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Emotion regulation strategy usage in a dynamic, high-intensity context

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ABSTRACT (236 / 250 Words): Successful emotion regulation requires effective strategy selection. Prior research suggests that disengagement strategies (e.g., distraction) are more likely to be selected than engagement strategies (e.g., reappraisal) as emotional experiences intensify. However, the extent to which emotion regulation strategy *choice* relationships in ideal or controlled circumstances reflect strategy *usage* during high-intensity, complex, multimodal events is not well understood. The present research uses a high-intensity, high-stimulation multimodal environment to examine the association between affective intensity and regulatory strategy usage among untrained participants - individuals given no prior regulation instructions or direction - while navigating a haunted house. Study 1 ($n = 118$) failed to find a relationship between emotional intensity and use of engagement and disengagement strategies to downregulate emotions. Though more intense experiences did not predict more frequent distraction usage, the regulatory success of distraction, but not reappraisal, decreased as emotional intensity increased in this context. This deviation from the expectations set by extant literature might reflect an inherent lack of distraction affordances during high-intensity, high-stimulation events. To determine whether less stimulating representations of the same experiences might better reflect established associations between strategy selection and emotional intensity, Study 2 participants ($n = 152$) predicted regulation strategy usage based on the experiences reported by the pilot participants. The forecasted choice of predictors closely mirrored regulatory choice associations reported in prior literature. This pattern of results emphasizes the importance of context in directing emotion regulation behavior and determining regulatory success.

SIGNIFICANCE: How individuals manage their emotions during high-intensity, high-stimulation experiences is an important question for anxiety- and trauma-based disorder prevention and treatment. This study found distraction, but not reappraisal, to be less effective as emotional intensity increases in these difficult-to-regulate environments, which contrasts findings from relatively less demanding contexts.

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

INTRODUCTION

Overwhelming and highly stimulating situations can generate profoundly intense emotions which often do not match our ideal emotional states. We can attempt to change our emotional responses when navigating loud, crowded spaces, unexpected confrontations, or circumstances that we lack control over, but our ability to successfully regulate our emotions in these contexts may be limited. A key factor which may drive the efficacy of regulation is which strategy an individual engages with, as the efficacy of a regulation strategy is highly context-dependent. As such, researchers have emphasized studying emotion regulation (ER) in different contexts as the next crucial direction for the field (Aldao, 2013; Dixon-Gordon et al., 2015; English et al., 2017; Rottweiler et al., 2018; Tang & Huang, 2019).

The Process Model of Emotion Regulation. Foundational emotion regulation research (i.e., the Process Model) has identified categories of common strategies that people use to regulate their emotions (Gross, 1998). Characteristics of the regulator and the context can determine the effectiveness of these strategies (Young & Suri, 2020) and people often choose strategies to match their present circumstances (Opitz et al., 2015; Sheppes et al., 2011). For example, regulation strategies are often dichotomized as engagement strategies which have high cognitive demands, like altering the meaning or interpretation of the emotion-eliciting stimulus (i.e., reappraisal), or disengagement strategies which have low cognitive demands, like diverting attention (i.e., distraction) or inhibiting the expression of emotion (i.e., suppression) (Sheppes & Gross, 2011).

Although not explicitly directed to do so, the anticipation of a scary moment during a horror movie might prompt a person to look away from the screen (distraction), think about the actors in a different light (reappraisal), or limit the expression of their fear, all in an effort to reduce, or downregulate, an unwanted feeling. People in situations with few cognitive resources may

compensate by selecting strategies that demand less cognitive effort according to the selection, optimization, and compensation hypothesis (Opitz et al., 2012). For example, if you are watching this horror movie while you are tired, it may be easier to look away from the screen than generate alternative, less fear-inducing perspectives by which to view the actors. Attempting to reappraise would constitute a high-risk strategy in this context because it might be less likely to work (Ford & Troy, 2019). This supposition is bolstered by the especially robust influence of emotional intensity upon strategy choice, as distraction is chosen more often and is more effective than reappraisal in response to high intensity stimuli (Hay et al., 2015; Orejuela-Dávila et al., 2019; Shafir et al., 2016; Sheppes & Gross, 2011; Young & Suri, 2020), at least in part because it is less effortful when emotional intensity is high (Silvers et al., 2014). This effect has been thoroughly replicated in lab studies and ecological momentary assessment (EMA) studies (Colombo et al., 2020; Haines et al., 2016; Heij & Cheavens, 2014). However, this association may not readily translate to more complex and demanding environments (Sheppes, 2020), like which we test directly here, due to differences in how we commonly measure and manipulate emotion regulation in order to study it.

Extant Emotion Regulation Paradigms. Lab ER paradigms differ from the everyday experience of ER in a few key ways. Lab ER paradigms (e.g., Sheppes et al., 2011, 2014) usually train participants to use regulatory strategies before a task begins, which may prime more introspection and metacognition (Carver & Scheier, 1981) than what occurs in the typical ER experience. Lab ER paradigms also often necessarily show previews of emotional stimuli to allow participants to prepare their regulatory responses, but high-intensity, stimulating events in our everyday lives are often unexpected or difficult to anticipate. Following stimulus previews, lab ER paradigms also frequently prompt individuals to select a strategy, but aversive experiences in

everyday life, like erratic driving behavior or being bullied, may not explicitly prompt the implementation of self-regulation.

Self-report capture of emotion in ER studies is often either assumed based upon standardized ratings associated with the stimuli (e.g., IAPS picture set) (Bradley & Lang, 2007), measured through unidimensional likert scales (e.g., Valence; (Shafir et al., 2016), or is captured through established measures (i.e., Positive and Negative Affect Schedule; (Watson et al., 1988; Weiss et al., 2021). These approaches offer strong-validation and unparalleled control but might not accurately reflect the multidimensionality of emotional experience. Modern constructivist theories of emotion hold that emotional experiences are dynamically constructed by individuals through cognitive and social processes, including personal interpretations, beliefs, and social interactions (Lindquist et al., 2012). However, advancements in natural language processing and linguistics make a more flexible and ecologically-valid capture of multidimensional emotional experiences, such as free-response, possible to better represent the idiosyncratic richness that constructivist frameworks emphasize (Mohammad, 2018) without sacrificing reporting accuracy (Diamond et al., 2020). Furthermore, by not limiting participant self-report options to discrete categories or unipolar scales, free-response can capture emotional experiences with less influence or fewer assumptions from researchers which might color the experience of participants (Gendron et al., 2012; Lindquist et al., 2006).

EMA studies capture emotionally evocative events within the daily lives of trained research participants (e.g., Colombo et al., 2020; Haines et al., 2016; Heiy & Cheavens, 2014). However, most people are not trained to consider their emotion regulation strategies in their daily lives and are not prompted or primed to engage regulatory control before an emotional event occurs (Friedman & Gustavson, 2022). As such, training participants may introduce important but often

underappreciated deviations in regulatory behaviors from how untrained counterparts might respond in the same situation. Correspondingly, research designs that incorporate more features of real-world regulation, such as not instructing or prompting participants to regulate (e.g., Heiy & Cheavens, 2014; Opitz et al., 2015) often find people explore and flexibly apply multiple strategies that blur the boundaries of typical strategy classifications (Aldao & Nolen-Hoeksema, 2013; Ford et al., 2019; Heiy & Cheavens, 2014; Opitz et al., 2015; Szasz et al., 2018). These approaches also capture meaningful variance in self-regulatory behaviors that more controlled designs cannot (Friedman & Gustavson, 2022; Kamradt et al., 2014; Malanchini et al., 2019). For example, overstimulation from complex, multimodal contexts may simultaneously be aversive and more cognitively demanding (i.e., better suited for disengagement strategies). However, attention may also be challenging to control in a context with so much attention-demanding stimuli, reducing the likelihood of observing the high-intensity-distraction association characterized in laboratory studies (Draheim et al., 2022). Spontaneous or untrained ER in these contexts may rely more heavily on person-level features like habits relative to contextual features like emotional intensity (Christou-Champi et al., 2015; Koole et al., 2015; Norem, 2008). Yet, challenging, high-stimulation situations may be precisely when adaptive regulatory control is most valuable, as maladaptive emotion regulation tendencies predict more severe manifestations of post-traumatic stress disorders (Hannan & Orcutt, 2020) and related post-traumatic stress disorder outcomes (Specker & Nickerson, 2022). Thus, identifying whether the established association between intensity and effort-related strategy usage occurs in high stress/stimulation contexts is important for the development of potential interventions.

The Present Study. To our knowledge, no study has examined whether affective intensity predicts strategy usage in aversive, high-intensity, multimodal contexts using untrained

participants (i.e., individuals given no prior training in how to use or classify emotion regulation strategies and no direction to regulate their experiences). While affective intensity represents a particularly prominent predictor of ER behavior (i.e., $r^+ = 0.46 - 0.61$; “a very large effect size”, according to recent meta-analyses (Matthews et al., 2021), the extent to which features of a challenging, high-stimulation, multimodal situation could overshadow this effect remain unclear. The goal of the present research is to examine whether these well-established 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. Haunted house experiences have been used with marked success in recent research to study emotion and self-regulation (Clasen, 2019; Stasiak et al., 2023; Tashjian et al., 2022). While haunted houses only represent a small proportion of the variability which emotionally-relevant experiences could materialize as, they nonetheless use safe and controlled but highly-stimulating events to elicit a wide range of emotional experiences (i.e., positive and negative emotions), intensities, and responses (i.e., regulation behaviors). This variance would be difficult to generate in any other complex multimodal context outside of the lab while offering the same level of safety to the participants and control to the researchers.

Because of the near ubiquitous comparison between reappraisal and distraction selection in the extant regulation literature (Heij & Cheavens, 2014), in Experiment 1 we aimed to replicate this effect by having untrained participants navigate a haunted house and report their undirected emotional and regulatory behaviors in a surprise recall task immediately after and one week after exposure, which granted high levels of fidelity in capturing the subjective participant emotion and experience. Surprisingly, we did not find an association between intensity and strategy usage. Important covariates including cognitive resources, regulation tendencies, and emotional goals

were captured and adjusted for in these statistical models, but still failed to generate significant associations. This surprising finding motivated Experiment 2, which aimed to determine whether participants exposed to similar experiences as the haunted house but in a less overwhelming, lower-intensity context would more often select distraction in response to high intensity events and reappraisal in response to low intensity events. We did observe the canonical association between emotional intensity and regulatory strategy selection with this design.

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 an immersive, high-intensity, multimodal setting with an untrained sample of participants. To assess emotional intensity, participants performed a surprise free recall task immediately after exposure during which they self-reported the emotions they experienced via free-response and the intensity of those emotions during self-selected events from the haunted house. Participants also noted the direction of their regulation attempts (i.e., upregulation, downregulation, no regulation), how effective those regulation attempts were, and the means by which they attempted to regulate in their own words. We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

PARTICIPANTS:

Pilot Study. A pilot study was conducted in October 2019 consisting of 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) who were recruited from a large northeastern city via flyers for an IRB-approved fear and memory study. Piloting allowed us to determine the distribution of emotion regulation strategy usage in this context and determine a more appropriate sample size for our primary study, as a review of the extant literature did not yield analogous study designs within the emotion regulation space. A priori power analyses for this pilot were conducted using the smallest effect size reported by Sheppes et al.'s 2011 examination of emotional intensity and regulatory choice ($\eta_p^2 = 0.43$). Using WebPower (Zhang & Mai, 2019) in R 3.6.1 (R Core Team, 2022), we determined 18 participants would sufficiently power our main effect in a typical lab context. Given the additional complications our study design introduces which would likely reduce the effect size between our variables of interest

and the resources we had available, we surmised a sample of 54 participants, three times the minimum sample size, might be sufficient to identify an effect. This exploration failed to find a statistically significant association between affective intensity and strategy usage, but our best performing multilevel binary logistic regression model [strategy ~ intensity + (1 | Participant)], as determined by an AIC comparison information theoretic approach, produced an odds ratio of OR = 1.83 (95% CI = [0.65, 3.2], $p = 0.079$) (See **Supplementary Materials** for more pilot design and analyses details). This observed model from the pilot was used to generate an a priori power curve for Experiment 1 via *simr* (Green & MacLeod, 2016) in R 3.6.1, which estimates the proportion of simulated datasets in which the null hypothesis is rejected given the target model. This approach to calculating power is preferable for hierarchically-structured data because it does not assume independence of observations. We determined that at least 76 participants with an average of 3 observations each (228 observations total) would be required to sufficiently power our experiment based upon simulations with the observed data (Two-tailed, $\alpha = 0.05$, $1-\beta = 0.80$, $Pr(Y=1/X=1) | H_0 = 0.615$). We increased the target sample size to 120 participants, due to attrition concerns and the needs of a concurrently-ran experiment on fear and memory. However, we were only able to recruit 98.33% of our recruitment goal due to time constraints (i.e., all data collection must occur before the haunted house closes for the season).

Experiment 1. 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 study on fear processing at a local haunted house attraction (**Fig. 1**). Eligible participants were native English speakers between the ages of 18 and 35, had normal or corrected-to-normal vision, were not pregnant, had no history of seizures, cardiovascular issues, or neurological disorders, could comfortably walk for at least one hour, and had not been to this

haunted house in the past. On average, participants were more educated (\bar{x} *Years of Education* = 16.90 yrs, *sd* *Years of Education* = 2.75 yrs) than the average US adult, who according the U.S. Census Bureau's American Community Survey, has completed 13.7 years of education. Categorically, 81.9% reported 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. Participants were compensated \$60.00 in Visa debit cards.

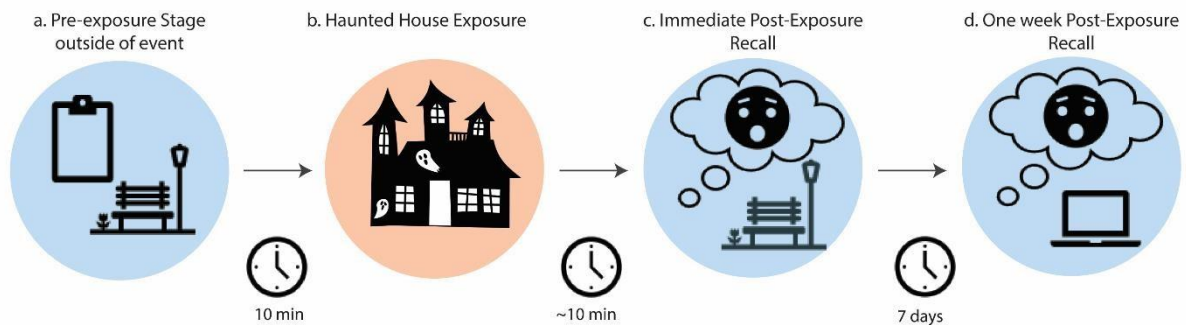


Fig 1. Study 2: Task Overview - One hundred and eighteen (118) participants traversed a haunted house in small groups. a. Prior to the haunted house, participants completed baseline questionnaires outside of the event at a local park. b. The haunted house lasted for ~37 minutes. c) Participants then 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:

Pre-Exposure. Participants reported to a provisional headquarters (i.e., tent, tables, chairs, computers, etc.) constructed just outside 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. To assess prior knowledge, participants indicated the number of times they had attended other haunted houses, how much information they feel they know about this specific haunted house (1 = ‘None at all’, 5 = ‘A great deal’), and from which sources had they learned information about this specific haunted house (e.g., advertisements, friends, news reports, etc.). To assess expectations, participants were asked how much positive and negative emotion they anticipated experiencing prior to exposure on a 5-point Likert scale, with 1 being ‘None at all’ and 5 being ‘A great deal’. Participants were also asked how fearful they felt, how sensitive they were to startling stimuli, how much they enjoy haunted houses, and how much they enjoy feeling fear (all assessed on Likert scales). Motivations to participate were assessed using 100-point sliding scales and included payment, thrills, novel experiences, challenges, social pressure, scientific interest or duty, and boredom. Cognitive load was assessed prior to exposure, immediately after exposure and at a later 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 & Jung-Beeman, 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, the data from which has been covered in another article (*See Stasiak et al., 2023*), and escorted to the haunted house entrance. All pre-exposure questionnaires and materials are available within our OSF repository (*See Open Practices*).

Exposure (Haunted House). Participants experienced the haunted house in 31 groups across 11 nights ($\bar{x}_{size} = 3.81$ participants; $sd_{size} = 1.12$ participants). This specific haunted house was chosen because: 1) it uses professional actors renowned for eliciting a range of affective responses; 2) it contained four themed sections each with a unique aesthetic providing variability to the stimuli; 3) it provides a remarkably consistent experience across sessions; and 4) coordination with the facility granted us special privileges to use equipment (i.e., computers, heart-rate monitors) and better guarantee consistency across exposures (i.e., entering before other guests, keeping groups together).

Participants received 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 without interacting with each other (i.e., grabbing, holding, touching, etc.). As part of a concurrently-run memory experiment, some participants ($n = 58$) did receive additional instruction to navigate specific sections as if they would later have to complete a memory test or write a review of that section. However, these groups did not statistically differ significantly from the control group in reported affective intensity ($F(2,81) = 1.41, p = 0.25$), regulation strategy choice ($\chi^2(2) = 4, p = 0.10$), or regulation strategy success ($F(2,81) = 1.93, p = 0.15$) as determined by mixed effects ANOVA and a chi square test. The data relevant to this memory experiment is beyond the purview of this study and is better captured within another forthcoming manuscript. The accompanying research assistant led the group through each section. The approximate exposure time was 37.4 minutes.

Post-Exposure. Following exposure, participants completed immediate post-exposure assessments at a remote site outside of the haunted house. Participants were tasked with identifying

three emotionally salient events that occurred from a randomly selected haunted house section and reporting affective and regulatory details of that event. Events from other haunted house sections were not tested during the immediate exposure session to avoid conflicts with the concurrently-running memory experiment. Participants were not trained in emotion regulation strategies, nor were they primed to consider their emotion regulation strategies prior to these questionnaires. Though experiential sampling methods (ESM) and ecological momentary assessments (EMA) are often applied in naturalistic settings to capture moment-to-moment fluctuations in emotion and regulation with considerable success (*See* Colombo et al., 2020; Shahane et al., 2023), we chose post-exposure assessments as our means of assessment in part for the following reasons : 1) the potential for participant reactivity in response to assessing mid-exposure can lead participants to alter their affective and regulatory behaviors in response to the assessment prompts (Stone et al., 2003), 2) training participants to use ESM or EMA technology effectively in this context would require training in emotion regulation strategy categorization in violation of the goals of this study, and 3) the use of such technology during exposure would violate the immersive, high-intensity nature of the context (Shiffman et al., 2008). Participants described the events, noted which emotions they felt via free response, how intense those emotions were on a 5-point Likert scale, and described how they tried to regulate those emotions, if at all, via free response. People's accuracy in recalling details of similar real-world experiences via free response has surprisingly high in recent investigations using similar methodology (Diamond et al., 2020). 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". Following completion of immediate post-exposure measures, participants

were dismissed, instructed to not discuss their experiences, and to remain in contact with researchers for a follow-up session which was conducted remotely (*time since exposure*: $\bar{x}_{delay} = 7.01$ days; $sd_{delay} = 0.91$ days) to assess how memory of self-regulation and memory accuracy in this context alters over time. At this delayed follow-up session, participants were tasked with identifying six additional events and their affective and regulatory responses to each.

Strategy Usage Coding. During piloting, two hypotheses-blind raters classified strategy descriptions into one or more strategy categories: Reappraisal, Distraction, Suppression, Situation Selection, Situation Modification, or ‘None of the above’ (IRR Agreement = 0.880). Raters were also provided the participant’s description of the event and the emotions they experienced which they indicated having downregulated. 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 (Shafir et al., 2016; Sheppes et al., 2011). Lastly, raters independently completed classification exercises using examples of regulation strategy descriptions from the same context but which were not included in the primary data 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, raters emailed their assessments to the moderator, who compared the ratings for disagreements (i.e., cases in which raters disagreed on how a regulation event should be classified). The moderator then 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’s role was to facilitate discussion of classifications and document

their conclusions, but was not involved in the discussion and disconnected during them (i.e., muted their microphone; turned off camera) to avoid unduly influencing the outcome.

This approach revealed that distraction and reappraisal were by far the most commonly used strategies in this context. Of the 182 self-reported events in which a participant indicated they attempted to downregulate their emotions, 30.7% used reappraisal and 61.5% used distraction, with the other three strategies (i.e., suppression, situation modification, situation selection) combined appearing in fewer than 20% of events (Note that the total percentage sum is greater than 100% due to the occurrence of multi-strategy events). Two hypotheses-blind raters classified each observation's strategy description in Study 1 into one or more strategy categories: Reappraisal, Distraction, Suppression, a combination of the three, or none of the above (IRR Agreement = 0.877). Situation Modification and Selection were excluded due to the infrequency of their use. Suppression was also used infrequently in Study 1, but was categorized by Study 1 raters due to its large presence within the broader literature. Raters were undergraduate research assistants who were trained using the same methodology described in the pilot study, but were not the same raters from the pilot study. The training materials and instructions generated for this purpose have been made available within our OSF repository (*See Open Practices*).

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.

Analysis. To explore our primary question, the effect of emotional intensity upon regulatory strategy usage, we 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 1 methods and hypotheses is publicly available at As Predicted (https://aspredicted.org/DPI_453).

EXPERIMENT 1 RESULTS

A subset of 298 observations in which a negative emotion was downregulated by either distraction or reappraisal was initially used for these analyses. These observations were reported by 77 participants. Of the 298 total observations, 175 (58.72%) reported using distraction to regulate their emotions. The average emotional intensity of observations was 2.44 (range: 0 – 4, Likert scale).

Covariates. Given the variance in experience granted to participants in pursuit of greater ecological validity, we anticipated that several covariates would be important to measure and adjust for within our models. These included cognitive load (RAT) (Dorman Ilan et al., 2019), emotion expectations (Denny et al., 2014) motivations to participate (Tamir, 2016), attitudes towards fear and haunted houses (Argyriou & Lee, 2020), sex (McRae et al., 2008), age (Blanchard-Fields et al., 2004), depression (BDI-II), anxiety (STAI), intolerance of uncertainty (IUS) (Aldao et al., 2010), regulation tendencies (ERQ) (Gross & John, 2003), time of day, presence of peers, and group member influence, among a few other variables. We employed a

variety of statistical approaches to assess each variable's potential covariation with affective intensity in predicting regulation usage, as well as collinearity with affective intensity. In summary, cognitive load post-exposure failed to predict usage of distraction versus reappraisal during exposure ($b = -0.02$, $se = 0.01$, $t(74) = -1.26$, $p = 0.21$), which was contrary to our predictions. No associations between strategy usage and other covariates were found.

Intensity did 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, no model performed better than our null ($ICC = 0.40$). Our best performing non-null model, including only intensity as a fixed effect ($p = 0.10$ when compared to null), failed to demonstrate that emotional intensity had predictive utility towards usage ($OR = 1.36$, $95\% CI = [0.95, 1.95]$, $p = 0.10$) (**Fig. 2**). An odds ratio of 1.36 suggests that for every one standard deviation unit increase in emotional intensity, the odds of choosing distraction to regulate increase by approximately 36%, but importantly, this association is not statistically significant and markedly smaller than what might be observed in more controlled strategy selection paradigms. As such, we did not find evidence to support that emotional intensity predicts strategy usage in this dynamic, high-intensity situation.

However, we expanded our scope and conducted an additional exploratory analysis to determine whether a stronger association between strategy choice and affective intensity could be found using a broader categorization schema, comparing engagement strategies (i.e., reappraisal) to disengagement strategies (i.e., suppression, distraction) as defined in the broader literature (e.g., Dixon-Gordon et al., 2015). Expanding our groups yielded a subset of 360 observations in which a negative emotion was downregulated by either disengagement or engagement strategy. These observations were reported by 89 participants. Of the total observations, 237 (65.80%) reported

using distraction or suppression to regulate their emotions. The average emotional intensity of observations was 2.40. However, our best performing non-null model, including only intensity as a fixed effect ($p = 0.32$ when compared to null), again failed to demonstrate that emotional intensity had predictive utility towards usage ($OR = 1.18$, $95\% \text{ CI} = [0.85, 1.63]$, $p = 0.32$). Again, though not significant, this statistic suggests that every one standard deviation unit increase in emotional intensity increases the odds of choosing a disengagement strategy by approximately 18%.

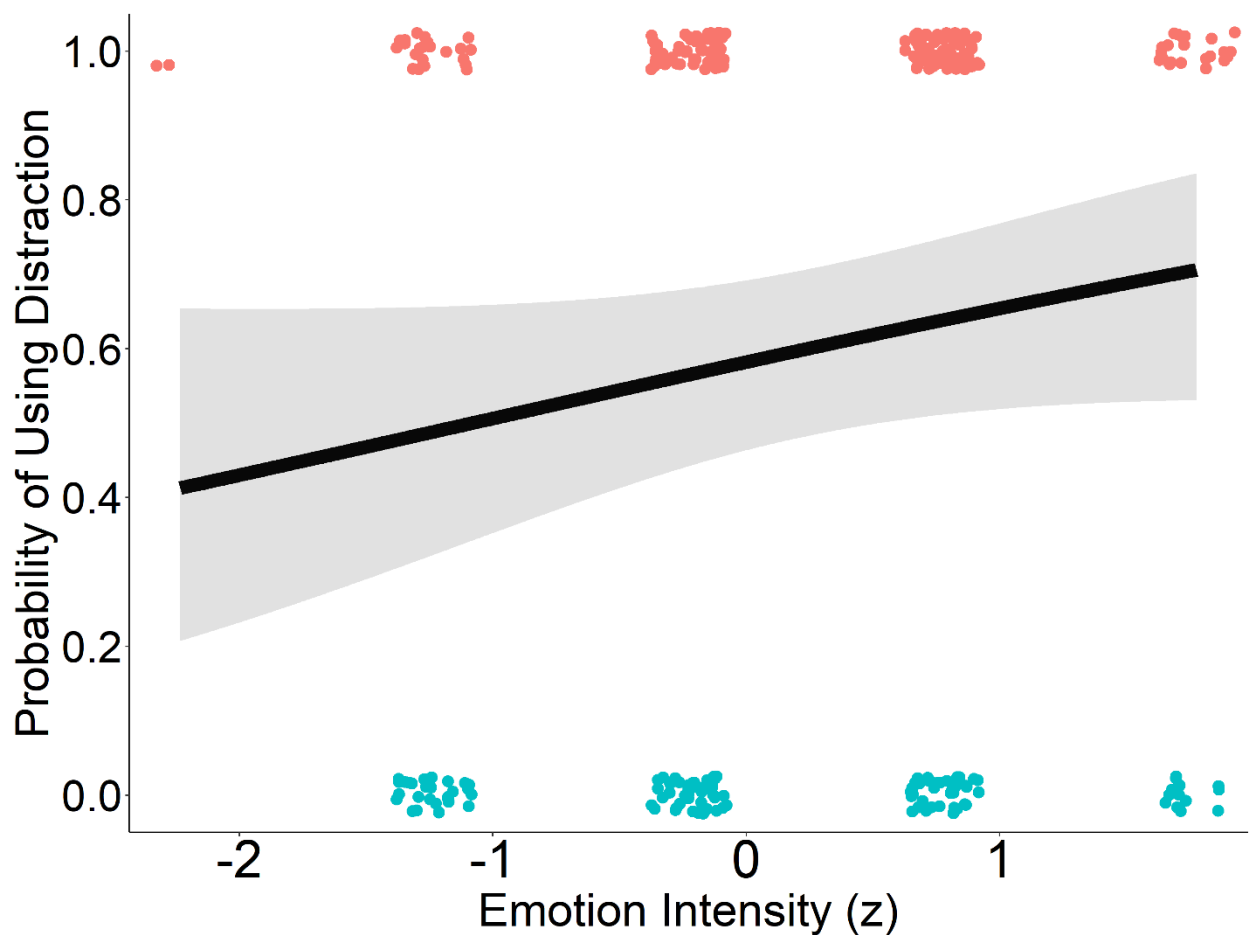


Fig 2. Across almost all tested mixed effects binary logistic regression models, emotional intensity failed to predict strategy usage. Visualized is our model using only emotional intensity to predict regulation strategy choice between reappraisal and distraction among negative emotions. Regression line 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 it could be argued that a haunted house setting could elicit greater contra-hedonic regulation activity (i.e., downregulating positive emotion), we then constructed a series of additional models which were beyond the purview of our initial aims and hypotheses to determine whether any statistically significant relationship could be observed between affective intensity and regulation strategy usage in this context. We iteratively modified predictors and outcome variables across 14 additional models, including covariate models adjusting for sex, cognitive load, and ERQ reappraisal subscale scores, which despite failing to demonstrate significance in this dataset often predict regulation choice in lab settings. We found only a single model which surpassed traditional statistical thresholds of significance in model fit ($ICC = 0.37$; $p = 0.04$ when compared to null). This model included a random intercept for participant and a single predictor, affective intensity of positive and negative emotions, regressed upon distraction versus reappraisal strategy usage with data from unique events reported both immediately after and one-week after exposure ($OR = 1.42$, 95% $CI = [1.03, 1.98]$, $p = 0.04$). The model composition, comparison and results of all of these models can be found in **Table 1**.

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, as high-intensity events using distraction should more successfully regulate emotions than high-intensity events using reappraisal (Sheppes et al., 2011). After constructing a series of multilevel linear models and again following an information 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 = $[-0.40, -0.16]$, $p < 0.001$) (**Fig. 3**). In other words, each standard deviation unit increase in emotional intensity yielded a -0.28 standard deviation decrease in the reported success of distraction, but not reappraisal, as an emotion regulation strategy. As such, our data seems to suggest the efficacy of using distraction within this high-intensity, quasi-naturalistic setting to be of a lesser magnitude than what had been found in lab studies wherein distraction was used.

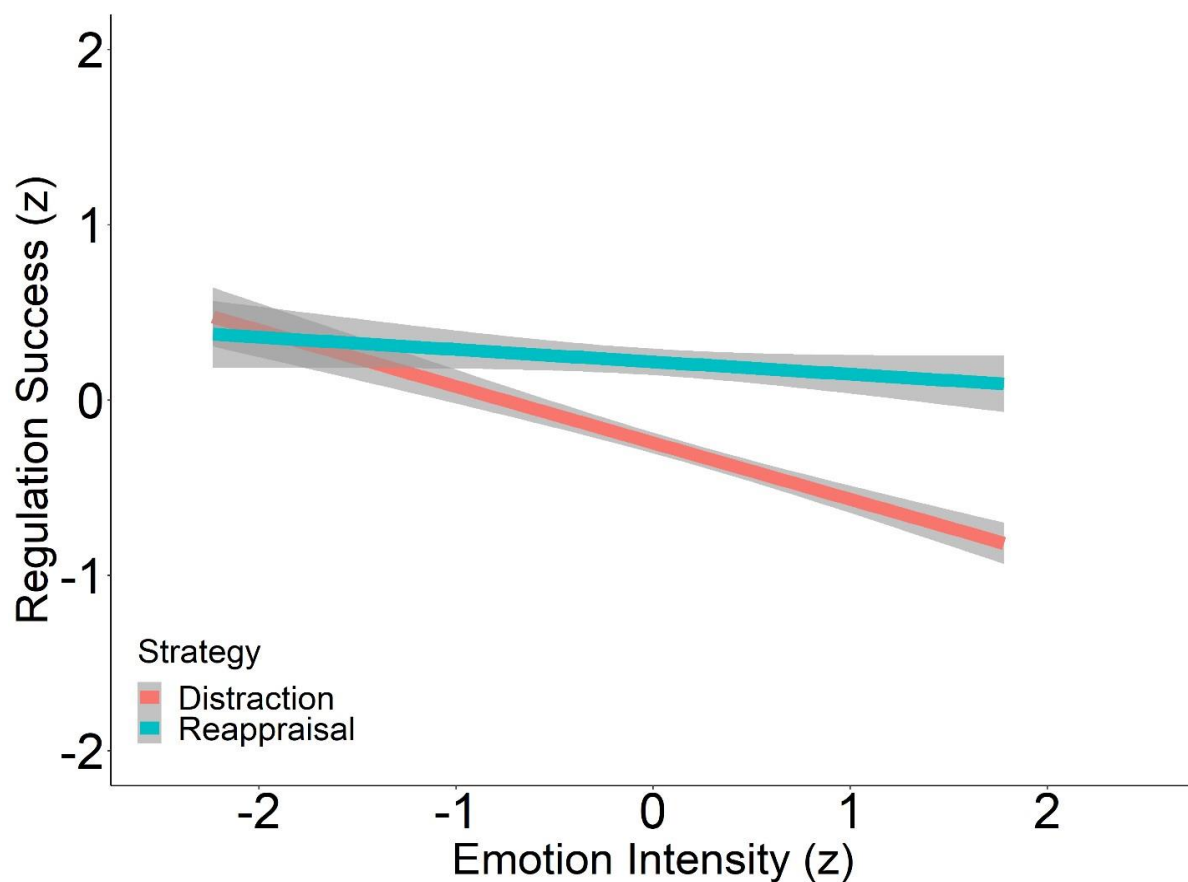


Fig 3. Strategy moderated the relationship between emotional intensity and regulatory success ($\beta = 0.25$, $p = 0.003$). While the success of reappraisal was relatively unrelated to emotional intensity, distraction demonstrated a negative association with emotional intensity, contrary to what extant 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 within our study.

Model Details				Participants (n)	Observations	Null ICC	Model Comparison (χ^2)	Model Significance	Affective Intensity (z)		
Outcome	Emotions Included	Data Collection Time	Covariates [†]						Odds Ratio	Lower Bound ^	Upper Bound ^
Disengage. v. Engage.	Positive & Negative	Immediate & Delayed	Included	90	397	0.34	-	-	1.27	0.93	1.73
			Not Included				2.64	0.10	1.28	0.95	1.71
Disengage. v. Engage.	Negative	Immediate & Delayed	Included	89	360	0.36	-	-	1.17	0.83	1.64
			Not Included				0.98	0.32	1.18	0.85	1.63
Distract. v. Reappraisal	Positive & Negative	Immediate & Delayed	Included	78	328	0.37	-	-	1.45	1.03	2.05
			Not Included				4.45	0.04 *	1.42	1.03	1.98
Distract. v. Reappraisal	Negative	Immediate & Delayed	Included	77	298	0.40	-	-	1.38	0.95	1.99
			Not Included				2.70	0.10	1.36	0.95	1.95
Disengage. v. Engage.	Positive & Negative	Immediate	Included	79	213	0.42	-	-	1.02	0.65	1.58
			Not Included				0.09	0.76	1.07	0.71	1.61
Disengage. v. Engage.	Negative	Immediate	Included	77	194	0.39	-	-	1.05	0.65	1.68
			Not Included				0.14	0.71	1.09	0.70	1.68
Distract. v. Reappraisal	Positive & Negative	Immediate	Included	64	171	0.45	-	-	1.28	0.78	2.11
			Not Included				0.98	0.32	1.26	0.79	2.01
Distract. v. Reappraisal	Negative	Immediate	Included	63	155	4.01	-	-	1.33	0.77	2.28
			Not Included				1.17	0.28	1.30	0.81	2.09

* = $p < 0.05$

[†] Covariates included Sex, Cognitive Load, and ERQ reappraisal subscale

[^] Bounds represent 95% confidence intervals

Table 1. Results of Study 1 Exploratory Models - Hierarchical binary logistic regression models were constructed to explore the predictive utility affective intensity demonstrates upon strategy usage and compared against null models allowing each participants' intercept to vary randomly. The outcome variable used, data inclusion criteria, and variables included are listed under the first four columns. Data size and model comparison results are listed under the subsequent five columns. The odds ratio of affective intensity within each model is listed in the latter three columns. Only a single model performed better than its null and found affective intensity to predict regulation strategy usage.

EXPERIMENT 2 METHODS

Hypothesized models across a pilot study and Experiment 1 both failed to find an association between affective intensity and strategy usage in a complex, high-intensity, multimodal, environment using untrained, undirected participants, even when adjusting for noted moderators like cognitive load. Exploratory models found that the relationship may appear, albeit weakly, when including positive and negative emotions, and that this lack of an effect may be due to distraction being less successful than hypothesized in this complex, high-intensity, multimodal experience. We hypothesized that participants exposed to similar information outside of the complex, high-intensity, multimodal environment would likely still demonstrate emotion regulation choice patterns in line with the extant literature. We hypothesized that generating a decontextualized representation of the experience with only the relevant information (i.e., description of event, emotions felt, intensity of emotions) present, which is typical of much of the prior laboratory-based research, would reproduce the positive association between the emotional intensity of an experience and the frequency of choosing disengagement over engagement regulation strategies. Although using audiovisual recordings from the experience would have been ideal, we were unable to obtain permission to record such data during the previous studies. However, We had access to the experiential information reported by participants who experienced these events (i.e., their text-formatted memories of the events). If there is a difference between participants reviewing an event and participants experiencing an event on the association between affective intensity and regulation strategy choice, it would further emphasize the complications that high-intensity, complex, multimodal contexts introduce to the emotion regulation space. In Experiment 2, a novel set of participants were presented with information about events reported by pilot participants (events available within OSF repository) and asked to choose a regulation

strategy to employ based upon the information provided. 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. Participants completed the study on Qualtrics and were recruited/filtered via Prolific. Eligible participants were native English speakers residing in the US between the ages of 18 and 85, had normal or corrected-to-normal vision, had no history of reading-related disorders or literacy difficulties, as well as no history of mild cognitive impairment, head injury leading to unconsciousness, or unregulated mental health diagnosis. 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 via a priori power analyses assuming an attrition rate of 10%, $r^2 \leq 0.10$ for covariates, and a small effect size ($OR = 1.68$), which suggested we must recruit at least 163 participants to achieve $1-\beta = 0.80$ ($\alpha = 0.05$, two-tailed); however, this approach had not taken into account the hierarchical nature of our observations and likely underestimates our true power. 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 seventy-eight negatively-valenced pilot study events regulated through either reappraisal or distraction were presented to online participants. 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 which required successfully defining and applying both categories before the primary task began (**Fig. 4**). Participants were provided an opportunity to pause participation and contact research staff if they had questions about definitions or strategy application before proceeding. All 78 events 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. Participants were granted as much time as needed to complete the task. Following the primary task, participants completed individual difference measures, including the Emotion Regulation Questionnaire, the Difficulties with Emotion Regulation Survey, and the Intolerance

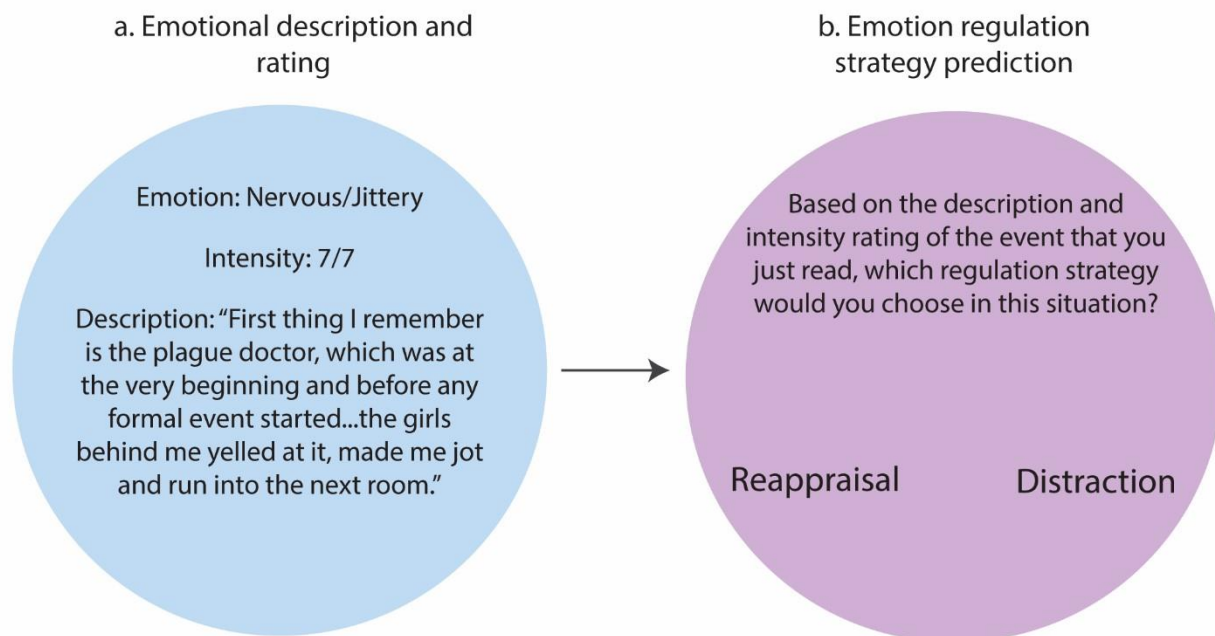


Fig 4. Study 2: Task Overview - One hundred and seventy (170) participants (forecasters) read the descriptions that pilot study participants (experiencers) wrote about their emotional experience in the haunted house. a. Forecasters read the experiencers' emotional descriptions and intensity rating . b. Forecasters indicated what regulation strategy (distraction or reappraisal) they would use to regulate their emotions in the described event.

of Uncertainty Scale. Participants completed the study in 33.7 minutes on average (median = 31.5 minutes, $sd = 14.2$ minutes, range = 10.9 – 88.4 minutes).

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 and compared to our 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 2 were preregistered with AsPredicted (https://aspredicted.org/XXH_W1V), though please note a discrepancy exists in the number of events used, as fewer met our outlined criteria than initially determined.

EXPERIMENT 2 RESULTS

Differences in Covariates Across Samples. Our first analyses aimed to determine whether relevant trait differences existed between the online sample of participants and the participants who experienced the haunted house. If such differences exist, they would limit our ability to associate differences in regulatory choice or usage to differences in presentation and context. Both pilot and experiment 2 participants completed the ERQ and IUS. If differences exist in ERQ scores, the groups may differ in their underlying propensity to choose specific strategies. Using a Welch’s Two Sample T-Test, we did not find significant differences between the groups in their likelihood of using reappraisal ($x_{pilot} = 29.9$, $x_{exp2} = 31.0$, 95% CI = [-3.22, 1.03], $t(45) = -1$, $p = 0.3$) according to the ERQ reappraisal subscale. However, significant differences were observed between the two groups for the expressive suppression ERQ subscale ($x_{pilot} = 12.5$, $x_{exp2} = 15.7$, $t(48) = -3$, $p < 0.001$). The relevancy of the suppression subscale is unclear in this context, as suppression is not directly tested and neither subscale proved to be predictive of strategy usage

during our pilot. Furthermore, a bivariate linear model found that neither the ERQ reappraisal subscale ($b = -0.001$, $se = 0.002$, $t(150) = -0.56$, $p = 0.58$) nor the suppression subscale ($b = 0.002$, $se = 0.002$, $t(150) = 0.93$, $p = 0.35$) predicted the proportion of trials in which participants selected reappraisal rather than distraction in this study as well. Additionally, if differences exist in IUS scores, the groups may differ in how they respond to ambiguity or uncertain situations. However, no differences were observed in IUS scores across groups ($x_{pilot} = 33.6$, $x_{exp2} = 34.3$, 95% CI = [-7.07, 5.59], $t(35) = -0.2$, $p = 0.8$). Assessing differences in difficulties in applying emotion regulation strategies via DERS subscales was not possible because it was not administered to pilot participants.

Intensity predicts regulatory strategy choice in a less stimulating context. Our first model, containing only the affective intensity of pilot participants as a predictor to predict online participants' strategy choice, performed better than our null model ($\chi^2 = 8.39$), demonstrating a small positive effect (OR = 1.06, 95% CI = [1.02, 1.10], $p = 0.004$) such that more intense events were associated with an increased probability that participants chose distraction to regulate them. Additional models included age, gender, IUS score, the DERS limited access to strategies subscale, and a combination of all four as covariates. However, each model failed to outperform our initial model in chi square tests of the models (age: $\chi^2 = 0.84$, $p = 0.36$; gender: $\chi^2 = 2.81$, $p = 0.25$; IUS: $\chi^2 = 0.89$, $p = 0.35$; DERS: $\chi^2 = 0.54$, $p = 0.46$; combo: $\chi^2 = 0.52$, $p = 0.52$; respectively).

Online participants matched pilot participants less than chance when selecting distraction. In signal detection theory, d' (prime (d')) is a measure of sensitivity that quantifies the ability to distinguish between signal and noise in a binary decision task, and thus, can be used to determine whether congruency in strategy choice and usage between pilot and experiment 2 participants is greater than chance. d' is calculated as the normalized value of the proportion of hits

(i.e., when a strategy was used by a pilot participant and selected by an experiment 2 participant) minus the proportion of false alarms (i.e., when a strategy was not used by a pilot participant but was selected by an experiment 2 participant). Importantly, d' is robust to unequal prior probabilities in binary outcomes, as occurs in our strategy selection (73.1% of pilot observations used distraction), through the incorporation of a bias parameter. Using this approach, we found that experiment 2 participants matched pilot participants in their selection of reappraisal nearly at chance ($d' = -0.08$) but were below chance in matching distraction ($d' = -0.41$) (**Fig. 5**). The difference in selection congruency between these strategies was significant as determined by a paired samples t-test ($x_{\text{diff}} = 0.328$, 95% CI(0.313, 0.342), $t(149) = 43$, $p < 0.001$), suggesting that differences in the deployment of distraction between the two groups may be driving differences in how predictive affective intensity was towards strategy choice or usage across these two contexts. The distribution of strategy selection differed between our online sample and haunted house sample, as distraction was only selected in 48.8% of observations for Experiment 2. Taken together, we found that participants used emotional intensity to inform their ER strategy choice in a low-stimulation, but not high-stimulation, paradigm and that this lack of relationship in our previous studies may be due to an observed overuse of distraction relative to what we predicted from lower-stimulation strategy choice contexts.

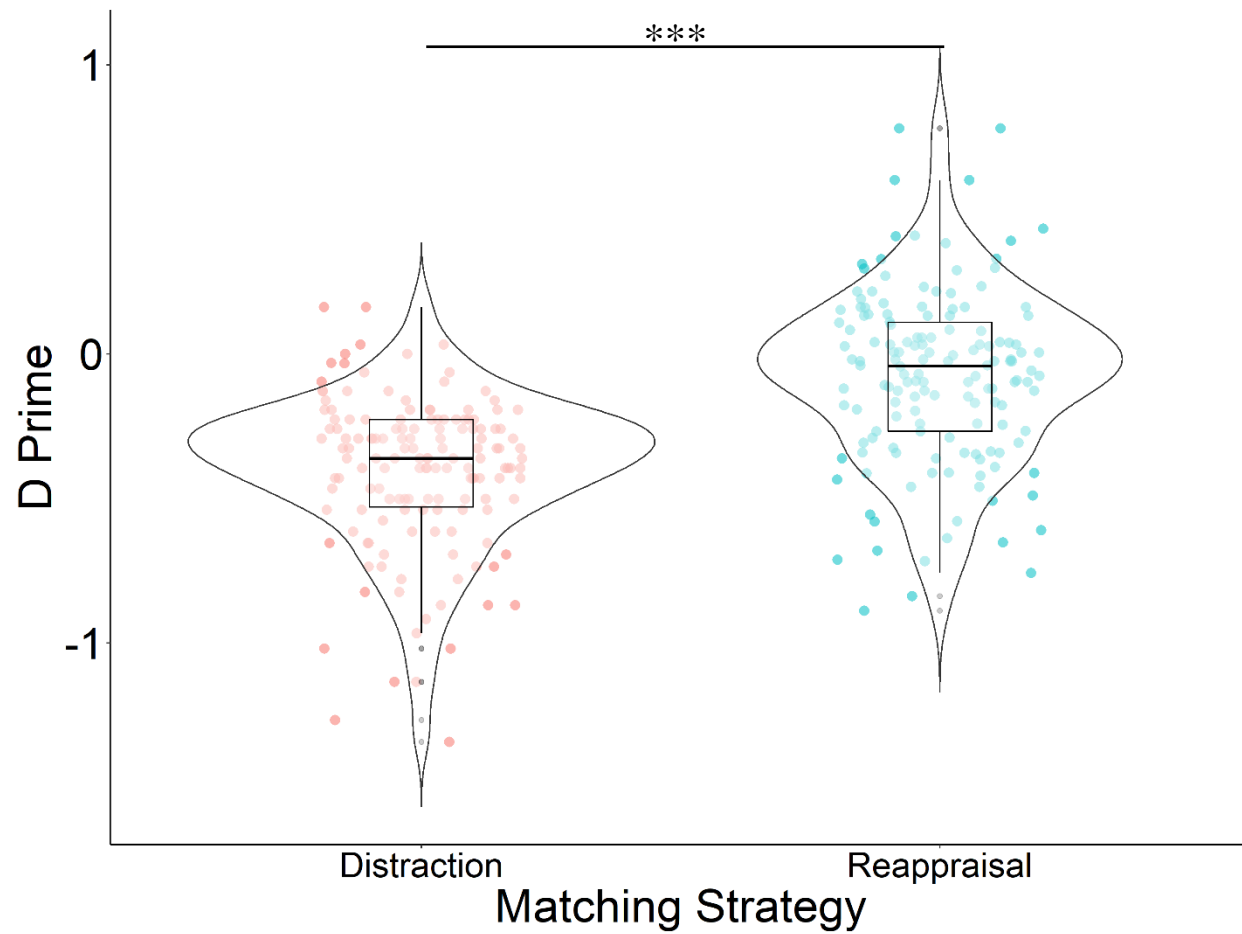


Fig 5. Study 2: Prediction Accuracy – The strategies participants predicted they would use were assessed against the strategies that were reported as used in each situation. While neither strategy was reported greater than chance, participants were significantly more likely to predict using reappraisal on trials when distraction was actually used when compared to predicting distraction when reappraisal was actually used.

GENERAL DISCUSSION

Two experiments examined the association between emotional intensity and regulation strategy usage in a complex, high-intensity, multimodal context. Experiments 1 tasked untrained participants to recall emotional and spontaneous regulatory behaviors in a surprise recall task after exposure. Affective intensity predicted regulation extent, but not strategy usage. Though distraction was used more often than reappraisal, distraction was less successful at regulating in response to high affective intensities in this context. Experiment 2 found an association between affective intensity and strategy choice among participants considering events that had occurred within the haunted house but which they were exposed to via decontextualized vignettes. 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.

These results may offer nuance to our understanding of affective intensity's influence upon regulation strategy application and should be framed by the research on environmental affordances, or the extent to which features of a situation lend themselves to either distraction or reappraisal (Suri et al., 2018; Young & Suri, 2020). Individuals likely found themselves initially regulating with the strategy they believed had the greatest value (i.e., the most effective strategy with the lowest effort investment) based upon models of regulation they had previously generated from experiences with similar media, as outlined by computational decision-making frameworks of emotion regulation (Etkin et al., 2015). However, the unrelenting, attention-grabbing nature of challenging high-intensity situations may grant few affordances by which to distract oneself. On the other hand, reappraisals may appear to be less valuable initially, resulting in lower usage, but could be more effective when used due to a relatively greater volume of environmental affordances (i.e., things to repurpose or reconstrue (Uusberg et al., 2019); e.g., actors, props, goals, etc.). This

explanation mirrors the strategy-selection relationship hypothesized by Etkin and colleagues who posited that a more explicit, higher-cost, model-based approach to emotion regulation may be applied more effectively when implicit, or model-free, emotion regulation tendencies were not arriving at their desired goal via prediction error adjustment alone (Etkin et al., 2015). Distilling events down to a low-stimulation, text-based representation, as had been done in Experiment 2, may provide greater distraction affordances and rebalance the likelihood of individuals choosing reappraisal or distraction in situations when it would canonically make sense to do so (i.e., low and high intensity, respectively).

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 as well. Individuals in “cold states” consistently underpredict the challenges associated with meeting affectively-relevant goals during “hot states” (Sayette et al., 2008; Van Boven & Loewenstein, 2003). Such a pattern mirrors the differences observed between Experiments 1 and 2, 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 a high-intensity, high-stimulation quasi-naturalistic paradigm to demonstrate this in the domain of ER, similar approaches have demonstrated similar discrepancies in moral domains (FeldmanHall et al., 2012).

There are several limitations in our experimental approach that have not been noted. First, our aims were relatively narrow in comparison to the vast emotion regulation behavior variability

captured by this dataset and resulted in excluding many observations that did not meet our inclusion criteria. More analyses are needed and planned to fully explore this space. Additionally, though many features of our design mirror regulation of emotions in everyday life, haunted houses may have limited generalizability to other high-intensity settings that we commonly experience (Clasen, 2019; Tashjian et al., 2022) and the purpose haunted houses commonly serve (i.e., entertainment) could also circumscribe their generalizability to graver situations. The use of a haunted house as our setting also may have resulted in self-selection biases within our sample. To monitor this, participants were asked several questions regarding their motivations and expectations regarding participation. 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). This means that our participants may have had somewhat atypical regulatory motivations relative to individuals who do not willingly sign up for haunted house studies. Additionally, we unfortunately do not have measures of startle sensitivity or fear-enjoyment from Experiment 2 participants, which may explain some of the differences in regulatory behaviors between samples. As such, further investigation into the effects of both context and individual differences upon regulatory behaviors are warranted.

A small but important contingent of the existing emotion regulation literature has highlighted intrastrategy heterogeneity in the regulation techniques that we had examined (Uusberg et al., 2019; Webb et al., 2012). For example, Webb and colleagues identified at least three distinct emotion regulation approaches which could be categorized as reappraisal (Reappraising the stimulus, Reappraising the emotional response, Reappraise via perspective-taking) and these reappraisal subtypes demonstrate varying effectiveness in modulating emotion

depending upon situational and personal factors. It may be the case that specific types of reappraisal and distraction demonstrate an intensity-selection relationship that better mirrors the canonical association observed in lab studies, but testing such a question would necessitate far more observations than are available in this dataset.

Due to resource constraints, participants also necessarily experienced the haunted house in groups. 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. However, post-hoc analyses failed to find any association between group membership and strategy usage ($F(30,45) = 0.93, p = 0.57$). The presence and strength of friendship among group members was also assessed and was not predictive of regulation ($t(60) = -0.4, p = 0.70$). Lastly, some events had to be captured at a delay due to collaboration with a memory study, which calls into question the reliability of some responses. Future research should limit the delay between experience and report as much as possible without interfering with the emotional event. Future research might also take interest in the order of strategies reported in regulation-challenging situations; that is to say, does the likelihood of using a reappraisal strategy for a given person in this context increase with each failed attempt to engage distraction? Although we did not have sufficient observations to examine the data with such granularity, examining associations between the intensity of specific emotions and regulation usage might also be of particular interest to future researchers in this space (Young & Suri, 2020). Despite its 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

high-stimulation setting using untrained participants. This approach offers an alternative means of exploring emotion regulation usage while pursuing greater ecologically-valid in study design. 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 but finding a modest association in Study 2, we may offer greater support for the importance of context in determining the fit of emotion regulation strategies, though the limitations inherent to this study leave room for other possibilities. Ultimately, though, this study highlights the importance of extending what we know about regulation in relatively mundane, controlled situations to those crowded, loud, and perhaps uncontrollable contexts in which emotion regulation success could be of dire consequence.

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

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Open Practices:

The preregistration for Experiments 1 and 2 can be found at https://aspredicted.org/DP1_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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Supplementary Materials

PILOT STUDY METHODS

A pilot study 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.

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., 2023*). Participants were then escorted by two research assistants to the remotely-located haunted house which was the same as used within Experiment 1.

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 Experiment 1, 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 et al., 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.

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.

PILOT STUDY 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.

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% $CI = [0.65, 3.2]$, $p = 0.079$).

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.