Emotional Arousal May Increase Susceptibility to Fraud in Older and Younger Adults

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Abstract

Financial fraud is a societal problem for adults of all ages, but financial losses are especially damaging to older adults who typically live on fixed incomes and have less time to recoup losses. Persuasion tactics used by fraud perpetrators often elicit high levels of emotional arousal; thus, studying emotional arousal may help to identify the conditions under which individuals are particularly susceptible to fraud. We examined whether inducing high-arousal positive (HAP) and high-arousal negative (HAN) emotions increased susceptibility to fraud. Older (ages 65 to 85) and younger (ages 30 to 40) adults were randomly assigned to one of three emotional arousal conditions in a laboratory task: HAP, HAN, or low arousal (LA). Fraud susceptibility was assessed through participants' responses to misleading advertisements. Both HAP and HAN emotions were successfully induced in older and younger participants. For participants who exhibited the intended induced emotional arousal, both the HAP and HAN conditions, relative to the LA condition, significantly increased participants' reported intention to purchase falsely advertised items. These effects did not differ significantly between older and younger adults, and were mitigated in participants who did not exhibit the intended emotional arousal. However, irrespective of the emotional arousal condition to which older adults were assigned (HAP, HAN, or LA), they reported greater purchase intention than did younger adults. These results inform the literature on fraud susceptibility and aging. Educating consumers to postpone financial decisions until they are in calm emotional states may protect against this common persuasion tactic.

Keywords: aging; financial fraud; emotion; arousal; persuasion

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Financial fraud, which costs Americans an estimated $50 billion per year (Deevy, Lucich, & Beals, 2012), refers to intentionally deceiving a person with the promise of goods, services, or other benefits that are nonexistent, unnecessary, or grossly misrepresented for the purpose of monetary gain (Beals, DeLiema, & Deevy, 2015). According to the Federal Trade Commission (FTC), 10.8% of Americans were victims of financial fraud in 2011 (Anderson, 2013). On average, individual consumers paid between $100 and $300 for bogus offers. While financial fraud is a societal problem for adults of all ages, financial losses are especially damaging to older adults who typically live on fixed incomes and have less time to recoup losses. Several studies suggest that factors associated with vulnerability to fraud may change as people age. For example, older adults appeared to be less sensitive to detecting untrustworthy facial characteristics (Castle et al., 2012) and less proficient at detecting lying (Ruffman, Murray, Halberstadt, & Vater, 2012; Stanley & Blanchard-Fields, 2008). They were also less likely than were younger adults to recall information in advertisements, but more prone to be persuaded by that information (Phillips & Stanton, 2004).

Emotional Arousal as a Fraud Tactic

One key way to explore factors that heighten vulnerability to scams is to investigate whether older and younger adults differ in their susceptibility to persuasion tactics used by fraudsters. One of the most common influence techniques relies on eliciting emotional arousal. Emotion is a subjective feeling state that can be represented along dimensions of valence (displeasure to pleasure) and arousal (deactivation to activation). Neural and physiological activity along these dimensions combine in various ways to shape different subjective states. Thus, states involving high levels of arousal can occur in either the positive domain (high-arousal positive [HAP] emotion; e.g., excitement, exhilaration) or negative domain (high-arousal negative [HAN] emotion; e.g., anger, fear) (Russell, 1980).

In the persuasion and decision-making literature, states of high emotional arousal, both positive and negative, commonly fall under the umbrella term of visceral factors. Con artists frequently invoke emotional arousal to persuade their targets to comply (Loewenstein, 1996). Appeals to visceral factors are theorized to be effective because they may promote heuristic or biased information processing rather than the effortful, higher-order cognitive processing needed for complex decision-making tasks (Ariely, Gneezy, Loewenstein & Mazar, 2009; Loewenstein, 2000). For example, high emotional arousal is posited to focus attention on reward cues associated with a scam, and to decrease attention to indicators of deception that

may mitigate the likelihood of responding (Langenderfer & Shimp, 2001). Because much of this literature is theoretical, experimental studies are needed to test the effects of HAP and HAN emotions on fraud susceptibility. In support of this position, Wang and colleagues (2012) found that attention to visceral factors reduced the cognitive effort expended in processing a phishing email, decreased attention to deception indicators in the email, and increased the likelihood of responding. Of course, we should note that different discrete emotions may uniquely affect information processing and decision-making. For example, Lerner and colleagues (2003) found that whereas anger inductions were associated with more optimistic risk estimates and risk-seeking choices in participants' appraisals of unrelated situations, fear had the opposite effects.

Both HAP and HAN emotional appeals are found in fraudulent communications. In an analysis of more than 100 Nigerian scam letters, researchers found consistent appeals to greed, guilt, lust, and charity (Cukier, Nesselroth, & Cody, 2007). DeLiema, Yon, and Wilber (2016) found that sales agents were specifically trained to put targets into an 'emotional ether' when persuading them to buy bogus annuity products. In another study, researchers analyzed undercover audiotapes of phone calls in which fraudsters induced a sense of urgency by claiming the product was in short supply and induced excitement by dangling the prospect of wealth before the target (NASD Investor Education Foundation, 2006).

Older Adults' Processing of Emotionally-Arousing Information

Aging is associated with changes in motivation and emotional experience. According to socioemotional selectivity theory (Carstensen, Isaacowitz, & Charles, 1999), as time horizons narrow with advancing age, individuals prioritize present-focused goals associated with optimizing emotional and socially meaningful experiences over future-oriented goals associated with developing new skills or learning new information (Carstensen, 2006). In line with this theory, older people tend to prefer and remember advertisements that contain emotionally meaningful information to those that emphasize exploration (Fung & Carstensen, 2003; Williams & Drolet, 2005). It is important to note, however, that not all emotionally-valenced information is attended to equally. Compared to younger adults, older adults tend to pay less attention to negative than to positive information (i.e., the positivity effect; e.g., Charles, Mather, & Carstensen, 2003; Reed & Carstensen, 2012). This preference for positive over negative information also has been observed in neuroimaging studies, along with its neural correlates. For older adults, viewing positive relative to negative pictures led to greater activation in the amygdala, a brain region associated with the emotional salience of stimuli. This difference in activation between positive and negative pictures was not found in younger adults (Mather et al., 2003). The positivity effect also has been documented in memory. For example, compared

to younger adults, older adults prefer and demonstrate better memory for positively-framed health care brochures than for negatively-framed brochures (Shamaskin, Mikels, & Reed, 2010) and, further, are more motivated to follow positively-framed than negatively-framed health recommendations (Notthoff & Carstensen, 2015; Notthoff, Klomp, Doerwald, & Scheibe, 2016). Older adults also tend to pay more attention to positive than to negative attributes when making decisions (Löckenhoff & Carstensen, 2007), and to take more risks when in positive mood states than in neutral or negative mood states (Chou et al., 2007). Thus, scams that use positive emotional appeals (e.g., winning a prize) may be especially likely to be elicit older peoples' compliance.

Additional research suggests that high levels of emotional arousal, positive or negative, may present distinct challenges for older adults. The strength and vulnerability integration (SAVI) model (Charles, 2010) postulates that reduced physiological flexibility associated with aging impairs homeostasis, making the regulation of high arousal emotions less efficient. Grühn and Scheibe (2008) and Keil and Freund (2009) found that older people perceived both positive and negative high-arousal stimuli (i.e., HAP and HAN) as less pleasant and more aversive than did younger adults. Streubel and Kunzmann (2011) reported that, while older adults reported less unpleasantness than did younger adults in response to low-arousal negative stimuli, the positivity effect diminished in response to high-arousal negative stimuli. A neuroimaging study by Dolcos, Katsumi, and Dixon (2014) showed increased activity in the anterior cingulate cortex and decreased activity in the amygdala in older versus younger adults in response to low-, but not high-, arousal negative images, suggesting that older adults selectively dampen responses to low-arousal negative stimuli. Last, in a marketing study, van der Groot, van Reijmersdal, and Kleemans (2015) demonstrated that older adults preferred calm television advertisements with few camera changes, slower speech, and relaxing or no music over arousing advertisements, and also had better memory for the products featured in the calm advertisements. Thus, making informed decisions while bombarded with high-arousal appeals from fraudsters, regardless of their valence, may be particularly unsettling for older adults.

A recently formulated theory, the Glutamate Amplifies Noradrenergic Effects (GANE) model (Mather, Clewett, Sakaki, & Harley, 2016), suggests that the effects of arousal on information processing depend on the priority of that information in a given context (e.g., the salience or goal relevance of the information). Specifically, arousal may enhance processing of information that is salient or goal relevant. In the context of the findings reviewed above for socioemotional selectivity theory and the positivity effect, the GANE model would suggest that arousal may enhance the salience of the advertisements differentially for younger and older

adults. In older adults, the positive aspects of the products (e.g., product attractiveness) may become relatively more salient under arousal, particularly under positive emotional arousal. In contrast, both positive aspects of the products and doubts about the claims of the advertisements may be enhanced in younger adults under arousal, leading to a weaker effect of arousal on susceptibility to the advertisements.

Finally, aging is associated with reductions in memory proficiency, processing speed, and inhibitory control, presumably reflecting neural degradation (however, see Blanco et al., 2016). HAP and HAN emotions may consume older adults' more limited attentional resources and interfere with differentiating legitimate offers from scams (Langenderfer & Shrimp, 2001). Mild cognitive impairment is also associated with poorer financial decision-making (e.g., Han et al., 2015) and increased susceptibility to potential scam offers (James, Boyle, & Bennett, 2014). Asp and colleagues (2012) found that participants with damage to the ventromedial prefrontal cortex (vmPFC), a brain region associated with appraising the veracity of information that is sometimes affected by aging, found misleading advertisements to be more credible than did an age-matched unimpaired control group. However, there is also evidence that vmPFC function remains intact in healthy aging, including in the context of emotion regulation (Samanez-Larkin & Carstensen, 2011).

The Present Study

In sum, elicitation of emotional arousal is a common fraud tactic used on targets of all ages. Nevertheless, changes in cognitive and emotional functioning with advancing age may converge to increase susceptibility to fraud in the context of emotional arousal. In the present study, we recruited samples of older and younger adults, induced HAP and HAN emotions, and then assessed responses to products featured in fraudulent advertisements. Participants were older (ages 65 to 85) and younger (ages 30 to 40) adults who were randomly assigned to one of three emotional arousal induction conditions in a laboratory task: HAP, HAN, or low arousal (LA). We examined fraud susceptibility through participants' assessments of the credibility of the advertisements and intention to purchase the advertised items.

By integrating socioemotional selectivity theory (Carstensen, Isaacowitz, & Charles, 1999) and findings of the age-related positivity effect with the GANE model (Mather et al., 2016) reviewed above, we hypothesized that older adults in the HAP condition would exhibit the greatest fraud susceptibility. We further hypothesized that, consistent with the SAVI model (Charles, 2010), older adults in both the HAP and HAN conditions would show greater fraud susceptibility than would older adults in the LA condition. For younger adults, we hypothesized that the high-arousal inductions would also increase fraud susceptibility, but these effects would

be smaller than those for older adults (i.e., a significant interaction between emotional arousal and age group). Finally, we conducted exploratory analyses examining associations between the two indices of fraud susceptibility, credulity to misleading advertisements and intention to purchase the advertised items.

Method

Participants

One hundred and sixteen older adults ages 65 to 85 years (*M*=73.30, *SD*=5.20; 61.2% female), and 115 younger adults ages 30 to 40 years (*M*=34.52, *SD*=3.16, 64.3% female) completed the study. Four older adults and five younger adults were recruited but did not provide usable data, due to technical problems (*n*=2), self-reported illness or fatigue (*n*=3), or being ineligible as determined at the study session (e.g., age outside range; *n*=4). Sample size was based on a power analysis (G*Power; Faul, Erdfelder, Lang, & Buchner, 2007) with a predicted medium effect size for emotional arousal condition (*f*=.25), α=.05 (two-tailed), power=.80, and estimation that approximately two-thirds of participants would adequately respond to the emotional arousal conditions (see below). Participants were recruited by a survey research firm and through advertisements in the community, and were screened for inclusion and exclusion criteria through a telephone interview. The telephone version of the Mini Mental State Examination was used to screen for potential cognitive impairment (Newkirk et al., 2004); only individuals scoring at least 23 out of 26 possible points participated in the study. Other exclusion criteria were: not fluent in English; history of learning disabilities, severe head trauma, psychotic symptoms, bipolar disorder; *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994)-defined alcohol or substance abuse in the past six months; and electrocardiogram confounds (e.g., diagnosis of cardiovascular disorder, cardiac pacemaker). Participants were compensated $25 per hour for their time.

Experimental Paradigm

Emotional Arousal Inductions

To induce different types of emotional arousal, we designed and administered modified versions of the computerized Monetary Incentive Delay (MID) task (Knutson, Westdorp, Kaiser, & Hommer, 2000) (see **Figure 1**). In the standard MID task, on each trial participants first view a monetary cue (e.g., +$0.50) that signals the possibility of winning or losing that amount of money on that trial. After each cue, a target (e.g., star) appears briefly on the screen; participants must respond with a key press as quickly as possible while the target is being presented in order to win or avoid losing the amount of money indicated by the initial cue. After

each cue-target presentation, participants receive feedback on the outcome (e.g., "Hit!" if they responded quickly enough, "Miss!" if they responded too slowly). In a typical MID task, the duration of the target is manipulated according to the performance of participants such that some criterion accuracy level (usually 66%) is maintained for each trial type. For example, as participants get faster for high reward trials, the target display duration decreases.

In the present study, the MID task was designed to be administered in eight blocks. While some commonly-used emotional arousal inductions involve brief interpersonal stimuli or interactions (e.g., Lobbestael, Arntz, & Wiers, 2008), we used the MID task as a highly standardized paradigm that could be separated into blocks in an attempt to sustain emotional arousal. This design permitted repeated assessments of fraud susceptibility after each block. Three different versions of the task were administered in order to induce different types of emotional arousal: HAP, HAN, and LA. Participants within each age group were randomly assigned to the experimental conditions. We made two modifications to the standard MID task: manipulation of initial wins/losses and the addition of sounds at feedback to increase the affective impact of the outcome. In the HAP condition, each block included a portion of trials that were rigged such that participants initially lost a relatively large amount of money (e.g., $5.00), and then gradually won money (e.g., $0.50 per trial) over the remaining course of the block. In addition, on trials in which participants won money, a positively-valenced sound (e.g., clapping, cash register) accompanied the feedback component of the trial. In contrast, in the HAN condition, each block included a portion of trials that were rigged such that participants initially won a relatively large amount of money (e.g., $5.00), and then gradually lost money (e.g., $0.50 per trial) over the remaining course of the block. On trials in which participants lost money, a negatively-valenced sound (e.g., booing, buzzer) accompanied the feedback component of the trial. Last, in the LA condition, each block included a portion of trials that were rigged such that only small amounts of money, if any, were won or lost over the course of each block (e.g., $0.00 or $0.50 per trial), and no sounds were presented during the feedback component of the trial. For all three conditions, feedback indicated "Hit!" or "Miss!" and the monetary gain/loss on that trial, but did not indicate the cumulative task earnings.

Cues were presented for 2000 ms across all trials and followed by a pre-target delay of variable duration (2000-2500 ms). On non-rigged trials, the target (star) was presented for a variable duration, which was updated during the course of the task to approximate a 66% probability of success based on each participant's previous reaction times to the target (see Knutson et al., 2000). On rigged "Hit!" trials, the target remained on the screen until participants responded. On rigged "Miss!" trials, the target was presented for 100 ms making it extremely

unlikely that a participant could respond. After a post-target delay of variable duration (4000 ms minus the pre-target delay duration), feedback was presented for 2000 ms. The inter-trial interval was 2000 ms, during which a fixation cross was presented. Each block included 18 task trials, for a total of 144 trials across the eight blocks. The exact number of trials of each type (potential win, potential loss, neutral, and the potential monetary amount) varied across blocks within conditions, in order for the blocks to not be fully repetitive with one another and to maintain deception.

To assess state emotional arousal as a function of the experimental manipulation, at the end of each block participants rated their current affective states along two Likert scales: valence (1=*very negative*, 7=*very positive*) and arousal (1=*not at all aroused*, 7=*very aroused*).

Responses to Misleading Advertisements

In all three conditions, after each block of the MID task, participants viewed one of eight different advertisements that had been previously designated by the FTC as misleading (FTC, 1991; FTC Bureau of Consumer Protection, 1998). These advertisements were chosen because they had been used in prior research on fraud susceptibility (Asp et al., 2012). Content in the eight advertisements included: automotive, food, and bedding products, luggage, charity, a sound amplifier, diet pill, and doll. For example, one advertisement inaccurately claimed that an automotive product would improve fuel economy by a substantial amount. After viewing the advertisement for 30 seconds, the image was removed and participants were asked to rate the advertisement on two separate Likert scales: (a) the degree to which they believed a specific aspect of the advertised content (i.e., advertisement credibility) (e.g., What do you believe to be true about this product?; e.g., 1=*use of this product will improve memory*, 7=*use of this product will NOT improve memory*); and (b) the likelihood that they would purchase the advertised item if it were available in the area and cost were not a consideration (i.e., purchase intention; 1=*unlikely*, 7=*likely*) (Asp et al., 2012). Participants were given 15 seconds to respond to each question. We used these two scales to examine different facets of fraud susceptibility. Within each emotional arousal condition, participants were randomly assigned to view the advertisements and rating scales in one of 16 different counterbalanced orders. Completion of the full experimental paradigm took approximately 35 minutes.

Covariates

To assess key aspects of cognitive functioning, all participants completed subtests of the Wechsler Adult Intelligence Scale (WAIS-III; Wechsler, 1997) measuring short-term memory (Digit Span) and perceptual speed (Digit Symbol), and the Shipley vocabulary self-administered test measuring verbal knowledge (Shipley, 1940). To assess general risk propensity in the

financial domain, participants completed the Domain-Specific Risk Attitude Scale (DOSPERT; Weber, Blais, & Betz, 2002) investment subscale, in which they reported their likelihood of engaging in various activities (e.g., investing in a speculative stock). Participants' demographic information (e.g., gender, race, ethnicity, education level) was also obtained.

Procedure

The study protocol was approved by the Stanford University Institutional Review Board. For reasons related to funding, the older adult sample completed the study first; within age group, however, all participants were randomly assigned to condition. Following the telephone screen, participants provided written informed consent and completed the study in the laboratory. The experimenter administered Digit Span and Digit Symbol, and participants completed questionnaires on the computer including the Shipley vocabulary test, DOSPERT, and demographic information. During the study, participants wore physiological sensors, but these data were not analyzed for this manuscript.

Participants completed a brief, baseline computerized task in which their mean reaction time (RT) to a target (star) over a series of trials was recorded. This standard procedure served to calibrate the duration of target presentation during the non-rigged trials of the MID task (see Knutson et al., 2000). Participants then completed an instructional block of the MID task, which was the same across all three experimental conditions and served as an assessment of baseline emotional arousal. The experimenter instructed participants on the MID task and emotional arousal rating scales. Participants were told that the monetary outcome of the task would be included in their compensation. For the rating scales, valence was described as a continuum from very negative to very positive, and arousal was described as a continuum from not at all aroused (e.g., relaxed, calm, dull) to very aroused (e.g., stimulated, frenzied, jittery). The experimenter then instructed participants on the advertisement viewing and rating task, and participants practiced viewing and rating a non-study advertisement. They then completed the experimental paradigm. In addition to participants' responses, RTs were recorded continuously during the MID task and advertisement ratings for use as covariates in the event of group differences. Following completion of the paradigm, participants were debriefed about the study, including deception with respect to the rigged trials. Task winnings were added to participants' compensation, but monetary losses were not deducted. The experimenter responded to any questions or concerns.

Data Preparation

Responsivity to Emotional Arousal Inductions

This study focused on the combined effects of valence and arousal, given that we aimed to induce positively-valenced arousal (PA) in the HAP condition and negatively-valenced arousal (NA) in the HAN condition. PA and NA can be represented by rotating the affective dimensions of valence and arousal by 45° within a two-dimensional Euclidean space (Watson, Wiese, Vaidya, & Tellegen, 1999). Thus, PA and NA quantify increasing arousal in the positive and negative domain, respectively. Baseline measures of PA and NA were calculated for each participant. Consistent with previous studies, responses to the valence and arousal scales at baseline (i.e., during the practice trial) were deviated from their respective means of 4 and then rotated by 45° to calculate baseline PA (PA=arousal/$\sqrt{2}$ + valence/$\sqrt{2}$) and NA (NA=arousal/$\sqrt{2}$ – valence/$\sqrt{2}$) (e.g., Knutson, Taylor, Kaufman, Peterson, & Glover, 2005; Samanez-Larkin et al., 2007). This same procedure was repeated for the averages of responses to the valence and arousal scales during the first four blocks (i.e., first half) and second four blocks (i.e., second half) of the MID task. Changes in PA and NA from baseline to the first half of the task, and from baseline to the second half of the task, were then computed.

We conducted the manipulation check during the first and second halves of the MID task separately based on the prediction that emotional arousal in response to the inductions would be strongest during the first half, when the task experiences were more novel. As predicted, paired-samples t-tests in the full sample indicated that the intended emotional arousal in response to the inductions was stronger during the first half than during the second half of the task. This was consistent in both the HAP condition (PA change from baseline to first half of task: M=0.69, SE=0.17; PA change from baseline to second half of task: M=-0.14, SE=0.19), $t(84)$=5.61, p<.001, and the HAN condition (full sample: NA change from baseline to first half of task: M=0.64, SE=0.16; NA change from baseline to second half of task: M=0.37, SE=0.15), $t(75)$=2.74, p=.008. Further, in both the HAP and HAN conditions, there were no significant differences between older and younger adults in this temporal effect.[1]

Focus on Emotional Arousal 'Responders'

We set *a priori* thresholds for participants' sufficient responses to the assigned experimental conditions based on changes in emotional arousal from baseline to the first half of the task. Specifically, participants in the HAP condition were classified as responders if their increase in PA was 0.5 points or greater, and participants in the HAN condition were classified as responders if their increase in NA was 0.5 points or greater. We selected the threshold of 0.5 as the average across the HAP and HAN conditions of mean change minus one standard error (i.e., [0.69-0.17+0.64-0.16]/2); thus, participants in the LA condition were classified as responders if their change in average arousal (mean of PA and NA) was less than 0.5 points.

Older and younger adults did not differ significantly in the proportion of participants classified as responders to the emotional arousal inductions based on these criteria; this was reflected in the HAP condition (older adults: 59.0%; younger adults: 52.2%), χ^2(1, N=85)=0.40, p=.530, the HAN condition (older adults: 57.9%; younger adults: 52.6%), χ^2(1, N=76)=0.21, p=.645, and the LA condition (older adults: 66.7%; younger adults: 77.4%), χ^2(1, N=70)=0.98, p=.323.[2] The full sample, including both responders and non-responders, and findings in the this full sample are presented in the **Supplemental Material**.

Ratings of Misleading Advertisements

Participants' responses to the misleading advertisements were extracted. Responses on the advertisement credibility scale were reverse-coded such that higher scores indicate greater credibility or susceptibility to the misleading information. Ratings of advertisement credibility and purchase intention were considered separately. Non-responses (2.8% of the data) were allowed in the multilevel modeling framework at Level 1.

Results

Participant Characteristics

Given our focus on the effects of emotional arousal on fraud susceptibility, the primary analyses examined responders, those participants who exhibited the intended emotional arousal. **Table 1** presents the demographic, cognitive, and behavioral characteristics of older adult and younger adult responders across the emotional arousal conditions. Differences in these characteristics as a function of experimental condition and age group were tested using a 3 (emotional arousal condition: HAP, HAN, LA) x 2 (age group: older, younger) multivariate analysis of variance (MANOVA). Across emotional arousal conditions, older adults had a smaller proportion of non-White participants, F(1,138)=24.14, p<.001, and exhibited slower perceptual speed on Digit Symbol, F(1,138)=93.09, p<.001, but greater verbal knowledge on the Shipley vocabulary test, F(1,138)=28.09, p<.001, than did younger adults. In addition, older adults were slower to respond to the target during the baseline task, F(1,138)=4.67, p=.032, and MID task, F(1,138)=19.34, p<.001, and when rating advertisement credibility, F(1,138)=66.14, p<.001, than were younger adults. Across age groups, participants in the LA condition scored higher on the DOSPERT investment risk-taking subscale than did participants in the HAP condition, F(2,138)=3.57, p=.031, and were slower to respond to the target during the MID task than were participants in both the HAP and HAN conditions, F(2,138)=8.56, p<.001. Finally, there were interactions of emotional arousal condition and age group in relation to education level, F(2,138)=3.49, p=.033, and score on Digit Span, F(2,138)=3.36, p=.038. For education level, no *post hoc* pairwise comparisons were significant. For Digit Span, older adults in the

HAP condition scored higher than those in the LA condition, *p*=.029, and younger adults in the HAN condition scored higher than those in the HAP condition, *p*=.023.

Effects of Emotional Arousal on Responses to Misleading Advertisements

Due to the nested structure of the dependent measures (task blocks nested within participants), we analyzed the data using multilevel modeling (Snijders & Bosker, 2011). Our Level 1 models quantified within-person ratings of advertisement credibility and purchase intention. Our Level 2 models quantified individual differences in these ratings as a function of emotional arousal condition and age group. Missing data were allowed at Level 1. HLM 6.08 software (Raudenbush, Bryk, & Congdon, 2004) was used. All models were random effects models in which intercepts and slopes were allowed to vary. Below, all parameter estimates are reported using robust standard errors. In the equations, *i* denotes block and *j* denotes participant. Whenever any emotional arousal condition and/or age group is included at Level 2, it is dummy coded (1=*participant is in that condition/group*; 0=*participant is not in that condition/group*). Due to dummy coding, models examining main effects were conducted first, followed by models examining interaction effects.

Prior to conducting the analyses, we used preliminary multilevel models to test the characteristics on which experimental conditions and/or age groups differed in relation to the dependent variables, participants' ratings of advertisement credibility and purchase intention. Participant race, education level, and Shipley vocabulary score each were significantly associated with select dependent variables. Therefore, these variables were entered as covariates in the primary analyses.[3] Race was dummy-coded (1=White, 0=Non-White), and Education level and Shipley score were centered at their respective grand means.

The primary analyses tested the effects of emotional arousal on responses to misleading advertisements in older and younger adults. Ratings of advertisement credibility and purchase intention were examined separately. To examine mean ratings across conditions and groups, we specified the following means-as-outcomes models (Raudenbush & Bryk, 2002) at Level 1 (block level; same equation used for advertisement credibility and purchase intention):

Advertisement Credibility$_{ij}$ or **Purchase Intention**$_{ij}$ = β_{0j} + r_{ij}

Advertisement Credibility$_{ij}$ or Purchase Intention$_{ij}$ denotes the rating for participant j at block i, β_{0j} denotes the mean rating across blocks for participant j, and r_{ij} denotes the within-person random effect. At Level 2, we first examined the main effects of emotional arousal condition and age group by specifying the following (participant level; same equation used for advertisement credibility and purchase intention):

β_{0j} = γ_{00} + γ_{01} (**HAP Condition**) + γ_{02} (**HAN Condition**) + γ_{03} (**Younger Adults**) + γ_{04} (Race)

$$+ \gamma_{05} \text{ (Education Level)} + \gamma_{06} \text{ (Shipley Score)} + u_{0j}$$

γ_{01} denotes the difference in mean rating between the LA condition and HAP condition, γ_{02} denotes the difference in mean rating between the LA condition and HAN condition, and γ_{03} denotes the difference in mean rating between older adults and younger adults, controlling for the other Level 2 variables. u_{0j} denotes the between-persons random effect.

Complete results (model coefficients, standard errors, *t*-statistics, and *p*-values) for all main effects on purchase intention are presented in **Table 2** (upper panel). As shown, there were significant effects of emotional arousal condition on ratings of purchase intention. As predicted, relative to participants in the LA condition, participants in both the HAP condition, *p*=.021, and HAN condition, *p*=.019, reported greater intention to purchase the advertised items. Though not predicted, there was also a significant effect of age group. Older adults reported greater intention to purchase the advertised items than did younger adults, *p*=.010.[4]

When controlling for estimates of both crystallized intelligence (Shipley score) and fluid intelligence (Digit Span and Digit Symbol) at Level 2, participants in both the HAP condition, *p*=.024, and HAN condition, *p*=.022, still reported greater intention to purchase the advertised items than did participants in the LA condition, but main effect of age group was no longer significant (unstd. coeff=-0.43, *SE*=0.27, *t*=-1.64, *p*=.104). Similarly, when controlling for the RT measures on which the age groups differed, participants in both the HAP condition, *p*=.012, and HAN condition, *p*=.010, still reported greater intention to purchase the advertised items than did participants in the LA condition, but the main effect of age group was no longer significant (unstd. coeff=-0.44, *SE*=0.26, *t*=-1.71, *p*=.090).

Complete results for all main effects on advertisement credibility are presented in **Table 3** (upper panel). There were no significant main effects of emotional arousal condition or age group on ratings of advertisement credibility, all *p*s$\geq$.201.

We next examined potential interactive effects of emotional arousal condition and age group by specifying the following Level 2 models (participant level; same equation used for advertisement credibility and purchase intention):

$$\beta_{0j} = \gamma_{00} + \gamma_{01} \textbf{ (HAP Condition)} + \gamma_{02} \textbf{ (HAN Condition)} + \gamma_{03} \textbf{ (Younger Adults)}$$
$$+ \gamma_{04} \textbf{ (HAP Condition x Younger Adults)} + \gamma_{05} \textbf{ (HAN Condition x Younger Adults)}$$
$$+ \gamma_{06} \text{ (Race)} + \gamma_{07} \text{ (Education Level)} + \gamma_{08} \text{ (Shipley Score)} + u_{0j}$$

Here, due to the addition of interactive effects, γ_{00} represents the mean rating for older adults in the LA condition, γ_{01} denotes the difference in mean rating between older adults in the LA condition and older adults in the HAP condition, γ_{02} denotes the difference in mean rating between older adults in the LA condition and older adults in the HAN condition, and γ_{03} denotes

the difference in mean rating between older and younger adults in the LA condition. γ_{04} denotes the interaction between HAP condition (vs. LA condition) and younger (vs. older) adults, and γ_{05} denotes the interaction between HAN condition (vs. LA condition) and younger (vs. older) adults. All other effects parallel the previous models. All effects control for all other Level 2 variables.

Complete results for these effects on purchase intention are presented in **Table 2** (lower panel) and **Figure 2**. As shown, there were significant simple effects of emotional arousal condition on ratings of purchase intention in older adults. As predicted, relative to older adults in the LA condition, older adults in both the HAP condition, *p*=.034, and HAN condition, *p*=.021, reported greater intention to purchase the advertised items. In a follow-up model that used older adults in the HAP condition as the referent group, there was no significant difference between older adults in the HAP condition and older adults in the HAN condition, *p*=.784. Also contrary to predictions, there was no significant interaction between HAP condition (vs. LA condition) and younger adults (vs. older adults), *p*=.766, or between HAN condition (vs. LA condition) and younger adults (vs. older adults), *p*=.498. That is, the effects of emotional arousal condition in the two age groups were not significantly different from one another. Supplementary analyses with younger adults as the referent group (as opposed to older adults as above) are presented in the **Supplemental Material**.

Complete results for these effects on advertisement credibility are presented in **Table 3** (lower panel). There were no significant interactive effects of emotional arousal condition and age group on ratings of advertisement credibility, all *p*s$\geq$.220.[4]

Follow-up analyses examined valence and arousal as independent predictors of fraud susceptibility within the emotional arousal conditions. The Level 1 models paralleled those in the primary analyses (block level). Because valence ratings changed in opposing directions in the HAP and HAN conditions, we conducted several Level 2 models that used different referent conditions (participant level):

(1) β_{0j} = γ_{00} + γ_{01} (**Change in Valence**) + γ_{02} (**Change in Arousal**) + γ_{03} (**HAN Condition**) + γ_{04} (**LA Condition**) + γ_{05} (**HAN Condition x Change in Valence**) + γ_{06} (**HAN Condition x Change in Arousal**) + γ_{07} (**LA Condition x Change in Valence**) + γ_{08} (**LA Condition x Change in Arousal**) + γ_{09} (Race) + γ_{10} (Education Level) + γ_{11} (Shipley Score) + u_{0j}

(2) β_{0j} = γ_{00} + γ_{01} (**Change in Valence**) + γ_{02} (**Change in Arousal**) + γ_{03} (**HAP Condition**) + γ_{04} (**LA Condition**) + γ_{05} (**HAP Condition x Change in Valence**) + γ_{06} (**HAP Condition x Change in Arousal**) + γ_{07} (**LA Condition x Change in Valence**) + γ_{08} (**LA Condition x Change in Arousal**) + γ_{09} (Race) + γ_{10} (Education Level) + γ_{11} (Shipley Score) + u_{0j}

Model (1) denotes the degree to which, in the HAP condition, participants' change in valence (γ_{01}) and change in arousal (γ_{02}) from baseline to the MID task predict the average rating of advertisement credibility or purchase intention. None of these coefficients were statistically significant, all $ps \geq .473$. However, for the prediction of purchase intention, the coefficient for HAN condition x change in valence (γ_{05}) was significant (unstd. coeff=-0.64, SE=0.32, t=-2.02, p=.046). This finding indicates that, as expected, the effect of valence on purchase intention was in opposing directions for the HAP and HAN conditions.

Similarly, model (2) denotes the degree to which, in the HAN condition, participants' change in valence (γ_{01}) and change in arousal (γ_{02}) from baseline to the MID task predict the average rating of advertisement credibility or purchase intention. Both of these coefficients were significant (change in valence: unstd. coeff=-0.51, SE=0.23, t=-2.24, p=.027; change in arousal: unstd. coeff=0.30, SE=0.14, t=2.08, p=.039). These findings indicate that in the HAN condition, both greater negative valence and greater arousal uniquely contributed to greater purchase intention. As in model (1), the coefficient for HAP condition x change in valence (γ_{05}) was significant (unstd. coeff=0.64, SE=0.32, t=2.02, p=.046). In addition, the coefficient for LA condition x change in arousal (γ_{08}) was significant (unstd. coeff=-0.52, SE=0.25, t=-2.03, p=.044). This finding indicates that the effect of greater arousal on greater purchase intention in the HAN condition was significantly lessened in the LA condition. For the prediction of advertisement credibility, none of these coefficients were statistically significant, all $ps \geq .353$.

Associations between Advertisement Credibility and Purchase Intention

Finally, we conducted exploratory multilevel models examining within-block associations between advertisement credibility and purchase intention in older and younger adult responders. We specified the following at Level 1 (block level):

Purchase Intention$_{ij}$ = β_{0j} + β_{1j} (**Advertisement Credibility**) + r_{ij}

β_{1j} denotes the average within-block association between rating of advertisement credibility and rating of purchase intention for participant j. As in the primary analyses, at Level 2 we examined main and interactive effects of emotional arousal condition and age group on this association (participant level; example using main effects):

β_{0j} = γ_{00} + γ_{01} (**HAP Condition**) + γ_{02} (**HAN Condition**) + γ_{03} (**Younger Adults**) + γ_{04} (Race)
    + γ_{05} (Education Level) + γ_{06} (Shipley Score) + u_{0j}

β_{1j} = γ_{10} + γ_{11} (**HAP Condition**) + γ_{12} (**HAN Condition**) + γ_{13} (**Younger Adults**) + γ_{14} (Race)
    + γ_{15} (Education Level) + γ_{16} (Shipley Score) + u_{1j}

γ_{11} denotes the difference in mean association between the LA condition and HAP condition, and so on. Complete results for all effects are presented in the **Supplemental Material**. As shown, there were no significant main or interactive effects of emotional arousal condition and age group on the association between advertisement credibility and purchase intention, all ps$\geq$.076.

Discussion

This study was designed to examine the effects of emotional arousal on older and younger adults' susceptibility to fraud. As predicted, we found that misleading advertisements were more persuasive for individuals under conditions of high-emotional-arousal than low-arousal. Indeed, participants' reported intent to purchase falsely advertised items was significantly increased in both the HAP and HAN conditions relative to the LA condition. We found that while this effect was significant specifically in older adults, there was no significant difference in this effect as a function of age group. Taken together, these findings indicate that both older and younger consumers may be susceptible to making poor consumer decisions when persuasion messages generate high levels of arousal, whether positive or negative.

We also found that, irrespective of the emotional arousal condition to which older adults were assigned (HAP, HAN, or LA), they reported greater purchase intention than did younger adults. While this main effect of age group was not significant in follow-up analyses that covaried measures of processing speed, age and processing speed are inextricably linked in real-world settings (Salthouse, 1996). Nevertheless, this study did not include assessments of participants' interest in or desirability of the advertised products, which also may have differed by age. These factors may be related to older adults' generally higher ratings of purchase intention relative to younger adults. Future work should examine these possibilities, and could include comparison advertisements for similar types of products that are not misleading. At present, interpretations of the main effect of age group would be premature.

For participants in this study, incidental emotional arousal affected their subsequent appraisal of stimuli, in this case misleading advertisements. Emotional arousal increased individuals' reported intent to purchase the items regardless of whether or not they perceived the advertisements as credible. This supports prior theoretical work that emotional responsiveness can have downstream effects on behavior (Loewenstein, 1996; Loewenstein & Lerner, 2002). The present study contributes to the literature by showing that emotional arousal can influence susceptibility to misleading information and that this effect occurs in both older and younger adults.

Contrary to prior work showing that different emotions elicit different behavioral responses (Lerner, Small, & Loewenstein, 2004; Lerner et al., 2003), in this case both positive and negative emotional arousal increased older adults' intent to purchase the advertised items. As we reviewed above with respect to the positivity effect and GANE model (Mather et al., 2016), it was possible that positive arousal would have led to the greatest purchase intention in older adults. However, consistent with the SAVI model (Charles, 2010), arousal – regardless of valence – appears to have affected information processing in older adults. Another possible reason that we did not observe a positivity effect is that the experimental task required participants to deliberate about the stimuli. Reed and Carstensen (2012; see also Carstensen & DeLiema, 2017) have argued that the motivational account of the positivity effect offered by socioemotional selectivity suggests that the positivity effect should be strongest in studies where attention to stimuli is unconstrained and weakest in experiments that demand deliberative processing of stimuli. That is, if the positivity effect reflects goal-directed processing, it would be most evident in studies where participants are free to 'just view' stimuli and weakest when explicitly asked to process stimuli. This argument was supported by a meta-analysis of one hundred studies of the positivity effect (Reed, Chan, & Mikels, 2014).

Another explanation for our findings is that the experience of repeated thwarted goal attainment in HAN condition of the MID task triggered risk-seeking approach behavior rather than avoidance behavior across both age groups. As reviewed above, Lerner and colleagues (2003) found that anger inductions were associated with increased optimistic risk estimates and risk-seeking choices. Further, our follow-up analyses indicated that between the HAP and HAN conditions, opposing changes in affective valence from baseline to the task related to greater purchase intention. That is, greater increases in positive valence in the HAP condition, and greater increases in negative valence in the HAN condition, both predicted greater purchase intention. Arousal (irrespective of valence) also exerted a unique effect on purchase intention in the HAN condition. Further studies may utilize both positive and negative low- and high-arousal inductions, in order to test potential interactive effects between valence and arousal. In addition, in the current study we did not ask participants to report their discrete emotions during the MID task. Future studies might assess the specific type of emotions that participants felt (e.g., anger, sadness, fear).

This study provides evidence that individuals process information differently under conditions of high versus low emotional arousal. Given that arousal-based enhancement of advertisement credulity was not a mediator of arousal-based differences in purchase intention, the precise mechanisms linking emotional arousal to purchase intention are unclear. Based on

the GANE model (Mather et al., 2016), it is possible that arousal enhanced product attractiveness for both older and younger adults if this information were viewed as salient. Unfortunately, because we did not collect additional measures concerning which features of the advertisements were most salient to the participants, we were not able to test these hypotheses directly.

Implications for Fraud Prevention

It appears that visceral excitation used in scam communications contributes to heuristic information processing, shifting attention toward a promised goal and encouraging individuals to prioritize short-term goals that satisfy emotional drives over long-term goals (Loewenstein, 1996). Perhaps the best strategy to resist scams is to resist making decisions in the 'heat of the moment,' and instead wait until emotions have returned to a calm, neutral state. One finding in support of this strategy comes from our supplementary analysis incorporating 'non-responders,' participants who did not increase arousal levels in response to the emotional arousal inductions. Interestingly, a substantial minority of both older and younger participants did not respond to the emotional arousal inductions as intended. When we incorporated these participants in the analyses, the observed fraud susceptibility was mitigated, suggesting that increased emotional arousal critically accounted for the effects. Although we did not find differences between responders and non-responders to the experimental manipulations in any characteristics assessed at baseline, future studies should examine individual differences that may buffer older and younger adults against appeals to emotional arousal.

By their very nature, visceral factors consume decision-making resources and motivate individuals to act immediately based on instinct (Langenderfer & Shrimp, 2001). Therefore, a more effective strategy for resisting scams may involve avoiding high-arousal sales situations in the first place. Everyday practices include, for example, not answering the phone in response to an unrecognized caller ID, never opening the door to unknown solicitors, and immediately throwing away sweepstakes-related mail. If high-pressure sales situations are unavoidable, such as when shopping for a big-ticket item like a new car, consumers should make a personal commitment before the sales interaction to delay making the decision until the next day. Chances are that decisions made after this 'cooling off' period will be more calculated and favorable to the consumer. Future research should explore how to make this momentary pause a default behavior when faced with financial decisions, particularly those that involve high stakes.

Tougher federal regulations on advertising claims and mandatory 'cooling off' periods will also protect consumers from paying for products and services they do not need. Yet, these

policy solutions only protect consumers from misleading offers presented by legitimate companies. Financial predators do not follow rules outlined by the FTC, Consumer Financial Protection Bureau, or Securities and Exchange Commission. Therefore, it is important that we educate consumers about how to recognize unfair advertising practices and learn how messages are crafted to mislead them. Through heightened awareness and improved knowledge about persuasion, consumers will be better able to differentiate legitimate offers from scams.

Study Limitations

The present study has notable strengths, including the induction of emotional arousal in a controlled laboratory setting and strong ecological validity through the use of real advertisements designated as misleading by the FTC. There are also several limitations of the study that warrant discussion. First, as noted above, the cell sizes testing each emotional arousal condition by age group were relatively small (n range = 20-26), because a substantial minority of participants did not respond to the emotional arousal inductions as intended. While this allowed us to conduct an analysis in which fraud susceptibility seemed to be diminished in non-responders, the potential mechanisms underlying how and why some participants did not respond to the inductions remain unknown. These individual differences will be important to characterize in future studies with larger samples as they may identify protective factors in individuals who might be less susceptible to emotional tactics in general. Second, emotional arousal was reduced from the first half to the second half of the task. While our analyses incorporated all task blocks, future studies might fruitfully explore other types of inductions that may have more enduring effects. Third, as noted, apart from credibility and purchase intention, this study did not include assessments of interest in or desirability of the advertised products. It is important that future work examine these factors. Fourth, because we did not assess actual purchasing behavior, we do not know whether or how emotional arousal influences naturalistic financial decisions. It is possible that reported purchase intentions may provide a point for intervention even if these reports do not translate perfectly to behavior. Finally, the precise mechanisms linking emotional arousal to intention to purchase fraudulent items remain to be elucidated, particularly because this mechanism did not operate through perceived credibility of the advertisements. Future studies may test additional processes and potential causal pathways, such as physiological or attentional mechanisms.

Conclusions

The present results inform the scientific literature on aging and fraud susceptibility, as well as potential interventions aimed at reducing financial fraud. Broadly communicating such

findings to consumers and investors may decrease the public's susceptibility to commonplace fraud tactics that are based in emotional arousal.

Footnotes

1. A series of follow-up one-sample *t*-tests examined whether each block of the MID task significantly evoked the intended emotional arousal. In the responder sample, each of the eight blocks significantly increased PA in the HAP condition, all $ps \leq .024$, and significantly increased NA in the HAN condition, all $ps < .001$. When examining across both responders and non-responders, the blocks did not consistently significantly increase PA in the HAP condition, p range $= <.001-.455$, or NA in the HAN condition, p range $= <.001-.160$.

2. We conducted a follow-up analysis to examine differences in baseline characteristics between emotional arousal responders and non-responders, given that it may be informative in the study of emotional arousal and fraud susceptibility. A 2 (responder status: responder, non-responder) x 3 (emotional arousal condition: HAP, HAN, LA) x 2 (age group: older, younger) ANOVA indicated that there were no significant main or interaction effects for responder status, all $ps \geq .113$. Thus, there were no significant differences in baseline characteristics between responders and non-responders, either as a main effect or in interaction with emotional arousal condition.and/or age group.

3. One participant did not complete the Shipley vocabulary test, a Level 2 variable; therefore, the advertisement rating data for this participant could not be included in the analyses.

4. A series of multilevel models in the responder sample examined whether task half (first half vs. second half) interacted with emotional arousal condition and/or age group in relation to rating of advertisement credibility or purchase intention. No interaction terms were significant, all $ps \geq .191$.

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Table 1

Characteristics of Older and Younger Adult Responders across Emotional Arousal Conditions

Variable (*M* [*SD*] or %)	Older Adults			Younger Adults		
	HAP (*n*=23)	HAN (*n*=22)	LA (*n*=26)	HAP (*n*=24)	HAN (*n*=20)	LA (*n*=24)
Age	74.09 (5.94)	72.59 (4.58)	74.54 (5.17)	34.42 (3.18)	34.15 (3.12)	34.83 (3.49)
Gender (% female)	60.9%	63.6%	61.5%	70.8%	45.0%	54.2%
Ethnicity (% non-Hispanic)[*]	95.7%	95.5%	88.5%	75.0%	90.0%	95.8%
Race[†]						
White	78.3%	90.9%	84.6%	41.7%	50.0%	50.0%
African-American	13.0%	4.5%	3.8%	8.3%	25.0%	8.3%
Asian-American	0.0%	4.5%	3.8%	20.8%	10.0%	37.5%
Mixed Race/Other	8.6%	0.0%	7.7%	29.2%	15.0%	4.2%
Education Level	7.04 (2.69)	7.18 (3.08)	6.15 (2.20)	5.88 (1.45)	6.00 (2.27)	7.13 (1.92)
Digit Span	16.91 (5.62)	16.05 (2.92)	14.58 (2.93)	14.67 (3.74)	17.40 (4.42)	15.88 (3.53)
Digit Symbol	44.17 (12.98)	45.91 (7.96)	44.04 (8.60)	62.92 (14.84)	63.10 (12.96)	64.75 (9.56)
Shipley Vocabulary[‡]	35.04 (4.08)	35.68 (2.90)	35.28 (4.18)	30.58 (5.51)	31.75 (3.51)	32.17 (4.56)
DOSPERT Investment Subscale	2.58 (1.07)	2.76 (0.95)	2.90 (0.82)	2.47 (1.01)	2.83 (0.77)	3.16 (0.89)
RT						
Target, Baseline Task (ms)	336.39 (65.03)	322.64 (52.63)	340.69 (81.58)	313.92 (94.36)	303.05 (79.88)	299.63 (55.93)
Target, MID Task (ms)	288.79 (50.87)	286.13 (81.60)	334.21 (89.03)	254.61 (36.11)	231.20 (32.73)	284.80 (51.87)
Advertisement Credibility (sec)	7.29 (2.41)	7.50 (2.36)	7.53 (1.82)	5.19 (1.71)	4.56 (1.27)	4.88 (1.12)
Purchase Intention (sec)	5.78 (2.16)	5.88 (1.50)	6.06 (1.42)	6.56 (2.23)	6.25 (2.06)	6.68 (1.76)

Note. HAP=High-arousal positive emotion condition; HAN=High-arousal negative emotion condition; LA=Low arousal condition; DOSPERT=Domain-Specific Risk Attitude Scale; RT=reaction time; ms=milliseconds; sec=seconds. *Ethnicity reported as "Hispanic," "non-Hispanic," or "Unknown." Four participants reported ethnicity as "Unknown." [†]Numbers do not always add up to 100% due to rounding. [‡]Data were missing for one participant.

Table 2

Ratings of Purchase Intention across Emotional Arousal Conditions in Older and Younger Adult

Responders

Predictor	Unstd. Coeff.	*SE*	*t*	*p*
Main Effects Model				
Intercept (γ_{00})	2.88	0.24	12.24	< .001
HAP vs. LA (γ_{01})	0.49	0.21	2.34	.021
HAN vs. LA (γ_{02})	0.50	0.21	2.38	.019
Younger vs. Older Adults (γ_{03})	-0.51	0.19	-2.62	.010
Race (γ_{04})	-0.10	0.22	-0.46	.647
Education Level (γ_{05})	-0.05	0.04	-1.27	.206
Shipley Score (γ_{06})	-0.11	0.02	-4.38	< .001
Interactive Effects Model				
Intercept (γ_{00})	2.82	0.22	12.86	< .001
HAP vs. LA in Older Adults (γ_{01})	0.55	0.26	2.15	.034
HAN vs. LA in Older Adults (γ_{02})	0.63	0.27	2.35	.021
Younger vs. Older Adults in LA (γ_{03})	-0.38	0.27	-1.39	.166
HAP vs. LA by Younger vs. Older Adults (γ_{04})	-0.12	0.42	-0.30	.766
HAN vs. LA by Younger vs. Older Adults (γ_{05})	-0.28	0.42	-0.68	.498
Race (γ_{06})	-0.10	0.22	-0.46	.648
Education Level (γ_{07})	-0.06	0.04	-1.38	.169
Shipley Score (γ_{08})	-0.11	0.02	-4.39	< .001

Note. HAP=high-arousal positive emotion condition; HAN=high-arousal negative emotion

condition; LA=low arousal condition; SE=standard error. Results reflect two multilevel models:

main effects model (upper panel) and interactive effects model (lower panel). Predictors are

listed at Level 2.

Table 3

Ratings of Advertisement Credibility across Emotional Arousal Conditions in Older and Younger Adult Responders

Predictor	Unstd. Coeff.	*SE*	*t*	*p*
Main Effects Model				
Intercept (γ_{00})	3.95	0.23	17.17	< .001
HAP vs. LA (γ_{01})	0.07	0.20	0.35	.726
HAN vs. LA (γ_{02})	0.23	0.22	1.07	.289
Younger vs. Older Adults (γ_{03})	0.26	0.20	1.29	.201
Race (γ_{04})	-0.08	0.22	-0.38	.703
Education Level (γ_{05})	0.04	0.04	1.09	.279
Shipley Score (γ_{06})	-0.04	0.02	-1.70	.091
Interactive Effects Model				
Intercept (γ_{00})	4.12	0.24	17.03	< .001
HAP vs. LA in Older Adults (γ_{01})	-0.18	0.29	-0.63	.528
HAN vs. LA in Older Adults (γ_{02})	-0.03	0.27	-0.10	.920
Younger vs. Older Adults in LA (γ_{03})	-0.07	0.27	-0.26	.797
HAP vs. LA by Younger vs. Older Adults (γ_{04})	0.50	0.42	1.18	.240
HAN vs. LA by Younger vs. Older Adults (γ_{05})	0.53	0.43	1.23	.220
Race (γ_{06})	-0.09	0.22	-0.41	.681
Education Level (γ_{07})	0.05	0.04	1.45	.151
Shipley Score (γ_{08})	-0.04	0.02	-1.72	.088

Note. HAP=high-arousal positive emotion condition; HAN=high-arousal negative emotion condition; LA=low arousal condition; SE=standard error. Results reflect two multilevel models: main effects model (upper panel) and interactive effects model (lower panel). Predictors are listed at Level 2.
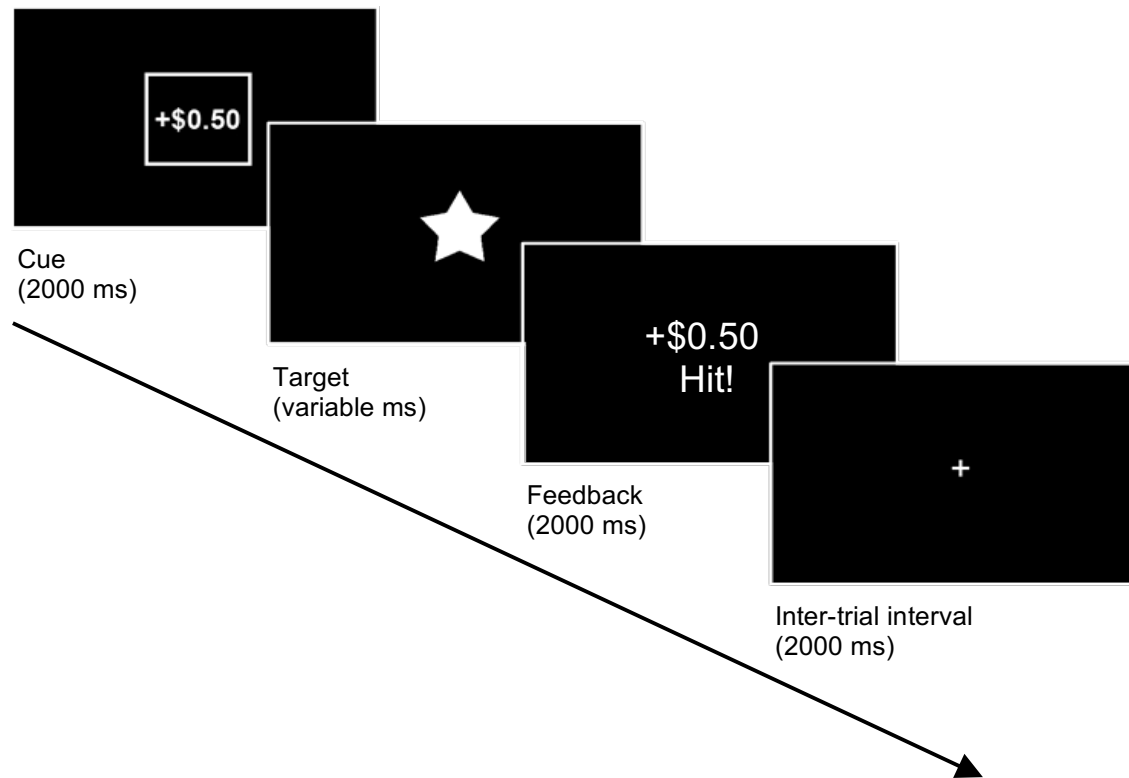
Figure 1. Simplified trial structure of modified MID task. During the task, the cue and target were each followed by a variable delay.

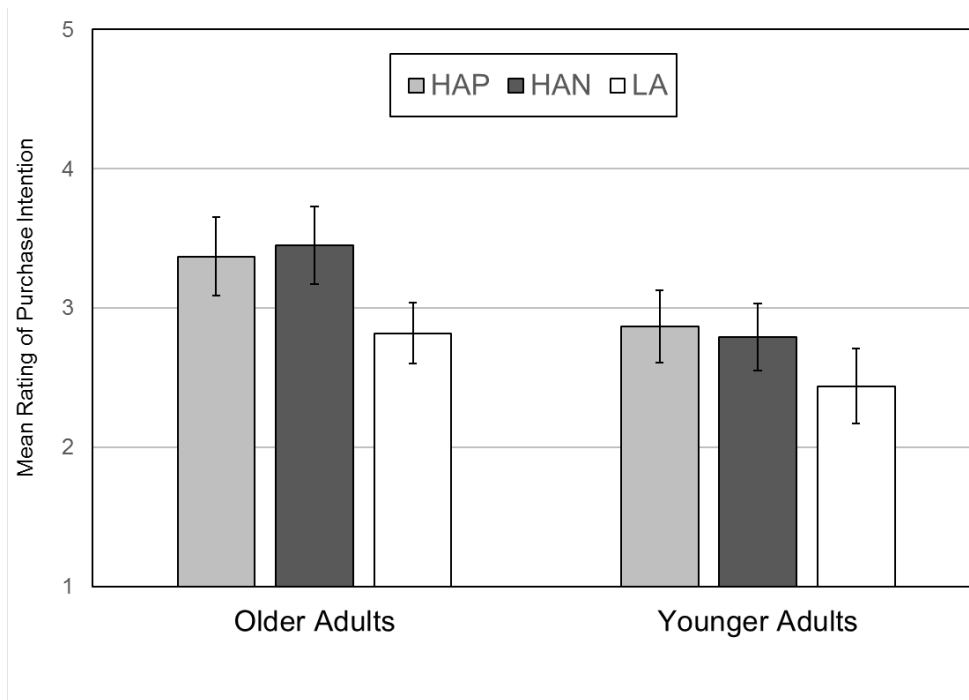Each emotional arousal condition included a proportion of rigged trials.

Figure 2. Mean ratings of purchase intention across blocks in older and younger adult responders across emotional arousal conditions. Data represent unstandardized coefficients and standard errors from multilevel models of interactive effects controlling for covariates. HAP=high-arousal positive emotion condition; HAN=high-arousal negative emotion condition; LA=low arousal condition. Error bars denote + 1 standard error.