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Concreteness of Positive, Negative, and Neutral Repetitive Thinking About the Future

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Abstract

Consistent with assertions that the adaptiveness of repetitive thinking is influenced by both its valence and style, Stöber (e.g., Stöber & Borkovec, 2002) has argued that worry is characterized by a reduced concreteness of thought content and that the resulting abstractness contributes to its inhibition of some aspects of anxious responding. However, extant research does not provide a direct test of Stöber's reduced concreteness theory of worry. We sought to test Stöber's theory and to examine the adaptiveness of repetitive worrisome thinking by randomly assigning 108 participants to engage in five consecutive periods of repetitive thinking about positively, negatively, or neutrally valenced potential future events. Results based on coding of thought data indicated that (a) repetitive thinking became increasingly less concrete as periods progressed; (b) contrary to Stöber's theory, both negative and positive repetitive future thinking were more concrete than neutral repetitive future thinking (and did not differ from each other); and (c) abstractness of thought during negative repetitive future thinking was associated with reduced reports of imagery-based activity. Results based on self-reported affect indicated that negatively valenced repetitive future thinking was uniquely associated with initial decreases in anxious affect, followed by increased anxious affect that coincided with increased imagery-based activity. This suggests that worry is associated with a sequential mitigation of anxious meaning followed by a strengthening of anxious meaning over time. Theoretical and clinical implications of these findings are discussed.

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Keywords

repetitive thought; worry; rumination; abstract; concrete

Repetitive thought is defined as the process of "thinking attentively, repetitively, or frequently about oneself and one's world" (Segerstrom, Stanton, Alden, & Shortridge, 2003, p. 909) and can lead to both adaptive and nonadaptive consequences. Recently, Watkins (2008) published a detailed review of the research on repetitive thinking and suggested that the adaptiveness versus nonadaptiveness of repetitive thought may be determined in part by both the structure (e.g., affective valence) and the process (i.e., thinking style) of those thoughts. Regarding the affective valence of thoughts, considerable theory (e.g., Segerstrom et al., 2003) and evidence exist indicating that the valence of repetitive thoughts likely moderates the relationship between repetitive thinking and a host of consequences. Extant research indicates that in contrast to general rumination, negative rumination predicts symptoms of depression 8 months later (Ito, Takenaka, Tomita, & Agari, 2006). Additionally, relative to self-focus on negative aspects of the self, self-focus on positive aspects of the self following a positive event is associated with lower negative affect (NA; Mor & Winquist, 2002). Valence of repetitive thoughts has also been found to predict health outcomes at a future date (e.g., Rude, Maestas, & Neff, 2007).

Regarding thinking style, significant emphasis has been placed on the degree to which repetitive thought is either abstract or concrete in nature, with thinking style moderating the relationship between trait predisposition to repetitive thinking and emotional reactivity. For example, higher levels of trait repetitive thinking are positively associated with higher negative mood about a recent failure experience only among participants assigned to engage in abstract/evaluative (as opposed to concrete/expressive) writing (Watkins, 2004). Similarly, higher levels of trait repetitive thinking are associated with lower levels of positive affect (PA) following an unanticipated failure experience only among participants assigned to think about emotional scenarios using abstract (as opposed to concrete) processing (Moberly & Watkins, 2006). Thus, it seems that abstract repetitive thought has nonadaptive effects on emotional responding, whereas concrete repetitive thought does not (however, see Ayduk & Kross, 2010; Updegraff & Suh, 2007).

One type of repetitive thought that has received extensive empirical and theoretical attention is worry. Worry represents repetitive thinking about potential negatively valenced future events and is associated with several affective, physiological, and cognitive phenomena. Importantly, worry is predominantly verbal–linguistic, as opposed to imagery-based, in nature (Behar, Zuellig, & Borkovec, 2005; Borkovec & Inz, 1990), and this verbal–linguistic nature is theorized to be at the genesis of a host of inhibitory functions that characterize the worry process. More specifically, the avoidance theory of worry (Borkovec, Alcaine, & Behar, 2004) posits that worry is often utilized as an attempt to prepare for the worst and to problem solve (both adaptive functions) but leads to numerous nonadaptive consequences, including the suppression of aversive imagery, increased subjective distress, disturbances to physiological processes, negative health effects, and inhibited somatic anxiety activation during subsequent periods of anxiety (as compared to individuals undergoing a prior period

of relaxation; Borkovec & Hu, 1990). Because (a) verbal articulation of fearful material leads to little cardiovascular activity, whereas imagery of the same material leads to a considerable cardiovascular response (Vrana, Cuthbert, & Lang, 1986); and (b) individuals spontaneously utilize verbalization as a strategy to elicit abstraction, disengagement, and emotional control when presented with highly arousing and aversive material (Tucker & Newman, 1981), theoretical accounts of worry have posited that it is worry's verbal–linguistic nature that is responsible for its inhibitory effects.

Stöber's reduced concreteness theory of worry focuses primarily on worry's hypothesized abstract nature in its conceptualization of worry's nonadaptive effects. Specifically, Stöber and his colleagues argue that the abstract thought that characterizes worry provides a mechanism by which individuals avoid fear-relevant imagery and its associated affective and physiological experience (Stöber, 1998; Stöber & Borkovec, 2002; Stöber, Tepperwein, & Staak, 2000). Stöber has empirically examined the degree to which worry is characterized by abstractness versus concreteness of thought, with the underlying postulation that concrete thinking about problems is adaptive in that it enables individuals to prepare for, prevent, and/or solve expected negative consequences of problems, whereas abstract thinking is nonadaptive in that it inhibits these functions (Stöber & Borkovec, 2002). Stöber et al. asked student participants to engage in problem elaborations of their worries using both problem elaboration charts (in which they indicated three potential antecedents and consequences of their worries) and catastrophizing interviews. Results indicated that elaborations of problems about which participants worried were associated with less concreteness than elaborations of problems about which they did not worry, and that the more participants worried about a problem, the less concrete their problem elaborations were. In another study, generalized anxiety disorder (GAD) clients described their worries in less concrete terms than did control participants, and these worry descriptions became significantly more concrete following 14 sessions of cognitive-behavioral therapy (Stöber & Borkovec, 2002).

Despite these findings, several limitations exist regarding our ability to unambiguously conclude that worry is characterized by reduced concreteness and our ability to understand the precise nonadaptive effects of this hypothesized reduction in concreteness. First, existing studies have not examined the concreteness of worrisome thinking per se; instead, studies have examined the concreteness of either problem elaborations or of brief worry descriptions. Whether worry episodes *themselves* are characterized by reduced concreteness remains to be directly tested. Second, worrisome thinking is future oriented, and it may be that the reduced concreteness theorized to be central to the worry process is merely a characteristic of future-oriented thought in general and not future-oriented negative thinking (i.e., worry) specifically.[1] Indeed, construal-level theory (Liberman & Trope, 1998; Trope & Liberman, 2003) proposes that the temporal distance of an event (i.e., whether it occurs in the near or distant future) influences individuals' mental representations of the event, whereby greater temporal distance is associated with more abstract, general, and decontextualized features, and less temporal distance is associated with more concrete, specific, and contextual features. Third, it is also unclear whether worry itself is

[1]Worry is repetitive negative thinking about the future. Whether there is some other negative future thinking that is *not* worry is not known, but is perhaps possible.

characterized by reduced concreteness, or whether any affectively laden repetitive thought would evidence reduced concreteness. Thus, it is important to rule out temporal distance and general emotional valence as alternative explanations in the conceptualization of worry as being uniquely associated with abstractness of thought. Doing so may increase our understanding of the adapativeness versus nonadaptiveness of worrisome thinking and how level of construal may or may not impact those qualities.

The present study seeks to avoid the above limitations by examining the degree to which repetitive thinking about a future event that is either positively, negatively, or neutrally valenced is characterized by (a) abstract versus concrete thought content, (b) verbal–linguistic versus imaginal activity, and (c) a range of affective outcomes. We posed several hypotheses based on Stöber's (1998) theoretical assertions and Watkins's (2008) conclusions regarding the nature of repetitive thinking. First, consistent with Stöber's reduced concreteness theory of worry, we hypothesized that future-oriented negative thoughts would be less concrete than future-oriented positive or neutral thoughts. Second, consistent with Stöber's assertion that abstract thinking inhibits imagery during the worry process, we expected that the degree of concreteness of sampled negative thoughts would be positively correlated with reported imagery and that this correlation would be stronger than correlations observed between reported imagery and the concreteness of positive or neutral thoughts. Third, in examining the adaptiveness of repetitive thinking as it relates to affective states, we hypothesized (consistent with conclusions by Watkins, 2008) that negative repetitive thinking would be associated with nonadaptive consequences, whereas positive and neutral repetitive thinking would not evidence such effects. Specifically, we predicted that negative repetitive thinking would be associated with decreased PA, increased depressed affect, and inhibition of fear-relevant affect (i.e., anxiety) as consistent with the assertion of the avoidance theory of worry that the verbal–linguistic, abstract nature of worry precludes emotional processing of fear stimuli (Borkovec et al., 2004).

Method

PARTICIPANTS

Participants were 108 undergraduate students enrolled in an introductory psychology course. Participants were 51% female and had a mean age of 18.92 years (*SD*=1.34). Of the sample, 81% (*n*=87) of participants identified as White, 7% (*n*=8) as African American, 7% (*n*=8) as Asian/Pacific Islander, 1% (*n*=1) as Hispanic/Latino, and 4% (*n*=4) as other. Although the representation of racial/ethnic groups was equivalent across the three conditions of the experiment, $\chi^2(8)=4.36$, *ns*, the representation of sex was nonequivalent, $\chi^2(2)= 8.11$, $p<.05$. Whereas the positive and negative repetitive thinking conditions both contained a greater representation of males (*n*=22 and 20, respectively) than females (*n*=13 and 18, respectively), the neutral repetitive thinking condition contained more females (*n*=24) than males (*n*=10), neutral versus positive: $\chi^2(1)=3.98$, $p<.05$; neutral versus negative: $\chi^2(1)=7.58$, $p<.05$, respectively. Thus, sex was entered as a covariate in all analyses.

MEASURES

Beck Depression Inventory—The Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item self-report measure of depressive symptoms with strong psychometric properties among outpatients (Beck et al., 1996) and student samples (Whisman, Perez, & Ramel, 2000). The BDI-II has demonstrated good internal consistency in nonclinical populations as well as favorable convergent validity with the Hamilton Rating Scale for Depression (.73 and greater; Beck et al., 1996). Internal consistency of the BDI was high in the present study (α=0.80).

Penn State Worry Questionnaire—The Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) is a 16-item measure of the frequency and intensity of trait worry. The PSWQ has high internal consistency (α=0.91) and high retest reliability (Meyer et al., 1990), and it distinguishes individuals with GAD from individuals with other anxiety disorders (Brown, Antony, & Barlow, 1992). Correlations between the PSWQ and measures of anxiety (.35), depression (.39), and emotional control (−.52) have supported the convergent and discriminant validity of this measure (Brown et al., 1992). In the present study, the sample had a mean PSWQ score of 44.87 (*SD*=15.59, range=16–80). We also examined the skewness and kurtosis of PSWQ scores and found that the distribution was normal, indicating that the full range of PSWQ scores was normally represented in our sample. Finally, internal consistency of the PSWQ was high in this sample (α=0.95).

Ruminations Inventory—The Ruminations Inventory (RI; McIntosh & Martin, 1992) is a 10-item questionnaire designed to measure a general tendency toward repetitive thought, including increased frequency and decreased controllability of thoughts, tendency to engage in mental rehearsal of future and past events, and distractibility. The RI evidences favorable retest reliability (.78 for 2-week periods). It also displays adequate discriminant validity with personality constructs such as conscientiousness and extroversion, and adequate convergent validity with neuroticism (*r*=.62). Internal consistency of the RI was good in the present study (α=0.69).

Mood and Anxiety Symptom Questionnaire—The Mood and Anxiety Symptom Questionnaire (MASQ; Watson & Clark, 1991) is a 90-item scale designed to measure trait symptoms of depression and anxiety. It consists of five scales that map on to Watson and Clark's tripartite model, namely, General Distress–Mixed Symptoms, General Distress–Anxious Symptoms, General Distress–Depressive Symptoms, Anhedonic Depression, and Anxious Arousal. The subscales have demonstrated satisfactory reliability (αs=.78–.93) as well as convergent (.54–.76) and discriminant (.25–.68) validities (Watson, Clark, et al., 1995; Watson, Weber, et al., 1995). Internal consistency of the subscales was high in the present study (.77≤αs≤0.92).

Positive and Negative Affect Schedule—The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item self-report measure that assesses both positive and NA. The PANAS demonstrates good internal consistency and retest reliability for both positive and NA scales. It also evidences good convergent (0.81–0.92 for

positive; 0.76–0.91 for negative) and discriminant (−0.36 to −0.12 for positive; −0.43 to −0.11 for negative) validities. The PANAS was administered five times over the course of the experiment, and evidenced consistently high internal consistency for both (PA; αs=.87, .90, .92, .92, .88) and (NA; αs=.85, .81, .81, .81, .81) subscales over time.

PROCEDURE

Participants were run in groups of 7–10 individuals, with each group randomly assigned to think about positively (*n*=35), negatively (*n*=38), or neutrally (*n*=35) valenced potential future events. In order to reduce the risk of cohort effects, we ran three groups of participants (one from each condition) on each day of data collection. After providing informed consent, all participants were asked to complete the BDI, PSWQ, RI, and MASQ (in counterbalanced order) in order to ascertain whether there were equivalent levels of trait depression, anxiety, worry, and rumination across the three randomly assigned groups. Participants were told that they would need to write down the contents of their minds several times throughout the experiment, to report their mood states, and to report the degree to which their mental activity consisted of thoughts versus images. The experimenter presented a brief tutorial in which operational definitions were provided for “thoughts” (“words you say to yourself in your mind”) and “images” (“pictures you notice in your mind’s eye”), as well as a specific example to demonstrate this distinction. Across all three valence conditions, participants were told to concentrate as much as possible on their assigned thinking material and that if they noticed their mind wandering, to bring the focus of their attention back to the assigned thoughts.

Participants in the positive thinking condition were asked to close their eyes and think about the possibility of being chosen at random as one of a small group of participants who would win $100 cash at the end of the study. Participants in the negative thinking condition were asked to think about the possibility of being chosen at random as one of a small group of participants who would have to give a speech in front of a video camera at the end of the session and that the videotaped speech would later be rated for quality by several graduate students and a professor. This speech-giving target was selected based on existing evidence linking worry to social-evaluative fears. Specifically, social fears correlate more strongly with worry than do nonsocial fears (Borkovec, Robinson, Pruzinsky, & DePree, 1983), interpersonal concerns comprise the most frequent category of worry topics (Roemer, Molina, & Borkovec, 1997), and social phobia is the most commonly diagnosed comorbid disorder for GAD (Brown & Barlow, 1992). Thus, we selected a standardized speech-giving anticipation task, given its likely similarity to the content of many naturally occurring worry topics.[2] Participants in the neutral thinking condition were asked to think about the advantages and disadvantages of unifying Europe under a central government and that some important things to consider were the economic consequences and cultural ramifications of such a unification.

[2]Our results should relate more strongly to worry than to some other forms of negative repetitive thinking, such as depressive rumination (which in contrast to worry consists of past-oriented thoughts; Watkins, Moulds, & Mackintosh, 2005) or obsessive thoughts (which in contrast to worry typically include themes of contamination, religion, sex, or aggression; Turner, Beidel, & Stanley, 1992).

Participants engaged in their assigned thinking conditions for five periods (4.5 minutes per period) for a total of 22.5 minutes. During these periods, participants were asked to focus on the topic dictated by their randomly assigned condition via the following instructions: "We would like you to close your eyes [imagine that you have been chosen to give the speech/ imagine that you have been chosen to win the money/think about the advantages and disadvantages of unifying Europe], and think about [having to give the speech/winning the money/the unification of Europe]. Please try to concentrate on thinking *only* about [giving this speech/winning the money/the unification of Europe]. If your mind wanders, please try to bring your focus back to [giving the speech/winning the money/the unification of Europe]." These instructions were intended to make participants' thoughts as repetitive as possible by encouraging their attentiveness, use of repetition of thought content, and frequency of assigned thoughts (Segerstrom et al., 2003).

Participants in all three conditions were first interrupted after 30 seconds of a period and then again at the 1:30-, 2:30-, 3:30-, and 4:30-minute marks, for a total of 25 interruptions. At each interruption, they were asked to (a) write down in as much detail as possible what was occurring in their mind at the exact moment of interruption (hereafter referred to as "thought samples"), and (b) rate the percentage of time during that period that they noticed thoughts, images, or neither thoughts nor images. They were then read the above instructions again; these reinductions of thinking were intended to make participants' thoughts as repetitive as possible. At the end of each of the five 4.5-minute periods, participants were asked to complete 1–5 Likert ratings of the degree to which they experienced (a) relaxed affect, (b) anxious affect, (c) depressed affect, and (d) PA and NA as measured by the PANAS (Watson et al., 1988) during the immediately preceding thinking period, as well as the degree to which they thought the future event was likely to actually occur (for participants in the negative and positive thinking conditions). At the conclusion of the experiment, participants in the positive and negative thinking conditions were informed that they would not be winning any money or giving a speech, respectively. All participants were then asked to engage in deep relaxation for 5 minutes to counter any negative effects of having engaged in experimental procedures.

All thought samples (n=2,700) were later rated on a 1–5 scale of abstractness to concreteness (with higher values indicating greater concreteness) according to Stöber's (1998) coding system. Four independent coders who had been trained in Stöber's coding system each coded all 2,700 thought samples. Stöber's system defines *abstract thought* as "indistinct, cross-situational, equivocal, unclear, aggregated" and *concrete thought* as "distinct, situationally specific, unequivocal, clear, singular." The rating scale consists of five categories: 1 (*abstract*), 2 (*somewhat abstract*), 3 (*neither abstract nor concrete*), 4 (*somewhat concrete*), and 5 (*concrete*). All four raters were blind to condition and to the purpose and hypotheses of the study, and they were initially trained by the first author using 100 thought samples from an unrelated study. Coding meetings entailed discussion of individual coders' ratings in order to arrive at a single consensus rating for each thought sample, which was thereafter utilized for all data analyses. To calculate the interrater reliability of the coders' original ratings, we followed McGraw and Wong's (1996) guidelines for selecting the appropriate intraclass coefficient (ICC). We utilized a two-way

mixed model with measures of absolute agreement with coders treated as a fixed factor and the ratings treated as a random factor. The reliability of coders' original ratings was excellent (ICC=.95).

Results

We sought to assess the degree to which our two primary constructs of interest (valence of repetitive thinking and time) influenced three main outcomes (concreteness of thoughts, imagery activity, and emotionality). In addition, correlational analyses served to test predictions regarding the relationship between abstractness of worry and degree of imagery.

PRELIMINARY ANALYSES

We first examined whether the three conditions evidenced equivalent levels of trait depression, anxiety, worry, and rumination. We ran separate one-way analyses of variance (ANOVAs) on the BDI, PSWQ, RI, and the five subscales of the MASQ across the three groups. The three groups evidenced equal severity of symptoms on all measures except the MASQ Anxious Arousal subscale, on which differences across conditions emerged, $F(2, 102)=3.11$, $p=.05$.[3] Fisher's LSD post hoc comparisons indicated that participants in the negative repetitive thinking condition reported higher levels of MASQ Anxious Arousal scores relative to participants in both the positive ($p<.05$) and neutral ($p=.05$) groups. MASQ Anxious Arousal scores were therefore entered as a covariate in all subsequent analyses. Table 1 presents the demographic and symptom information for participants in each of the three experimental conditions.

We also examined whether the negative and positive thinking topics were perceived by participants as equally likely to occur. We calculated mean likelihood scores by averaging the five ratings provided at the end of each of the five thinking periods. Participants rated the negative event (being chosen to give a speech; $M=2.30$, $SD=.80$) as significantly more likely to occur than the positive event (being chosen to win money; $M=1.84$, $SD=1.05$), $t(71)=2.12$, $p<.05$. Although participants' likelihood ratings were relatively low, it should be noted that naturally occurring worries are not necessarily distressing due to worriers' perceived high likelihood of those worries coming true. Rather, worriers often worry and become distressed in spite of their recognition of the fact that certain worries (e.g., the feared death of a healthy loved one) are quite unlikely to occur and in spite of past personal experience with the non-occurrence of a particular worry (see Borkovec, Hazlett-Stevens, & Diaz, 1999).

CONCRETENESS OF REPETITIVE THINKING

We first averaged concreteness values from the five thought samples within each of the five periods in order to calculate a single concreteness estimate for each period. Consensus ratings of the degree of concreteness were then submitted to a 3 × 5 (Condition: positive, negative, neutral × Period: first, second, third, fourth, fifth) mixed-model ANCOVA (with

[3]Due to various cases of incomplete self-report data, degrees of freedom may vary slightly across analyses. Specifically, data were missing from participants for the following variables: demographic information ($n=1$); BDI and RI ($n=1$); PSWQ and MASQ ($n=3$); % thoughts and images (n range=1–3, depending on the period); relaxed, anxious, and depressed affect (n range=1–4); and PA and NA (n range=1–3).

MASQ Anxious Arousal and Sex as covariates), with Condition as a between-subjects factor and Period as a repeated measures factor.[4] Results indicated a main effect of Period, $F(4, 97)=4.34$, $p<.01$, $\eta^2=0.15$. Within-subjects contrasts further indicated both a significant linear function, $F(1, 100)=10.14$, $p<.01$, $\eta^2=0.09$, and a significant cubic function, $F(1, 100)=5.69$, $p<.05$, $\eta^2=0.05$. Concreteness decreased from the first ($M = 3.25$, $SD = .51$) to the second ($M = 3.10$, $SD=.64$) thinking period, remained stable during the second, third ($M=3.09$, $SD=.64$), and fourth ($M=3.09$, $SD=.62$) periods, and then decreased again from the fourth to the fifth ($M= 2.96$, $SD=.61$) thinking periods. The decrease in concreteness from the first to the fifth thinking period was medium-sized in magnitude ($d=.51$).

Results also indicated a main effect of Condition, $F(2, 100)=9.67$, $p<.001$, $\eta^2=0.16$, with post hoc Bonferroni tests indicating that neutral repetitive thinking ($M=2.83$, $SD=.47$) was significantly less concrete than both positive ($M=3.33$, $SD=.31$; $p<.001$, $d=1.26$) and negative ($M=3.12$, $SD=.41$; $p<.05$, $d=.66$) repetitive thinking (see Figure 1). Furthermore, although the relatively lower concreteness evidenced in negative repetitive thinking relative to positive repetitive thinking did not reach statistical significance, the effect size associated with this difference indicated a medium-sized effect ($d = .58$). No interaction between Period and Condition emerged, $F(8, 196)=.17$, *ns*.

IMAGERY ACTIVITY DURING REPETITIVE THINKING

We first averaged reported imagery values from the five thought samples comprising each of the five periods in order to calculate a single imagery value for each period of the experiment. Imagery ratings were then submitted to a 3×5 (Condition × Period) mixed-model ANCOVA (MASQ Anxious Arousal and Sex as covariates). Results indicated a main effect of Period, $F(4, 94)=4.74$, $p<.01$, $\eta^2=0.17$, with within-subjects contrasts indicating a linear function, $F(1, 97)=11.48$, $p<.01$, $\eta^2=0.11$. Post hoc Bonferroni comparisons indicated that the first thinking period ($M=36.24\%$, $SD=24.16\%$) evidenced greater imagery than the second ($M=29.07\%$, $SD=24.16\%$; $d=.30$), fourth ($M = 26.50\%$, $SD = 22.70\%$; $d = .42$), and fifth ($M=26.55\%$, $SD=23.29\%$; $d=.41$) periods (all ps $<.001$) and that the third thinking period ($M=33.05\%$, $SD=24.80\%$) evidenced greater imagery than the fourth($p<.05$, $d=.28$) and fifth thinking periods ($p=.05$, $d=.27$). No main effect of Condition, $F(2, 97)=1.92$, *ns*, or Condition × Period interaction, $F(8, 190)=.78$, *ns*, emerged.

Given assertions by Stöber (1998) that the abstractness of worry leads to reductions in imagery, we also examined the relationship between these two variables differentially among the three valence conditions. Table 2 reports the bivariate correlations between concreteness of thought samples and percentage of imagery reported for the five periods of the experiment, separately for each condition. In both the negative and positive valence conditions, there was a positive correlation between concreteness and imagery ratings (negative condition: $.24\leq r s\leq .59$, with significant correlations during the third, fourth, and fifth periods; positive condition: $.02\leq r s\leq .33$, all of which were nonsignificant). However, in

[4]For this and all subsequent analyses, we first ran a 3×5×5 (Condition × Period × Thought Sample) mixed-model ANCOVA (with MASQ Anxious Arousal and Sex as covariates, and Period and Thought Sample as repeated measures factors), but in no case was there a significant effect involving Thought Sample. Therefore, all dependent variables were collapsed across Thought Sample (i.e., averaged across each period of five thought samples), instead of analyzed individually for each of five thought samples within each of five periods. All data, including individual thought samples and their coded values, are available from the first author upon request.

the neutral condition, the correlation between concreteness and imagery was negative in the first through fourth periods (−.08≤*r*s≤ −.56), and *r*=.05 in the fifth period. Furthermore, across all five periods of the experiment, the correlations between the negative condition and the neutral condition (but not between positive and neutral, or positive and negative except for Period 2) were significantly different from one another (see Table 2 for between-groups comparisons using an *r*-to-*z* test).

EMOTIONAL EFFECTS OF REPETITIVE THINKING

All self-report affect data were analyzed using separate 3×5 (Condition × Period) mixed-model ANCOVAs (with MASQ Anxious Arousal and Sex as covariates). Affect data for all participants across all periods of the experiment are reported in Table 3. For the PA analysis, there was a significant main effect of Period, $F(4, 95)=12.94$, $p<.001$, $\eta^2 = 0.24$, qualified by a significant Period × Condition interaction, $F(8, 192)=2.36$, $p<.05$, $\eta^2 =0.07$. We deconstructed this interaction by conducting separate one-way (Period) repeated measures ANCOVAs for each condition separately and examining both linear and higher-order results. Results of the ANCOVA for the negative thinking condition had no linear or higher-order effects (all *p*s>.05), suggesting that PA remained stable during negative repetitive thinking. Results of the ANCOVA for the positive thinking condition indicated both a linear, $F(1, 32)=41.54$, $p<.000$, $\eta^2 =0.57$, and a quadratic, $F(1, 32)=11.02$, $p<.01$, $\eta^2 =0.26$, effect, showing that PA decreased linearly from the first to the fourth periods, and then stabilized. Results of the ANCOVA for the neutral thinking condition indicated a quadratic effect, $F(1, 30)=12.81$, $p<.01$, $\eta^2 =0.30$, indicating that PA decreased from the first to the third thinking periods and then increased from the fourth to the fifth periods. No main effect of Condition emerged, $F(2, 98)=2.07$, *ns*.

For the NA analysis, there was a main effect of Period, $F(4, 95)=4.83$, $p<.01$, $\eta^2=0.17$, with post hoc Bonferroni tests indicating that NA during the fourth period (*M*=14.90, *SD*=5.77) was significantly higher than NA during the second period (*M*=13.75, *SD*=4.61; $p<.05$; *d*=.22). Thus, it appears that regardless of valence, repetitive thinking was associated with an increase in NA over time. No main effect of Condition, $F(2, 98)=2.55$, *ns*, or Condition × Period interaction, $F(8, 192)=.30$, *ns*, emerged.

For the anxious affect analysis, there were no main effects of Period, $F(4, 93)=1.14$, *ns*, or Condition, $F(2, 96)=1.80$, *ns*. However, there was a significant Period × Condition interaction, $F(8, 188)=2.37$, $p<.05$, $\eta^2 =0.09$. We deconstructed this interaction by conducting three separate one-way (Period) repeated measures ANCOVAs for each condition separately and examining both linear and higher-order results. Results of the ANCOVA for the negative thinking condition indicated a quadratic effect, $F(1, 32)=8.40$, $p<.01$, $\eta^2=0.21$, showing that anxious affect decreased from the first to the third periods, and then increased. Results of the ANCOVA for the positive thinking condition indicated no linear or higher-order effects (all *p*s>.05), suggesting that anxious affect remained stable during positive repetitive thinking. Results of the ANCOVA for the neutral thinking condition indicated a linear effect, $F(1, 29)=6.92$, $p<.05$, $\eta^2 =0.19$, showing that anxious affect increased linearly across periods. Thus, over the course of repetitive thinking periods, positive thinking was associated with stable anxious affect, neutral thinking was associated

with increased anxious affect, and negative thinking was associated with decreased anxious affect that then increased following the third thinking period (see Figure 2).

The relaxed affect analyses did not indicate main effects of Condition, $F(2, 96)=.35$, *ns*, or Period, $F(4, 93)=.55$, *ns*, or an interaction, $F(8, 188)=.90$, *ns*. Likewise, the depressed affect analyses did not indicate main effects of Condition, $F(2, 96)= .93$, *ns*, or Period, $F(4, 93)=1.16$, *ns*, or an interaction, $F(8, 188)=.25$, *ns*.

Discussion

The results of this investigation indicated that repetitive thinking became increasingly less concrete as thinking progressed, indicating that ruminatory processes are associated with increasing abstraction of thought. However, the prediction that negative thinking would evidence the greatest abstractness of thought was not supported. In fact, both negative and positive repetitive future thinking were *more* concrete than neutral thinking, and did not differ from each other on this index. Rather, the relationship between worry, abstract thinking, and imagery may be more nuanced than originally proposed by Stöber (1998). Abstract thinking was indeed associated with less imagery activity during negative thinking (supporting our second hypothesis), and this relationship was especially strong during and following the spike in imagery observed during the third period; in contrast, this relationship was weaker (and nonsignificant) during positive thinking, and inverted during neutral thinking. This provides partial support for Stöber's theory in that it shows a unique relationship between abstract thought and reductions in imagery during repetitive worry. Thus, although worrisome thinking in general may not be characterized by reduced concreteness, it seems that catastrophic images during the worry process may set off a process of reduced imagery that is closely tied to abstraction. Theoretically, the abstractness and reduced imagery that follows these catastrophic images represents a reduction in negative states that is negatively reinforced (see Mowrer, 1947).

Our results indicate a range of emotional effects that may clarify the affective consequences of repetitive thinking in general and worrisome repetitive thinking in particular. First, NA increased across periods for all three valences of repetitive thinking, replicating the finding that repetitive thought is associated with increased negative mood (e.g., McLaughlin, Borkovec, & Sibrava, 2007; Moberly & Watkins, 2008). Second, PA evidenced differential trends across thinking conditions. Although PA remained stable over time during negative thinking, it decreased over time and then stabilized during positive thinking and decreased over time and then increased during neutral thinking. Thus, whereas McLaughlin et al. found that PA decreased during relatively short periods of negative repetitive thinking relative to baseline, our results indicate that PA remains stable when that negative repetitive thinking is continued for longer periods of time. This is consistent with the tripartite theory, which argues that a reduction in PA typifies depressive, but not anxious, states (e.g., Clark & Watson, 1991).

The anxious affect analysis perhaps constituted the most direct test of hypothesized nonadaptive affective consequences of worry (Borkovec et al., 2004). These results indicated that neutrally valenced repetitive thinking was associated with linear increases in

anxious affect over time and that positively valenced repetitive thinking was associated with stable levels of anxious affect over time. In contrast, negatively valenced repetitive future thinking (i.e., worry) evidenced initial decreases, followed by subsequent increases, in anxious affect across thinking periods. This finding stands in partial support of our prediction that worry would be associated with overall decreases in anxious affect over time. Our initial prediction was based on past evidence suggesting that worry about an aversive future event is associated with inhibition of anxious arousal during subsequent emotion-eliciting tasks (e.g., Behar, 2005; Borkovec & Hu, 1990; Borkovec, Lyonfields, Wiser, & Deihl, 1993; Butler, Wells, & Dewick, 1995; Peasley-Miklus & Vrana, 2000). Theoretical accounts argue that such inhibitions of fear-relevant emotion preclude the emotional processing of fear that is necessary for successful habituation of anxious responses (Foa & Kozak, 1986; cf., Craske et al., 2008). However, these past studies examined the effects of periods of worry that were shorter in duration than the repetitive, 22.5-minute worry induction employed in the current study. Our results indicate that following initial reductions, anxious affect then *increases*. The avoidance theory of worry (Borkovec et al., 2004) pays special attention to precisely this juxtaposition of emotional consequences of worrying. Specifically, in addition to evidence suggesting that worry lessens some aspects of anxious responding in the short term, there are also indications that worry strengthens anxious meaning in the long term. The emerging picture is one in which aversive imagery (and its associated strengthening of anxious meaning) and suppression of imagery (and its associated, temporary weakening of anxious responding) act cyclically. Such a view was anticipated by Mathews's (1990) conclusion that worry sequentially entails hypervigilance to threat, followed by avoidance of threat.

A detailed view of our results presents an even more compelling picture regarding the effects of repetitive worry. Between the first and third thinking periods, concreteness of thoughts decreased and then stabilized across all conditions, and anxious affect decreased during this time only for the negative thinking condition. During the third thinking period, there was a "spike" in degree of reported imagery during mentation for all participants, and at this time the degree of concreteness became more strongly associated with reported imagery only among participants in the negative thinking condition. Then, between the third and fifth thinking periods, concreteness of thoughts decreased for all conditions, and anxious affect increased only in the negative thinking condition. Thus, it may be that over extended periods of worrisome thinking, anxious affect decreases as individuals seek to avoid fear-relevant emotion, and then increases as catastrophic images continue to occur, and so on, cyclically, ultimately leading to sequential instances of weakened anxious responding and strengthened anxious meaning.[5] This mirrors a sequential time effect that we recently documented in another investigation in which periods of induced worry preceded repeated presentations of an interoceptive exposure task (Behar, 2005). In that study, worry that was

[5]In one past study, Borkovec et al. (1983) found that 15 minutes of worry resulted in an apparent incubation of negative thought intrusions, whereas 0 and 30 minutes of worry each resulted in a decrease in intrusions. In contrast to our findings, Borkovec et al. did not find any affect differences across the 0-, 15-, and 30-minute worry conditions, whereas our results indicate increased NA following 13.5 minutes of repetitive worry. These discrepant results may be due to the fact that Borkovec et al. asked participants in the 15-minute worry condition to engage in 15 minutes of relaxation prior to worrying and measured their affect during a subsequent 5-minute focused breathing task. Our participants did not engage in prior relaxation and were interrupted during the worry process itself to provide affect information.

rich in verbal–linguistic activity was associated with subjective distress that decreased from the first to the second rebreathing task, and then increased from the second to the third rebreathing task. Thus, this sequential effect seems to exist not only during worrisome thinking (the current study), but also during anxiety-inducing tasks that follow periods of worrisome thinking (Behar, 2005). These results also raise interesting questions about the specific timing of vigiliance and avoidance during the worry process. One possibility is that vigilance comes first in the worry process and begins the cycle of vigilance and avoidance. Indeed, the vigilance–avoidance hypothesis (Mogg & Bradley, 2005; Mogg, Mathews, & Weinman, 1987), as well as psychophysiological evidence (Oathes, Siegle, & Ray, 2011), proposes that anxious individuals identify potentially threatening events and then avoid the aversive emotional material that follows. A second possibility is that avoidance occurs first in the worry process, thereby beginning the cycle of vigilance and avoidance. This is consistent with the James–Lange theory of emotions (James, 1884) whereby the act of avoiding something could strengthen the anxious meaning of that object, as well as research by Roemer and Borkovec (1994) suggesting that the process of suppressing a thought increases its anxiety-provoking value. Although our results seem to support this latter possibility, future investigations should measure vigilance and avoidance indices in more microscopic time frames in order to adequately address the question of which process occurs at the very inception of the worry process. Furthermore, although the current study's design included five thinking periods, it would be informative to examine what happens to anxious affect over an even more prolonged period. If we are correct in our view of worry as cyclically entailing processing of anxious affect on the one hand and avoidance of anxious affect on the other hand, then continuous cyclical trends would potentially emerge as worrisome thinking progressed. Future research would usefully test these hypotheses in an a priori fashion in order to elucidate the precise nature of these sequential relationships. Future research should also include multiple-item measures of anxious affect, as single-item measures may be psychometrically problematic (e.g., low reliability).

Of course, our experimental design does not allow us to test whether reduced concreteness and/or associated spikes (followed by decreases) in imagery caused these emotional consequences of worrisome thinking. We can conclude only that the initial reduction and subsequent increase in anxious affect occurred simultaneously with progressively decreasing concreteness of thoughts (as compared to positively valenced thinking), and that the "shift" from decreasing anxious affect to increasing anxious affect occurred simultaneously with a reported increase in imagery-based activity during the third period. Thus, it is possible that reduced concreteness of worrisome thinking was causally related to both reduced imagery and nonadaptive affective consequences, but abstractness versus concreteness of worrisome thinking would have to be manipulated in order to test such causal predictions. Extant research indeed shows that participants assigned to worry about an upcoming speech-giving task in a specific (concrete) way show greater resolution of fear relative to participants assigned to worry in a general (abstract) way or to engage in distraction (Philippot, Baeyens, & Douilliez, 2006). This points to clear clinical implications of our findings. Perhaps, as with dysphoria (Watkins & Moberly, 2009), concreteness training may reduce trait worry, and perhaps the mechanism by which this occurs is through sustaining increased imagery and facilitating associated accession of anxious meaning. Future research would helpfully

examine the effects of concreteness training on anxious affect and associated levels of imaginal activity and emotional processing.

Our use of an undergraduate sample is consistent with the results of extant research indicating that selected and unselected samples report similar cognitive and emotional processes during worry. For example, both types of samples report a predominance of verbal–linguistic activity during worry as compared to nonworrisome activity (Behar et al., 2005; Borkovec & Inz, 1990; Freeston, Dugas, & Ladouceur, 1996; McLaughlin et al., 2007); this is particularly salient given the centrality of the verbal–linguistic quality of worry to Stöber's reduced concreteness theory. Extant evidence of greater abstractness of thought during worry-relevant periods (Stöber et al., 2000) as well as the impact of concrete worry on reductions in anxiety during worry-inducing situations (Philippot et al., 2006) is also consistent across selected and unselected samples. Additionally, evidence of the maladaptive emotional effects of worrisome thinking is similar across both types of samples (e.g., Behar et al., 2005; McLaughlin et al., 2007). Finally, Ruscio, Borkovec, and Ruscio (2001) have suggested that worry is a dimensional as opposed to categorical construct, and that normal and pathological worry thus do not constitute discrete phenomena, but rather that worry lies on a continuum with normal and pathological extremes. Utilizing an unselected sample such as ours is thus valuable and informs knowledge regarding the basic nature of worry as a general process. Still, future research would benefit from investigating these constructs in diagnosed samples. These future investigations will serve to test the replicability of our findings and inform clinical interventions.

Although our results help to clarify and extend previous findings regarding the nature of worry, some rival hypotheses remain that should be addressed in future investigations. First, the finding that neutral repetitive thinking was more abstract than either emotionally valenced condition may have been influenced by the nonpersonal nature of the stimulus (unification of Europe) as contrasted with the more personally relevant nature of the emotional stimuli (i.e., giving a speech, winning money) and not to emotionality per se. Second, although we were careful to ensure that all three conditions entailed repetitive thinking about future-oriented material in order to control for temporal orientation (which has been shown to impact concreteness of thought; Liberman & Trope, 1998), it may be that the three conditions were not perfectly equated with respect to temporal distance of thought stimuli. The positive and negative conditions entailed potential events in the immediate future, whereas the neutral condition entailed a potential event in the distant future. Research findings suggest that the more temporally distant an event is, the more abstract thoughts about the event will be (Trope & Liberman, 2003). Third, it is important to note that the relatively low levels of concreteness evidenced in the neutral condition may also have been influenced by the relatively hypothetical nature of that thought stimulus as compared with the arguably more plausible nature of the positive and negative stimuli. Fourth, any differences between the positive and negative thinking conditions in this investigation may have been influenced by participants' greater perceived likelihood of being chosen to give a speech than winning money. Fifth, in our repetitive thinking instructions to participants, we asked them to "bring their focus back" to the assigned topic if they noticed their minds wandering. Future studies using these instructions should measure and statistically control for trait mindfulness as a measure of the ability to maintain and redirect attention to a task or

thought. Finally, it is unclear the extent to which the nature of the negative repetitive thinking task resembled worry in its natural form. Anxiety-relevant thinking about a potential future social-evaluative event (e.g., giving a speech) seems logically to be similar or equivalent to worrying that has a social/interpersonal content focus, and it has been used in previous investigations (Borkovec & Hu, 1990; Hazlett-Stevens & Borkovec, 2001). However, this type of worry may differ phenomenologically from other domains of worry (e.g., health, work/professional) and may have instead tapped into a social anxiety thinking process as opposed to a worry process per se. Alternatively, there may be some other form of negative repetitive thinking about the future that is something other than worry and that our participants at least partially engaged in such thinking (although we cannot think of any example). We sought to standardize stimuli across participants for this first experimental investigation of concreteness during worry activity, but future investigations would benefit from taking a more idiographic approach to stimulus selection in order to maximize the likelihood that the natural worry process will be reproduced as closely as possible.

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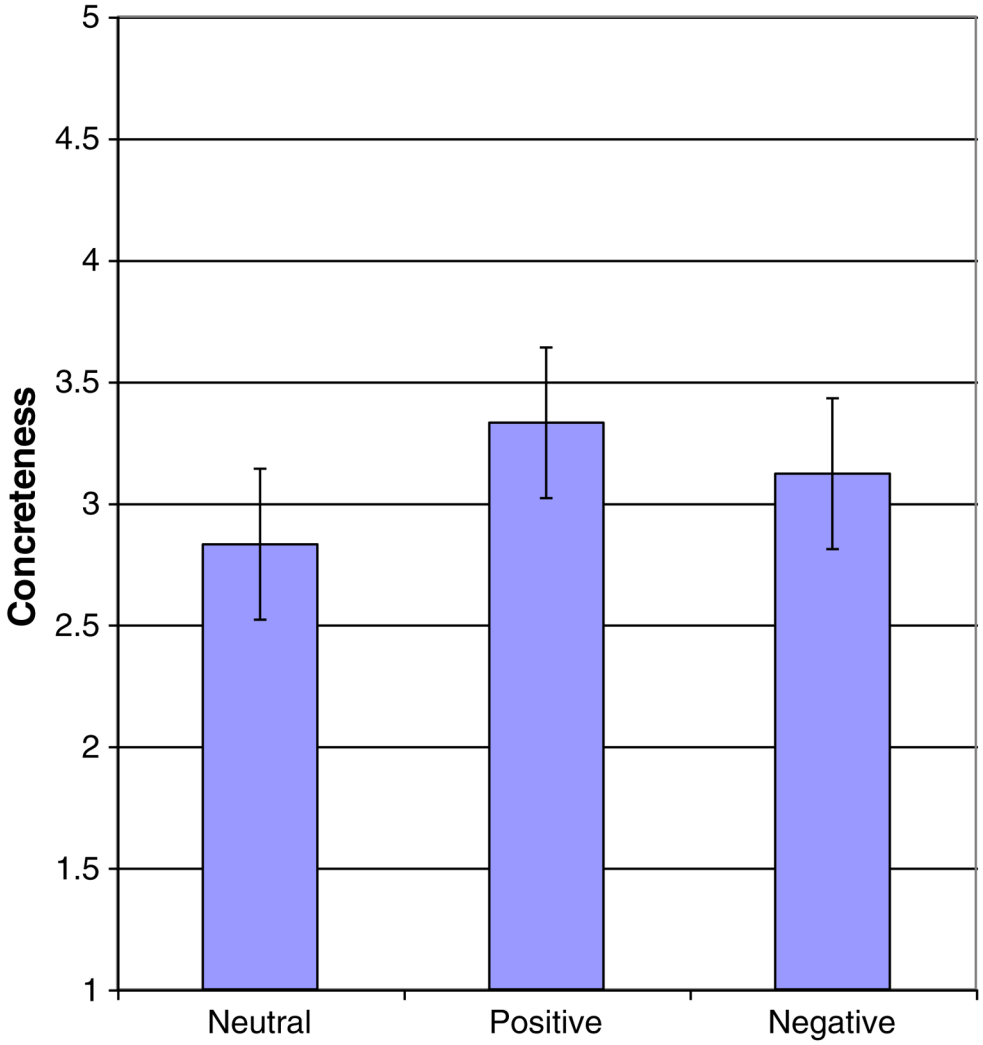

FIGURE 1.
Concreteness of neutral, positive, and negative repetitive thoughts.

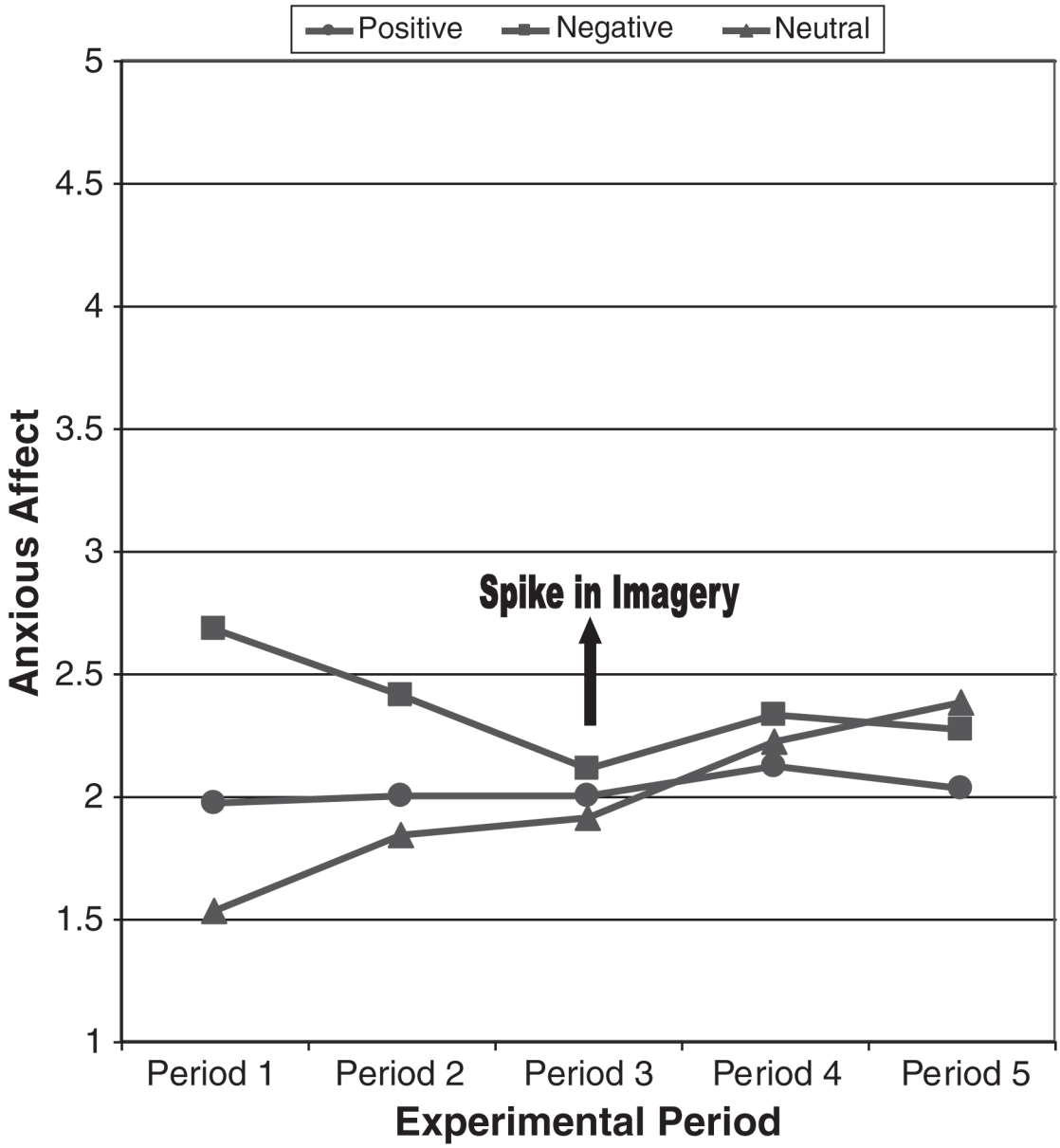

FIGURE 2.
Anxious affect across all periods for each condition.

Table 1

Demographic and Symptom Information for all Participants Across Conditions

	Condition			
	Positive	**Negative**	**Neutral**	***p***
Age	18.57 (.85)	18.92 (1.24)	19.12 (1.30)	*ns*
Sex (M/F)	22/13[a]	20/18[a]	10/24[b]	<.05
Penn State Worry Questionnaire	42.63 (14.20)	45.73 (14.88)	44.76 (19.14)	*ns*
Beck Depression Inventory	7.40 (7.43)	6.58 (4.52)	7.18 (5.04)	*ns*
Rumination Inventory	47.34 (7.81)	48.42 (6.88)	47.94 (8.75)	*ns*
MASQ: Anhedonic Depression	59.69 (13.25)	60.14 (14.52)	62.62 (13.48)	*ns*
MASQ: Depressive Symptoms	11.91 (8.69)	14.53 (10.53)	10.97 (9.56)	*ns*
MASQ: Anxious Arousal	7.09 (8.89)[a]	12.58 (11.85)[b]	7.79 (9.24)[a]	<.05
MASQ: Anxious Symptoms	9.43 (5.78)	11.28 (8.68)	8.15 (7.46)	*ns*
MASQ: Mixed Symptoms	18.86 (11.72)	23.61 (13.73)	18.71 (10.31)	*ns*

Note. Different superscripts denote statistically significant group differences as per post hoc comparisons.

Table 2

Correlations Between Concreteness of Thought Samples and Reported Imagery at Each Period

	Condition			
	Positive	**Negative**	**Neutral**	**Between-Groups Comparisons**
First Period	.02	.24	−.23	Negative vs. Neutral, $p<.05$
Second Period	.33	.28	−.56*	Negative vs. Neutral, $p<.001$ Positive vs. Neutral, $p<.001$
Third Period	.25	.56*	−.08	Negative vs. Neutral, $p<.01$
Fourth Period	.21	.59*	−.12	Negative vs. Neutral, $p<.01$
Fifth Period	.28	.49*	.05	Negative vs. Neutral, $p=.05$

Note. Between-groups comparisons represent statistical comparisons between bivariate correlations using an *r*-to-*z* test.

* $p<.01$.

Table 3

Self-Reported Affect for Each Condition at Each Thinking Period

	Condition		
	Positive	**Negative**	**Neutral**
Positive Affect			
First Period	20.51 (7.49)	20.56 (7.72)	17.49 (4.28)
Second Period	17.86 (7.88)	19.33 (8.50)	14.94 (3.90)
Third Period	15.37 (7.22)	17.47 (7.44)	13.52 (4.46)
Fourth Period	14.43 (5.74)	16.36 (8.69)	13.42 (4.60)
Fifth Period	14.63 (4.71)	16.89 (8.31)	15.73 (5.13)
Negative Affect			
First Period	12.54 (3.64)	16.39 (6.78)	12.61 (3.44)
Second Period	12.74 (3.20)	15.83 (5.70)	12.85 (4.21)
Third Period	13.77 (4.45)	16.31 (6.67)	13.36 (4.23)
Fourth Period	14.49 (5.02)	16.67 (7.41)	13.79 (4.36)
Fifth Period	14.11 (4.59)	15.78 (7.23)	13.49 (4.98)
Anxious Affect			
First Period	1.97 (.97)	2.68 (1.00)	1.53 (.80)
Second Period	2.00 (1.15)	2.41 (1.01)	1.84 (1.05)
Third Period	2.00 (1.18)	2.11 (1.13)	1.91 (1.15)
Fourth Period	2.12 (1.25)	2.33 (1.20)	2.22 (1.34)
Fifth Period	2.03 (1.14)	2.27 (1.28)	2.38 (1.43)
Relaxed Affect			
First Period	3.74 (1.24)	3.22 (1.08)	3.66 (1.04)
Second Period	3.56 (1.38)	3.24 (1.14)	3.25 (1.19)
Third Period	3.44 (1.31)	3.30 (1.27)	3.31 (1.12)
Fourth Period	3.29 (1.43)	3.30 (1.33)	3.19 (1.18)
Fifth Period	3.38 (1.44)	3.03 (1.36)	3.16 (1.08)
Depressed Affect			
First Period	1.18 (.72)	1.38 (.76)	1.13 (.34)
Second Period	1.18 (.46)	1.41 (.80)	1.16 (.37)
Third Period	1.15 (.56)	1.22 (.48)	1.13 (.34)
Fourth Period	1.06 (.24)	1.27 (.56)	1.13 (.42)
Fifth Period	1.15 (.70)	1.27(.56)	1.09 (.30)