How Do People Escape Rumination? Development of a Laboratory Task to Assess the Role of Negative Valenced Distraction

THESIS

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By

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Abstract

Rumination is a form of unconstructive repetitive thought (Watkins, 2008) that has been associated with psychopathology. Once it starts, this process is difficult to stop and recent models have suggested that people might even engage in self-destructive behaviors to escape from ruminative thoughts (e.g., Baumeister, 1991; Nolen-Hoeksema, Stice, Wade, & Bohon, 2007; Selby & Joiner, 2009). Extant work is limited to correlational designs. The present thesis aims to experimentally test whether people might be willing to escape rumination, even if that entails engaging with aversive stimuli. Participants (N = 110) completed a thought task that provided opportunities to “escape” thoughts and instead view a film clip (two blocks of neutral film clips, four blocks of disgust film clips). They were randomly assigned to one of two experimental conditions (distraction or rumination). There were no main effects of thought condition or interactions in predicting switching behavior from the thought task to the film clip. Similarly, there were no significant associations between switching behavior and individual differences in psychopathology symptoms, emotion dysregulation, habitual rumination, disgust sensitivity and propensity, or resting heart rate variability. The one exception was that individual differences in disgust propensity predicted fewer switches to the disgust film (that is, across both conditions, participants higher in disgust propensity preferred to engage in thinking, rather than viewing the aversive stimulus). Of note, the effect of the rumination induction was weak. Thus, it will be essential for future work examining the process of stopping rumination to utilize stronger, more aversive inductions. Additionally, future research should expand to include clinical populations to
increase power to detect individual differences in mental health functioning and habitual use of rumination.
Vita

2011.................................................................B.S. Psychology, Simmons College

Publications


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Introduction

Sometimes people become trapped in unconstructive repetitive thoughts as they replay events in their mind and pick apart their past failures (Watkins, 2008). In such instances, they are engaging in rumination, which is a past-oriented self-focused perseverative process whereby people try to make sense of their past experiences, and mistakes, as well as solve problems (e.g., Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). However, rumination actually interferes with instrumental behavior and problem solving (e.g., Gotlib & Joormann, 2010; Lyubomirsky, Layous, Chancellor, & Nelson, 2015; Nolen-Hoeksema et al., 2008). In one study of problem solving, self-focused ruminative-style questions caused participants to generate less effective solutions to hypothetical problems relative to a process focused control group (Watkins & Baracaia, 2002). Another study found that rumination was associated with reduced confidence in self-generated solutions to a problem (Ward, Lyubomirsky, Sousa, & Nolen-Hoeksema, 2003). Further, trait rumination has been associated with reduced flexibility and cognitive control (Davis & Nolen-Hoeksema, 2000; Philippot & Brutoux, 2008; Watkins & Brown, 2002). Given all these deleterious consequences of rumination, it is not surprising that this process has been implicated in the development and maintenance of a wide range of mental disorders, including depression, anxiety, eating disorders, and substance abuse problems (e.g., Aldao, Nolen-Hoeksema, & Schweizer, 2010; Alloy et al., 1999; Nolen-Hoeksema & Watkins, 2011).

Rumination leads to maladaptive outcomes by reinforcing a vicious cycle of negative affect (Nolen-Hoeksema et al., 2008). This notion has been captured in the mood-as-input hypothesis, which suggests that a ruminative cycle might be reinforced by a combination of “stop rules” and negative affect (e.g., Meeten & Davey, 2011). Specifically, the model argues that
faulty stop rules (e.g. “I feel bad so I should continue until I feel better”) may lead to perseverative processes (Meeten & Davey, 2011). For example, when a person is generating a list and uses an “as many as can” stop rule (e.g. “stop whenever you believe no more items can be generated”), negative affect signals the task is not complete, therefore leading the person to continue engaging in this process. This notion has been tested experimentally in several studies (Hawksley & Davey, 2010; Meeten & Davey, 2011). In one investigation, participants were asked to complete a rumination interview. One group was instructed to use an “as many as can” stop rule that said to continue until they felt they had finished, while the other group was instructed to use an “as long as you feel like” stop rule that required participants to continue until they no longer wanted to continue (Chan, Davey, & Brewin, 2013). Participants in the “as many as you can” condition persevered longer than those in the “as long as you feel like” condition, as evidenced by their completing more steps in the rumination interview. Thus, when using “as many as you can” rules, rumination and negative affect can perpetuate each other in problematic vicious cycles.

Another model seeking to explain the mechanisms underlying the perseverative nature of rumination is the “impaired disengagement hypothesis,” which suggests that rumination occurs when negative self-focused thoughts hijack attentional processes, making it almost impossible for the person to stop (Gotlib & Joormann, 2010; Koster, De Lissnyder, Derakshan, & De Raedt, 2011). Evidence from this model comes from a series of studies showing that rumination makes it more difficult to disengage from negative information (e.g., Donaldson, Lam, & Mathews, 2007).

Critically, many individuals tend to find rumination to be extremely aversive (e.g., Nolen-Hoeksema et al., 2008). Yet, breaking the ruminative cycle can be very difficult. Although
considerable work has been done examining why rumination begins (Watkins & Baracaia, 2001) and how it is maintained (e.g., Kühn, Vanderhassele, De Raedt, & Gallinat, 2012; Raes, Hermans, Williams, Bijttebier, & Eelen, 2008), less research has been conducted to identify mechanisms underlying the efforts (successful or not) to disrupt it.

One exception is the most recent work by Nolen-Hoeksema and colleagues, who in recent years have begun to stipulate that stopping rumination might be so difficult that some people choose to engage in extreme behaviors to “escape the self” (e.g., Baumeister, 1991). Supporting evidence for this idea comes from a number of studies showing that rumination is associated with dysregulated behaviors, such as non-suicidal self-injury (NSSI; e.g., Hoff & Muehlenkamp, 2009; Voon, Hasking, & Martin, 2013), alcohol abuse (Caselli, Bortolai, Leoni, Rovetto, & Spada, 2008), aggression (e.g., Anestis, Anestis, Selby, & Joiner, 2009; Denson, Pedersen, Friese, Hahn, & Roberts, 2011) and disordered eating (e.g., Gordon, Holm-Denoma, Troop-Gordon, & Sand, 2012).

More recently, Selby and Joiner (2009) expanded upon Nolen-Hoeksema’s work to study rumination in the context of borderline personality disorder (BPD), a condition characterized by affective lability, unstable views of the self, and heightened impulsivity (Linehan, 1993). Selby and Joiner have proposed that rumination might be so aversive to people with BPD that it might lead to an “emotional cascade,” whereby these individuals seek to avoid rumination via the enactment of dysregulated behaviors, such as NSSI, alcohol use, reckless driving, and disordered eating (Selby, Anestis, & Joiner, 2008). The emotional cascade model proposes that the perseverative nature of rumination, paired with its tendency to escalate negative affect creates a context in which escape through impulsive behaviors is more desirable than remaining in contact
with one’s internal experiences (Selby et al., 2008). Critical to this model is the idea that dysregulated behaviors are in part negatively reinforced, as they disrupt an aversive internal experience via distraction (Selby et al., 2008).

Evidence for the emotional cascade model’s assertions regarding the temporal course of rumination and dysregulated behaviors comes from a number of studies. In an experience sampling study with a community sample reporting elevated impulsive behaviors, rumination was found to temporally precede self-destructive behavior (e.g., NSSI, impulsive shopping). Importantly, negative affect also predicted dysregulated behaviors, such as NSSI, but only when paired with elevated rumination (Selby & Joiner, 2013). In another experience sampling study, within-day fluctuations in rumination were associated with a greater number of NSSI episodes (Selby, Franklin, Carson-Wong, & Rizvi, 2013). Similarly, in a longitudinal study of college students reporting high impulsivity, increases in rumination over a one month period were associated with increases in behavioral impulsivity one month later (Selby et al., 2008). In a more recent experience sampling study of individuals with elevated impulsive behaviors, rapid acceleration in both state-level negative affect and rumination were associated with greater numbers of dysregulated behaviors (Selby, Kranzler, Panza, & Fehling, 2015).

While the extant research on the cascades model provides great promise for our understanding of how rumination is linked to impulsive behaviors, there are several critical areas of inquiry that remain untested. I propose to expand on this work in two critical ways: 1) by adopting an experimental approach (e.g., Aldao, 2013) and 2) by exploring the transdiagnostic versus disorder-specific nature of the relationship between rumination and dysregulated behaviors (e.g., Aldao et al., 2010; Kring & Sloan, 2010).
First, an experimental approach is necessary to test causality. The majority of the research on the cascade model has been correlational. Although Selby and Joiner (2013) provided evidence for a temporal relationship between rumination and destructive behaviors, they did not experimentally test potential causal mechanisms. To do so, I adopted an experimental psychopathology approach to test whether rumination increases willingness to distract using aversive stimuli. Crucial to this endeavor is the identification of stimuli that primarily generate negative affect. If the proposed stimuli activated positive emotion, this would pose a potential confound for identifying a negative reinforcement component within a model of these behaviors. In this respect, the examination of NSSI, alcohol consumption, and disordered eating are problematic, as they all provide significant positive reinforcements. The pain analgesia/opiate hypothesis suggests that individuals who engage in various forms of NSSI (e.g., cutting, burning, pinching) may have reduced tonic opioids (Stanley et al., 2010), and thus, engaging in these dysregulated behaviors might help restore the balance (Bresin, 2014; Selby, Nock, & Kranzler, 2014). Recent work on the affective underpinnings of eating disorders suggests that disordered eating (e.g., bingeing, restricting) might result in pleasurable feelings (Macht & Dettmer, 2006). Similarly, alcohol use is, in many instances, driven by the motivation to enhance positive affect (Lynne, Russell, Skinner, & Windle, 1992). As such, I cannot directly study the behaviors of clinical interest while simultaneously isolating this mechanism. For this reason, the present study aims to use a basic processes approach.

Although positive reinforcement (addition of positive affect) may play an important role in these behaviors, to test a negative reinforcement mechanism model (reduced rumination) it is essential to utilize stimuli that do not activate positive affect. Thus, in order to provide a more
precise test of the mechanisms underlying the negative reinforcement function of dysregulated behaviors in stopping ruminative cycles I have developed a task that primarily elicits negative affect: watching disgust-eliciting film clips (e.g., Gross & Levenson, 1995; Rottenberg, Clift, Bolden, & Salomon, 2007). This allowed me to test the negative reinforcement mechanism without a positive affect confound. In our lab, we have used a number of film clips depicting people eating disgusting objects and creatures, such as cow brains or live bugs, and we have identified a number of clips that reliably induce intense disgust (e.g., Aldao, Dixon-Gordon, & Reyes, 2015; Dunn, Aldao, & De Los Reyes, 2015). Disgust is an emotion typically associated with avoidance motivations (see review by Tybur et al., 2013) and thus, disgust-eliciting stimuli generate aversive states. I have developed a paradigm in which participants are randomly assigned to either ruminate or distract themselves during 5-minute blocks (based on the instructions by Nolen-Hoeksema & Morrow, 1993). The rumination and distraction inductions require that participants sit alone with their thoughts. I expected that being with one’s thoughts would be more aversive in the rumination than in the distraction condition.

During each block, participants were given the chance to press a key to stop the rumination/distraction task. When they did so, for four of the blocks, the disgust film clip played for however much time remained in the 5-minute block. Thus, escaping thoughts would come at a price: the experience of intense levels of disgust. As a control, I also included two blocks with a neutral film clip instead of a disgust-eliciting one (bringing the total number to six blocks presented in a randomized order). In the neutral blocks, escaping thoughts did not come with the aversive consequence of disgust and, as such, viewing the neutral films should constitute an adaptive emotional outcome for those in the rumination condition.
The second way in which I sought to expand upon the cascade model is by focusing on other forms of psychopathology. The research to date on the cascade model primarily operates as a lens through which we can understand dysregulated behaviors in the context of BPD (Selby & Joiner, 2009). However, because BPD is characterized by some of the most severe patterns of affective and behavioral dysregulation across mental disorders (Linehan, 1993), it is possible that the associations might be different in individuals experiencing other forms of psychopathology. For example, Nolen-Hoeksema suggested that behaviorally dysregulated consequences of rumination may by applicable to a variety of disorders, such as binge eating and alcohol abuse (Nolen-Hoeksema, 1998). Furthermore, Selby and colleagues (2009) proposed that this process might occur as a broader emotion regulation strategy (e.g. taking a cold shower) in non-BPD populations (Selby & Joiner, 2009). However no studies have causally investigated these broader transdiagnostic implications. In other words, much remains to be understood about the extent to which the choices to escape rumination might underlie a common transdiagnostic mechanism or might vary as a function of type of psychopathology. Thus, I tested whether individual differences in symptoms of psychopathology predict greater willingness to escape their thoughts. I examined symptoms of depression, in light of the extensive literature suggesting that rumination is a core process in this disorder (d= .55, Aldao et al., 2010). I also modeled the lifetime frequency of self-injurious behaviors given their centrality to the cascade model (Selby et al., 2013). In light of previous work, I expect that individuals with elevated depression and/or lifetime history of self-injurious behaviors would be most willing to escape their thoughts, especially when assigned to the rumination condition.
Very little is known about how individual differences in emotion regulation relate to the cascade processes underlying rumination. This is a noteworthy omission, given that emotion regulation deficits have been associated with dysregulated behaviors (Gratz, 2007). For example, individuals who report a reduced access to emotion regulation strategies on the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) are more likely to engage in NSSI (Perez, Venta, Garnaat, & Sharp, 2012), binge eating (Whiteside et al., 2007), and excessive gambling (Williams, Grisham, Erskine, & Cassedy, 2012). Thus, I tested whether individual differences in emotion dysregulation are associated with greater escaping of rumination. In addition, I tested individual differences in the habitual use of rumination. I expected that participants who were emotionally dysregulated and/or ruminators would be most willing to escape their thoughts, especially when assigned to the rumination condition.

In addition, I tested individual differences in vagal tone, which reflects beat-to-beat fluctuations in the heart rate driven by the parasympathetic nervous system (e.g., Thayer, Åhs, Fredrikson, Sollers, & Wager, 2012). Extensive research suggests that higher resting vagal tone (i.e., vagal tone before encountering emotionally evocative contexts) reflects adaptive patterns of emotion regulation flexibility (e.g., Demaree, Robinson, Pu, & Allen, 2006; Gyurak & Ayduk, 2008; Ingjaldsson, Laberg, & Thayer, 2003; Park, Vasey, Van Bavel, & Thayer, 2013; Vasilev, Crowell, Beauchaine, Mead, & Gatzke-Kopp, 2009). Additionally, there is growing evidence that perseverative cognition, such as rumination, may be associated with low resting vagal tone (Brosschot, Gerin, & Thayer, 2006). Thus, I tested whether individual differences in vagal tone (i.e., respiratory sinus arrhythmia [RSA]) are associated with performance on this paradigm. I expect that individuals with lower resting vagal tone (i.e., those with less flexible emotion
regulation) would be most willing to escape their thoughts, especially when assigned to the rumination condition.

**Hypotheses**

I have developed several hypotheses. First, I expected the rumination condition to lead to greater avoidance of thoughts than the distraction condition. I predicted that participants in the rumination condition would switch out of the thought task faster and more frequently than those in the distraction condition. Second, I expected that individual differences (i.e., greater symptoms of psychopathology, lower disgust propensity and sensitivity, lower access to emotion regulation strategies, greater habitual use of rumination, lower resting RSA) would be associated with switching to the video clips faster and more frequently. Third, I predicted that the main effects of condition would be qualified by an interaction with individual differences, such that, participants with higher symptoms of psychopathology, lower disgust propensity and sensitivity, lower access to emotion regulation strategies, greater habitual use of rumination, and lower resting RSA would switch out faster and more frequently, particularly in the rumination condition. This is because I expected these individuals would quickly take the opportunity to escape rumination.
Method

Participants

Participants were 115 undergraduate students recruited from the Psych 1100 Research Experience Program (REP) at The Ohio State University. They completed a two-hour study and received course credit for their participation. I oversampled for elevated trait rumination by using a pre-screening survey in the REP study pool with the RRS-brooding scale (see below for information about the cutoff score used). I emailed study invitations to eligible high trait rumination individuals identified by the pre-screening survey. Individuals who did not complete the pre-screening survey or without high trait rumination were still able to sign up for the study, but did not receive a recruitment email invitation. I excluded two participants who fell asleep during the study and three participants who did not follow directions (e.g. using a phone during the session). This resulted in a final sample of 110 participants (63.6% female; mean age=19.27 years, range=18-29; 77.3% Caucasian). They first completed a series of baseline questionnaires, and then participated in the thought task (see Figure 1 for a flow chart of the entire study).
Figure 1: Study flow chart with timing of state assessments

Baseline Questionnaires

Demographic Questions. Participants completed a brief survey consisting of basic demographic questions (age, gender, and ethnicity). They also listed any medical conditions they might have, as well as any medications and/or drugs they might be currently taking. This information is important to identify participants to exclude from analyses of physiological data (e.g. cardiac conditions, use of stimulant medications). See more information about exclusions in the RSA section below.
Psychopathology

**Centers for Epidemiological Studies — Depression Scale (CES-D).** The CES-D (Radloff, 1977) is a 20-item questionnaire that assesses symptoms of depression. Each item ranges from 0 “rarely” to 3 “most of the time” for a total score of 60. Sample items: “I was bothered by things that usually don’t bother me”, “I did not feel like eating; my appetite was poor”, and “I felt that I could not shake off the blues even with help from my family or friends”. The total score has been shown to have good internal consistency in prior studies (α = .89; Radloff, 1977) and in the current study (α = .90).

**Deliberate Self-Harm Inventory (DSHI).** The DSHI (Gratz, 2001) is a measure designed to assess the number of episodes in which participants have engaged in deliberate self-harm in their lifetime and has shown high internal reliability (α = .82; Gratz, 2001). Each item asked participants about a form of deliberate self-harm (e.g. “Have you ever intentionally (i.e., on purpose) cut your wrist, arms, or other area(s) of your body (without intending to kill yourself)?”). If the participant responded “Yes” to an item about a self-harm method the following further questions are asked “How old were you when you first did this?”, “How many times have you done this?”, “When was the last time you did this?”, “How many years have you been doing this? (If you are no longer doing this, how many years did you do this before you stopped?)”, and “Has this behavior ever resulted in hospitalization or injury severe enough to require medical treatment?”. To ensure numeric responses to the question “How many times have you done this?” I configured Qualtrics to display an error message to the participant if they provided a non-numeric response. Prior research has used this measure to create a dichotomous
variable to identify people who habitually self-harm (e.g., Arbuthnott, Lewis, & Bailey, 2014). In this sample, 15.5% of participants reported 10 or more lifetime instances of deliberate self-harm.

**Emotion Dysregulation**

**Difficulties with Emotion Regulation Scale (DEERS) — Access To Strategies Subscale.** The DERS (Gratz & Roemer, 2004) is a 36-item self-report measure that assesses habitual difficulties regulating emotions in a number of dimensions. Items are on a 5-point Likert-type scale with higher scores indicating more difficulties regulating emotions. For the analyses in the present study, I only used the Strategies subscale, which represents perceived ability to access effective emotion regulation strategies when distressed. Sample items: “When I’m upset, I believe that I’ll end up feeling very depressed”, “When I’m upset, I believe that I will remain that way for a long time”, and “When I’m upset, I believe that wallowing in it is all I can do”. It has shown excellent internal reliability in previous samples (α = .88; Gratz & Roemer, 2004) and in the current sample (α = .93).

**Rumination**

**Ruminative Responses Scale — Brooding (RRS-B).** The RRS-B (Treynor, Gonzalez, & Nolen-Hoeksema, 2003) is a 22-item trait measure of rumination that assesses the tendency to engage in ruminative behavior in response to stress. Treynor and colleagues (2003) have removed those items with a high content overlap with depressive symptoms. The resulting brooding subscale contains 5 items and reflects the depressive rumination at the core of Nolen-Hoeksema’s (1991) rumination theory. Sample items “What am I doing to deserve this?”, “Why do I always react this way?”, and “Why do I have problems other people don’t have?”. It has shown good internal consistency in prior work (α = .77; Treynor et al., 2003) and in the current
sample ($\alpha = .82$). I oversampled participants for high rumination using a cutoff of 13 or higher on the RRS-B. I derived this cutoff using 1 SD above the mean reported by the Treynor et al., (2003) sample. In all, 37.2% of the sample met this cutoff for elevated rumination.

**Responses to Positive Affect (RPA).** The RPA (Feldman, Joormann, & Johnson, 2008) is a 17-item measure with questions on 4-point Likert-type scale. It assesses responses to positive affect and contains three factors: emotion-focused, dampening, and self-focus. For each item participants responded about their reactions when they feel “happy, excited, or enthused”.

Sample items for the emotion-focused subscale: "Think about how happy you feel", "Think about how strong you feel", and "Think about how you feel up to doing everything". Sample items for the dampening subscale: "Think My streak of luck is going to end soon", "Think I don’t deserve this”, "Think about things that could go wrong". Sample items for the self-focus subscale: "Think I am achieving everything”, "Think I am living up to my potential” and “Think about how proud you are of yourself”. The three subscales have shown acceptable internal reliability ($\alpha = .71$ to .79) in prior studies (Feldman et al., 2008) and good internal reliability in this sample ($\alpha$’s = .75 to .84).

**Disgust Sensitivity**

**Disgust Propensity and Sensitivity Scale – Revised (DPSS-R).** The DPSS-R (van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006) is a 16-item self-report questionnaire that assesses the frequency of disgust experiences (disgust propensity) and the emotional impact of such experiences (disgust sensitivity). Sample items for disgust propensity: “I experience disgust”, “I find something disgusting” and “I feel repulsed”. Sample items for disgust sensitivity: “When I feel disgusted, I worry that I might pass out”, “I think feeling disgust is bad for me” and
“I think disgusting items could cause me illness/infection”. It has shown to have good internal consistency in prior samples (α for disgust propensity = .78 and α for disgust sensitivity = .77; van Overveld et al., 2006) and good internal consistency in this sample (α for disgust propensity = 82 and α for disgust sensitivity = .73).

**Resting RSA**

Following the completion of the self-report questionnaires, research assistants connected participants to the psychophysiological equipment in order to assess resting RSA. To calculate RSA, I used Biolab 3.013 (MindWare Technologies, Ltd., Gahanna, OH) to record electrocardiogram data (ECG) with a lead II configuration (i.e., one sensor on the lower left ribcage, one below the lower right ribcage, and one below the right collar bone) and a sampling rate of 1000 Hz with a gain of 500. Research assistants visually inspected each heartbeat for movement artifacts. I calculated RSA using a spectral analysis with a high frequency band of .12 to .40 adjusting for the respiration cycle (this is also known as “respiratory sinus arrhythmia” or RSA). I assessed RSA during a 5 minute resting baseline.

Six participants did not have usable data RSA due to technical and signal quality problems. I excluded three participants from the analyses using RSA due to self-reported medical conditions impacting the cardiac system. This resulted in a total of 101 participants with resting RSA data. In the analyses not including resting RSA, I used the full sample of 110 participants.

**Thought Task**

Participants sat in front of a 46” television screen in a darkened quiet room for the duration of the task. The thought task consisted of six 5-minute blocks. In two of the blocks, participants had to choose between engaging in rumination or distraction (depending on their
randomly assigned condition; see below) and watching a neutral film clip. This allowed me to control for willingness to escape rumination in the absence of aversive stimuli. In four of the blocks, they had a choice between engaging in rumination or distraction and watching the disgust film clip. To minimize the impact of order effects, I counterbalanced the six blocks (two neutral and four disgust).

Switching to the film clip did not alter the overall task length. That is, if a participant completed three minutes of the thought exercise before deciding to switch to the film clip, s/he would have to watch the film clip for the remaining two minutes (see Figure 2 for a flow chart each block in this task). To verify that participants understood the directions, research assistants asked them to restate the directions in their own words prior to the first block and did not proceed until the participant could correctly explain the task.

The main dependent variables were the length of time that each participant spent in the thought exercise before switching to watching the film clip and whether the participant switched to the film clip or not. I programmed this task on E-prime (Psychology Software Tools, Pittsburgh, PA).
Film Clip Previews. Participants viewed 15-second previews of the disgust and neutral film clips in a counterbalanced order (see Figure 1 for the study flow chart) prior to randomization and the thought avoidance task blocks. I included the previews in order to increase the experiential nature of the manipulation. In each film clip preview, I assessed interest by asking the question “How much do you want to see more of this film clip?” (Scale ranging from 0 = “not at all” to 100 = “extremely”).

Film Clip Still Frames. I used still frames from the two film clips to remind participants of the film clip content when responding to questions about the film clip or making decisions about the film clip prior to the beginning of each block (see Figure 3). Prior to each block, participants saw an image of one of the film clips on the screen and the research assistant explained that the film clip in the image would be the one they would watch if they chose to switch away from the audio recording.
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<td><img src="image2.png" alt="Disgust Film Clip" /></td>
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**Figure 3.** Film clip still frames

**Baseline Audio Recording**

Immediately prior to the thought task, participants were randomly assigned to listen to either a neutral distraction or rumination audio recording for five minutes (see Figure 1 for flow chart of the entire study). The instructions to induce rumination/distraction were based on Nolen-Hoeksema’s (1993) task. This task has been used previously with success in numerous prior studies (e.g., Lyubomirsky & Nolen-Hoeksema, 1993; Watkins & Moulds, 2005). The audio (recorded by one of our RAs) involved brief prompts that directed participants to think about different topics (see Appendix A for full list of prompts). Following each prompt, there were 15 seconds of silence before the next prompt was presented. Participants were asked to sit up straight and keep still with their eyes closed during this part of the experiment.

**Film Clips**

**Neutral Film Clip.** This film clip featured content from the television program “How It’s Made” showing industrial scenes of people creating several different types of objects. In order to
reduce the extent to which the film might elicit positive affect, I edited out the parts in which presented the finished product. Participants viewed the same clip during both neutral blocks.

**Disgust Film Clip.** This film depicted scenes from two episodes of the television program “Fear Factor” in which contestants were shown eating live bugs and raw cow brains, and drinking blood. Similar film clips from this program have reliably induced disgust in previous investigations (e.g., Aldao et al., 2015; Dunn et al., 2015; Shiota & Levenson, 2012). I edited the film clips to remove content where contestants reassured each other and celebrations of victory to reduce positive affect. Participants viewed the same clip during all four disgust blocks.

**State Level Assessments**

Participants provided ratings of their disgust and rumination using a visual analogue scale ranging from 0 = “not at all” to 100 “extremely” that was presented at several timepoints: 1) following each film clip preview, 2) before and after the resting physiology baseline, 3) before and after the audio baseline, 4) after each decision to switch from listening to the audio recording to watching the film clip and 5) after each block in the thought avoidance task (see Figure 1).

In order to ensure that they understood my operationalization of rumination, at the beginning of the study the research assistant explained to them that rumination “involves mulling things over in our heads about things that have happened to us in the past.” The study did not proceed until the research assistant verified that the participants had understood our operationalization of this process. This step was included with the aim of increasing the validity of the state measure of rumination.
Data Analysis Plan

First I examined whether there were any outliers (defined as 3 SDs above/below the mean) for each of the variables of the measures of individual differences (CES-D, disgust propensity, disgust sensitivity, DERS Strategies, RPA self-focus, RPA emotion, RPA dampening, RRS brooding, and resting RSA). Then I tested whether the variables met assumptions of normality by examining skew ratios (skewness/SE). If a variable had a skew ratio (Skewness/SE) greater than 2, I removed outliers +/- 3 SD above the mean and assessed whether the skew ratio remains above 2. If removing outliers did not correct the skew, I transformed the variables with skew ratios greater than 2 and used the transformed variables for analyses. DSH Lifetime > 10 is a dichotomous variable so it was excluded from these steps.

Next, I conducted manipulation checks to ensure that the disgust video was effective in inducing disgust. To do so, I ran a paired-samples t-test with disgust after the disgust video preview compared with disgust following the neutral preview. To assess whether the film clip was aversive I ran a paired-samples t-test with excitement following the disgust video preview compared with excitement following the neutral preview. I then checked that the experimental manipulation was effective by conducting one repeated measures MANOVA predicting rumination and another one predicting sadness (pre, post induction) with condition (rumination, distraction).

I assessed the tendency to switch to the video in two ways. First, I calculated whether a participant switched to the film clip (yes/no) in each of the blocks and added up this total in order to have an indication of overall escape behavior. This total number of switches score ranged from 0 (never switched) to 4 (always switched). I predicted this total number of switches with
regulation condition and individual differences (and their interactions). For a more conservative analyses controlling for the general tendency to switch, I co-varied the total number of switches to the neutral video, which can range from 0 (never switched) to 2 (always switched).

Second, I calculated how long it took each participant to switch to the video for the first time during the neutral blocks and the first time to switch during the disgust blocks. The latency to first disgust switch score ranged from 0 seconds (switched right away in the first disgust block) to 1200 seconds (did not switch in any of the 4 disgust blocks) for the disgust blocks. For example, if a participant switched five seconds into the third disgust block to the film clip, but had not switched during either of the earlier two disgust blocks, the participant would have a value of 605 seconds. This would allow me to identify how long participants listened to the audio recording in each type of block before their first switch to each respective video.

I used Cox regression to predict latency to first disgust switch. Cox regression can account for the two related dependent variables (whether occurred participant switched to the film clip & the latency to switch to the film clip) and the risk that an independent variable confers for that event over time. Cox regression has features in common with an odds ratio in that it uses an independent variable to predict the likelihood that a dichotomous outcome (e.g. switching to the disgust film clip) will occur. At each moment in a study one can calculate a “hazard rate” representing the probability that an event of interest occurred. This proportional hazard rate is reflected in $Exp(B)$. The score on the independent variable (e.g. a measure of psychopathology) multiplied by $Exp(B)$ represents the change in the predicted hazard rate. Values of $Exp(B)$ greater than one indicate that increases in the independent variable are associated with increased hazard rates, whereas values of $Exp(B)$ less than one indicate that decreases in the independent
variable are associated with increased hazard (see Hosmer, Lemeshow, & May, 2008). As such Cox regression allows me to determine whether independent variables confer increased likelihood to switch to the video sooner. In this respect, I predicted latency to first disgust switch by running Cox regressions with regulation condition and individual differences (and their interactions). For a more conservative analyses controlling for the tendency to switch, I co-varied the latency to first neutral switch. This score can range from 0 seconds (switched right away in the first neutral block) to 600 seconds (did not switch in either neutral block).
Results

CES-D and DERS Strategies did not contain any outliers; however they each had skew ratios greater than 2. I transformed CES-D and DERS strategies by taking their square root to reduce the skewness. RPA dampening had 1 outlier; however dropping the outlier did not reduce the skew ratio. I transformed RPA dampening to reduce the skew. I transformed RPA dampening first using a square root. The square root transformation did not reduce the skew ratio to a value below 2. Next I transformed RPA dampening using a log transformation. The log transformation reduced the skew ratio of RPA dampening to below 2. I used the log transformation of RPA dampening in subsequent analyses. I did not transform or remove outliers for the remaining individual difference variables. Table 1 shows the correlations between each of the measures of individual differences and the untransformed means and standard deviations.
Table 1

Correlations between individual differences

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Disgust propensity</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2. Disgust sensitivity</td>
<td>.583**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3. DERS strategies</td>
<td>.114</td>
<td>.280**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. RPA dampening</td>
<td>.093</td>
<td>.262**</td>
<td>.553**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5. RPA self-focus</td>
<td>.131</td>
<td>.065</td>
<td>.007</td>
<td>.119</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6. RPA emotion</td>
<td>.141</td>
<td>.152</td>
<td>-.132</td>
<td>.004</td>
<td>.569**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7. RRS-brooding</td>
<td>.191*</td>
<td>.341**</td>
<td>.697**</td>
<td>.551**</td>
<td>.110</td>
<td>.011</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8. CES-D</td>
<td>.240*</td>
<td>.303**</td>
<td>.718**</td>
<td>.468**</td>
<td>-.114</td>
<td>-.143</td>
<td>.643**</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9. DSHI &gt;10</td>
<td>.098</td>
<td>.069</td>
<td>.164</td>
<td>.106</td>
<td>-.145</td>
<td>-.042</td>
<td>.172</td>
<td>.345**</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>10. Resting RSA</td>
<td>.036</td>
<td>-.019</td>
<td>-.090</td>
<td>-.034</td>
<td>.075</td>
<td>-.065</td>
<td>-.117</td>
<td>-.048</td>
<td>-.062</td>
<td>1</td>
</tr>
<tr>
<td>SD</td>
<td>.6258</td>
<td>.656</td>
<td>7.9891</td>
<td>5.1515</td>
<td>2.8095</td>
<td>3.0024</td>
<td>3.498</td>
<td>9.3929</td>
<td>NA</td>
<td>1.162</td>
</tr>
</tbody>
</table>

Note. Means and Standard Deviations reported on untransformed variables. ** Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

Group Differences

There was a significant pre-randomization difference between groups for RPA emotion ($t$ (108) $=-2.069$, $p = .041$) and resting RSA ($t$ (99) $=2.143$, $p = .014$) with lower RPA emotion and
higher resting RSA in the rumination condition than in the distraction condition. Due to these group differences I did not examine their interactions with condition.

**Manipulation Checks**

Participants rated their disgust higher following the disgust video preview than following the neutral video preview, $t(109) = 10.486, p < .01, d = 1.365$. Disgust sensitivity ($r = .260, p < .01$) and disgust propensity ($r = .477, p < .01$) were both significantly correlated with self-reported disgust following the disgust video preview.

Participants rated their excitement higher following the disgust preview video than the neutral video preview, $t(109) = 2.579, p = .011, d = 0.193$. Disgust sensitivity ($r = .105, p = .274$) and disgust propensity ($r = -.133, p = .167$) were not significantly correlated with self-reported excitement following the disgust preview.

I conducted a repeated measures MANOVA predicting state rumination (pre, post induction) with condition (rumination, distraction). There was a significant interaction between condition and time, $F(1,108) = 13.131, p < .05$, partial $\eta^2 = .108$ (small-to-medium). In the rumination condition, there was a significant increase in state rumination, $t(53) = 9.704, p = .003$, $d = .419$ (medium), whereas in the distraction condition there was no significant change, $t(55) = -1.792, p = .079$ (see Figure 4).

I conducted a repeated measures MANOVA predicting state sadness (pre, post audio mood induction) with condition (rumination, distraction). There was a significant interaction of condition and time, $F(1,108) = 14.432, p < .05$, partial $\eta^2 = .118$ (small-to-medium). In the rumination condition, there was a significant increase in sadness, $t(53) = 4.830, p < .001$, $d =$
.453 (medium) whereas in the distraction condition there was no significant change, \( t(55) = -.113, p = .911 \) (See Figure 4).

**Figure 4.** Repeated measure MANOVAs pre and post mood induction predicting sadness and rumination by condition.

**Descriptive Statistics**

**Total number of switches.** Across the neutral blocks, the percentage of participants who switched to the film clip ranged from 75.9% to 77.8% in the rumination condition and from 71.4% to 85.7% in the distraction condition. Across the disgust blocks, the percentage of participants who switched to the video ranged from 40.7% to 70.4% in the rumination condition and 44.6% to 64.3% for the distraction condition. I conducted a Chi-Square test for each block. There were no significant differences in the percentage of switched to the video by condition (\( ps \))
≥ .252). See Table 2 for the percent of participants who switched to the video by condition and block.

Table 2

*Percent of participants who switched to the film clip by condition and block*

<table>
<thead>
<tr>
<th></th>
<th>% Switch Distraction Audio</th>
<th>% Switch Rumination Audio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disgust 1</td>
<td>46.4</td>
<td>40.7</td>
</tr>
<tr>
<td>Disgust 2</td>
<td>64.3</td>
<td>70.4</td>
</tr>
<tr>
<td>Disgust 3</td>
<td>55.4</td>
<td>44.4</td>
</tr>
<tr>
<td>Disgust 4</td>
<td>44.6</td>
<td>48.1</td>
</tr>
<tr>
<td>Neutral 1</td>
<td>71.4</td>
<td>75.9</td>
</tr>
<tr>
<td>Neutral 2</td>
<td>85.7</td>
<td>77.8</td>
</tr>
</tbody>
</table>

In the rumination condition 7.4% of participants never switched to the neutral film and also 7.4% of them never switched to the disgust film. In the distraction condition 7.1% of participants never switched to the neutral film in any block and 8.9% of them never switched to the disgust film in any block (see Tables 3 and 4 for the total number of videos viewed by participants by video type). Participants who never switched to the disgust film were censored for Cox regression analyses. This means that the Cox regression models identified them as hitting the measurement ceiling.
Table 3

*Total switches to disgust film clip over entire study by condition*

<table>
<thead>
<tr>
<th></th>
<th>Neutral Audio</th>
<th>Rumination Audio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Switch</td>
<td>8.9%</td>
<td>7.4%</td>
</tr>
<tr>
<td>1 Switch</td>
<td>32.1%</td>
<td>27.8%</td>
</tr>
<tr>
<td>2 Switch</td>
<td>14.3%</td>
<td>35.2%</td>
</tr>
<tr>
<td>3 Switch</td>
<td>28.6%</td>
<td>13.0%</td>
</tr>
<tr>
<td>4 Switch</td>
<td>16.1%</td>
<td>16.7%</td>
</tr>
</tbody>
</table>

Table 4

*Total switches to neutral film clip over entire study by condition*

<table>
<thead>
<tr>
<th></th>
<th>Neutral Audio</th>
<th>Rumination Audio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Switch</td>
<td>7.1%</td>
<td>7.4%</td>
</tr>
<tr>
<td>1 Switch</td>
<td>28.6%</td>
<td>31.5%</td>
</tr>
<tr>
<td>2 Switch</td>
<td>64.3%</td>
<td>61.1%</td>
</tr>
</tbody>
</table>

Descriptive Statistics

**Latency to switch.** The amount of time spent listening to the audio (the inverse of duration viewing the video) all blocks was highly skewed (See Table 5 for descriptive statistics) and therefore did not conform to the assumptions of a normal distribution required by linear
regression and Pearson correlations. However, Cox regression does not require normally distributed dependent variables so this deviation from the normal distribution is acceptable for these analyses (Hosmer et al., 2008).

Table 5

Descriptive statistics for duration (seconds) listening to audio recording by block

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Skewness SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disgust1</td>
<td>.77</td>
<td>300</td>
<td>192.6508</td>
<td>127.117</td>
<td>-.400</td>
<td>.230</td>
</tr>
<tr>
<td>Disgust2</td>
<td>.47</td>
<td>300</td>
<td>126.7976</td>
<td>125.732</td>
<td>.572</td>
<td>.230</td>
</tr>
<tr>
<td>Disgust3</td>
<td>.60</td>
<td>300</td>
<td>177.2229</td>
<td>132.837</td>
<td>-.262</td>
<td>.230</td>
</tr>
<tr>
<td>Disgust4</td>
<td>.51</td>
<td>300</td>
<td>181.5966</td>
<td>134.398</td>
<td>-.347</td>
<td>.230</td>
</tr>
<tr>
<td>Neutral1</td>
<td>.99</td>
<td>300</td>
<td>107.8039</td>
<td>121.750</td>
<td>.877</td>
<td>.230</td>
</tr>
<tr>
<td>Neutral2</td>
<td>.37</td>
<td>300</td>
<td>72.9614</td>
<td>110.837</td>
<td>1.494</td>
<td>.230</td>
</tr>
</tbody>
</table>

*Note.* The maximum duration is 300 for each block because each block was 300 seconds long. Participants with values of 300 seconds for these variables listened to the audio recording for the full durations of the block.

**Testing Hypothesis 1: Main Effects of Condition**

**Total number of switches.** There was no significant main effect of condition when predicting the total number of times switched to disgust ($p = .766$). This remained non-significant when controlling for total number of switches to the neutral video ($p = .806$).

**Likelihood of switching.** There was no significant main effect of condition when predicting latency to first switch disgust ($p = .773$). This remained non-significant when controlling for latency to switch to the neutral video ($p = .590$).
Testing Hypothesis 2: Main Effects of Individual Differences

**Total number of switches.** There were no significant main effects of CES-D, DSH >10 lifetime, RRS- brooding, RPA emotion, RPA dampening, RPA self-focus, or resting RSA predicting total number of times switched to disgust \((p \geq .136)\). There was a marginal relationship between disgust sensitivity and total switch to disgust \((p = .085)\) in the direction of greater disgust sensitivity predicting fewer switches to the disgust film clip. In addition, there was a significant main effect of disgust propensity predicting number of times switched to the disgust film clip. Higher levels of disgust propensity were associated with switching to the disgust videos less often \((\beta = -.541, p < .01)\). When controlling for total number of switches to the neutral video, disgust propensity remained a significant predictor of total switch to disgust \((\beta = -.645, p < .01)\).

All of the previously non-significant individual differences remained non-significant \((p \geq .102)\).

**Likelihood of switching.** There were no significant main effects any of CES-D, DSH >10 lifetime, disgust propensity, disgust sensitivity, RRS- brooding, RPA emotion, RPA dampening, RPA self-focus, or resting RSA predicting latency to first switch to disgust \((p \geq .114)\). When controlling for latency to first neutral switch, there was a significant relationship between disgust propensity and latency to first disgust switch, \(\beta = -.429, Wald \chi^2 = 5.404, p = .020, Exp(B) = .651[.453, .935]\). Higher levels of disgust propensity were associated with a lower likelihood to switch to the disgust video.

Testing Hypothesis 3: Individual Differences Interacting with Condition

**Total number of switches.** I conducted separate linear regressions examining whether individual differences would moderate the relationship between condition and total number of switches to the disgust video. There were no significant interactions between condition and CES-
D, DSH >10 lifetime, disgust propensity, disgust sensitivity, RRS- brooding, RPA dampening, or RPA self-focus predicting total times switching to the disgust film, \( (ps \geq .253) \). I excluded resting RSA and RPA emotion from these analyses due to group differences between conditions at baseline. When controlling for total switch to neutral as a covariate, each of the interactions remained non-significant \( (ps \geq .124) \).

**Likelihood of switching.** I conducted separate Cox regressions examining whether individual differences moderated the relationship between conditions predicting latency to first switch to the disgust video. I excluded RPA Emotion and resting RSA from these analyses due to the baseline differences between groups. There were no significant two-way interactions between condition and CES-D, DSH >10 lifetime, disgust propensity, disgust sensitivity, RRS-brooding, RPA dampening, or RPA self-focus latency to first disgust switch \( (ps \geq .181) \). The interactions between CES-D, disgust propensity, disgust sensitivity, RRS-brooding, RPA dampening, or RPA self-focus and condition were run with latency to first neutral switch as a covariate and the results remained non-significant \( (ps \geq .289) \). There was a marginal interaction between DSH lifetime and condition predicting latency to first disgust switch when controlling for latency to first neutral switch \( (p = .096) \). When I broke it down, I found no significant relationship between DSH lifetime and latency to first disgust switch in the distraction condition. In the rumination condition, there was a marginal relationship between DSH lifetime and latency to first disgust switch, \( \beta = -.751, \ Wald \chi^2 = .384, p = .050, \ Exp(B) = .472[.223, 1.001] \), such that participants with a lifetime history of at least 10 episodes of deliberate self-harm had a greater likelihood to switch to the disgust film clip when they were in the rumination condition.
Discussion

Recent work suggests that self-destructive behaviors may function to disrupt rumination, thus operating through negative reinforcement (e.g., Baumeister, 1991; Nolen-Hoeksema et al., 2007; Selby & Joiner, 2009). In particular, the cascade model suggests that in order to escape rumination, individuals might be willing to endure aversive states, such as binge drinking or self-injurious behaviors (Selby & Joiner, 2009). However, most of the research on emotional cascades has been correlational, thus failing to examine causal relationships. As such, the goal of this thesis was to adapt an experimental approach to test whether rumination increases the willingness to distract via an aversive stimulus (i.e., disgust film clip). Overall, there were no significant effects of rumination induction (versus the distraction induction) and only one of the individual difference variables (disgust sensitivity) was associated with switching behavior. Below, I discuss several possibilities that might account for the lack of support for the emotional cascades model.

I first predicted that participants in the rumination condition would watch more of the disgust film than those in the distraction condition. However, there was no significant main effect of experimental condition predicting or total number of times switching to the disgust film or latency to switch to the disgust film even after controlling for switching activity in the neutral blocks. As such, the findings do not support Hypothesis 1.

One possible explanation is that the rumination induction might not have been strong enough to have a measurable impact on behavior. Although I relied on a widely used manipulation (e.g., Lyubomirsky & Nolen-Hoeksema, 1993; Watkins & Moulds, 2005) and obtained medium-size effect sizes ($d = .419$ for increases in state rumination; $d = .453$ for
increases in sadness, partial $\eta^2 = .108$ for the model predicting increases in rumination with experimental condition and partial $\eta^2 = .118$ for the model predicting increases in sadness with experimental condition), it is possible that larger effect sizes might have been needed in order to produce downstream effects on behavioral outcomes (see Christensen & Aldao, 2015). This suggests that in future work it will be essential to conduct stronger rumination inductions. One possibility in this respect is to present participants with negative mood inductions (such as negative peer feedback) before their rumination induction (e.g., Hilt & Pollak, 2012). In this vein, much work is needed to determine how to increase the intensity of rumination inductions.

Another important consideration would be to increase the intensity of the aversive stimuli. In the present study, more than half of participants switched to the disgust film multiple times and participants rated the disgust film preview more exciting than the neutral film preview. This suggests that the film clips might not have been aversive enough. Future work might utilize stronger stimuli. One way of doing so is by relying on stimuli that are idiographically relevant (e.g., Barlow & Nock, 2009; Rottenberg, Joormann, Brozovich, & Gotlib, 2005). One option might be to ask participants to rank stimuli in order of most to least aversive and then present back the highest ranked items. In another vein, future work might try to address potential confounds associated with one of the options consisted of listening to an audio file and the other one of watching a film clip. In this respect, it might be useful to present the rumination and distraction inductions in a video format. For example, participants might view a video of themselves earlier in the study completing a difficult task with rumination audio prompts while viewing the clip.
For Hypothesis 2, I anticipated that individual differences in psychopathology, disgust sensitivity, and emotion regulation would probability to switch to the disgust film and total times switched to the disgust film, which had mild support. There were no significant main effects of psychopathology, emotion dysregulation, trait rumination or resting RSA predicting latency to first disgust switch or total switch to disgust. There was, however, a main effect of disgust propensity. Participants who were more prone to experience disgust switched to the disgust film fewer times and were more likely to switch to the disgust film than those less prone to experience disgust. In other words, they displayed less approach behavior towards the disgust-eliciting film clips. This finding suggests that individual differences related to the specific stimulus content (disgust) might have influenced participant willingness to stay in their thoughts.

For Hypothesis 3, I predicted that there would be two-way interactions between measures of individual differences and experimental condition. Specifically, I hypothesized that individuals who had greater symptoms of psychopathology, lower disgust propensity and sensitivity, lower access to emotion regulation strategies, and greater habitual use of rumination would be more likely to switch to the disgust films and do so more frequently to the, particularly in the rumination condition. There were no significant interactions between condition and trait level individual differences predicting latency to switch to the disgust film or total number of times switched to the disgust film. As such, the present study does not provide support for Hypothesis 3.

To address this limitation, a natural extension would be to test this type of paradigm in clinical populations. In particular, it might be good to focus on individuals who engage in deliberate self-harm, given that the DSH lifetime >10 had a marginal interaction with condition
when predicting latency to first switch to the disgust film clip. In this marginal interaction there was a trend for individuals with a lifetime history of 10 or more episodes of deliberate self-harm to be more likely to switch to the disgust film clip when they were in the rumination condition. Future work might seek to include a larger sample with a history of deliberate self-harm to examine whether this population responds differently to a rumination induction than among those without a history of deliberate self-harm. The present study is limited in that only 15.5% of the sample endorsed a lifetime history of 10 or more instances of deliberate self-harm and as such is likely underpowered to identify an interaction effect. A greater representation of clinical participants might help more broadly with the other measures of individual differences to increase variability in the sample. In particular, future work might include individuals with depressive disorders because rumination is a key feature of those disorders (Nolen-Hoeksema et al., 2008). It is possible that the effect of the rumination induction might be greater for clinical populations, and this might lead to stronger effects of the induction. The present study is also limited because I excluded resting RSA from this set of analyses due to the pre-randomization difference in resting RSA. Future work with another sample could test whether there is an interaction between resting RSA and condition.

Although in the present study I used the neutral clips as a control to assess general tendency to switch to a video stimulus, the present study might have benefited from an equal number of neutral blocks relative to disgust blocks to allow comparisons between two types of stimuli. Future work might also incorporate a broader range of stimuli, perhaps utilizing an idiographic approach to ensure that each participant makes decisions about stimuli they personally consider aversive.
Additionally in the present study, during each block the participant was not able to switch back to the audio recording during the block. If a participant quickly regretted their decision to switch to the video clip, this design was unable to capture that information. A future design might incorporate options to switch back and forth between the audio and video stimuli. This might better mimic the real world where individual might engage in distraction from rumination, but then return to their thoughts.

The timing of the option to switch to the film clip may have contributed to the lack of effects. Recent work (Suri, Sheppes, Schwartz, & Gross, 2013) suggests that when one option is presented as a default (selected via inaction such as listening to the audio in the present study), participants make decisions that are objectively worse than when forced to make a choice between options. This suggests that a forced choice response at the beginning of each block might have led to different results. However, emotion regulation in the real world does not require a forced choice response. In the real world individuals must overcome default inaction when they select and apply emotion regulation strategies. In the present study, use of a forced choice paradigm might have reduced the external validity of the design.

In this thesis I developed a novel design to experimentally test participants’ willingness to disrupt ruminative thoughts by engaging with aversive stimuli. Unfortunately, most of the analyses yielded non-significant results. They suggest two areas for future work. First, the relative low strength of the experimental manipulation underscores the importance of conducting work to identity how to generate intense rumination inductions, especially when seeking to test their downstream effects on behavior (Christensen & Aldao, 2015). Second, it will be important to conduct this work with clinical populations, as this will affords us with greater variability in
individual differences in symptoms, habitual use of rumination, and emotion dysregulation. I look forward to pursuing those lines of work.
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Appendix A

**Text of Rumination & Distraction Audio Recordings**: (Based on Nolen-Hoeksema 1993)

**Rumination Instructions:**

For the next few minutes, try your best to focus your attention on each of the following ideas. Listen to each item slowly and silently to yourself. As you listen to the items, think about things you regret. Spend a few moments visualizing and concentrating on each item. Please continue until the experimenter returns.

Think About:

your character and who you strive to be

Think About:

why you react the way you do

Think About:

the way you feel inside

Think About:

the possible consequences of your current mental state

Think About:

how similar/different you are relative to other people

Think About:

what it would be like if your present feelings lasted

Think About:

why things turn out the way they do
Think About:
trying to understand your feelings
Think About:
whether you are fulfilled
Think About:
your physical appearance
Think About:
whether you feel stressed right now
Think About:
the long-term goals you have set
Think About:
the amount of certainty you feel
Think About:
your present feelings of fatigue/energy
Think About:
how hopeful/hopeless you are feeling
Think About:
the level of motivation you feel right now

Distraction Instructions:
For the next few minutes, try your best to focus your attention on each of the ideas you will be listening to.

Listen to each item carefully. As you do so, use your imagination and concentration to focus your mind on each of the ideas. Spend a few moments visualizing and concentrating on each item.

Please continue until the experimenter returns  [15 seconds per prompt]

Think About:

the layout of a typical classroom

Think About:

the shape of a large black umbrella

Think About:

a double-decker bus driving down a street

Think About:

and picture a full moon on a clear night

Think About:

the layout of the local shopping center

Think About:

and imagine a plane flying overhead

Think About:

and concentrate on the expression on the face of the Mona Lisa

Think About:

a clown putting on his or her make-up

Think About:
the shadow of a stop sign

Think About:
the layout of the local post office

Think About:
the structure of a high-rise office building

Think About:
and picture the Eiffel Tower

Think About:
and imagine a truckload of watermelons

Think About:
the pattern on an Oriental rug

Think About:
the shape of the continent of Africa

Think About:
the shape of the torch on the Statue of Liberty