

The Relationship Between Reflective Rumination and Musical Ability

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Rumination has primarily been described as maladaptive due to its relation with depression. However, rumination has also been associated with artistic creativity. Higher levels of rumination in musicians may be associated with ability because the repetitive thought style in rumination may mirror the repetitive practice required to succeed as a musician. The current study examined reflective and brooding rumination in relation to depression in musicians and nonmusicians. Results indicated that musicians exhibited higher levels of reflective rumination than nonmusicians and that, within musicians, reflective rumination was related to certain aspects of musical performance. The current findings indicate that having a reflective ruminative thought style is predictive of musical performance.

Keywords: music, rumination, depression, reflection, creativity

Rumination has been thought to be a primarily maladaptive thought style in which intense self-reflection and repetitive, rigid thought amplifies nearly all personal experiences, especially negative experiences (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Trapnell & Campbell, 1999). However, it may be that not all patterns of ruminative thought lead directly and exclusively to detrimental outcomes. Researchers have explored possible positive aspects of rumination (Altamirano, Miyake, & Whitmer, 2010; Andrews & Thomson, 2009; Verhaeghen, Khan, & Joormann, 2005). For example, Andrews and Thomson (2009) suggested that rumination might be an evolved adaption that facilitates effective stress response and Altamirano, Miyake, and Whitmer (2010) found that the more singular mindset that underlies rumination is helpful for certain tasks.

Further, research from a wide range of perspectives has suggested that multiple ruminative styles exist that may involve different mechanisms of self-attentiveness (e.g., Nolen-Hoeksema et al., 2008). Trapnell and Campbell (1999) established two distinct

factors of private self-consciousness—neurotic self-attentiveness, or rumination, and intellectual self-attentiveness, or reflection. In parallel, Nolen-Hoeksema, Wisco, and Lyubomirsky (2008) define rumination as repetitive focus on distress and negative affect but distinguish between brooding rumination, more passive and abstract, and reflective rumination, more purposeful and concrete. Similarly, Conway, Csank, Holm, and Blake (2000) established a construct to solely target a more maladaptive sadness ruminative style, which appears to parallel to brooding rumination.

Central to our focus, artistic creativity has been associated with reflective rumination (Cohen & Ferrari, 2010; Verhaeghen et al., 2005) and may explain why artistic types exhibit higher levels of depression (Akinola & Mendes, 2008; Jamison, 1993; Young, Winner & Cordes, 2012). Participants high in reflective rumination were more serious about their creative endeavors and exhibited greater creativity (Verhaeghen et al., 2005). Here we explored musical ability as an area in which a ruminative thought style may be prevalent and beneficial.

Rumination

Response styles theory, as developed by Nolen-Hoeksema et al. (2008), describes rumination as a coping mechanism through which individuals engage in repetitive and passive thought on the symptoms and possible causes of distress. They found that ruminative tendencies are relatively stable over time and are linked to several maladaptive consequences including negative attributional styles, self-criticism, pessimism, neuroticism, and problem-solving deficits. A key feature of rumination is that the repetitive thoughts persist when no demand exists (Verhaeghen et al., 2005).

Nolen-Hoeksema et al.'s (2008) rumination construct distinguishes brooding rumination from reflective rumination. Brooding rumination involves negative thoughts about mood and how a

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person's current state fails to reach some unachieved standard (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Reflective rumination involves a more active effort to understand the causes of distress. Although the act of rumination is passive, reflective rumination can be described as more purposeful and self-directed in nature. While brooding is more emotion-focused, reflection is more cognition-focused (Treynor et al., 2003). Unlike brooding which is directly related to negative emotion, the repetitive thought of reflective rumination may be directed toward actions and behavior in such a way that may distract from or regulate negative emotion. Somewhat similarly, Trapnell and Campbell's (1999) rumination factor is thought to be motivated by threats or losses (similar to brooding rumination), and the reflection factor is thought to be motivated by self-interest or curiosity (similar to reflective rumination). A reflective rumination style driven equally by self-interest and curiosity (Trapnell & Campbell, 1999) and motivation to understand distressing situations (Nolen-Hoeksema et al., 2008) may be more beneficial than maladaptive. Still, both Nolen-Hoeksema et al.'s (2008) reflective rumination and Trapnell and Campbell's (1999) reflection factor were significantly related to brooding rumination and depression (Nolen-Hoeksema et al., 2008; Siegle, Moore, & Thase, 2004). Several studies have found significant relationships between rumination and depression (Lyubomirsky, Tucker, Caldwell, & Berg, 1999; McFarland & Buehler, 1998; Nolen-Hoeksema et al., 2008), however, there is a lack of consistency in the current research regarding the influence of brooding and reflective rumination on the onset, duration, and resurgence of depression. Although brooding rumination is consistently concurrently linked to depression, Treynor, Gonzalez, and Nolen-Hoeksema (2003) found that reflective rumination predicted a decrease in symptoms of depression over time. This finding implies that although brooding may be more likely to lead to inaction, reflection may be more likely to lead to action, both positive in the form of recovery (Treynor et al., 2003) and negative in the form of suicide (Surrence, Miranda, Marroquin, & Chan, 2009; although see Crane, Barnhofer, & Williams, 2007). Further, brooding, but not reflection, has been associated with an attentional bias toward negative stimuli (Joormann, Dkane, & Gotlib, 2006). In sum, although reflective rumination is often associated with both brooding rumination and depression, reflective tendencies may be less harmful.

Possible Benefits of a Ruminative Style

Despite the extent of evidence supporting a negative view of rumination, researchers have recently explored potentially beneficial outcomes of having a ruminative style. Andrews and Thomson (2009) proposed the *analytical rumination hypothesis*, which holds that one immediate function of depression is to promote a detail-oriented analytical reasoning style (rumination) that is directed toward solving the triggering problem. In support, Watkins and Molds (2005a) established that depressed people reported that their ruminations (both brooding and reflective) could provide insight into their problems. Further, type of ruminative style might matter in solving stress-inducing problems. Watkins and Molds (2005b) found that social problem solving was improved by a concrete ruminative self-focus (similar to reflective rumination), but not by an abstract ruminative self-focus (similar to brooding rumination).

The singular, goal directed pattern of thought associated with rumination might be helpful in pursuits other than solving stressful situations. Participants high in reflective rumination scored higher on the Runco Ideational Behavior Scale, a measure of creative problem solving (Cohen & Ferrari, 2010), and scored better on a creativity task involving items from the Purdue Creativity Test and the Abbreviated Torrance Test for Adults (Verhaeghen et al., 2005). Scoring for this task was based on fluency (number of ideas generated), originality (number of unique ideas generated), and elaboration (number of details provided about those ideas).

One possible reason for increased creative fluency for people high in rumination is that ruminators might be better able to maintain their focus on the creative process once it is started. Ruminators tend to exhibit "inflexibility" when performing tasks that require shifting of attention (Davis & Nolen-Hoeksema, 2000). Although this cognitive style is often seen as maladaptive with thoughts "stuck" in working memory, it is possible that both mental flexibility and mental inflexibility can be useful in different contexts. Altamirano et al. (2010) found that high ruminators (defined as the combination of brooding and reflective rumination scores) performed significantly better than low ruminators on a goal-maintenance task, a modified Stroop task, but significantly worse on a goal-switching task, an alternating letter naming task. Participants high in reflective rumination find it difficult to switch to a new task, seeming to continue thinking about the previous task (Whitmer & Banich, 2007). Although ruminators are not good at tasks that require switching focus, they are good at maintaining focus on tasks that require perseverance.

Musicians

A unique task for which a ruminative mind-set might be particularly helpful may be music—mastery of which requires repetitive focus on a single objective. A possible reason that musicians in particular might be prone to the repetitive thought patterns of rumination is the very nature of being a musician: practice of music for performance is a type of repetitive thought that may mirror rumination and/or be facilitated by a ruminative thought style.

High-ruminators appear to be particularly adept at goal-maintenance on repetitive tasks where maintaining attention on a single problem or task can be adaptive (Altamirano et al., 2010; Whitmer & Banich, 2007). It may be that high ruminators are better able to succeed as musicians because they are better able to stay engaged with the goal of perfecting a piece for performance. Further, type of ruminative style, reflective or brooding, might matter in terms of benefits. It may be that reflective rumination, which tends to be more analytical and active, is more helpful to musicians than brooding rumination, which is more emotion-focused and passive.

Alternatively, ruminative tendencies could be related to musical ability in that both rumination and music are strongly associated with the expression and regulation of emotion (Juslin & Västfjäll, 2008; Nolen-Hoeksema et al., 2008). For example, it is possible that playing music could facilitate a ruminative style. Music has been associated with absorption, a cognitive state that refers to effortless engagement with current contents of consciousness (Herbert, 2012). Rumination (in any context) is essentially self-absorption in that repetitive thoughts about one's current mood,

problems, or goals dominate consciousness (Trapnell & Campbell, 1999). In this way, music may encourage ruminative tendencies. In addition, ruminative tendencies may be beneficial to musicians as an emotion regulation technique (Tsay & Banaji, 2011). Musicians who are high ruminators may be less impacted by the emotional/stressful demands experienced during a performance. The current study aimed to examine brooding and reflective ruminative tendencies and potential positive (in terms of musical ability) and negative (in terms of depression) outcomes that may be associated with each in musicians. We hypothesized that musicians would exhibit higher levels of reflective rumination and that reflective rumination would be associated with positive outcomes in musical ability.

Method

Participants

Seventy-one Elizabethtown College students (14 males, 57 females) between the ages of 18 and 21 ($M = 19.4$) participated in this study. Nonmusicians ($n = 28$) were recruited from general psychology classes and received course credit in exchange for participation. Musicians ($n = 43$) were recruited from music classes and bands and were entered into a raffle drawing for a gift card in exchange for participation. The 43 participants in the musician group consented to allow access to their end of the year jury scores for musical performance, with jury scores obtained for 22 participants (14 instrumentalists and eight vocalists).

Materials

Ruminative Response Scale (RRS). This measurement is used to assess ruminative tendencies (Treynor et al., 2003). The items used in the measurement can be separated into three factors: depressive rumination, brooding rumination, and reflective rumination. For this study, only the 10 items aimed at brooding ($\alpha = .79$) and reflective ($\alpha = .79$) rumination were used to exclude rumination that can be accounted for directly by depression (see Nolen-Hoeksema et al., 2008).

Center for Epidemiologic Studies Depression Scale (CES-D). This 20-item measurement is used to assess depressive symptoms (Radloff, 1977). This questionnaire requires participants to rate the extent to which they experience feelings of sadness, hopelessness, and negative affect ($\alpha = .92$).

Procedure

Questionnaire measures of depression symptoms, ruminative tendencies, and, for musicians, a brief questionnaire regarding music practice time were administered electronically through MediaLab. Participants were seated at a computer and the questionnaires appeared in random order. In the practice-time questionnaire, participants were asked to indicate the number of hours per week they spent practicing music total, for their classes, and for their own pleasure/personal reasons. Participants also completed measures of personality and cognitive style that were not directly related to the current study. These measures were included along with the variables of interest in random order. The entire study took about 25 to 30 min to complete.

Upon completion, participants in the musician group were asked to provide their student ID numbers. These were used to obtain "jury scores" from the Elizabethtown College music department, measures of musical ability administered during finals week of each semester to all music students taking individual lessons. Juries of two to four faculty members that varied in composition (depending on performance instrument) rated each musician based on a final performance and these ratings were combined to determine a final grade for the student. Importantly, jury ratings like these play a pivotal role in the life of a musician for a number of processes, such as hiring. Using a scale of 1 to 5, jury members rated the performers in the following six categories: tone quality (warmth and expressiveness), intonation (pitch accuracy), articulation (quality of transitions and continuity of notes), breathing (quality of phrasing and breath placement), rhythm (consistency and clarity of rhythm), and musicianship (quality of phrasing and dynamics; whether the performance was more "natural" or "mechanical").¹ The student ID numbers were matched with participant numbers to maintain participant confidentiality in obtaining scores.

Results

Means for all variables are presented in Table 1. Note that rating for the music students all tended to be fairly high: on the 5-point scale, no musician was assessed a 1 or 2 for any of the categories.

Of participants in the nonmusician group, 18% (five of 28) had some musical experience in that they reported playing at least one musical instrument. There were significantly more females in the musician group than in the nonmusician group, $\chi^2(1, N = 71) = 4.03, p = .034$. However, there were no significant differences based on gender for reflective rumination, $t(69) = -1.063, p = .292, d = .26$, brooding rumination, $t(69) = -1.061, p = .293, d = .26$, or depression, $t(69) = .158, p = .875, d = .04$.

Rumination in Overall Sample

The differences between musicians and nonmusicians for each of the variables measured are presented in Figure 1. Musicians exhibited significantly higher levels of reflective rumination than nonmusicians, $t(69) = -3.73, p < .001, d = .90$. There were no significant differences in brooding rumination, $t(69) = 1.41, p = .16, d = .33$ or depression, $t(69) = .32, p = .75, d = .08$. Although musicians were higher in rumination, this difference was only observed for reflective rumination.

For the entire sample, reflective rumination, brooding rumination, and depression were all significantly correlated (see Table 2). Multiple regression analysis was conducted to examine the impact of brooding and reflective rumination on depression. Results indicate that when both reflective and brooding rumination are used to predict depression, $R^2 = .36, F(2, 68) = 18.87, p < .001$, only brooding was a significant predictor of depression, $\beta = .51, t(69) = 4.57, p < .001$ (see Table 3). Musicians tended to be higher in reflective rumination only, which was not a strong predictor of depression.

¹ For the vocalists there were additional categories, but only the categories that corresponded to those used by the instrumentalists were used.

Rumination in Musicians

Due to the small number of musicians in the sample ($n = 22$), we were restricted to simple correlational analysis in examining the influence of rumination and depression on musical ability (see Table 2). Because the jury scores for vocalists appeared to be much higher than those for instrumentalists, indicating potential differences in scale use for the different jury members (see Table 1), scores for the vocalists and instrumentalists were converted to Z-scores before they were combined. High reflective ruminative tendencies appear to be related to better musical performance: reflective rumination was significantly related to musicianship, $r(22) = .464, p = .030$ and marginally related to tone, $r(22) = .361, p = .099$. The relationship between reflective rumination and these two musical categories does not appear to be driven by one or two outliers, but is a fairly continuous function. Brooding rumination was not significantly related to any of the six dimensions of musical ability, although there was an indication of a relationship with musicianship, $r(22) = .380, p = .081$. Interestingly, score on the depression scale was significantly correlated with both breathing, $r(22) = .590, p = .004$, and musicianship, $r(22) = .523, p = .012$.² Although the correlations reported here were computed by averaging together judge ratings as was done to determine the students final grade, we also ran the above analyses keeping judges separate using a crossed random effects model. Results for these analyses were consistent with the simple correlational analyses and are reported in detail in the Appendix.

Although reflective rumination and depression were linked to higher jury scores for at least some of the categories, the positive influence on performance cannot be explained by increased practice time. There was no relationship between either reflection or depression on time spent practicing for class, $r(22) = -.111, p = .623$, and $r(22) = .077, p = .733$, respectively; or time spent practicing for enjoyment, $r(22) = -.007, p = .975$, and $r(22) = .230, p = .304$, respectively.

Discussion

Although there are many negatives associated rumination (Nolen-Hoeksema et al., 2008), recent research has detailed possible positive outcomes associated with having a ruminative style

Table 1
Descriptive Statistics

	N	Mean	Standard deviation
Reflective rumination	71	2.75	0.80
Brooding rumination	71	2.93	0.79
Depression	71	2.34	0.60
Tone (instrumentalists)	14	4.23	0.29
Tone (vocalists)	8	4.86	0.14
Intonation (instrumentalists)	14	4.02	0.28
Intonation (vocalists)	8	4.94	0.07
Articulation (instrumentalists)	14	3.90	0.40
Articulation (vocalists)	8	4.90	0.08
Breathing (instrumentalists)	14	4.12	0.36
Breathing (vocalists)	8	4.91	0.11
Rhythm (instrumentalists)	14	4.12	0.23
Rhythm (vocalists)	8	4.93	0.17
Musicianship (instrumentalists)	14	4.03	0.35
Musicianship (vocalists)	8	4.95	0.09

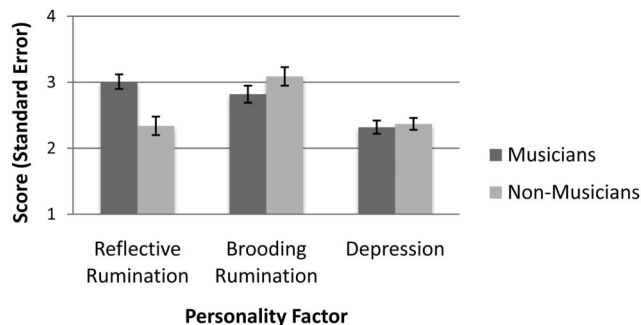


Figure 1. Differences between musicians and nonmusicians.

(Altamirano et al., 2010; Andrews & Thomson, 2009; Verhaeghen et al., 2005). Here we found that musicians were higher on rumination than nonmusicians and that this was related to their musical skills. Further, results indicate that musicians were high on one specific type of rumination, reflective rumination, and that this specific type of rumination may not have all the negative consequences normally associated with rumination. What at first blush might seem to be a negative, being high in rumination, might actually be associated with benefits to musicians (see Livingstone, Lafer-Sousa, & Conway, 2011 for a similar example with stereopsis in artists).

Differences Between Musicians and Nonmusicians

Previous research found that reflective rumination is correlated with creative ability and creative and artistic interest, suggesting that reflective rumination can be adaptive (Verhaeghen et al., 2005). Here we find that musicians, in particular, exhibited significantly higher levels of reflective rumination than nonmusicians. The difference between musicians and nonmusicians in reflective rumination was large, nearly one standard deviation. We have suggested that this may be due to the fact that music rehearsal involves the same repetitive thoughts and behaviors as are seen in rumination. For example, high ruminators could be drawn to a music career because such cognitive demands are familiar and comfortable, similarly, cognitive demands involved in musician-ship could induce or enhance ruminative-like behavior.

Interestingly, musicians and nonmusicians did not differ in brooding rumination or depression symptoms. Although this contradicts previous research that has found higher levels of depression in musicians (Jamison, 1993; Young et al., 2012), this finding provides additional evidence that brooding and reflective rumination serve different functions, as our sample of musicians was only higher in reflective but not brooding ruminative tendencies. Musicians do tend to report high levels of stress but low levels of stress-buffering personality factors such as optimism (Getz, Marks, & Roy, 2012). An inability to inhibit certain thoughts could, at times, lead to depression, but could also be helpful in artistic creation (Young et al., 2012). We suggest that the difference observed between musicians and nonmusicians in reflective

² It should be noted that although participants did vary on the depression scale, participants at the high end of the scale were still below levels of clinical depression (CES-D scores ranged from 1.10 to 3.95; $M = 2.34$).

Table 2
Correlations Between Rumination/Depression and Musical Performance

	Reflective rumination	Brooding rumination	Depression	Tone	Intonation	Articulation	Breathing	Rhythm
Brooding rumination	.475**							
Depression	.399**	.613**						
Tone	.361 ⁺	.352	.348					
Intonation	-.150	-.059	-.192	.298				
Articulation	.193	.198	.276	.193	.492*			
Breathing	.304	.301	.590**	.518*	.229	.425*		
Rhythm	.287	.267	.344	.588**	.177	.236	.525*	
Musicianship	.464*	.380 ⁺	.523*	.717**	.423*	.510*	.709**	.672**
	71	71	22	22	22	22	22	22

Note. Pearson Correlation (top), N (bottom).

⁺ $p < .1$. * $p < .05$. ** $p < .01$.

rumination may reflect a commonality between musicianship and reflective tendencies.

It may be that differences in how the musician and nonmusician samples were solicited can explain why the musicians, if anything, seemed to be lower on depression: The musician sample was a group that volunteered for the study, yet the nonmusicians participated as a requirement for course credit. It may be that nondepressed musicians were more likely to volunteer than depressed musicians.

Possible Benefits of a Ruminative Style for Musicians

The second aim of the current study was to examine ruminative tendencies in relation to musical performance. Rumination, depression, and practice time were compared to six dimensions of musical ability (tone, intonation, articulation, breathing, rhythm, and musicianship) as rated by two to four instructors in the Elizabethtown College music department. These types of jury ratings play a crucial role in the lives of musicians. Results indicated that reflective rumination, which is seen as more purposeful and concrete, but not brooding rumination, which is more passive and abstract, was related to aspects of musical performance.

We hypothesized that ruminative tendencies may be related to musical performance in that the repetitive patterns involved in rumination may mirror and/or facilitate the repetitive practice required to succeed as a musician. However, results indicate that the more expressive areas of rating, musicianship and tone, were related to reflective rumination although the more technical as-

pects of performing, such as intonation, articulation and rhythm, were not. In relation, the benefits of reflective rumination existed with no relation to the amount of time the participants spent practicing. All participants were music majors and spent a great deal of time practicing, and this was likely reflected in their technical ability. Differences in performance related to reflective rumination seemed to be limited to expressiveness while playing the piece. It should be noted that the category of musicianship, although indicative of expressiveness, was significantly related to all other categories of performance (the only category for which this is true), and appears to best capture the musicians' overall performance.

The lack of difference in practice time suggests that a ruminative thought style was associated with musical ability because it was more likely related to other factors, such as efficiency of practice, and not amount of practice (see also Ritchie & Willimon, 2012). Research has found that it is not amount of practice, but how the musician practices that best predicts performance (Duke, Simmons, & Cash, 2009). Specifically, how the musician identifies and corrects errors during practice of a musical piece is predictive of the quality of subsequent performance. Reflective rumination tends to be analytical and active (Nolen-Hoeksema et al., 2008) and may lead musicians high in reflection to better focus on eliminating errors. It is also possible that participants high in reflective rumination might be more likely to engage in mental practice throughout the day, possibly even when they do not want to. Mental practice has been found to be beneficial for a number of skills (Driskell, Copper & Moran, 1994), including musical performance (Highben & Palmer, 2004).

Alternatively, reflective rumination may have been related to visual aspects of the performer/performance that can influence ratings of musical ability (e.g., Goldin & Rouse, 2000). For example, participants high in reflective rumination may have seemed more "natural" in their performance, leading to higher evaluations (Tsay & Banaji, 2011). It is also possible that those higher in reflective rumination may be better able to regulate nerves and pressure during a performance or better express the emotions that

Table 3
Multiple Regression Analysis Predicting Depression

Predictor	b	SE B	β	t
Reflective	0.12	0.08	0.16	1.44
Brooding	0.38	0.08	0.51	4.57***

*** $p < .001$.

they are feeling leading to higher evaluations. For example, Kreutz, Ott, Teichmann, Osawa, and Vaitl (2008) found that individuals who scored higher in trait self-absorption experienced stronger music-induced activation and intensity of emotions. It may be that musicians high in reflective rumination are better able to explore different ways that musical pieces can be interpreted. Indeed, both rumination and music could serve as similar emotional coping mechanisms. Research indicates that a common use of listening to music is for emotional regulation (Chamorro-Premuzic & Furnham, 2007), especially by people prone to negative thoughts (Getz, Chamorro-Premuzic, Roy, & Devroop, 2012; Getz et al., 2012). In this case, a third variable—having emotions to cope with—could explain the relationship between rumination, depression and musicianship. However, we suggest that this does not exclude the possibility that ruminative tendencies and musicianship could be mutually beneficial in that rumination could enhance musical performance and practice and musical performance and practice could amplify ruminative tendencies.

Here we found that musicians who scored higher on the depression scale also scored higher in aspects related to how they phrased the musical piece, as reflected in high correlations with the categories of breathing and musicianship. However, the influence of depression on performance appears to be separate from that of reflective rumination with depression, but not reflection, related to breathing. It is possible that musicians tend to be high in depression due to possible benefits of having a depressive style (e.g., Andrews & Thomson, 2009). Participants higher in depression have been found to do better on tasks that require a more analytical or effortful deliberation style (Alloy & Abramson, 1979; Ambady & Gray, 2002; Yost & Weary, 1996) and do better at reading the thoughts and emotions of others (Harkness, Sabbagh, Jacobsen, Chowdry, & Chen, 2005; Lane & DePaulo, 1999; McCaul, 1983). In relation, it may be that having a depressive style makes it so that musicians can be more analytical and deliberative in their approach to playing a piece (leading to improved phrasing) or better able to read the reactions of an audience to their performance (leading to increased emotional expression and connection with the audience).

Relationship Between Type of Rumination and Depression

Brooding rumination appears to be more strongly related to depression than reflective rumination. Treynor et al. (2003) previously demonstrated that reflective rumination does not predict depression longitudinally (see also Siegle et al., 2004). The current finding provides additional evidence that reflective rumination may not be as harmful as brooding rumination. Brooding rumination may be a maladaptive coping strategy and reflective rumination may reflect a cognitive mechanism that serves a distinctly different function. Given that the musicians in our sample were high in reflective and not brooding rumination, the type of rumination that was associated with higher musical ability might not directly have the negative consequences often associated with rumination and depression (Nolen-Hoeksema et al., 2008).

Limitations and Summary

There are a number of limitations to the current study. Given that there was no relationship between reflective rumination and

amount of musical practice, we were not able to determine the specific aspects of having a ruminative style that lead to the association with performance. Future research should try to determine what aspects of reflective rumination are associated with improved musical ability. Future research should also expand beyond the current sample to include professional musicians, who have been able to carve out a successful career in their field. Further, we were restricted by our small sample size to simple correlational analysis. A larger sample would allow the influence of different aspects of personality and outlook, such as self-efficacy (Ritchie & Williamon, 2012), on musical performance to be teased apart using more sophisticated analyses. For example, the independent influences of depression and rumination on musical ability could be further examined and detailed.

With these limitations in mind, the current study provides evidence that musicians exhibit significantly higher levels of reflective rumination than nonmusicians. Results indicate that reflective rumination may not be maladaptive because it does not directly predict depression and appears to be related to enhanced musical performance.

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(Appendix follows)

Appendix Crossed Random Effects Analysis

To assess the variability in the judges' ratings of each musician, we fit a crossed random effects model using Stata 13's xtmixed program (StataCorp, 2013). Here a is the overall mean, u_i the musician effect, v_j the judge effect, and e_{ij} the interaction term containing both musician \times judge effects and error. This model decomposes total variance on a rating into three components of variation, that due to musician, judge, and interaction.

$$\text{rating}_{ij} = \alpha + u_i + v_j + e_{ij}.$$

To assess this we consider ratios of the variances (Rabe-Hesketh & Skrondal, 2012), which define relevant intra-class correlations. For instance, the ICC for judge is:

$$\text{ICC}_{\text{judge}} = \frac{\sigma_{\text{judge}}^2}{\sigma_{\text{musician}}^2 + \sigma_{\text{judge}}^2 + \sigma_{\text{musician} \times \text{judge}}^2}.$$

In general, the judge effects were substantial, suggesting that adjustment for judge was necessary. This may be due to differences in how judges for different types of performance—vocal or a specific type of instrument—differed in their scale usage. Individual judges tended to be fairly consistent in their scale use, but differed from each other.

To generate judge- and musician-adjusted correlations, we fit the following crossed random effects model for each of the six ratings on the three scales, which were z-scored to standardize. The relevant term we analyze is b, which gives the standardized

effect of a particular scale (brooding, reflective, or depression) on the relevant rating, adjusted for musician and judge.

$$\text{rating}_{ij} = \alpha + \beta \text{scale}_i + u_i + v_j + e_{ij}.$$

All regressions converged without problems. Results are presented in Table.

Results of Crossed Random Effects Analysis

Performance attributes	Reliability		Standardized regression coefficients		
	ICC (musician)	ICC (judge)	Reflection	Brooding	Depression
Tone	.172	.494	.210*	.200 +	.170
Intonation	.099	.716	.014	.020	-.033
Articulation	.104	.791	.059	.035	.025
Breathing	.000	.658	.058	.037	.170*
Rhythm	.079	.708	.100	.140	.120
Musicianship	.055	.679	.180*	.110	.150 +

+ $p < .1$. * $p < .05$.

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