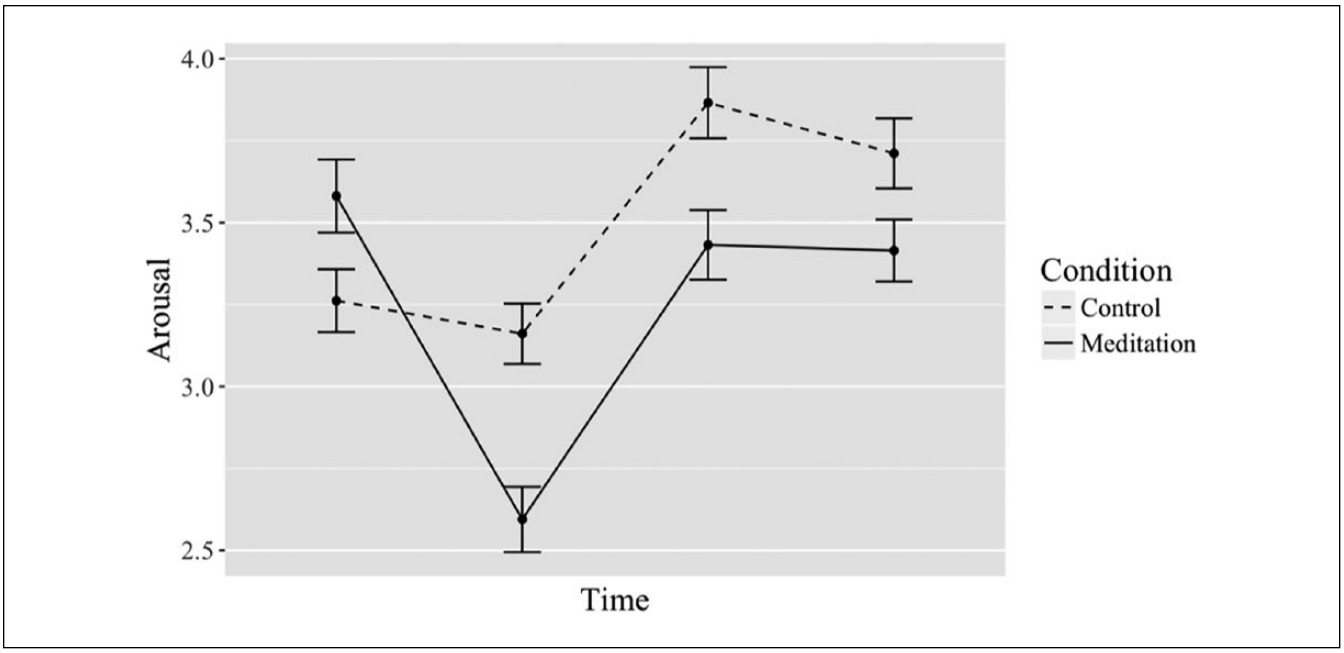

Figure 2. Arousal across time by condition (Study 2).
Note. Error bars are standard errors.

.17, $d = 0.16$, $CI_d = [-0.07, 0.39]$, or time spent reading, $t(294) = 1.12$, $p = .26$, $d = 0.13$, $CI_d = [-0.10, 0.36]$.

Extraneous Affect, Reported Attention, and Comprehension

A single model tested whether the meditation manipulation impacted valence and/or arousal, whether valence and arousal then predicted reported attention, and whether attention predicted comprehension. The path analysis was conducted with the lavaan package in R (Rosseel, 2012). To accurately estimate indirect effects, we also modeled all direct effects and used bias-corrected and accelerated bootstrap confidence intervals (CIs) to test for significance (Preacher & Hayes, 2008). To model change in affect following the intervention, baseline valence and arousal were included as covariates predicting postintervention valence and arousal, respectively. This initial model showed good fit, $\chi^2(7) = 12.8$, $p = .08$; comparative fit index (CFI) = 0.99; root mean square error of approximation (RMSEA) = 0.05; standardized root mean square residual (SRMR) = 0.03. The model was adjusted further to include the correlation between these variables ($r = -0.27$, $p < .001$). This final model had substantially improved fit, $\chi^2(6) = 2.29$, $p = .89$; CFI = 1.00; RMSEA = 0.00; SRMR = 0.01.

Indirect effects through valence. Participants in the mindfulness condition felt more positive following the intervention ($\hat{\beta} = .26$, $p < .001$), and participants who felt more positive reported more attention to the health messages ($\hat{\beta} = .13$, $p = .04$). This translated to a significant indirect effect of mindfulness on self-reported attention through valence, $b = 0.09$, $SE = 0.05$, 95% CI = [0.008, 0.21]. Those who reported attention to the health messages also answered more multiple choice questions correctly ($\hat{\beta} = .28$, $p < .001$). This ultimately translated to a significant indirect effect from mindfulness to comprehension through both valence and attention ($b = 0.024$, $SE = 0.015$, 95% CI = [0.003, 0.064])

Indirect effects through arousal. Participants in the mindfulness condition reported feeling less arousal after the intervention ($\hat{\beta} = -.23$, $p < .001$); lower arousal predicted greater attention to the health messages ($\hat{\beta} = -.14$, $p = .04$). This again resulted in a significant indirect effect of mindfulness on reported attention through arousal ($b = 0.09$, $SE = 0.05$, 95% CI = [0.01, 0.20]) and a full indirect effect from meditation to comprehension was significant through arousal and attention ($b = 0.024$, $SE = 0.013$, 95% CI = [0.004, 0.059]).

Extraneous Affect, Reading Time, and Comprehension

The results were similar, but weaker with time spent reading (log-transformed) as the attention measure. The indirect effect on comprehension through arousal and reading time was in the predicted direction, but did not reach statistical significance ($b = 0.041$, $SE = 0.025$, 95% CI = [–0.001, 0.098]) and nonsignificance through valence and reading

time ($b = 0.004$, $SE = 0.024$, 95% CI = [–0.040, 0.058]). For more details on reading time analyses across all studies, see Supplemental Appendix E.

Discussion

Meditation indirectly impacted message reception through extraneous valence and arousal. Participants who reported more attention also answered more multiple choice questions correctly. Together, this is initial evidence that targeting extraneous affect can promote message reception. However, unlike Study 1, Study 2 only found evidence for an indirect effect on attention and no total effect. This may be due in part to the removal of the reminders between messages, resulting in a weaker total effect. In any case, Study 2 does suggest that mindfulness can indirectly impact message reception insofar as it influences extraneous affect.

Study 3

Study 3 tested whether the previous findings generalize across types of extraneous affect manipulations and across health domains. First, if extraneous affect is what matters most, then progressive relaxation techniques should be as effective as a brief mindfulness meditation session (Johnson et al., 2015). Progressive relaxation is often used as a control for mindfulness meditation because it involves body focus, breathing exercises, and an emphasis on reducing tension, but without an emphasis on present focus or thoughts and feelings (Ortner, Kilner, & Zelazo, 2012). Progressive relaxation also makes people feel less aroused and more positive (Johnson et al., 2015), making it suitable for testing effects through extraneous affect that may not be specific to mindfulness.

Study 3 also tested whether the effects found in the previous studies generalize to other health domains, such as mental (vs. physical) health. Depression and anxiety are increasingly prevalent among college students, making mental health information clinically relevant for this sample (Center for Collegiate Mental Health, 2017).

Method

Participants and Procedure

Participants were 168 introductory psychology students (80 female, 87 male, one preferring not to respond) recruited to participate in exchange for course credit. Participants were randomly assigned to a guided mindfulness meditation ($n = 54$), a guided progressive relaxation ($n = 57$), or a neutral control audio clip ($n = 57$) before completing the same procedure as Study 2. Data were collected over two academic terms and continued until the academic year ended.[5] Sensitivity analyses indicated Study 3 had 80% power to detect effect sizes of $|d| = .53$ for pairwise comparisons and $|r| = .21$ for regression paths.

Materials

Relaxation condition. Participants listened to a 10-min audio clip directing their breathing and instructing them to progressively notice and release tension in different parts of their body (Banks, Welhaf, & Srour, 2015; Jacobson, 1938). Unlike mindfulness, there is no emphasis on thoughts and feelings.

Health messages. All participants read three sets of mental health messages adapted from information from the Centers for Disease Control and Prevention (CDC; 2016) and from the university health services website. The first message gave basic information about depression, its prevalence among college students, its symptoms, and common treatments. The second gave similar information for anxiety. Finally, participants read general recommendations for managing mental health (i.e., exercise, diet, sleep, and treatment seeking).

Measures. All measures were identical to those used in Study 2 except for the multiple choice questions, which were changed to reflect the new messages (see Supplemental Appendix B for a complete list).

Results

Meditation and Attention

Attention was first regressed onto two dummy codes, one for mindfulness and another with relaxation, with the neutral control condition serving as the reference group. Relative to those in the neutral control condition, those in the relaxation condition reported marginally more attention, $t(164) = 1.84$, $p = .07$, $d = 0.33$, 95% CI_d = [–0.03, 0.72]. No difference emerged between the mindfulness and neutral control condition, $t(164) = 0.60$, $p = .55$, $d = 0.12$, 95% CI_d = [–0.26, 0.49]. Unlike the previous studies, mean reading time was highest in the control condition (mindfulness: $M = 152.2$ s, $SD = 80.9$; relaxation: $M = 165.4$, $SD = 86.5$; control: $M = 181.5$ s, $SD = 102.4$). However, this was driven by an outlier (578 s, 3.88 *SD* above group mean); tests with log-transformed reading time show no significant differences across conditions.

Indirect Effects on Reported Attention Through Extraneous Affect

The next step was to test whether meditation had indirect effects through both valence and arousal. The path model was similar to Study 2 with the exception of the multiple dummy codes for the conditions; paths were specified from each dummy to postintervention valence and arousal, from valence and arousal to attention, and from attention to comprehension. All direct effects were also included. Fit

indices for the initial model were mixed but suggested reasonable fit, $\chi^2(7) = 14.35$, $p = .045$; CFI = 0.98; RMSEA = 0.08; SRMR = 0.03. Model fit improved when postintervention valence and arousal were allowed to covary, $\chi^2(6) = 6.18$, $p = .40$; CFI = 0.999; RMSEA = 0.01; SRMR = 0.02.

Results revealed a significant indirect effect on reported attention through valence for both mindfulness ($b = 0.26$, $SE = 0.11$, 95% CI = [0.08, 0.54]) and relaxation training ($b = 0.32$, $SE = 0.13$, 95% CI = [0.10, 0.60]). Compared with the neutral control, participants felt more positive after both the relaxation ($\hat{\beta} = .40$, $p < .001$) and mindfulness meditations ($\hat{\beta} = .32$, $p < .001$); postintervention valence in turn predicted greater reported attention ($\hat{\beta} = .27$, $p = .004$).

Participants also reported less arousal in the relaxation ($\hat{\beta} = -.31$, $p < .001$) and mindfulness conditions ($\hat{\beta} = -.32$, $p < .001$) when compared with those in the neutral control condition. However, the indirect effects on attention through arousal were not significant for either the relaxation ($b = 0.02$, $SE = 0.08$, 95% CI = [–0.14, 0.16]) or the mindfulness meditations ($b = 0.02$, $SE = 0.08$, 95% CI = [–0.15, 0.18]). This was likely because there was no direct effect between arousal and attention ($\hat{\beta} = -.02$, $p = .78$).

Serial indirect effect on comprehension. As in Study 2, attention predicted comprehension ($\hat{\beta} = .23$, $p = .002$), resulting in a full sequential indirect effect from condition to valence to attention to comprehension (mindfulness: $b = 0.05$, $SE = 0.03$, 95% CI = [0.02, 0.14]; relaxation: $b = 0.07$, $SE = 0.03$, 95% CI = [0.02, 0.16]). No such indirect effects were found for the predicted path through arousal. There was, however, an unpredicted direct effect of arousal on comprehension ($\hat{\beta} = -.17$, $p = .04$). We also tested these models with time spent reading instead of attention, which did not show significant indirect effects (see Supplemental Appendix E).

Discussion

Study 3 corroborated and generalized the finding that extraneous affect can be leveraged to increase message reception. Participants who experienced more positive valence before reading the messages reported greater attention and subsequently answered more multiple choice questions correctly. Extraneous affect also had downstream impacts on attention and comprehension regardless of whether it was caused by mindfulness meditation or progressive relaxation. This suggests that the observed effects on message reception are less about the idiosyncrasies of one meditation or another and more about extraneous affect. However, unlike Study 2, the results of Study 3 do not indicate that decreased arousal predicted greater attention. We did find direct effects of arousal on comprehension, but because we did not predict this finding, we sought to replicate the full pattern of results before interpreting this link.

Study 4

Although we found evidence that extraneous affect impacts health message reception, a number of open questions remain. First, because the information was about real health conditions, participants likely had varying degrees of preexisting knowledge, which makes the comprehension measure more challenging to interpret if people could have learned the information from other sources. Although understanding attention to information about familiar health conditions is of practical importance, testing attention to novel health conditions provides stronger evidence of the hypothesized process.

Second, given prior work suggesting that threat drives avoidance, extraneous affect may work by countering message-based affect that would otherwise impede reception. Post hoc analyses of Studies 1 to 3, however, are inconclusive about the role of threat. Counter to our expectations, participants were not threatened by the health messages (see Supplemental Appendix E). In addition, there were no consistent differences between attention to threatening (e.g., HIV) versus nonthreatening (e.g., flu) messages. Furthermore, message-based affect did not moderate results. Although these studies were not designed to test for the role of threat, results hint that the effects of extraneous affect may not depend on threat reduction. Study 4 was thus developed to examine a more general mechanism for the effects of extraneous affect on reception independent of message threat.

For instance, positive extraneous affect may more generally increase receptivity to messages, regardless of threat. The emphasis on defensive processing in prior research would suggest that threat drives avoidance; however, it may be that this overlooks a broader continuum of defensiveness and receptivity (e.g., defensive/not-defensive vs. defensive/receptive). Positive extraneous affect may work not just by reducing avoidance, but also by increasing approach (see Carver, 2003). For this reason, Study 4 formally tested whether extraneous affect impacted attention by making people more receptive to new information.

Study 4 included additional measures and new messages about a fictional health condition, which were either threatening or nonthreatening. In doing so, Study 4 more effectively tested mechanisms of extraneous affect (threat vs. receptivity) while also replicating prior findings with a larger sample.

Pilot Tests

Due to logistical concerns that accompany a larger study, we opted to run Study 4 online. Although this had the added benefit of being a nonstudent sample, it also required pretesting to ensure feasibility of the meditation intervention (Pilot 1). Pretesting suggested that participants were generally engaged, completed the tasks, and experienced the expected change in affect (see Supplemental Appendix E). A pilot test

of the new health messages also indicated that the high- and low-threat messages were differentially and sufficiently threatening (Pilot 2a). Participants reported more fear after reading the high-threat message ($M = 4.28$, $SD = 1.72$, on 7-point scale) versus the low-threat message, $M = 3.56$, $SD = 1.80$; $t(149) = 2.49$, $d = 0.41$, $p = .01$. Both messages were also rated as highly realistic/believable, on a 9-point scale, $M_{High} = 8.00$, $SD_{High} = 1.94$; $M_{Low} = 8.10$, $SD_{Low} = 1.46$, $t(149) = -0.37$, $d = -.06$, $p = .71$.

To strengthen inference about effects on attention, this pilot also included a thought-listing task to measure engagement with the health messages as an additional attention measure (Cacioppo, Glass, & Merluzzi, 1979). For this task, participants listed the thoughts they had as they read the message and rated the relevance of each. To select a primary attention measure for the preregistered analyses, we tested criterion validity using correlations between each attention measure (self-report, the log of time spent reading, and thought relevance) and comprehension of novel health information. Self-reported attention and reading time most strongly predicted comprehension (self-reported: $r = .58$, $p < .001$; reading time: $r = .63$, $p < .001$; thought relevance: $r = .19$, $p = .02$). Reported attention was selected as the primary measure considering these results, the results of Studies 1 to 3, and challenges with interpreting reading time (Earl & Nisson, 2015).

A nearly identical pilot (Pilot 2b) added and pretested additional measures of receptivity/defensiveness to the health messages presented after the threat messages and attention measures. Participants indicated how they felt as they were reading the health messages using the following 9-point semantic differential scales: closed-minded to open-minded, defensive to receptive, and impatient to patient ($\alpha_{Pilot} = .91$).

Method

Preregistration

Key hypotheses, analyses, and measures were preregistered on OSF (https://osf.io/fxdtm/). The study also included exploratory measures that were not considered part of the preregistered analyses. All registered analyses are reported below.

Participants and Procedures

Sample size was selected with a priori power analyses to have 80% power to detect an effect size of $d = .27$, the smallest effect size of interest from an internal meta-analysis. Because Study 4 utilized multigroup structural equation modeling (SEM) to test the path model in both a low- and high-threat condition, the study was powered to detect this effect separately in each group. This resulted in a suggested 217 participants per cell ($N = 868$). We rounded up for a total target N of 900. A total of 901 participants completed this study through MTurk (41.9% male, 57.4% female, 0.01% were transgender, nonbinary, or preferred not to respond; 70.7% White). Because the intervention required audio, participants were only eligible to participate if they could correctly input a six-digit code from an embedded audio file.

Materials and Measures

The audio clips, affect measures, and self-reported attention measure were the same as previous studies. Study 4 also included new materials and measures.

Fictional health messages. To manipulate threat and ensure prior knowledge did not confound comprehension, Study 4 used fictional health messages generated by the research team. These messages described a condition called gastrointestinal veisalgia hypoactivity or GVH. Participants read one of two pretested versions of the GVH message: a high-threat message (GVH as common and severe) or a low-threat message (GVH as rare and mild). The 12-item multiple choice quiz at the end of the study was based on information found exclusively in these health messages (see Supplemental Appendix D).

Thought-listing task. Participants spent up to 2.5 min listing up to 10 thoughts that went through their mind while reading the messages (Cacioppo, Glass, & Merluzzi, 1979). Afterward, each thought was piped onto the screen and participants used 9-point semantic differential scales to rate how negative/positive and irrelevant/relevant each thought was, which was converted to a ratio of relevant to irrelevant thoughts.

Receptivity/defensiveness. Study 4 tested whether extraneous affect impacted attention by increasing receptivity to new ideas and information. This was measured using the same semantic differential items from Pilot 2b (Study 4, $\alpha = .87$).

Results

Checking Affect, Threat, and Attention

Both the meditation intervention and the message threat manipulation worked as expected. Participants in the meditation condition felt more positive ($M = 6.93$, $SD = 1.60$) than those in the control condition, $M = 5.52$, $SD = 1.81$; $t(899) = 12.44$, $p < .001$, $d = 0.83$, $CI_d = [0.69, 0.96]$. Similarly, those in the meditation condition felt less arousal ($M = 2.45$, $SD = 1.84$) than those in the control condition, $M = 3.48$, $SD = 2.09$; $t(899) = -7.87$, $p < .001$, $d = -0.52$, $CI_d = [-0.66, -0.39]$. In terms of total effects, participants in the meditation condition did not report significantly more attention ($M = 8.39$, $SD = 1.00$) than those in the control condition, $M = 8.31$, $SD = 1.06$; $t(899) = 1.16$, $p = .25$, $d = 0.08$, 95% $CI_d = [-0.05, 0.21]$. Similarly, people in the meditation

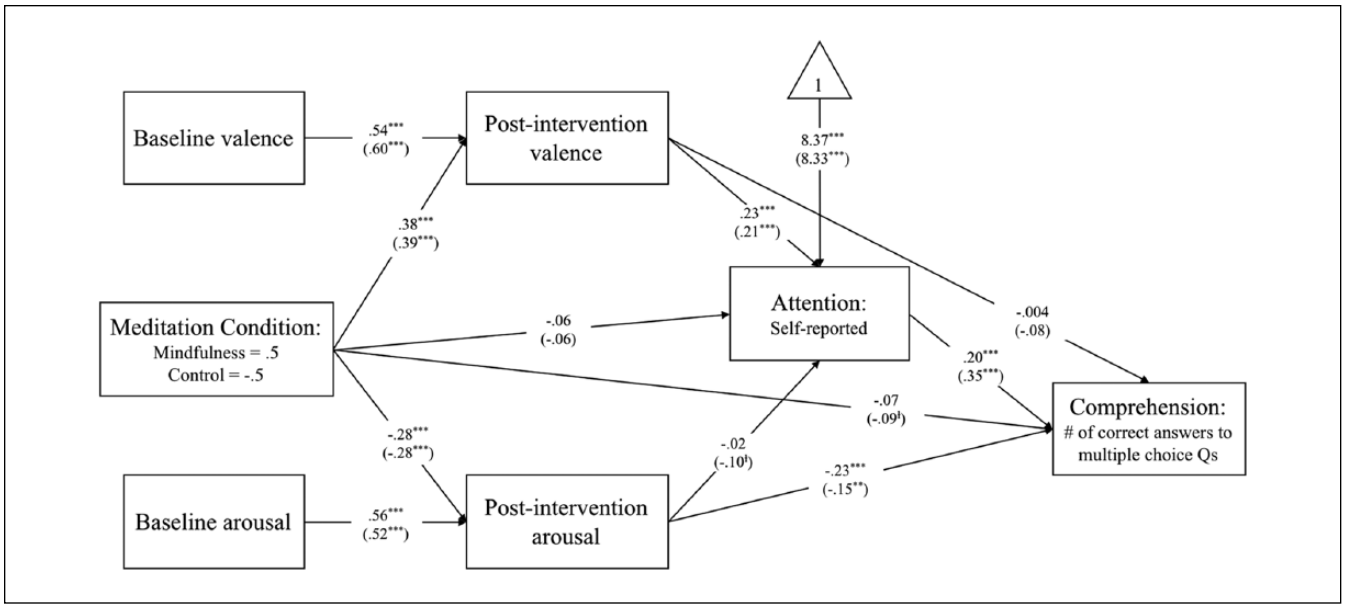

Figure 3. Multigroup SEM for full path model across levels of threat (Study 4).
Note. Coefficients are outside the parentheses for the high-threat group and inside for the low-threat group. Coefficients are standardized with the exception of the intercept for attention, which reflects the means. The correlation between postintervention valence and arousal is not pictured here for presentation purposes. SEM = structural equation modeling.

condition did not spend significantly more time reading, log transformed; $b = 0.04$, $t(899) = 0.89$, $p = .37$, $d = 0.06$, 95% $CI_d = [–0.07, 0.37]$. They did, however, report more relevant thoughts after meditating, $b = 0.22$, $t(888) = 2.00$, $p = .046$, $d = 0.13$, 95% $CI_d = [0.002, 0.26]$.

Consistent with pilot data, participants who read the high- versus low-threat message reported more fear, high-threat: $M = 3.87$, $SD = 1.73$; low-threat: $M = 3.21$, $SD = 1.73$; $t(899) = 5.74$, $p < .001$, $d = 0.38$, 95% $CI_d = [0.25, 0.51]$. However, there were no differences in attention to the high- versus low-threat message, high-threat: $M = 8.40$, $SD = 0.97$; low-threat: $M = 8.31$, $SD = 1.09$; $t(899) = 1.30$, $p = .19$, $d = 0.09$, 95% $CI_d = [–0.04, 0.22]$.

Across conditions, participants correctly answered 78% of the 12 multiple choice questions correctly ($M = 9.33$, $SD = 2.07$). Comprehension was also correlated with reported attention ($r = .27$, $p < .001$), time spent reading (log; $r = .35$, $p < .001$), and thought relevance ($r = .14$, $p < .001$).

Indirect Effects Through Extraneous Affect

The first model tested whether the previous findings replicate with novel health information. Key indirect effects were estimated using bootstrapped standard errors with 5,000 bootstrapped samples. Overall, this model fit the data well, $\chi^2(6) = 15.94$, $p = .01$; CFI = 0.991; RMSEA = 0.043; SRMR = 0.022.

The key hypotheses were the indirect effects of meditation on attention and comprehension through (a) postintervention valence or (b) postintervention arousal. As predicted, there was a significant indirect effect of meditation on comprehension through valence and reported attention ($b = 0.09$, $SE = 0.02$, 95% CI = [0.05, 0.15]). In particular, meditation led to significantly more positive valence ($\hat{\beta} = .38$, $p < .001$), which predicted greater reported attention, ($\hat{\beta} = .22$, $p < .001$), which then predicted greater comprehension ($\hat{\beta} = .26$, $p < .001$). However, contrary to our predictions, the indirect effect through arousal did not reach significance ($b = 0.02$, $SE = 0.01$, 95% CI = [–0.001, 0.04]). Meditation decreased arousal ($\hat{\beta} = –.28$, $p < .001$), but postintervention arousal did not significantly predict reported attention, ($\hat{\beta} = –.06$, $p = .076$). Interestingly and consistent with Study 3, there was a significant effect of postintervention arousal on comprehension, which was not explained by attention ($\hat{\beta} = –.19$, $p < .001$). This translated to a significant indirect effect from meditation to postintervention arousal to comprehension ($b = 0.21$, $SE = 0.05$, 95% CI = [0.13, 0.32]).

Role of Threat in Extraneous Affect-Message Reception Process

We next conducted a multigroup SEM to test whether the effects of extraneous affect depended on or generalized across levels of message threat. The model was estimated separately for the high- and low-threat groups; we could then compare models that freely estimate or constrain specific paths to be equal; if key paths are different across groups, a test of the difference between the free and constrained model should be significant.[6] In general, effects were nearly identical across threat conditions (see Figure 3). To formally test

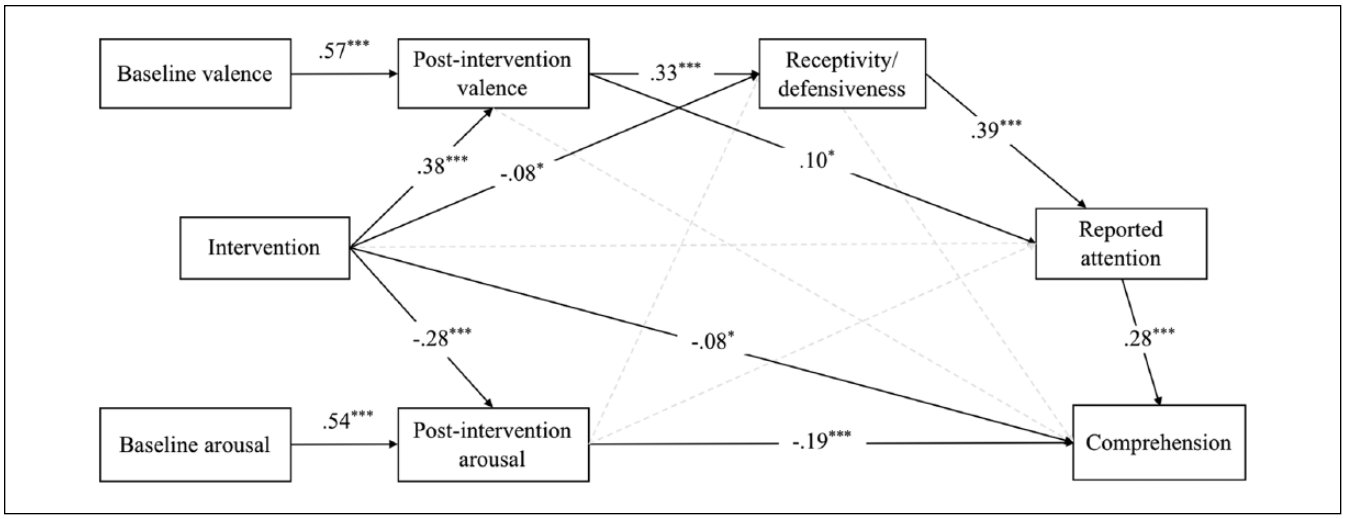

Figure 4. Complete path model with receptivity/defensiveness (Study 4).
Note. Coefficients are standardized. Gray dashed lines are nonsignificant paths. The correlation between postintervention valence and arousal are not pictured here for presentation purposes.

whether the processes differed across groups, we first tested the χ^2 difference between a model in which the effects of valence and arousal on attention are assumed to be identical across groups and one in which they were not. These models were not significantly different, $\chi^2_{\text{difference}}(2) = 1.51, p = .47$, suggesting that the effects of extraneous affect on attention are equivalent across message threat groups.

Testing Mediation Through Receptivity/ Defensiveness

We ran an additional preregistered model to test whether the link between extraneous affect and attention (and subsequently comprehension) could instead be explained by how generally receptive/defensive people were as they read the messages. As with the previous model, all direct effects were modeled to appropriately estimate the indirect effects, $\chi^2(8) = 35.74, p < .001$; CFI = 0.980; RMSEA = 0.062; SRMR = 0.028; see Figure 4. Results showed that people who felt more positive before reading the messages were more receptive to new information ($\hat{\beta} = .33, p < .001$), which was a strong predictor of attention ($\hat{\beta} = .39, p < .001$). This resulted in the full, predicted indirect effect from meditation to comprehension through valence, receptivity, and attention ($b = 0.06$, $SE = 0.01$, 95% CI = [0.03, 0.09]). However, this was again untrue for arousal, which did not predict receptivity ($\hat{\beta} = -.03, p = .35$). There was thus little evidence of a comparable indirect effect through arousal, attention, and receptivity ($b = 0.004$, $SE = 0.004$, 95% CI = [–0.004, 0.013]). However, the indirect effect from meditation to postintervention arousal to comprehension remained significant in this model ($b = 0.22$, $SE = 0.05$, 95% CI = [0.12, 0.32]).

Additional Analyses

Finally, we replicated the above models with time spent reading and thought relevance to ensure results were not specific to self-reported attention (for full analyses, see Supplemental Appendix E). All key findings were identical with one exception. When using time spent reading as an attention measure, the indirect effect of meditation on comprehension through arousal and attention became significant ($b = 0.03$, $SE = 0.02$, 95% CI = [0.01, 0.07]). However, the direct link between arousal and comprehension remained ($\hat{\beta} = -.18, p < .001$).

Discussion

Study 4 provides converging evidence that extraneous affect plays a role in message reception. Participants paid more attention to novel health messages if they experienced more positively valenced extraneous affect beforehand. Again, reported attention, time spent reading, and thought relevance all subsequently predicted greater comprehension of the information. Because the health information was created for this study, reading the messages was the only way to get the correct answers to the multiple choice questions. The results of Study 4 are thus unlikely to be an artifact of prior knowledge and any confound that may come with it. Together, these results provide more comprehensive evidence that extraneous affect can be leveraged to promote health message reception.

Importantly, this pattern was nearly identical across levels of message threat. As such, extraneous affect does not seem to work by simply removing threat (e.g., through the absence of defensiveness). Instead, evidence from Study 4 suggests that positive extraneous affect works

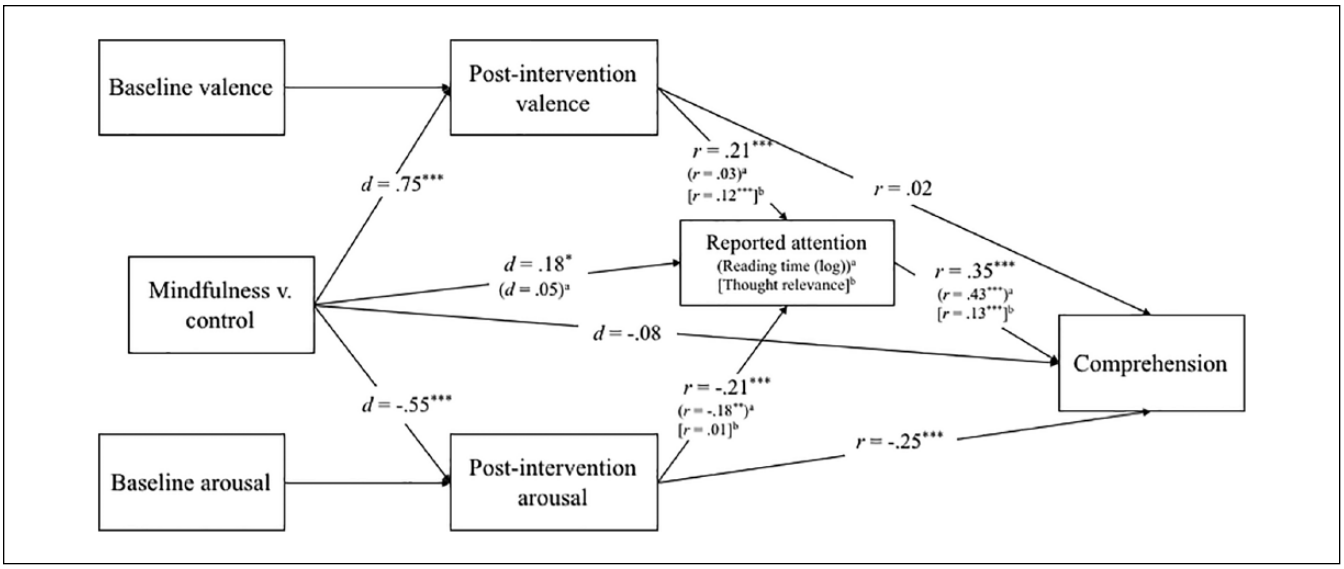

Figure 5. Internal meta-analysis of total effects.
Note. Effects sizes are meta-analytic total effects. Paths to and from attention also include three estimates corresponding to the attention measure: For effects to and from attention, we included estimates for self-reported attention, reading time (log), and thought relevance. We only included estimates for which there were at least two studies of data, which is why the total effect of meditation on thought relevance is not pictured here. See Supplemental Appendix F for more information on the internal meta-analysis.
[a]Reading time.
[b]Thought relevance.

along a broader continuum of defensiveness to receptivity. Positive extraneous affect increased receptivity to new information, which incrementally boosted attention even to messages people would already be comfortable reading. Put simply, positive extraneous affect increases receptivity to information more broadly.

Of note, Study 4 found that postintervention/premessage arousal also affected message reception, but not through predicted paths. People who felt less arousal before reading the health messages recognized more factual information, reproducing the pattern observed in Study 3 and Pilots 2a and 2b. Furthermore, neither the amount of attention participants reported, the amount of time they spent reading, nor the relevance of listed thoughts accounted for the relationship between premessage arousal and comprehension.

General Discussion

The present studies provide consistent evidence that extraneous affect can be leveraged to promote receptivity to health messages. People who felt more positive before being given health messages ultimately reported greater attention and comprehension. This pattern generalized across extraneous affect manipulations (mindfulness meditation and progressive relaxation), contexts (public and private), types of health information (physical and mental health; familiar and novel), and samples (college student and MTurk). This adds to a body of work demonstrating the variety of ways that affect motivates engagement and avoidance (Jonas et al., 2006; Sweeny et al., 2010). Specifically, past research suggests that negative affect increases dissonance-related motivations to selectively avoid information, whereas positive affect decreases it (Jonas et al., 2006). The present studies provide converging evidence that intervening on extraneous affect can indirectly impact receptivity beyond message exposure.

Across studies, we find strong evidence that meditation is effective at inducing low arousal, positively valenced affect prior to message exposure, both of which consistently facilitated reception. The path model tested in Study 4 provides reliable evidence for these sequential processes and of the independent influence of valence and arousal. This model represents the most direct test of the theoretical relationships, but we can also examine the general pattern across studies independent of the specific indirect and direct effects we specified. To summarize this evidence, we conducted an internal meta-analysis of the total effects across all studies. Specifically, we estimated the weighted mean effect size for the effects of mindfulness versus control (estimated as Cohen's *d*) and for the relationships between continuous variables (as *r*). Including only mindfulness versus control and not relaxation versus control not only kept the effects more comparable, but also created more conservative estimates given that effects were somewhat larger for relaxation. Estimates included data from all four studies and any of the three pilot studies where a given effect could be estimated (total $N = 1{,}811$; see Figure 5).[7] Effect sizes here are interpreted with empirical benchmarks for typical social psychology effect sizes, which suggests that small, medium, and large effects correspond, respectively, to *d*s of 0.15, 0.40, and 0.70 or correlations of .10, .25, or .40 (Lovakov & Agadullina, 2017).

Considering evidence across all studies, we found medium to large effects of mindfulness meditation (vs. control) on postintervention valence ($d = 0.75$, 95% CI: = [0.38, 1.12]) and arousal ($d = -0.55$, 95% CI: = [–0.74, –0.36]). There were also reliable small to medium relationships between postintervention valence and attention ($r = .21$, 95% CI: = [.16, .25]) and postintervention arousal and attention, ($r = -.21$, 95% CI: = [–.31, –.10]). Reported attention was also predictive of comprehension ($r = .35$, 95% CI: = [.23, .48]). In sum, these data show reliable and informative links between (a) extraneous affect and reported attention and (b) reported attention and comprehension. There was also a small total effect of the mindfulness meditation on attention ($d = 0.18$, 95% CI = [0.001, 0.35]), but no significant total effects on time spent reading ($d = 0.05$, 95% CI = [–0.05, 0.15]) or comprehension ($d = -0.08$, 95% CI = [–0.18, 0.02]). These studies thus provide strong evidence for the key hypotheses concerning extraneous affect as well as additional, albeit weaker evidence of total effects of the intervention on attention.

Theoretical Implications

Together, these findings help to broaden our understanding of the relationship between affect and persuasion. Much of the research in this area has focused on the impact of positive and negative affect elicited by a message. Message-based affect is known to influence the likelihood that people will defensively process a message (Liberman & Chaiken, 1992; Reed & Aspinwall, 1998) as well as the likelihood that they will engage with it at all (Earl et al., 2015). Other work has focused on the effect of extraneous affect on message evaluations. If people are not aware of the true source of their affect, they tend to attribute extraneous affect to an attitude object (Schwarz & Clore, 1983). In this way, the effects of extraneous affect on message yielding are more consistent with a misattribution account, where people attribute their preexisting affect to the message (Albarracín & Kumkale, 2003; Schwarz & Clore, 1983).

How extraneous affect impacts message reception, however, is somewhat different. Participants in our studies were asked about their affect immediately after completing the guided meditations. This is unlike the effect of extraneous affect on message yielding, which dissipates if people are given the opportunity to reflect on their affective states prior to receiving a message (Albarracín & Kumkale, 2003). Because affect continued to exert influence on attention even when participants reported their affect, it is likely that affect impacts message reception (exposure, attention, and comprehension) and yielding (acceptance, retention, and enactment) through different processes.

Also theoretically meaningful was the observation that the valence and arousal of extraneous affect impacted different parts of the message reception process. Extraneous valence indirectly impacted comprehension through receptivity to new information and attention. The direct impact of extraneous arousal on comprehension, however, could not be explained by receptivity or attention. The process through which premessage arousal impacts message reception is thus distinct from the process through valence. One explanation is that valence operates through the parts of the message reception process that depend on explicit regulation of attention, which is frequently motivated (Lang, 2000). The hypotheses we generated were based on prior work suggesting that affect motivates attention, but much of this has emphasized valence (Monahan, 1995). It is possible that arousal operates independently by impacting the ability to engage with messages more so than the motivation to do so. This is consistent with prior research on message-based arousal showing that people encode less information about arousing messages, leading to decreased comprehension (Lang, 2000).

Together, these findings suggest that valence facilitates the controlled, motivated stages of the reception process (selective attention) and arousal constrains capacity to comprehend persuasive messages (e.g., the amount of information encoded; see Lang, 2000). Of course, evocative stimuli influence valence and arousal simultaneously, making it difficult to understand the impact of affect on message reception without considering both dimensions. This may help to explain discrepancies in the prior literature. For instance, our finding that arousal directly reduces comprehension is consistent with cognitive capacity models of extraneous affect and persuasion (Lang, 2000; Mackie & Worth, 1989). Simultaneously, our findings that valence is related to more motivated and controlled parts of the reception process (e.g., receptivity, attention, and time-spent reading) is consistent with motivational accounts of extraneous affect, whereby extraneous affect changes the type of information people are willing to process (Jonas et al., 2006; Wegner et al., 1995).

Given that past research often uses happiness or amusement, which are both positive and highly arousing, we would predict mixed results—particularly if persuasion is inconsistently operationalized (e.g., if attention, comprehension, and message evaluations are treated interchangeably). The present results complement other work differentiating the effects of negative emotions like sadness and anger on information processing or identifying similarities between high-arousal emotions like anger and happiness (Bodenhausen, Sheppard, & Kramer, 1994; Clore, Schiller, & Shaked, 2018). Decoupling valence and arousal (see Monahan, 1995) and identifying persuasion processes more precisely (McGuire, 1968) may provide promising new directions for future research.

Evidence from the current studies supports prior work on the roles of both valence (Carver, 2003) and arousal (Lang, 2000) on motivation and ability for message reception. However, other theoretical accounts may also be at play. For instance, positive valence could promote

curiosity (e.g., Silvia, 2008), which could also influence receptivity to messages. Other work suggests that cognitive appraisals linked to emotional states may explain effects of extraneous affect for which valence alone cannot account (e.g., perceived control; Lerner, Li, Valdesolo, & Kassam, 2015). The specific message processing strategy people use to process a message (e.g., motivated reasoning, heuristic processing) is also known to modulate the link between extraneous affect and persuasion (Forgas, 1995). Our findings are not mutually exclusive with these accounts, but future research may explore conditions under which each model explains the complicated relationship between affect and persuasion.

Practical Implications

The present studies point to possible interventions to promote attention. Although the total effects on attention were small, a guided meditation intervention with prerecorded audio clips would be low-cost and easy to implement. Given that the total effect was strongest in Study 1, where participants were given reminders to use the meditation exercises as needed while reading the information and also completed the extraneous affect manipulation alone, practical interventions may benefit from instructions that guide participants more and are delivered in a private versus public context (see also, Earl & Lewis, 2019). In addition, the present findings would suggest that interventions may be strengthened by making them more enjoyable. Study 3 provided a suggestion of this, given that participants were most positive after the relaxation, which ultimately translated to increased attention. Of course, applications for practical interventions would need to be tested in future work. Finally, it is worth noting the lack of a total effect on comprehension, which is an important limitation. Our results do show that extraneous affect manipulation may impact the more motivated and controlled message reception processes (attention). However, future work would be needed to develop such interventions to more effectively target independently important parts of the message reception process. In any case, the present studies contribute to a deeper theoretical understanding of affect and message reception that can inform future research and interventions.

Acknowledgments

We would like to thank Julia Briskin, Lauren Olswanger, Harrison Bell, and Raivynn Smith for their help in conducting these studies. We would also like to thank the members of the Health, Attitudes, and Influence Lab at the University of Michigan, Denise Sekaquaptewa, Nicholas Michalak, and Daniel Weissman for their feedback on the manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This material is based upon work supported by the National Science Foundation Graduate Research Fellowship under Grant 1256260 DGE to Koji J. Takahashi and funds from the Department of Psychology at the University of Michigan awarded to Allison Earl.

Notes

1. See Supplemental Appendix A for the transcript of both the meditation and the neutral control condition.
2. The degree of problems with the distribution of time spent reading varied across studies. To keep analyses consistent across studies, we report log reading time in all studies. Results were generally consistent with some larger effects for raw scores. For completeness, we have presented both versions of the analysis for all studies in Supplemental Appendix E for interested readers.
3. Although they are not central to our research questions, we also measured message-based affect and message evaluation. A list of all measures for all studies can be found in Supplemental Appendix B.
4. This pattern was consistent across studies. More information about change in affect across time across all studies can be found in Supplemental Appendix C.
5. Initially Study 3 included a 2-week follow-up to assess support seeking. Because attrition was high overall, with even more missing data for questions about mental health (up to 47% missing), these data were not included.
6. This multigroup structural equation modeling (SEM) is conceptually equivalent to a moderated mediation but was selected because it allows us to test moderation of specific paths in a more parsimonious way. This decision was preregistered, but exploratory analyses with conventional moderation tests lead to the same conclusion.
7. See Supplemental Appendix G for more information on the meta-analyses.

Supplemental Material

Supplemental material is available online with this article.

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