

Emotion regulation strategy usage in a quasi-naturalistic context

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ABSTRACT (219 / 250 Words):

Successful emotion regulation requires effective strategy selection. Prior research suggests that low-effort relative to high-effort strategies are more likely to be selected as emotional experiences intensify. However, the extent to which strategy choice reflects strategy usage as circumstances more closely reflect the complications of a complex, multimodal world is not yet well understood. The present research uses a quasi-naturalistic approach to examine the association between affective intensity and strategy usage using untrained participants who were given minimal direction while navigating a haunted house and subsequently reporting emotional states, intensities, and regulation attempts. Studies 1 ($n = 47$) and 2 ($n = 118$) found no relationship between emotional intensity and use of high- vs. low effort strategies, which may have been due to the relative underperformance of distraction as an emotion regulation strategy. Study 3 participants ($n = 152$) predicted regulation strategy usage based on the experiences reported by Study 1 participants, and their forecasts matched the regulatory choice associations reported in prior literature. Though such a quasi-naturalistic approach cannot isolate variable associations like the strategy choice paradigms that laid the groundwork for the field, the pattern of results may highlight differences between emotion regulation choice and usage as research paradigms shift to encompass more naturalistic features within their designs and literature which may explain the observed differences is discussed.

KEYWORDS: emotion, self-regulation, naturalistic stimuli, decision making

INTRODUCTION

On comedian Nathan Fielder's HBO series *The Rehearsal*, participants are given the opportunity to prepare for upcoming, emotional life events through extensive simulation. Inherent in this absurdist premise is recognition that theory often fails to materialize in practice. Such concerns plague not only the unfortunate participants in Fielder's experiments, but also every person who has predicted that getting what they wanted would make them happy or that they could handle a tough critique. The prediction-practice disconnect is of particular importance in the study of emotion regulation (ER), as the strategy choice and effectiveness observed in lab settings may not generalize to how emotions are regulated beyond the lab (Sheppes, 2020).

ER paradigms often isolate complex associations by training participants to use regulatory strategies, showing previews of emotional stimuli, giving prompts to select preferred strategies, asking participants to regulate using the selected strategy during an extended stimulus presentation and recording their regulatory and affective responses (e.g., Sheppes et al., 2011; 2014). These experiments strongly suggest that less cognitively-taxing strategies like distraction (focusing attention away from an emotion-eliciting stimulus) are selected more often and are more effective as affective intensity increases. Likewise, as affective intensity decreases, engagement strategies like reappraisal (changing the emotional meaning of a stimulus to modulate the emotional reaction) are selected more often and are more effective (Hay et al., 2015; Sheppes et al., 2011, 2014; Orejuela-Dávila et al., 2019; Shafir et al., 2016; Young & Suri, 2020).

Despite the indisputable value of these approaches, certain features of real-world ER usage are often uncommon in these designs. For example, ER choice has been replicated using unimodal stimuli (Feldman & Freitas, 2021; Shafir et al., 2018; Sheppes et al., 2011), but real-

world stimuli are often multimodal and complex. This relative overabundance of information may negatively influence attentional control, which is one of the most robust predictors of real-world outcomes for cognitive behavior (Draheim et al., 2022). Other approaches have used real-world circumstances (Shafir et al., 2017), but individuals regulating emotion in their daily lives are also often untrained, stimuli are not previewed, and behavior is unprompted (Friedman & Gustavson, 2022). When allowed, individuals also explore and flexibly apply multiple strategies that blur the boundaries of typical strategy classifications, emphasizing important differences between ‘usage’ and ‘choice’ (Opitz, Cavanagh, and Urry, 2015; Heiy & Ceavens, 2014; Szasz et al., 2018; Aldao & Nolen-Hoeksema, 2013). For these reasons, it may be the case that studies characterized by more naturalistic features would capture meaningful but different variance in self-regulatory behaviors (Friedman & Gustavson, 2022; Malanchini et al., 2019; Kamradt et al., 2014). As such, researchers have emphasized capturing ER in context as the next crucial step for the field (Tang & Huang, 2019; Rottweiler, Taxer, & Nett, 2018; English et al., 2017; Dixon-Gordon et al., 2015; Aldao, 2013).

Experiential sampling and ecological momentary assessment (EMA) approaches do capture strategy in context (e.g., Haines et al., 2016; Heiy & Ceavens, 2014; Colombo et al., 2020). However, capturing emotion in relatively mundane circumstances often leads to relatively average emotional responses, which might not necessarily reflect behaviors at emotional extremes; when ER usage is perhaps most consequential. A paradigm which reliably captures naturalistic ER responses in controlled but high-intensity environments has not yet been established within the field, and little is known about whether ER behavior observed in response to high-intensity stimuli generalizes across the ecological-validity continuum. The goal of the present research is to examine whether these regulatory patterns emerge in a sample of untrained

participants exposed to a controlled but quasi-naturalistic setting high in emotional variability: an immersive haunted house.

We focused on a particularly robust predictor of ER choice from the lab literature: emotional intensity (Sheppes, 2011). A recent meta-analysis found a very large effect size in the relationship between strategy choice and emotional intensity ($r+ = 0.46 - 0.61$) (Matthews et al., 2021). To better mirror the focus of these previous strategy choice paradigms in a quasi-naturalistic context, we analyzed observations in which participants reported regulatory behaviors congruent with either distraction or reappraisal while navigating a haunted house. This comparison is nearly ubiquitous in the literature (Heiy & Cheavens, 2014) examining regulatory responses to negatively valenced emotional events.

We hypothesized that affective intensity would be less predictive of ER behavior as a paradigm becomes relatively more naturalistic (e.g., uses untrained, unprompted participants and complex contextualized stimuli). This is due to a few reasons. First, spontaneous or untrained ER may rely more heavily on implicit, reflexive processes like habits and schemas (Christou-Champi, Farrow, & Webb, 2014; Norem, 2007) more than characteristics of the context, such as emotional intensity (Koole et al., 2015). This may especially be the case in attention-demanding, multimodal situations (Draheim et al., 2022). Secondly, the Selection, Optimization, and Compensation in the Domain of Emotion Regulation (SOC-ER) framework, which emphasizes the importance of individual differences and context, suggests that regulators may engage in idiosyncratic exploratory behaviors to maximize outcomes as their circumstances change (Opitz, Gross, and Urry, 2012) which is supported by studies which had relaxed ER instructions and constraints (Opitz, Cavanagh, and Urry, 2015; Heiy & Ceavens, 2014). We predicted that we would not find significant associations between affective intensity and strategy *usage* when

measuring ER in our quasi-naturalistic unconstrained contexts. However, we also hypothesized that decontextualizing information from those events, or presenting stimuli in a trial-by-trial fashion with fewer naturalistic features, would result in the canonical association between affective intensity and ER *choice*.

We used three experiments to explore these aims. In Experiment 1, we tested whether affective intensity predicted selection of low-effort (distraction) versus high-effort (reappraisal) regulatory strategies in a quasi-naturalistic setting. To test this prediction, untrained participants navigated a haunted house and later reported emotional and spontaneous regulatory behaviors in a surprise recall task. Experiment 2 replicated and improved upon the design of Experiment 1 by doubling sample size and observing changes in affective and regulatory reporting over time. Experiment 3 built upon Experiments 1 and 2, using the events described by those who experienced the haunted house in Experiment 1 to test how a new set of participants might forecast regulatory behaviors.

EXPERIMENT 1 METHODS

Experiment 1 tested whether the emotional intensity of negatively-valenced events was associated with the likelihood of using a low-effort or high-effort regulatory strategy in a quasi-naturalistic setting with an untrained sample. To assess emotional intensity, participants self-reported the emotional intensity of events from the haunted house one week after exposure during a surprise recall task. Participants also noted whether they wanted to reduce the intensity of these emotions and, if so, how they attempted to do so in their own words. We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

PARTICIPANTS: In October 2019, 54 participants ($\bar{x}_{age} = 24.22$ yrs, range = 18 - 34 yrs, $sd_{age} = 3.97$ yrs, 26 female, 1 non-binary, 18.51% Hispanic) were recruited from a large

northeastern city via flyers for an IRB-approved fear and memory study. Participants were predominantly well-educated (\bar{x} *Years of Education* = 15.3 yrs, *sd* *Years of Education* = 2.4 yrs), with 92.6% reporting having completed some college (35.2%), a 4-year degree (29.6%), some post-graduate studies (16.7%), or a post-graduate degree (11.1%). Socioeconomic status was more normally distributed, with 12.7% of respondents reporting making less than \$15,000 per year, 16.3% reporting between \$15,001 and \$25,000, 09.1% reporting \$25,001 to \$35,000, 23.6% reporting between \$35,001 and \$50,000, 12.7% reporting between \$50,001 and \$75,000, 16.4% reporting between \$75,001 and \$100,000, 09.1% reporting between \$100,001 and \$150,000, and no one reporting greater than \$150,000. The racial identity of participants was not assessed.

A priori power analyses using the WebPower (Zhang, Z., & Mai, Y., 2019) in R 3.6.1 (R Core Team, 2022) determined 18 participants would sufficiently power our main effect using the smallest effect size reported by Sheppes et al.'s 2011 examination of emotional intensity and regulatory choice ($\eta_p^2 = 0.43$). Participants were excluded for previously visiting the haunted house ($n = 1$), not completing the study ($n = 1$), identifying English as their second-language ($n = 2$), or not following instructions ($n = 3$). Participants received \$70.00 in Visa debit cards for participating.

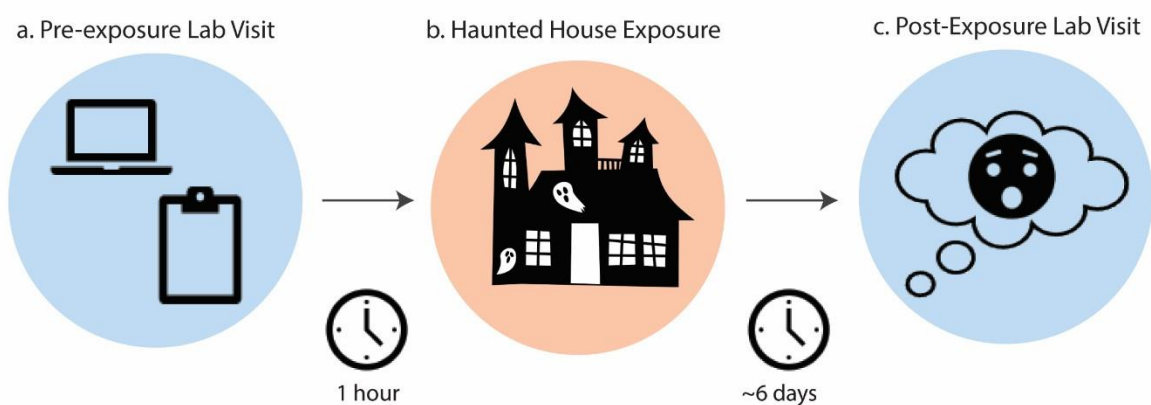


Fig 1. Study 1: Task Overview - Fifty-four (54) participants traversed a haunted house in small groups. a. Prior to the haunted house, participants completed baseline questionnaires. b. The haunted house lasted for ~1 hour. c) Participants returned to the laboratory ~6 days later for the emotion regulation recall task.

MATERIALS AND PROCEDURE: Our design consisted of an exposure session and a follow-up. Following consent, participants completed computerized questionnaires and were fitted with physiological monitors which are beyond the purview of this study (*See Stasiak et al., 2021; Reisman et al. 2021*). Participants were then escorted by two research assistants to the remotely-located haunted house.

This specific haunted house experience was chosen because: A) it uses professional actors renowned for eliciting a range of affective responses, B) it contained six themed sections each with a unique aesthetic providing variability to the stimuli, C) it provides a remarkably consistent experience across sessions, and D) coordination with the facility allowed us to enter the haunted house before other patrons to guarantee consistency.

Session 1, Haunted House. Participants navigated the haunted house in twelve groups ($\bar{x}_{size} = 4.50$ participants; $sd_{size} = 0.79$ participants) for approximately 55.40 minutes ($sd = 5.05$ minutes) and were provided with minimal instructions to promote ecological validity (participants were to walk through the haunted house in a single file line and avoid sharing thoughts, reactions, and experiences with other participants). However, they were encouraged to act and react as naturally as possible. Each participant was randomly assigned to lead the group through one section. The accompanying research assistant led the group through any sections without a participant-leader. Following exposure, participants were scheduled for an individual follow-up and were instructed to not discuss their experience with anyone.

Session 2, Laboratory follow-up session. At follow-up (*time since exposure*: $\bar{x}_{delay} = 5.98$ days; $sd_{delay} = 0.79$ days), participants completed a surprise free-recall memory task and questionnaires. Notably, participants identified, described, and chronologically ordered ten (10) discrete events from within the haunted house. For each event, participants identified which of 13 emotion

categories they had felt, the intensity of each of those emotions, the extent to which they tried to regulate each of those emotions, and to describe how they attempted to regulate them (if at all). It must be noted that while participants were able to endorse multiple emotions of differing intensities for any one event, participants were only asked about their regulatory behavior once per event and not whether that regulatory behavior was directed towards any specific emotions endorsed during that event. Thus, because we have greater granularity of emotion than we do the regulatory responses to those emotions, the association between these variables was assessed through multiple approaches to account for this discrepancy. To avoid confusion, we refer to this approach as capturing regulatory behaviors at the “event-level”. During Study 2, we ask participants about their regulatory responses to each emotion they endorsed, which we refer to as capturing regulatory responses at the “emotion-level”. For any one event, one or more emotions may have been endorsed by the participant.

Participants were not trained in emotion regulation strategies, nor were they primed to consider their emotion regulation strategies prior to these questionnaires. Though EMA approaches could also be applied in such a setting, the training and/or consideration of experience required would violate the immersive, naturalistic experience we aimed to model. Emotion categories were adapted from the Positive and Negative Affect Schedule (PANAS) (Watson, Clark, & Tellegen, 1988). Some noted additions relevant to a typical haunted house experience included “tense”, and “disgusted”. Ten of the 13 options were negatively-valenced emotions (i.e., *Disgusted/Grossed Out*, *Fearful/Afraid*, *Hostile/Aggressive*, *Irritable/Annoyed*, *Nervous/Jittery*, *Overwhelmed*, *Panicked*, *Shocked/Surprised*, *Tense*, *Upset/Distressed*). Applying Cronbach's alpha to the emotional intensity value of negative emotions yielded a value of $\alpha = 0.91$ (95% CI = [0.89, 0.92]), suggesting excellent internal consistency. Both emotional

intensity and regulation extent were captured on a 7-point Likert scale, with 1 representing “Not at all” and 7 representing “A great deal”. Regulation strategies were captured for each event using free-response to the prompt: *If you did attempt to change or regulate your emotions, how did you do so?* Participants were subsequently debriefed and paid for their participation.

Questionnaire response coding. Two hypotheses-blind raters classified strategy descriptions into one or more strategy categories: Reappraisal, Distraction, another Process Model strategy (e.g., Suppression, Situation Modification), a combination of the three, or none of the above (IRR Agreement = 0.880). Raters were not privy to the emotion intensity ratings participants endorsed. Raters were undergraduate research assistants who trained by first reviewing examples of landmark literature which defined the strategies of interest as commonly used in the field (Gross, 1998; 2002). Raters then reviewed select methodological excerpts from experimental papers to see how cognitive reappraisal, attention deployment, and other Process Model strategies were defined within past studies (Sheppes, 2011; Shafir, 2016). Lastly, raters independently completed classification exercises using examples of regulation strategy descriptions not included in the primary sample set. Through the training and classification process, raters were instructed not to collaborate or discuss their ratings with each other during the rating process. After individually classifying each description, a researcher met with both raters remotely using a digital video conferencing platform and moderated a review of the classifications, asking raters to compromise in cases of classification disagreement. The moderator was not involved in classifications and was muted and had their video off during these compromise exchanges to avoid undue influence.

Analysis. To explore our primary question, the effect of emotional intensity upon regulatory strategy usage, we specified multilevel binary logistic regressions accounting for the

random effect of participants using the “lme4” package (Bates et al., 2015) in R (R Core Team, 2022). We followed an information theoretic approach via AIC comparison. Our model comparisons included a: A) a null model without fixed effects, B) a model containing only z-scored emotional intensity as a fixed effect, C) a model containing only person-centered, z-scored emotional intensity and person-mean, z-scored emotional intensity as fixed effects, and D) a model including person-centered and person-mean z-scored emotional intensity with covariates. All data and scripts used to produce this analysis are publicly available at OSF (*See Open Practices*). This study was not pre-registered.

RESULTS

As we primarily aimed to determine how analogous associations observed in ER strategy choice paradigms were to ER usage in quasi-naturalistic contexts, observations that did not contain negative emotions regulated by either distraction or reappraisal were beyond the purview of our study. Our full dataset consisted of 469 unique events from 47 participants with an average of 2.43 emotions (SD) endorsed per event. Of the 1138 endorsed emotions, 603 (52.99%) were classified as being negatively valenced. Of the 603 negative emotions endorsed, there were 166 observations in which a negative emotion was downregulated by either distraction or reappraisal. These 166 observations came from 78 unique events reported by 32 participants. Of the 78 unique events, 57 events (74.36%), or 130 observations (78.31%) reported using distraction to regulate their emotions. The average emotional intensity of observations was 5.55 (range: 1 – 7, Likert scale).

Intensity predicts regulatory extent. Pro-hedonic emotion regulation (i.e., minimizing aversive experiences) suggests that a positive linear relationship should exist between negative affective intensity and effort to regulate that experience. If no association was found between the

two variables, it may suggest errors in methodology. To assess this, we ran multilevel linear models specifying regulatory extent as our criterion variable, participant as a random intercept, and building fixed effects from a null model ($ICC = 0.35$). Our best performing model as determined by AIC comparison found person-centered emotional intensity to be a significant predictor of regulation extent ($\beta = 0.31$, 95% CI = [0.17, 0.46], $p < 0.001$), which suggests our paradigm elicited regulatory behaviors from participants as predicted.

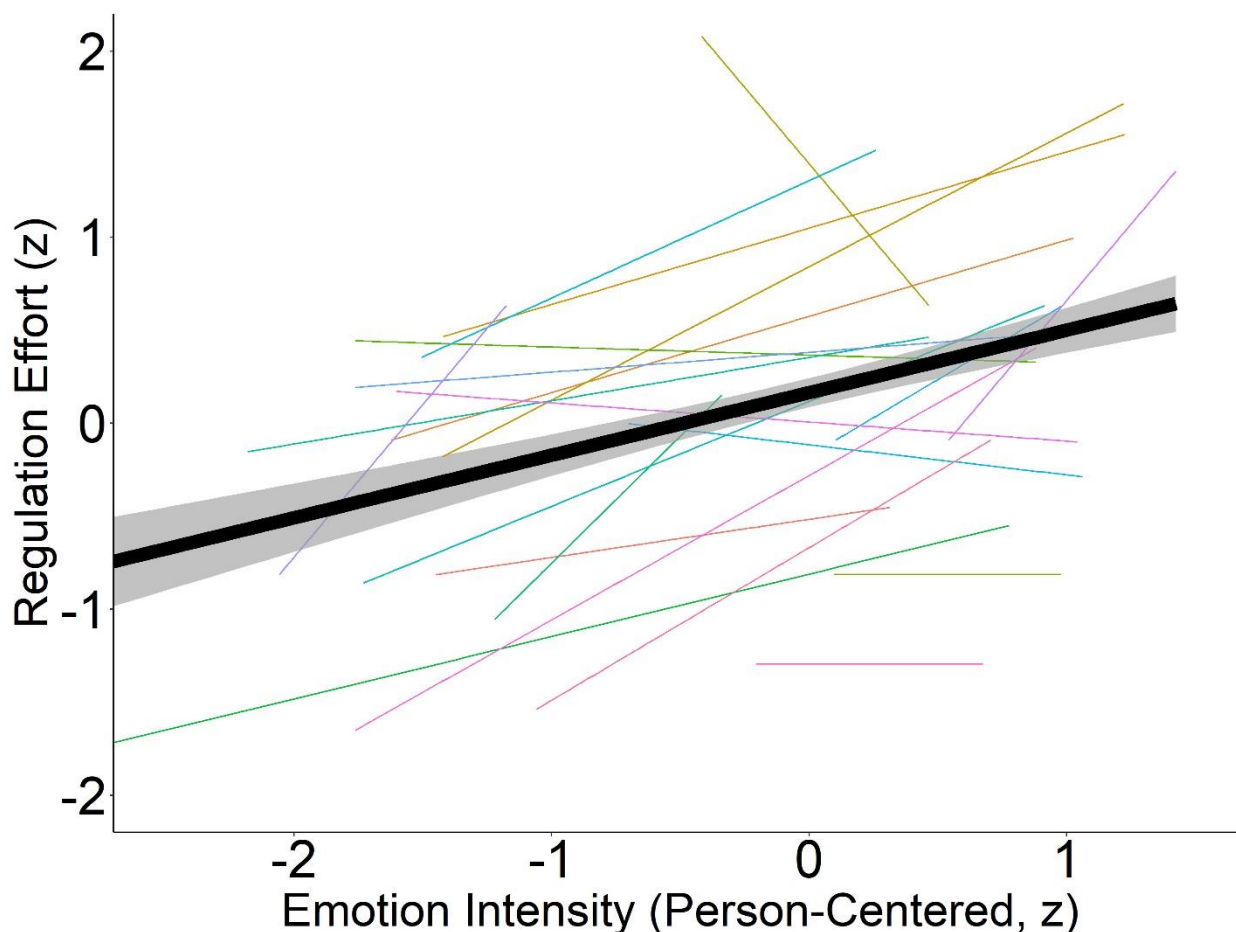


Fig 2. Emotional intensity predicts regulation extent ($\beta = 0.31$, $p < 0.001$) using a person-centered mixed effects linear model. The thick black line represents the sample trend while thinner lines represent the trajectories of individual participants. Regression ribbon represents standard error.

Intensity did not predict regulatory strategy usage. Using multilevel binary logistic regression models specifying regulation strategy usage as our criterion variable, participant as a random intercept, and building fixed effects from a null model ($ICC = 0.70$), we failed to find

any model that performed better than our null model by AIC comparison. Our model using only emotional intensity to predict regulation strategy usage trended significant in the model comparison ($p = 0.063$). However, even if traditional statistical thresholds were loosened and the model was deemed superior to our null, within that model, we did not find that emotional intensity demonstrated predictive utility towards strategy usage in that model (OR = 1.83, 95% CI = [0.65, 3.2], $p = 0.079$).

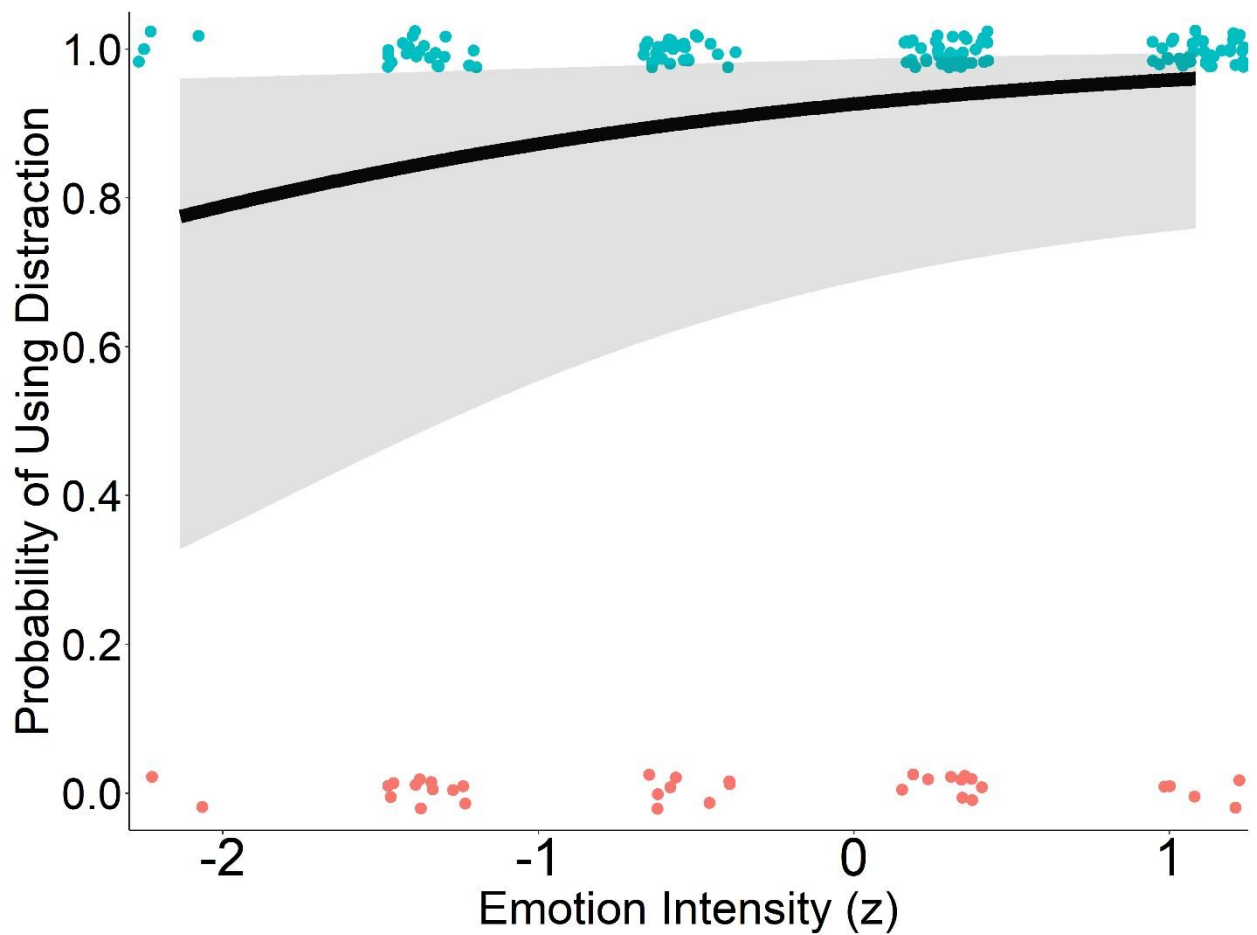


Fig 3. Across all tested mixed effects binary logistic regression models, emotional intensity failed to predict strategy usage. Visualized is our model using only emotional intensity to predict regulation strategy choice. Regression line represents likelihood of selecting distraction as opposed to reappraisal at any given emotional intensity value. Points represent individual observations. Regression ribbon represents standard error.

Because of the previously noted discrepancy in granularity of capturing emotion and regulation, analyzing the relationship between individual emotions and event-level regulatory strategies may be missing stronger relationships between emotions and regulation that exist when analyzing data at the event-level only. As such, additional analyses were conducted using the average emotional intensity of each event to predict strategy choice as well as the sum of emotional intensity for each event to predict strategy usage. In both cases, multilevel binary logistic regressions failed to perform better than the null model (ICC = 0.28; Emotion Sum: $p = 0.130$; Emotion Average: $p = 0.430$) and none of the affective variables demonstrated predictive utility towards strategy usage, reinforcing the results of our primary analysis. Thus, regardless of whether emotions are considered individually or concurrently, we do not find evidence to support an association between affective intensity and ER strategy usage in this context.

EXPERIMENT 2 METHODS

Experiment 1 found that emotional intensity did not predict which strategies people used in a quasi-naturalistic context, but suffered from limitations. In Experiment 2, we aimed to replicate and address limitations from Experiment 1 by A) doubling our sample size, B) capturing experiences immediately after exposure and at one week post-exposure to assess recall biases, C) assessing regulatory behaviors at the emotion-level D) capturing emotion in free response, and E) measuring notable covariates such as cognitive load, affective expectations, and motivations. We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

PARTICIPANTS: In October, 2021, 118 participants ($\bar{x}_{age} = 20.80$ yrs, range = 18 – 34 yrs, $sd_{age} = 2.87$ yrs, 73 female, 5 non-binary) were recruited from a large northeastern city via flyers for an IRB-approved fear and memory study. Sample size was increased relative to Study

1 to account for possible overestimation of effect sizes when translated to this new paradigm. Participants were compensated \$60.00 in Visa debit cards. Participants were less educated on average than Study 1 (\bar{x} *Years of Education* = 16.90 yrs, *sd* *Years of Education* = 2.75 yrs), with 81.9% reporting having completed some college (58.6%), a 4-year degree (12.9%), some post-graduate studies (03.4%), or a post-graduate degree (06.9%). Socioeconomic status was slightly negatively skewed, with 14.5% of respondents reporting making less than \$15,000 per year, 07.7% reporting between \$15,001 and \$25,000, 07.7% reporting \$25,001 to \$35,000, 05.1% reporting between \$35,001 and \$50,000, 22.2% reporting between \$50,001 and \$75,000, 12.8% reporting between \$75,001 and \$100,000, 17.9% reporting between \$100,001 and \$150,000, and 12.0% reporting greater than \$150,000. The racial and ethnic identities of participants were not assessed.

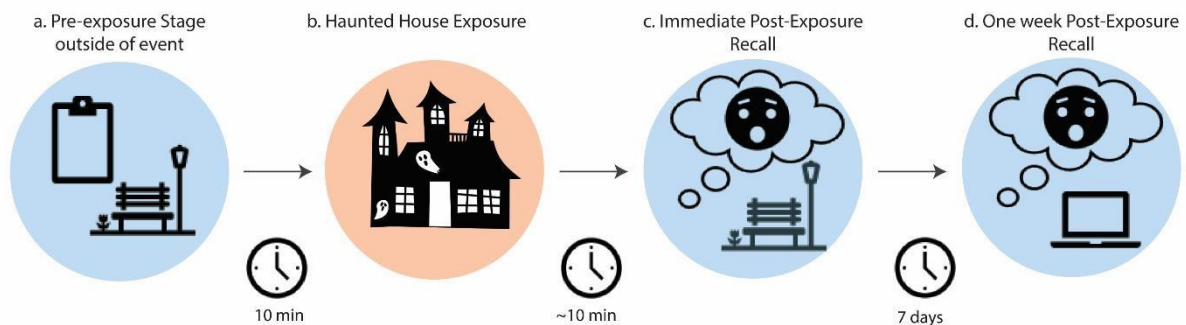


Fig 4. Study 2: Task Overview - One hundred and eighteen (118) participants traversed a haunted house in small groups. a. Prior to the haunted house, participants completed baseline questionnaires outside of the event at a local park. b. The haunted house lasted for ~37 minutes. c) Participants then immediately recalled three events, and their attempts to regulate them post exposure. d) They then again recalled the same three events and an additional six events at an online follow-up session.

MATERIALS AND PROCEDURE: Study 2 primarily mirrored Study 1 in design; therefore, we focus on deviations from Study 1.

Participants reported to a remote site located on the haunted house property to complete individual difference questionnaires, questionnaires assessing prior knowledge of the haunted

house, expectations, and motivations for participating, as well as a measure of cognitive load. Cognitive load was assessed prior to exposure, immediately after exposure and at follow-up using a 15-item Remote Associates Test (RAT). Forty-five RAT items were selected for their difficulty as measured by Bowden's 15-second trials, such that each item had two equally difficult counterparts which could be randomly assigned across the three timepoints (Bowden et al., 2003). Following instructions, participants completed three practice trials with feedback. During the RAT task, participants had 15 seconds to identify the target word and did not receive feedback. Participants were then fitted with heartrate monitors and escorted to the haunted house entrance.

Session 1, Haunted House. Due to COVID-related safety measures, the haunted house restructured to a non-linear format and reduced the number of themed sections. Our participants no longer entered before other patrons, but the format allowed the actors to reset before each new group entered the haunted house. Participants were binned into 31 groups across 11 nights ($\bar{x}_{size} = 3.81$ participants; $sd_{size} = 1.12$ participants). Participants were briefed with the same instructions as Study 1 before entry. The accompanying research assistant led the group through each section. The approximate exposure time was 37.40 minutes.

Session 1, Immediate follow-up session. Following exposure, participants completed immediate post-exposure assessments at the remote site. This included a surprise free recall and questionnaire for a randomly selected haunted house section. Participants were also tasked with identifying three emotionally salient events that occurred within that section and reporting affective and regulatory details of that event. Like Study 1, participants described the events, noted which emotions they felt, how intense those emotions were, and described how they tried to regulate those emotions, if at all. However, free response replaced emotion categories to better

reflect the natural, idiosyncratic affective experiences of participants. Participants were also asked directly whether they attempted to down- or up-regulate their experiences, how successful their regulatory efforts were, and regulatory responses were assessed in response to each emotion rather than each event. We refer to data captured at this time point as being “immediately reported”. These changes allowed us to examine regulation with greater precision than in Study 1, during which regulation was captured at the event-level and success and direction could only be inferred. Following completion of immediate post-exposure measures, participants were dismissed, instructed to not discuss their experiences, and to remain in contact with researchers for the one-week follow-up.

Session 2, Online follow-up session. Follow-up sessions were conducted remotely (*time since exposure*: $\bar{x}_{delay} = 7.01$ days; $sd_{delay} = 0.91$ days), though staff were readily available to respond to participant issues and questions. At follow-up, participants were reminded of the events they identified at immediately post-exposure with a keyword they provided to summarize the event. Participants were then tasked with recalling the affective and regulatory details of those previously recorded events. We refer to this data as “delayed recall”. Participants also identified 6 new events that they would be reporting on for the first time, which we refer to as “delayed reporting”. This allowed us to assess how the report of affective and regulatory event details may have changed between exposure and follow-up.

Questionnaire response processing and coding. Emotion responses were processed by: 1) removing entries lacking intelligible affective information (e.g., “-“, “nothing”, “idk man”), 2) removing unnecessary punctuation, hyphenation, and qualitative modifiers (e.g., “very sad” becomes “sad”, 3) splitting compound emotion response (e.g., “sad / angry” becomes “sad” and “angry”, 4) correcting spelling errors according to the top suggestions recommended by R’s

native spell checking software, 5) lemmatization (e.g., “annoyance”, “annoying”, and “annoyed” become “annoy”). These modified emotion responses were then merged with the NRC lexicon which contains over 20,000 English emotion words human rated by valence, arousal, and dominance (Mohammad, 2018). Valence was determined using NRC lexicon valence scores. Observations without an associated NRC lexicon entry were dropped due to lack of valence data. Two hypotheses-blind raters classified each observation’s strategy description into one or more strategy categories: Reappraisal, Distraction, a combination of the two, or none of the above (IRR Agreement = 0.877). Other Process Model strategies were not coded due to the relative infrequency with which they were reported during Study 1. Raters were undergraduate research assistants who were trained using the same methodology described in Study 1.

Analysis. To explore our primary question, the effect of emotional intensity upon regulatory strategy usage, we again specified mixed effect binary logistic regressions accounting for the random effect of participants using the “lme4” package (Bates et al., 2015) in R (R Core Team, 2022) and followed an information theoretic approach via AIC comparison. All data and scripts used to produce this analysis are publicly available at OSF (*See Open Practices*). Preregistration for Experiment 2 methods and hypotheses is publicly available at As Predicted (https://aspredicted.org/DPI_453).

RESULTS

A subset of 436 observations in which a negative emotion was downregulated by either distraction or reappraisal were used for these analyses. These observations came from 302 unique events reported by 84 participants across both timepoints. Of the 436 total observations, 254 (58.30%) reported using distraction to regulate their emotions. The average emotional intensity of observations was 2.34 (range: 0 – 4, Likert scale).

There were no differences in reported emotional intensity between immediate and delayed recall. We first aimed to retroactively determine the viability of examining emotion and regulation after a delay, as we had in Study 1, by comparing changes in affective and regulatory detail reporting over time. The z-scored emotional intensity of events immediately reported after exposure and reported after a delay (one week post-exposure) were not statistically different, as determined by a two-sample t-test ($x_{diff} = 0.10$, 95% CI = [-0.12, 0.31], $t(297) = 0.90$, $p = 0.4$) and the frequency of strategy reporting between the two time points also failed to demonstrate statistically significant differences, as determined by a chi square test ($\chi^2 = 0.4$, $p = 0.8$).

Participants accurately remembered their reported strategy usage, but not the emotion they reported experiencing. When comparing events reported immediately after exposure to what they recalled reporting one week later, we found that 84.62% of matched observations were classified with the same regulation strategy. However, we also found participants were only able to recall the same emotion they initially reported 26.21% of the time and a paired t-test revealed that the emotional intensity between these matched events decreased by an average of 0.29 standard deviation units over time (95% CI = [-0.53, -0.062], $t(57) = -3$, $p = 0.01$). Though, in comparing one-week post-exposure recall to events reported for the first time one-week post-exposure, we only find a trending statistically significant difference in affective intensity ($x_{diff} = 0.20$, 95% CI = [-0.40, 0.02], $t(278) = -2$, $p = 0.06$) and frequency of strategy usage. These results finding differences in average intensity between immediate report and delayed recall, but not immediate report and delayed report or delayed recall and delayed report may be indicative of affective labeling as a regulatory mechanism. Regardless, because of the lack of consistency in recalling the same emotion labels, we can only offer mixed support for the aim of our initial analyses.

Intensity does not predict regulatory strategy usage. To test our primary hypotheses, models using either z-scored emotional intensity or person-centered emotional intensity as the primary predictor were constructed, but across all model comparisons, including those adjusting for gender, age, motivations for participating, the extent to which participants anticipated feeling positive or negative emotions, cognitive load, an individual's general enjoyment of fear, State-Trait Anxiety Inventory scores, or Emotion Regulation Questionnaire scores, no model performed better than our null ($ICC = 0.488$). Our best performing non-null model, including only intensity as a fixed effect ($p = 0.16$ when compared to null), failed to demonstrate that

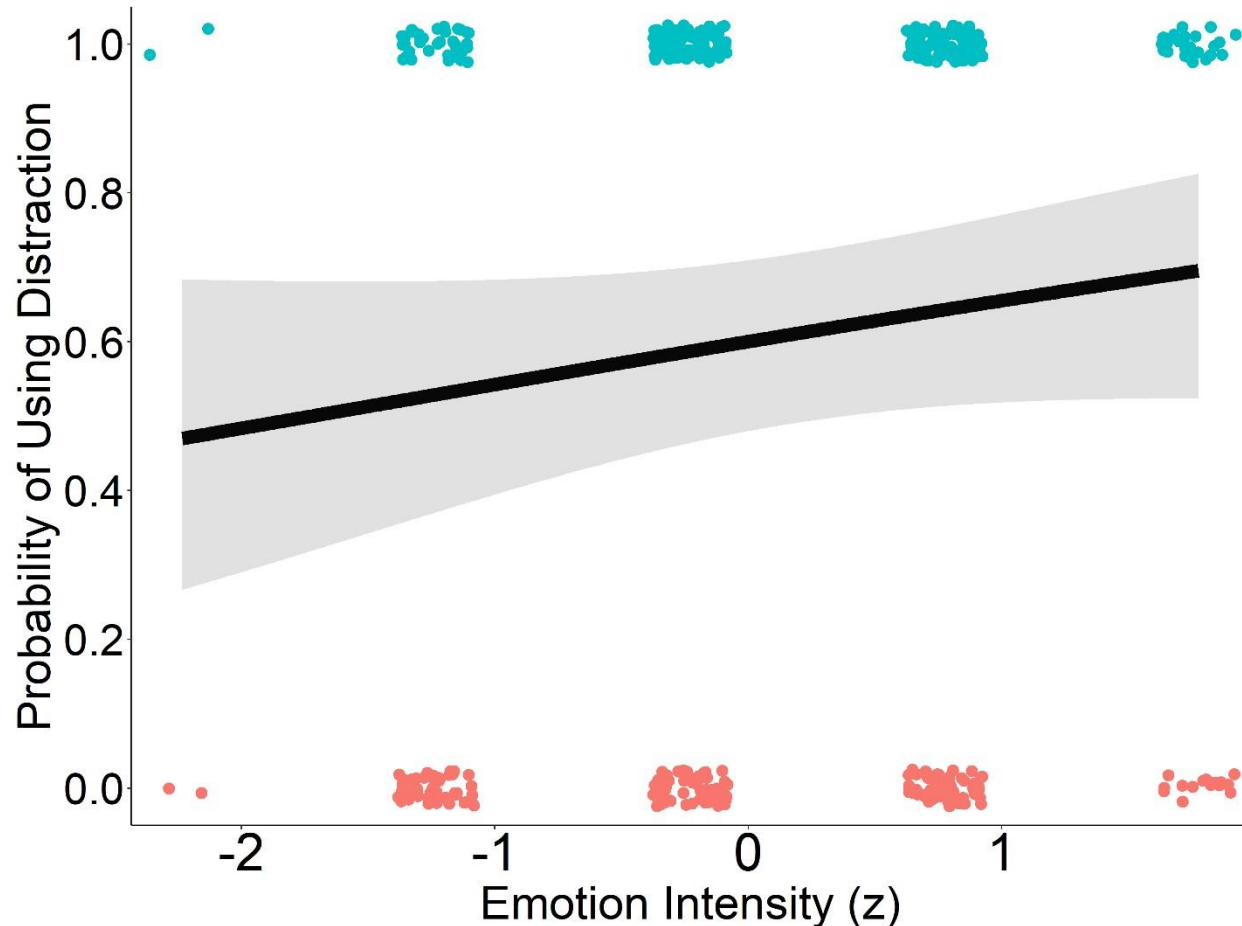


Fig 5. Across all tested mixed effects binary logistic regression models, emotional intensity again failed to predict strategy usage. Visualized is our model using only emotional intensity to predict regulation strategy choice. Regression line represents likelihood of selecting distraction as opposed to reappraisal at any given emotional intensity value. Points represent individual observations. Regression ribbon represents standard error.

emotional intensity had predictive utility towards usage (OR = 1.27, 95% CI = [0.92, 1.75], $p = 0.15$). This lack of effect was observed across time points as well. As such, we did not find evidence to support that emotional intensity predicts strategy usage in quasi-naturalistic circumstances.

Regulatory strategy usage and intensity interact to predict regulatory success.

Following our emotional intensity analyses, we explored how strategy usage moderated the relationship between intensity and success, high-intensity events using distraction should more successfully regulate emotions than high-intensity events using reappraisal (Sheppes, 2011).

After constructing a series of multilevel linear models and again following an information

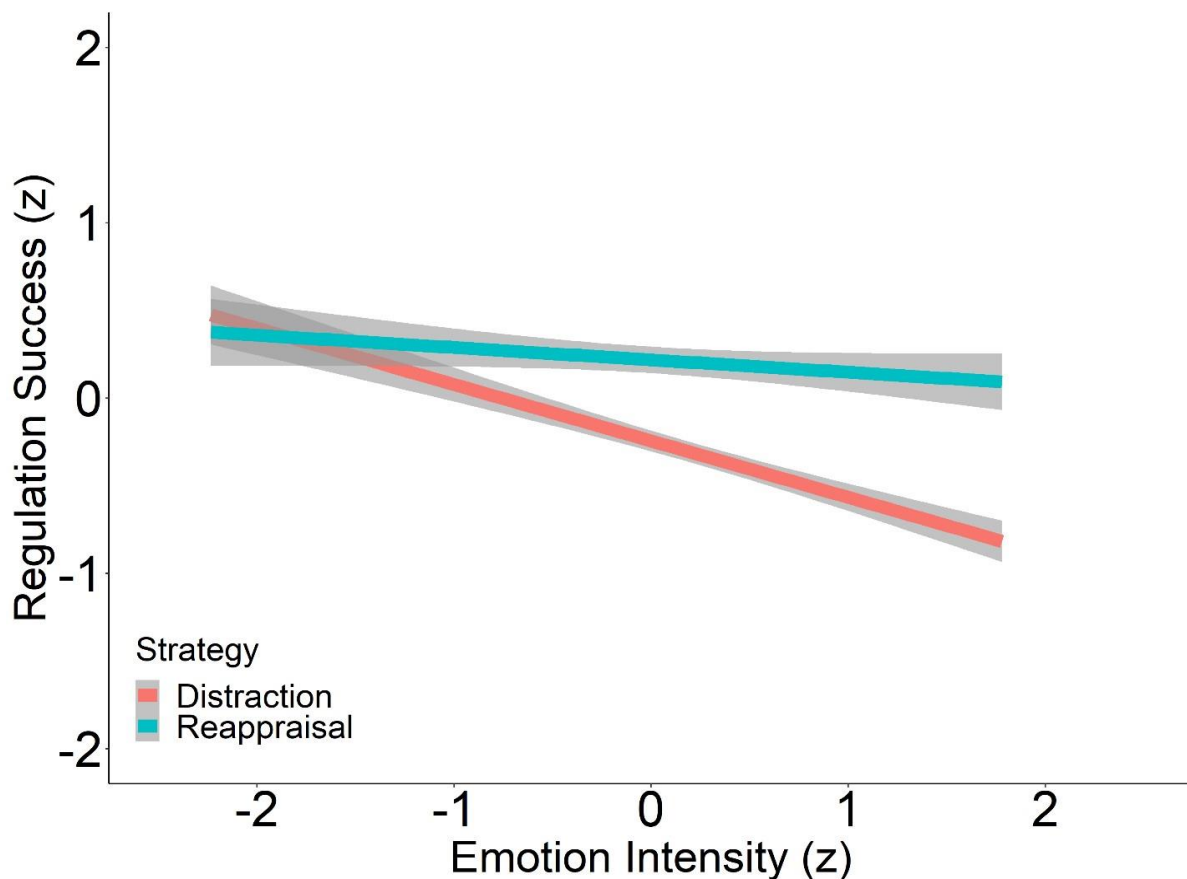


Fig 6. Strategy moderated the relationship between emotional intensity and regulatory success ($\beta = 0.25$, $p = 0.003$). While the success of reappraisal was relatively unrelated to emotional intensity, distraction demonstrated a negative association with emotional intensity, contrary to what extant literature might suggest. Given the frequency with which distraction was reported, the relative underperformance of distraction at high emotional intensities may partially explain the absence of an association between strategy choice and emotional intensity

theoretic approach, we found that our best-performing model did indeed include an interaction between strategy usage and emotional intensity ($ICC = 0.42$, $p = 0.003$) and found that interaction to be significant ($\beta = 0.25$, 95% CI = [0.09, 0.42], $p = 0.003$). However, a simple slopes analysis revealed a surprising finding: no relationship was observed between regulatory success and emotional intensity for events regulated via reappraisal ($\beta = -0.03$, 95% CI = [-0.16, 0.10], $p = 0.70$), but regulatory success was negatively associated with emotional intensity for distraction-regulated events ($\beta = -0.28$, 95% CI = [-0.40, -0.16], $p < 0.001$). As such, our data suggests that the efficacy of using distraction in high-intensity, quasi-naturalistic settings does not match that which has been established with lab paradigms.

EXPERIMENT 3 METHODS

Experiments 1 and 2 found emotional intensity predicted regulation effort, but not strategy usage. We theorized that isolating the stimuli from the complexity of our quasi-naturalistic setting might reintroduce the association between ER strategy and emotional intensity observed in strategy choice studies. We tested this in Experiment 3 by presenting the events recalled by experiencers (haunted house participants) to forecasters (people who had not been to the haunted house tasked with predicting how they would have responded to the events) (Wilson & Gilbert, 2003). Such a pattern of results may support the notion that ER behavior does not generalize across a continuum of ecological-validity in paradigm features. We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

PARTICIPANTS: In July 2021, 170 participants ($\bar{x}_{age} = 34.34$ yrs, range = 18 -75 yrs, $sd_{age} = 14.31$ yrs, 100 female, 2 non-binary) consented to an IRB-approved online study described as measuring individual differences in choice predictions. The racial identity of participants were as follows: 13.6% Asian, 06.8% Black, 04.3% Mixed, 03.7% Other, and 71.6%

White. Although socioeconomic status data is not available, 45.2% of participants reported working full-time, 19.2% reported working part-time, 24.7 % reported not working full- or part-time, and 11.0% did not specify their work status.

Sample size was determined assuming a 10% attrition rate, an r-squared value of up to 0.10 for covariates, and a small effect size ($OR = 1.68$, $1-\beta = 0.80$, $\alpha = 0.05$, two-tailed). Participants were screened for English fluency, literacy difficulties, cognitive impairments, vision impairments and a United States based-location. Eighteen participants were excluded for failing attention checks ($n = 7$), failing to complete the study ($n = 9$), and scoring a Q Recaptcha Score lower than 0.7, indicating significant bot activity ($n = 2$). Participants were paid at a rate of \$10.25/hr.

MATERIALS AND PROCEDURE: Details from the seventy-eight negatively-valenced Study 1 events regulated through either reappraisal or distraction were presented to participants who had not been to the haunted house. Although video and/or audio of the experience might have been preferable, the stipulations of our collaboration with the participating site meant we were not able to collect such stimuli. Participants first read definitions of both reappraisal (thinking about the experience in a way that reduces the intensity of the negative emotions) and distraction (looking or thinking about something else that is emotionally neutral) and reviewed examples of how both strategies might be employed. Participants performed a brief practice task before the primary task began. All 78 events from the primary task were randomized and serially presented. For each event, the emotions experienced, the intensity of each emotion, how the experiencer described the event, and definitions for both strategies were displayed. Participants were then asked to predict which strategy they would

choose to reduce the emotional intensity of the situation. Following the primary task, participants completed individual difference measures.

Analysis. To explore whether the affective intensity experiencers reported influenced the strategies forecasters chose, we again specified mixed effect binary logistic regressions accounting for the random effect of participant (both forecaster and experiencer) using the “lme4” package (Bates et al., 2015) in R (R Core Team, 2022) and followed an information theoretic approach via AIC comparison. Fixed effects models were built from a null model (ICC = 0.14). All data and scripts used to produce this analysis are publicly available at OSF (See Open Practices). The design and hypotheses of Study 3 were preregistered with AsPredicted (https://aspredicted.org/XXH_W1V).

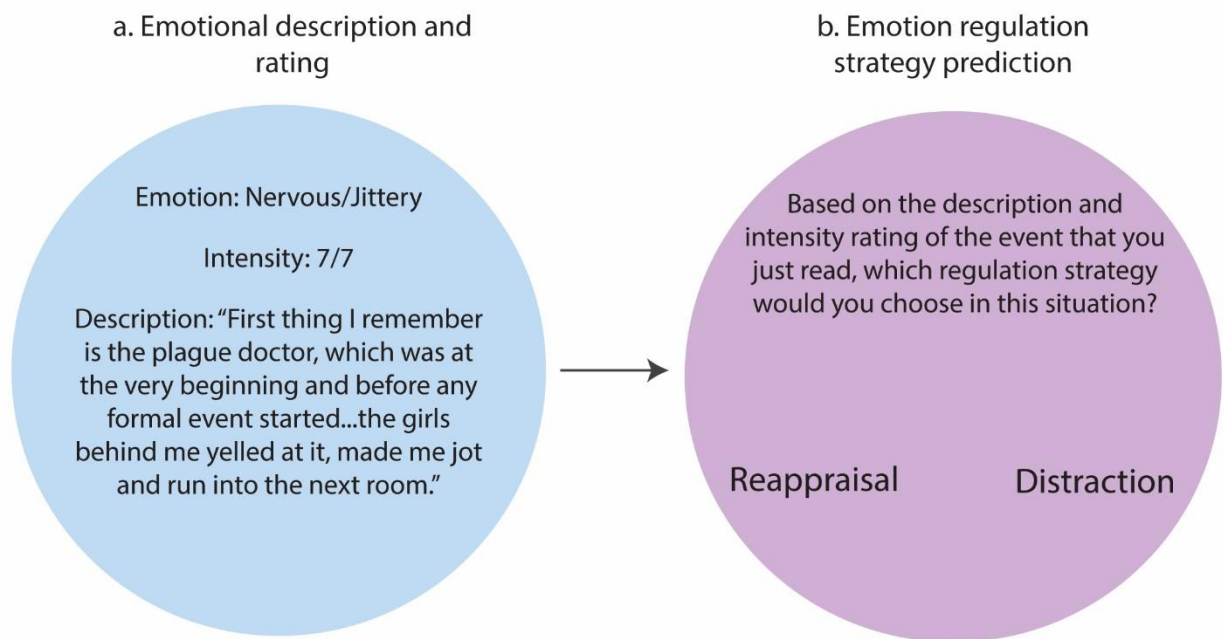


Fig 7. Study 3: Task Overview - One hundred and seventy (170) participants (forecasters) read the descriptions that Study 1 participants (experiencers) wrote about their emotional experience in the haunted house. a. Forecasters read the experiencers’ emotional descriptions and intensity rating . b. Forecasters indicated what regulation strategy (distraction or reappraisal) they would use to regulate their emotions in the described event.

RESULTS

Intensity predicts regulatory strategy choice for forecasters, but not for experiencers. We found that our model using only emotional intensity to predict strategy choice performed better than our null model ($p = 0.004$) and comparable, more complex models. In this model, we observed a small association between choice and emotional intensity (OR = 1.06, 95% CI = [1.02, 1.10], $p = 0.004$). Like Study 1, we also explored this relationship when emotional intensity was summed and averaged at the event level. We found that analyzing using event-average emotional intensity mirrored our primary analysis in model performance and criterion-predictor association (OR = 1.12, 95% CI = [1.06, 1.19], $p < 0.001$) as did our summed emotional intensity approach (OR = 1.03, 95% CI = [1.01, 1.05], $p = 0.032$). Though we remain agnostic as to which approach might be most appropriate, the pattern of significance across all

three approaches is clear: the relationship between emotion intensity and strategy choice resembled that observed within emotion-regulation choice lab paradigms.

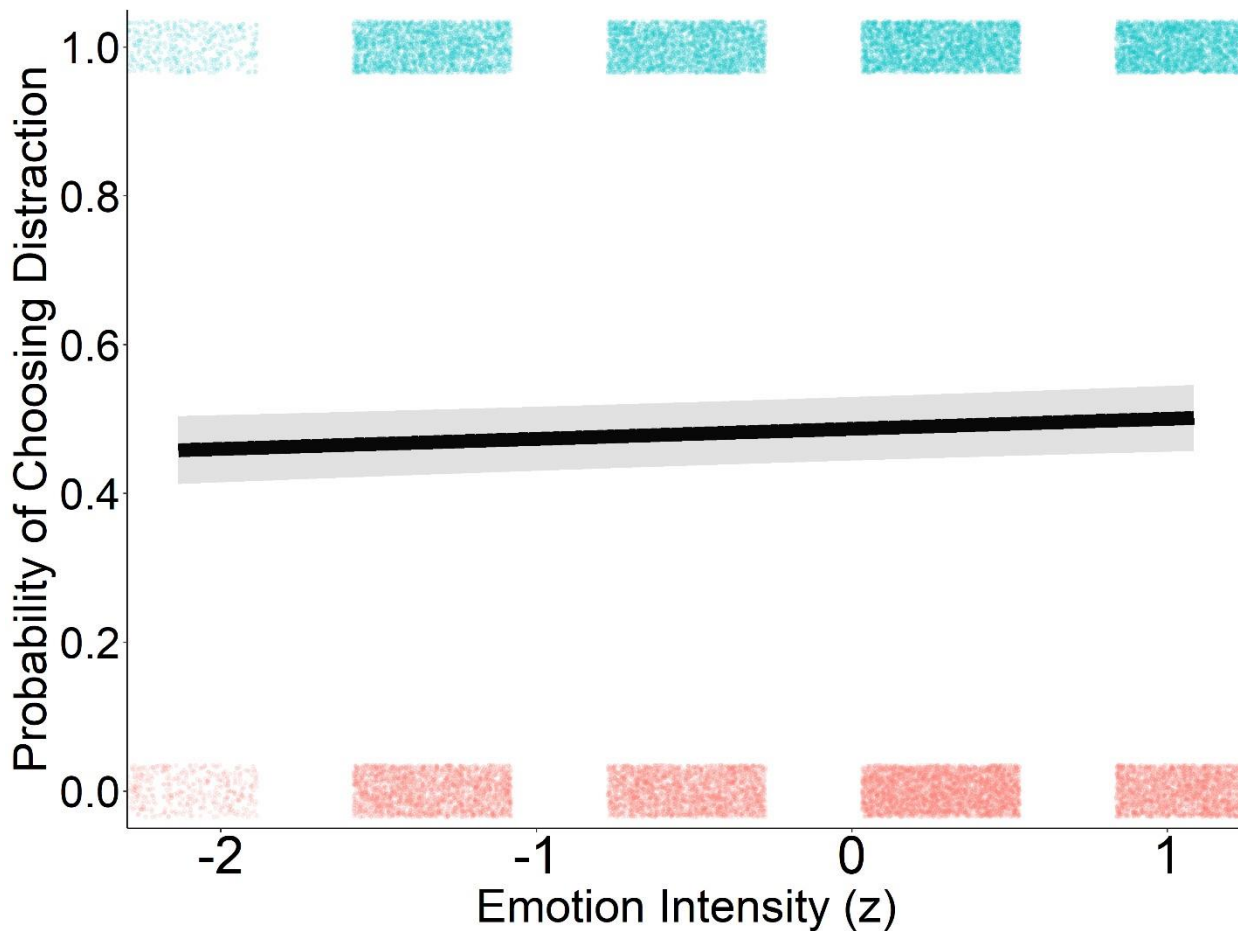


Fig 8. Emotional intensity did predict the strategies individuals chose once events were decontextualized (OR = 1.056, $p = 0.004$). Regression line represents likelihood of selecting distraction as opposed to reappraisal at any given emotional intensity value. Points represent individual observations. Regression ribbon represents standard error.

GENERAL DISCUSSION

Three experiments examined the association between emotional intensity and regulation strategy usage in a quasi-naturalistic context. Experiments 1 and 2 tasked untrained participants to recall emotional and spontaneous regulatory behaviors in a surprise recall task after exposure. As predicted, emotional intensity predicted regulation extent, but not strategy usage. Experiment 3 demonstrated that decontextualizing the events reported in Study 1 introduced associations

between affective intensity and strategy choice akin to lab studies, albeit, with a much smaller effect size. The present findings highlight challenges in translating emotion regulation theory to real-world application, as decontextualized high-intensity paradigms may not accurately reflect regulatory behaviors in everyday life.

Cold-to-hot empathy gap research, or forecasting differences between how people feel in relatively decontextualized circumstances and how they think they would feel in more intense circumstances (Loewenstein, 1996), may be of note. Individuals in “cold states” consistently under predict the challenges associated with meeting affectively-relevant goals during “hot states” (Fisher et al., 2014; Sayette et al., 2008; Van Boven et al., 2003). Such a pattern mirrors the differences observed between Experiments 1 & 2 and Experiment 3, wherein decontextualizing events (i.e., shifting from a hot state to a cold state) yielded a predictable pattern in strategy choice not observed during hot state ER usage. Such patterns highlight that emotion self-regulation is a complex, multi-faceted construct and different proportions of its variability may be better captured by different approaches (Friedman & Gustavson, 2022). Though this study is the first to our knowledge that has utilized quasi-naturalistic paradigms to demonstrate this in the domain of ER, similar approaches have demonstrated similar discrepancies in moral domains (FeldmanHall et al., 2012).

We also observed in Study 2 that recalling previously reported emotion reduced intensity but differences were not observed between the emotional intensity of events reported immediately after exposure and one week after exposure. Such patterns might parallel similar trajectories outlined within the affective labeling literature, in which the act of semantically reviewing an emotional experience can itself be a form of ER and reduce the emotional intensity of an experience (Torre & Lieberman, 2018). The process of evaluating experiences within our

surprise self-report task may itself be a form of regulation and introduce additional variability into the association between emotional intensity and ER strategy usage.

There are several limitations in our experimental approach that have not been noted. First, our narrow aims resulted in excluding many observations, though the volume of observations not meeting lab-like standards further highlights the discrepancy between ER choice paradigms and actual ER usage. Additionally, though many of the features they possess may overlap with common situations in which we may regulate emotions (Clasen, Andersen, and Schjoedt, 2019 ; Tashjian et al., 2022), haunted houses may not generalize to other high-intensity naturalistic settings. The use of a haunted house as our setting also may have resulted in self-selection biases. When asked about motivations for participating, thrill seeking ($x = 65.7$, 0 – 100 scale) was slightly above the average of all motivations ($x = 52.0$, $sd = 28.5$) and enjoyment of fear was just above the scale midpoint ($x = 3.88$, 0 – 6 scale). Although participants were instructed to not discuss their experiences, the group context in which the experience occurred may have influenced behavior choices and cognitive perceptions. Future research should limit the delay between experience and report as much as possible without interfering with the emotional event. Despite limitations, this dataset and approach may be of interest to those exploring spontaneous regulation tendencies from untrained participants in response to both positive and negative events.

Taken together, the present experiments represent what we believe to be the first attempt to extend the association observed between affective intensity and ER behavior to a high-intensity quasi-naturalistic setting using untrained participants. This approach offers an alternative means of exploring emotion regulation usage in an ecologically-valid fashion. Our data and results may be of particular interest to other emotion, self-regulation, and cognitive

control researchers interested in quasi-naturalistic design. In failing to replicate lab results with Studies 1 and 2 but finding a modest association in Study 3, we may have support for theories postulating a divergence in the mechanisms underlying ER choice and usage, though the limitations inherent to this study leave room for other possibilities. As such, if we aim to more accurately model human regulatory behavior, it may be necessary for researchers to capture phenomena beyond the labs; to observe the awards that left us unfulfilled, the feedback that we couldn't handle, and the Fielder-esque awkward moments that elicit strong emotional reactions.

Acknowledgments:

We thank Ian O'Shea, Isabel Leiva, Angelique Vittone, Lauren Iglio, Kathryn Lockwood, Devlin Eckardt, Adhya Gowda, and Troy Houser for collecting and/or coding data.

Declaration Of Conflicting Interests:

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Funding:

This work was funded in part by the Brain and Behavioral Research Foundation's NARSAD Young Investigator Award received by Vishnu P. Murty and by the National Science Foundation (Grant No. 2123474).

Open Practices:

Experiment 1 was not preregistered; the preregistration for Experiments 2 and 3 can be found at https://aspredicted.org/DPI_453 and https://aspredicted.org/XXH_W1V, respectively.

Deidentified data, code, and questionnaires to replicate the findings have been made publicly available via OSF and can be accessed at

https://osf.io/j5sku/?view_only=89d87669e7674096819c439ca109c483.

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